“Sink or swim”: Buoyancy and coping in the test anxiety – academic performance relationship.

Abstract

This study explores the relationship between students' self-report levels of test anxiety, academic buoyancy (withstanding and successfully responding to routine school challenges and setbacks), coping processes and their achieved grades in high stakes national examinations at the end of compulsory schooling. The sample comprised 325 secondary school students in England. The findings suggest that students who reported greater worry, but lower tension, reported less use of effective pre-exam coping strategies and, in turn, lower examination scores. High academic buoyancy reduced the impact of high worry and low tension on pre-exam coping strategies and lower examination scores. The paper concludes that providing in-school training in coping strategies and how to withstand academic pressures may help to ameliorate the influence of performance-interfering worries, and potentially enhance performance among students inclined to worry about examinations.

Keywords: Test anxiety, coping, academic buoyancy, academic performance, examinations

"Sink or swim": Buoyancy and coping in the test anxiety and academic performance relationship.

Introduction

Test anxiety is a reliable and robust, if modest, predictor of lower academic performance (Chapell et al. 2005; Hembree, 1988). It is, therefore, of theoretical and practical importance to identify the factors that moderate the relationship between test anxiety and academic performance (in terms of altering the magnitude of this relationship), and the factors that may mediate it (account for or explain why test anxiety may led to lower performance outcomes). In this paper we report on a study that examined whether students' tendencies towards academic buoyancy moderated the inverse relationship between test anxiety and academic performance in high-stakes examinations, while controlling for their previous academic achievement. We also explored whether students' coping strategies played a mediational role in that relationship.

Our study offers methodological and conceptual strength by bringing the moderational and mediational analyses together in a single theoretical model. We also include a social component of test anxiety that hitherto has not been explored in great detail in previous studies. Although test anxiety, and its relation to performance, is relevant to all stages of education, we chose to focus on students aged 14-16 years following the programme of study leading to the General Certificate of Secondary Education (GCSE) examinations taken at the end of compulsory secondary education. These are arguably the prima facia high-stakes examinations taken by students in England, Wales and Northern Ireland. Results can, and do, influence access to post-compulsory education (vocational, technical and academic) and entry to the labour market (Denscombe, 2000). GCSE examination results exert a critical influence on students' subsequent life trajectory.

Test anxiety: The appraisal of examinations as threatening

Test anxiety refers to a situation-specific form of trait anxiety: that is, individual differences in the tendency to appraise performance-evaluative situations, such as an examination, as threatening (Spielberger & Vagg, 1995). Test anxiety is viewed as having distinct cognitive and affective-physiological components (Cassady, 2009; McDonald, 2001; Zeidner, 2007). The cognitive component includes worrisome thoughts concerning failure and the consequences of failure (referred to as 'worry' in the instrument used in this study), whereas the affective-physiological component refers to the person's perception of the somatic elements of anxiety. The instrument used in this study measures the general feelings of autonomic anxiety, referred to as 'tension', and does not include specific physiological markers of anxiety such as trembling muscles and a dry mouth (Sarason, 1984, 1988). Although these cognitive and affective-physiological elements correlate strongly, they show distinct factor loadings and patterns of relations with performance outcomes (e.g., Benson, Moulin-Julian, Schwarzer, Seipp, & El-Zahhar, 1992; Hembree, 1988) and are, therefore, best conceptualised as theoretically distinct, but empirically related.

Worry consistently shows small to moderate inverse relations with different types of academic performance and achievement, whereas tension (often referred to as emotionality in earlier studies) typically shows negligible or small inverse relations (e.g., Chapell et al., 2005; Hembree, 1988). The worry component of test anxiety is believed to occupy and interefere with working memory processing during testing (Owens, Stevenson, Norgate, & Hadwin, 2008; Owens, Stevenson, Hadwin, & Norgate, 2012; Owens, Stevenson, & Hadwin, & Norgate, 2014). More recently, a social component of test anxiety that reflects concerns about negative judgements from others (e.g., parents, teachers and peers) has been incorporated into the domain and measurement of test anxiety (e.g., Friedman & Bendas-Jacob, 1997; Lowe & Ang, 2011; Lowe, Ang, & Loke, 2011). The social component, referred to as 'social derogation' in the instrument used in this study is also negatively related to test performance

(Lowe et al., 2008). Given that theory and evidence linking anxiety and performance to working memory capacity (Derakshan & Eysenck, 2009; Eysenck, Derakshan, Santos, Calvo, 2007; Hadwin, Brogan & Stevenson, 2005) propose that it is the presence of interfering cognitions that impacts on working memory resources, rather than the content of those cognitions, it would seem plausible that social derogation would also interfere with and occupy working memory resources, and show a negative relation with performance.

Academic buoyancy: withstanding the pressure of testing

Academic buoyancy refers to individual differences in the ability to withstand and respond successfully to the types of challenges and setbacks associated with routine school life, such as competing deadlines, examination pressure and poor grades (Martin & Marsh, 2008a, 2009). It is predicted by the 5Cs: confidence, coordination, control, composure, and commitment (Martin, Colmar, Davey, & Marsh, 2010; Martin & Marsh, 2006). Academic buoyancy can be conceptually differentiated from the related construct of academic resiliency on three grounds (Martin & Marsh, 2009). First, resiliency refers to an adaptive response to severe and adverse challenges, such as school refusal and chronic underachievement. Academic buoyancy refers to an adaptive response to the more typical and everyday challenges posed by school, such as patches of poor performance or dips in motivation. Second, academic buoyancy consequently has greater relevance to the typical school population than academic resilience. Third, buoyancy is considered to be a proactive approach to managing academic challenges before they become major adversities whereas cademic resilience refers to a retroactive and more robust form of managing academic adversity.

