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Is Reducing Uncertain Control the Key to Successful Test Anxiety Intervention for Secondary School Students? Findings From a Randomized Control Trial.

Is Reducing Uncertain Control the Key to Successful Test Anxiety Intervention for Secondary School Students? Findings from a Randomized Control Trial

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Abstract

Objective: The aim of the study was to conduct a randomized control trial of a targeted, facilitated, test anxiety intervention for a group of adolescent students, and to examine the mediating role of uncertain control.

Method: Fifty-six participants (male = 19, white = 21, mean age = 14.7 years) were randomly allocated to an early intervention or wait-list control group. Participants completed the Revised Test Anxiety Scale and the Uncertain Control Scale from the Motivation and Engagement Scale at baseline, after the early intervention group had received the intervention, and again, after the wait-list control group had received the intervention.

Results: Participants showed moderate to large reductions in the worry and tension components of test anxiety, and uncertain control, after the intervention. The reduction in worry and tension was partially mediated by the reduction in uncertain control.

Conclusions: Findings contribute to the evidence base for test anxiety interventions designed for school age populations and highlight uncertain control as an important factor in test anxiety intervention.

Keywords: Test anxiety, worry, tension, uncertain control, intervention

Impact and Implications

This study uses a robust design to show that it is possible to reduce the anxiety associated with high-stakes tests in secondary school students. One key factor in reducing testing anxiety is increasing student's sense of being in control.

Test anxiety is a concern for students, educators and psychologists. High levels of test anxiety can interfere with academic achievement (Hembree, 1988) and contribute to poor student wellbeing (Steinmayr, Crede, McElvany, & Wirthwein, 2016). These effects are magnified in educational systems that use student test data for accountability purposes (von der Embse & Hasson, 2012). Accordingly, test anxiety interventions have been purposefully utilized to support at-risk students. However, the literature base for the effectiveness of school based interventions is lacking (von der Embse, Barterian, & Segool, 2013). To address the paucity of studies in this area we conducted a randomized control-trial of a targeted, facilitated, test anxiety intervention with adolescent students preparing for high-stakes secondary school leaving examinations. Furthermore, given that the extant literature has yet to identify mediators of test anxiety intervention, the role of uncertain control was examined as one such mediator.

What is Test Anxiety and Why is it Important?

Test anxiety is a situational-specific form of trait anxiety; defined as individual differences in the general tendency to appraise performance-evaluative situations, such as examinations, as threatening (Spielberger & Vagg, 1995). Thus, individuals high in trait test anxiety will not respond with greater state anxiety to all threat situations, only those where only performance will be evaluated. It comprises of theoretically distinct, although empirically related, cognitive and affective-physiological components. The measurement model of test anxiety employed in the present study (Hagtvet & Benson, 1997; Sarason, 1984) includes two cognitive aspects (worry and test-irrelevant thoughts) and two affective-physiological aspects (tension and bodily symptoms of test anxiety). Worry refers to unconstructive thoughts concerning failure, and its consequences, and test-irrelevant thoughts to distracting thoughts that do not necessarily concern failure (e.g., a forthcoming holiday). Tension refers to general

perceptions of autonomic arousal and bodily symptoms to specific physiological indicators of anxiety (e.g., a dry mouth).

The importance of test anxiety has been largely derived from showing a negative correlation, especially the worry component, with measures of academic achievement (e.g., Chapell et al., 2005; Hembree, 1988). High levels of test anxiety interfere with working memory resources, negatively impacting on memory and attention (e.g., Owens, Stevenson, Hadwin, & Norgate, 2014; Owens, Stevenson, Norgate, & Hadwin, 2008), and students might typically experience difficulty in recalling learnt material, organizing their thoughts, and performing tasks with a high cognitive load (e.g., Dutke, & Stöber, 2001; Richards, French, Keogh, & Carter, 2000). There is an increasing recognition, however, that test anxiety is associated with poor student wellbeing. The upper 33rd percentile of test anxiety scores can reliably predict clinical anxiety in 93.6% of cases (Herzer, Wendt, & Hamm, 2014), greater test anxiety predicts lower subjective wellbeing in secondary school students (Steinmayr et al., 2016), and high levels of test anxiety are accompanied by a cognitive triad of dysfunctional attitudes, automatic thoughts and irrational beliefs (Wong, 2008).

Establishing the prevalence of highly test anxious students is not straightforward. There is no single accepted definition of what constitutes as ‘high’ and many oft-cited sources of prevalence were inappropriately derived from experimental manipulations (e.g., Turner, Beidel, Hughes, & Turner, 1993) or reviews not based on empirical data (e.g., Goonan, 2004). Two relatively recent studies are notable exceptions. Putwain and Daly (2014) found 16.4% of a representative sample of 2,345 English secondary school students in Years 10 and 11 reported test anxiety in the upper 33rd percentile of scores. von der Embse, Mata, and Scott (2014), used latent profile analysis to show 30.4% of a sample of 1,133 11th grade high school students in the United States as being highly test anxious (for a similar study using undergraduate sample see Thomas, Cassady, & Finch, 2017). These studies

indicate that a substantial proportion of students may at risk from the deleterious effects of test anxiety on academic achievement and wellbeing.

The Self-referent Executive Processing (S-REF) Model of Test Anxiety

The S-REF model, proposed by Zeidner and Matthews (2005), comprises of three central inter-related systems: Executive processing, self-knowledge beliefs, and maladaptive situational interactions. Executive processes are triggered by either external stimuli (e.g., being reminded about a forthcoming examination by a teacher) or internal cycles of processing (e.g., thinking about failure). These include an appraisal of the evaluative situation, the likely consequences of failure, plans for coping, and metacognitive processes. In the short-term, test anxiety is created by negative self-beliefs, such as poor competence beliefs, self-blame, and avoidant motivation, resulting in threat appraisals, self-focused attention, and emotion-focused coping. These can be maintained or heightened by certain metacognitive beliefs (e.g., that ruminating on worry is an effective response to threat).

