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Academic buoyancy and academic outcomes: Towards a further understanding of students with attention-deficit/hyperactivity disorder (ADHD), students without ADHD, and academic buoyancy itself

Andrew J. Martin*

Faculty of Education and Social Work, University of Sydney, Australia

Background. Academic buoyancy is students' capacity to successfully overcome setback and challenge that is typical of the ordinary course of everyday academic life. It may represent an important factor on the psycho-educational landscape assisting students who experience difficulties in school and schoolwork.

Aims. This study investigated the role of academic buoyancy in the achievement and cognitive, affective and behavioural engagement of (1) students with attention-deficit/hyperactivity disorder (ADHD) and (2) 'regular' (or 'general') students residing in the same classrooms and schools. The study also sought to extend prior research into academic buoyancy by including previously neglected and potentially influential factors such as personality and socio-economic status.

Sample. Participants were $n = 87$ high school students with ADHD, $n = 3374$ non-ADHD peers, and $n = 87$ randomly drawn non-ADHD students.

Method. Survey-based data were analysed using multigroup (ADHD, non-ADHD, randomly weighted non-ADHD) multivariate (multiple independent/covariate and dependent variables) path analysis.

Results. The findings revealed a significant and positive association between academic buoyancy and outcomes for students with ADHD that generalized to non-ADHD groups. On occasion where academic buoyancy effects differed between the groups, effects favoured students with ADHD. Furthermore, academic buoyancy explained significant variance in outcomes for both groups of students after covariates (age, gender, parent education, language background, socio-economic status, personality) were entered.

Conclusion. It is concluded that there is merit in widely promoting and fostering academic buoyancy among ADHD and non-ADHD students alike – and that academic buoyancy explains variance in outcomes beyond major intrapersonal factors such as personality, socio-economic status, ethnicity, and the like.

*Correspondence should be addressed to Andrew J. Martin, Faculty of Education and Social Work, A35 – Education Building, University of Sydney, Sydney, NSW 2006, Australia (email: andrew.martin@sydney.edu.au).

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Academic buoyancy is defined as students' capacity to successfully overcome setbacks and challenges that are typical of the ordinary course of everyday academic life (e.g., poor performance, competing deadlines, performance pressure, difficult tasks; Martin & Marsh, 2009; Putwain, Connors, Symes, & Douglas-Osborn, 2012). Given this definition, academic buoyancy may represent an important factor on the psycho-educational landscape assisting students who experience difficulties in their academic life. The present study investigates this in the context of students with attention-deficit/hyperactivity disorder (ADHD)[1], relative to 'regular' (or 'general') students without ADHD. Because most students with ADHD reside in 'regular' (or 'general') classrooms and schools (Barkley, 2006), exploring positive approaches that might generalize across them and their non-ADHD peers is important. Thus, a first aim of the study is to explore the generalizability of academic buoyancy across students with ADHD and their non-ADHD peers.

A second aim of the study is to extend prior research into academic buoyancy by better differentiating its variance from that attributable to other factors relevant to students' academic lives. Prior research into academic buoyancy has neglected some potentially important factors that are necessary to disentangle from academic buoyancy and the outcomes it is reported to predict (e.g., Martin, Colmar, Davey, & Marsh, 2010; Martin & Marsh, 2008a,b; Putwain *et al.*, 2012). Factors such as personality and socio-economic status, for example, have not been disentangled from academic buoyancy in prior modelling. Taking personality as a case in point (but see below for other factors), it may be that high conscientiousness and/or low neuroticism share sufficient variance with academic outcomes (O'Connor & Paunonen, 2007) that they reduce or eliminate academic buoyancy effects. Inclusion of these factors in the context of this study's large sample provides an opportunity to examine the unique variance in academic outcomes attributable to academic buoyancy. Taken together, the present investigation seeks to extend current understanding of academic buoyancy in terms of the samples to which it may be relevant and the factors to which it might be related. As discussed below, this has significant implications for 'inclusive' classroom practices – as well as empirical implications relevant to the factors to include alongside academic buoyancy in future research.

ADHD, academic risk, and academic buoyancy

ADHD and academic risk

Attention-deficit/hyperactivity disorder has been defined as 'a persistent pattern of inattention and/or hyperactivity-impulsivity that is more frequent and severe than typically observed in individuals at a comparable level of development' (American Psychiatric Association, 2000; DSM-IV-TR). Dominant conceptual models of ADHD emphasize impairments to executive function and self-regulation. This theorizing also identifies a leading role for diminished behavioural inhibition that delays (or inhibits) initial prepotent responses to an event, stops ongoing responses, and controls potential interferences and distractions (Barkley, 2006; Nigg, 2001). The operation of these inhibitions is crucial for the individual to have the time to then enact appropriate self-directed actions that constitute self-control and self-regulation (Barkley, 2006). These

[1] *The terms 'students with ADHD' and 'ADHD students' are sometimes used interchangeably. Importantly, the use of the latter term is not meant to indicate students are defined by their ADHD condition.*

self-directed actions are, according to Barkley, the executive functions required to successfully engage in tasks and activities, including schoolwork. Four executive functions are identified (non-working memory, verbal working memory, self-regulation of motivation, and reconstitution; Barkley, 2006). The joint operation of all four executive functions leads to self-regulatory control (Barkley, 2006). The executive functions of students with ADHD tend to be impaired, as are component functions more proximally related to outcomes. Other psychological models of ADHD emphasizing cognitive and neuropsychological risk include the motivation inhibition model of Gray and McNaughton (2003), the attentional neural network model of Swanson *et al.* (1998), the working memory model of Rapport, Chung, Shore and Isaacs (2001), the executive function model of Brown (2005), and the cognitive-energetic model of Sergeant (2005). Alongside these cognitive and neuropsychological models of impairment are neuro-scientific and biochemical models that emphasize reduced metabolic activity in frontal areas of the brain that are responsible for impulsivity, inattention, and memory as well as abnormalities in neurotransmitter functioning that regulate attention and impulse control (see Barkley, 2006; Chandler, 2010 for summaries). In all cases and models, there are cognitive, neurological, and biochemical risk factors specific to ADHD that increase the likelihood of problematic processes that are likely to impair academic outcomes (Vostanis, 2007; Wilmhurst, Peele, & Wilmhurst, 2011).

