

Anxiety and inattention as predictors of achievement in early elementary school children

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The objective of this study was to examine the relations among anxiety, inattention, and math/reading achievement, as well as the mediating/moderating role of inattention in the anxiety-achievement association both concurrently and longitudinally. Participants included 161 ethnically diverse children (aged 6–8) and their teachers. At the middle and end of first grade (approximately 5 months apart), students completed measures of anxiety and achievement while their teachers completed a measure of inattention. For the concurrent analyses, greater harm avoidance anxiety was associated with better attention, which was in turn related to better achievement. For the longitudinal analyses, mid-year inattention interacted with harm avoidance and separation anxiety to predict end of year reading fluency. For those rated as more attentive, greater separation anxiety symptoms were associated with decreased fluency performance while greater harm avoidance symptoms were associated with increased performance. Findings were discussed in terms of the importance of considering socioemotional variables in the study of children's academic achievement and the potential utility of early anxiety prevention/intervention programs, especially for children experiencing academic difficulties who also show internalizing behaviors.

Keywords: anxiety; inattention; attention; academic achievement; learning

Introduction

The study of anxiety in children has been a burgeoning area for several decades. Anxiety disorders are common, even in young children, and an even greater group of children experience subclinical anxiety symptoms that can be debilitating in a variety of socioemotional domains (Kessler, Berglund, Demler, Jin, & Walters, 2005; Lavigne, LeBailly, Hopkins, Gouze, & Binns, 2009).

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Anxiety and achievement

Although less commonly studied, academic performance has also been linked with anxiety in youth. Researchers have found that children who report high rates of test anxiety perform worse on classroom tests (e.g., Everson, Smoldaka, & Tobias, 1994; Tobias, 1992). More general anxiety symptoms (as compared with the specific area of test anxiety) have also been reported to influence students' performance on achievement measures (e.g., Bryan, Burstein, & Ergul, 2004; Durbrow, Schaefer, & Jimerson, 2001; Ialongo, Edelson, Werthamer-Larsson, Crockett, & Kellam, 1994; Normandeau & Guay, 1998). In this domain, longitudinal studies have provided some support for the predictive role of anxiety, specifically suggesting that anxiety may lead to lowered achievement. To illustrate, Ialongo et al. (1994) examined the relation between anxiety and achievement in 684 regular classroom students evaluated in the fall and spring of their first-grade year. Children identified as highly anxious in the fall, using a quartile split on a general measure of anxiety, were significantly more likely to be in the lowest quartile for math and reading achievement in the spring.

Considering the three main areas that comprise anxiety-physical signs of anxious arousal, threat cognitions, and avoidance (Dozois & Westra, 2004) – anxiety could influence children's learning, achievement, or academic environment in a number of ways. For instance, children may misinterpret physical signs of anxiety (e.g., stomach- or head-aches, shaking hands) and stay home from school thus missing important academic lessons. Indeed, children reporting physical symptoms of anxiety have been found to miss more school (Bernstein, Massie, Thuras, & Perwien, 1997; Hughes, Lourea-Waddell, & Kendall, 2008). Children who are focused on anxious thoughts/worries or physical signs of anxiety may miss information presented by the teacher (e.g., academic lessons or instructions for completing assignments) or fail to complete items during testing. For example, an attention bias toward perceived threatening situations or stimuli (and thus away from on-task behavior) has been reported for a variety of anxious child and adult samples (e.g., Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007), including those with test anxiety (Putwain, Langdale, Woods, & Nicholson, 2011). Avoidance can also influence learning and academic achievement because once a child learns to escape anxious feelings, they will likely continue to try and do so. For instance, children may continue to miss school (e.g., truant, feign illness) if they have school-related anxieties that they find are relieved at home. In addition, anxiety symptoms may indirectly influence achievement performance through associations with other variables. One variable that has been linked with both anxiety and achievement is inattention.

Anxiety and inattention

Anxiety and inattention have been linked in both clinical (e.g., Mayes, Calhoun, Chase, Mink, & Stagg, 2009; Tannock, 2008) and nonclinical (Fernández-Castillo & Gutiérrez-Rojas, 2009) samples of children. Clinically, comorbidity has been reported for ADHD-Inattentive Type (ADHD-I) and various anxiety disorders in the range of approximately 20–25% for community samples and even greater for clinical samples (see Tannock, 2008 for review). Further, the overlap of these symptoms appears to

begin early. For instance, children as young as 4–6 years with subclinical ADHD-I have been found to experience significantly more parent-reported internalizing symptoms (anxiety and depressive symptoms combined) than comparison (non-ADHD) children (Massetti et al., 2008). Thus, anxiety and inattentive symptoms may be similarly related in clinical and nonclinical child samples.

Inattention and achievement

Numerous studies have shown that children experiencing greater inattention (e.g., from teacher or parent reports or diagnoses of ADHD-I) perform more poorly on reading and math achievement tests both concurrently and over time, even after controlling for intelligence and other confounds (e.g., Barriga et al., 2002; Durbrow et al., 2001; Fuchs et al., 2005; Massetti et al., 2008; Rabiner & Coie, 2000; Tannock & Brown, 2009). For example, Massetti et al. (2008) reported on an 8-year study that followed children who had subclinical/modified diagnoses of ADHD (children met all symptom criteria but were only required to show impairment in one area) at ages 4–6. Children with ADHD-I (but not the hyperactive or combined subtypes) had significantly poorer reading and math achievement scores over the 8-year period when compared with a matched comparison sample of children without ADHD. Interestingly, internalizing symptoms also predicted poorer achievement scores in reading and math over the 8-year period, suggesting that both inattentiveness and internalizing symptoms are “robust predictors of future academic underachievement” (p. 409, Massetti et al., 2008).