The appraisal of the evaluative situation as a threat causes an increase in acute worry and distress, and interferes with cognitive processes (such as working memory). In the longer-term, test anxiety is maintained by maladaptive situational interactions. Failure, or perceived failure, results in a strategic withdrawal of effort, a hypervigilance for situational threat cues, and an avoidance of learning opportunities and evaluative situations (paradoxically increasing the likelihood of future failure). The three components (executive processing, self-knowledge, and maladaptive situational interactions) interact dynamically over time, so that maladaptive situational interactions become internalized into negative self-beliefs (e.g., ‘I can never success in exams’), further increasing the likelihood of subsequent evaluative situations being appraised as a threat. The various relations proposed in the S-REF model have received extensive empirical support (e.g., Putwain, Connors, & Symes, 2010; Putwain & Symes, 2012; Putwain, Daly, Chamberlain, & Saddredini, 2016).

Test Anxiety and Uncertain Control

Of particular interest to this study is the role of uncertain control in test anxiety. Control is one of the three dimensions (along with locus and stability) by which an individual attributes causality to their actions (Weiner, 2010). In the context of evaluative situations, control refers to the extent to which an individual believes they are capable of affecting a successful outcome (Pekrun, 2006; Pekrun & Perry, 2014). From the perspective of the S-REF model, uncertain control would be considered as one of the self-beliefs that contributes to the appraisal of an evaluative situation as threatening. Persons with uncertain control cannot understand how their actions or choice of strategy is linked to outcomes, will not be confident about their abilities, and anticipate likely failure (Martin, 2002, 2007). Studies have shown how uncertain control is positively correlated with general academic anxiety (Martin, Colmar, Davey, & Marsh, 2010; Martin & Marsh, 2008) and test anxiety (Pekrun, Goetz, Perry, Kramer, Hochstadt, & Molfenter, 2004; Putwain & Aveyard, 2016).

Test Anxiety Intervention

Various forms of cognitive and behavioral therapies have been adapted for use with highly test anxious persons often in conjunction with study and test-taking skills. Meta-analyses have shown test anxiety interventions, based on these approaches, to be effective in reducing the cognitive and affective-physiological dimensions of test anxiety (Hembree, 1988; Ergene, 2003; von der Embse et al., 2013). However, the overwhelming majority of test anxiety interventions described in the extant literature are based on programs designed for undergraduate students. The evidence base for school-based programs, designed and evaluated for use with younger students, is extremely limited (von der Embse et al., 2013). Adolescent students may yet have developed the regulative, coping, or study skills of older students (e.g., Blair, 2010; Eisenberg, Spinrad, & Eggum, 2010; Lerner et al., 2011). School-

based intervention in adolescence has the potential to lessen or even prevent the educational underachievement and threat to wellbeing resulting from high test anxiety that might impact negatively on a student's future life trajectory (Fisak, Richard, & Mann, 2011; Esbjørn, Bender, Reinholdt-Dunne, Munck, & Ollendick, 2012).

Three contemporaneous examples show how test anxiety intervention can be successfully used with school-aged populations. Weems et al. (2015) evaluated a five session behavioural intervention, comprising of relaxation training with exposure to test threat stimuli, in a targeted sample of students aged 8-17 years. Sessions were delivered in small groups (4-8 persons per group) by a trained facilitator student. Intervention group students showed a statistically significant reduction in test anxiety compared to a waitlist control group that was part randomly, and part quasi-randomly, allocated. Yeo, Goh, and Liem, (2016), evaluated a four-session, non-targeted, cognitive-behavioural intervention (comprising relaxation, study skills training, and calming self-talk), delivered by a trained doctoral student to whole classes of students aged 9-12 years. Compared to a quasi-allocated control group, students in the intervention groups showed a reduction in test anxiety that was greatest in those with the highest baseline test anxiety.

Finally, Putwain, Chamberlain, Daly, and Saddredini (2014), evaluated a six-session non-targeted, cognitive-behavioral, intervention referred to as STEPs[1] (comprising relaxation, study skills training, and replacing negative with positive self-talk) in students aged 14-16 years. Sessions were presented using a computerized presentation comprising of quiz-based reinforcement, self-reflection exercises, practice of anxiety management strategies, and short video clips of adolescent students talking about their own experience of test anxiety. These followed a self-help format and were completed alone rather than in groups. Students who were high in test anxiety at baseline showed a reduction in worry and tension following intervention compared to a waitlist quasi-randomly allocated control group. Inspired by the

dearth of research into test anxiety intervention for school-based populations, and the potential benefits to students, we set out to conduct a further evaluate of STEPS, along with a potential mediator of the anticipated mechanism (uncertain control).

The finding that STEPs was only effective in those students that were highly test anxious to begin with (also see Yeo et al., 2016) would suggest that intervention is best delivered as a targeted, rather than inclusive, intervention. School-based prevention and intervention programs for clinical and general forms of anxiety (rather than test anxiety specifically) also show greater effect sizes for targeted than inclusive interventions (Neil & Christensen. 2009). Moreover, STEPs was not completed by many students suggesting that relying on a self-help format was not an effective mode of delivery (dropout was much lower in Weems et al., 2015, and Yeo et al., 2016). We address these limitations in the present study by using a facilitated delivery targeted on highly test anxious students. Given that the studies described above (Putwain et al., 2014; Weems et al., 2015; Yeo et al., 2016) used either a quasi-random allocation of participants to intervention and control groups (or a mixture of random and quasi-random procedures), we evaluate STEPs using a robust randomized control design with a wait-list control group (see Grossman & Mackenzie, 2005).