Many of the tasks presented to children and young people at school require the very functions that ADHD seems to most impair (Martin, 2012a). Thus, students with ADHD are at significantly greater academic risk than students without ADHD. In relation to achievement, a common educational feature of ADHD is poor performance (DuPaul, Rutherford, & Hosterman, 2008; DuPaul & Stoner, 2003; Purdie, Hattie, & Carroll, 2002). In relation to engagement, students with ADHD demonstrate significantly lower levels on multiple dimensions of engagement. Behaviourally, they show poor self-regulation (Barkley, 2006; Purdie *et al.*, 2002; Wagner, 2000), difficulty completing tasks such as homework and assignments (Purdie *et al.*, 2002), and low persistence in class (Martin, 2012b). Cognitively, they show low levels of self-efficacy, sense of control, and aspirations (e.g., Dumas & Pelletier, 1999; Tabassam & Grainger, 2002). Affectively, they tend not to enjoy or value school as much as students without ADHD (DeRuvo, 2009).

Thus, students with ADHD reflect a profile that suggests an accumulation of risk that poses substantial threat to educational development. Indeed, theories of risk emphasize the distinct challenges created by the compounding of risk (Masten & Powell, 2003; Rutter, 2006). In recent research, it seems the presence of two risk factors is sufficient to predict academic failure (Lucio, Hunt, & Bornovalova, 2012). There is also the issue of timing. If multiple risks impinge on the individual concurrently, adaptive outcomes come under even greater threat. In the case of students with ADHD, it can be the case that numerous risks described above co-occur relatively frequently. Academic buoyancy has been described as one factor that assists students to deal with academic risk (Martin & Marsh, 2009), particularly risk that occurs relatively frequently and on an ongoing and 'everyday' basis – such as study deadlines, a poor result, negative feedback from teachers, study pressure, and difficult schoolwork. As such, it may be considered an academic enabling construct that facilitates students' benefit from and participation in teaching and learning in the classroom (DiPerna, 2006; DiPerna & Elliott, 2002).

Academic buoyancy has been empirically differentiated from coping (Putwain *et al.*, 2012), adaptability (Martin, Nejad, Colmar, & Liem, 2012), and academic resilience (Martin, in press) and suggested to be a factor that practitioners might consider sustaining on an ongoing basis to help students deal with ongoing academic difficulty. Prior

research has established this for 'general' samples, but not for those at markedly greater academic risk – such as students with ADHD. Academic buoyancy tends to be considered alongside resilience more than other factors. Martin and Marsh (2009) have suggested that whereas academic buoyancy refers to an ability to deal with everyday academic setback and challenge (i.e., minor adversity; see also Putwain *et al.*, 2012), academic resilience refers to an ability to deal with chronic and/or acute academic adversity (i.e., major adversity). Indeed, recent research supports these contentions, with academic buoyancy significantly associated with low-level maladaptive phenomena (e.g., fear of failure, anxiety, low control) and academic resilience associated with major maladaptive phenomena (e.g., disengagement, self-handicapping) (Martin, in press). Because 'everyday' functioning is the focus of the present study, academic buoyancy is the construct under central consideration here.

Academic buoyancy and ADHD: the case for and against

Martin and Marsh (2008a,b, 2009) contended that academic buoyancy applies to 'everyday' academic setback and is not to be confused with academic resilience that applies to acute and/or chronic risk that is a major threat to educational development. Indeed, recent research with high school students found that academic buoyancy and academic resilience share no more than 35% variance (Martin, in press). Given the substantial academic and clinical challenges facing students with ADHD (see above; see also Barkley, 2006), it may be that academic buoyancy (that is aimed at relatively low-level risk and adversity) is not sufficient for these students to achieve and engage.

It may also be that low levels of perceived competence and a sense of helplessness pose barriers to potentially positive effects of academic buoyancy. Tabassam and Grainger (2002) found that students with ADHD reported lower academic self-concept and academic self-efficacy than peers achieving at typical levels. In terms of helplessness, Douglas (1985) suggested that students with ADHD experience significant task-relevant frustration and do not invest the effort needed to complete important tasks. In failing to complete tasks, they solve fewer problems and increasingly cut themselves off from possible academic success. This can set in train a pattern of helplessness that may present a major barrier to psycho-educational factors such as academic buoyancy that may help them deal with academic difficulty (Martin, 2012a). Indeed, Weiss and Hechtman (1986) suggested that the actual symptoms of ADHD may be less problematic than the psycho-social and psycho-educational problems that result from the symptoms.

On the other hand, recent empirical research has indicated that academic buoyancy predicts academic resilience (Martin, in press) and to the extent that ADHD students are academically resilient, they may also be buoyant. Also, other normative factors have been found to generalize across ADHD and non-ADHD samples. For example, recent research has shown the utility of personal best (PB) goals in the 'regular' classroom for ADHD and non-ADHD groups (Martin, in press). In addition, intervention studies with ADHD groups have shown intervention to address attributions can be effective in increasing self-esteem (Treuting & Hinshaw, 2001). This line of research would thus predict that as with other psycho-educational factors and intervention, the role of academic buoyancy can generalize across ADHD and non-ADHD groups. The present study is aimed at assessing this.

Studying associations between factors and implications for practice

Ideally, then, two effects are suggested for academic buoyancy and ADHD. The first is that there is a significant positive relationship between academic buoyancy and academic

outcomes for students with ADHD. The second is that the significant associations for students with ADHD are not significantly different from associations for students without ADHD. The former effect indicates the role of academic buoyancy for students with ADHD; the latter effect indicates the generalizability of academic buoyancy. As described in Martin (2012b), the focus of most studies of ADHD and educational outcomes has been on mean levels of these outcomes as a function of ADHD status – for example, whether there are differences in mean levels of engagement and achievement for students with or without ADHD. Far less attention has been given to studying differences in relationships between educational factors (e.g., between academic buoyancy and academic achievement) and the extent to which these relationships depart or align for students with ADHD and those without.

