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# Does Test Anxiety Predispose Poor School-Related Wellbeing and Enhanced Risk of Emotional Disorders?

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## Abstract

**Background** Previous studies have shown that children and adolescents who report high levels of test anxiety also report symptoms of, and meet clinical criteria for, emotion disorders (anxiety and depression). However, the directionality of this relation cannot be established from existing studies: Is high test anxiety predisposing persons at elevated risk for developing emotion disorders or vice versa? In the present study, we addressed this question in a sample of adolescents. In addition to the risk of developing an emotion disorder, based on the Dual Factor Model of Mental Health, we also considered school-related wellbeing.

**Method** Self-reported data were collected over two waves from 1198 participants, aged 16–19 years, in upper secondary education.

**Results** Data were analysed using a structural equation model controlling for gender and age. We found reciprocal relations between test anxiety and elevated risk for developing emotion disorders, and between school-related wellbeing and elevated risk for developing emotion disorders. School-related wellbeing was negatively related to subsequent test anxiety but not vice versa.

**Conclusions** Our findings imply that there would be downstream benefits to improved mental health from using interventions to address test anxiety but also, from addressing emotion disorders, to improve school-related wellbeing and test anxiety.

**Keywords** Test anxiety · Emotion disorders · Emotion risk · Subjective wellbeing · School-related wellbeing

There have been numerous reports in recent years pointing to serious concerns about the mental health and wellbeing of children and young people and specifically to the increase in the incidence of anxiety (e.g., Bor et al. 2014; Collishaw 2014; Gore et al. 2011). Numerous reasons for the increase in anxiety have been speculated including the use of social media, increased exposure to violence, trauma, conflict, and excessive pressure to succeed at school (Davey 2018). With regards to the latter, results from the 2015 PISA survey, for instance, showed that 55% of adolescent students from

participating OECD countries indicated frequently worrying about poor performance in school even if they had prepared well for a test (OECD 2017). Studies, however, are only beginning to empirically address possible reasons for the contemporary increases in anxiety (Viner et al. 2019). In the present study, the link between excessive academic pressures (measured using test anxiety as an indicator of excessive perceived academic pressure) and subsequent risk for emotion disorders (i.e., anxiety and depression) is examined within a sample of students aged 16–19 years in an upper tier of secondary education (referred to colloquially in England as ‘6th form’) studying for examinations on which university entrance is based. Test anxiety, school-related wellbeing, and risk for emotion disorders were measured over two waves near the beginning and end of the academic school year.

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## Test Anxiety: An Indicator of Perceived Academic Pressure

Test anxiety is experienced when a person appraises performance-evaluative situations as threatening. This can refer to specific episodes of state anxiety or, the approach we adopt in the present study, enduring trait-like individual differences in the threat appraisal of performance-evaluative situations. In the Self-referent Executive Processing (S-REF) model (Zeidner and Matthews 2005), elevated test anxiety arises from the negative self-beliefs (e.g., self-doubt and anticipated failure) combining with executive processing strategies (including coping and metacognition) that magnify threat, and maladaptive person-situation interactions (e.g., avoiding opportunities to improve). Various studies have provided strong empirical support for the various processes outlined in the S-REF model (e.g., Matthews et al. 1999; Putwain 2019). Meta-analyses have evidenced a negative relation between test anxiety, especially its cognitive component (worries about failure and its consequences), and educational achievement (e.g., Hembree 1988; von der Embse et al. 2018). This negative relation is often used to justify the relevance of test anxiety as a construct of practical and theoretical significance. An often overlooked outcome within the academic literature is how test anxiety may relate to student wellbeing and mental health.

## Test Anxiety, Subjective, and School-Related Wellbeing

There is a burgeoning literature on the wellbeing of children and young people. The term ‘subjective wellbeing’, however, is used in a hazy and ill-defined way (Statham and Chase 2010). In the present study, we define *subjective* wellbeing as the presence of happiness, satisfaction, and positive emotions (Diener 1994; Diener et al. 2003). Subjective wellbeing could refer to one’s life in general or to specific elements of one’s life, such as schooling (Diener et al. 2018). Hascher (2003, 2008) specifically defines school-related wellbeing as the perceived balance between three positive and three negative aspects of school life. The three positive elements are: Attitudes towards school (e.g., valuing school), enjoyment in school (e.g., receiving a good grade), and academic self-concept (e.g., meeting school standards). The three negative elements are: Worries about school (e.g., poor academic progress), physical complaints in school (e.g., headaches and dizziness), and social problems at school (e.g., poor relationships with peers).

High test anxiety could potentially lower wellbeing directly via worry about failing tests and examinations,

and indirectly through tainting the positive elements of school life (e.g., reduced confidence in one’s ability and positive attitudes towards school). Few studies, however, have investigated relations between test anxiety and subjective or school-related wellbeing. In cross-sectional studies, negative relations between test anxiety and school-related wellbeing were reported by Hascher (2007;  $r_s$   $-0.15$  to  $-0.46$ ) and by Putwain et al. (2020a, b;  $r_s$   $-0.03$  to  $-0.33$ ) in secondary school students, and for subjective wellbeing by Lin and McKeachie (1971;  $r_s$   $-0.26$  to  $-0.59$ ) in undergraduate students. In a two-wave study of upper-secondary school students, the cognitive dimension of test anxiety was negatively related to subjective wellbeing twelve months later (positive mood:  $\beta = -0.21$ ; life satisfaction:  $\beta = -0.12$ ) having controlled for autoregressive and concurrent relations (Steinmayr et al. 2016).

