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Understanding the relation between reading and anxiety among upper elementary students with reading difficulties

Sarah Fishstrom[1], **Philip Capin**[2], **Anna-Mari Fall**[2], **Gregory Roberts**[2], **Amie E. Grills**[3], **Sharon Vaughn**[2]

[1]College of Education, University of Hawai'i at Manoa, 1776 University Avenue, Wist 121, Honolulu, HI 96822, USA

[2]The Meadows Center for Preventing Educational Risk, The University of Texas at Austin, Austin, TX, USA

[3]School of Education, Boston University, Boston, MA, USA

Abstract

This study examined the relations between reading anxiety, general anxiety, and test anxiety in a sample of students with reading difficulties ($n = 536$). It also tested if dimensions of anxiety were differentially related to word reading accuracy and fluency, text reading fluency, or reading comprehension. The results indicated that the three anxiety measures were significantly related ($r = 0.51$ to 0.56, $p < .001$). Additionally, higher reading anxiety was related to poorer word reading fluency, text reading fluency, and comprehension outcomes. Further analyses indicated that these relations existed in students who fell in the middle and upper quantiles for reading, but not the lowest quantile. This pattern of findings suggests that the relation is complex and varies depending on severity of reading difficulty. Results may help to inform future efforts to support students with reading difficulties, including students with dyslexia.

Keywords

Anxiety; Reading achievement; Reading difficulties; Quantile regression

According to data released by the National Center for Education Statistics (NCES), only 32% of fourth grade students are reading at proficient levels (National Center for Educational Statistics, 2022) despite the fact that literacy was deemed a public health crisis 25 years ago (Lyon, 1998). This is concerning because low reading proficiency is a predictor of poor academic outcomes (Hernandez, 2011), behavioral issues, high-school dropout, incarceration, and unemployment (Caspi et al., 1998; Chitsabesan et al., 2007; Hernandez, 2011; Morgan et al., 2008; Sum et al., 2009).

Sarah Fishstrom sarahcf@hawaii.edu.

Declarations

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There are several reasons why individuals are unable to develop reading proficiency, which can be defined as the ability to read accurately and fluently (Barth & Elleman, 2017; Gough & Tunmer, 1986; Hoover & Tunmer, 2018; Perfetti, 2007). These reasons relate to individual factors (e.g., working memory; Peng et al., 2018), instructional factors (e.g., inadequate explicit phonics curriculum; Fletcher et al., 2021), and environmental factors (e.g., socioeconomic status; Seidenberg, 2017).Another critical factor relates to emotional health—in particular, anxiety (Fletcher & Grigorenko, 2017).

Anxiety in children

Anxiety has been defined as "a state of heightened distress, arousal, and vigilance that can be elicited by potential threat. When extreme or pervasive, anxiety can be debilitating" (Shackman & Fox, 2021; p. 106). Although the incidence of childhood anxiety was a source of concern before COVID19 (Ghandour et al., 2019), it appeared to skyrocket during the pandemic (Racine et al., 2021). For example, according to the 2022 School Pulse Panel, 70% of public schools have reported an increase in students asking for mental health services since the start of the pandemic, and 76% of schools have reported that staff observed students exhibiting symptoms of anxiety (National Center for Education Statistics, 2022). Given that anxiety is often under-detected and under-reported, these statistics will underestimate the proportion of students who actually experience anxiety (Al-Biltagi & Sarhan, 2016; Tandon et al., 2009).

The association between anxiety and reading in children

Higher anxiety has been found to be consistently related to lower academic performance (Francis et al., 2019; von der Embse et al., 2018; see also McArthur et al. and Kargiotidis & Manolitsis, in this issue). This relationship may exist for various reasons, such as task avoidance, attention and concentration problems, difficulties with problem-solving, and emotional dysregulation (Cassady, 2010; Tutsch et al., 2019). This association has been observed in children in the early elementary grades (first and second grade; Ramirez et al., 2019), which is troubling because anxiety—like low reading proficiency—predicts poor life outcomes (Tomb & Hunter, 2004).

One academic ability that appears to be related to anxiety is reading (Ramirez et al., 2019; Zbornik & Wallbrown, 1991). To date, only one systematic review has estimated the strength of the association between poor reading and anxiety, which included studies of children, adolescents, and adults. Francis et al. (2019) identified 22 studies (with 11,372 participants) that compared the anxiety scores of groups of participants with and without reading difficulties. The results indicated a moderately strong and statistically significant association between anxiety and poor reading. The results also indicated that there were too few studies for Francis et al. to conduct planned moderator analyses for factors such as anxiety type (i.e., generalised anxiety, separation anxiety, social anxiety, specific phobias, panic disorder) and reading type (i.e., phonological recoding, visual word recognition, reading fluency, mixed reading difficulties).

