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Adaptability vs. buoyancy: Which offers the greater protection against test anxiety and could relations be reciprocal?

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ABSTRACT

In the present study we ask which of academic buoyancy and adaptability offers a greater degree of protection from test anxiety and whether academic buoyancy/adaptability relate to test anxiety in a reciprocal fashion. Data were collected in two waves from 1198 participants in upper secondary education. A structural equation model showed that academic buoyancy predicted subsequent all components of test anxiety. In contrast, adaptability only predicted tension, but with a negligible regression coefficient. Reciprocal relations were shown for the worry component of test anxiety but not adaptability. We concluded that academic buoyancy offered greater protection from test anxiety than adaptability. Adaptive regulation of cognition, behaviour, and emotion, may assist students to become more buoyant and less anxious in the face of exam pressures.

1. Adaptability vs. buoyancy: which helps the most in managing test anxiety?

The school environment is, among other things, characterised by varying degrees of novel circumstances and relatively minor, day-to-day, adversities. Adaptability and academic buoyancy are two synergistic asset-driven psychological attributes that enable persons to flourish in the school environment. Adaptability is defined as the ability to respond effectively to novel situations and academic buoyancy the ability to respond effectively to minor academic adversity. High-stakes examinations are those where grades or marks can have profound consequences for students such educational progression, access to the labour market, and entry into higher education. Such examinations are found in many countries and education systems throughout the world as part of school-exit qualifications. A common feature of high-stakes examinations is the use of previously unseen questions (i.e., novel) and pressured (i.e., adverse) situations. Accordingly, highly adaptive and academically buoyant students would be expected to respond to the novel and pressured nature of high-stakes examinations more effectively. Previous studies have shown negative relations between test anxiety and academic buoyancy, but at present evidence is lacking for how test anxiety relates to adaptability. Moreover, it is not clear whether adaptability and buoyancy show unique, independent, relations with test anxiety. The present study addresses this gap in the literature in a two-wave study using a sample of upper-secondary school students.

1.1. Test anxiety

Test anxiety refers to emotional and physical reactions (e.g., panic, dizziness, and feeling scared) accompanied by worrisome thoughts about failing, and its consequences, arising from the appraisal of a performance-evaluative situation as threatening (Putwain et al., 2022). Test anxiety was conceptualised in the present study as being a relatively stable, trait-like, construct; highly test anxious persons will consistently experience elevated state anxiety in performance-evaluative situations (Spielberger & Vagg, 1995). It is widely considered that test anxiety is multidimensional comprising affective-physiological and cognitive components. In the present study we used a four-factor model of test anxiety (Putwain, von der Embse, et al., 2021; von der Embse et al., 2021). There were two affective-physiological factors, namely *tension* (feelings of unpleasant emotions associated with anxiety) and *physiological indicators* of anxiety (the perception of autonomic arousal associated with anxiety). The remaining two factors were cognitive; *worry* (thoughts focused on failure and its consequences) and *cognitive interference* (problems in recall and keeping attention focused on the task at hand).

There is a long-standing body of work, summarised in meta-analyses, showing that higher test anxiety, especially the cognitive component, is associated with lower achievement (Hembree, 1988; von der Embse et al., 2018). Importantly, studies have shown that test anxiety predicts lower achievement even after accounting for prior achievement

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(Pekrun, 1991, 1992; Putwain et al., 2016) and cognitive ability (Putwain et al., 2013). The relationship between test anxiety, mental health, and wellbeing, has received less attention in the research literature. Nonetheless, studies have shown that highly test anxious students show greater symptoms of anxiety disorders (Putwain, Stockinger, et al., 2021; von der Embse et al., 2021; Weems et al., 2015) and meet diagnostic thresholds for anxiety disorders (Herzer et al., 2014; King et al., 1995). In addition, after accounting for concurrent relations, test anxiety has been shown to predict an increased risk for lower wellbeing (Steinmayr et al., 2015) and subsequent emotion disorders (Putwain, Gallard, et al., 2021). In summary, test anxiety has been shown to be damaging to achievement, wellbeing, and mental health. Next we consider two psychological attributes, namely academic buoyancy and adaptability, with the potential to offer protection from test anxiety.

1.2. Academic buoyancy

Academic buoyancy is the capacity of students to quickly recover from instances of low to moderate academic adversities that are routinely encountered during schooling (Martin & Marsh, 2008, 2009). Instances of such adversity include struggling with difficult work, examination pressures, receiving lower than expected grades, managing multiple deadlines, declines in motivation, difficult relationships with peers and/or teachers, and so on. Highly buoyant students are able to overcome these adversities to respond positively to pressure, persist with difficult work, manage deadlines, improve grades, recover motivation, and overcome difficult relationships. Accordingly, buoyancy can be seen as an asset-driven psychological attribute that helps students flourish. A contrast can made with academic resilience referring to the capacity to overcome *major* school-related adversities such as bullying, school refusal, chronic underachievement, truancy, incapacitating learning anxieties, and so on (Condly, 2006; Downey, 2008). Martin (2013a) evidenced this distinction in showing that buoyancy, rather than resilience, predicted beneficial responses to lower-level school adversities (reduced anxiety, uncertain control, and failure avoidance) but not more substantial school adversities. Resilience, however, predicted favourable responses to more substantial school adversities (disengagement and academic self-handicapping) rather than lower-level school adversities.

1.3. Adaptability

Whereas buoyancy is concerned with responding to adversity, adaptability is concerned with responding to situations that are novel, uncertain, or changeable (VandenBos, 2007). When faced with such circumstances, adaptable persons can regulate their emotion, cognition, and behaviour, in such a way as to thrive (Martin, 2012; Martin et al., 2012). Such an attribute would be highly beneficial in the academic environment where change and uncertainty are commonplace (Martin, 2012; Martin, 2013b). Within the school environment students are faced with learning new material in their lessons and taking tests with previously unseen questions. In addition, teachers and classmates may change, students may be moved from one academic stream to another, and also move to a different school for more (e.g., exclusion) or less (e.g., transition from one stage of schooling to the next) nefarious reasons. Students able to adapt these changing circumstances more effectively are at an advantage. Indeed, higher adaptability has been shown to predict favourable achievement-related behaviours, cognitions, and emotions, including greater school engagement, participation in lessons, valuing of school, mastery orientation, and setting of personal goals, alongside lower instances of misconduct and academic self-handicapping (Burns et al., 2018; Collie & Martin, 2017; Martin et al., 2016; Martin, Nejad, et al., 2013; Putwain et al., 2020).

1.4. Test anxiety, academic buoyancy, and adaptability

Academic buoyancy and adaptability present two adaptive psychological attributes to assist students flourishing at school. A key challenge many students are routinely faced with is preparing for and taking, high-stakes examinations that may have a significant bearing on their future life trajectory. Many secondary school students, aged 14 to 18 years, experience high levels of test anxiety (Putwain, 2020; Putwain & Daly, 2014) that, as we have already outlined, can be detrimental to achievement, wellbeing, and mental health. Might academic buoyancy and adaptability be of benefit to students, allowing them to respond to the pressures of high-stakes examinations in a salubrious, non-damaging, manner and experience lower test anxiety?