The implications of findings emanating from this perspective (on associations) are important. For example, if the relationship between academic buoyancy and educational outcomes is weaker for students with ADHD (than for those without), then there may be disproportionate disadvantage in promoting it on a general basis (or it may signal a need to focus on academic resilience, rather than academic buoyancy, for students with ADHD). Or, to the extent that the positive role of academic buoyancy found in prior research into 'regular' ('general') samples generalizes to students with ADHD, systemic practice and wider implementation are appropriate. Further, insofar as findings for academic buoyancy are applicable to students with ADHD, there are identifiable processes that comprise academic buoyancy to implement in assisting them. For example, Morales (2000; see also Rutter, 1987) proposed a cycle in which the student realistically and effectively identifies major risk and the student then activates an attribute (e.g., academic buoyancy – see Martin & Marsh, 2008a) that can offset or reduce the negative effects of the risk. Examination of relevant attributes in this process is therefore of applied importance. Such concerns are most appropriately evaluated by exploring comparative correlation and regression parameters (see Marsh, 1993) to determine whether – and how – the role of academic buoyancy varies according to ADHD status.

Better understanding the unique effects of academic buoyancy

The study has a second aim. This aim is to better understand unique variance attributable to academic buoyancy after including potential confounds that have been neglected in prior research. Thus, this second aim is relevant to all students – those with ADHD and those without. Accordingly, the present study includes numerous covariates in order to partial their variance out of the relationship between academic buoyancy and educational outcomes. These covariates are personality, gender, age, SES and language background. Variance in achievement and related educational outcomes is partly explained by personality (O'Connor & Paunonen, 2007; Thompson, 2008). Furthermore, aspects of personality may be correlated with academic buoyancy. For example, perhaps high conscientiousness and/or low neuroticism explain significant academic buoyancy variance. This has not been investigated to date. In terms of socio-demographic factors, due to background and contextual disadvantage, it is not uncommon for non-English-speaking background (NESB) or low SES students to experience academic adversity, underachieve and disengage [Organisation for Economic Cooperation & Development (OECD), 2006]. Thus, variance attributable to SES and language background is important to control when seeking to understand academic buoyancy. In related vein, parents' education may confound findings. It is necessary to know whether poor academic outcomes are due to low parental education (Hattie, 2009) or due to low

academic buoyancy. In terms of gender, research has pointed to declining levels of achievement and engagement among boys over the past decade or so (see Rowe & Rowe, 1999; Weaver-Hightower, 2003). In addition, research has indicated a decline on some engagement factors as students move further into high school (Martin, 2009). Prior research into academic buoyancy has not demonstrated that academic buoyancy is distinct from various socio-demographic and personality factors that may (better) explain variance in outcomes. Thus, disentangling such variance extends existing understanding of academic buoyancy more broadly.

Method

Participants and procedure[2]

Students with ADHD

The sample of students with ADHD (n = 87) were in junior high school (11–14 years, 61%) and senior high school (15–19 years, 39%) from nine 'regular' (or 'general') schools in major urban areas on the east coast of Australia. A formal medical diagnosis of ADHD had been received by these students. n = 87 corresponds to a 2.5% incidence relative to the total sample – a prevalence broadly aligning (but at the lower bound) with many estimates of adolescents with ADHD (Barkley, 2006; Mannuzza & Klein, 2000; Shaw-Zirt, Popali-Lehane, Chaplin, & Bergman, 2005). The average time since diagnosis was 6.84 years (SD = 3.73). Preliminary analyses revealed no significant correlation between years since diagnosis and academic buoyancy and the four dependent measures (hence, time since diagnosis was not controlled for in the study). It was not possible to identify whether students were mainly inattentive type, hyperactive type or both – thus, the broad ADHD designation was used. Just under half the sample (46%) was on medication to help manage the condition – a figure generally lower than population estimates (Visser, Bitsko, Danielson, Perou & Blumberg, 2010). In tests for mean-level effects using MANOVA, there were no significant differences (p = .60) on academic buoyancy and the four dependent measures as a function of medication status (thus, medication was also not a control factor in the study). Consistent with population statistics is the prevalence of males (70%) to females (30%) with ADHD, $\chi^2(1) = 8.79$, $p < .01$.

Importantly, the present sample of students with ADHD is larger than that in most studies. Purdie *et al.* (2002) reported in a meta-analysis of 74 ADHD studies that the participant range is n = 1 to n = 161, with a mean sample of n = 29 students. Analyses were conducted to determine whether these students were disproportionately more likely to have comorbidities. It was determined that students with ADHD were significantly more likely to have reading difficulty/dyslexia $\chi 2$ (1) = 92.22, $p < .001$, mathematics difficulty/dyscalculia $\chi 2$ (1) = 34.95, $p < .001$, writing difficulty/dysgraphia $\chi 2$ (1) = 36.86, $p < .001$, hearing difficulties $\chi 2$ (1) = 34.24, $p < .001$, and sight difficulties $\chi 2$ (1) = 8.51, $p < .01$. The reader is advised to interpret the findings with this comorbidity in mind. A total of 7% of students with ADHD were from a NESB. Analysis

[2] *Participants and procedures are the same as that in Martin's (2012b) study of ADHD and goal setting. Testing empirical congruence across studies, academic buoyancy and goals shared 13% variance for the large non-ADHD sample, 9% variance for the random weighted non-ADHD sample and 11% variance for the ADHD sample. For completeness, supplementary multigroup multivariate path analyses controlling for goals identified the same comparative pattern for academic buoyancy as in Table 2 (e.g., on only one of the eight final academic buoyancy parameters was buoyancy, a stronger predictor for the non-ADHD sample than for the ADHD sample).*

of the data indicated that students with ADHD were no more or less likely to come from a NESB, χ^2 (1) = 2.78, $p > .05$.

Participating schools were 'regular' (or 'general') schools of comprehensive (or mixed) ability. Four of these schools were co-educational, three comprised boys only, and two comprised girls only. Schools were part of a broader research programme funded by the Australian Research Council. They were selected on the basis of previous research participation, prior professional development within the school by the researcher, or expressions of interest distributed through education associations and networks. Schools were from the systemic Catholic sector and the independent school sector. Schools represented students from a range of SES levels, from 737 to 1213 on the Australian Bureau of Statistics Index of Relative Socio-Economic Advantage and Disadvantage classification, with a mean of 1045 (*SD* = 83), which is higher than the national average of 1000. Although the schools trended higher in achievement, achievement scores spanned below national average to above national average as indicated by literacy and numeracy data from Australian Curriculum and Assessment Authority (ACARA).