Uncertain Control: A Plausible Mediator

A notable omission from the test anxiety intervention literature is the absence of variables that account for the mechanisms by which the intervention might bring about change. The analysis of mediators helps to advance understanding of why and how interventions work, the processes involved in change, and how interventions can be further refined and developed (e.g., Gardner, Hutchings, Bywater, & Whitaker, 2010). We examine uncertain control in this study as one such potential mediator. Since the intervention we evaluate aims to identify and control negative thoughts concerning failure, control physiological reactions to stressors, and teach explicit examination-preparation strategies, we would anticipate it would also reduce uncertain

control. Participants will be able to build positive self-knowledge and reduce maladaptive situational interactions. According to the S-REF model this would lead to a reduction in perceived threat and, in turn, a reduction in acute worry, distress, and cognitive interference. Thus, a reduction in test anxiety following the intervention could be underpinned by a reduction in uncertain control.

Aims of the Present Study

The aim of the present study was to conduct an evaluation of a targeted, facilitated, test anxiety intervention for a group of adolescent students preparing for high-stakes school leaving examinations. This is widely regarded as a highly stressful period for students (Rodway et al., 2016; Thornton, 2016). Results of these examinations can, and do, determine access to the labor market and continuing education and training opportunities (Maguire, 2010; Unwin, 2010).We hypothesized that test anxiety will reduce following intervention, but do not make any predictions regarding the specific components of test anxiety (*H1*). We also hypothesized that uncertain control would mediate the effect of the intervention on test anxiety; a reduction in test anxiety will be underpinned by a reduction in uncertain control (*H2*).

Method

Participants

The participants in this study were 56 secondary school students (male = 19, female = 37), in their final two years of secondary schooling (Year 10 = 30, Year 11 = 26), and with a mean age of 14.7 years (*SD* = .69). Students were drawn from two secondary schools located in urban areas of England and represented an ethnically heterogeneous sample (Asian = 10, Black = 12, White = 21, other = 8, mixed heritage = 5) with 12 students eligible for free school meals (a proxy for low income). Ten participants chose not to complete the intervention leaving 46 participants with analyzable data of which there were 1.1% missing

responses. These were unrelated to substantive or demographic study variables and imputed using the expectation maximization approach in SPSS (see Graham, 2012).

Research Design

The study used a 2x3 mixed factorial design. Participants were allocated to one of two intervention groups: An early intervention group (n = 25) or a wait-list control group (n = 31) using a simple concealed randomization procedure. Outcome variables were measured in all participants at three time points: A baseline measurement before either group had received their intervention, after the early intervention group had received the intervention (T_1) and after the wait-list control group had received the intervention (T_2). An a priori sample size calculation, using the G*Power v. 3.1 software (Faul, Erdfelder, Buchner, & Lang, 2009), indicated that a minimum of 44 participants would be required for a 2x3 ANOVA, including an interaction, for a moderate effect size (f = .25), at standard alpha and power values (.05 and .95 respectively), with a strong correlation between repeated measures (r = .5), and a non-sphericity correction of $\varepsilon = 1$.

Measures

Test anxiety. Test anxiety was measured using the twenty-item *Revised Test Anxiety Scale* (Hagtvet & Benson, 1997) in which the word 'test' was replaced with 'exam' to match the parlance of English secondary education. This instrument provides scores on four test anxiety subscales; two cognitive (worry and test-irrelevant thoughts) and two affective-physiological (tension and bodily symptoms of anxiety). Six items measure worry (e.g., 'During exams I find myself thinking about the consequences of failing'), four measure test-irrelevant thoughts (e.g., 'While taking exams I sometimes think about being somewhere else'), five measure tension (e.g., 'During exams I feel very tense'), and five measure bodily symptoms of anxiety (e.g., 'I sometimes find myself trembling before or during an exam'). Participants responded to items on a four-point scale (1 = never, 4 = always). Previous studies

have shown the construct validity, predictive validity, and internal consistency, of data collected using this scale with adolescent samples (e.g., Putwain, Connors, & Symes, 2010; Putwain, Symes, Connors, & Douglas-Osborn, 2012). The internal consistency of the four scales in the present study were good (Cronbach's α worry = .80, .86, and .88; test-irrelevant thoughts = 81, 71, and .90; tension = .82, .89, and .85; bodily symptoms = .80, .78, and .87, for baseline, T_1 and T_2, respectively).

Uncertain control. Uncertain control was measured using the four-item scale from Martin's (2007) *Motivation and Engagement Scale*. Participants responded to items (e.g., 'When I get a good mark I'm often not sure how I'm going to get that mark again') on five-point scale (1 = Strongly disagree, 5 = Strongly agree). Data collected using this scale with adolescent students in previous studies has shown construct and predictive validity, and internal consistency (e.g., Green, Martin, & Marsh, 2007; Plenty & Heubeck, 2013). The internal consistency in the present study was good (Cronbach's α = .73, .75, .76, for baseline, T_1 and T_2, respectively).

Procedure

Schools were working in partnership with the institution of the first author in an ongoing project to identify and support students who may require support for exam-related anxiety. The entire cohorts for Year 10 and 11 students at participating schools were screened using the *Revised Test Anxiety Scale* to identify participants in the upper 66th percentile of total test anxiety scores who may benefit from intervention. Pastoral teams were also invited to recommend students who might benefit and student self-referrals were added to this group. Scores from screening (along with uncertain control) were used for the baseline measurement. Students were invited to a meeting where the purpose and commitment of the intervention was explained and students were invited to opt in to the program (it was not compulsory). Students were randomly allocated to an early intervention condition or a wait-

list control condition using a randomly generated number sequence by an on-site research assistant. Participants with even numbers were allocated to the early intervention group and those with odd numbers to the wait-list control group. Allocation was concealed from the first author, who was responsible for analyzing data (see Figure 1 for participant flow chart). The intervention was facilitated by trained assistant psychologists. All students completed measures of test anxiety and uncertain control after the intervention and wait-list control conditions. Written informed consent was provided by participating students and the head teacher of the participating schools, and passive (opt-out) consent provided by parents/ carers of participating students. This project received approval from the Liverpool John Moores University Research Ethics Committee.