Based on the Self-Regulatory Executive Function (S-REF) model of test anxiety (Zeidner & Matthews, 2005), there are four possible ways that buoyancy could offer protection from test anxiety (Putwain & Daly, 2013). First, positive self-beliefs about competence and motivation reduces threat appraisal and subsequent anxiety. Second, responding to lower-than-expected grades with cognitive and behavioural strategies to reduce the likelihood for future failure will maintain positive self-beliefs and reduce threat appraisal. Third, less use of self-worth protection strategies (e.g., strategic withdrawal of effort) following lower-than-expected grades will reduce threat appraisal. Fourth, if despite these assets, a highly buoyant student still becomes test anxious (e.g., through metacognitive beliefs that intensify internal monitoring and suppress negative emotion) they will be able to employ cognitive emotion regulation strategies to enable them to recover more quickly and hence be less prone to the performance-interfering effects of test anxiety.

Studies have shown unequivocal support for the protective role of academic buoyancy on test anxiety. In samples of secondary school students, academic buoyancy has been shown to negatively correlate with worry, tension, and physiological indicators, and less so with test-irrelevant thoughts (Putwain, Connors, Symes, & Douglas-Osborn, 2012[1]) and, over time, show negative reciprocal relations with worry component of test anxiety (Putwain et al., 2015). Furthermore, academic buoyancy has been shown to reduce the negative relations between the worry and tension components of test anxiety and achievement through greater use of problem-focus coping strategies (Putwain et al., 2016). In a cluster analysis, while clusters of higher buoyancy, lower test anxiety, and higher achievement, were found, Putwain and Daly (2014) also found a profile characterised by higher buoyancy, yet also higher test anxiety (worry and tension components) and achievement. Hence academic buoyancy could function to both reduce test anxiety and protect achievement. Relatedly, Hirvonen et al. (2019) showed that academic buoyancy predicted lower stress perceptions (i.e., high demands) in primary school students.

As high-stakes examinations involve varying degrees of uncertainty and novelty, it would be anticipated that highly adaptable students, who are able to effectively respond to such circumstances, would experience lower test anxiety. For example, if faced with a novel examination question, the highly adaptive student would be able to appraise and reappraise the situation as less-threatening by drawing on similar questions they may have prepared or practiced for. (e.g., see Boekaerts, 2007). When faced with the uncertainty posed by an exam situation where many aspects (e.g., which questions are asked, their difficulty, the grading processes, and so on) are outside of one's control, the highly adaptive student can use effective study and preparation strategies to maximise chances of success (and thereby reduce threat) over the aspects of the exam they can exert control over (e.g., see Jain & Dowson, 2009). Similarly, when faced with uncertainty, the highly adaptive student can disengage from threat cues to maintain task focus and does not attempt to suppress anxious thoughts (e.g., see Sheppes & Gross,

[1] The test-irrelevant thoughts component of test anxiety was not measured in the present study.

2012). In summary, adaptive students can flexibly use a range of cognitive, behaviour, and emotion, regulation strategies, in such a way that reduces test anxiety. As adaptability comprises cognitive, behaviour, and emotion, regulation strategies, we expect similar relations for the cognitive (worry and cognitive interference) and the affective-physiological components of test anxiety (tension and physiological indicators). Only one study, thus far, has examined relations between test anxiety and adaptability; in a cross-sectional study of undergraduate students, academic buoyancy was negatively related to test anxiety (relations for separate components were not reported) whereas adaptability was unrelated (Zong et al., 2021).

1.5. Aim of the present study

Academic buoyancy and adaptability might, therefore, offer a degree of protection against high anxiety; academic buoyancy to respond to the pressure of testing and adaptability to respond to the novelty and uncertainty of testing. While academic buoyancy and adaptability are cognate, operating in a simultaneous and synergistic fashion in a network of adaptive constructs (see Martin, 2013b), research to address whether their influence is unique and, if so, which offers the greater degree of protection, is limited. That is, when included within a single analytic model to account for their likely positive correlation, does the capacity to respond to pressure (academic buoyancy) offer a greater protection from test anxiety than the capacity to respond to novelty and uncertainty (adaptability)? The answer to this question is not trivial and can inform practitioners the types of intervention required in order to deal with exam pressures effectively. That is, would it be more effective for intervention to focus on dealing with adversity or responding to uncertainty. We address this question in the present study using a two-wave cross-lagged panel model and hypothesise that both academic buoyancy and adaptability will be uniquely and independently related to subsequent test anxiety in a negative fashion. Whether academic buoyancy or adaptability emerges as the stronger predictor we leave as an open question.

Although not the main focus of this study, by virtue of using such a two-wave design we are also able to assess whether relations between academic buoyancy/ adaptability and test anxiety, are bidirectional. In the S-REF model (Zeidner & Matthews, 2005) feedback loops are proposed between self-beliefs, person-situation interactions, and appraisal processes. In ongoing cycles of appraisal and re-appraisal, a person who experiences low anxiety when faced with pressured testing situations would have their belief in their ability to respond effectively (i.e., higher academic buoyancy) reinforced. Studies have shown reciprocal relations between general academic anxiety (Martin, Ginns, et al., 2013; Martin & Marsh, 2008) and the worry aspect of test anxiety (Putwain et al., 2015). It is likely a similar mechanism would operate for adaptability; effective coping with test-based novelty and uncertainty would reinforce adaptability. Accordingly, we expected that reciprocal relations would be shown between buoyancy (especially the worry component)/adaptability and test anxiety.

2. Method

2.1. Procedure, participants, and missing data

A letter outlining the aims of the study, and inviting participation, was sent to colleges specialising in academic upper secondary education located in the North West of England. Three colleges agreed to join the study. Data were collected over two waves separated by a six-month interval (T_1: October 2017; T_2 May 2018) and collected during a period of the college day used for administrative purposes by the regular tutor following a script. The study was approved by the institutional research ethics committee (EHC/16/TPL).

The participants were 1198 students (419 male, 755 female, and 24 declined to reply), with a mean age of 16.5 years (SD = 0.60), and following two-year pre-university courses in the General Certificate of Education: Advanced Level (colloquially known as 'A Levels'). The ethnic heritage of participants was principally white Caucasian (n = 1031), followed by Asian (n = 103), other (n = 18), and Black (n = 17) backgrounds (29 participants did not report their ethnic heritage). In 2017 to 2018, the year that the data for the present were collected, 21.8 % of students in England, aged 16–19 years, belonged to an ethnic minority group (Department for Education, 2018). Accordingly, such students were under-represented in the present study which is due to the socio-demographic make-up of the geographical location of participating colleges.

A relatively small proportion of the data was missing (5.05 %) and a Little's omnibus test for missing completely at random (MCAR) was statistically significant ($p < .001$) indicating that MCAR could not be assumed. A series of follow-up t-tests were conducted to compare adaptability, academic buoyancy, total anxiety scores, and age, for complete and incomplete data. A logistic regression was used to compare complete and incomplete data for gender. Incomplete T_2 adaptability data was more likely in participants with lower T_1 test anxiety scores, $t(1156) = -2.09$, $p = .04$, incomplete T_2 academic buoyancy data was more likely in participants with lower T_1 test anxiety scores, $t(1156) = -2.52$, $p = .01$, and higher T_2 academic buoyancy scores, $t(1166) = 2.08$, $p = .04$, and incomplete T_2 test anxiety data was more likely in participants with lower T_1 test anxiety scores, $t(1156) = -2.85$, $p = .005$, and higher T_2 academic buoyancy scores, $t(1166) = 2.07$, $p = .04$.

