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Is Perceived Control a Critical Factor in Understanding the Negative Relationship Between Cognitive Test Anxiety and Examination Performance?

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Abstract

A well established finding is that the cognitive component of test anxiety (worry) is negatively related to examination performance. The present study examined how three self-beliefs (academic buoyancy, perceived control, and test competence) moderated the strength of the relationship between worry and examination performance in a sample of 270 final year secondary school students. Participants completed self-reports of academic buoyancy, perceived control, test competence, and cognitive test anxiety, that were matched with examination grades in English, science, and mathematics. Results showed an interaction between worry and perceived control. Students with higher perceived control performed better at low levels of worry. As worry increased, the differential advantage offered by higher perceived control diminished. At high levels of worry control made little difference to examination performance. Interventions designed to reduce worry may not necessarily improve examination performance unless they also target improved control.

Keywords: Test anxiety, academic buoyancy, perceived control, test competence, examination performance

Is Perceived Control a Critical Factor in Understanding the Negative Relationship Between Cognitive Test Anxiety and Examination Performance?

A robust finding is that test anxiety, or to be more precise, the cognitive aspect of test anxiety is associated with lower test and examination performance (e.g., Chapell et al. 2005; Hembree, 1988). Examination performance may have profound consequences for students and teachers. For students, examination performance can influence access to the job market and future educational opportunities (e.g., Bradley & Lenton, 2007; Heath, Rothon, & Kilpi, 2008). For teachers, accountability systems use student examination performance as measures of teaching quality (Perryman, 2006; von der Embse, Schoemann, Kilgus, Wicoff, & Bowler, 2016) in the US (e.g., Common Core State Standards Initiative) and internationally (OECD, 2013). Identifying those factors that exacerbate or ameliorate the relationship between test anxiety and examination performance is, therefore, of practical and theoretical value. Such findings can be used to inform the development of intervention to minimize influence of test anxiety. In this study we examined three self-belief constructs (academic buoyancy, perceived control, and test competence) that were likely to influence a student's approach to, and performance in, examinations, and whether those moderated the magnitude of the relationship between cognitive test anxiety and examination performance.

Defining the Key Constructs

Test anxiety. Test anxiety refers to individual differences in an enduring, trait-like, tendency to appraise performance situations (like examinations) as threatening (Spielberger & Vagg, 1995). Persons high in test anxiety tend to anticipate failure, freeze in performance situations, and have difficulty in concentrating in test settings (Zeidner, 2007, 2014). It has been widely accepted for some time that test anxiety is a multidimensional phenomenon that includes cognitive and affective-physiological elements (e.g., Lowe et al., 2008; Segool, von der Embse, Mata, & Gallant, 2014). The cognitive element, often referred to as worry, refers

to negative catastrophic thoughts concerning failure, and its consequences; the affective-physiological element refers to feelings of tension and accompanying physiological manifestations of anxiety such as an increased heart-rate.

Academic buoyancy. Academic buoyancy is the perceived capacity of a student to withstand the pressures and challenges that are typical for school (e.g., competing deadlines, examination pressure, and poor grades) and respond positively to experiences of failure (Martin & Marsh, 2008). Unlike resiliency, which refers to responses to severe adversity (e.g., school refusal and chronic bullying), academic buoyancy has greater relevance to students facing every day stressors (Martin & Marsh, 2008, Martin, 2013). Indeed, academic buoyancy has been described as an 'everyday' form of resilience (Martin & Marsh, 2009).

Perceived control. Perceived control refers to the degree of certainty a student has about how to achieve good marks or avoid doing poorly (Connell, 1985; Martin, 2007). The locus of perceived control is one of the three key elements of the attributional theory of motivation (Graham & Taylor, 2016; Weiner, 2010); the other two being stability and controllability. A student with high perceived control is able to see and understand the link between their effort or strategy and the academic outcome whereas those low in perceived control are at risk of helplessness or self-sabotage, such as a strategic withdrawal of effort (Martin, 2001a, 2001b). Accordingly, perceived control influences how students prepare for and perform in tests and examinations (Martin, 2010).