The Intervention

STEPs comprised of six sessions, each lasting approximately forty minutes, delivered over six weeks (one session per week), by a trained facilitator in small groups (maximum of six participants). STEPs incorporated recent developments in the design and delivery of test anxiety intervention: Multi-modal, uses a computerized presentation format, and incorporated into the school ecology. Multi-modal interventions draw on differing combinations of cognitive and behavioral approaches and may be particularly suited to test anxiety intervention; some highly test anxious students might be primarily characterized by cognitive concerns, others by excessive physiological reactions or behavioral avoidance (Zeidner & Matthews, 2005). Multi-modal approaches, therefore, offer a greater range of management approaches than more narrowly focused interventions (Flaxman, Bond & Keogh, 2003). Session one focused on identifying test anxious signs and triggers, session two on identifying negative self-talk and replacing it with positive self-talk, session three on relaxation techniques, session four on study and test-taking skills, session five on goal setting, and session six was a plenary to reflect on

which elements worked most successfully (for further details of content see Putwain et al., 2014).

The content of the intervention was programmed using the Articulate software and the facilitator followed the protocol provided by the computer-based presentation (for other examples of computer-based delivery of interventions see Kaltenthaler, Parry & Beverley, 2004; Orbach, Lindsay, & Grey, 2007). This enabled a more standardized approach to the delivery of the intervention by different facilitators; all participants received the same content in the same order at roughly the same pace. Although each session focused on a particular theme (listed above) they all incorporated the following principles to ensure effective and engaging delivery of content: Quiz-based reinforcement, self-reflection exercises, practice of anxiety management strategies, and short video clips of adolescent students talking about their own experience of test anxiety. In order to fit the social ecology of the school, the intervention was evaluated at two schools for whom student anxiety and wellbeing was a specific concern (see Weems et al., 2015) and scheduled so not to interfere with students' regular instruction for their forthcoming high-stakes school leaving examinations.

Results

Data were analyzed using a 2x3 mixed ANOVA with one between-participants factor (early intervention vs. wait-list control) and one within-participants factor (baseline, T_1, and T_2.). Outcome variables were the four components of test anxiety (worry, test-irrelevant thoughts, tension, and bodily symptoms) and uncertain control (as a potential mediator). Descriptive data are reported in Table 1. Cohen's *d* effect size calculations were adjusted for within-participants comparisons (Morris & DeShon, 2002)[2].

Worry

There was a main effect of time, $F(2, 88) = 12.47$, $p < .001$, $\eta_p^2 = .22$, but not intervention group, $F(1, 44) = 2.58$, $p = .12$, $\eta_p^2 = .06$, that was qualified by a time × intervention group interaction: $F(2, 88) = 10.92$, $p < .001$, $\eta_p^2 = .20$. In the early intervention group worry showed a moderate decline from baseline to T_1, $t(24) = 4.63$, $p < .001$, $d = .76$, whereas the wait-list group no statistically significantly change: $t(30) = -0.26$, $p = .80$, d = -.15. From T_1 to T_2 worry showed a small increase for the early intervention group, $t(24) = -2.19$, $p = .04$, $d = -.20$, and a moderate decrease in the wait-list group $t(30) = 4.84$, $p < .001$, $d = .79$. The interaction is graphed in Figure 2.

Test-irrelevant Thoughts

There were main effects of time, $F(2, 88) = 10.37$, $p < .001$, $\eta_p^2 = .20$, and intervention group, $F(1, 44) = 9.31$, $p = .004$, $\eta_p^2 = .18$, but no time × intervention group interaction: $F(2, 88) = 2.02$, $p = .14$, $\eta_p^2 = .04$. Model estimated means showed a decline for test-irrelevant thinking from baseline ($M = 2.89$, $SE = .11$), to T_1 ($M = 2.37$, $SE = .09$), and T_2 ($M = 2.23$, $SE = .11$) for both intervention groups. Furthermore, test-irrelevant thinking was lower, across all three measurement points, for the early intervention group ($M = 2.28$, $SE = .12$) compared to the wait-list control group ($M = 2.70$, $SE = .10$).

Tension

There was a main effect of time, $F(2, 88) = 33.11$, $p < .001$, $\eta_p^2 = .23$, but not intervention group, $F(1, 44) = 1.14$, $p = .29$, $\eta_p^2 = .03$, that was qualified by a time × intervention group interaction: $F(2, 88) = 8.52$, $p < .001$, $\eta_p^2 = .16$. Tension showed a large decline from baseline to T_1 for the early intervention group, $t(24) = 5.96$, $p < .001$, $d = 1.14$, and a negligible decline in the wait-list group, $t(30) = 3.05$, $p = .005$, $d = .08$. From T_1 to T_2 tension showed no statistically significant change for the early intervention group, $t(24) = -1.44$, $p = .016$, $d = -.09$, and a large decrease in the wait-list group $t(30) = 4.51$, $p < .001$, $d = .80$. The interaction is graphed in Figure 3.

Bodily Symptoms

There was a main effect of time, $F(2, 88) = 10.37$, $p < .001$, $\eta_p^2 = .20$. Intervention group, $F(1, 44) = 0.01$, $p = .99$, $\eta_p^2 < .01$, and the time × intervention group interaction: $F(2, 88) = 0.30$, $p = .74$, $\eta_p^2 < .01$, were not statistically significant. Model estimated means showed a decline in bodily symptoms from baseline ($M = 2.40$, $SE = .12$), to T_1 ($M = 1.86$, $SE = .10$), and T_2 ($M = 1.65$, $SE = .09$) for both intervention groups.