Students without ADHD

Large unweighted sample. The non-ADHD group comprised a large unweighted sample of n = 3,374[3] students from the same schools and year levels as the ADHD group. The non-ADHD group included students in junior high school (11–14 years, 60%) and senior high school (15–19 years, 40%) from the same nine high schools. Nearly half (47%) the participants were females and 53% were males. The average age was 14.17 years (*SD* = 1.53). Thirteen per cent of the sample was from a NESB.

Random weighted sample of students without ADHD. Analyses also involved a random draw of n = 87 (from the n = 3,374 sample) non-ADHD students. In this random draw, data for these n = 87 non-ADHD students were weighted to the gender profile of the 87 students with ADHD (given that gender is one of the most striking demographic factors differentiating students with and without ADHD; Purdie *et al.*, 2002). Hence, in this random weighted draw, males were 70% of the sample, and females 30%. The average age was 14.15 (*SD* = 1.53) years (not significantly different at $p < .05$ from the ADHD group). Fifteen per cent of the random weighted non-ADHD sample was from a NESB (not significantly different at $p < .05$ from the ADHD group). Hence, this random weighted non-ADHD sample, matched for size, reflected a demographic similar to the ADHD group.

Procedure

Ethics approval was received from the University Human Research Ethics Committee. Informed and signed consent was provided by the school Principal to conduct the study and by parents/caregivers for their child to participate in the study. The procedure

[3] *It is recognized that the non-ADHD sample is substantially larger than the ADHD sample and that this has implications for statistical significance, biasing the non-ADHD parameters towards significance relative to the ADHD sample. However, because the study aimed to comprise a participant pool that reflected the real ratio of ADHD to non-ADHD students and because it was of interest to derive less biased standard error estimates through a larger sample size, comprehensive representation of non-ADHD students was of central interest. Nevertheless, a weighted random* n = *87 non-ADHD subsample was included in supplementary analyses.*

involved administration of a survey instrument to all participants in normally scheduled classes. A standard set of instructions was provided to every teacher administering the survey. The rating scale was explained by the teacher and a sample item presented to students. Students were asked not to identify themselves to ensure anonymity and to allow them to respond as fully and frankly as possible. Students were also asked to complete the instrument on their own. Students were instructed to ask teachers for assistance with any survey items they had difficulty reading or understanding.

Materials

The independent variable: academic buoyancy

Academic buoyancy was assessed using the Academic Buoyancy Scale (ABS; Martin & Marsh, 2008a,b). The ABS comprises four items ('I'm good at dealing with setbacks at school – e.g., negative feedback on my work, poor result'; 'I don't let study stress get on top of me'; 'I think I'm good at dealing with schoolwork pressures'; 'I don't let a bad mark affect my confidence'). The items are rated from 1 ('Strongly Disagree') to 7 ('Strongly Agree'). Prior research has shown academic buoyancy to be significantly distinct from cognate constructs such as coping, predicting different academic outcomes and processes to different degrees (Putwain *et al.*, 2012). Other research has demonstrated reliability (typical range α = .80–.82), unidimensionality (typical factor loading range .67–.78), invariance as a function of age, ethnicity, and gender (CFI not varying by >.01 and RMSEA not changing by >.015 in models that constrain parameters across these groupings), approximately normal distribution (skew and kurtosis typically <|1|), and significant associations with numerous educational outcomes (e.g., with self-efficacy, low anxiety, control, persistence, teacher–student relationships, $p < .05$ to $p < .001$) (Martin & Marsh, 2008a,b; Martin *et al.*, 2010). Table 1 presents factor loadings, reliability coefficients, descriptive data, and distributional properties for ADHD and non-ADHD groups.

The dependent variables

Achievement. In the present study, academic achievement is derived from students' results in annual nation-wide assessment of literacy and numeracy (National Assessment Program in Literacy and Numeracy, NAPLAN) administered by the Australian Curriculum and Assessment and Reporting Authority (ACARA, 2012). It is a nationally standardized test for which school students receive a score (on the same scale of measurement) for each of literacy and numeracy. Students were asked to report their numeracy and literacy NAPLAN scores. To determine the extent to which their reports aligned with school records, NAPLAN data were analysed from the records of one school in the research programme. The findings demonstrated that there was no significant difference between the self-reported scores and the records at the school for numeracy, $t(340) = -.45$, p = ns, and literacy, $t(340) = -.17$, p = ns. This is consistent with meta-analysis of 209 studies showing the correlation between self-reported grades and actual grades as the highest of any factors correlated with achievement (Hattie, 2009). Although these alignments are reassuring, the reader is urged to interpret achievement data with this in mind and in recognition of working memory deficits relevant to students with ADHD. An achievement indicator was formed by calculating the average of

Table 1. Descriptive statistics for ADHD and non-ADHD samples: academic buoyancy and dependent variables (including weighted $n = 87$ non-ADHD)

	Correlation with academic buoyancy		Raw Means/*SD*		Skewness/Kurtosis		Factor loadings		Cronbach's α	
	Non-ADHD (random sample)	ADHD	Non-ADHD (random sample)	ADHD	Non-ADHD (random sample)	ADHD	Non-ADHD (random sample)	ADHD	Non-ADHD (random sample)	ADHD
Academic buoyancy	–	–	4.64/1.22 (4.76/1.19)	4.78/1.06	−0.43/0.03 (−0.39/0.40)	0.02/−0.08	0.61–0.75 (0.55–0.62)	0.44–0.65	.77 (.75)	.65
Achievement	0.13 (0.09)	0.19	7.29/1.44 (7.34/1.33)	7.09/1.53	−0.29/0.03 (−0.47/0.24)	−0.53/1.17	–	–	–	–
Enjoyment of school	0.39 (0.32)	0.33	5.43/1.39 (5.17/1.57)	5.21/1.54	−1.03/0.64 (−1.05/0.78)	−0.99/0.27	0.54–0.95 (0.38–0.95)	0.72–0.96	.92 (.89)	.92
Class participation	0.35 (0.35)	0.38	5.31/1.22 (5.27/1.13)	5.30/1.22	−0.74/0.39 (−0.47/−0.03)	−0.49/−0.28	0.72–0.87 (0.61–0.93)	0.60–0.82	.89 (.89)	.86
Positive intentions	0.29 (0.32)	0.26	5.83/1.06 (5.63/1.15)	5.61/1.22	−1.24/1.64 (−1.20/2.15)	−1.24/1.84	0.39–0.76 (0.61–0.75)	0.30–0.61	.79 (.80)	.81

Note. Parameters in brackets () are parameters for a weighted $n = 87$ non-ADHD sample.

the literacy and numeracy scores. Descriptive and reliability results for achievement are presented in Table 1.