The aforementioned studies suggest that test anxiety may indeed lead to lower school-related wellbeing. It is, however, plausible to assume that test anxiety and school-related wellbeing are related in a bidirectional fashion. That is, not only might higher test anxiety lead to lower wellbeing over time, but lower wellbeing might also lead to higher test anxiety over time. Theoretically speaking, negative self-beliefs (a negative element of school life) are a key antecedent of high test anxiety in the S-REF model and there is substantial evidence to suggest that lower academic self-concept predicts subsequent higher test anxiety (e.g., Arens et al. 2017; Putwain et al. 2020a, b). Furthermore, a tendency to experience somatic complaints (another negative element of school life) is related to higher test anxiety (Beidel 1988; Chin et al. 2017), and could become a precursor to test anxiety (see Hagtvet and Benson 1997).

In short, there are good reasons for assuming that lower school-related wellbeing, as defined by Hascher (2007), would predict subsequent higher test anxiety. In the aforementioned study by Steinmayr et al. (2016), however, the relations between subjective wellbeing to test anxiety were not statistically significant. A specific school-related measure of wellbeing, however, might be expected to show stronger relations with subsequent test anxiety than a general measure of subjective wellbeing that is concerned with both school and non-school influences. Accordingly, in the present study we used a specific measure of school-related wellbeing.

## Test Anxiety and Emotion Disorder

Emotion disorder is an omnibus term used for anxiety and mood disorders that overlap in symptomology and etiology, and are underpinned by common biological, psychological, and experiential, vulnerabilities (Barlow et al. 2016).

Emotion disorders are discrete (i.e., diagnosed as absent or present) whereas test anxiety is represented on a continuum. Persons with high scores on trait test anxiety (and also general trait anxiety; see Chambers et al. 2004), however, may show levels of distress, dysfunction, and symptomology, that correspond to those of emotion disorders (Gerwing et al. 2015; Pekrun and Loderer 2020). A binary approach to the conceptualisation of discrete emotion disorders is not universally accepted and there may be many benefits to adopting a dimensional approach to emotion disorders (e.g., Goldberg 2000; Shear et al. 2007). Although DSM-5 includes dimensional assessment of emotion disorders (e.g., Möller et al. 2014; Möller and Bögels 2016), the assumption of categorically distinct emotion disorders remains.

The integrative network approach proposes that symptoms of anxiety disorders are represented as nodes in distributed systems of associations (Hereen and McNally 2016, 2018). Central nodes are those with more dense connections to other symptoms and accordingly occupy an influential role. Activation of these nodes will spread to associated nodes more quickly and powerfully than nodes with fewer, and less dense, connections to others and play an important role in the development and maintenance of a disorder. The integrated network approach can not only account for comorbidity across emotion disorders by reconceptualising symptoms as systems of clustered associations but also highlights the role of trait anxiety as risk factor for developing an anxiety disorder through activating central nodes (Hereen et al. 2018).

In highly test anxious elementary school children (Test Anxiety Scale for Children [TASC] scores at the 40th scale percentile for males and 53rd scale percentile for females), 60% of 3rd to 6th Grade students (Beidel and Turner 1988) and 57% of students with a mean age of 10 years (Beidel et al. 1994) met DSM criteria for an anxiety disorder following diagnostic interview. Furthermore, Weems et al. (2010) showed that highly anxious 4th to 8th grade students (TASC scores  $\geq$  44th scale percentile) reported higher anxiety ( $d$ s = 0.71 to 0.95) and depression ( $d$  = 0.86) symptoms than their low test anxious students (TASC scores < 44th scale percentile).

In highly test anxious secondary school students (top 5% of the distribution of TASC scores; 60th scale percentile for males and 77th scale percentile for females), 61% of students in Grades 9 and 10 (aged 15 years) met DSM criteria for an anxiety disorder following diagnostic interview (King et al. 1995). Furthermore, large differences in anxiety ( $d$  = 2.06) and depression ( $d$  = 1.56) symptoms were shown compared to those reporting in the bottom 5% of the distribution of TASC scores. In a sample of secondary school students aged 9 to 16 years, Warren and colleagues (1996) found that those scoring in the upper 60th scale percentile of the Test Anxiety Inventory (TAI) reported significant higher anxiety

( $d$ s = 0.72 to 2.67) and depression ( $d$ s = 0.57 to 1.88) symptoms than their low test anxiety counterparts (33rd scale percentile). Owens et al. (2012) found, in a sample of secondary school students aged 12–13 years that the cognitive (Worry) component of the Children's Test Anxiety Scale strongly correlated with RCADs depression scores ( $r$  = 0.62).

More recently, Herzer et al. (2014) found that among a sample of adults aged 20 to 25 years, studying for university or vocational examinations, those reporting in the upper 66th scale percentile of the German TAI were diagnosed (with 96.6% accuracy) with an emotion disorder following diagnostic interview. Putwain et al. (2020c) reported that test anxiety was positively correlated ( $r$ s = 0.13 to 0.46 for the different components of test anxiety) with an elevated risk of developing an emotion disorder (assessed via the Social, Academic, and Emotional, Behavior Risk Screener [SAE-BRS; von der Embse et al. 2016]) in a sample of secondary school students aged 11–19 years.