Academic buoyancy correlates negatively with both general academic anxiety (Martin & Marsh, 2008a, 2008b; Martin et al., 2010) and test anxiety (Putwain et al., 2012), and has been shown to be empirically distinct from cognate constructs such as adaptive coping

(Martin & Marsh, 2009; Putwain et al., 2012) and academic resilience (Martin, 2013; also see Martin & Marsh, 2009, for a fuller discussion), and is relatively consistent across a range of different academic subjects (Malmberg, Hall, & Martin, 2013). Academic buoyancy therefore appears to offer an enabling and asset-focused approach to studying how 'everyday' resilience can help explain the cognitive-affective factors related to examination performance.

Academic buoyancy and test anxiety

One way that academic buoyancy can enable adaptive outcomes is by buffering against the effects of academic adversity (Martin & Marsh, 2009). The performance-interfering outcome associated with adverse reactions to examination pressure, test anxiety, and particularly the cognitive (worry) element, might therefore be ameliorated or reduced by greater academic buoyancy. On initial reading, the moderating influence of buoyancy might be seen as counter-intuitive. After all, the studies reviewed earlier include the finding that academic buoyancy is inversely related to general academic anxiety (Martin & Marsh, 2008a, 2008b, Martin et al., 2010) and test anxiety (Putwain et al., 2012). One might expect academically buoyant students to simply be less anxious. However, while this might appear be reasonable, cluster analyses of academic buoyancy and general academic anxiety (Martin & Marsh, 2006) and test anxiety (Putwain & Daly, 2013) suggest a more nuanced picture. In these studies, some students reporting mid to high levels of buoyancy also reported low anxiety, whereas other students with mid to high levels of buoyancy reported mid-high levels of anxiety. This implies that buoyancy and anxiety are, to some degree, independent and that they could therefore interact.

According to the self-referent executive processing (S-REF) model (Zeidner & Matthews, 2005) test anxiety is distributed across several processes. Some individuals might become highly test anxious because they have low competence beliefs or make negative attributions

of failure (see Putwain, Woods & Symes, 2010). It is likely that academic buoyancy would reduce test anxiety by protecting against low competence beliefs and negative attributions following failure. However, others might become test anxious due to other processes, such as metacognitive beliefs in the positive value of worry (see Matthews, Hillyard, & Campbell, 1999; O'Carroll & Fisher, 2013), that are unrelated to academic buoyancy. In such people, high academic buoyancy may play a different role. Rather than reducing test anxiety, per se, academic buoyancy would protect the highly test anxious person from the performance interfering aspects of test anxiety. Such persons can employ the emotional self-regulation strategies before or during testing (see Pekrun & Stephens, 2009; Tyson, Linnenbrink-Garcia, & Hill, 2009) to prevent a catastrophic reaction (see Putwain, 2009; Putwain, Connors et al., 2010). The academic performance of these students is likely to be improved when compared to those highly test anxious students who are not also highly academically buoyant.

Coping with examination pressure and test anxiety

Coping refers to the processes involved in an individual's response to a performance-evaluative situation, such a forthcoming examination (Lazarus & Folkman, 1985; Zeidner, 1995). Taxonomies of coping delineate between: (a) task- or problem-focused processes, which attempt to reduce the performance-evaluative threat; (b) emotion-focused processes, which focus on managing or changing thoughts and feelings concerning the performance-evaluative threat; and (c) avoidance processes, which refer to suppressing thoughts and feelings or distracting oneself (Carver, Scheier, & Weintrub, 1989; Endler & Parker, 1990). Task- and problem-focused processes are typically thought of as adaptive approaches to evaluative pressure because strategies, such as planning and suppression of competing activities, are focused on reducing evaluative threat (Matthews, Hillyard & Campbell., 1999; Zeidner, 1995). In contrast, emotion-focused and avoidance coping processes, such as mental

and behavioural disengagement, are less adaptive because attention is withdrawn or diverted from the evaluative threat.

Worry and tension components of test anxiety have been found to positively correlate with emotion-focused and avoidance coping (e.g., Blankstein, Flett, & Watson, 1992; Matthews et al., 1999; Putwain et al., 2012; Stöber, 2004; Zeidner, 1994, 1996). There are, however, inconsistent findings regarding task- and problem-focused strategies. Matthews et al. (1999) found a negative relation with worry and null relation with tension. Zeidner (1996) found positive relations with both worry and emotionality and others (e.g., Putwain, Connors, Symes & Douglas-Osborn, 2012; Stöber, 2004) have found null relations with both worry and tension. This inconsistency may be partly attributable to the use of: (a) measures of general coping strategies, rather than those specifically focused on coping with examination pressure; and (b) measures of trait coping strategies, which do not differentiate between the pre, during and post phases of testing (see Zeidner, 1995, 1996). Hence, an important design strategy of our study was to use a measure that focused specifically on coping with evaluative pressure in the phase critical to the present study: the pre-examination phase (cf. Stöber, 2004), rather than a measure containing elements that may be unrelated to coping with evaluative pressure or more relevant to coping during or after an examination (e.g., COPE Inventory; see Carver et al., 1989). Furthermore, research has yet to examine the relations between social derogation and coping processes.

The mediating role of coping processes in the test anxiety and academic performance relationship

As noted earlier, task- and problem-focused processes are positively related to educational achievement, whereas emotion-focused and avoidance processes are negatively related (e.g., MacCann, Fogarty, Zeidner, & Roberts, 2011; MacCann, Lipnevich, Burrus, & Roberts, 2012). It is proposed that a path can therefore be tracked from high test anxiety to lower

academic performance via students' coping processes. Prior research has examined how coping processes may mediate relations from other psychological constructs, such as emotional intelligence, to academic performance (e.g., MacCann et al., 2011) or how cognitive factors may mediate relations from test anxiety to academic performance (e.g., Sarason, 1984, 1988; Zatz & Chassin, 1983, 1985). Research has yet to test mediational models that link test anxiety to academic performance via coping processes.