It may be the case that persons with lower T_1 test anxiety and higher academic buoyancy saw less value in this study than their counterparts with lower T_1 test anxiety and higher academic buoyancy, and hence were less inclined to participate at T_2. In cases where the sources of missingness are identified, data can be treated as missing at random (MAR) and handled using full-information-maximum-likelihood (FIML) estimation in M*plus* when the variables responsible for the missingness are included in subsequent models (Nicholson et al., 2017). FIML has been shown in simulation studies to provide robust estimates for longitudinal studies containing missing data (Jeličič et al., 2009).

2.2. Measures

2.2.1. Test anxiety

Test anxiety was measured using the 16-item Multidimensional Test Anxiety Scale (MTAS: Putwain, von der Embse, et al., 2021). The MTAS consists of four subscales comprising four-items each: Worry (e.g., "Before a test/ exam, I am worried I will fail"), cognitive interference (e.g., "I forget facts I have learnt during tests/exams"), tension (e.g., "I feel tense before taking a test/exam"), and physiological indicators (e.g., "During a test/ exam I experience stomach discomfort"). Participants responded to items on a five-point scale (1 = "strongly disagree" to 5 = "strongly agree"). Items were not adapted to refer to a specific high-stakes examination (i.e., 'A Levels'). Nonetheless, the context in which participants completed measures is characterised by high-stakes as virtue of university entrance depending on A Level examination grades. Studies have shown the MTAS to demonstrate strong internal consistency, test-retest reliability, strong factor loadings, and predictive validity for achievement and wellbeing (Putwain, von der Embse, et al., 2021; von der Embse et al., 2021). Accordingly, either model could be used depending on the aims of one's research. The internal consistency in the present study for all four MTAS factors at T_1 and T_2 was good (see Table 1).

2.2.2. Academic buoyancy

Academic buoyancy was measured using the four-item *Academic Buoyancy Scale* (ABS: Martin & Marsh, 2008). Participants responded to items (e.g., "I don't let study stress get on top of me") on a five-point scale (1 = "strongly disagree" to 5 = "strongly agree"). Numerous studies have provided strong support for the single factor structure,

Table 1
Descriptive statistics for adaptability, academic buoyancy, and test anxiety.

	Range	Mean	SD	ω	ρ_I	Skewness	Kurtosis	Factor Loadings
T_1 Adaptability	9–40	31.53	4.82	0.85	0.02	−0.36	0.97	0.51–0.72
T_2 Adaptability	9–40	30.95	5.26	0.88	0.03	−0.54	0.65	0.56–0.79
T_1 Academic Buoyancy	4–20	11.83	3.34	0.80	0.05	0.06	−0.37	0.65–0.79
T_2 Academic Buoyancy	4–20	11.60	3.37	0.81	0.01	−0.04	−0.36	0.65–0.78
T_1Worry	4–20	14.43	3.67	0.88	0.06	−0.66	−0.05	0.72–0.82
T_2 Worry	4–20	14.77	3.37	0.87	0.07	−0.72	0.27	0.71–0.84
T_1 Cognitive Interference	4–20	12.89	3.26	0.80	0.01	−0.13	−0.36	0.44–0.85
T_2 Cognitive Interference	4–20	13.48	3.28	0.84	0.02	−0.23	−0.35	0.53–0.90
T_1 Tension	4–20	15.18	3.73	0.92	0.08	−1.02	0.71	0.73–0.94
T_2 Tension	4–20	15.14	3.34	0.88	0.09	−0.80	0.65	0.79–0.82
T_1 Physiological Indicators	4–20	11.07	3.80	0.85	0.09	0.22	−0.53	0.64–0.85
T_2 Physiological Indicators	4–20	11.33	3.73	0.84	0.06	0.07	−0.42	0.64–0.88

internal consistency and predictive validity of the ABS (e.g., Datu & Yang, 2018; Martin & Marsh, 2008) along with the predictive validity for myriad adaptive educational beliefs, emotions, and behaviours (e.g., Hirvonen et al., 2020, 2019; Malmberg et al., 2013; Martin 2013). The internal consistency of the ABS in the present study at T_1 and T_2 was good (see Table 1).

2.2.3. Adaptability

Adaptability was measured using the nine-item Adaptability Scale (AS: Martin et al., 2012). Six items pertain to the cognitive-behavioural dimension of adaptability (e.g., "I am able to think through a number of possible options to assist me in a new situation") and three to affective adaptability (e.g., "When uncertainty arises, I am able to minimize frustration or irritation so I can deal with it best"). Both dimensions were represented as single-factor (see Martin et al., 2012) and residual variance for the emotional items allowed to correlate in order to account for the commonality in item domain content. Participants responded to items on a five-point scale (1 = "strongly disagree" to 5 = "strongly agree"). In previous studies support has been shown for a unidimensional structure to the AS, good internal consistency, and predictive validity for school-related wellbeing and engagement, among other adaptive educational emotions and behaviours (e.g., Martin et al., 2015; Martin, Ginns, et al., 2013; Putwain et al., 2020). The ABS showed good internal consistency in the present study at T_1 and T_2 (see Table 1).

2.3. Analytic strategy

The analytic approach followed three steps. First, confirmatory factor analysis (CFA) was used to test a measurement model of the data and estimate latent bivariate correlations. Second, CFAs were used to check for longitudinal measurement invariance of adaptability, academic buoyancy, and test anxiety at T_1 and T_2 (a necessary requirement for longitudinal structural equation modeling). Third, a structural equation model (SEM) was used to examine a two-wave cross-lagged panel model of the relations between adaptability, academic buoyancy, and test anxiety at T_1 and T_2. In the SEM, standardised beta coefficients (βs) were interpreted following Keith's (2014) guidance: $\beta s > 0.05$ small, $\beta s > 0.10$ moderate, and $\beta s > 0.25$ large.

All models were conducted using the M*plus* 8.3 software (Muthén & Muthén, 2017). Model fit was assessed using the root mean error of approximation (RMSEA), standardised root mean residual (SRMR), confirmatory fit index (CFI), and Tucker-Lewis index (TLI). Simulation studies have shown RMSEA ≈ 0.05, SRMR ≈ 0.08, and CFI and TLI ≈ 0.95, indicate the model fits the data well (Hu & Bentler, 1999). These criteria should be applied with caution, however, in complex models using naturalistic data (Heene et al., 2011; Lance et al., 2006).

In tests of longitudinal measurement invariance constraints are added to successive models in order to specify item-factor loadings, item intercepts, and item residual variances, are equal at T_1 and T_2 (see Meredith, 1993). A substantive decline in model fit (RMSEA >0.015 and CFI/TLI <0.1; see Chen, 2007; Cheung & Rensvold, 2002) after a set of constraints are added, indicates non-invariance.

3. Results

3.1. Descriptive statistics, latent bivariate correlations, and invariance tests

Descriptive statistics are shown in Table 1. All variables were within ±1SD, except for T_1 Tension that showed a small positive skew, and the internal consistency for all variables was good (McDonalds ωs ≥ 0.80). Intraclass correlations showed approximately 6 to 9 % of the variance in worry, tension, and physiological indicators, occurred between colleges (ρ_Is = 0.06 to 0.09) and were smaller for adaptability, academic buoyancy, and tension (ρ_Is ≤ 0.05). A measurement model was built with four indicators for each of the four test anxiety components and academic buoyancy, and nine indicators for adaptability, T_1 and T_2. Residual variance was allowed to correlate for each of the corresponding indicators at T_1 and T_2. In addition, residual variance for one pair of worry items with similar wording (see Putwain, von der Embse, et al., 2021), and the three emotion-behaviour adaptability items, were allowed to correlate within each wave. The type = "complex" command was used for all subsequent models in M*plus* to adjust standard errors for between-college variance. Although data were not overly skewed, the maximum likelihood estimator with robust standard errors (MLR) is required for use with the type = "complex" command.