The association between different domains of anxiety and reading

Francis et al. (2019) were unable to conduct the planned moderator analyses for anxiety type and reading type, which was unfortunate given that some studies have reported specific relationships between certain domains of anxiety and reading. Grills-Taquechel and colleagues have explored these relations in three different studies. In the first study, Grills-Taquechel et al. (2012) tested 153 first-grade students in general classrooms for four types of anxiety (physical symptoms, harm avoidance, social anxiety and separation anxiety) and two types of reading (basic reading; word and pseudoword reading accuracy and text reading fluency). Their hierarchical linear regression results indicated that poor text reading fluency scores predicted higher separation anxiety scores, and that word and pseudoword reading accuracy scores predicted low harm avoidance scores (i.e., poorer word reading was associated with fewer symptoms of perfectionism). These results suggested that different types of anxiety may have different relations with different reading outcomes.

In a second study, Grills-Taquechel et al. (2013) assessed 161 first-grade children in general education in four types of anxiety (physical symptoms, harm avoidance, social anxiety and separation anxiety) and three types of reading (basic reading; word and pseudoword reading accuracy, text reading fluency, and comprehension). They also tested children's attention. Hierarchical linear regression suggested that elevated separation anxiety predicted poor reading fluency and word and pseudoword reading accuracy, and low harm avoidance predicted poor text reading fluency and comprehension. Attention interacted with separation anxiety and harm avoidance to predict text reading fluency. These findings differed somewhat from Grills-Taquechel et al. (2012) and yet still indicated that the relation between various categories of reading and anxiety may differ.

Finally, in their third study, Grills-Taquechel et al. (2013) tested 114 first-grade children (N = 83 with reading difficulties) in four types of anxiety (physical symptoms, harm avoidance, social anxiety, and separation anxiety) and two types of reading (basic reading; word and pseudoword reading accuracy and text reading fluency). The results indicated that students who improved in text reading fluency reported a decrease in social and separation anxiety symptoms. This pattern of results was not observed for harm avoidance symptoms, which were again found to be low in students with reading difficulties. It is important to consider that this study focused on first grade students, and that separation anxiety (i.e., elevated fears about being separated from significant others) is more likely to be identified in younger than older children (Feriante et al, 2023). Thus, the relationship between reading fluency and separation anxiety may not be relevant to students in higher grades.

More recently, Macdonald et al. (2021) examined 272 fourth and fifth grade students with reading difficulties for two types of anxiety (reading and general anxiety), and three types of reading (i.e., word reading accuracy, text reading fluency, and comprehension). The results showed that reading anxiety and general anxiety measures were moderately correlated (r = 0.63), and that reading anxiety was more closely correlated to all three reading outcomes than general anxiety, which was only correlated with text reading fluency. These findings were the first to suggest that reading anxiety and general anxiety may be related to different reading outcomes.

Francis et al. (2022) assessed 284 students from second to sixth grade (ages ranged from 7–12 years old; $N = 82$ with reading difficulty; $N = 49$ with anxiety; $N = 108$ with reading difficulty and anxiety; $N = 45$ as comparison). They utilized a comprehensive battery with six anxiety measures (social anxiety, generalized anxiety, and separation anxiety, physical injury fears and phobias, panic, and obsessive-compulsive symptoms) and seven reading measures (word reading accuracy, pseudoword reading accuracy, text reading accuracy, word reading fluency, pseudoword reading fluency, text reading fluency, and comprehension). A correlation analyses, revealed a weak but statistically significant association between word reading accuracy and social anxiety. However, a subsequent principal components analysis suggested no association between different types of reading and anxiety. Thus, this study adds complexity to our understanding of these relations since it failed to replicate previous relationships between various types of reading and particular domains of anxiety.

Most recently, Kargiotidis and Manolitsis (2023) tested the reading skills of 121 students (69 with literacy difficulties) in second and third grade. Their battery included various reading outcomes (word reading accuracy, text-reading fluency, reading comprehension, and spelling), and domains of anxiety (social and generalized) and attention in the fifth grade. Between-groups ANOVAs and t-tests indicated that students with reading *and* spelling difficulties had higher levels of inattention, social anxiety, and generalized anxiety than students who had a reading difficulty *or* spelling difficulty. ANCOVAs controlling for attention revealed that the former had elevated social anxiety but not generalized anxiety. These findings suggest that more severe literacy difficulties may be associated with social anxiety.

The results of this small corpus of studies suggest a nuanced relation between reading and anxiety domains. Specifically, the findings of multiple studies suggest that various literacy difficulties (word accuracy, text fluency, reading comprehension, spelling) may be associated with higher levels of social anxiety (Francis et al., 2022; Grills et al., 2014; Kargiotidis & Manolitsis, 2023), and yet lower levels of harm avoidance (Grills-Taquechel et al., 2012, 2013; Grills et al., 2014). Further, there may be an association between various reading difficulties (word accuracy, text fluency, reading comprehension) and separation anxiety (Grills-Taquechel et al., 2012, 2013), although this may be restricted to younger children. It is notable that only one study has included a measure of reading anxiety, arguably the most proximal anxiety to reading (MacDonald et al., 2021). Another proximal anxiety to reading may be test anxiety, which was not assessed in any of the studies above. It is also notable that the results of the most recent study (Kargiotidis & Manolitsis, 2023) suggest that students with more severe literacy difficulties (i.e., reading and spelling) may have higher levels of anxiety than those with reading or spelling difficulties. The reliability of this finding, which makes sense intuitively, requires testing by an independent study.