Although the aforementioned studies used different criteria with which to establish the cut-point for 'high' test anxiety on continuous scales with no rationale or explanation, they do provide compelling evidence that high levels of test anxiety can overlap with emotion disorders. These studies do not, however, address questions of directionality. That is, the question remains to what extent test anxiety may predispose students to a greater risk of developing emotional disorders and/or vice versa. Following the integrative network approach, we propose that bidirectional relations between test anxiety and enhanced risk of developing emotion disorders (henceforth referred to as *emotion risk* for brevity) are plausible. Test anxious cognitions (e.g., worrying about negative outcomes), for instance, could generalise from testing to social situations through activating networks of associated anxiety and depression symptom nodes (see Hereen et al. 2018). Similarly, cognitive biases that underpin emotion disorders (e.g., selective abstraction, catastrophising, and overgeneralisation) could influence the executive processes specified in the S-REF model to magnify fear of failure and increase subsequent test anxiety.

## The Dual-Factor Model of Mental Health

In the present study we have theorised separate bidirectional relations between test anxiety and school-related wellbeing, and between test anxiety and emotion risk. Our reasoning for considering school-related wellbeing *and* emotion risk was informed by the Dual-Factor Model of Mental Health (DFM; Suldo and Shaffer 2008). The DFM is based on the premise that mental health is not simply the absence of a mental disorder, but must be accompanied by the presence of subjective markers of wellbeing (Diener et al. 2002). Wellbeing and psychopathology are related but distinct constructs and

therefore it is possible that some persons may experience moderate or even high subjective wellbeing despite suffering from a mental disorder and, conversely, low subjective wellbeing in the absence of any mental disorder (e.g., Antaramian et al. 2010; Greenspoon and Saklofske 2001; Lyons et al. 2013; Suldo et al. 2016).

Hence, if test anxiety does show bidirectional relations with greater emotion risk, as theorised, it cannot be assumed this would necessarily predict lower school-related wellbeing and vice versa. Accordingly, we included both school-related wellbeing *and* emotion risk in the present study. Analysing data in a single analytic model presents an opportunity to also assess bidirectional relations between school-related wellbeing and emotion risk. Notwithstanding the rationale underpinning the DFM, all things being equal, we hypothesised that higher emotion risk would be related to lower school-related wellbeing and vice versa. The presence of an emotion disorder is likely to contribute to the negative aspects of school life, namely, worries about school, physical complaints in school, and social problems that contribute to school-related wellbeing, and vice versa (e.g., Crawford and Manassis 2011; Millings et al. 2012; Oldfield et al. 2016).

## Aim of the Present Study

The aim of the present study was to investigate bidirectional relations between test anxiety, school-related wellbeing, and emotion risk, in a sample of upper secondary school students following a programme of study for university entrance examinations. Since previous studies have shown differences in test anxiety, subjective wellbeing, and emotion disorders for gender, age, and economic deprivation (e.g., Asher and Aderka 2018; – 2007; Rees and Bradshaw 2016), we controlled for the influence of demographic variables in our analyses. The following hypotheses were tested:

*Hypothesis 1:* Higher test anxiety will be related to greater subsequent emotion risk and lower school-related wellbeing.

*Hypothesis 2:* Higher school-related wellbeing will be related to lower subsequent test anxiety and lower emotion risk.

*Hypothesis 3:* Higher emotion risk will be related to higher subsequent test anxiety and lower school-related wellbeing.

## Method

### Participants

There were 1198 participants in the study (male = 419, female = 775, chose not to disclose = 24) from a convenience sample. All participants were in the first year of a tier

of upper secondary education (Year 12) with a mean age of 16.5 years ( $SD = 0.60$ ) at  $T_1$  data collection and following pre-university programmes of study (General Certificate of Education, Advanced Level: A-Level) taken at the end of the following academic year (Year 13). This tier of education is referred to as 6th form in England and participants were drawn from three colleges specialising in 6th form study<sup>1</sup>. The ethnic heritage of participants was predominantly White Caucasian ( $n = 1031$ ) with smaller numbers from Black ( $n = 17$ ), Asian ( $n = 103$ ), and mixed heritage/other backgrounds ( $n = 18$ ), and 29 missing responses. The proportion of students from Black and Minority Ethnic backgrounds in the present study was broadly representative of the proportion found in all forms of 16–19 years education in England for 2017–18 (21.8%), the year that data were collected in the present study (Department for Education 2018).

There was a relatively small proportion of missing data (5.5%) that were not missing completely at random (MCAR: Little's test  $p < 0.001$ ). A series of follow-up  $t$ -tests were used to examine whether missing data in  $T_2$  test anxiety, wellbeing, and emotion risk, differed as a function of  $T_1$  scores in the aforementioned variables and age; logistic regression was used to establish whether missing data in  $T_2$  test anxiety, wellbeing, and emotion risk, differed by gender or dummy coded ethnic heritage.  $T_2$  missing data for wellbeing were more likely in participants with lower  $T_1$  test anxiety ( $p < 0.05$ ), and  $T_2$  missing data for test anxiety were more likely in participants with lower  $T_1$  test anxiety and emotion risk, and higher  $T_1$  wellbeing ( $ps < 0.05$ ), and therefore were treated as missing at random (MAR). It is a possible that such participants placed less value on aims of the study influencing their decision to withdraw participation at  $T_2$ . In subsequent latent variable modelling, full information maximum likelihood (FIML) was used to deal with missing data. When the variable(s) responsible for missingness are included in models, as they are in the present study, FIML has been shown to produce robust and unbiased estimates (Nicholson et al. 2017).