This measurement model showed a reasonably good fit to the data, $\chi^2(1492) = 2544.58$ (1492), $p < .001$, RMSEA = 0.024, SRMR = 0.067, CFI = 0.942, and TLI = 0.936, and factor loadings reported in Table 1 were all good (λs ≥ 0.44). A measurement model with gender added, in order to generate latent bivariate correlations, also showed a reasonably good fit to the data: $\chi^2(1492) = 2603.97$ (1538), $p < .001$, RMSEA = 0.024, SRMR = 0.066, CFI = 0.941, and TLI = 0.935 (see Table 2). Adaptability showed a weak positive correlation with academic buoyancy. Test anxiety showed weak negative correlations with adaptability and moderate negative correlations with academic buoyancy.

A precondition of modeling relations over time is that the constructs in question demonstrate equivalent measurement properties at all measurement points (Widaman et al., 2010). Accordingly, we conducted a series of tests for the longitudinal measurement invariance of adaptability, academic buoyancy, and test anxiety. We started with a configural model, which specifies the same factor structure at T_1 and T_2, followed with a metric (or weak) invariance model whereby factor loadings were constrained to be equivalent at T_1 and T_2, a scalar (or strong) invariance model whereby factor intercepts were constrained to be equivalent at T_1 and T_2, and finally a residual (or strict) invariance model whereby items residual variances were constrained to be equivalent at T_1 and T_2. Results of the invariance tests are shown in Table 3. Adaptability, academic buoyancy, and test anxiety, all showed strict longitudinal measurement invariance, with no substantial loss of fit (ΔRMSEA <0.015; ΔCFI/TLI <0.01).

Table 2
Latent bivariate correlations between adaptability, academic buoyancy, and test anxiety.

	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. T_1 Adaptability	0.18**	−0.14*	−0.10	−0.11*	−0.12	0.12***	0.15***	−0.11*	−0.08	−0.08*	−0.10*	−0.15***
2. T_1 Academic Buoyancy	–	−0.39**	−0.22***	−0.31**	−0.31***	0.14**	0.36***	−0.36***	−0.23***	−0.27**	−0.32***	−0.30**
3. T_1 Worry		–	0.40**	0.67***	0.57***	−0.09**	−0.33***	0.57***	0.28***	0.44***	0.47***	0.35**
4. T_1 Cognitive Interference			–	0.30**	0.35***	−0.06**	−0.18***	0.30***	0.34***	0.18**	0.29***	0.19***
5. T_1 Tension				–	0.60***	−0.07	−0.26**	0.46***	0.20**	0.46***	0.45***	0.27**
6. T_1 Physiological Indicators					–	−0.09***	−0.27***	0.42***	0.24***	0.41***	0.78***	0.26***
7. T_2 Adaptability						–	0.18***	−0.11***	−0.10***	−0.08*	−0.11***	−0.15*
8. T_2 Academic Buoyancy							–	−0.40***	−0.24***	0.28**	−0.32***	−0.31***
9. T_2 Worry								–	0.36**	0.52***	0.54***	0.35***
10. T_2 Cognitive Interference									–	0.26***	0.35***	0.19***
11. T_2 Tension										–	0.50***	0.32***
12. T_2 Physiological Indicators											–	0.22*
13. Gender												–

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

Table 3
Invariance tests for adaptability, academic buoyancy, and test anxiety.

	χ^2 (df)	RMSEA	SRMR	CFI	TLI	Δ RMSEA	Δ RMSEA	Δ RMSEA
Adaptability								
Configural Invariance	264.74 (119)	0.032	0.056	0.950	0.936			
Metric Invariance	270.47 (127)	0.031	0.059	0.951	0.941	−0.001	+0.001	+0.005
Scalar Invariance	279.77 (136)	0.030	0.061	0.951	0.945	−0.001	0.000	+0.004
Residual Invariance	291.19 (145)	0.029	0.066	0.950	0.947	−0.001	−0.001	+0.002
Academic Buoyancy								
Configural Invariance	30.62 (13)	0.034	0.028	0.992	0.983			
Metric Invariance	36.57 (16)	0.033	0.030	0.991	0.984	−0.001	−0.001	+0.001
Scalar Invariance	53.58 (20)	0.037	0.043	0.985	0.979	+0.004	−0.006	−0.005
Residual Invariance	55.82 (24)	0.033	0.051	0.986	0.983	−0.004	+0.001	+0.004
Test Anxiety								
Configural Invariance	971.81 (418)	0.033	0.059	0.967	0.961			
Metric Invariance	1026.23 (430)	0.034	0.063	0.965	0.960	+0.001	−0.002	−0.001
Scalar Invariance	1095.03 (466)	0.035	0.065	0.962	0.958	+0.001	−0.003	−0.002
Residual Invariance	1187.53 (462)	0.036	0.061	0.957	0.954	+0.001	−0.005	−0.004

Note. χ^2 for all models $p < .001$.

3.2. Structural equation modeling

The two-wave, cross-lagged panel model showed a relatively good fit to the data: $\chi^2(1538) = 2590.86$, $p < .001$, RMSEA = 0.024, SRMR = 0.066, CFI = 0.941, and TLI = 0.935. Standardised beta coefficients for auto-regressive and cross-lagged paths are shown in Table 4. Having controlled for the variance accounted for by concurrent relations between adaptability, academic buoyancy, and test anxiety, at T_1 and T_2, and the auto-lagged paths from T_1 to T_2 adaptability, academic buoyancy, and test anxiety, the following cross-lagged paths were shown to be statistically significant. Academic buoyancy was a negative predictor of worry ($\beta = -0.22$, $p < .001$), cognitive interference ($\beta = -0.25$, $p < .001$), tension ($\beta = -0.17$, $p < .001$), and physiological indicators ($\beta = -0.14$, $p = .004$). Only worry was a negative predictor of academic buoyancy ($\beta = -0.19$, $p = .010$). Adaptability was a positive predictor of tension ($\beta = 0.03$, $p < .001$) and no test anxiety components predicted adaptability. Furthermore, buoyancy did not predict adaptability and vice versa. Statistically significant auto- and cross-lagged

Table 4
Standardised regression coefficients from the two-wave cross-lagged panel model.

	T_2 Adaptability	T_2 Academic Buoyancy	T_2 Worry	T_2 Cognitive Interference	T_2 Tension	T_2 Physiological Indicators	Gender
T_1 Adaptability	0.45***	0.10	0.06	0.04	0.03***	0.04	−0.15***
T_1 Academic Buoyancy	0.16	0.54**	−0.22***	−0.25*	−0.17***	−0.14**	−0.30***
T_1 Worry	0.01	−0.19**	0.80***	−0.01	0.37***	0.09	0.35***
T_1 Cognitive Interference	0.02	0.03	−0.03	0.57***	−0.13***	−0.01	0.20***
T_1 Tension	0.06	0.07	−0.15	−0.05	0.25*	−0.12***	0.27**
T_1 Physiological Indicators	−0.04	−0.02	0.02	0.01	0.15***	0.73***	0.26***
Gender	−0.05	−0.09*	−0.05	−0.03	−0.06	−0.01	

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

paths are shown in Fig. 1 (un-lagged, concurrent, relations are reported in the Appendix).