The current study

The current study was designed to answer the following questions:

1. to what extent are reading anxiety, general anxiety, and test anxiety related to each other in a sample of elementary grade students with reading difficulties?

2. do reading anxiety, general anxiety, and test anxiety predict performance on tests of word reading accuracy and fluency, text reading fluency, and comprehension measures? and

3. does this relationship vary as a function of the severity of students' reading difficulties?

Based on existing, albeit limited, evidence, we hypothesized that: (1) the two academic domains of anxiety—reading and test—would be more closely related to each other than to general anxiety (Cassady, 2010; Fishstrom et al., 2022); (2) reading anxiety would be negatively correlated with word reading accuracy to some degree, to text reading fluency to a greater degree, and reading comprehension the greatest degree (similar to findings by Macdonald et al., 2021), while general anxiety would correlate with reading fluency to a lesser degree than reading anxiety (Macdonald et al., 2021); and (3) anxiety and reading would be most strongly related in students with the greatest difficulty with reading (Kargiotidis & Manolitsis, 2023).

Method

We used pretest data from a multiple cohort RCT, which examined the impact of a reading and anxiety management intervention (RANX: Grills & Vaughn, 2017–2022). Students were in grades 3 to 5 and attended six schools across two school districts in the southwestern United States. They were included in the RCT if (1) they provided assent and a parent provided consent for participation, and (2) the student scored at or below a standard score of 92 (30th percentile) on a reading screening test—the Gates-MacGinitie Reading Test 4th Edition (GMRT-4) Reading Comprehension subtest (MacGinitie et al., 2000). We opted to use a lenient "cut-off" (i.e., 30th percentile rather than, say, 16th or 5th percentile) to (1) better represent a broad range of students with reading difficulties, and (2) enable a UQR analysis to test if the relations between reading and anxiety were moderated by severity of reading difficulties.

The sample size for the RCT, and hence this study, was $n = 536$. The age range was 7.75 to 11.33 (M = 9.12) years. The demographics of the participating students were 16% White, 65% Hispanic, 8% African American, and 10% other or multiple races. Of the students for whom data were available, 40% received free or reduced lunch, 19% had parents who spoke another language at home (data from cohorts 2 and 3 only), and 24% were identified with a disability. Student demographic information is presented in Table 1.

Assessment procedures

In total, 536 students completed three self-report anxiety measures and five reading assessments (outlined below) at pretest. Trained research personnel, who were blind to study condition, administered and scored measures to all students before instruction began. Staff had to pass a one-on-one reliability session with a highly qualified assessment team member to demonstrate mastery of each assessments' administration procedures (e.g., stopping at the correct points, prompting and discontinuing testing when applicable) in order to administer the assessments in the field. All measures were double-scored and double-entered to ensure accuracy. A 20% discrepancy check on the data was also conducted before being analyzed.

Also, we standardized all scores (for both reading achievement and anxiety measures) by converting them to z-scores.

Anxiety measures

The anxiety measures served as predictor variables for the five reading outcomes. The three measures used self-report, which is widely used to gauge students' internal experiences (March, 1997). The anxiety measures battery included a total of 56 questions, which took around 30 min to administer. Higher scores indicated higher anxiety. The questions were read aloud slowly to the students in a group setting, who were encouraged to ask questions about items that they thought were unclear, and skip items that they did not comfortable answering. The anxiety and reading batteries were administered on different days to avoid assessment fatigue, and were counterbalanced to avoid order effects.

Reading anxiety—We used the Reading Anxiety Questionnaire (RAQ; Grills et al., unpublished) to assess anxiety about reading. The scale has 6 self-report items that student's rate on a 5-point Likert-type scale (e.g., 1 = I never feel this way; 3 = sometimes I feel this way; 5 = I always feel this way). The measure was developed for elementary school aged children and has undergone an iterative process to ensure questions (e.g., "taking reading tests scares me") are appropriate for children (Grills et al., unpublished). Internal consistency for the measure has ranged from 0.76 to 0.79 and adequately of the six questions on the assessment to differentiate between student reading-related anxiety levels has been determined (Grills et al., unpublished).

General anxiety—The Beck Anxiety Inventory for Youth (BAI-Y; Beck et al., 2001) is a subscale of the Beck Youth Inventories Second Edition that measures general anxiety in children and adolescents (7 to 18 years old). It is a 20-item self-report that utilizes a Likert-type 4-point subscale (1 = never; 4 = always). Example items include: "I worry," "I have trouble sleeping," and "I get shaky." Internal consistency is reported to be above 0.86 and test-retest reliability above 0.74 (Beck Youth Inventories, 2012). Moreover, previous research demonstrates strong reliability of the BAI-Y for children (Carsley et al., 2017).

Test anxiety—The Children's Test Anxiety Scale (CTAS; Wren & Benson, 2004) is a 30-item version of the widely-used measure of test anxiety in children (the Test Anxiety Scale for Children; Sarason et al., 1958). Using 4-point Likert scales, students respond to statements about three components of test anxiety (i.e., thoughts, off-task behaviors, and autonomic reactions) such as "I feel nervous," "I look around the room," and "my belly feels funny." The 30-item measure has a reliability coefficient alpha of 0.92 and construct validity has been confirmed via factor analyses (Wren & Benson, 2004).