Engagement. Consistent with Fredricks, Blumenfeld and Paris (2004), three engagement measures (behavioural, affective, and cognitive) were examined in this study. Following Martin (2009), the three measures selected for this purpose were class participation (behavioural), enjoyment of school (affective), and positive intent (cognitive). For affective engagement, students were administered items that explored their *enjoyment* of school (four items; e.g., 'I like school'). For behavioural engagement, *class participation* items were administered (four items; e.g., 'I get involved in things we do in class'). For cognitive engagement, items assessing positive intent were administered (four items; e.g., 'I intend to complete school'). These measures were rated on a 1 ('Strongly Disagree') to 7 ('Strongly Agree') scale and were drawn from Martin (2009) who has shown them to be reliable, a good fit to the data in factor analysis, and invariant as a function of socio-demographics. For each of ADHD and non-ADHD groups, Table 1 presents descriptive statistics and reliability coefficients for each of the three engagement scales. Factor loadings are also presented in Table 1, derived from principal axis factoring with oblique rotation (as factors were expected to correlate) and explaining 69% of the variance for the non-ADHD group and 69% of the variance for the ADHD group.

Other predictors (covariates)

Personality. Five personality factors – Extraversion, Openness to Experience, Neuroticism, Conscientiousness, and Agreeableness, with eight items per factor – were assessed using the 40-item International English Big-Five Mini-Markers instrument (IEBM; Thompson, 2008). Participants rated the extent to which 40 trait adjectives were accurate descriptors of themselves. Items for the IEBM are each represented by one word in which the respondent rates themselves 1 ('Very Inaccurate') to 7 ('Very Accurate'). Sample words for each factor are as follows: 'talkative' (extraversion), 'creative' (openness), 'moody' (neuroticism), 'efficient' (conscientiousness), and 'warm' (agreeableness). Thompson has previously demonstrated the reliability and predictive validity of the five factors among adolescents. Reliability for this study is detailed in Results.

Socio-demographics. Socio-demographic variables were gender, age, language background, SES, parent education, and parent occupation. For language background, participants were asked whether they spoke English (0) or another language (1 – NESB) at home. Gender was coded 0 for females and 1 for males. Age was a continuous variable. Students were asked to report their mother's (or female caregiver's) and father's (or male caregiver's) educational and occupational status using an ordinal scale from Australian Bureau of Statistics categories. A parent education factor and a parent occupation factor were developed from the ordinal scales by finding the mean of mother and father educational score (for parent education) and the mean of the mother and father occupational score (for parent occupation). Students' SES was scored on the basis of their home postcode using the Australian Bureau of Statistics (ABS) relative advantage/disadvantage index, with higher scores reflecting higher SES.

Data analysis

Multigroup multivariate analyses. Data were analysed using multigroup (ADHD, non-ADHD, random weighted non-ADHD) multivariate (multiple independent/covariate and dependent variables) path analysis with Mplus 6.0 (Muthén & Muthén, 1998–2010). Analysis proceeded in three steps in order to ascertain the change in academic buoyancy as a function of covariates entered into the model. Step 1 entered academic buoyancy as a predictor of achievement, participation, enjoyment and intent. Step 2 added socio-demographics (age, gender, language background, SES, parent education and occupation) to the model as predictors. The third and final step entered the five personality factors to academic buoyancy and socio-demographics. The four dependent variables were included in the one analytic model so that shared variance between them could be accounted for, leading to a better understanding of the unique role of academic buoyancy for each dependent measure. For each step, multigroup analysis was conducted such that ADHD and non-ADHD parameters were estimated in the one model. To adjust for clustering within schools, all analyses implemented the Mplus 'cluster' command with the 'complex' method. This procedure provides adjusted standard errors and so does not bias tests of statistical significance due to clustering of students within schools (Muthén & Muthén, 1998–2010).

Invariance tests. The advantage of multigroup (ADHD/non-ADHD) analyses is that parameters between the two groups can be constrained to determine whether one group significantly differs from the other (indicated by a significant change in model fit based on a change in CFI >.01, Cheung & Rensvold, 2002; and a change in RMSEA >.015, Chen, 2007). In the present study, this was done by constraining the parameter between academic buoyancy and outcomes to be equal across the two groups and assessing the change in model fit. Significant decline in model fit (from the fit of a model where academic buoyancy parameters were freely estimated in both groups) indicates a significant difference between the two groups in the role of academic buoyancy for academic outcomes.

Sample size considerations. It is recognized that the non-ADHD sample is much larger than the ADHD sample. This has implications for statistical significance – including biasing non-ADHD parameters to statistical significance relative to ADHD parameters. Hence, when considering effects between ADHD and non-ADHD samples, there is also consideration of (1) effect sizes (converting standardized betas to *d*-values using Peterson & Brown, 2005 formula – and using Hattie, 2009 criteria of $d = .20, .40$, and .60 indicating small, medium, and large effect sizes, respectively) and (2) the absolute size of estimates.

Missing data. For large-scale studies, missing data are not uncommon and can pose problems if exceeding 5% (e.g., Graham & Hoffer, 2000). Numerous concerns about pairwise, listwise, and mean substitution approaches to missing data have been identified (Graham & Hoffer, 2000), leading to implementation of the Expectation Maximization Algorithm, operationalized in the present study using LISREL 8.80 (Jöreskog & Sörbom,

2006). Imputation identified 4.98% of the data were missing and so the EM Algorithm was employed as an appropriate approach to manage this.