The expected relations between adaptability and test anxiety components were not shown in the aforementioned SEM but a strong correlation was shown between T_1 adaptability and T_1 academic buoyancy. This may imply that adaptability was indirectly related to subsequent test anxiety via academic buoyancy. To test this possibility, the concurrent correlation was replaced with a directional path from T_1 adaptability to T_1 academic buoyancy and the model re-tested in a supplementary analysis (all other model specifications remained identical). Model fit was virtually identical to the hypothesised SEM. T_1 adaptability was strongly, and positively, related to T_1 academic buoyancy ($\beta = 0.51, p < .001$). Statistically significant indirect relations from T_1 adaptability, mediated by T_1 academic buoyancy, were shown with T_2 worry ($\beta = -0.11$, $SE = 0.01$, 95 % CIs [-0.09, -0.13]), T_2 cognitive interference ($\beta = -0.12$, $SE = 0.05$, 95 % CIs [-0.05, -0.21]), T_2 tension ($\beta = -0.09$, $SE = 0.03$, 95 % CIs [-0.05, -0.13]), and T_2 physiological indicators ($\beta = -0.07$, $SE = 0.03$, 95 % CIs [-0.02, -0.13]). Full results can be found in the Supplementary Materials.

4. Discussion

The aim of the present study was to examine the relations between test anxiety components, academic buoyancy, and adaptability. Specifically, we set out to address whether academic buoyancy and adaptability were unique negative predictors of subsequent test anxiety components; a corollary was which of buoyancy and adaptability would be more strongly related. Results showed that, over and beyond the variance accounted for by concurrent and autoregressive relations, higher academic buoyancy predicted subsequent lower test anxiety components ($\beta s = -0.14$ to -0.25). In contrast, higher adaptability predicted only the tension component of subsequent test anxiety, showing a very small coefficient ($\beta = -0.03$). Accordingly, results show that academic buoyancy offers greater protection against subsequent test anxiety than adaptability. In addition, and as anticipated, lower worry predicted subsequent higher academic buoyancy, thus confirming positive reciprocal relations for worry and academic buoyancy. Test anxiety was, however, unrelated to subsequent adaptability.

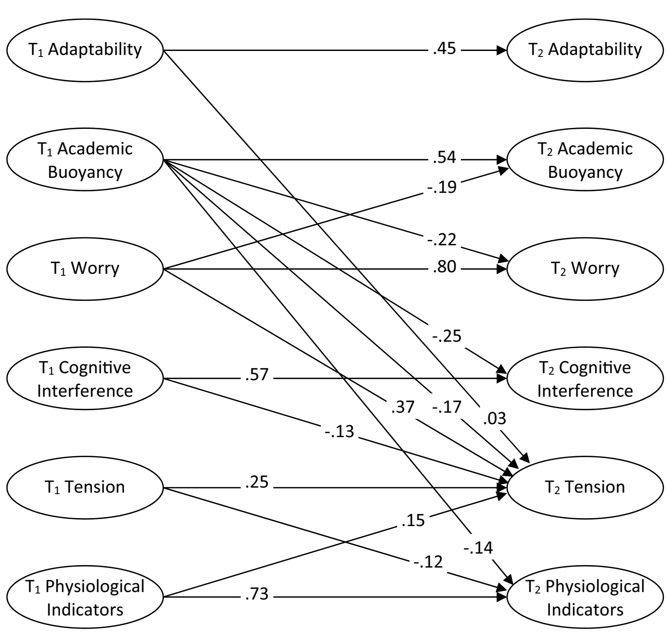

Fig. 1. Statistically significant paths from the two-wave cross-lagged panel model.
Note. Within-wave correlations and gender were omitted to avoid over cluttering Fig. 1.

Academic buoyancy and adaptability were both considered as asset-driven psychological attributes that may be beneficial in protecting against test anxiety through self-regulatory mechanisms (Martin, 2013b; Martin, Nejad, et al., 2013). Only academic buoyancy, however, showed substantive negative relations with subsequent test anxiety components. Relations were slightly stronger for worry and cognitive interference ($\beta s = -0.22$ and -0.25 respectively) than for the affective-physiological components ($\beta s = -0.17$ and -0.14 respectively). Notwithstanding the small relation shown from adaptability to tension, adaptability was unrelated to subsequent test anxiety and therefore offers partial support for our hypothesising. Academic buoyancy and adaptability were not unique predictors of test anxiety and academic buoyancy offers greater protection from test anxiety than adaptability.

The finding that higher academic buoyancy protected against higher worry, tension, and physiological indicators, is consistent with prior findings, also conducted with samples of secondary school students (Putwain et al., 2012; Putwain et al., 2015) and school stress in primary school children (Hirvonen et al., 2019). The present study showed that academic buoyancy also protected cognitive interference which was not measured as a component of test anxiety in Putwain et al., (2012, 2015). Highly buoyant students deploy adaptive behavioural strategies, such as persistence, planning, and effort, and hold stronger competence beliefs (Martin, Colmar, Davey, & Marsh, 2010; Malmberg et al., 2013). Such cognitive and behavioural strategies are theorised within the S-REF model of test anxiety (Putwain & Daly, 2014) to reduce the perception of performance-evaluative situations as threatening, and hence highly buoyant students experience less test anxiety.

Adaptability has also been associated, in previous studies, with adaptive behaviours and cognitions, including participation in lessons, setting goals, less self-handicapping and behavioural misconduct (Burns et al., 2018; Collie & Martin, 2017; Martin, Nejad, et al., 2013; Putwain et al., 2020). Furthermore, in previous studies including both academic buoyancy and adaptability, unique relations have been shown with achievement-related behaviours and motivations (Martin et al., 2016) or adaptability has emerged the stronger predictor of achievement-related behaviour (Martin, Nejad, et al., 2013).

While adaptability may be equally, or even more, beneficial than academic buoyancy in the general school environment, the present study indicates that when specifically dealing with testing pressure, especially high-stakes tests (germane to participants in the present study), academic buoyancy is of greater benefit. It may be the case that adaptability is indirectly, and negatively, related to test anxiety through concurrent academic buoyancy (see supplementary analyses). This would imply the greater capacity to regulate cognition, emotion, and behaviour when facing uncertainty and novelty, could boost one's capacity to manage the pressures of high-stakes tests. However, without a temporal gap between T_1 adaptability and T_1 academic buoyancy (albeit small), to distinguish their ordering, this link cannot be conclusively supported from the present data.

Although not a question central to the aims of the present study reciprocal relations between test anxiety and academic buoyancy/adaptability were also examined. Consistent with previous findings (Putwain et al., 2015), reciprocal relations were only shown for the worry component of test anxiety. This finding not only confirms the status of worry as the key variable in dynamic and ongoing relations with anxiety but may also reflect on the conceptualization of academic buoyancy as a cognitive representation (i.e., belief) about one's capacity to overcome routine, minor, adversity, rather than the actual capacity per se. That is, lower tension, physiological arousal, and cognitive interference, associated with anxiety, do not necessarily reinforce future higher academic buoyancy, only a reduced belief in the likelihood of failure. As we have already mentioned, adaptability was not substantively related to future test anxiety. In addition, test anxiety was also unrelated to subsequent adaptability; hence test anxiety did not appear to reinforce one's capacity to effectively deal with uncertainty and novelty. This may be related to the status of uncertainty and novelty simply being less relevant to dealing with exam pressures or that effects are being channeled through academic buoyancy.