Anxiety, inattention, and achievement

As previously described, poorer achievement performance may occur if students are distracted by anxious thoughts and feelings, which, in turn, interfere with their ability to concentrate, learn, and/or complete academic tasks. In this manner, the inattention that occurs as a result of the anxious thoughts/feelings could account for the association of anxiety with achievement. Incorporating the disruptions that occur from anxiety in this way is consistent with Tobias’ (1992) information processing model and Eysenck and colleagues attentional control theory (e.g., Eysenck, 1979; Eysenck, Derakshan, Santos, & Calvo, 2007). In addition, studies employing varied anxiety (test, stress, general), inattention (working memory, observations of on-task behavior, teacher ratings), and cognitive measures have provided support for this mediating model. For instance, Owens, Stevenson, Norgate and Hadwin (2008) reported that poor working memory functions partially mediated the relation between trait anxiety and cognitive test performance in their study of 50 UK children. Likewise, Barriga et al. (2002) determined that teacher-reported attention problems mediated the association between teacher-reported withdrawal symptoms and achievement in reading, spelling, and math. Although this result was not duplicated with the teacher-reported anxiety/depression scale, this may have been due to the combination of these two symptom areas or reliance on teacher report of child internalizing symptoms.

Inattention may also serve as a moderator of the relation of anxiety and achievement, with anxiety more strongly relating to achievement performance among children who are inattentive versus those who are attentive. Consistent

with this suggestion, Massetti et al. (2008) noted that, “children who have early problems with inattention and who also have difficulties with depression or anxiety may have particular difficulties in attending to and participating fully in the learning environment at school, thereby experiencing early deficits that persist over time.” Likewise, Barbosa, Tannock and Manassis (2002) examined children with diagnoses of anxiety, ADHD, or both and reported significantly poorer reading achievement performance for only children with comorbid ADHD and anxiety when compared to normal controls. Taken together, these findings suggest that the combination of anxiety and inattention symptoms may be particularly detrimental. However, research to date has not examined these relations in nonclinical samples of children.

Rationale for the present study

In summary, both anxiety and inattention have been linked with poorer achievement performance in young people, and these two socioemotional domains have been associated with one another as well. Previous research has suggested that inattention could mediate or moderate the anxiety-achievement association; however, no studies were found to have examined each of these potential models. Moreover, research including inattention has most often compared children by diagnostic status (i.e., ADHD-I) or has focused on a specific aspect of attention (e.g., working memory). Absent from the literature are studies that examine a broad spectrum of inattention (i.e., from attentive to inattentive) and various anxiety symptoms (e.g., using a multi-dimensional scale) among nonclinical samples of students, as well as their influence on academic performance. Research in this area has also had a variety of methodological limitations, including: the exclusive use of teacher-reported data and examination of only broadly measured anxiety, test anxiety, or the combination of anxiety and depressive symptoms. Thus, the primary aims of the current study were to examine the relations among anxiety, inattention, and academic performance using standardized and psychometrically sound measures, both concurrently and longitudinally.

Hypotheses

Child-reported anxiety was expected to show direct and indirect influences on students' reading and math achievement performance. All areas of anxiety were predicted to be correlated with achievement, as was inattention. Based on the children's ages and past research, physical symptoms and separation anxiety were expected to emerge from the regression analyses as the most consistent anxiety predictors of achievement. Given a mixture of findings suggesting both a mediating and moderating role for inattention in anxiety-achievement associations, specific predictions were not made for these analyses. Rather, inattention was explored in both of these capacities.

Method

Participants

Participants represented a subset of students taking part in a larger randomized clinical trial investigating a response to intervention model for reading difficulties (see Denton et al., 2011, for intervention study details). Figure 1 illustrates the

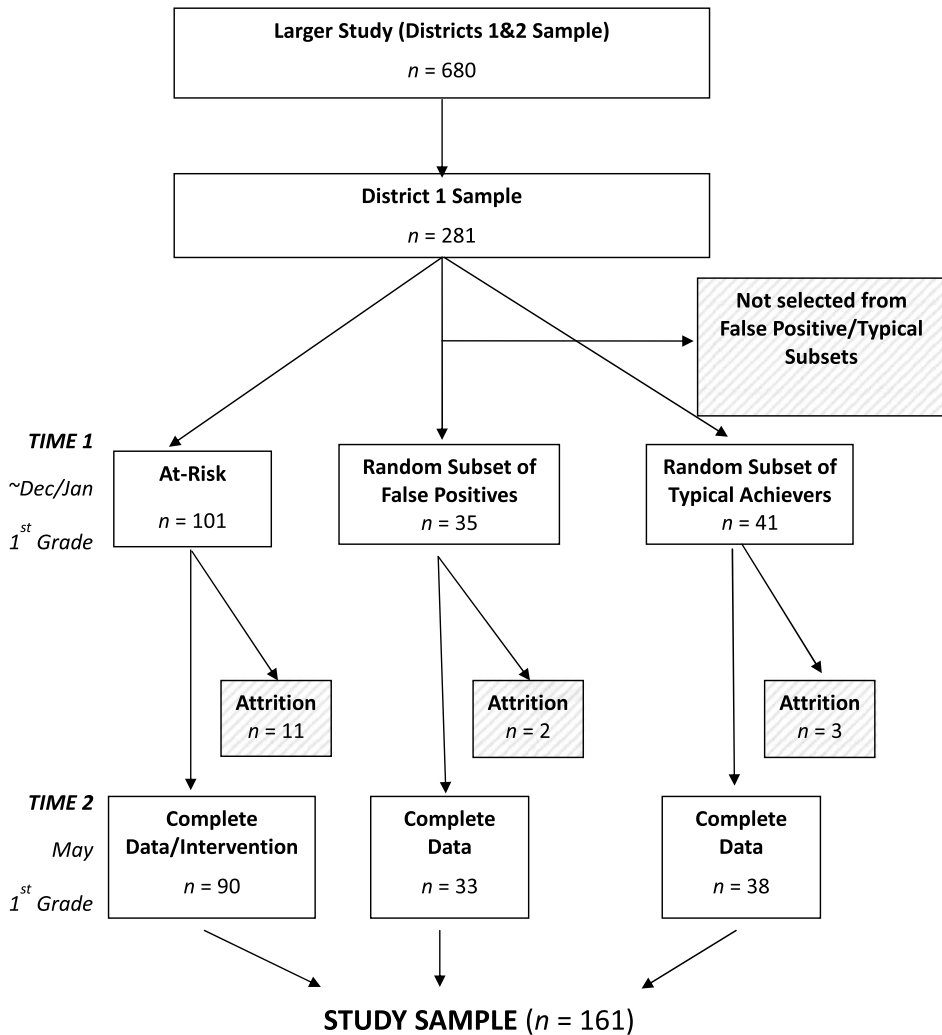


Figure 1. Participant flowchart.