Test competence. Test competence is the belief that one has the capacity to perform well on tests and examinations (Topman, Kleijn, van der Ploeg, & Masset, 1992). Students may hold competence beliefs about their academic subject knowledge, subject-specific academic self-concept or self-efficacy in mathematics, English, science, and so on, but this does not necessarily mean that those students will be confident about demonstrating that knowledge under test or examination conditions (Putwain, Woods, & Symes, 2010). In

addition to subject knowledge, successful examination performance requires students to be able to work quickly under limited time conditions and to be able to successfully understand and respond to assessment demands (Kleijn, van der Ploeg & Topman, 1994). Students with high test competence believe that they have exam and test-taking skills to demonstrate their knowledge under test conditions.

Test Anxiety, Self-beliefs, and Examination Performance

A small to moderate negative correlation has been found between cognitive test anxiety and performance on tests and examinations (e.g., Cassady & Johnson, 2002; Putwain, 2008). This has been attributed to anxiety interfering with working memory capacity and function (e.g., Owens, Stevenson, Norgate, & Hadwin, 2008; Putwain, Shah, & Lewis, 2014). Importantly, this relationship remains when controlling for the influence of prior examination performance (e.g., Putwain, Daly, Chamberlain, & Saddredini, 2016). That is, a change in test anxiety precedes and predicts changes in subsequent examination performance that is not simply an artifact of prior low attainment. As the relationship between the affective-physiological component of test anxiety is typically negligible (e.g., Hembree, 1988; Seip, 1991), we focused solely on the cognitive aspect of test anxiety as being the component most germane to the focus of this study (the relationship with examination performance).

Self-beliefs also show small to moderate positive correlations with examination performance. Higher test and examination performance is related to higher academic buoyancy (Martin, 2014; Putwain, Chamberlain, Daly, & Saddredini, 2015), higher perceived control (Collie, Martin, Malmberg, Hall, & Ginns, 2015; Leim & Martin, 2012), and higher test competence (Kleijn et al., 1994; Birenbaum & Pinku, 1997). Higher academic buoyancy, perceived control, and test competence, are all implicated in a network of adaptive cognition, emotion, motivation, behavior, and self-regulation (e.g., effort, persistence, effective use of

cognitive strategies, and so on) that are all likely to result in better examination performance (Kitsantas & Cleary, 2016; Martin, 2007).

Might Self-beliefs Moderate the Test Anxiety and Examination Performance Relationship?

A moderating variable is one that changes the magnitude and/ or direction of the relationship between two other variables (Fairchild & McQullin, 2010). Studies have examined the moderating role of demographics (e.g., age, gender), task characteristics (e.g., difficulty, administration), and situational factors (e.g., feedback, time pressure) on the relationship between cognitive test anxiety and examination performance (for reviews of moderating factors see Hembree, 1988; Zeidner, 1998). No studies, to date, have examined how self-beliefs might interact with cognitive test anxiety to predict examination performance. Two related studies, however, suggest that self-beliefs might be a plausible candidate. Putwain et al. (2016) reported an interaction between cognitive test anxiety and academic buoyancy on task-focused coping; the negative correlation was amplified in low buoyancy students. Putwain and Daly (2013) used a person-centered approach to show distinct clusters of students with similar levels of test anxiety, but differing levels of academic buoyancy and examination scores.

Models of test anxiety propose that competence beliefs play an important role in determining the degree and severity of anxiety (e.g., Segool et al., 2014; Zeidner & Matthews, 2005). All things being equal, a student with low competence beliefs, and anticipates failure, is more likely to experience a high degree of test anxiety. Empirical evidence bears out this prediction for academic buoyancy (Putwain, Connors, Symes, & Douglas-Osborn, 2012), perceived control (Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011; Pekrun, Goetz, Perry, Kramer, Hochstadt, & Molfenter, 2004), and test competence (Preiss, Gayle, & Allen, 2006; Putwain et al., 2010). Furthermore, negative correlations have

also been reported between general academic anxiety and academic buoyancy/ perceived control (Martin & Marsh, 2008; Martin, Colmar, Davey, & Marsh, 2010). Given that lower academic buoyancy, perceived control, and test competence, are all implicated as antecedents on test anxiety, why might these constructs also interact with test anxiety?