Uncertain Control

There was a main effect of time, $F(2, 88) = 2.95$, $p = .005$, $\eta_p^2 = .12$, but not intervention group, $F(1, 44) = 1.96$, $p = .17$, $\eta_p^2 = .04$, that was qualified by a time × intervention group interaction: $F(2, 88) = 3.46$, $p = .04$, $\eta_p^2 = .07$. Uncertain control showed a moderate decline from baseline to T_1 for the early intervention group, $t(24) = 3.39$, $p = .003$, $d = .64$, and no statistically significant change in the wait-list group, $t(30) = 0.457$, $p = .65$, $d = .08$. From T_1 to T_2 uncertain control showed no statistically significant change for the early intervention group, $t(24) = -1.98$, $p = .06$, $d = -.23$, and a moderate decrease in the wait-list group $t(30) = 2.46$, $p = .02$, $d = .47$. The interaction is graphed in Figure 4.

Mediational Analysis

A meditational analysis was conducted to examine whether the reduction in worry and tension scores, following intervention, was mediated by concurrent changes in uncertain control. The analysis was performed using the PROCESS macro in SPSS (Hayes, 2013) by creating 95% confidence intervals around unstandardized regression coefficients of the indirect effect of intervention group (0 = early intervention and 1 = wait-list control) on changes in worry and tension scores, based on 1000 bootstrapped samples. A statistically significant indirect effect (at $p < .05$) is found where the 95% CIs do not cross zero (MacKinnon, Fritz, Williams, & Lockwood, 2007). Two models were performed each for worry and tension scores; first to examine changes from baseline to T_1 and second to examine

changes from T_1 to T_2. Change scores were calculated by subtracting the later time point from the earlier time point (i.e., T_1 minus baseline, and T_2 minus T_1) such that a positive score indicated an increase, and a negative score a decrease, in worry/ tension. Total, direct, and indirect effects, are reported in Table 2.

From baseline to T_1, the decline in worry and tension scores for the early intervention group, relative to the wait-list control group, were partly mediated by uncertain control (R^2 = .079/ .064 for worry/ tension respectively). From T_1 to T_2, the decline in worry and tension scores for the wait-list control group relative to the early intervention group was partly mediated by a concurrent decline in uncertain control (R^2 = .204/ .178 for worry/ tension respectively).

Discussion

The aim of this study was to conduct a randomized control trial of a targeted, facilitated, test anxiety intervention, used with a group of secondary school students preparing for high-stakes school exit examinations, and to examine the role of uncertain control as a possible mediator. Results showed that following intervention there were moderate to large statistically significant reductions in the worry and tension components of test anxiety that were mediated by a reduction in uncertain control. These findings offer a robust test of the effectiveness of the STEPs intervention, in a real-world school setting, and add to the evidence base more generally for test anxiety interventions designed for, and evaluated with, school aged populations. These findings partially support *H1* (worry and tension were reduced following intervention, but not test-irrelevant thoughts or bodily symptoms) and *H2* (uncertain control mediated reductions in worry and tension, but not test-irrelevant thoughts or bodily symptoms).

Worry and tension scores of participants in the early intervention group showed a moderate to large decline following intervention; moving from scores in the upper 33rd

percentile to scores below. In contrast, the scores of the wait-list control group showed no change for worry, and a slight decrease for tension, but importantly remained in the upper 33rd percentile. The scores of participants in the wait-list control group showed a similar magnitude of reduction following intervention. Encouragingly at T_2, the worry and tension scores of the early intervention group (delayed post-test) remained below the upper 33rd percentile.

These findings support findings from other contemporaneous studies showing that test anxiety can be successfully reduced in school age populations (Putwain et al., 2014; Weems et al., 2015; Yeo et al., 2016). Whereas earlier studies used either quasi-random allocation (Putwain et al., 2014; Yeo et al., 2016), or a combination of random and quasi-random allocation (Weems et al., 2015), our study used a robust design with random allocation and followed up students after early and waitlist control groups. Thus, we can be confident that the reduction in worry, tension, and uncertain control, is attributable to the intervention rather than any pre-existing differences between the early intervention and wait-list groups. Our study, like Weems et al. (2015) targeted students with high test anxiety at baseline for intervention and delivered the intervention with a facilitator in small groups. Importantly, this addressed the concern raised by Putwain et al. (2014) that self-help was not a suitable format for intervention for many students. Although some students did not choose to complete STEPs in this study the dropout (17.9%) was much lower compared to that of Putwain et al. (86.3%). The use of a small group facilitated delivery seems to have reduced dropout considerably.

Arguably the worry component of test anxiety is the most salient target of intervention as this shows the strongest link to educational achievement (e.g., Hembree, 1988) and wellbeing (Steinmayr et al., 2016). The likely reason why test-irrelevant thoughts and bodily symptoms did not respond to intervention is partly because participants were

selected on having total test anxiety scores in the upper 33rd percentile, and baseline scores for test-irrelevant thoughts and bodily symptoms were below this, and partly, in the case of test-irrelevant thoughts, that the intervention did not focus on attentional control techniques. It is also notable that test-irrelevant thoughts and bodily symptoms declined without intervention. This could be a result of increased examination practice as school-exit examinations approach, which is a common practice in English secondary schools (Wiliam, Lee, Harrison, & Black, 2004). With practice, students are better able to regulate test-irrelevant thoughts (Ben-Eliyahu & Linnenbrink-Garcia, 2015) and become desensitized to test situations (Zimmer & Hocevar, 1994)

Findings supported the role of uncertain control as mediating the effect of the intervention on worry and tension. This is an important theoretical development as test anxiety intervention has yet to identify mediators of intervention effects. The strategies implemented in the intervention, such as identifying personal triggers for anxiety, controlling negative thoughts concerning failure and autonomic reactions, and learning test-preparation strategies, have reduced uncertain control; that is students believed that they were more able to achieve their anticipated examination outcomes, and that in turn reduced high levels of worry and tension. There are many other plausible mediators of intervention, identified in the S-REF model, that might usefully incorporated in future intervention research. These include self-sabotage and self-handicapping, emotional regulation, avoidant motivation, and coping strategies.