derivation of the current sample. The present study included first-grade general education students from one of two districts ($n = 281$) involved with the larger project. Students were screened at the beginning of their first-grade school year with the Texas Primary Reading Inventory and classified as typically achieving or potentially at-risk for reading difficulties (see www.texasldcenter.org for a detailed description of measures used in the larger study). For eight weeks, the progress of children in the at-risk group was monitored with a measure of oral reading fluency. At the end of that 8-week period, students were identified as at-risk if they continued to fail benchmark standards ($n = 101$) or “false positive” if they were initially identified as at-risk but subsequently met benchmarks. A subset of the false positive ($n = 35$) and typically achieving ($n = 41$) students were randomly selected to be followed throughout the study. In November or December of first grade, all participants received a standardized assessment battery that included the Basic

Reading subtests of the Woodcock-Johnson PsychoEducational Test Battery (WJBR). Beginning in January, students identified as at-risk received supplemental small-group reading intervention. In April or May, students who were not lost to attrition or dropped received an expanded standardized test battery that included the WJ Basic Reading, Passage Comprehension, and Calculation subtests and the Test of Word Reading Efficiency (described below).

Of the 161 students included in this study (end of year age range 6–8, $M = 7.3$, $SD = .50$), 57% were male and the majority were African-American (60%), followed by Hispanic/Latino (26%), Caucasian (9%), and Asian-American (5%). 67% of the students received free/reduced lunch and about half were receiving special education services. Attrition was low, with three students removed from analyses for missing anxiety data at both time points, 10 because they moved before mid-year assessments were complete, and three because they withdrew from the larger study. Completers and noncompleters were compared on achievement, anxiety, and demographic variables with no significant differences.

Measures

The *Multidimensional Anxiety Scale for Children (MASC)* is a 39-item self-report measure designed for use with children and adolescents (March, 1997). For each item, children record their response on a 4-point Likert scale from “Never true about me” (0) to “Often true about me” (3). The MASC provides four scale scores (Physical Symptoms, Harm Avoidance, Social Anxiety, Separation Anxiety), as well as a summed total score and Anxiety Disorder and Inconsistency Indices. Satisfactory to excellent internal consistency and test–retest reliability coefficients have been reported (.64–.93; Grills-Taquechel, Ollendick, & Fisak, 2008; March, 1997), including with a recent sample of children diagnosed with learning disabilities (.70–.83; Thaler, Kazemi, & Wood, 2010). Although initially normed for children 8 years and older, several empirical studies have used this measure with 7-year old children (Meuret, Ehrenreich, Pincus, & Ritz, 2006; Saxe et al., 2005; Suveg, Kendall, Comer, & Robin, 2006). This practice has been sanctioned by the scale developer for children as young as six if items are read to the child and age 8 norms are used (J. March, personal communication, 25 May 2007). Nonetheless, to ensure fit with the young children included in the current study, a confirmatory factor analysis was conducted using MPLUS version 6.1. Although slightly poorer fit was revealed for the full MASC scale, satisfactory fit was demonstrated for each of the MASC subscales used in this study at both assessments. The following fit indices emerged for the MASC subscales, RMSEA (Time 1: .040–.067; Time 2: .000–.064), CFI (Time 1: .85–.96; Time 2: .93–1.00), and TLI (Time 1: .80–.95; Time 2: .90–1.00).

The *Strengths and Weakness of ADHD-Symptoms and Normal-Behavior (SWAN;* Swanson et al., 2006) is an 18-item scale that presents the DSM-IV Diagnostic criteria for ADHD with the items reworded to allow raters to capture both positive and negative aspects. The 9-item inattention scale (INA) was included in the present study. A sample item from this scale is: “Compared to other children, how does this child give close attention to detail and avoid careless mistakes?” Teachers rated each item on the inattention scale using the 7-point Likert scale which ranges from “far below average” (+3) to “far above average” (–3). An average rating-per-item score

is also calculated, with greater (more positive) scores representing more difficulties with inattention.

The *Woodcock-Johnson PsychoEducational Test Battery-III (WJIII;* Woodcock, McGrew, & Mather, 2001) is a nationally standardized, individually administered battery of cognitive and achievement tests. For the current study, the Basic Reading composite (WJBR), Passage Comprehension, and Calculation scores were examined. The WJBR is composed of Letter-Word Identification, which assesses the ability to read real words, and Word Attack, in which children read phonetically correct nonsense words as an assessment of decoding ability. The Passage Comprehension subtest (WJPC) assesses students' language comprehension and reading skills using a cloze procedure. The Calculation subtest (WJC) assesses computation of math problems with paper and pencil that begin with writing numbers and progress to increasingly difficult computations. Each of these subtests has previously been found to have excellent reliability in young elementary school age children (.80-.97).

The *Test of Word Reading Efficiency (TOWRE;* Torgesen, Wagner, & Rashotte, 1999) is a measure of word reading fluency, accuracy, and decoding. The Word Reading Efficiency Standard Score is comprised of Sight Word Efficiency and Phonemic Decoding Efficiency subtests, which ask students to read as many real words or nonwords, respectively, as quickly and accurately as possible in 45 seconds. Alternate forms and test-retest reliability coefficients are typically at or above .90 in this age range.

Procedures

All procedures were approved by the University of Houston Committee for the Protection of Human Subjects. Students were read an assent statement and could choose at any time to participate or not. The MASC and SWAN were completed twice, once approximately one month after the mid-year achievement measures, and again at the year-end assessment concurrent with the achievement measures. Children were read each MASC item in small groups and were allowed ample time to respond as well as to ask questions prior to proceeding to subsequent items. Achievement measures were given individually by examiners with extensive training in psychoeducational battery administration.