According to theory, test anxiety is a multi-causal phenomenon that will be influenced by many factors other than self-beliefs. Other factors include metacognition, coping strategies, and motivation (Zeidner & Matthews, 2005), study strategies (Preiss et al., 2007; Lowe et al., 2008), perceived test importance (Segool et al., 2014), and attentional bias (Putwain, Langdale, Woods, & Nicholson, 2011). Thus it is possible that some students will become highly test anxious for reasons unrelated to their academic buoyancy, perceived control, or test competence. For instance, if a student held a strong metacognitive belief that worry was an effective coping strategy, they might still become highly test anxious by ruminating on the consequences of failure, even though they believe themselves to be buoyant, in control, and good at taking examinations (see Matthews, Hillyard, & Campbell, 1999; O'Carroll & Fisher, 2013).

Notwithstanding the possibility that self-beliefs might contribute to test anxiety, or that over time test anxiety might also impact on self-beliefs, cognitive test anxiety would also be expected to interact with self-beliefs. That is, self-beliefs might alter the magnitude of the cognitive test anxiety and examination performance relationship. At present there is no empirical evidence for how self-beliefs might moderate the cognitive test anxiety and performance relationship. We address this gap in the literature in the present study by examining how academic buoyancy, perceived control, and test competence, might interact with cognitive test anxiety to predict examination performance. Broadly speaking, we would anticipate that stronger self-beliefs (i.e., higher academic buoyancy, perceived control, or test competence) would buffer performance against the negative impact of test anxiety. That is,

the performance of high worry students who believe that they can withstand the pressure of testing (high buoyancy), are certain how to attain good marks (high perceived control), or believe they can demonstrate their knowledge under examination conditions (high test competence), might be less adversely influenced.

Research Questions and Hypotheses of the Present Study

This study set out to address the question of whether self-beliefs (academic buoyancy, perceived control, and test competence) moderated the negative relationship between cognitive test anxiety and examination performance. As demographic variables (gender, age, and socio-economic background) have all been shown to account for a small proportion of variance in test anxiety scores (e.g., Putwain, 2007, Putwain & Daly, 2014) these were included as covariates. The following hypotheses were tested:

H_1: Self-beliefs (academic buoyancy, perceived control, and test competence) will negatively correlate with cognitive test anxiety.

H_2: Self-beliefs (academic buoyancy, perceived control, and test competence) will positively correlate, and cognitive test anxiety negatively correlate, with examination performance.

H_3: Self-beliefs (academic buoyancy, perceived control, and test competence) will moderate the negative correlation between cognitive test anxiety and examination performance.

Method

Sample and Procedure

Data were collected from 270 participants (male n = 88, female n = 178, and 4 not reported) from two English secondary schools. Students were in their final year of secondary schooling (Year 11), following the eighteen-month programmed of study leading to the secondary school leaving qualification (the General Certificate of Secondary Education: GCSE), and had a mean age of 15.01 years (SD = .89). The sample was ethnically heterogeneous; typical for urban metropolitan areas of England (Asian n = 128, black n = 35,

white *n* = 62, other *n* = 30, mixed heritage *n* = 15). Student eligibility for free school meals (FSM) was used as a proxy for low income (*n* = 34 eligible). A small proportion of the sample data were missing (0.9%) and these were imputed using the expectation maximization algorithm in SPSS. This approach is preferable to listwise deletion or replacing missing values with the scale mean which may distort the distribution (Graham, 2012).

Self-report data were collected early on in the first term of the school year (October). A questionnaire pack was completed by students in a period of the timetable used for administrative purposes so not to interfere with routine lessons. Questionnaires were administered by a trained teacher who followed a standardized script that included information about the purpose of the study, ethical aspects (withdrawal, consent, and so on), and that the questionnaires did not constitute a 'test'). The pack included an information sheet, consent sheet, test anxiety questionnaire, and self-belief questionnaire. The presentational order of the test anxiety and self-belief questionnaires was counterbalanced and the ordering of test anxiety and self-belief items, within each questionnaire, were randomly determined. Written permission to collect data was provided by the school Head Teacher and as well as the individual participants. Participants were not offered any incentives.