The main limitations of our study pertain to the relatively restricted sample, the limited range of outcomes, and the exclusive use of self-report measures. Although our study was sufficiently powered to demonstrate internal (experimental) validity, the external (generalizability) validity could be compromised by the relatively small sample size. We would therefore encourage colleagues to conduct and report robust evaluations of test anxiety

interventions to build the evidence base for effective interventions and approaches for school age populations. Our study focused on primary outcomes (test anxiety and uncertain control). As we note above, however, the importance of test anxiety is derived from its potential to negatively impact educational achievement and wellbeing. Thus, future intervention research should, in addition to including plausible mediators, also include educational achievement and wellbeing as potential outcomes. Since, self-report measures can be prone to reporting bias (Chan, 2009) and result in common method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003), the inclusion of behavioural measures (such as achievement and school attendance), can also help to address potential threats to validity arising from sole reliance on self-report measures.

Implications for School Psychologists

As educational accountability systems become increasingly based on student performance from high-stakes tests (see OECD, 2013) it is likely that school psychologists will be called on more frequently to design, implement, and evaluate intervention programs for test anxiety. The findings from this, and other studies, provide some useful pointers for school psychologists asked to undertake such work. First, intervention is more effective when targeted at students with high baseline test anxiety than more inclusive, non-targeted, programs. Thus, an effective way of screening and identifying highly test anxious students is required. At present there is no universally accepted definition of what constitutes 'high' test anxiety. In the current study, students were selected on the basis of having total test anxiety scores in the upper 33rd percentile. Until a universally accepted definition of high test anxiety is established this would seem a reasonable point on which to identify suitable candidates for intervention. However, future work that identifies the point, or range, where test anxiety becomes detrimental to test performance and student wellbeing would be a valuable resource for practitioners.

Second, the facilitators used in the present study were assistant psychologists who were familiar with the various theoretical principles incorporated into the intervention. Training, therefore, was able to focus on content and delivery of intervention and how to effectively facilitate reflective tasks. If the intervention was to be delivered by facilitators without a background in psychology, we would recommend an additional element of training would be incorporated to include the theoretical dimensions (anxiety, cognitive-behavior principles, and behavior change). Third, the findings of this study highlighted that control was a mediator of the reduction in worry and tension. Although it would likely benefit future interventions to include protocols designed to reduce uncertain control, we would caution against focusing solely on uncertain control. In present study, uncertain control was a partial mediator of the intervention and it is likely that other, as yet unknown, mechanisms were also responsible for the reduction of worry and tension. As we note above, it would be useful avenue for future research to identifies other mediators of intervention.

Conclusion

The results presented here offer encouragement that the worry and tension of secondary school students preparing for high-stakes examinations can be successfully reduced in a relatively short and non-intensive intervention. This is consistent with the findings of earlier evaluative work that did not use such a robust design (e.g., Putwain et al., 2014; Weems et al., 2015; Yeo et al., 2016) and the larger body of work showing that test anxiety intervention can be successfully used with school age populations (von der Embse et al., 2013). Such an intervention can be incorporated into the school ecology, as it does not require extensive time away from regular instruction) and is relatively cost effective (Weems et al., 2015). Specifically, our study showed that reducing uncertain control was a partially responsible for the reduction in worry and tension. Identifying mediators is useful for helping to guide the

development of future intervention focus on those elements most likely to result in effective change.

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Endnotes.

[1] STEPs was not an acronym but shorthand for Steps to Success.

[2] Cohen's *d* effect sizes were interpreted as *d* >.02, small, *d* >.05 moderate, and *d* >.08, large.

Table 1

Descriptive Data for Test Anxiety (Worry, Test-irrelevant Thoughts, Tension, and Bodily Symptoms) and Uncertain Control at Baseline, T_1 and T_2, for the Two Intervention Groups (Early Intervention vs. Wait-list Control).

	Baseline		T_1		T_2	
	M	*SD*	*M*	*SD*	*M*	*SD*
Worry						
Early Intervention	3.08	0.71	2.47	0.80	2.65	0.71
Wait-list Control	3.12	0.62	3.22	0.61	2.63	0.63
Test-irrelevant Thoughts						
Early Intervention	2.60	0.92	1.98	0.67	2.08	0.92
Wait-list Control	2.98	0.70	2.77	0.55	2.44	0.70
Tension						
Early Intervention	3.32	0.47	2.50	0.79	2.58	0.72
Wait-list Control	3.32	0.80	3.16	0.76	2.51	0.68
Bodily Symptoms						
Early Intervention	2.28	0.81	1.90	0.97	1.58	0.78
Wait-list Control	2.23	0.87	1.85	0.51	1.69	0.55
Uncertain Control						
Early Intervention	3.23	.84	2.58	.73	2.85	.95
Wait-list Control	3.33	.75	3.25	.87	2.79	.71

Table 2

Total, Direct, and Indirect Effects, of Intervention Group on Changes in Worry and Tension Scores, Mediated by Changes in Uncertain Control Scores.