Reading measures

Half of the reading measures were administered to students individually (word reading accuracy, word reading fluency, pseudoword reading fluency) and half in groups (screening measure, text reading fluency, text reading fluency and comprehension). Higher scores represented higher reading performance.

Screening measure—The GMRT-4 comprehension subtest (MacGinitie et al., 2000) was used to screen students for their overall reading ability. It is a timed, standardized, and norm-referenced reading measure for K-12 grade students that is administered in a group. It requires students to silently read expository and narrative passages that range from 3 to 15 sentences and then answer multiple-choice questions (48 in total). Alternate-form reliability ranges from 0.80 to 0.87 and internal consistency has been found to range from 0.91 to 0.93 (Macdonald et al., 2021).

Word reading accuracy—Woodcock Johnson Test of Achievement- Letter Word Identification (WJ-LWID; Woodcock et al., 2001) is an untimed measure that assesses students' ability to accurately read increasingly difficult letters and words. Basal and ceiling rules are utilized to get an accurate score without over assessing students. The WJ-LWID subtest has a median reliability of 0.93 for upper elementary aged children (Author) and test–retest reliability is about 0.85 (Woodcock et al., 2001).

Word reading fluency—Word reading fluency was assessed using the Test of Word Reading Efficiency Sight Word Efficiency Subtest (TOWRE-SWE; Torgesen et al., 2012). This test asks students to read as many increasingly-difficulty words as they can—with accuracy—in 45 s. Alternate- form and test–retest reliability have both yielded at or above 0.90 for upper elementary aged students (Daniel et al., 2022).

Pseudoword reading accuracy—We used the Woodcock Johnson Test of Achievement-III Word Attack subtest (WJWA; Woodcock et al., 2001) to assess students' pseudoword-level reading skills. Similar to the TOWRE-SWE, this subtest asked students to read as many increasingly difficult nonwords as they can in 45 s. Internal reliability ranges from 0.87 to 0.94 and the test–retest reliability ranges from 0.81 to 0.85 for the subtest (Daniel & Barth, 2023).

Text reading fluency—The Test of Silent Contextual Reading Fluency (TOSCRF; Hammill et al., 2006) uses short passages to assess text reading fluency. All words are presented in uppercase without any punctuation or spaces (e.g., AYELLOWBIRDWITHBLUEWINGS). This group administered measure asks students to draw a line between as many words as they can in 3 min. The passages increase in complexity (of content, grammar, and vocabulary) as the assessment progresses. Test–retest reliability has been identified as high, above 0.84 (Hammill et al., 2006).

Text reading fluency and comprehension—The Test of Silent Reading Efficiency and Comprehension (TOSREC; Wagner et al., 2010) is a standardized measure of text reading fluency and comprehension that is group-administered. Students were given 3 min to read and assess the truthfulness of a series of short sentences. For example, students will need to answer 'yes' or 'no' to sentences such as, "A fish lives on land." Performance in TOSREC has been found to be consistent with scores from oral fluency measures and to also provide unique information above text reading fluency (Johnson et al., 2011). Alternate-form reliability is higher than 0.86 (Wagner et al., 2010).

Data analyses

Our data analyses included three steps. First, we standardized all raw scores by converting them to a z score. Second, we used ordinary least-squares (OLS) to estimate the impact of an independent variable (e.g., reading anxiety) on the unconditional mean of an outcome variable (e.g., comprehension; Burton, 2021). Third, we used an unconditional quantile regression (UQR) method to provide estimates between independent and dependent variables for different quantiles of students across the outcome distribution (Porter, 2015). UQR enables the exploration of potential heterogeneity across the distribution, which is useful for understanding heterogenous groups such as students with learning difficulties (Rios-Avila & Maroto, 2020; Schneider & Kaufman, 2017).

We used a two-step method developed by Firpo et al. (2009) to carry out the UQR analysis. First, we used the Stata 15.1 *rifhdreg* command to create a binary variable relying on the re-centered influence function (RIF) for each quantile of interest (20, 0.50, 0.80). We then fit OLS regression models replacing the original dependent variable with the RIF-based binary variable. We modeled three comparisons for each predictor (i.e., type of anxiety) while controlling for the other anxiety measures: the conditional coefficients at 0.20 versus 0.50 quantiles, at the 0.20 versus 0.80 quantiles, and at the 0.50 versus 0.80 quantiles.

It is important to note that percentiles represent participants' rank within a sample, and so quantiles in this study can be interpreted as low, medium, and high levels of reading performance within a sample of poor readers. Thus, the medium and high quantiles should be interpreted within the context of all students having some degree of reading difficulty. Also, guided by Cohen (1969), we considered correlation coefficients of around 0.2, 0.5, and 0.8 to represent small, medium, and large effects.

Results

Preliminary analyses

First, we examined the data for outliers and multicollinearity. When screening the data, six students were identified to have standard scores ranging from 16 to 48 on word reading accuracy as measured by the WJ-LWID subtest. These scores represent invalid scores (i.e., the minimum valid standard score is 50), so these students were removed. Next, we checked for multicollinearity. None of the correlations between the predictor variables exceeded 0.80, suggesting multicollinearity problems were not present. All reading measures were positively related to each other (ranging from $r = 0.38$—0.78, $p < 0.01$; see Table 2). Moreover, Pearson's correlations revealed negative correlations between reading anxiety and three out of the five reading achievement measures (pseudoword reading accuracy, word reading fluency, and both text fluency and comprehension) and no significant relations between test and general anxiety and any reading outcome.