## Measures

### Test Anxiety

Test anxiety was measured using the 16-item *Multidimensional Test Anxiety Scale* (MTAS: Putwain et al. 2020c). This scale contains four subscales, each comprising of four items each: Worry (e.g., 'I am afraid of writing the wrong answer during a test/exam'), cognitive interference (e.g., 'During tests/exams, I forget things that I have learnt'), feeling of tension (e.g., 'Even when I have prepared for a test/ exam I feel nervous about it'), and physiological indicators of anxiety (e.g., 'My heart races when I take a test/ exam'). Participants responded to items on a five-point scale

(1 = *strongly disagree*, 3 = *neither*, 5 = *strongly agree*), thus higher scores represent higher levels of test anxiety. Depending on the substantive focus on one's research questions, MTAS data can be modelled as four correlated subscales or as a higher-order model with a single total test anxiety score (Putwain et al. 2020c). In the present study, a higher-order model was used as our research questions were not germane to the differentiated components of test anxiety. The higher order model showed a good fit the data and excellent internal consistency (see Table 1).

### School-Related Wellbeing

School-Related wellbeing was measured using the brief, six-item, unidimensional school-related wellbeing scale (SWBS; Loderer et al. 2016). This scale is designed to capture global judgements of student's subjective wellbeing at school. Following the parlance used in participating institutions, items were adapted to refer to 'college' rather than 'school'. Participants responded to items (e.g., 'College is going well for me') on a five-point scale (1 = *strongly disagree*, 3 = *neither*, 5 = *strongly agree*), meaning that higher scores represent higher wellbeing. Previous research has demonstrated good construct validity and internal consistency of data using this scale (e.g., Putwain et al. 2020c). In the present study the unidimensional scale showed a good fit the data and excellent internal consistency (see Table 1).

### Emotion Risk

The SAEBRS is a multi-instrument assessment suite comprising a teacher report (-TRS; 19 items), parent report (-PRS; 19 items) and student self-report (-SRS; 20 items) that identifies emotional, social, and behavioral risk. Development of the scale was guided by the DFM, and it measures pre-symptomology indicative of psychopathology as well as the presence of prosocial and adaptive skills. The SAEBRS-SRS was used in the present study, and includes a total score in addition to three subscales for Social Behaviours, Emotional Behaviours, and Academic Behaviors (von der Embse et al. 2016, 2017a, b). We specifically utilized the seven-item 'Emotional Behaviour' subscale as being the most germane of the three SAEBRS

subscales to risk of developing an emotion disorder. Participants were instructed to respond to items (e.g., 'I am sad', 'I am worried', and 'When something bad happens, it takes me a while to feel better') based on how they had felt in the last month using a 4-point scale (0 = never, 1 = sometimes, 2 = often, 3 = almost always). SAEBRS has demonstrated good construct validity and internal consistency in previous research (von der Embse et al. 2017a, b). In the present study, the Emotional Behaviour scale also showed a good fit to the data and excellent internal consistency (see Table 1).

### Procedure

The first wave of data collection ( $T_1$ ) took place in October of the Autumn term and the second wave of data collection ( $T_2$ ) in May of the Summer term, of the same academic year. Students were scheduled to take internal college examinations during June. Although these internal examinations do not carry the same weight as actual A-Level examinations taken at the end-of-Year 13, grades from the end-of-Year 12 examinations were used by UK universities to offer provisional places on competitive courses. End-of-Year 12 examinations may not, therefore, be low-stakes for students with aspirations to study at university. At each phase of data collection, participants were provided with a questionnaire bundle that included the aforementioned measures, an information sheet that outlined the aims of the study and ethical issues, and a page for reporting demographic details (gender, age, and ethnicity). Data were collected in college during a period of the timetable used for personal, social and health education, and were administered by regular college staff. College staff followed a script that reiterated the points in the information sheet, and emphasised that participation was voluntary and data could be retrospectively withdrawn. An anonymous code was used to match up the questionnaires from  $T_1$  to  $T_2$ . Written consent was provided by the College Principals and individual participants. This project was approved by an institutional research ethics committee (EHC/16/TPL).

**Table 1** Descriptive statistics for test anxiety, school-related wellbeing, and emotional risk

	Mean	SD	$\omega$	$\rho_t$	Skewness	Kurtosis	Factor loadings
$T_1$ Total test anxiety	53.54	11.94	.93	.09	-0.50	0.29	.70-.93
$T_2$ Total test anxiety	54.89	11.12	.93	.09	-0.27	0.31	.70-.93
$T_1$ School-related wellbeing	23.05	3.21	.86	.02	-0.98	2.82	.55-.91
$T_2$ School-related wellbeing	21.48	3.58	.84	.06	-0.87	0.78	.63-.81
$T_1$ Emotional risk	16.37	3.74	.72	.32	0.16	-0.81	.29-.88
$T_2$ Emotional risk	14.32	4.24	.84	.14	0.32	-0.34	.32-.91

## Results

### Descriptive Statistics

Descriptive statistics are shown in Table 1. Test anxiety and emotion risk were normally distributed and although school-related wellbeing was not overly skewed there was a small leptokurtic distribution. The internal consistency (assessed using McDonald's  $\omega$ ) was excellent for all constructs ( $\omega_s \geq 0.83$ ). The intraclass reliability coefficients (ICC1, or  $\rho_I$ ) showed the proportion of variance in the data attributable to the school level (i.e., between-college differences) was higher for test anxiety and emotion risk than for school-related wellbeing. With one exception, factor loadings, drawn from the measurement model described below, were good (one T<sub>1</sub> emotion risk item loaded  $\lambda < 0.3$ ). A measurement model was built to assess the psychometric properties of constructs prior to subsequent structural equation modelling. Test anxiety was modelled with a higher-order structure. Four lower-order factors, each with four items (worry, cognitive interference, tension, and physiological indicators) were used as indicators for one higher-order factor. School-related wellbeing and emotion risk were modelled as unidimensional scales comprising of 6 and 7 items respectively. Identical factor structures were used for T<sub>1</sub> and T<sub>2</sub> and residual variance between corresponding items at T<sub>1</sub> and T<sub>2</sub> was allowed to correlate.