Results

Preliminary descriptive and psychometric analyses

Distributional properties for the central factors are shown in Table 1. Skewness and kurtosis values indicate that scales for each group were normally distributed, based on West, Finch and Curran's (1995) criteria. Means and *SD*s are also presented in Table 1. Reliabilities for these scale scores for each of the three groups are presented in Table 1. For completeness, reliabilities for the five personality factors ranged between .69 and .83 for students with ADHD, between .72 and .84 for non-ADHD students, and between .65 and .84 for random weighted non-ADHD students. Factor loadings (based on principal axis factoring with oblique rotation) for ADHD, non-ADHD, and random weighted non-ADHD samples are shown in Table 1. Correlations between academic buoyancy and achievement and engagement measures are also presented in Table 1. For all three groups, academic buoyancy is positively correlated with achievement and engagement.

Multigroup multivariate path analyses

Analyses proceeded to hierarchical (independent variables entered in steps) multigroup multivariate path analysis. In the first step, academic buoyancy predicted all four dependent variables, in the second step socio-demographics were entered, and in the third step personality factors were included. Table 2 shows standardized betas for academic buoyancy in all three steps, effect sizes for academic buoyancy in the third step and final betas for covariates in the third step. Figure 1a and b presents standardized beta coefficients for the large unweighted and random weighted samples, respectively. The results in Table 2 and Figure 1a and b show that after controlling for socio-demographics and personality, academic buoyancy yields 'medium' to 'large' effect sizes for the ADHD group on all outcome variables and 'small' to 'large' effect sizes for the non-ADHD and random weighted non-ADHD groups (based on Hattie's, 2009, large $d > .60$, medium $d > .40$, small $d > .20$). For all four dependent variables, the effect size tended to be larger for students with ADHD than one or both groups of non-ADHD students (achievement: non-ADHD $\beta = .07$, $d = .24$, random weighted non-ADHD $\beta = .01$, $d = .12$, ADHD $\beta = .15$, $d = .38$; enjoyment: non-ADHD $\beta = .31$, $d = .77$, random weighted non-ADHD $\beta = .12$, $d = .35$, ADHD $\beta = .29$, $d = .72$; participation: non-ADHD $\beta = .25$, $d = .63$, random weighted non-ADHD $\beta = .25$, $d = .63$, ADHD $\beta = .37$, $d = .93$; intent: non-ADHD $\beta = .23$, $d = .58$, random weighted non-ADHD $\beta = .25$, $d = .63$, ADHD $\beta = .25$, $d = .63$).

Invariance tests

Thus, there is a significant role of academic buoyancy for students with ADHD and this role trended larger for these students than for students without ADHD. It was therefore important to utilize the multigroup set-up to formally assess whether there are significant differences in academic buoyancy beta parameters between the ADHD and non-ADHD students. This involved constraining parallel parameters across the two groups. These analyses indicated that when testing for differences in model fit as a function of constraining academic buoyancy coefficients, there was significant ($p < .05$) decline in

Table 2. Standardized beta parameters and effect sizes (based on final step in model) in multigroup multivariate path analysis: ADHD and Non-ADHD samples (including weighted n = 87 non-ADHD)

	Achievement		Enjoyment		Participation		Intentions	
	Non-ADHD β	ADHD β	Non-ADHD β	ADHD β	Non-ADHD β	ADHD β	Non-ADHD β	ADHD β
Step 1: academic buoyancy	.13 (.09)	.19	.40 (.32)	.33	.35 (.35)	.38	.29 (.32)	.26
Step 2: academic buoyancy (controlling socio-demographics)	.13 (.12)	.22	.39 (.23)	.34	.35 (.33)	.42	.31 (.33)	.28
Step 3: academic buoyancy (controlling Step 2 + personality)	.07 (.01)	.15	.31 (.12)	.29	.25 (.25)	.37	.23 (.25)	.25
Academic Buoyancy Step 3 Effect size	.24 – Small (.12 – < Small)	.41 – Medium	.77 – Large (.35 – Small)	.72 – Large	.63 – Large (.63 – Large)	.93 – Large	.58 – Medium (.63 – Large)	.63 – Large
Covariates – socio-demographic (Step 3 β/Effect Size)								
Gender	.03/.16	−.11/−.22	.02/.14	.15/.41	−.01/−.02	−.05/−.10	−.07/−.14	.01/.12
Age	.18/.47	.15/.41	−.08/−.16	.08/.26	−.03/−.06	.05/.20	.04/.18	.06/.22
NESB	.07/.24	.09/.28	.01/.12	−.08/−.16	−.02/−.04	−.04/−.08	.03/.16	.02/.14
SES area								

Continued

Table 2. (*Continued*)

	Achievement		Enjoyment		Participation		Intentions	
	Non-ADHD β	ADHD β	Non-ADHD β	ADHD β	Non-ADHD β	ADHD β	Non-ADHD β	ADHD β
	.11/.32	−.07/−.14	.05/.20	.03/.16	.04/.18	.04/.18	.04/.18	−.01/−.02
Parent education	.20/.52	.35/.87	.04/.18	.27/.68	.02/.14	.19/.50	.10/.30	.37/.93
Parent occupation	−.01/−.02	.10/.30	.03/.16	−.02/−.04	.01/.12	−.06/−.12	.03/.16	.06/.22
Covariates – personality (Step 3 β/ Effect Size)								
Extraversion	−.03/−.06	−.12/−.24	.04/.18	−.03/−.06	.31/.77	.15/.41	.02/.14	−.08/−.16
Openness	.24/.61	.34/.85	.02/.14	−.01/−.02	.09/.28	.12/.35	.13/.37	.18/.47
Neuroticism	.01/.12	−.09/−.18	.02/.14	.02/.14	.08/.26	.08/.26	.08/.26	.17/.45
Conscientiousness	.10/.30	.09/.28	.16/.43	.04/.18	.15/.41	−.01/−.02	.19/.50	−.04/−.08
Agreeableness	.03/−.06	−.02/−.04	.19/.50	.33/.82	.17/.45	.28/.70	.19/.50	.35/.87