Relations between dimensions of anxiety

To estimate the relationship among self-reported reading anxiety, general anxiety, and test anxiety, we produced a bivariate correlation matrix. Reading anxiety and test anxiety were moderately and positively correlated, $r(528) = 0.51$, $p < 0.001$, as were reading anxiety and

general anxiety, $r(528) = 0.51$, $p < 0.001$, and test anxiety and general anxiety, $r(519) = 0.57$, $p < 0.001$. Correlations and descriptive statistics are presented in Table 2.

Anxiety and reading performance

Results of OLS regression analysis are presented in Table 3. Results indicated that reading anxiety was negatively related with word reading fluency ($\beta = -0.10$, $SE = 0.05$, $p < 0.05$) and text reading fluency and comprehension ($\beta = -0.12$, $SE = 0.05$, $p < 0.05$). The associations between general anxiety, test anxiety and reading achievement based on word reading, fluency, and comprehension measures were not statistically significant.

We then used the UQR analysis to test if the influence of reading anxiety, general anxiety, and test anxiety on reading outcomes varied for students with different levels of reading achievement. Controlling for the effect of other predictors (general anxiety and test anxiety), we found that reading anxiety was significantly and negatively related to word reading fluency and text reading fluency and comprehension for students at the 50th and 80th quantiles of reading performance. We also found that reading anxiety was a significant predictor of pseudoword reading accuracy at the highest quantile (0.80), but not at lower quantiles. Finally, controlling for the effect of other predictors, we found that general anxiety was significantly related to text reading fluency at the highest quantile (0.80) only (see Table 3 for OLS and UQR estimates).

To evaluate if predictors differed significantly between the reading-difficulties quantiles, we compared conditional coefficients between quantiles (see Table 3 for results). We found that the relation between reading anxiety and pseudoword reading accuracy was significantly higher for students in the highest quantile (0.80; $\beta = -0.19$) than the middle quantile (0.50; $\beta = -0.03$); and the relation between general anxiety and word reading fluency was stronger at the middle quantile (0.50; $\beta = 0.12$) than the lowest quantile (0.20; $\beta = -0.07$).

Discussion

The purpose of this study was to determine the degree to which reading anxiety, general anxiety, and test anxiety are related to each other in elementary grade students with reading difficulties, and to determine if any of these anxiety types predict word reading accuracy and fluency, text reading fluency, or reading comprehension in these children. We also explored if the relationship between these different types of anxiety and reading varied as a function of the severity of students' reading difficulties. In the following sections, we address each of these issues sequentially utilizing the data.

The relationships between reading, general, and test anxiety

Based on existing evidence, we predicted that the two academic domains of anxiety—reading and test—would be more closely related to each other than to general anxiety (Cassady, 2010; Fishstrom et al., 2022). The results of this study suggest that test anxiety, general anxiety, and reading anxiety are moderately related to each other. Hence, they may provide complementary pieces of information about anxiety symptoms in children with reading difficulties. More specifically, the reading anxiety measure may capture a type of anxiety that provides additional information beyond general anxiety and test anxiety. This

aligns with findings of previous studies showing that measures of different domains of anxiety provide unique information (Macdonald et al., 2021; Zbornik & Wallbrown, 1991).

Predicting reading outcomes from different types of anxiety

Reading anxiety—We hypothesized that reading anxiety would be negatively correlated with word reading accuracy to some degree (Macdonald et al., 2021). We found a non-significant relation between word reading accuracy and reading anxiety, a significant correlation between pseudoword reading accuracy and reading anxiety ($r = -0.09$), and a significant relation between word reading fluency and reading anxiety ($r = -0.11$). When compared with research conducted by Macdonald et al. (2021), we find converging evidence for a negative relationship between reading anxiety and word reading. However, the two studies reveal diverging evidence regarding the relation between untimed word reading accuracy and reading anxiety in elementary students. One possible explanation for this difference is that our study included 3rd grade students in addition to 4th and 5th grade students, which was not the case in Macdonald et al.'s paper. von der Embse et al. (2018) reported that students in the middle grades are more concerned about assessments than students in earlier grades. Perhaps the higher proportion of "older" elementary students in Macdonald et al.'s study explains why they found a relation between reading anxiety and untimed word reading while we did not.

Next, we hypothesized that text reading fluency would be more highly correlated with reading anxiety (Macdonald et al., 2021). This was not supported by our results. In fact, we found a non-significant correlation when reading fluency was measured with the TOSCRF, and there was only a small significant relation between reading anxiety and the TOSREC ($r = -0.09$). The discrepancy may be explained by various factors, one being that the latter measure included a comprehension component. It is noteworthy that Macdonald et al. (2021) found a significant and stronger relation between oral reading fluency and reading anxiety ($r = -0.24$). It seems these differences may lend credence to oral reading fluency, in contrast to silent reading fluency assessments, as being more related to reading anxiety, perhaps due to anxiety aroused by reading aloud in front of others (Breznitz, 1991).