Our study, therefore, extends the literature by testing the mediating role of coping processes and by using a measure of coping that focuses specifically on coping strategies most pertinent to the pre-examination phase (Stöber, 2004; Zeidner, 1996). Task-focus and orientation refers to problem-focused strategies and includes active coping, planning, suppression of competing activities and controlling threat by means of study. Avoidance corresponds to avoidance-focused coping and includes denial and mental disengagement. Social support is a form of emotion-focused coping that includes seeking emotional and instrumental support from others. While avoidance and social support coping may provide a short-term relief from negative emotions, they are not adaptive forms of coping because evaluative threat is not reduced and the chances of success are not enhanced. Task-focus and orientation, in contrast, is an adaptive form of coping because the evaluative threat is reduced and the chances of success are enhanced. In line with the S-REF model of test anxiety (Zeidner & Matthews, 2005) we expected that students with higher test anxiety (worry, tension and social derogation) would cope with evaluative pressure by making greater use of avoidance and social support coping and less use of task-focused coping.

An integrative model of buoyancy and coping in test anxiety

Within the test anxiety and academic performance relationship, academic buoyancy has been theorised as an individual difference variable that can buffer against performance debilitating consequences (a moderator). Coping has been theorised as the process to explain

performance debilitating consequences (a mediator). The moderating and mediating influences of academic buoyancy and coping, respectively, can be brought together in a single model to offer a more powerful theoretical and conceptual analysis. As such, we build on the work of McCann et al. (2011, 2012) and Mathews et al. (1999) to examine the mediating effect of coping processes, and the work of Martin and colleagues (e.g., Martin & Marsh, 2008a, 2009) to establish the moderating influence of academic buoyancy. In bringing both elements together, we can also establish whether any buoyancy-moderated relationship between test anxiety and examination performance is mediated via coping processes.

To address these questions coefficients were estimated for paths from test anxiety and academic buoyancy (including their interaction) to coping processes, and from coping processes to academic performance in a single structural equation model. Prior achievement was included to control for autoregressive relations from test anxiety, academic buoyancy and coping processes. The interactions between test anxiety and academic buoyancy on coping processes were followed with simple slope analyses to establish the strength of the relationship between test anxiety and coping and performance outcome, at different levels of academic buoyancy. Mediating effects of coping processes were established through calculating the indirect relationship between test anxiety and academic performance.

Aims of this study

The aims of this study were twoefold. First, we examined how academic buoyancy moderated the relationship between test anxiety and academic performance by buffering against performance-debilitating consequences. Second, we examined whether students' coping processes mediated the relations between test anxiety and academic performance, including any moderated effect of academic buoyancy. We expected that coping would mediate the test anxiety and performance relationship either through less use of task-focus and orientation, or through greater use of social support and avoidance coping. We also

anticipated that academic buoyancy would reduce the magnitude of the inverse relationship between test anxiety and performance outcomes, by more use of adaptive strategies or less use of maladaptive strategies. We included a social dimension of test anxiety ('social derogation') and expected it would show a similar direction of relations to the worry component of test anxiety.

Method

Participants

The 325 school students (male n = 142, female n = 183) who participated in this study were drawn from eight secondary schools in the North West of England. All students were following the GCSE programme of study. Secondary education in England covers Year 7, aged 11 years, to Year 11, aged 16 years. Students follow a programme of study in Years 10 and 11 (usually covering 8-11 subjects) leading to the GCSE qualification. Students were 14-16 years of age (M = 15.3, SD = 0.61). Although this sample might appear relatively small when compared to the total student cohort in participating schools, it was not due to non-responses or students not choosing to participate. A large number of students were entered by their schools for 'early entry' maths and English GCSE in the November of the school year that we collected data in and, therefore, these students were not eligible to participate.

The participating schools represented a convenience sample, but nevertheless demonstrated diversity in terms of socio-demographic profiles and attainment profiles of the student populations (judged on school average GCSE performance). The proportion of students eligible for free school meals (as a proxy indicator for low income) ranged from 4.5% to 33.2% with a sample mean of 14.3% (the average for all English schools at the time of data collection was 15.9%). The proportion of students for who English was not their native language ranged from 0.8% to 65.1% with a sample mean of 12.0% (the average for all English schools at the time of data collection was 12.3%). The proportion of students

attaining five GCSE passes or more ranged from 46.6% to 77.0% with a sample mean of 61.8% (the average for all English schools at the time of data collection was 59.4%). Missing data were present in a small number of test anxiety and academic buoyancy items (representing 0.8% of variables) and were imputed using expectation maximization in SPSS (Little's Test, $p > .05$). No missing data pertained to the measure of prior achievement or GCSE data.

Measures

Test anxiety was measured using a 19-item measure consisting of worry, tension, and social derogation scales. The worry (6 items) and tension (5 items) scales were taken from the *Revised Test Anxiety Scale* (Benson et al., 1992; Hagtvet & Benson, 1997). Exemplar items include 'During exams I find myself thinking about the consequences of failing' (worry) and 'I start feeling very uneasy just before getting an important exam grade back' (tension). The social derogation scale (8 items) was taken from the *Friedben Test Anxiety Scale* (Friedman & Bendas-Jacob, 1997) and an exemplar item is 'I am worried that if I fail an exam my parents will not like it'. Students responded on a 4-point scale (1 = Almost never, 2 = Sometimes, 3 = Often and 4 = Almost always). The reliability and factorial validity of data using these scales have been established in previous research, including with English students aged 14 to 16 years (e.g., Hagtvet & Benson, 1997; Putwain, Connors et al., 2010), and the internal reliability coefficients for the present study, as reported in Table 1, were acceptable (Cronbach's $\alpha > .70$).