4.1. Limitations and directions for future research

Although findings of the present study offer useful theoretical and practical insights, there are four limitations to highlight. First, academic buoyancy is theorised to reduce test anxiety by maintaining positive self-beliefs, using effective cognitive and behavioural strategies to reduce future failure, not using self-worth protection strategies, and by recovering quickly. These are not addressed in the present study, or elsewhere, and would be a worthwhile avenue for future studies. Theoretically, a study of the possible mediators between academic buoyancy and test anxiety would facilitate understanding of intra-personal mechanisms in the regulation of anxiety. Practically, such findings could inform which mechanisms would be useful for interventions to target.

Second, and relatedly, the dynamic relations between academic buoyancy and test anxiety would unfold, in the S-REF model (Zeidner & Matthews, 2005), in repeated cycles of appraisal and re-appraisal, within-persons, and in real life. The use of static trait-like measures, like those in the present study, that use between-person differences to test relations, fail to capture the ongoing, real-time, dynamic. Such intra-individual dynamics have utilised experience sampling with technology to model related constructs, such as classroom engagement and effort (e.g., Martin et al., 2019; Vasalampi et al., 2021), but such approaches have yet to be applied to the study of academic buoyancy. Future studies could examine bidirectional relations between academic buoyancy and test anxiety over repeated time points, examine how day-to-day academic buoyancy fluctuates with routine minor academic adversities (such as tests), and importantly, provide a method to establish the speed of recovery. Speeded recovery from adversity (e.g., test pressures) is theorised to be a key benefit of academic buoyancy, but cannot be tested in naturalistic settings without multiple, time sensitive measurements.

Third, the MTAS and ABS are education specific measures, whereas the AS is domain general. Could this account for the stronger relations shown in the present study for academic buoyancy and test anxiety? Certainly, this has not been the case in previous studies where adaptability has linked to achievement-related cognitions and beliefs independently and alongside academic buoyancy (e.g., Martin et al., 2016, Martin, Ginns, et al., 2013). Nonetheless, it would be a useful check for future studies that include adaptability alongside other education or school-specific measures to adapt adaptability items to refer specifically to, for instance, school or tests, or direct students to respond to items in relation school or tests.

Fourth, students from minority ethnic backgrounds were underrepresented in the study which may limit the external generalisability of findings. Students from different backgrounds may show higher or lower levels of test anxiety, academic buoyancy, and adaptability. Furthermore, students from different backgrounds may benefit more or less from (i.e., play a mediating role) the protective role of academic buoyancy and adaptability. At present there is limited research into ethnic, and indeed other socio-demographic, differences in test anxiety, academic buoyancy, and adaptability (for an exception with regards to test anxiety, see Putwain, 2007). Future studies could check for ethnic (and other) differences in level and whether such differences moderate responses to minor adversity and novelty.

4.2. Implications for practice

Our findings have implications for both intervention and classroom practice. The key mechanisms by which buoyancy will lower anxiety, and vice versa, are the adaptive and synergistic regulation of cognition, emotion, and behaviour, in relation to exam pressures. Key regulatory strategies include, but are not limited to, self-beliefs about one's academic competence, study strategies that enhance the likelihood of success, and self-worth protection strategies that can reduce anxiety but at the expense of an increased likelihood of failure. We recommend a four-phase approach to assisting students based on insights drawn from the cognitive-behavioural intervention and self-regulation literatures (e.g., Boekaerts, 2007; Williams & Chellingsworth, 2010; Zimmerman et al., 2017).

First, psychoeducation is used to inform students how cognition, behaviour, and emotion, are all implicated in anxiety; specifically, which regulatory strategies raise, and which lower, anxiety. Second, is for students to reflect and identify which strategies they are using and whether these strategies are adaptive or not in response to exam pressure. Third, is for students to make concrete, achievable, and specific plans, for using adaptive strategies in place of non-adaptive strategies. Fourth, is for students to practice and reflect on their use of such strategies, followed by another round of planning, and reflection. Such a four-phase approach could be used for specific intervention targeted at high test anxious, or low buoyancy students, or more generally as part of lessons for all students on preparing for high-stakes tests in the most effective manner.

4.3. Conclusion

Findings of the present study show that academic buoyancy offers greater protection from test anxiety than adaptability. Based on the S-REF model (Zeidner & Matthews, 2005) the protection offered by academic buoyancy is theorised to result from adaptive cognitive, behavioural, and emotion, regulation strategies used in the face of exam pressures, along with a quick recovery (Putwain & Daly, 2013). Does this mean adaptability is of no value whatsoever for test anxiety? Supplementary analyses indicated that adaptability may provide indirect protection from test anxiety through concurrent academic buoyancy. Until future studies have demonstrated this indirect relation with a temporal gap between adaptability and academic buoyancy, however, the interpretation of directionality cannot be treated as unequivocal.

Declaration of competing interest

We have no known conflict of interest to disclose. The dataset on which this study was based can be accessed at https://doi: 10.17632/6bhr52dc5v.1.

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Appendix A. Concurrent correlations between adaptability, academic buoyancy, and test anxiety from the two-wave cross-lagged panel model

	1.	2.	3.	4.	5.	6.
1. Adaptability	–	0.53***	−0.31***	−0.28***	−0.23**	−0.23*
2. Academic Buoyancy	0.34*	–	−0.57***	−0.37***	−0.42***	−0.38***
3. Worry	−0.15	−0.46***	–	0.61***	0.79***	0.62***
4. Cognitive Interference	−0.21***	−0.23***	0.56***	–	0.41**	0.45***
5. Tension	−0.07	−0.24*	0.85***	0.47***	–	0.61***
6. Physiological Indicators	−0.10***	−0.20**	0.55***	0.38***	0.57***	–

T_1 correlations above, and T_2 correlations below, the diagonal.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.lindif.2022.102247.

References

Boekaerts, M. (2007). Understanding students' affective processes in the classroom. In P. A. Schutz, & R. Pekrun (Eds.), *Emotion in education* (pp. 37–56). Elsevier.

Burns, E. C., Martin, A. J., & Collie, R. J. (2018). Adaptability, personal best (PB) goals, and gains in students' academic outcomes: A longitudinal examination from a social cognitive perspective. *Contemporary Educational Psychology, 53*, 57–72. https://doi.org/10.1016/j.cedpsych.2018.02.001

Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling, 14*(3), 464–504. https://doi.org/10.1080/10705510701301834

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*(2), 233–255. https://doi.org/10.1207/S15328007SEM0902_5

Collie, R. J., & Martin, A. J. (2017). Students' adaptability in mathematics: Examining self-reports and teachers' reports and links with engagement and achievement outcomes. *Contemporary Educational Psychology, 49*, 355–366. https://doi.org/10.1016/j.cedpsych.2017.04.001

Condly, S. J. (2006). Resilience in children: A review of literature with implications for education. *Urban Education, 41*(3), 211–236. https://doi.org/10.1177/0042085906287902

Datu, J. A., & Yang, W. (2018). Psychometric validity and gender invariance of the academic buoyancy scale: A construct validation approach. *Journal of Psychoeducational Assessment, 36*(3), 278–283. https://doi.org/10.1177/0734282916674423

Department for Education. (2018). *Further education and skills participation for 2017 to 2018*. Her Majesty's Stationary Office.