Grades in English, mathematics, and science, were taken from examinations sat Approx 6 weeks later in December. Actual GCSE examinations were scheduled in May and June of the following year. Examinations for some subjects, including English, mathematics, and science, were offered at one of two levels of difficulty (intermediate or higher). At the point our study was conducted, GCSE examination scores were graded using an eight-letter system using a criterion-referenced approach against grade descriptors provided by the Office for Qualifications and Examinations Regulation (e.g., Office of Qualifications and Examinations Regulation, 2011). The highest grade was a Grade A*, followed by Grade A,

Grade B, and so on down to a grade G[1]. Students who are entered for the intermediate tier can gain a maximum grade of C (the minimum pass grade) whereas students who are entered for the higher tier can gain a maximum grade of A*.

It is common practice in English schools to schedule at least one round of mock GCSE examinations. The examination grades used in this study were taken from one such set of mock examinations. Mock examinations were taken under formal conditions designed to replicate those taken for actual GCSE examinations (i.e., examinations are taken in silence by the whole year cohort in the examination hall seated in rows) rather than as informal class tests. The purpose of mock examination results was to gauge likely GCSE results, inform final decisions about the tier of entry a student was entered for, and the level of support and/ or intervention offered to students in their final six months of secondary school for students who are not reaching target grades. GCSE results determine, for students, future post-compulsory educational opportunities and job prospects (Onion, 2004; Roberts, 2004). For teachers, GCSE results are used in performance review and can determine pay increments and promotional opportunities. GCSE results are also used to rank order schools for local districts based on GCSE grades and the school inspectorate can recommend school management is replaced or even that a school is closed where GCSE targets are repeatedly missed (Perryman, 2005, 2006). Due to the conditions under which mock examinations are taken, their proximity to actual GCSE examinations, and the use of results to indicate likely GCSE outcomes, although the stakes were not as high as for actual GCSE examinations, we would argue that the mock GCSE sufficiently represented a high-stakes examination

Measures

[1] From 2016 onwards, lettered grades will be gradually replaced with numerical grades 1-9 (Office of Qualifications and Examinations Regulation, 2016).

Cognitive test anxiety. Cognitive test anxiety was measured using the six-item worry scale from the *Revised Test Anxiety Scale* (Hagtvet & Benson, 1997). Participants responded to items (e.g., 'During exams I find myself thinking about the consequences of failing') on a scale of 1 – 4 (1 = Almost never, 2 = Sometimes, 3 = Often, and 4 = Always). Data collected using this scale has shown internal consistency and validity (construct, predictive, and discriminatory) in samples of secondary school students, including those in England (e.g., Putwain & Daly, 2014; Putwain, Woods, & Symes, 2010). A good level of internal consistency was shown in the present study (Cronbach's $\alpha = .78$). Cronbach's $\alpha = .70$ is the minimum acceptable value for internal consistency (Cortina, 1993).

Academic buoyancy. Academic buoyancy was measured using the four-item *Academic Buoyancy Scale* (Martin & Marsh, 2008). Participants responded to items (e.g., 'I don't let study stress get on top of me') on scale of 1 – 5 (1 = Strongly disagree, 3 = Neither agree nor disagree, and 5 = Strongly agree). Previous research using samples of secondary school students have shown data collected using this scale to demonstrate validity (construct, predictive, and discriminant) and internal consistency (e.g., Malmberg, Hall, & Martin, 2013; Martin, 2013). Internal consistency, in the present study, was good (Cronbach's $\alpha = .78$).

Perceived control. Perceived control was measured using the four uncertain control items from the high-school version of the *Motivation and Engagement Scale* (Martin, 2007). Participants responded to items (e.g., 'When I get a good mark I'm often not sure how I'm going to get that mark again') on scale of 1 – 5 (1 = Strongly disagree, 3 = Neither agree nor disagree, and 5 = Strongly agree). Item scoring was reversed such that a higher score represented higher perceived control. Extensive research has documented the psychometric properties of data collected using the high-school version of this scale (e.g., Green, Martin, & Marsh, 2007; Plenty & Heubeck, 2013). In the present study the internal consistency was adequate (Cronbach's $\alpha = .70$).

Test competence. Test competence was measured using four items from the *Study Management and Academic Results Test* (Topman et al., 1992) adapted by Putwain et al. (2010) to refer to GCSE examinations rather than tests in general. Participants responded to items (e.g., 'I can easily manage the amount of material taught for the GCSE exams) on scale of 1 – 5 (1 = Strongly disagree, 3 = Neither agree nor disagree, and 5 = Strongly agree). Data collected using this scale has shown internal consistency and predictive validity (Kleijn, van der Ploeg, & Topman, 1994; Putwain et al., 2010). Internal reliability, in the present study, was good (Cronbach's $\alpha = .79$).