The 4-item *Academic Buoyancy Scale* (Martin & Marsh, 2008) was used to measure the corresponding construct. Students responded to items (e.g., 'I think I'm good at dealing with schoolwork pressures') on 5-point scale (1 = Strongly disagree, 3 = Neither agree nor disagree, and 5 = Strongly agree). The reliability and factorial validity of data using this scale have been established in previous research, including 14 to 16 year-old English students

(Martin & Marsh, 2008, 2009; Putwain et al., 2012), and the internal reliability coefficient for the present study, reported in Table 1, was acceptable (Cronbach's $\alpha > .70$).

Students' approach to coping with the pressure and stress of GCSEs was measured using the 21-item *Coping with Pre-exam Anxiety and Uncertainty* (Stöber, 2004), in which instructions referred specifically to the GCSE context. This measure contained three scales: task orientation and preparation (e.g., 'I put other activities to one side and concentrate on the exams coming up'), social support (e.g., 'I talk to others to find out more about the exam') and avoidance (e.g., 'I go to the movies or watch TV so I don't think about the exams so much'). Participants responded on a 5-point scale (1 = Strongly disagree, 3 = Neither agree nor disagree, and 5 = Strongly agree). The reliability and factorial validity of data using these scales has been established in previous research including with English students aged 14 to 16 years (Stöber, 2004; Putwain et al., 2012) and the internal reliability coefficients for the present study, as reported in Table 1, were acceptable (Cronbach's $\alpha > .70$).

A measure of participants' prior achievement was gathered in the form of a mean score across National Curriculum Tests (NCTs) in English, math and science at the end of primary education (age 10 to 11 years; referred to as Key Stage 2) and represent the only high-stakes test data available prior to GCSE. The scores correspond to the National Curriculum Level attained, with a score of 1 denoting Level 2, 2 = Level 3, 3 = Level 4 (the target level for Year 6 pupils) and 4 = Level 5. A measure of participants' attainment after the study was also gathered consisting of participants' GCSE scores. GCSEs are graded using an 8-point grade scale (A* is the highest grade, A the next highest, B the next highest and so on), which was converted to a numerical score using the convention for educational research in the UK (A* = 8, A = 7, B = 6 and so forth, G = 1). Participants' mean aggregated GCSE score for English, math and science represented the outcome variable.

Procedure

Coping processes (the mediating variables) were measured in March which is the point in the academic year that the GCSE programme of teaching is completed and attention turns to examination preparation. Measures of test anxiety and academic buoyancy (the predictor and moderator variables) were measured six weeks prior to this (in February) as giving temporal precedence to predictors (and moderators of predictors), rather than measuring concurrently with mediators, aligns the design with the conceptual model (see Kenny, Kashy & Bolger, 1998). GCSE examinations were taken during May and June, approximately three to four months later. Questionnaires were completed at school during a period of the timetable typically used for administrative and pastoral purposes. They were administered by school staff who were provided with a standardised instruction and procedure sheet. This sheet emphasised that the questionnaires were part of a research project into student attitudes and feelings towards their GCSEs, that it was not a test, and that individual results were confidential.

All written and verbal instructions, and all questionnaire items, were presented in English. Questionnaire items were randomised within their respective instruments and presented to students in a counterbalanced order. Institutional consent was provided by the Head Teacher of each participating school and individual written consent by the participating student. Post-administration interviews with teachers and focus groups with students confirmed that questionnaires were administered by schools as requested. Passive parental consent was obtained by providing details about the study as part of a regular school newsletter sent to parents, who were invited to respond if they did not wish for their son or daughter to participate. Participating students were offered the opportunity to withdraw their data retrospectively, although none took up this offer. No incentives to participate were offered to students and participating schools were offered book vouchers.

Results

Descriptive statistics

Internal reliability coefficients for all the measures were acceptable (Cronbach's $\alpha \geq .70$) and skewness and kurtosis statistics were within acceptable limits (±1). Factor loadings from the measurement model, described more fully below, indicated no weakly loading items. No data transformations were considered necessary prior to subsequent analyses that required normally distributed data.

[Table 1 about here]

Analytic rationale

We tested three structural equation models (SEMs), beginning with a fully mediated moderational SEM. Coefficients and their standard errors were estimated for paths from the predictor variables (worry, tension, and social derogation) to the mediating variables (task-focus and orientation, social support, and avoidance coping). Given that we were also predicting a moderating role for academic buoyancy, coefficients and their standard errors were estimated for the main effect of academic buoyancy and interactions between the three test anxiety components (worry, tension, and social derogation) and academic buoyancy. Coefficients and their standard errors were estimated from the mediating variables (task-focus and orientation, social support, and avoidance coping) to the outcome variable mean GCSE score. The influence of prior achievement (NCT scores) on GCSE score was controlled for and gender was included in all models as a covariate. Second, we tested a partially mediated moderational SEM that included direct paths from test anxiety, academic buoyancy and the moderating influence of academic buoyancy on test anxiety to GCSE score. Third, we tested a direct SEM, with interactions, that omitted paths from test anxiety, academic buoyancy and the interaction between test anxiety and academic buoyancy (paths α_1, α_2 and α_3 in Figure 1) on coping processes.