A confirmatory factor analysis was used to test the measurement model in the *Mplus* v.8.3 software (Muthén and Muthén 2017) using the weighted least square mean and variance adjusted (WLSMV) estimator. WLSMV is preferable for use with scales using categorical or ordinal responses (Lubke and Muthén 2004). The 'type = complex' command was used to adjust standard errors for the clustering of data within colleges. The following widely used indices were consulted for in order to assess model

fit: Root mean error of approximation (RMSEA), standardised root mean residual (SRMR), confirmatory fit index (CFI), and the Tucker-Lewis Index (TLI). Guidelines suggest a good fitting model is indicated by RMSEA  $< 0.05$ , SRMR  $< 0.08$ , and CFI and TLI  $> 0.95$  (Hu and Bentler 1999); the measurement model (estimated using WLSMV) showed a good fit to the data:  $\chi^2(1659) = 2272.67$ ,  $p < 0.001$ , RMSEA = 0.018, SRMR = 0.079, CFI = 0.963, and TLI = 0.960.

### Latent Bivariate Correlations

Demographic covariates (gender and age) were added to the measurement model as manifest variables in order to estimate latent bivariate correlations. This model showed a good fit to the data,  $\chi^2(1647) = 2124.60$ ,  $p < 0.001$ , RMSEA = 0.016, SRMR = 0.071, CFI = 0.971, and TLI = 0.969, and latent bivariate correlations are reported in Table 2. Test anxiety correlated negatively with school-related wellbeing and positively with emotion risk at T<sub>1</sub> and T<sub>2</sub>. T<sub>1</sub> School-related wellbeing and emotion risk were negatively related at T<sub>1</sub>. T<sub>2</sub> School-related wellbeing was negatively related to T<sub>1</sub>, but not T<sub>2</sub>, emotion risk. Gender was correlated with T<sub>1</sub> and T<sub>2</sub> test anxiety and emotion risk, and T<sub>1</sub> school-related wellbeing (female students reported higher test anxiety and emotion risk, and lower school-related wellbeing). Age negatively correlated with T<sub>1</sub> and T<sub>2</sub> school-related wellbeing. Emotion risk correlated positively with age at T<sub>1</sub> and negatively at T<sub>2</sub>.

### Measurement Invariance

A series of tests were conducted to establish measurement invariance across the two time points. This is an important preliminary step in modelling data over time to demonstrate that instruments represent the same underlying construct at the different waves of measurement. As indicators were treated as categorical, and estimated using WLSMV, we

**Table 2** Bivariate correlations between test anxiety, school-related wellbeing, emotion risk and demographic covariates (Gender and age)

	1	2	3	4	5	6	7	8
1. T <sub>1</sub> Total test anxiety	–	.84***	–.25***	–.18***	.50***	.43***	.33***	.02
2. T <sub>2</sub> Total test anxiety	.72***	–	–.18***	–.28***	.52***	.41***	.32***	–.01
3. T <sub>1</sub> School-related wellbeing	–.18***	–.17***	–	.61***	–.19**	–.12***	–.11***	–.14***
4. T <sub>2</sub> School-related wellbeing	–.18***	–.21***	.46***	–	–.18***	–.01	–.04	–.09***
5. T <sub>1</sub> emotion risk	.43***	.38***	–.16***	–.13***	–	.19***	.23***	.09**
6. T <sub>2</sub> emotion risk	.27***	.36***	–.06	–.06	.21***	–	.18***	–.18*
7. Gender	.32***	.29***	–.07*	–.01	.23***	.15***	–	–
8. Age	.05	.02	–.13***	–.06*	.14***	–.18***	–	–

Latent bivariate correlations above, and manifest correlations below, the diagonal. Gender was coded 0 = male and 1 = female

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

followed the approach described by Edossa et al. (2018). Invariance of factor loadings was tested in a configural invariance model and invariance of item loadings and thresholds in a strong invariance model. Strong invariance is the minimum requirement for the modelling of structural relations over time. For completeness, however, we also tested for strict invariance of item residuals in a residual invariance model (Widaman et al. 2010).

As categorical data thresholds and factor loadings have to be varied together, the metric invariance step, commonly found in invariance testing using continuous indicators, was not required. The ‘type=complex’ command was used for school-related wellbeing to adjust standard errors for clustering of data within colleges. Invariance models for test anxiety, school-related wellbeing, and emotional risk are

reported in Table 3. As successive constraints are applied to each model, a substantial deterioration in model fit ( $\Delta RMSEA = +0.015$  and  $\Delta CFI/TLI = -0.01$ ) indicates a lack of invariance (Chen 2007; Cheung and Rensvold 2002). Test anxiety, school-related wellbeing, and emotional risk, all demonstrated residual invariance.