Examination grades. English, mathematics, and science examinations were based on the GCSE curriculum appropriate to that point in the programmed of study. Examinations were marked by teachers against standardized descriptors using an eight-point grading system (grades A* – G). Letter grades were converted to a numerical equivalent (A* = 8, A = 1, B = 2, G = 1). In this metric a higher grade had higher numerical value. Although it is not possible to establish the internal reliability of the examination grade data collected for this study, previous research has suggested that GCSE examination data show high internal consistency (mean Cronbach's $\alpha = .82$; Bramley & Dhawan, 2011) and teachers' marking corresponds closely to that of independent raters (mean $r = .90$; Dhawan & Bramley &, 2013).

Results

Descriptive Statistics and Bivariate Correlations

Descriptive statistics and bivariate correlations are reported in Table 1. All variables were normally distributed (skewness and kurtosis within ±1) with the exception of English examination grades, that showed a slight negatively skew (-1.01) and leptokurtic distribution of scores (1.29). Worry negatively correlated with academic buoyancy, perceived control, test competence, and examination grades in English, science, and mathematics. Academic buoyancy, perceived control, test competence, positively correlated with academic buoyancy,

perceived control, test competence, and examination grades in English, science, and mathematics. Positive intercorrelations were shown between examination grades in English, science, and mathematics, and academic buoyancy, perceived control, test competence.

[Table 1 here]

Hierarchical Regression Analysis

We examined interactions between worry, and academic buoyancy, perceived control, and test competence, in a hierarchical regression analysis. Demographic variables gender (0 = male, 1 = female), age, and FSM eligibility (0 = no FSM, 1 = FSM), were entered in Step 1. The main effects for worry, academic buoyancy, perceived control, test competence, were entered in Step 2. Two-way interactions between worry and academic buoyancy, perceived control, test competence, were entered in Step 3. Worry, academic buoyancy, perceived control, and test competence, were mean-centered prior to analysis in order to reduce potential multicolinearity effects in the interaction terms (Aiken & West, 1991). As examination grades in English, science, and mathematics, were positively intercorrelated and showed a similar pattern of correlations with worry, academic buoyancy, perceived control, and test competence, we aggregated them into a single score (Cronbach's $\alpha = .80$, $M = 5.41$, $SD = 1.51$, skewness = -.65, and kurtosis = .15). Despite the positive intercorrelations between worry, academic buoyancy, perceived control, and test competence, the average variance inflation factors suggested model parameters were not biased (mean VIF = 1.71). Other assumptions required for hierarchical regression analysis were also met including independence of residual data, multivariate normality, and linearity between test anxiety and examination performance. Results are reported in Table 2.

[Table 2 here]

Demographic variables accounted for a small proportion of variance and were not statistically significant predictors of examination grades. Worry, and academic buoyancy,

perceived control, test competence, accounted for an additional 10% of variance in examination grades. Worry predicted a lower examination grade (β = -.31, p <.001) and perceived control predicted a higher examination grade (β =.19, p =.002). Two-way interactions between worry and academic buoyancy, perceived control, test competence, accounted for an additional 3% of variance in examination grades. A statistically significant interaction was found between worry and perceived control (β = -.15, p =.02) that we probed using simple slope analyses at ±1SD.

The negative relationship between worry and examinations grades at mean perceived control (B = -.70, p <.001) became weaker at low levels (-1SD) of perceived control (B = -.30, p =.21) and stronger at higher levels (+1SD) of perceived control (B = -1.09, p <.001). This interaction is graphed in Figure 1. Although this finding might seem paradoxical at first sight, a visual inspection of Figure 1 shows that at lower levels of worry (-1SD) students with high perceived control achieved better examination grades than their counterparts with low levels of control. The advantage offered by high perceived control diminished with increasing levels of worry. At higher levels of worry (+1SD) the examination grades of students with higher (+1SD) and lower levels of worry (-1SD) converged.