	Baseline to T_1			T_1 to T_2		
	B	*SE*	95% CIs	*B*	*SE*	95% CIs
Worry						
Total	.664	.168	.327, .998	-.773	.173	-.998, -.424
Direct	.561	.164	.231, .891	-.500	.163	-.828, -.171
Indirect	.103	.073	.001, .296	-.273	.092	-.467, -.111
Tension						
Total	.602	.182	.235, .968	-.726	.175	-.997, -.373
Direct	.498	.180	.136, .861	-.483	.172	-.830, -.136
Indirect	.103	.072	.002, .292	-.243	.123	-.526, -.136

Note. Intervention group was coded 0 = early intervention group and 1 = control-list wait group

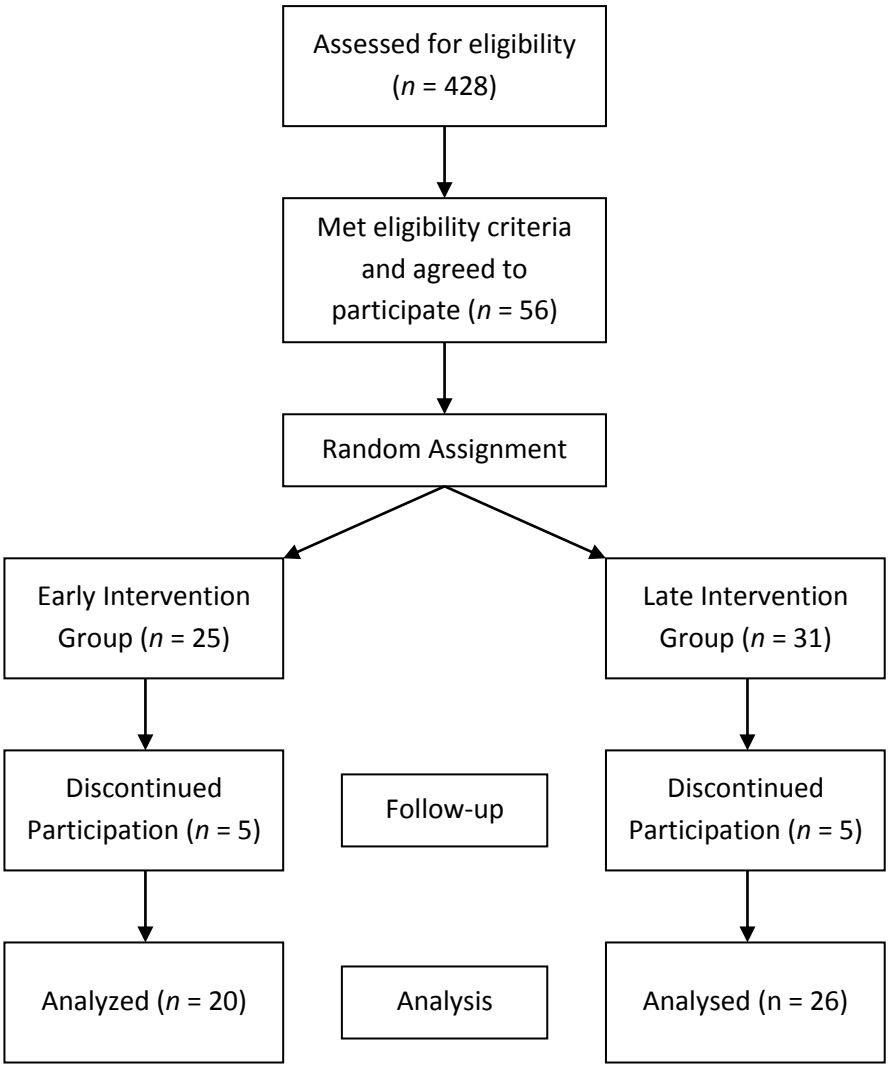

Figure 1. *Participant flow chart*.

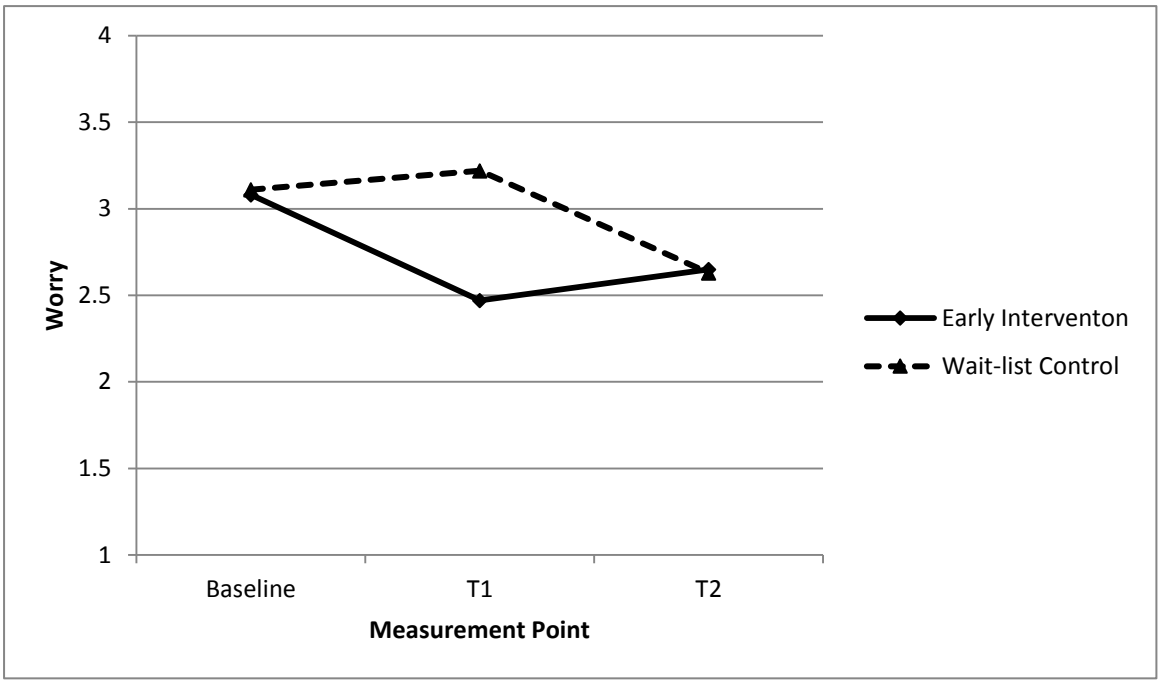

Figure 2. *The interaction between measurement point and intervention group for worry*.