Downey, J. A. (2008). Recommendations for fostering educational resilience in the classroom. *Preventing School Failure: Alternative Education for Children and Youth, 53*(1), 56–64. https://doi.org/10.3200/PSFL.53.1.56-64

Heene, M., Hilbert, S., Draxler, C., Ziegler, M., & Bühner, M. (2011). Masking misfit in confirmatory factor analysis by increasing unique variances: A cautionary note on the usefulness of cutoff values of fit indices. *Psychological Methods, 16*(3), 319–336. https://doi.org/10.1037/a0024917

Hembree, R. (1988). Correlates, causes, effects and treatment of test anxiety. *Review of Educational Research, 58*(1), 47–77. https://doi.org/10.3102/00346543058001047

Herzer, F., Wendt, J., & Hamm, A. O. (2014). Discriminating clinical from nonclinical manifestations of test anxiety: A validation study. *Behavior Therapy, 45*, 222–231. https://doi.org/10.1016/j.beth.2013.11.001

Hirvonen, R., Putwain, D. W., Määttä, S., Ahonen, T., & Kiuru, N. (2020). The role of academic buoyancy and emotions in students' learning-related expectations and behaviours in primary school. *British Journal of Educational Psychology, 90*(4), 948–963. https://doi.org/10.1111/bjep.12336

Hirvonen, R., Yli-Kivisto, L., Putwain, D. W., Ahonen, T., & Kiuru, N. (2019). School related stress among sixth-grade students – Associations with academic buoyancy and temperament. *Learning and Individual Differences, 70*, 100–108. https://doi.org/10.1016/j.lindif.2019.01.012

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*, 1–55. https://doi.org/10.1080/10705519909540118

Jain, S., & Dowson, M. (2009). Mathematics anxiety as a function of multidimensional self-regulation and self-efficacy. *Contemporary Educational Psychology, 34*(3), 240–249. https://doi.org/10.1016/j.cedpsych.2009.05.004

Jeličič, H., Phelps, E., & Lerner, R. M. (2009). Use of missing data methods in longitudinal studies: The persistence of bad practices in developmental psychology. *Developmental Psychology, 45*(4), 1195–1199. https://doi.org/10.1037/a0015665

Keith, T. Z. (2014). *Multiple regression and beyond: An introduction to multiple regression and structural equation modeling*. Routledge.

King, N. J., Mietz, A., Tinney, L., & Ollendick, T. H. (1995). Psychopathology and cognition in adolescents experiencing severe test anxiety. *Journal of Clinical Child Psychology, 24*, 49–54. https://doi.org/10.1207/s15374424jccp2401_6

Lance, C. E., Butts, M. M., & Michels, L. C. (2006). The sources of four commonly reported cutoff criteria what did they really say? *Organizational Research Methods, 9*(2), 202–220. https://doi.org/10.1177/1094428105284919

Malmberg, L.-E., Hall, J., & Martin, A. J. (2013). Academic buoyancy in secondary school: Exploring patterns of convergence in english, mathematics, science, and physical education. *Learning and Individual Differences, 23*, 262–266. https://doi.org/10.1016/j.lindif.2012.07.014

Martin, A. J. (2012). Adaptability and learning. In N. M. Seel (Ed.), *Encyclopedia of the sciences of learning* (pp. 90–92). Springer.

Martin, A. J. (2013b). The personal proficiency network: Key self-system factors and processes to optimize academic development. In D. M. McInerney, H. W. Marsh, R. G. Craven, & F. Guay (Eds.), *Theory driving research: New wave perspectives on self-processes and human development*. Information Age Publishing.

Martin, A. J., Colmar, S. H., Davey, L. A., & Marsh, H. W. (2010). Longitudinal modelling of academic buoyancy and motivation: Do the '5Cs' hold up over time? *British Journal of Educational Psychology, 30*(3), 473–495. https://doi.org/10.1348/000709910X486376

Martin, A. J., Ginns, P., Brackett, M. A., & Malmberg, L.-E. (2013). Academic buoyancy and psychological risk: Exploring reciprocal relationships. *Learning and Individual Differences, 27*, 128–133. https://doi.org/10.1016/j.lindif.2013.06.006

Martin, A. J., Mansour, M., & Malmberg, L. E. (2019). What factors influence students' real-time motivation and engagement? An experience sampling study of high school students using mobile technology. *Educational Psychology, 40*(9), 1113–1135. https://doi.org/10.1080/01443410.2018.1545997

Martin, A. J., & Marsh, H. W. (2008). Academic buoyancy: Towards an understanding of students' everyday academic resilience. *Journal of School Psychology, 46*, 53–83. https://doi.org/10.1016/j.jsp.2007.01.002

Martin, A. J., & Marsh, H. W. (2009). Academic resilience and academic buoyancy: Multidimensional and hierarchical conceptual framing of causes, correlates and cognate constructs. *Oxford Review of Education, 35*(3), 353–370. https://doi.org/10.1080/03054980902934639

Martin, A. J., Nejad, H., Colmar, S., & Liem, G. A. D. (2012). Adaptability: Conceptual and empirical perspectives on responses to change, novelty and uncertainty. *Australian Journal of Guidance and Counselling, 22*(1), 58–81. https://doi.org/10.1017/jgc.2012.8

Martin, A. J., Nejad, H., Colmar, S., Liem, G. A. D., & Collie, R. J. (2015). The role of adaptability in promoting control and reducing failure dynamics: A mediation model. *Learning and Individual Differences, 38*, 36–43. https://doi.org/10.1016/j.lindif.2015.02.004

Martin, A. J., Nejad, H. G., Colmar, S., & Liem, G. A. D. (2013). Adaptability: How students' responses to uncertainty and novelty predict their academic and non-academic outcomes. *Journal of Educational Psychology, 105*(3), 728–746. https://doi.org/10.1037/a0032794

Martin, A. J., Yu, K., Ginns, P., & Papworth, B. (2016). Young people's academic buoyancy and adaptability: A cross-cultural comparison of China with North America and the United Kingdom. *Educational Psychology, 37*, 930–946. https://doi.org/10.1080/01443410.2016.1202904

Martin, A. M. (2013a). Academic buoyancy and academic resilience: Exploring 'everyday' and 'classic' resilience in the face of academic adversity. *School Psychology International, 34*(5), 488–500. https://doi.org/10.1177/0143034312472759

Meredith, W. (1993). Measurement invariance, factor analysis and factorial invariance. *Psychometrika, 58*, 525–543. https://doi.org/10.1007/BF02294825

Muthén, L. K., & Muthén, B. O. (2017). *Mplus user's guide* (8th ed.). Muthén & Muthén.

Nicholson, J. S., Deboeck, P. R., & Howard, W. (2017). Attrition in developmental psychology: A review of modern missing data reporting and practices. *International*

Journal of Behavioural Development, 41(1), 143–153. https://doi.org/10.1177/0165025415618275

Pekrun, R. (1991). Prüfungsangst und schulleistung: Eine Längsschnittanalyse [Test anxiety and academic achievement: A longitudinal analysis]. *Zeitschrift für Pädagogische Psychologie, 5*, 99–109.