Estimating the SEMs

All analyses were estimated in M*p*lus 7.1 (Muthén & Muthén, 2012) using maximum likelihood with robustness to non-normality and non-independence of observations. In order to account for the clustering of participants within schools we used the cluster and complex commands. This provides standard errors that adjust for clustering.M*p*lus 7.1 output files provide four model fit indices: The root mean square error of approximation (RMSEA), the Standardized Root Mean Square Residual (SRMR), the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI). A reasonable model fit is indicated by RMSEA/ SRMR of $\leq .10$ and CFI/ TLI values of $\geq .90$ and a good model fit indicated by RMSEA/ SRMR of $\leq .05$ and CFI/ TLI values of $\geq .95$ (Marsh, Hau, & Grayson, 2005; Marsh, Hau & Wen, 2004). Latent indicators for three interaction terms (worry x academic buoyancy, tension x academic buoyancy and social derogation x academic buoyancy) were created from mean-centred indicators for predictor (worry, tension and social derogation) and moderator (academic buoyancy) variables using the matched-pair strategy (see Marsh, Wen & Hau, 2004). The means of latent predictor and moderator variables were fixed to zero and the mean of the latent interaction variables fixed to equal the covariance of the predictor and moderator variables (see Marsh et al., 2004; Steinmetz, Davidov & Schmidt, 2011).

The complexity of our SEMs (three latent predictors, one latent moderator, three latent interactions, three latent mediators and one manifest covariarate) produced a large number of parameters to estimate relative to the sample size. In order to reduce the number of parameters in our model, we created three indicators for each latent variable by randomly parcelling items to create just-identified models. We are mindful that parcelling can be a controversial procedure used to artificially inflate model fit indices and hide model misspecification (Marsh, Lütdke, Nagengast, Morin & Davier, 2013). One of the few occasions that its use can be justified is when testing latent interactions (e.g., Nagengast, Marsh, Scalas, Xu & Trautwein, 2011). In order to demonstrate that our SEMs built out of

three indicators are not hiding a misspecified model we present the model fit indices for the measurement model of test anxiety, academic buoyancy and coping processes using original indicators and the revised measurement model built from three indicators. Although, as expected, a better fit was reported for the measurement model using three indicators per latent variable, $\chi^2(168) = 308.96$, $p < .001$, RMSEA = .051, SRMR = .049, CFI = .945, TLI = .931, a reasonable fit was reported for the measurement model built from original indicators ($\chi^2(681) = 872.31$, $p < .001$, RMSEA = .058, SRMR = .062, CFI = .943, TLI = .928). We are confident that our three-indicator measurement model does not hide any misspecification and is a sound basis on which to test our SEMs. Factor loadings reported in Table 1 are taken from the measurement model built from original items. Bivariate correlations, estimated from the revised measurement model built out of parcelled items, is reported in Table 2.

[Table 2 here]

Testing the three SEMs

Reasonable fitting models were found for the fully mediated moderational model, $\chi^2(456) = 770.34$, $p < .001$, RMSEA = .050, SRMR = .048, CFI = .930, TLI = .928, and the partially mediated moderational model, $\chi^2(449) = 735.34$, $p < .001$, RMSEA = .054, SRMR = .064, CFI = .928, TLI = .912). The direct model, with interactions, did not show a good model fit, $\chi^2(470) = 861.42$, $p < .001$, RMSEA = .054, SRMR = .064, CFI = .878, TLI = .855. The fully mediated moderational model showed a significantly better fit, $\Delta\chi^2(7) = 34.49$, $p < .001$, than the partially mediated moderational model and this was accepted as the final model.

Worry predicted less use of task-focus and orientation (B = -.249, SE = .086, p =.004, β = -.24) that was moderated by academic buoyancy (worry x academic buoyancy interaction: B =.239, SE = .104, p ==.008, β =.20). Tension predicted more use of task-focus and orientation (B = .221, SE = .092, p = 02, β = .18) that was moderated by academic buoyancy (tension x academic buoyancy interaction: B = ..199, SE = .074, p =.02, β = .20).

Worry predicted more use of avoidance coping (B = .137, SE = .067, p =.04, β = .16) and tension predicted less use of avoidance coping (B = -.224, SE = .063, p <.001, β = -.28). All other main effects and interactions between test anxiety and coping processes were non-significant (p*s* all >.05). GCSE score was predicted from task-focus and orientation (B = .239, SE = .077, p =.01, β = .18), social support (B = -.253, SE = .071, p = .004, β = -.21) and SAT score (B = 2.154, SE = .511, p <.001, β = .22). Avoidance did not predict GCSE score (p >.05). The proportion of variance explained in GCSE score was approximately 10.9% (R^2 = .109). Statistically significant paths are presented in Figure 2. For expediency we have omitted those latent variables (academic buoyancy, social derogation and the social derogation x academic buoyancy interaction) where no statistically significant paths were found.

[Figure 1 here]

The moderating role of academic buoyancy

Academic buoyancy was shown, in the fully mediated SEM, to moderate the relationships between worry and task-focus and orientation, and between tension and task-focus and orientation. To probe the interactions between worry and academic buoyancy, and between tension and acadmeic buoyancy, we conducted simple slope analyses (Aiken & West, 1991). When academic buoyancy was high (+1SD), the slope for worry was calculated as B = -.021, SE = .133, p = .80; and when academic buoyancy was low (-1SD) the slope was calculated as B = -.480, SE = .148, p = .001. A stronger negative relationship between worry and task-focus and orientation was found in low buoyancy students. This negative relationship wasweaker, and not statistically significant, in high buoyancy students. When academic buoyancy was high (+1SD), the slope for tension was calculated as B = .410, SE = .118, p = .001 and when academic buoyancy was low (-1SD) the slope was calculated as B = ..030, SE = .134, p = .80. The positive relationship between tension and task-focus and orientation was

stronger in high buoyancy students and weaker, and also not statistically significant, in low buoyancy students.

The mediating role of task-focus and orientation

The coefficients generated in the above analysis suggest that task-focus and orientation may play a mediating role between worry and GCSE score, and between tension and GCSE score, at different levels of academic buoyancy. Tests of mediation were conducted using the procedure outlined in MacKinnon, Fritz, Williams, and Lockwood (2007). This process involves first estimating the coefficient (and its standard error) of the indirect path ($\alpha_1\beta$) and then generating 95% confidence intervals (CIs) around this estimate using the PRODCLIN software; 95% CIs which do not cross zero indicate a significant mediated effect (at $p < .05$).