Data analytic plan

Missing data were minimal for the child anxiety (2-7%) and achievement measures (1-9%), while missing teacher data were more substantial (17-35%). As data tended to be missing for individual measures only (e.g., teacher refused to complete inattention measure, child absent during individual testing session), pairwise exclusions were used in the analyses. Descriptive information was examined for each scale and compared with existing normative data. Individual associations were examined with correlations across (T1-T2) and within (T2) assessments. A critical level of alpha ($p < .025$) was selected to balance the risk of Type I and Type II errors. Hierarchical linear regression analyses were conducted to examine the predictive and interactive roles of child-reported anxiety and teacher-reported inattention on achievement. Since the WJBR was measured at both time points, it was controlled in step 1 of the longitudinal analyses. The four anxiety scales were entered together to

determine which aspects predicted achievement. All of the predictors were centered and separate regressions were conducted for each of the four dependent variables (i.e., WJBR, WJPC, WJC, and TOWRE). Two sets of analyses were conducted, one with T1 anxiety and T1 inattention ratings predicting T2 achievement (longitudinal), and the other with all T2 measures (concurrent). For significant moderation findings, post-hoc follow-ups were conducted with conditional moderators and regression lines were plotted by substituting high (one standard deviation above the mean) or low (one standard deviation below the mean) predictor values into the resulting equations (see Holmbeck, 2002). To examine the potential mediating role of inattention, the procedures outlined in Preacher and Hayes (2004) were used along with their SPSS macro. Bias-corrected bootstrapped point estimates (5000 resamples) were examined for the indirect effects of the anxiety scales on achievement through inattention with standard errors and 95% confidence intervals.

Results

Descriptive information

For all predictor variables, scale mean scores, standard deviations, and internal consistency coefficients were found to be generally commensurate with their respective published norms.¹ At each assessment, interscale correlations were significant for the MASC ($r_s = .15-.61$) and consistent with those previously reported ($r_s = .16-.56$; March 1997). Across the two assessments each scale was significantly correlated with itself ($r_s = .17-.27$), but not the other scales ($r_s = -.01-.19$). Children did not differ by gender, race, or paid/free lunch status (i.e., socioeconomic status) on the MASC scales at either assessment. Students' scores on the dependent measures also represented a broad range, with appropriate means/standard deviations.²

Correlations (see Table 1)

Correlations examined individual associations among the anxiety, inattention, and achievement scores. Across the concurrent and longitudinal analyses, inattention was significantly and negatively related to all achievement scores. For the concurrent analyses, T2 harm avoidance was significantly correlated with T2 inattention and all T2 achievement scores, while T2 separation panic was associated with only the fluency scores. For the longitudinal analyses, the only significant correlation emerged for T1 physical anxiety symptoms and T2 calculation. Time 1–2 difference scores were also calculated, with no significant correlations found for these and the Time 2 achievement measures (see Table 1).

Moderator analyses³

Concurrent (all T2 measures; see Table 2)

Anxiety scales predicted a significant proportion of the variance in the passage comprehension and fluency (i.e., TOWRE) scores at block 1, while inattention predicted a significant proportion of variance for all achievement scales in the next block. No significant interactions emerged in the final block. Significant individual

Table 1. Zero-order correlations among predictors and achievement outcomes across (Time 1–Time 2) and within (Time 2) assessment points and with time 1–2 difference scores.

	Time	Inattention 1	Inattention 2	Basic reading 2	Passage comprehension 2	Calculation 2	Reading fluency 2
Physical Symptoms	T1	-.04	–	-.13	-.12	-.17 ^b	-.05
	T2	–	.07	.05	-.02	-.01	-.04
Harm Avoidance	T1	-.13	–	.11	.14	.13	.15
	T2	–	-.24 ^a	.21 ^a	.20 ^a	.17 ^b	.18 ^b
Social Anxiety	T1	-.03	–	-.08	.00	-.01	.03
	T2	–	.05	.02	-.06	-.01	-.08
Separation/panic	T1	.07	–	-.06	-.07	-.10	-.04
	T2	–	.13	-.16	-.15	-.09	-.24 ^a
Inattention	T1	–	–	-.46 ^a	-.46 ^a	-.39 ^a	-.49 ^a
	T2	–	–	-.49 ^a	-.47 ^a	-.35 ^a	-.51 ^a
Time 1–Time 2 difference scores							
Physical symptoms	T1–T2			-.15	-.09	-.17	-.04
Harm avoidance	T1–T2			-.08	-.04	-.05	-.02
Social anxiety	T1–T2			-.05	.07	-.03	.09
Separation/panic	T1–T2			.09	.06	-.02	.16
Inattention	T1–T2			-.05	.04	.14	.01

Note T1 = Time 1 (midyear 1st grade) is reported on the upper line; T2 = Time 2 (end of first-grade year) is reported in italics on the lower line. ^a $p < .025$, two-tailed, ^b $p < .05$, two-tailed.

predictors included the separation anxiety scale for basic reading and fluency, as well as harm avoidance for fluency and passage comprehension.

Longitudinal (see Table 3)

At block 1 (or block 2 in the case of basic reading), entering the T1 anxiety scales did not account for a significant proportion of variance for any of the T2 achievement outcomes. The inclusion of T1 inattention at block 2 was significant in all cases except for basic reading. The inclusion of the interaction terms in the final block only accounted for a significant increase in the proportion of variance for fluency (i.e., TOWRE), with both the harm avoidance/inattention and separation anxiety/inattention interactions significant. Post-hoc probing of these interactions indicated that greater harm avoidance scores were associated with decrements in fluency performance for those in the low attention group as opposed to increased fluency scores for those with better attention (see Figure 2). In contrast, the separation anxiety \times inattention interaction showed that as anxiety symptoms increased, fluency scores decreased for those with better attention while increasing slightly for those in the low attention group (see Figure 3).

Table 2. Concurrent (all at Time 2) hierarchical regression analyses for anxiety, inattention, and achievement scales.