Discussion

This study set out to address the question of whether self-beliefs (academic buoyancy, perceived control, and test competence) moderated the relationship between cognitive test anxiety (worry) and examination performance. Self-report data for self-belief constructs and worry were collected from a sample of final year secondary school students and examined in relation to mock GCSE examinations in English, science, and mathematics. Worry predicted lower, and perceived control predicted higher, examination grades, over and above the variance accounted for by demographic covariates. Furthermore, perceived control moderated the relationship between worry and examination performance. At lower levels of worry,

students with higher perceived control performed better than those with lower perceived control. The performance advantage offered by high perceived control diminished as worry increased. Academic buoyancy and test competence did not predict examination grade (when included in the regression analysis together with worry and perceived control) or moderate the worry and examination performance.

Results supported H_1. Self-beliefs (academic buoyancy, perceived control, and test competence) correlated negatively with worry. This is consistent with models of test anxiety in which the appraisal of a performance-evaluative situation is judged, in part, on one's level of perceived competence (e.g., Segool et al., 2014; Zeidner & Matthews, 2005). All things being equal, students who perceive themselves as less able to withstand the pressure of testing (low buoyancy), who are not certain how to avoid failure (low perceived control), and who do not believe that they can demonstrate their knowledge under examination conditions, report greater worry. Competence beliefs are usually conceptualized in relation to academic competence (e.g., academic self-efficacy or academic self-concept). In this study we examined additional forms of self-beliefs that are relevant to test anxiety. Empirically speaking, these results support, and build on, prior work linking higher academic buoyancy to lower worry (Putwain et al., 2012, 2015) and lower academic anxiety (Martin, 2013; Martin et al., 2010), and higher test competence to lower test anxiety (Putwain et al., 2010).

Results supported H_2. Self-beliefs correlated positively with examination performance whereas worry correlated negatively with examination performance. These findings are consistent with cognitive-motivational theories linking self-beliefs and emotions to academic achievement (Pekrun 2006; Pekrun & Perry, 2014). Positive self-beliefs facilitate the use of flexible learning strategies, effort, and persistence whereas negative emotions, such as anxiety, undermine strategic use of learning strategies and disrupt attentional focus. However, being mindful not to overstate the substantive implications of these findings, the correlations

between academic buoyancy/ test competence and examination grades were small and only statistically significant for mathematics and science respectively. This is consistent with other findings (e.g., Martin, 2014; Putwain et al., 2015) suggesting that impact of buoyancy and test competence on cognitive-motivational factors and examination performance may not be as great as that of worry and perceived control. Notably, when all three self-beliefs were simultaneously entered into step 2 of the regression model, along with worry, it was only perceived control and worry that emerged as statistically significant predictors of examination performance.

Results offered partial support for H_3. Perceived control, but not academic buoyancy or test competence, moderated the relationship between worry and examination performance. This supports theorizing that test anxiety is a multi-causal phenomenon. Although self-beliefs, such as perceived control, can contribute to one's level of test anxiety, there might be other reasons why an individual may become highly test anxious (e.g., avoidance coping strategies or metacognitive beliefs in the usefulness of worry). Thus, some individuals with high perceived control still become test anxious and vice versa. Although we anticipated the performance of high worry students might be less adversely affected if they were high in perceived control, our results showed the performance of low worry students was only better than their high worry counterparts if they were also high in perceived control. With increasing worry, the performance advantage of high perceived control gradually declined. From the perspective of cognitive-motivational theory, it would seem plausible that the capacity of persons high in perceived control to deploy their competencies is undermined at higher levels of worry. This could be due to the high worry interfering with attentional resources (e.g., Owens, 2008; Putwain et al., 2014) or not being able to deploy the use of strategic learning strategies (e.g., Spada & Moneta, 2012). At low worry, although students may not have been susceptible to the interfering effect of worry on attention resources or

learning strategies, if students are low in control they may not know how to deploy their competencies.

Academic buoyancy and test competence did not interact with worry to predict examination performance or predict examination grades in the hierarchical regression analysis over and above the other predictors (worry and perceived competence). This may be partly a result of being weakly related to examination performance (*r*s = .12 – .16). It is also possible that academic buoyancy and test competence might contribute to a sense of control. Students with a belief that they can 'bounce back' from failure or that they can demonstrate their knowledge under examination conditions might come to develop a greater sense of certainty that they can achieve good marks or avoid failure (see Collie, Martin, Malmberg, Hall, & Ginns, 2015; Martin et al., 2010). Thus, academic buoyancy and test competence might be indirectly related to academic performance via perceived control. This would imply a more complex relationship between worry and different types of self-beliefs (moderated mediation).