The indirect path from worry to GCSE score was significantly mediated by task-focus and orientation at low (-1SD), *B* = -.115, *SE* = .051, 95% CI [-.232, -.029], and mean, *B* = -.060, *SE* = .028 95% CI [-.125, -.013],academic buoyancy, as 95% confidence intervals did not cross zero. At high (+1SD) academic buoyancy, the indirect path from worry to GCSE score was not significantly mediated by task-focus and orientation, *B* = -.006, *SE* = .032, 95%CI [-.075, .062], as 95% confidence intervals crossed zero. Students reporting greater worry used less task-focus and orientation and had a lower GCSE score. This indirect relationship was stronger when academic buoyancy was low and weaker (and non-significant) when academic buoyancy was high. The indirect path from tension to GCSE score was also significantly mediated by task-focus and orientation at high (+1SD), *B* = .098, *SE* = .042, 95% CI [.026, .194], and mean, *B* = .051, *SE* = .028, 95% CI [.007, 118], academic buoyancy, as 95% confidence intervals did not cross zero. At low (-1SD) the indirect path from tension to GCSE score was not significantly mediated by task-focus and orientation, *B* = .030, *SE* = .134, 95% CIs [-.060, .078], as 95% confidence intervals crossed zero.Students reporting greater tension used more task-focus and orientation and had a lower

GCSE score. This indirect relationship was stronger when academic buoyancy was high and weaker when academic buoyancy was low.

Discussion

The aim of this study was to test a model in which academic buoyancy was hypothesised to moderate, and coping processes were hypothesised to mediate, the relations between test anxiety and academic performance. While controlling for prior academic achievement and using a model of test anxiety that included a social component (social derogation), we found partial support for our model. Academic buoyancy moderated the relationship between the worry and tension components of test anxiety and task-focus and orientation. The inverse relation between worry and task-focus and orientation was weaker in highly buoyant students. The positive relation between tension and task-focus and orientation was stronger in highly buoyancy students. Greater use of task-focus and orientation predicted, in turn, a higher GCSE score. Task-focus and orientation mediated the indirect relations between the worry and tension components of test anxiety and academic performance. Higher worry led to less use of task-focus and orientation and, consequently, lower academic performance. For low buoyancy students the negative indirect effect of higher worry was stronger than for highly buoyant students. Somewhat surprisingly, higher tension led to more use of task-focus and orientation and consequently higher academic performance. For highly buoyant students the positive indirect effect of higher tension was stronger than for low buoyancy students.

The first aim of our study was to examine whether academic buoyancy moderated the relationship between test anxiety and academic performance. Our results showed that buoyancy did indeed play a moderating role. The indirect negative relationship from worry to GSCE score was weakened, and the positive indirect relationship with tension was strengthened, with higher academic buoyancy. One advantage of our design was to control for prior achievement and, thus, the moderating influence of academic buoyancy cannot be

simply limited to those students with higher achievement at an earlier stage of education. These findings support the role of academic buoyancy as an enabling influence on academic achievement (Martin & Marsh, 2008a, 2009) and provide evidence for how highly buoyant students may be able to withstand examination pressures more successfully. As currently conceptualised, academic buoyancy may provide this 'buffering' role against worry before or during examinations. For instance, highly test anxious, but academically buoyant, students may still become anxious at the outset of an examination, yet they are able to employ strategies that allow anxiety to subside or prevent a catastrophic reaction (see Pekrun & Stephens, 2009; Putwain, 2009; Tyson et al., 2009). Alternatively, as a 'frontline' approach to dealing with academic adversity (Martin & Marsh, 2009), highly test anxious, but academically buoyant, students may worry about failure during an examination, but employ strategies (such as over-learning) that are less susceptible to anxiety-interfering cognitions that may arise during the actual examination. Although our findings cannot support conclusively one explanation over the other we believe that the evidence leans towards the latter explanation as we discuss next.

The second aim of our study was to incorporate the mediating role of coping, using a measure which focused specifically on the examination preparation phase. Higher use of task-focus and orientation and less social support resulted in an improved performance in the SEM controlling for prior achievement, test anxiety and buoyancy. These findings are in line with those of MacCann et al. (2011, 2012) who also found, when controlling for shared variance between different coping processes, that problem-focused coping was a positive predictor of academic performance. As noted earlier, task-focus and orientation refers to those problem-focused approaches to coping utilised in the pre-examination phase. In the SEMs, worry was found to be related to greater use of avoidance coping strategies, and tension to less use of avoidance coping, but as avoidance coping was not significantly related

to academic performance, the mediating role of coping was limited to that of task-focus and orientation. Similarly, social support was related to lower academic performance, but was unrelated to test anxiety.

The relationship between higher worry and lower academic performance was mediated by a reduced task-focus and orientation in the examination preparation phase. The relationship between higher tension and higher academic performance was mediated by a greater task-focus and orientation in the examination preparation phase. The buffering role of academic buoyancy was mediated through task-focus and orientation. This finding may imply, as noted above, that academic buoyancy was more likely to buffer against worry before rather than during an examination. It is of course possible that academic buoyancy moderated worry during examinations, but via a process which we have not measured here.