	SE				SE				SE				SE			
	<i>B</i>	<i>B</i>	β	<i>t</i>	<i>B</i>	<i>B</i>	β	<i>t</i>	<i>B</i>	<i>B</i>	β	<i>t</i>	<i>B</i>	<i>B</i>	β	<i>t</i>
	T2-Basic reading ^a (<i>n</i> = 127)				T2-Passage comprehension (<i>n</i> = 127)				T2-Reading fluency (<i>n</i> = 127)				T2-Calculation (<i>n</i> = 123)			
Block 1	$R^2 = .82$				$R^2 = .06$				$R^2 = .10$				$R^2 = .03$			
Physical symptoms	.11	.12	.04	.89	-.16	.23	-.08	-.69	-.13	.30	-.05	-.42	-.15	.28	-.06	-.53
Harm avoidance	.01	.11	.00	.08	.46	.20	.22	2.31*	.59	.26	.21	2.28*	.44	.25	.18	1.79
Social anxiety	.21	.14	.08	1.45	.00	.27	.00	.01	.12	.35	.04	.33	.13	.34	.05	.38
Separation/panic	-.39	.14	-.12	-2.71**	-.48	.27	-.19	-1.78	-1.00	.34	-.30	-2.92**	-.36	.33	-.12	-1.12
Block 2	$R^2 = .83$				$R^2 = .24$				$R^2 = .27$				$R^2 = .13$			
Physical symptoms	.13	.12	.05	1.09	-.06	.21	-.03	-.26	.01	.27	.01	.05	-.08	.27	-.03	-.29
Harm avoidance	-.05	.11	-.02	-.49	.16	.19	.07	.82	.18	.24	.07	.75	.18	.25	.07	.74
Social anxiety	.20	.14	.07	1.41	-.03	.25	-.02	-.14	.07	.31	.02	.22	.07	.32	.03	.23
Separation/panic	-.34	.14	-.11	-2.42*	-.26	.25	-.10	-1.04	-.71	.32	-.21	-2.27*	-.16	.32	-.05	-.50
Inattention	-.14	.06	-.10	-2.33*	-.48	.09	-.44	-5.22**	-.64	.12	-.44	-5.37**	-.44	.12	-.33	-3.60**
Block 3	$R^2 = .83$				$R^2 = .26$				$R^2 = .29$				$R^2 = .18$			
Physical symptoms	.13	.13	.05	1.01	-.00	.22	-.00	-.02	.02	.28	.01	.08	-.00	.27	-.00	-.01
Harm avoidance	-.05	.11	-.02	-.42	.20	.19	.10	1.05	.23	.25	.08	.93	.14	.25	.06	.57
Social anxiety	.23	.15	.09	1.60	-.08	.25	-.03	-.31	-.02	.32	-.01	-.06	-.05	.32	-.02	-.16
Separation/panic	-.33	.15	-.11	-2.25	-.23	.26	-.09	-.91	-.64	.33	-.19	-1.94	-.20	.33	-.07	-.61
Inattention	-.13	.06	-.10	-2.10	-.50	.10	-.45	-5.16**	-.66	.12	-.45	5.31**	-.41	.13	-.30	-3.27**
Physical Sx \times Inattention	-.01	.01	-.00	-.01	-.02	.02	-.11	-1.04	-.02	.02	-.07	-.69	-.04	.02	-.19	-1.65
Harm Av \times Inattention	.00	.01	.00	.10	.02	.02	.11	1.21	-.03	.02	-.11	-1.29	.02	.02	.09	.89
Social Anx \times Inattention	-.01	.01	-.05	-.87	.02	.02	.10	.90	.02	.03	.07	.58	.07	.03	.29	2.40*
Separation \times Inattention	-.00	.01	-.02	-.37	-.01	.02	-.02	-.24	.02	.03	.08	.85	-.01	.03	-.04	-.37

* $p < .025$; ** $p < .01$.^aFor the WJBR, the time 1 WJBR score was included with a Block 1: $R^2 = .81$, $B = .86$, $SE B = .04$, $\beta = .90$, $t = 23.13$ **;; Block 2: $B = .85$, $SE B = .04$, $\beta = .89$, $t = 22.78$ **;; Block 3: $B = .81$, $SE B = .04$, $\beta = .85$, $t = 20.39$ **;; and Block 4: $B = .82$, $SE B = .04$, $\beta = .86$, and $t = 20.01$ **.

Table 3. Longitudinal hierarchical regression analyses for Time 1 anxiety and inattention predicting Time 2 achievement scales.