Implications for Practice

Combinations of cognitive and behavioral interventions are effective in reducing worry and other aspects of test anxiety (e.g., Ergene, 2003, von der Embse, Barterian, & Segool, 2013) but less so for improving examination performance (Vagg & Spielberger, 1995). Our findings shed some possible light on this anomaly. Reducing worry would only offer potential benefit for the performance of those persons who were high in perceived control. If students were low in perceived control, reducing worry would offer a limited performance benefit. Thus, interventions that aim to reduce test anxiety *and* improve performance, rather than those that solely to reduce test anxiety, need to focus on both reducing worry and increasing perceived control. Attributional retraining is a form of intervention designed to encourage control attributions over the perceived causes of success

or failure (e.g., Hall, Perry, Goetz, Ruthig, Stupnisky, & Newall, 2007; Stewart, Clifton, Daniels, Perry, Chipperfield, & Ruthig, 2011). It is possible that attributional retraining could be used in tandem with cognitive and behavioral approaches to test anxiety in intervention in order to both reduce worry and improve performance. Given the instrumental role played by teachers in shaping attributions when providing feedback to students (Hattie & Timperley, 2007), there may also be a role for psychologists in preparing teachers to use the principles of attributional training during routine instruction and assessment (Margolis & McCabe, 2006).

Limitations

There are four limitations that we would like to highlight. First, we used data from a mock GCSE rather than an actual examination. Although we argue that that mock GCSE examinations are high-stakes there is no doubt that the pressures associated with actual mock GCSE examinations (and other tests and examination results used to select students for the job market or further education or evaluate teachers) will be higher. It is possible that the relationships identified in this study would be amplified in a higher-stakes setting. For instance, one's ability to withstand pressure (high academic buoyancy) may become more relevant when the pressure associated with higher-takes examinations in increased. Second, we speculated that academic buoyancy and test competence may be precursors of perceived control but cannot test for this possibility using the cross-sectional design used in this study. Thus, important contributions of academic buoyancy and test competence may not have been evident from the findings of this study. It would be beneficial for future research to employ a longitudinal design, in order to temporally separate academic buoyancy and test competence from perceived control, to examine this possibility.

Third, this study was conducted on a narrow sample of adolescent students at the end of secondary education. It is not clear whether there is a developmental dynamic to self-belief constructs which may limit the generalization of these findings to students of adolescent (and

older) students. To verify this possibility, it would be prudent to examine the roles of worry and self-belief constructs in both older and younger students.

Fourth, the overall model accounted for approximately 15% of the variance in examination performance. At first sight, this might not appear a particularly large proportion of the variance accounted for. However, it is in keeping with findings from the extant literature showing that text anxiety and self-beliefs constructs can typically account for up to 6-7% of the variance in examination and test scores (e.g., Marsh & Martin, 2011; Seipp, 1991). There are likely to be a multiplicity of other influences on examination performance including cognitive ability, familial background, socio-demographic factors (e.g., deprivation), school, and teacher factors. Any assessment of the likely contribution to examination performance made by student-centered constructs (e.g., cognitive test anxiety and self-beliefs) must be mindful of the myriad competing influences. In particular it would be useful to establish the role of cognitive test anxiety and control on examination performance over and above the variance accounted for by prior examination performance. Hence, future research should endeavor, where possible, to include pre-measures of examination performance.

Conclusion

Perceived control moderated the relationship between worry and examination performance. At lower levels of worry, performance of persons higher in perceived control was better than for those lower in perceived control. However, the performance advantage offered by perceived control diminished as worry increased. This suggests that test anxiety is multi-causal and some persons may become test anxious for reasons other than their self-beliefs. Furthermore, interventions designed to reduce worry and improve examination performance should include elements of attributional retraining.

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Table 1

Descriptive statistics and bivariate correlations for test anxiety, academic buoyancy, perceived control, test competence, and Year 11 mid-term examination results in English, mathematics, and science.