### Structural Equation Modelling

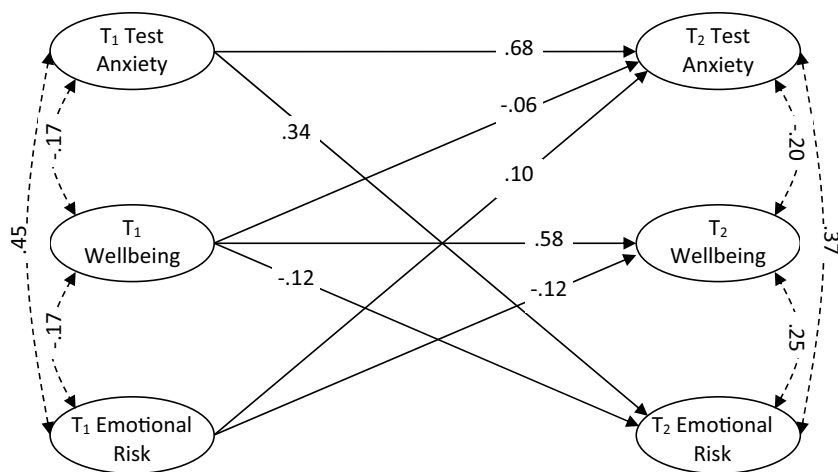
A structural equation model (SEM) was used to assess bidirectional relations between test anxiety, school-related wellbeing, and emotion risk (see Fig. 1). Autoregressive and cross-lagged paths were specified between test anxiety, school-related wellbeing, and emotion risk, at T<sub>1</sub> and T<sub>2</sub>. Age and gender were included as demographic covariates.

**Table 3** Tests of measurement invariance

	$\chi^2(df)$	RMSEA	SRMR	CFI	TLI	$\Delta RMSEA$	$\Delta CFL$	$\Delta TLI$
School-related wellbeing								
Configural invariance	83.48 (53)*	.022	.040	.998	.998			
Strong invariance	106.97 (68)**	.022	.045	.998	.998	.000	.000	.000
Residual invariance	158.99 (73)***	.031	.056	.995	.996	+.009	-.003	-.002
Test anxiety								
Configural invariance	608.22 (431)***	.019	.050	.992	.990			
Strong invariance	637.02 (490)***	.018	.053	.991	.991	-.001	.001	+.001
Residual invariance	704.41 (506)***	.018	.054	.991	.991	.000	.000	.000
Emotion risk								
Configural invariance	109.62 (65)***	.024	.056	.971	.960			
Strong invariance	130.74 (85)***	.021	.089	.971	.969	-.003	.000	+.009
Residual invariance	137.80 (92)***	.020	.080	.971	.971	-.001	.000	+.002

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

**Fig. 1** Statistically significant coefficients in the bidirectional model of test anxiety, school-related wellbeing, and emotion risk



*Note.* Solid black lines represent structural paths and dashed lines represent correlations. Age and gender were included as covariates for all models but for simplicity omitted from the figure. For brevity, we refer to school-related wellbeing in Figure 1 simply as wellbeing.

The SEM showed a good fit to the data on all indices except the SRMR,  $\chi^2(1639)=2173.75, p < 0.001$ , RMSEA = 0.017, SRMR = 0.097, CFI = 0.980, and TLI = 0.978, and so we proceeded to inspect path coefficients (see Table 4). We interpreted  $\beta$ s from 0.05 to 0.09 as small, 0.10 to 0.24 as moderate, and  $> 0.25$  as large (Keith 2006).

T<sub>2</sub> test anxiety was predicted positively by T<sub>1</sub> test anxiety and T<sub>1</sub> emotion risk, and negatively by T<sub>1</sub> school-related wellbeing. T<sub>2</sub> school-related wellbeing was predicted positively by T<sub>1</sub> school-related wellbeing, and negatively by T<sub>1</sub> emotion risk, and was unrelated to T<sub>1</sub> test anxiety. T<sub>2</sub> emotion risk was predicted positively by T<sub>1</sub> test anxiety and negatively by T<sub>1</sub> school-related wellbeing, and was unrelated to T<sub>1</sub> emotion risk. Female students reported higher T<sub>1</sub> and T<sub>2</sub> test anxiety, higher T<sub>1</sub> and T<sub>2</sub> emotion risk, and lower T<sub>1</sub>, but higher T<sub>2</sub> school-related wellbeing. Older students reported lower T<sub>1</sub> school-related wellbeing, higher T<sub>1</sub> emotion risk, and lower T<sub>2</sub> emotion risk. Statistically significant path coefficients are diagrammed in Fig. 1.

The correlation between T<sub>2</sub> school-related wellbeing and emotion risk was unexpectedly positive ( $r=0.25$ ) and differed markedly from the latent bivariate correlation ( $r=-0.01$ ). This is a likely case of statistical suppression (Maassen and Bakker 2001) resulting from the shared variance between test anxiety, emotion risk, and school-related wellbeing over the two waves exaggerating uncommon elements of T<sub>2</sub> emotion risk, and school-related wellbeing.

## Discussion

The aim of this study was to examine bidirectional relations between test anxiety, school-related wellbeing, and emotion risk, in a sample of adolescent students. Self-reported data for test anxiety, school-related wellbeing, and emotion risk were collected twice from participants in a tier of upper secondary education (referred to as 6<sup>th</sup> form) over a single academic year (separated by approximately seven months). Bidirectional relations were examined using a

structural equation model. After controlling for the concurrent relations, gender, and age, higher T<sub>1</sub> test anxiety predicted higher T<sub>2</sub> emotion risk but was unrelated to T<sub>2</sub> school-related wellbeing (partly supporting Hypothesis 1). Higher T<sub>1</sub> school-related wellbeing was related to lower T<sub>2</sub> test anxiety and T<sub>2</sub> emotion risk (supporting Hypothesis 2). Finally, higher T<sub>1</sub> emotion risk was related to higher T<sub>2</sub> test anxiety, and lower T<sub>2</sub> school-related wellbeing (supporting Hypothesis 3). In summary, bidirectional relations were found between test anxiety and emotion risk, and between school-related wellbeing and emotion risk. Test anxiety and school-related wellbeing were related in a unidirectional rather than bidirectional fashion.