	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>
	T2-Basic reading ^a (<i>n</i> = 100)				T2-Passage comprehension (<i>n</i> = 100)				T2-Reading fluency (<i>n</i> = 100)				T2-Calculation (<i>n</i> = 93)			
Block 1	$R^2 = .80$				$R^2 = .06$				$R^2 = .04$				$R^2 = .10$			
Physical symptoms	-.18	.14	-.08	-1.29	-.06	.25	-.03	-.23	.11	.33	.04	.32	-.30	.29	-.13	-1.05
Harm avoidance	.12	.14	.05	.89	.26	.25	.12	1.05	.42	.32	.15	1.31	.51	.28	.20	1.81
Social anxiety	.03	.17	.01	.18	.28	.30	.12	.91	.30	.39	.10	.76	.20	.36	.07	.56
Separation/panic	-.19	.19	-.06	-.99	-.73	.33	-.27	-2.18	-.71	.44	-.21	-1.64	-.83	.38	-.27	-2.17
Block 2	$R^2 = .81$				$R^2 = .24$				$R^2 = .26$				$R^2 = .23$			
Physical symptoms	-.19	.14	-.08	-1.38	-.15	.23	-.08	-.66	-.03	.29	-.01	-.09	-.39	.27	-.17	-1.43
Harm avoidance	.09	.14	.03	.65	.05	.23	.02	.23	.13	.29	.04	.45	.33	.27	.13	1.25
Social anxiety	.02	.17	.01	.15	.27	.27	.11	.99	.29	.35	.10	.84	.14	.33	.05	.43
Separation/Panic	-.16	.19	-.05	-.84	-.48	.30	-.18	-1.58	-.37	.39	-.11	-.95	-.57	.36	-.19	-1.58
Inattention	-.08	.06	-.07	-1.31	-.41	.09	-.44	-4.83**	-.58	.11	-.49	-5.36**	-.41	.11	-.37	-3.85**
Block 3	$R^2 = .81$				$R^2 = .28$				$R^2 = .34$				$R^2 = .27$			
Physical symptoms	-.20	.14	-.08	-1.38	-.14	.23	-.07	-.62	.02	.28	.01	.08	-.39	.27	-.17	-1.43
Harm avoidance	.10	.14	.04	.69	.05	.23	.02	.20	.11	.28	.04	.40	.39	.27	.16	1.47
Social anxiety	-.00	.17	-.00	-.02	.19	.28	.08	.70	.17	.34	.06	.49	.17	.35	.06	.48
Separation/Panic	-.16	.19	-.05	-.85	-.49	.31	-.18	-1.60	-.42	.38	-.12	-1.12	-.65	.37	.21	-1.78
Inattention	-.09	.06	-.08	-1.42	-.43	.09	-.46	-4.86**	-.58	.11	-.48	5.34**	-.38	.11	-.35	-3.50**
Physical Sx \times Inattention	-.01	.01	-.05	-.86	-.01	.02	-.05	-.48	-.03	.02	-.16	-1.51	-.04	.02	-.21	-1.84
Harm Av \times Inattention	-.00	.01	-.00	.00	-.01	.02	-.08	-.72	-.05	.02	-.25	-2.51*	-.01	.02	-.03	-.25
Social Anx \times Inattention	-.01	.01	-.03	-.44	-.02	.02	-.11	-.98	-.01	.03	-.04	-.37	.03	.03	.13	1.05
Separation \times Inattention	.02	.02	.07	1.10	.05	.02	.24	1.97	.09	.03	.35	3.09**	.03	.03	.12	.97

* $p < .025$; ** $p < .01$.^aFor the WJBR, the time 1 WJBR score was included with a Block 1: $R^2 = .80$, $B = .86$, $SE B = .04$, $\beta = .89$, $t = 19.44^{**}$; Block 2: $B = .85$, $SE B = .04$, $\beta = .88$, $t = 19.07^{**}$; Block 3: $B = .82$, $SE B = .05$, $\beta = .85$, $t = 16.44^{**}$; and Block 4: $B = .81$, $SE B = .05$, $\beta = .84$, and $t = 15.65^{**}$.

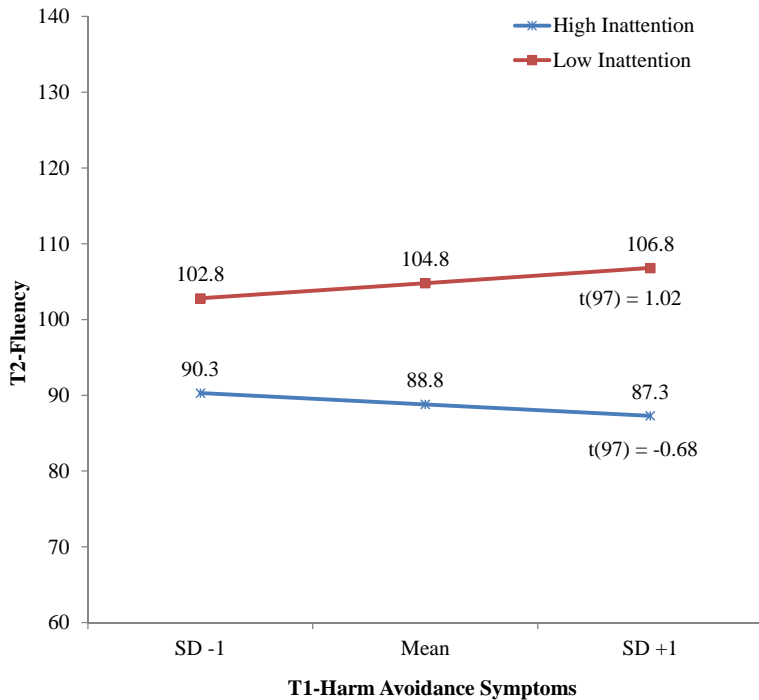


Figure 2. Interaction of Time 1 harm avoidance and inattention predicting Time 2 TOWRE fluency standard scores.

Mediator analyses

Concurrent

The association between T2 harm avoidance and all T2 achievement measures was significantly mediated by T2 inattention. *Z*-scores from the Sobel tests and indirect effects (IE)/confidence intervals (CI) from the bootstrapped point estimates were as follows: WJBR: $Z = 2.54$, $p < .01$, IE = .29, CI = .11–.49; WJPC: $Z = 2.49$, $p < .01$, IE = .24, CI = .09–.41; TOWRE: $Z = 2.51$, $p < .01$, IE = .33, CI = .12–.55; WJC: $Z = 2.17$, $p < .05$, IE = .20, CI = .05–.41. Reverse models (T2 harm avoidance as the mediator, T2 inattention as the independent variable) were also run for each of these with nonsignificant results in all cases.

Longitudinal

T1-inattention was not found to be a significant mediator of the T1 anxiety-T2 achievement association for any of the analyses.

Discussion

The primary aims of the current study were to: (1) examine the roles of anxiety and inattention in the prediction of achievement and (2) examine the potential moderating/mediating role of inattention in the anxiety-achievement relations, both within (concurrent) and across (longitudinal) assessment points. Overall, a