One of the more surprising and intriguing findings was that tension was also mediated by task-focus and orientation, but in the opposite direction to that of worry. Higher tension resulted in a greater use of task-focus and orientation, which in turn resulted in higher academic performance. Furthermore, tension resulted in less use of avoidance coping, although this was unrelated to academic performance. These findings are in contrast to earlier research showing that emotionality (comprising of tension and specific physiological symptoms of anxiety) correlates positively with avoidance and emotion-focused coping (Zeidner, 1994, 1996). It may be that tension, which is not directly equivalent to emotionality as it does not include the specific bodily symptoms of test anxiety, may be the activating impulse to engage with adaptive forms of coping (see Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011) once beliefs concerning failure are controlled. We would draw attention to the findings of Ciani, Easter, Summers, and Posada (2009) along with earlier research (e.g., Holroyd & Appel, 1980; Holroyd, Westbrook, Wolf, & Badhorn, 1978) suggesting that the perception of autonomic arousal need not necessarily be associated with negative outcomes.

It is only when autonomic arousal is conjoined with a cognitive labelling of the experience as anxiety that it becomes pejorative. Furthermore, adolescent students have described how some anxiety prior to examinations can be helpful in focusing attention, motivation, and engagement with preparatory activities (Chamberlain, Daly, & Spalding, 2011; also see Lowe et al., 2008, for a discussion of facilitating anxiety). Such findings are consistent with greater use of task-focus and orientation and less use of avoidance coping in the pre-examination phase.

An additional novel aspect of our study was to include a social dimension to test anxiety, that of social derogation. Small bivariate correlations have been reported between the social component of test anxiety and performance in low-stakes reading and spelling tests (Lowe et al., 2008). However, research has yet to examine relations with performance on high-stakes tests. The bivariate correlations reported here suggest that social derogation, as with other components of test anxiety, shows an inverse relation with academic performance. As anticipated, this relation was smaller than that reported for the worry component of test anxiety and more similar to that of the tension component.

However the SEMs showed that, when prior achievement and the shared variance between different test anxiety components were controlled for, social derogation was not significantly related to GCSE score either directly or indirectly, via the mediating coping processes. The worry and social derogation components of test anxiety may share a common element, that is, expectations and beliefs about failure. It is possible that the performance-interfering elements of such beliefs are more adequately represented by the worry component than the social derogation construct. Social derogation added no additional variance to the relationship with academic performance that had not already been accounted for by worry. These findings may raise doubts as to the potential usefulness of social derogation within the domain of test anxiety. However, there is more to test anxiety than simply predicting achievement and

performance outcomes, and the social element of test anxiety may show important and illuminative relations with other outcomes, such as relationships with parents and teachers (e.g., Putwain et al., 2010; Shadach & Ganor-Miller, 2013). Indeed, academic stresses can be seen to arise from combinations of expectations and pressures from oneself and one's teachers and parents (Ang & Huan, 2006).

As a relatively recent academic construct, findings are beginning to emerge showing how academic buoyancy may be differentiated from other, related constructs, such as that of adapting coping and academic resiliency. Our study offers further insights into the discriminative validity of academic buoyancy and the first replication of relations between academic buoyancy and coping strategies. The first study to examine relations between academic buoyancy and coping processes (Putwain et al., 2012) reported no significant relations between the two constructs. These findings are replicated in our study and (see Table 2) supports the conclusion that academic buoyancy is distinct from general adaptive coping processes.

Study limitations

As with any study relying on self-report data, there is always a danger of self-presentation biases, which may contribute to an over- or underestimation of relations and generally add to measurement error. The components of test anxiety included in this study (worry, the *perception* of somatic arousal and social fears) are private, subjective experiences and some mode of self-report is therefore required to access them. The same position applies to academic buoyancy, where the critical components are *beliefs* that one can withstand pressure, bounce back from failure, and so on. Dot-probe and implicit association tests have been used to assess trait anxiety (e.g., Cilser & Koster, 2010; Egloff & Schmuckle, 2004) and could possibly be adapted to measure test anxiety (see Putwain, Langdale, Woods, & Nicholson, 2012) or to triangulate with self-reports.

At present, however, there are few alternatives to using self-report measures in this context. While it may be possible for future research to include teacher and student reports of task preparatory approaches, combined with classroom observations to increase the breadth of data collected, this approach may contain other biases. It has long been acknowledged by engagement researchers, for example, that teachers and external observers may rely too heavily on observable (behavioural) indicators of engagement at the expense of non-observable (cognitive and affective) aspects (e.g., Appleton, Christenson, & Furlong, 2008; Reschly & Christenson, 2012). Nonetheless, different sources of data for test anxiety, acadmeic buoyancy and coping could be incorporated and assessed using a multi-trait, multi-method approach to disentangle variance attributable to the methods used from variance that is representative of the constructs under study.

Although we have followed best practice and separated our measures temporally to facilitate the mediational analysis and control for prior achievement (see Kenny et al., 1998), coefficients for the paths we have identified here cannot be attributed causal status. While we included a prior measure of educational achievement, so that paths from test anxiety and coping processes to GCSE achievement cannot be attributed to autoregressive relations, we cannot make the same claim for coping processes. It may be the case that the paths from test anxiety to coping processes reflect a prior tendency to prepare for examinations in a particular way. Future research may wish to consider a more robust design to collect measures of test anxiety, academic buoyancy, and coping processes at all measurement points. This would allow all autoregressive relations between test anxiety, academic buoyancy and coping processes to be controlled for.

Educational applications

Our findings have two implications for educational practice. First, test anxiety interventions tend to focus on reducing anxiety and to improving academic performance

directly through combinations of relaxation with cognitive-behavioural approaches, study skills and test-taking training (e.g., Ergene, 2003; Gregor, 2005; von der Embse, Barterian, & Segool, 2013). Our results, however, suggest that training students in academic buoyancy could be an effective way of ameliorating the performance-interfering influence of worry. Martin and Marsh (2006) identify several ways in which this could be done by increasing the 5 Cs of buoyancy. These include: (a) individualising work to facilitate academic self-efficacy; (b) showing students how to set goals and work towards them in order to facilitate planning and persistence; (c) using feedback to reinforce the link between effort and academic outcomes to reduce uncertain control; and (d) using feedback to illustrate how mistakes do not indicate low ability, but are diagnostic for future success, to reduce a fear of failure. Furthermore, there are several well-established programmes designed to promote academic resilience (Brunwasser, Gillham, & Kim, 2009) that could be adapted to the more typical and routine events captured in the domain of academic buoyancy.