Lastly, we hypothesized that reading comprehension would be correlated with reading anxiety to the greatest degree (Macdonald et al., 2021). As mentioned, we utilized TOSREC to measure both fluency efficiency and comprehension together, which yielded a weak correlation ($r = -0.09$). Macdonald et al. (2021) found a much stronger correlation between reading anxiety and comprehension, but utilized a different comprehension measure, the GMRT, which asks students to read both expository and narrative passages and then answer multiple-choice questions. Taken together, these findings suggest that reading anxiety may be associated with comprehension outcomes for students with reading difficulty, but it may be worth considering that different measures of comprehension do not correlate strongly with each other and may load on different factors (Keenan et al., 2008).

In sum, when considering our findings as well as findings from Macdonald et al. (2021), reading anxiety is related with word reading fluency and accuracy, text reading fluency and comprehension in students with reading difficulties, but these relations appear to be

complex and discrepancies may be explained by various factors (e.g., how the assessment was administered and the type of assessment).

Test anxiety—Unlike previous studies that have reported negative correlations between test anxiety and achievement (McDonald, 2001; von Der Embse et al., 2013), we found test anxiety was not significantly correlated with timed measures of fluency including word reading, text reading, and a measure that included both fluency and comprehension. These inconsistent findings might be explained by developmental differences in text anxiety. Specifically, von der Embse et al. (2018) found that test anxiety is more evident in middle-school grades than lower elementary grades. It is also worth considering that the reading anxiety measure (RAQ), which was controlled for in the test anxiety model, also has an evaluative element (i.e., some questions refer to reading tests, such as 'taking reading tests scares me'). This may have accounted for some of the variance explained by the test anxiety measure.

General anxiety—We hypothesized that general anxiety would correlate with reading fluency and, to a lesser degree than reading anxiety (Macdonald et al., 2021). However, we found that general anxiety did not correlate with any reading outcome. These findings do not align with those of Zbornik and Wallbrown (1991) who reported that general anxiety was correlated with a composite reading achievement measure in elementary students without reading difficulties. An explanation for these inconsistent findings is that students with reading difficulties produce a more restricted range of reading scores than students without reading difficulties, which may reduce the potential size of the correlation coefficients. Alternatively, it may be that general anxiety simply is not related to reading in children with reading difficulties (Francis et al., 2022; Kargiotidis & Manolitsis, 2023). In short, findings from this study, as well as from other studies in this line of research, indicate that general anxiety does not predict reading outcomes, or at least is not a strong predictor (Macdonald et al., 2021).

Relations between anxiety and reading at different levels of reading difficulty

Based on the findings of Kargiotidis and Manolitsis (2023), we predicted that anxiety and reading would be more strongly related in students with the greatest difficulty in reading. The results of the UQR analysis did not support this hypothesis. Rather, we found significant relations between reading anxiety and text reading fluency and comprehension in the upper (i.e. least severe reading difficulty) and middle quantiles (i.e., moderate reading difficulty) but not the lower quantile (i.e., most severe reading difficulty). In addition, we found significant relations between reading anxiety and pseudoword reading accuracy, as well as general anxiety and text reading fluency, in the upper quantile but not middle or lower quantiles. The discrepant findings may be also because of the cutoff scores used to identify the struggling readers.

It is important to note that when we compared coefficients between the three quantiles, the lowest quantile did not differ from the middle quantile. However, we offer the following possible explanations for why children with the most severe reading difficulties did not show a relation between their reading and anxiety scores. First, it is possible that children in the

elementary grades with the most severe reading difficulties may experience emotions other than anxiety (e.g., learned helplessness, dissociation, low motivation) that may contribute to their making random responses on anxiety assessments (Gerber et al., 2018; Stanovich, 1986). Second, although the anxiety assessments were read aloud to students, and testers encouraged students to ask questions, it is possible that students with the most severe reading difficulties had greater difficulties understanding and responding to the self-report anxiety questionaries. This may be a direct result of their reading difficulty, or because they experience a comorbidity such as inattention or spoken language difficulty, which makes it difficult for them to understand and respond to verbal questionnaires. Third, it is also possible—somewhat paradoxically—that the poorest readers in a cohort are, in fact, anxious, and their anxiety prevents them from either asking for help with understanding the questions, or from reporting their anxiety. It would be useful if a qualitative study could determine if students with severe reading difficulties show visible signs of anxiety or lack of care or understanding when completing anxiety assessments (Nelson et al., 2015).

Limitations

One limitation of this study relates to the sole use of self-report anxiety questionnaires. These measures are widely utilized due to their time efficiency, ease of administration, and ability to accurately capture a student's internal experiences, including symptoms (Hodges, 1990). However, self-report anxiety measures may be challenging for children (Baldwin & Dadds, 2007), so some researchers recommend multiple method (i.e., self-report, observations, structured interviews, measuring heart rate) and multiple informant (i.e., teacher, parent, and student) approaches (Fishstrom et al., 2022; Lowe et al., 2011; Rose & Lomas, 2020; Schniering et al., 2000; Wood, 2006). Unfortunately, these approaches are time-consuming and rarely practical for school-based research. Also, adding additional reporters raises issues related to parent-child agreement, which has been identified as low in prior research (e.g., Multidimensional Anxiety Scale for Children; Baldwin & Dadds, 2007). Thus, although reliance on self-report measures is a limitation, it is also the primary mechanism utilized in studies of anxiety.