Pekrun, R. (1992). The expectancy-value theory of anxiety: Overview and implications. In D. G. Forgays, T. Sosnowski, & K. Wrzesniewski (Eds.), *Anxiety: Recent developments in self-appraisal, psychophysiological and health research* (pp. 23–41). Hemisphere.

Putwain, D. W. (2007). Test Anxiety in UK schoolchildren: prevalence and demographic patterns. *British Journal of Educational Psychology, 77*(3), 579–593. https://doi.org/10.1348/000709906X161704

Putwain, D. W. (2020). *Examination pressures on children and young people: Are they taken seriously enough?* The British Academy.

Putwain, D. W., Chamberlain, S., Daly, T., & Saddredini, S. (2015). Academically buoyant students are less anxious about and perform better in high-stakes examinations. *British Journal of Educational Psychology, 85*(3), 247–263. https://doi.org/10.1111/bjep.12068

Putwain, D. W., & Daly, A. L. (2014). Test anxiety prevalence and gender differences in a sample of English secondary school students. *Educational Studies, 40*(5), 554–570. https://doi.org/10.1080/03055698.2014.953914

Putwain, D. W., Connors, L., Symes, W., & Douglas-Osborn, E. (2012). Is academic buoyancy anything more than adaptive coping? *Anxiety, Stress, and Coping, 25*(3), 349–358. https://doi.org/10.1080/10615806.2011.582459

Putwain, D. W., & Daly, T. (2013). Do clusters of test anxiety and academic buoyancy differentially predict academic performance? *Learning and Individual Differences, 27*, 157–162. https://doi.org/10.1016/j.lindif.2013.07.010

Putwain, D. W., Daly, T., Chamberlain, S., & Saddredini, S. (2016). "Sink or swim": Buoyancy and coping in the test anxiety and academic performance relationship. *Educational Psychology, 36*(10), 1807–1825. https://doi.org/10.1080/01443410.2015.1066493

Putwain, D. W., Gallard, D. G., Beaumont, J., Loderer, K., & von der Embse, N. (2021). Does test anxiety predispose poor school-related wellbeing and enhanced risk of emotional disorders? *Cognitive Therapy and Research, 45*(6), 1150–1163. https://doi.org/10.1007/s10608-021-10211-x

Putwain, D. W., Loderer, K., Gallard, D., & Beaumont, J. (2020). School-related wellbeing promotes adaptability, achievement and behavioural conduct: A longitudinal examination. *British Journal of Educational Psychology, 90*(1), 92–108. https://doi.org/10.1111/bjep.12266

Putwain, D. W., Nicholson, L. J., Connors, E., & Woods, K. A. (2013). More resilient children are less test anxious and perform better in tests at the end of primary schooling. *Learning and Individual Differences, 21*(8), 41–46. https://doi.org/10.1016/j.lindif.2013.09.010

Putwain, D. W., Pekrun, R., Rainbird, E. M., & Roberts, C. M. (2022). Cognitive-behavioural intervention for test anxiety: Could teachers deliver the STEPS program and what training would they require? In L. R. V. Gonzala, L. L. Dellazzana-Zanon, & M. B. da Silva (Eds.), *Handbook of stress and academic anxiety: Psychological processes and interventions with students and teachers (pp. 381-399)*. Springer.

Putwain, D. W., Stockinger, K., von der Embse, N. P., Suldo, S. M., & Daumiller, M. (2021). Test anxiety, anxiety disorders, and school-related wellbeing: Manifestations of the same or different constructs? *Journal of School Psychology, 88*, 47–67. https://doi.org/10.1016/j.jsp.2021.08.001

Putwain, D. W., von der Embse, N. P., Rainbird, E. C., & West, G. (2021). The development and validation of a new multidimensional test anxiety scale (MTAS). *European Journal of Psychological Assessment, 37*(3), 236–246. https://doi.org/10.1027/1015-5759/a000604

Sheppes, G., & Gross, J. J. (2012). Emotion regulation effectiveness: What works when. In H. A. Tennen, & J. M. Suls (Eds.), *Handbook of psychology: Personality and social psychology* (pp. 391–406). Wiley.

Spielberger, C. D., & Vagg, R. P. (1995). Test anxiety: A transactional process model. In C. D. Spielberger, & P. R. Vagg (Eds.), *Test anxiety: Theory, assessment and treatment* (pp. 3–14). Taylor & Francis.

Steinmayr, R., Crede, J., McElvany, N., & Wirthwein, L. (2015). Subjective well-being, test anxiety, academic achievement: Testing for reciprocal effects. *Frontiers in Psychology, 6*, 1994. https://doi.org/10.3389/fpsyg.2015.01994

VandenBos, G. R. (Ed.). (2007). *American Psychological Association dictionary of psychology*. American Psychological Association.

Vasalampi, K., Muotka, J., Malmberg, L.-E., Aunola, K., & Lerkkanen, M.-K. (2021). Intra-individual dynamics of lesson-specific engagement: Lagged and cross-lagged effects from one lesson to the next. *British Journal of Educational Psychology, 91*(3), 997–1014. https://doi.org/10.1111/bjep.12404

von der Embse, N. P., Jester, D., Roy, D., & Post, J. (2018). Test anxiety effects, predictors, and correlates: A 30-year meta-analytic review. *Journal of Affective Disorders, 227*, 483–493. https://doi.org/10.1016/j.jad.2017.11.048

von der Embse, N. P., Putwain, D. W., & Francis, G. (2021). Interpretation and use of the multidimensional test anxiety scale (MTAS). *School Psychology, 36*(2), 86–96. https://doi.org/10.1037/spq0000427

Weems, C. F., Scott, B. G., Graham, R. A., Banks, D. M., Russell, J. D., Taylor, L. K., & Marino, R. C. (2015). Fitting anxious emotion-focused intervention into the ecology of schools: Results from a test anxiety program evaluation. *Prevention Science, 16*(2), 200–210. https://doi.org/10.1007/s11121-014-0491-1

Widaman, K. F., Ferrer, E., & Conger, R. D. (2010). Factorial invariance within longitudinal structural equation models: Measuring the same construct across time. *Child Development Perspectives, 4*(1), 10–18. https://doi.org/10.1111/j.1750-8606.2009.00110.x

Williams, C., & Chellingsworth, M. (2010). *CBT: A clinicians guide to using the five areas approach*. Hodder Arnold.

Zeidner, M., & Matthews, G. (2005). Evaluation anxiety. In A. J. Elliot, & C. S. Dweck (Eds.), *Handbook of competence and motivation* (pp. 141–163). Guilford Press.

Zimmerman, B. J., Schunk, D. H., & DiBenedetto, M. K. (2017). The role of self-efficacy and related beliefs in self-regulation of learning and performance. In A. J. Elliot, C. S. Dweck, & D. S. Yeager (Eds.), *Handbook of competence and motivation: Theory and application* (pp. 313–333). The Guildford Press.

Zong, Y., Holliman, A., Waldeck, D., & Abbott, N. (2021). Examining the contribution of motivation, adaptability, and buoyancy to course satisfaction and test anxiety among university students. *Psychology of Education Review, 45*(2), 75–79. https://eric.ed.gov/?id=EJ1317016.