Notes. All parameters estimated in one multigroup multivariate path analysis. Parameters in brackets () are parameters for a weighted $n = 87$ non-ADHD sample. Step 1 Academic buoyancy; Step 2 Academic buoyancy + Socio-demographics; Step 3 Academic buoyancy + Socio-demographics + Personality

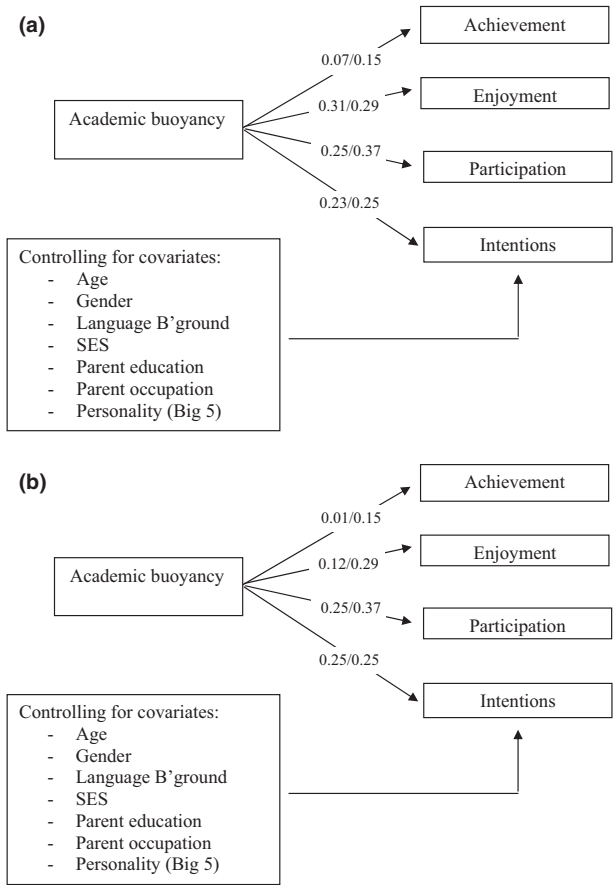

Figure 1. (a) Standardized parameters for non-ADHD (n = 3374) and ADHD (n = 87) samples. (b) Standardized parameters for random non-ADHD (n = 87) and ADHD (n = 87) samples. All parameters estimated in one multigroup multivariate path analysis.

model fit for class participation for the full sample and for school enjoyment for the random weighted sample (with parameters stronger for students with ADHD). Thus, the majority of academic buoyancy parameters were congruent across ADHD and non-ADHD groups. Where differences emerged, the positive role of academic buoyancy was stronger for students with ADHD than for those without.

Discussion

Findings of note and implications

Top line findings

Of particular relevance to mainstream/inclusive classrooms and schools, it is significant that the adaptive role of academic buoyancy is positive and statistically significant for students with ADHD – and generalizes across students with ADHD and those without. For

a number of reasons, it was speculated that the role of academic buoyancy (found to be significant in prior work with 'regular' samples) might not generalize to students with ADHD. The low self-concept (Tabassam & Grainger, 2002) and maladaptive attributions (Douglas, 1985; Martin, 2012a) found among students with ADHD students may pose significant barriers to the adaptive buoyancy construct. Or, it may be that academic buoyancy, aimed at addressing relatively low-level 'everyday' academic risk, may not be sufficient for students who face substantial academic and clinical challenges – such as those with ADHD (Barkley, 2006). Based on the present data, these potential threats to the effects of academic buoyancy for ADHD students are not evident.

Some relative benefits to students with ADHD?

Notwithstanding congruent parameters, significant differences in academic buoyancy effects did emerge for class participation and school enjoyment – with the ADHD group evincing stronger effects of academic buoyancy than the non-ADHD group. Furthermore, the bulk of effect sizes trended larger for the ADHD group. Thus, although it is concluded that academic buoyancy generalizes across the two groups, significant differences are in favour of the students with ADHD. To the extent that this is the case, we begin to gain some insight into the potential for academic buoyancy to help narrow engagement differences between ADHD and non-ADHD groups. Thus, the bulk of students stand to gain from academic buoyancy – but there are some factors on which at-risk students stand to gain to such an extent that engagement parity may be possible. Research is needed to replicate the findings and further explore this tentative thesis.

The question is why academic buoyancy leads to improved outcomes for students with ADHD. Prior research into academic buoyancy may hold part of the answer. Research exploring predictors of academic buoyancy has identified self-efficacy, planning, persistence, control and low anxiety as major factors (Martin & Marsh, 2006; Martin *et al.*, 2010). Alongside this research is other work finding students with ADHD lower in perceived competence, sense of control and self-efficacy, and higher in task-relevant frustration (e.g., Douglas, 1985; Tabassam & Grainger, 2002). Taking these findings together, it may be that fundamental elements of academic buoyancy (e.g., self-efficacy, control, persistence) counteract fundamental psycho-educational impediments associated with ADHD. It may also be that low levels of perceived competence and a sense of helplessness pose barriers to potentially positive effects of academic buoyancy. As Weiss and Hechtman (1986) point out, the symptoms of ADHD may be less problematic than the psycho-educational problems resulting from the symptoms – hence, if academic buoyancy comprises elements that directly diminish these psycho-educational problems, then this may be an important means by which it is particularly beneficial for students with ADHD. Related to this, in the introduction it was reported that academic buoyancy may be considered an academic enabler (see DiPerna, 2006; DiPerna & Elliott, 2002). Recent research has found that academic enablers mediate the relationship between symptoms of ADHD and academic outcomes – similar to what is suggested here in relation to academic buoyancy.

In addition to this, there may be self-regulatory factors that lead to positive effects of academic buoyancy for students with ADHD. In Barkley's (2006) multidimensional model of ADHD, there is an important role played by the self-regulation of affect and the self-regulation of arousal that lead to control required for goal-directed action and task engagement. Similarly, Brown (2005) recognizes the importance of emotion regulation such as managing frustration. Prior research has identified anxiety to be one of the

strongest predictors of academic buoyancy, with students high in academic buoyancy low in anxiety (Martin & Marsh, 2006; Martin *et al.*, 2010). It may be that students with ADHD who are academically buoyant are capable of regulating negative affect and arousal (i.e., anxiety) and that this leads to greater engagement relative to students who are poor self-regulators of affect and arousal.