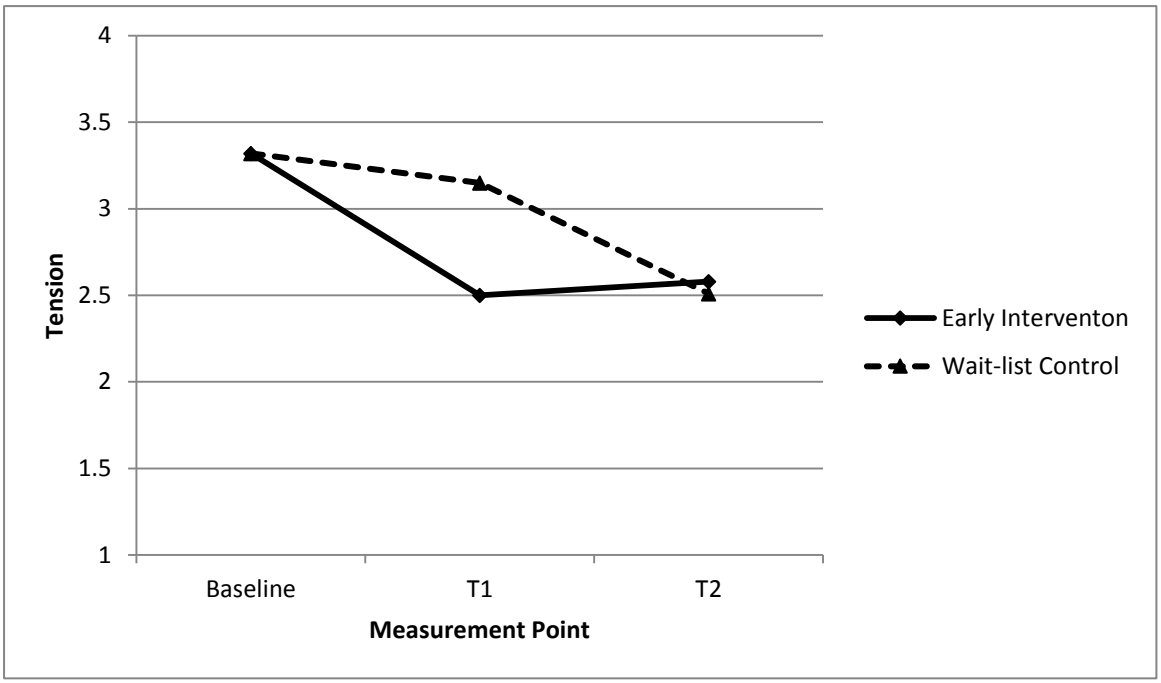

Figure 3. *The interaction between measurement point and intervention group for tension*.

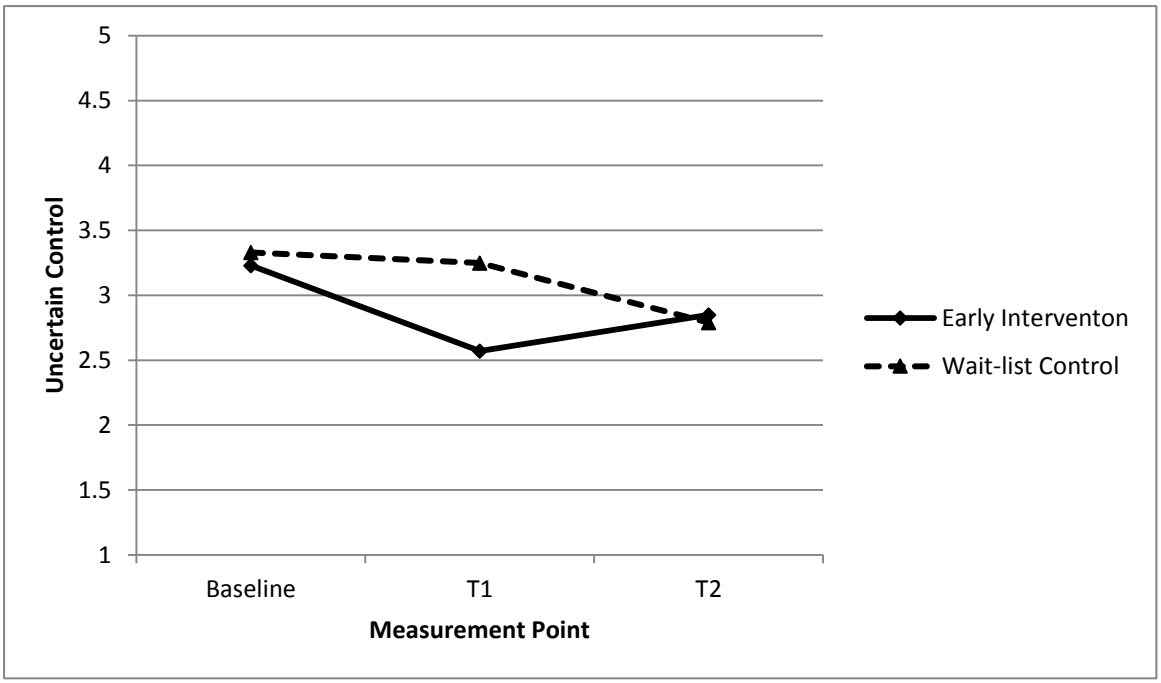

Figure 4. *The interaction between measurement point and intervention group for uncertain control*.