	1.	2.	3.	4.	5.	6.	7.
1. Worry	—	-.69***	-.72***	-.66***	-.22**	-.27***	-.30***
2. Academic Buoyancy		—	.71***	.87***	.12	.13	.15*
3. Perceived Control			—	.71***	.27***	.31***	.27***
4. Test Competence				—	.15	.16**	.15
5. English Grade					—	.58***	.64***
6. Science Grade						—	.76***
7. Mathematics Grade							—
Range	1–4	1–5	1–5	1–5	1–8	1–8	1–8
Mean	2.37	2.86	3.25	2.77	5.84	5.07	5.32
SD	0.69	0.89	0.81	0.83	1.71	1.78	1.64
Cronbach's α	.78	.78	.70	.79	—	—	—

*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

Table 2

Hierarchical regression analysis to examine the interactions between worry, academic buoyancy, perceived control, and test competence in predicting examination grade, after controlling for demographic variables.

	R^2	ΔR^2	F (df)	B	SE	β	VIF
Step 1	.01	.01	0.89 (2, 237)				
Gender				.01	.01	.09	1.01
Age				-.02	.10	-.02	1.01
Free School Meal				-.01	.01	-.05	1.02
Step 2	.12	.11	6.87 (4, 233)***				
Worry				-.70	.18	-.27***	1.68
Buoyancy				-.23	.15	-.13	2.10
Perceived control				.36	.15	.18**	1.64
Test competence				-.08	.16	-.01	1.97
Step 3	.15	.03	2.30 (3, 230) *				
Worry × Buoyancy				-.11	.23	-.05	2.57
Worry × Perceived control				-.40	.19	-.15*	1.48
Worry × Test competence				.04	.23	.02	2.64

Note. VIF = Variance Inflation Factor

*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

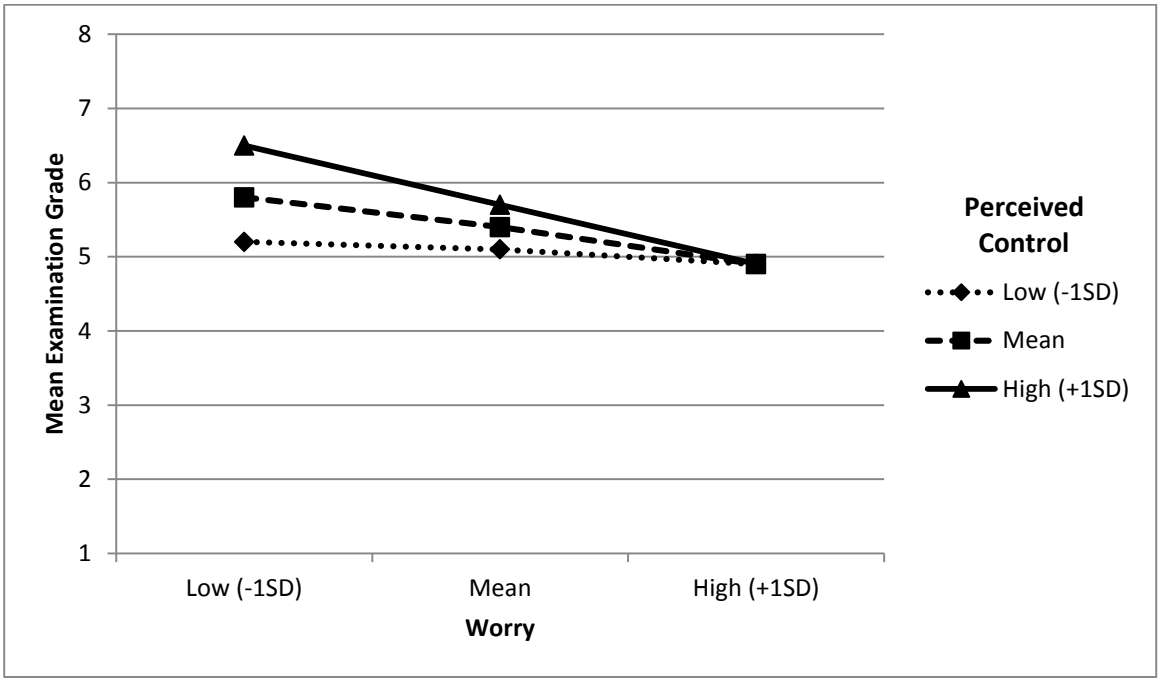

Figure 1. The interaction between worry and perceived control in predicting examination grade.