Unique variance in academic buoyancy

An important purpose of including covariates was to better understand unique variance attributable to academic buoyancy. The dominant finding is that academic buoyancy effects are significant after controlling for these factors. In terms of moderation, including personality reduced academic buoyancy parameters more than including socio-demographic factors. Interestingly, however, the relationship between academic buoyancy and outcomes seemed more moderated for the non-ADHD group than for the ADHD group. For the students with ADHD, the relationship between academic buoyancy and outcomes seemed quite robust even after covariates were entered. Thus, in the case of students with ADHD, the main effect of academic buoyancy (controlling for covariates) was powerful, relative to students without ADHD. It is also worth noting that parent education predicted academic outcomes for students with ADHD more consistently than for students without. It may be the case that parents who themselves have successfully engaged with education and the education system may be in a good position to provide greater support to their child with ADHD and in so doing, help raise their child's achievement and engagement (Hattie, 2009).

Intervention promoting academic buoyancy

Prior consideration has been given to promoting students' academic buoyancy. Here, two lines of research are summarized. The first focused on what has been referred to as the '5Cs' of academic buoyancy (Martin & Marsh, 2006; Martin *et al.*, 2010): confidence (self-efficacy), coordination (planning), commitment (persistence), control, and composure (low anxiety). In cross-sectional (Martin & Marsh, 2006) and longitudinal studies (Martin *et al.*, 2010), these factors were found to significantly underpin students' academic buoyancy. The researchers further argued that these might be useful points for intervention – with a prior and well-established evidence based on interventions successfully addressing these (e.g., see Craven, Marsh & Debus, 1991; Hattie, 2009; Marsh, 2007; Martin, 2008; O'Mara, Marsh, Craven, & Debus, 2006). Interestingly, anxiety is a factor often found to be comorbid with ADHD (Barkley, 2006; Chandler, 2010). Hence, if prioritizing intervention on academic buoyancy for students with ADHD, anxiety may be an important factor to consider.

The second line of research sought to identify complementary contextual factors that promote academic buoyancy (Martin & Marsh, 2008a). Consistent with much prior research into risk (Masten, 2001), this research identified the importance of good teacher–student relationships for promoting academic buoyancy. Recent reviews have pointed to the need for teacher professional development (in-servicing) to assist disengaged and disadvantaged students. It is noteworthy that one of the key areas targeted for such professional development is improving teacher–student relationships (Becker & Luthar, 2002; Martin & Dowson, 2009). Teacher professional development on ADHD itself has demonstrated gains in knowledge about the condition as well as increased use of behaviour modification techniques in the classroom (Jones & Chronis-Tuscano, 2008).

Notably, however, academic buoyancy intervention for students with ADHD has not yet been investigated and so this is an area for future research.

Implications for theories and perspectives on ADHD

Given the cognitive and neuropsychological bases of ADHD (Chandler, 2010), it is perhaps unsurprising that much psychological research focuses on cognitive science and neuropsychological issues. Less attention has been paid to psycho-educational factors relevant to ADHD academic risk. The present study contributes to theory and perspectives on ADHD by suggesting concurrent considerations to psycho-educational factors such as academic buoyancy that clearly have yield. Most models of ADHD (e.g., behavioural inhibition models of Barkley, 2006 and Nigg, 2001; motivation inhibition model of Gray & McNaughton, 2003; attentional neural network model of Swanson *et al.*, 1998; working memory model of Rapport *et al.*, 2001; executive function model of Brown, 2005; the cognitive-energetic model of Sergeant, 2005) tend not to explicitly or saliently incorporate risk-relevant factors such as buoyancy into their formulations. Present findings suggest a need to more fully consider where psycho-educational risk-relevant factors such as academic buoyancy might place in a contemporary multidisciplinary model of ADHD.

Limitations, cautions and future directions

There are a number of potential limitations to consider when interpreting findings, and which suggest some caution and also some direction for future research. The first is that the data are self-reported. Given the intrapsychic nature of academic buoyancy, this has some justification; however, future research would do well to explore these issues using data derived from additional sources such as observing students' responses to everyday setback and the implications for their achievement and engagement. It was interesting that the reliability of academic buoyancy for students with ADHD was lower than for those without. Follow-up inspection of item-total correlations indicates that those with ADHD rated the item 'I don't let study stress get on top of me' somewhat lower than other items compared with non-ADHD students (who rated this item relatively higher than other items). Further work is required to better understand the nature of 'study stress' experienced by students with ADHD. Longitudinal data are also needed to support present claims about academic buoyancy and ADHD. Qualitative research might also lend insight into the precise mechanisms and processes relevant to academic buoyancy, achievement and engagement.

The role of academic buoyancy juxtaposed with cognate factors needs to be examined. Although Putwain *et al.* (2012) showed that academic buoyancy is empirically distinct from coping, research is needed to ascertain this is the case for students with ADHD and their educational outcomes. The present study was also unable to differentiate between students who are predominantly hyperactive, predominantly inattentive, or both ('combined type'). The combined type may represent a greater risk profile and may represent a degree and nature of risk that mitigates the yield of academic buoyancy. Related to this, the present study did not collect data on ADHD symptomatology and so could not rule out variance associated with this in the ADHD sample and the non-ADHD sample (there will be some with the disorder who do not have a formal diagnosis). Future research ought not simply rely on reports of ADHD diagnosis – instead, data on symptoms should also be collected. Also worth noting is that even within these ADHD types,

research has identified some aspects (e.g., aspects of impulsivity) that are in fact positively associated with achievement (Tymms & Merrell, 2011). Finally, a note of caution. A suggested focus on academic buoyancy for students with ADHD is not to preclude other evidence-based treatment modes (e.g., medication, clinical therapy; Barkley, 2006; Pliszka, 2009). The point of this study is to identify what factors educational practitioners and researchers may consider when seeking to assist academic outcomes in diverse classrooms – and thus, academic buoyancy alongside other treatment modes is a consideration with empirical merit.

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