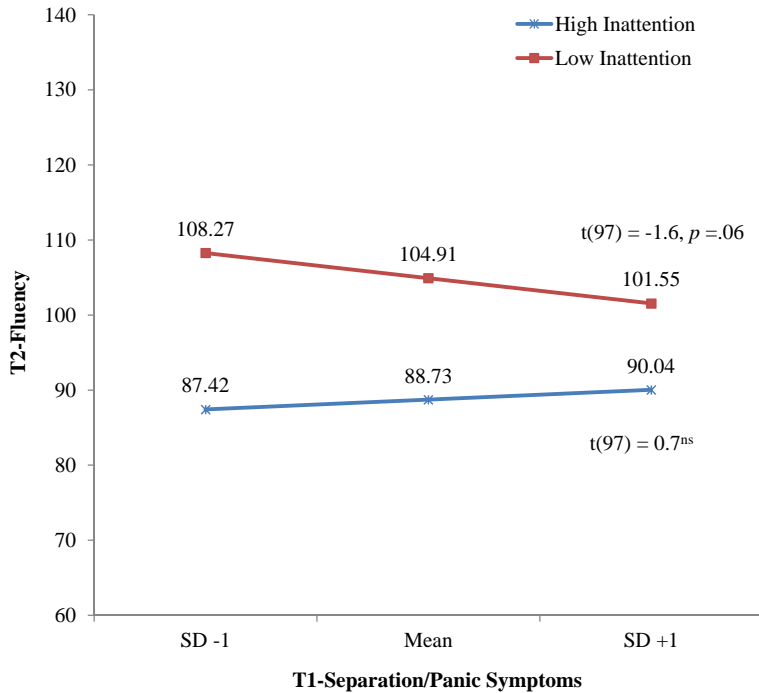


Figure 3. Interaction of Time 1 separation/panic and inattention predicting Time 2 TOWRE fluency standard scores.

few consistent patterns emerged; specifically with regard to the child-reported harm avoidance and separation anxiety scales, as well as the teacher-reported inattention scale. The correlations and direct effects (blocks 1 and 2) from the regression analyses are discussed first, followed by a discussion of the results examining moderation/mediation.

Concurrent and longitudinal relations among measures

Concurrently, the only significant associations with achievement emerged for the harm avoidance and separation anxiety scales. The findings for separation anxiety symptoms were as predicted and suggest that students who reported more of these symptoms at the end of first grade also tended to have lower reading achievement scores at that time. These results are consistent with past research examining anxiety more broadly and reporting poorer performance on academic/achievement tasks for children reporting greater anxiety symptoms (Bryan et al., 2004; Davis, Ollendick, & Nebel-Schwalm, 2008; Durbrow et al., 2001; Fincham, Hokoda, & Sanders, 1989; Ialongo et al., 1994; Normandeau & Guay, 1998). In addition, separation anxiety symptoms have been reported to increase or become triggered in young children who are experiencing transitions or coping with stressors (Eisen, Brien, Bowers, & Strudler, 2001). Since a number of transitions occur in the first-grade year (e.g., students attend school for full-days, academic demands increase, and high stakes accountability testing initiates) and a number of students in the current study were

experiencing difficulties with learning to read, it is not surprising that this area was found to be particularly pertinent.

The findings for the end-of-year harm avoidance scale revealed that students who reported more symptoms tended to have higher achievement scores at that time. Although contrary to that predicted, these findings are consistent with extensive literature showing a motivating role for moderate levels of anxiety (e.g., Humphreys & Revelle, 1984; Manassis, Tannock, Young, & Francis-John, 2007; Yerkes & Dodson, 1908). For example, Fernández-Castillo and Gutiérrez-Rojas (2009) recently reported associations between grade-point average and moderate anxiety levels in adolescents. Interestingly, this phenomenon was exclusively demonstrated with the harm avoidance scale. However, an examination of the items that comprise the harm avoidance scale suggests that its items assess behaviors that can be characterized as perfectionistic, socially desirable, or avoidant, for example. Although some previous studies have shown detrimental associations for behaviors such as these on child adjustment and achievement measures (e.g., Hewitt et al., 2002; Stornelli, Flett, & Hewitt, 2009), others have shown a more positive and motivating role for them. For example, positive perfectionism behaviors (i.e., striving for perfection) have been related to greater motivation and better achievement, particularly when negative reactions to imperfection are low (e.g., Accordino, Accordino, & Slaney, 2000; Stoeber & Rambow, 2007). In the current study, students who reported higher scores on this scale may have been particularly motivated during the achievement tasks as they were administered in an individualized format and students may have been trying to please the examiner. Thus, while the influence of anxiety has been noted to depend on task and situational variables (e.g., high anxiety enhances performance on easy tasks but hinders it on hard/new tasks; Humphreys & Revelle, 1984), the findings from the present study suggest that the type of anxiety experienced may also be important to consider. Although remarkable, it will be necessary to replicate these findings, as well as to conduct longitudinal studies to examine whether high levels of these motivating behaviors become more problematic over time.

Contrary to hypotheses, neither physical nor social anxiety symptoms predicted achievement in the regression analyses conducted. These findings may speak to the different manner with which anxiety is often expressed by children of different ages. That is, separation anxiety is far more common in younger aged children, while social anxiety concerns typically develop later in childhood/early adolescence (Ollendick, Grills, & Alexander, 2001). Further, researchers have suggested that younger aged children may not readily recognize the physical signs of anxiety and/or may lack the understanding that these symptoms are internally caused by anxiety (Muris, Mayer, Freher, Duncan, & den Hout, 2010; Nelles & Barlow, 1988). Finally, with one exception, child anxiety and teacher inattention ratings were not significantly correlated. Although this was not as predicted and is in contrast to some previous research examining these areas, our findings were likely influenced by the different reporters used for these two scales. That is, children reported on their own anxiety levels, while teachers reported on inattention. A large literature has previously demonstrated poor agreement among teachers, parents, and children on anxiety and inattention scales (e.g., Achenbach, McConaughy, & Howell, 1987; DiBartolo & Grills, 2006; Murray et al., 2007). Indeed, our own work has also shown that teachers and children evidenced poor agreement on ratings of anxiety in the

current project (Grills-Taquechel et al., 2012). Therefore, it will be important for future work to examine ratings of anxiety and inattention by both sets of informants.

Finally, teacher-reported inattention at mid-year and year-end were strongly related to all end of year achievement scores. When entered in the concurrent and longitudinal regression analyses (with the anxiety scales also in the model), inattention was in all cases but one a significant predictor. Consistent with past research (e.g., Barriga et al., 2002; Durbrow et al., 2001; Fuchs et al., 2005; Massetti et al., 2008; Rabiner & Coie, 2000; Tannock & Brown, 2009), these findings demonstrated that students experiencing greater difficulty with attention also performed worse on the reading and calculation measures in this study.