Another limitation of this study relates to the fact that we recruited students with reading difficulties who scored below the 30th percentile on the GMRT-4. This means that there was a restricted range of scores across the sample, and an even more restricted range of scores within each quantile. Given that the whole sample produced moderate and significant correlations in some analyses, this may not have affected the results relating to our first two questions too much. However, it is possible this affected the results for the lowest quantile of poor readers whose data helped us address the third question. Future research might consider a less restricted range of scores or utilizing a different measure (e.g., word reading assessment) as a screener.

Implications for science and practice

Findings from this study demonstrate that reading anxiety may be more related to reading outcomes in students with reading difficulties than general or test anxiety. For this reason, clinicians, school psychologists, teachers and counselors might consider attending to students' reading anxiety and screening for reading anxiety in students with reading

difficulties, in order to then address the individual's symptoms. For example, if a student is worried about reading aloud and how they are perceived by peers and teachers, then that could be addressed directly. There is evidence that anxiety management techniques (e.g., deep breathing, guided imagery, cognitive behavior therapy; Francis et al., 2021; Podell et al., 2010; Tutsch et al., 2019; Vaughn et al., 2022) have been found to be successfully delivered in schools by classroom teachers and school staff in addition to mental health personnel (Werner-Seidler et al., 2017). Also, it may be worth considering that some students with reading difficulties may benefit from anxiety management supports specifically related to reading. However, the question remaining is: "for whom" should anxiety be addressed?

Future studies might identify subgroups of students with various degrees and types of anxiety symptoms who would benefit from anxiety management supports. This suggestion considers that anxiety is very individualized, but it is not often realistic for schools to be able to provide individual reading and anxiety supports.

An additional consideration is the social dimension of reading anxiety (i.e., that students are sensitive to how they are perceived by peers and adults), which may also provide novel insight into how to best support students with reading difficulties on oral assessments. Some students who struggle to read may feel threatened by the perceptions others have about them during assessments (Gerber et al., 2018). If a student is being assessed in a group, there may be social evaluative pressures that influence performance that may not be relevant with individual assessments. It should be noted that this is a consideration for developing novel ways to support students prior to or in conjunction with reading assessments (e.g., supporting a student with reducing anxiety prior to an assessment with a relaxation exercise), since it would be very difficult to develop anxiety-preventing reading assessment methods. In other words, it may not be possible to administer all reading measures without having students read aloud, but there are anxiety management strategies that could be taught to reduce any negative impact of anxiety symptoms on assessments.

Conclusion

In sum, we examined the extent to which reading anxiety, general anxiety, and test anxiety relate to each other in a sample of elementary grade students with reading difficulties, and if different domains of anxiety predict performance on tests of word reading accuracy and fluency, text reading fluency, and comprehension measures. We also examined if the relations between anxiety and reading outcomes vary as a function of the severity of students' reading difficulties. We found that all three anxiety domains were moderately related, but that reading anxiety was more closely related to reading outcomes in struggling readers. Higher reading anxiety was related to poorer word reading fluency, text reading fluency, and comprehension outcomes. Further analyses indicated that these relations existed among students with mild or moderate reading difficulties, but not among those with the most severe reading problems. This study reveals the complexity of the relation between anxiety and reading achievement, and encourages greater efforts to support the academic and emotional wellbeing of students with reading difficulties to help them reach their potential.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Student demographic data

	N	%
Gender		
Female	259	48%
Male	277	52%
Special Education		
No	307	57%
Yes	127	24%
Missing	102	19%
Free/Reduced Lunch		
No	126	24%
Yes	214	40%
Missing	196	37%
Race		
Latino/Hispanic	350	65%
Caucasian/White	87	16%
African American/Black	43	8%
Other or Multiple Races	56	10%

Table 2

Correlations and descriptive statistics

Measure	1	2	3	4	5	6	7	8
1. Word Reading Accuracy	1							
2. Pseudoword Reading Accuracy	.78**	1						
3. Text Reading Fluency and Comprehension	.56**	.43**	1					
4. Word Reading Fluency	.67**	.51**	.53**	1				
5. Text Reading Fluency	.47**	.38**	.40**	.46**	1			
6. Reading Anxiety	–0.07	–.09*	–0.09*	–.11*	–0.02	1		
7. General Anxiety	–0.08	–0.08	–0.041	–0.06	–0.04	.51**	1	
8. Test Anxiety	–0.03	–0.03	0.00	–0.07	0.02	.51**	.57**	1
M	97.79	99.03	82.83	86.28	78.84	16.23	56.24	70.86
SD	12.52	11.33	13.19	13.60	13.97	5.98	13.46	17.17
n	533	533	522	533	528	530	521	530