Based on the integrative network approach (Hereen and McNally 2016, 2018) and S-REF model (Zeidner and Matthews 2005) we theorized that test anxiety would be related to emotion risk in a bidirectional fashion. Test anxiety might predispose persons to emotion risk by acting as ‘hidden generators’ that activate related clusters of anxiety and depression symptoms and the cognitive biases that underpin emotion disorders would also lead to enhanced threat of failure in tests and exams. Extant research has shown that test anxiety and emotion disorders are related (e.g., King et al. 1995; Owens et al. 2012; Weems et al. 2010) but has yet to examine the question of directionality. The findings of the present study address this gap in the literature and reveal bidirectional relations; higher test anxiety was related to greater subsequent emotion risk, and greater emotion risk was related to higher subsequent test anxiety.

It is notable that the path from test anxiety to emotion risk ( $\beta=0.34$ ) was considerably stronger than the path from emotion risk to test anxiety ( $\beta=0.10$ ). This is perhaps not surprising given that test anxiety was conceptualized as being trait-like and was highly stable across the two waves of measurement in the present study. In comparison, emotion risk was conceptualized as being more state-like (participants were asked to report on the last four weeks) and less stable; the autoregressive path across the two waves of measurement for emotion risk was not statistically significant.

**Table 4** Standardized path coefficients for bidirectional model of test anxiety, school-related wellbeing, and emotion risk (Standard errors in parentheses)

	T <sub>1</sub> test anxiety	T <sub>1</sub> School-related wellbeing	T <sub>1</sub> Emotion risk	T <sub>2</sub> Test anxiety	T <sub>2</sub> School-related wellbeing	T <sub>2</sub> Emotion risk
T <sub>1</sub> Test anxiety				.68 (.03)***	.02 (.01)	.34 (.04)***
T <sub>1</sub> School-related wellbeing				-.06 (.01)***	.58 (.03)***	-.11 (.03)***
T <sub>1</sub> Emotion risk				.10 (.04)*	-.12 (.03)***	.01 (.02)
Gender	.34 (.02)***	-.10 (.02)***	.26 (.01)***	.10 (.04)***	.04 (.01)**	.06 (.01)***
Age	.03 (.03)	-.15 (.02)***	.13 (.01)***	.01 (.03)	.03 (.02)	-.19 (.08)**

Gender was coded 0 = male and 1 = female

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

In addition, the second wave of measurement took place approximately one month prior to end-of-Year 12 examinations which have a significant bearing on being made an offer of university study. This may have contributed to an elevated emotion risk in highly test anxious persons. Test anxiety might therefore be considered a substantive risk factor for the development of subsequent emotion disorders.

Based on the DFM (Suldo and Shaffer 2008), we reasoned that school-related wellbeing should be considered as distinct to emotion risk. That is, low school-related wellbeing cannot necessarily be inferred solely from the presence of emotion risk. We theorized that negative elements of school-related wellbeing (e.g., negative beliefs about school and somatic complaints) could become a precursor to greater test anxiety and that higher test anxiety could taint the positive elements of school life, leading to lower wellbeing. Previous research using cross-sectional designs has confirmed negative relations between test anxiety and school-related and subjective wellbeing (Putwain et al. 2020c; Hascher 2007; Lin and McKeachie 1971). Only one study has examined bidirectional relations, however. In this study, higher cognitive test anxiety predicted lower subjective wellbeing but not vice versa (Steinmayr et al. 2016). We reasoned that relations with test anxiety would be higher with a school-specific measure of wellbeing than a general measure of subjective wellbeing.

Our data did not support reciprocal relations. Higher school-related wellbeing predicted lower test anxiety, but test anxiety was unrelated to subsequent wellbeing. Thus, negative elements of school life, such as negative beliefs about school, may indeed contribute to subsequent test anxiety. This is consistent with findings from other studies showing how negative beliefs contribute to subsequent test anxiety (e.g., Arens et al. 2017; – et al. 2020a, b), although not those of Steinmayr et al. (2016). It is important, however, not to overstate this finding as the relation was only small ( $\beta = -0.06$ ). Although we theorized that higher test anxiety would taint positive aspects of school life and lead to lower wellbeing, this was not supported by the data and contradicts Steinmayr et al.'s (2016) finding.

Since school-related wellbeing is malleable and responsive to environmental conditions in school, such as the quality of peer and teacher relationships (e.g., Goswami 2012; Lee and Yoo 2015), it is possible that relations between test anxiety and school-related wellbeing were temporally sensitive. Test anxiety may influence immediate school-related wellbeing but over a longer term period, such as the seven month interval used in the present study, positive aspects of wellbeing may reassert. This may also partly explain the contrasted findings with Steinmayr et al. (2016) who used a more trait-like measure of subjective being. Experience sampling approaches (see Zirkel et al. 2015), using real-time measures of school-related wellbeing, would be an effective

approach to map relations with test anxiety over time. It likely that relations between test anxiety and school-related wellbeing would differ depending on the emotion regulation strategies used (see Balzarotti et al. 2016) and could be a fruitful avenue for future research studies. It is clear, however, that simply using a school-specific measure of wellbeing does not result in larger relations than a more general measure of subjective wellbeing.