Second, teachers and educational instructors can encourage students to adopt a task-focus and orientation approach to examination preparation by employing planning and study strategies. Based on evaluations of programmes designed to build educational resiliency (e.g., Challen, Machin, Noden, & West, 2011), one would expect successful attempts to build and develop buoyancy through the 5Cs to require long-term investment. By comparison, instructing and supporting students in the use of coping processes may be easier to implement in the short-term.

Conclusion

Our findings add to the extant literature by showing how academic buoyancy is an important variable in the test anxiety process. Although it may serve to reduce threat appraisals, we critically found that it may buffer against the performance debilitating aspects of test anxiety and may therefore offer a new approach for test anxiety interventions. We also

included a social dimension to our model of test anxiety, social derogation. This was not related to coping or academic performance (when controlling for prior achievement and shared variance between test anxiety components). However, it may have more substantive and theoretical relevance when considering social outcomes such as relations with teachers, parents, and peers. Although coping has long been researched in the test anxiety literature, we offer evidence that task-focus and orientation can play a mediating role between the worry and tension components of test anxiety and academic performance.

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Table 1

Descriptive statistics for test anxiety, academic buoyancy, NCT and GCSE scores (n = 325).

	Range	*M (SD)*	α	Skew	Kurtosis	Factor Loadings
Worry	1–4	2.34 (0.66)	.76	.30	-.51	.65 - .84
Tension	1–4	2.66 (0.80)	.83	-.15	-.89	.63 - .79
Social derogation	1–4	2.01 (0.73)	.88	.69	-.19	.80 - .86
Academic buoyancy	1–5	3.10 (0.89)	.76	-.18	-.47	.58 - .70
Task-focus and orientation	1–5	3.33 (0.78)	.86	-.26	.05	.60 - .76
Social support	1–5	2.83 (0.78)	.83	-.09	-.18	.49 - .87
Avoidance	1–5	2.81 (0.70)	.77	.01	.14	.56 - .72
NCT score	1–4	3.35 (0.53)	—	-.70	.13	—
GCSE score	1–8	5.24 (1.24)	—	-.19	.11	—

Table 2

Latent variable bivariate correlations for test anxiety, academic buoyancy, NCT and GCSE score.

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Worry	—	.79***	.66***	-.64***	-.12*	.08	.17*	-.15***	-.28***
2. Tension		—	.53***	-.64***	.17*	.07	.15*	-.10*	-.13*
3. Social derogation			—	-.52***	-.06	.07	.02	-.10*	-.14*
4. Academic buoyancy				—	-.07	-.11	.07	.11*	.10
5. Task focus & orientation					—	.35***	-.22***	-.07	.12*
6. Social support						—	.18***	-.12*	-.l4*
7. Avoidance							—	-.06	-.06
8. NCT score								—	.22***
9. GCSE score									—

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

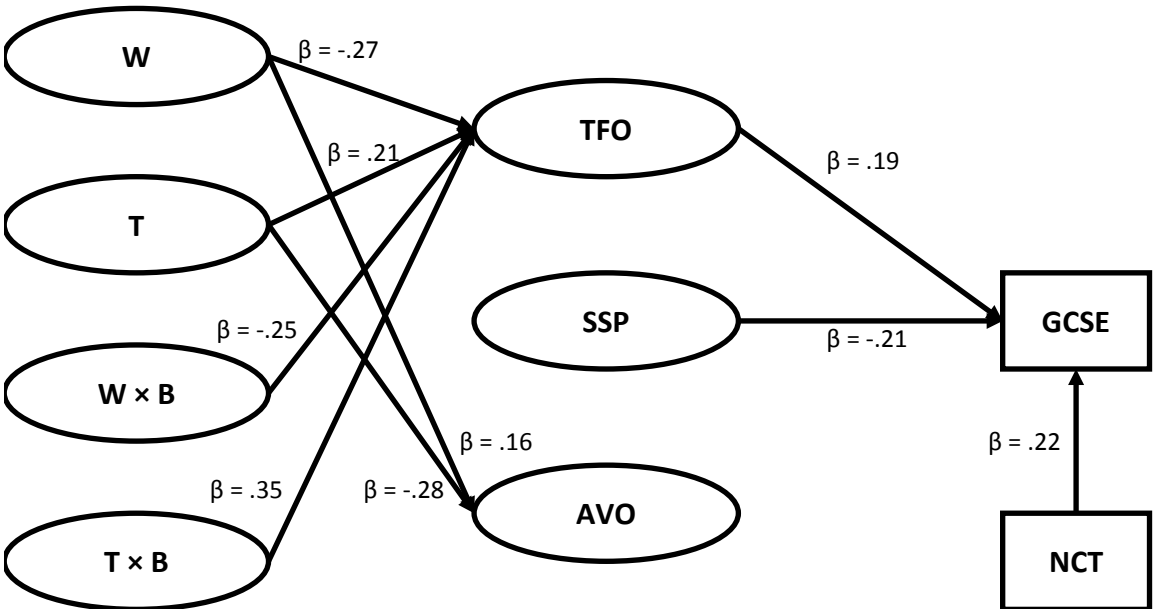

Figure 1. Path diagram reporting the significant standardised beta coefficients from the fully mediated moderational model (Note. W = Worry, T = Tension, W×B = the interaction between worry and academic buoyancy, T×B = the interaction between tension and academic buoyancy, TFO = Task-focus and orientation, SSP = Social support and AVO = avoidance, NCT = NCT score and GCSE = GCSE score and).