Inattention as a moderator

In the longitudinal analyses, mid-year teacher-reported inattention interacted with child-reported harm avoidance and separation anxiety to predict end-of-year TOWRE scores. However, the anxiety scales interacted differently with inattention in the prediction of this reading fluency scale. Specifically, greater levels of harm avoidance were associated with higher fluency scores for students who were rated as more attentive, but with poorer fluency scores for children rated as more inattentive. Thus, for students with better attention, the previously described motivating role of harm avoidance may be especially beneficial and result in focused and accurate performance in reading fluency. In contrast, children who report wanting to do well and please others but who struggle to pay attention may have their focus especially impaired, resulting in slower reading rates. This finding is consistent with past research showing that children who experience discrepancies in their goal striving and actual performance tend to evidence greater psychopathology (Accordino et al., 2000). Such students may be particularly impaired by compounded inattentiveness (distracted by stimuli in the environment and their anxious thoughts). Alternatively, it may be that these represent cases where child and teacher agreement on inattentiveness coincide but for one of these reporters the cause is misinterpreted. That is, teachers may be unaware that the child is anxious and distracted by their anxious thoughts and feelings but because they observe the child's inattentiveness can rate them as such (Durbrow et al., 2001).

In contrast, under conditions of low separation anxiety, students with poor attention performed more poorly on reading fluency than those with better attention. Post-hoc probing revealed that those reported to have better attention showed significant decrements in fluency performance as separation anxiety symptoms increased while those with poorer attention showed little change regardless of anxiety level. While it was predicted that the combination of anxiety and inattention would be most detrimental, these findings suggest an impeding influence of separation anxiety symptoms for attentive students, at least in terms of fluency performance. In addition, these findings are consistent with Ialongo et al. (1994) who reported that greater fall anxiety levels predicted poorer spring achievement performance. Although the interactions were small and are in need of further replication, these findings suggest that identifying and providing intervention for young children experiencing elevated anxiety concerns may be beneficial for their later academic achievement test performance.

Inattention as a mediator

For the concurrent analyses, end-of-year inattention was a significant mediator of the harm avoidance-achievement associations found at that time. The direction of the findings suggested that greater harm avoidance symptoms were associated with better attention which was, in turn, related to better reading and calculation scores. Although these findings were not replicated in the longitudinal analyses, this is understandable since an increased drive to perform well and please others could be motivating and result in greater on-task attention in the present but not necessarily the future (e.g., harm avoidance and/or inattention symptoms may have changed over time). Nonetheless, researchers have previously shown detrimental influences (including mediating) for anxious and inattentive symptoms on academic/achievement tasks (e.g., Eysenck et al., 2007; Tobias, 1992). The inconsistency of our findings and those previously reported may be due, in part, to the young age of our sample or the fact that this study measured anxiety with a multidimensional scale and inattention with a scale that parallels the diagnostic criteria for ADHD-I. In contrast, most previous studies have used measures of test anxiety and attention has been represented by working memory or distracter tasks (see Eysenck et al., 2007; Tobias, 1992 for reviews). Finally, it may be that a negative mediating influence of inattention emerges later in children's schooling as task demands increase and children transition from learning to read to reading to learn. Therefore, future studies should include older children and adolescents to explicate the nature of these relations for youth at different ages. Overall, it is apparent that additional studies are needed to replicate these findings and to clarify types of anxiety and inattention and how these interact to influence children's performance on various academic tasks.

Limitations, future directions, and clinical significance

In addition to limitations previously discussed, this study was limited by the use of single informants for socioemotional ratings, a small sample size, and two-time point data analysis; all of which should be addressed in future studies. The noted interactions were small, possibly due to the sample size, and are clearly in need of replication. Future studies should also continue to follow students for a longer period of time to provide better understanding of the relations among anxiety, inattention, and achievement as children progress through school. For example, anxious children may be particularly sensitive to academic failures which compounds the difficulties experienced (Manassis et al., 2007). In addition, the current findings are limited in their generalizability to other samples. Given the varied findings that emerged for different types of anxiety, it will be important for future studies to utilize multidimensional or multiple diverse measures of anxiety. Employing the summed (total) score in the present study would have resulted in null findings (as was confirmed with post-hoc analyses), as the positive and negative associations would have cancelled each other out. In addition, using a multidimensional measure may reveal that different areas of anxiety play a greater role for children of different ages (e.g., separation anxiety in younger children and social or generalized anxiety in older children). Finally, future work should attempt to integrate across research domains; for instance, the present findings may have implications for research on such areas as cognitive demand/vigilance (e.g., Helton & Russell, 2011) or high stress

performance-related activities (e.g., gifted tests, elite athletes/musicians; Mesagno, Harvey, & Janelle, 2012) – areas of research conducted in older samples of adolescents and adults to date.

Overall, findings from the present study significantly add to a growing literature showing an important role for socioemotional variables in the study of children's academic achievement. Further, our findings are consistent with Massetti et al. (2008) showing that associations among anxiety, inattention, and achievement may begin quite young and suggest the need to begin evaluations of such areas as early as first grade. It may prove fruitful to provide early anxiety prevention/intervention, especially for children experiencing (or at-risk for) academic difficulties. For young children, our findings suggest that such programs could aim to reduce separation anxiety symptoms, as well as enhance goal-striving behaviors. Given the finding that greater levels of harm avoidance were associated with lower fluency scores for children with greater attention difficulties, it may be particularly important that teachers recognize signs of anxiety and structure instruction to reduce it (e.g., setting attainable short-term goals and providing positive reinforcement for small gains). Finally, these findings also point to the need to consider the potential impact of children's emotional concerns on high stakes testing.

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Notes

1. Detailed information available at <http://www.texasldcenter.org/>.
2. See note (1) above.
3. Analyses were also conducted controlling for IQ using the *Kaufman Brief Intelligence Test-2* composite score (Kaufman & Kaufman, 2004) and including gender as a moderator. Since the overall conclusions did not change with any of these analyses, the models were reduced to that described.

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