The inclusion of school-related wellbeing, as well as emotion risk, also offered the opportunity to examine relations between these two constructs over time. We theorized relations would be reciprocal; lower school-related wellbeing would be related to higher subsequent emotion risk as a result of worries about school, physical complaints in school, and social problems and emotion risk would contribute to the negative elements of school-related wellbeing (e.g., Crawford and Manassis 2011; Millings et al. 2012; Oldfield et al. 2016). Results supported this hypothesising and confirmed directional relationships between school-related wellbeing and emotion risk. An assumption of the DFM is that not all students with high emotion risk will have lower subsequent wellbeing (Suldo and Shaffer 2008). Our results, however, showed the overall relation is a negative one. Higher emotion risk might therefore be considered a high risk factor for the subsequent low school-related wellbeing and vice versa.

### Limitations and Suggestions for Future Studies

Although in the present study, we used a strong design and an appropriately powered robust analytic approach (see Bentler and Chou 1987) to model bidirectional relations between test anxiety, emotion risk, and school-related wellbeing, there are nonetheless three principal limitations to highlight. First, we did not measure emotion disorder symptomology directly, but relied on a proxy measure of risk for developing emotion disorders. Future studies could potentially utilise more direct measures of emotion disorders. The benefits of this approach, however, must be weighed against the likelihood of longer measures resulting in a greater number of spoilt or incomplete student responses. Second, although we theorised relations between test anxiety and emotion risk partly on the basis of integrative network approach (Hereen and McNally 2016, 2018) we did not directly examine networks of test anxiety and emotion risk. Future studies could examine the strength and centrality of test anxiety and emotion disorders indicators using network analysis (see Epskamp et al. 2017).

Third, based on the DFM (Suldo and Shaffer 2008) we included both school-related wellbeing and emotion risk as independent but related constructs and demonstrated that they were negatively related in a bidirectional fashion using variable-centred analyses. However, we did not examine the

subtleties in the relations between school-related wellbeing and emotion risk as predicted by DFM. Future studies could use cuts-score or person-centred analyses (e.g., Rose et al. 2017) to examine whether there are groups of students with higher school-related wellbeing with higher emotion risk (i.e., symptomatic but content), and lower school-related wellbeing with lower emotion risk (i.e., vulnerable).

We would also like to briefly comment on the conceptualisation of test anxiety, emotion disorder, and school-related wellbeing. In the present study, these constructs were treated as conceptually distinct, although empirically related. However, there are alternative perspectives. Rather than test anxiety being distinct from that of emotion disorder it is possible that test anxious symptoms are a manifestation of one or more emotion disorder (e.g., LeBeau et al. 2010). Fears about testing, for example, are included within the social phobia subscale of the Revised Child Anxiety and Depression Scale (Chorpita et al. 2005). Thus, test anxiety and emotion disorder could be related in a part-whole fashion rather than representing distinct categories. Furthermore, test anxiety could be considered as an indicator of low subjective or school-related wellbeing through contributing to school-related worries (Hascher 2003), rather than as separate construct. The purpose of the present study was not to unpick these thorny conceptual issues and data collected not designed in such a way as to address these issues. Rather, we wished to highlight that future studies may wish to address conceptual distinctions between test anxiety, emotion disorder, and school-related wellbeing.

## Implications for Practice

Returning to the question posed in the title of this paper, test anxiety can indeed predispose adolescents for enhanced risk of developing emotion disorders, but may not necessarily substantially impact their school-related wellbeing within a relatively brief timespan covering about seven months of schooling. This would suggest that interventions designed to address test anxiety would have downstream benefits for mental health by reducing emotion risk. There are well-established and impactful psychological interventions for test anxiety (Ergene 2003; von der Embse et al. 2013) and recent evidence has shown that a relatively brief six-session cognitive-behavioural intervention (CBIs) is effective in reducing both test anxiety and anxiety disorder symptoms (Putwain and Prescod 2018; Putwain et al. 2020c). In periods of testing when academic pressures are heightened, test anxiety interventions may be especially helpful in ensuring that anxieties regarding examinations do not become sufficiently ingrained and intensify into emotion disorders. However, as shown in the findings of this study, there would also be downstream benefits to raising subsequent school-related

wellbeing and lowering subsequent test anxiety by addressing emotion disorders.

## Conclusion

Test anxiety was positively reciprocally related with a subsequent elevated risk of developing an emotion disorder and the risk of developing an emotion disorder was negatively reciprocally related with subsequent school-related wellbeing. School-related wellbeing was negatively related to subsequent test anxiety but not vice versa. Theoretically speaking, these findings support the integrative network approach (Hereen and McNally 2016, 2018) and highlight the importance of attending to emotion disorders as distinct from wellbeing as proposed in the DFM (Suldo and Shaffer 2008). Practically speaking, interventions designed to reduce test anxiety will likely benefit mental health through reduced risk of developing emotion disorders. Interventions designed to treat emotion disorders will likely improve school-related wellbeing and reduce test anxiety. Greater provision is needed for children and adolescents to be able to access such interventions without having to face excessively long waiting times.

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## Compliance with Ethical Standards

**Conflict of Interest** David W. Putwain, Diahann Gallard, Joanna Beaumont, Kristina Loderer and Nathaniel P. von der Embse declares that they have no conflict of interest.

**Informed Consent** All procedures followed were in accordance with the ethical standards of the Liverpool John Moores Institutional Research Committee. Informed consent was obtained from all participants.

**Research Involving Human and Animal Rights** No animal studies were carried out by the authors for this article.

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