Word Reading Accuracy = Woodcock Johnson Test of Achievement Letter Word Identification (Woodcock et al., 2001); Pseudoword Reading Accuracy = Woodcock Johnson Word Attack (Woodcock et al., 2001); Text Reading Fluency and Comprehension = The Test of Silent Reading Efficiency and Comprehension (Wagner et al., 2010); Word Reading Fluency = Test of Word Reading Efficiency Sight Word Efficiency Subtest (Torgesen et al., 2012); Text Reading Fluency = The Test of Silent Contextual Reading Fluency (Hammill et al., 2006); Reading Anxiety = Reading Anxiety Questionnaire (Grills et al., Unpublished); General Anxiety = The Beck Anxiety Inventory for Youth (Beck et al., 2001); Test Anxiety = The Children's Test Anxiety Scale (Wren & Benson, 2004)

*$p < .05$

**$p < .01$

Table 3

OLS and UQR estimates for reading outcomes

		Quantile coefficients			Comparison of coefficients across quantiles		
Predictor	**OLS**	**0.2**	**0.5**	**0.8**	**.50 vs. .20**	**.80 vs. .50**	**.80 vs. .20**
Woodcock Johnson Test of Letter Word Identification (Word Reading Accuracy)							
Reading Anxiety							
Estimate	−0.05	−0.01	−0.07	−0.12	−0.06	−0.04	−0.10
SE	0.05	0.07	0.06	0.06	0.06	0.06	0.08
General Anxiety							
Estimate	−0.08	−0.09	−0.02	−0.03	0.07	−0.01	0.06
SE	0.06	0.07	0.06	0.07	0.07	0.07	0.08
Test Anxiety							
Estimate	0.06	0.07	0.06	0.04	−0.01	−0.02	−0.03
SE	0.06	0.07	0.06	0.07	0.07	0.06	0.09
Test of Word Reading Efficiency Sight Word Subtest (Word Reading Fluency)							
Reading Anxiety							
Estimate	**−0.10** *	−0.05	**−0.17** **	**−0.12** *	−0.11	0.05	−0.07
SE	**0.05**	0.10	**0.06**	**0.06**	0.09	0.06	0.10
General Anxiety							
Estimate	0.00	−0.07	0.12	0.09	**0.19** *	−0.03	0.16
SE	0.06	0.10	0.07	0.07	**0.09**	0.07	0.10
Test Anxiety							
Estimate	−0.02	0.02	−0.05	−0.07	−0.07	−0.02	−0.09
SE	0.06	0.10	0.07	0.06	0.09	0.06	0.11
Woodcock Johnson Word Attack Subtest (Pseudoword Reading Accuracy)							
Reading Anxiety							
Estimate	−0.08	−0.07	−0.03	**−0.19** *	0.03	**−0.16** *	−0.13
SE	0.05	0.07	0.06	0.07	0.07	**0.07**	0.09
General Anxiety							
Estimate	−0.05	−0.01	−0.07	0.00	−0.07	0.07	0.01
SE	0.06	0.07	0.06	0.08	0.07	0.07	0.09
Test Anxiety							
Estimate	0.03	0.01	0.07	0.11	0.07	0.03	0.10
SE	0.06	0.07	0.06	0.08	0.08	0.07	0.09
OLS and UQR Estimates for The Test of Silent Contextual Reading Fluency (Text Reading Fluency)							
Reading Anxiety							
Estimate	−0.01	0.02	−0.01	−0.02	−0.03	−0.01	−0.04
SE	0.05	0.10	0.07	0.07	0.08	0.07	0.10
General Anxiety							
Estimate	−0.08	−0.12	−0.05	**−0.15** *	0.07	−0.11	−0.03
SE	0.06	0.10	0.08	**0.08**	0.08	0.08	0.10

		Quantile coefficients			Comparison of coefficients across quantiles		
Predictor	**OLS**	**0.2**	**0.5**	**0.8**	**.50 vs. .20**	**.80 vs. .50**	**.80 vs. .20**
Test Anxiety							
Estimate	0.07	0.08	0.04	0.13	−0.04	0.09	0.05
SE	0.06	0.09	0.08	0.08	0.09	0.07	0.10
The Test of Silent Reading Efficiency and Comprehension (Text Reading Fluency and Comprehension)							
Reading Anxiety							
Estimate	**−0.12***	−0.02	**−0.17***	**−0.16***	−0.15	0.01	−0.14
SE	**0.05**	0.09	**0.07**	**0.07**	0.09	0.06	0.1
General Anxiety							
Estimate	0.03	−0.13	−0.02	0.03	0.11	0.05	0.16
SE	0.06	0.09	0.07	0.07	0.09	0.07	0.1
Test Anxiety							
Estimate	0.09	0.15	0.08	0.04	−0.07	−0.04	−0.12
SE	0.05	0.09	0.07	0.07	0.09	0.07	0.10

Woodcock Johnson Test of Letter Word Identification (Woodcock et al., 2001); Bold text indicates a statistically significant correlation; Test of Word Reading Efficiency Sight Word Subtest (Torgesen et al., 2012); Woodcock Johnson Word Attack Subtest (Woodcock et al., 2001); The Test of Silent Contextual Reading Fluency (Hammill et al., 2006); The Test of Silent Reading Efficiency and Comprehension (Wagner et al., 2010)

* $p < .05$

** $p < .01$