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Gender Moderates Association Between Emotional-Behavioral Problems and Text Comprehension in Children with Both Reading Difficulties and Adhd

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Abstract

Evidence suggests that higher order linguistic functioning such as text comprehension is particularly vulnerable to emotional modulation. Gender has been identified as an important moderating variable in emotional expression such that girls tend toward internalizing emotions (e.g., sadness, anxiety) whereas boys tend toward externalizing emotions (e.g., anger, combativeness), which may influence the relationship between emotion and text comprehension. The present study examined whether gender moderates the relationship between emotional-behavioral problems and text comprehension among children ($n = 187$; boys = 115, girls = 72) with both word reading difficulties (RD) and attention-deficit/hyperactivity disorder (ADHD), a sample widely acknowledged to be at increased risk for developing emotional-behavioral problems such as anxiety, poor academic self-concept, and delinquency. A moderated regression analysis tested for the significance of two separate interaction terms (i.e., gender \times externalizing problems, gender \times internalizing problems) after controlling for gender, IQ, basic reading skills, cognitive-linguistic processes closely related to reading, attentional problems, internalizing problems, and externalizing problems. Results indicated that gender significantly and uniquely moderates the relationship between emotional-behavioral problems and text comprehension. Specifically, text comprehension was relatively lower among girls with relatively higher externalizing problems, whereas no such association was observed among boys. These results contribute to our understanding of cognition-emotion interactions within reading development and raise important implications.

Emotional expression is widely regarded to be related to reading proficiency. Children with word reading difficulties and disabilities (RD) are at increased risk for developing emotional problems such as anxiety, poor academic self-concept, and delinquency (e.g., Alexander-Passe, 2007; Diakakis et al., 2008; Grills-Taquechel, Fletcher, Vaughn, & Stuebing, 2012; Halonen, Aunola, & Ahonen, 2006; Mugnaini, Lassi, La Malfa, & Albertini, 2009; Nelson & Harwood, 2011). Both externalizing (e.g., anger, combativeness) and internalizing problems (e.g., sadness, anxiety) have been observed among children with RD (see Mugnaini et al., 2009, for reviews), and may be particularly pronounced among economically disadvantaged children (Ackerman, Izard, Koback, Brown, & Smith, 2007). The relations between emotional problems and RD appear to be in place from an early age; Halonen et al. (2006) found risk of RD among preschool and elementary school children to be associated significantly with both internalizing and externalizing problems. Moreover, a meta-analytic review suggested that emotional-behavioral problems among those with RD do not decline but instead persist into adulthood (Klassen, Tze, & Hannok, 2011). An understanding of the relation between emotional modulation and reading development should factor into the development of reading remediation programs. However, more information is needed about the nature of this relation. For example, little is known about whether emotional expression interacts with gender in a manner that alters the association between emotions and text comprehension. Such knowledge could help school psychologists appropriately tailor reading intervention strategies for boys and girls struggling with emotional-behavioral problems.

Research suggests that both internalizing and externalizing problems may best be viewed from a developmental psychopathology perspective (e.g., Deault, 2010; Kimonis, Frick, & McMahon, 2014; Muris, 2006), such that a number of vulnerability and risk factors appear to play a role in the development, maintenance, and exacerbation of symptoms. Temperamental diatheses (e.g., behavioral inhibition, high levels of negative affect, low levels of effortful control) and environmental influences (e.g., negative learning experiences) have been shown to predict childhood internalizing problems (Anthony, Lonigan, Hooe, & Phillips, 2002; Degnan, Almas, & Fox, 2010; Verstraeten, Vasey, Raes, & Bijttebier, 2009). Similarly, externalizing problems (e.g., impulsivity, aggression, and combativeness; Achenbach & Edelbrock, 1978; Lahey et al., 2004) also stem from complex interactions between genetic and environmental (e.g., parenting behaviors) risk factors (Deault, 2010).

Emotional Modulation and Reading Comprehension

Reading development entails the development of proficiency in word reading (supported by phonemic awareness [PA] and phonics instruction), reading fluency, vocabulary knowledge, and reading comprehension (National Institute of Child Health and Human Development, 2000). Of these, reading comprehension is perhaps the most essential, and children must learn to understand and remember ideas from text to be successful in school. Emotional problems have been found to particularly disrupt reading comprehension. For example, evidence suggests that anxiety is particularly disruptive to higher order cognitive functions (e.g., working memory), which are critical for the comprehension of text (Calvo & Carreiras, 1993). Emotions such as those related to anxiety appear to be selectively disruptive to text-level processing (e.g., narrative comprehension) but not to lower-order reading skills such as

those involved with encoding and lexical access (Calvo & Carreiras, 1993). Calvo and Eysenck (1996) similarly found that anxiety selectively impairs text comprehension, but only when phonological working memory is burdened with a concurrent task. Such findings suggest that emotion may not be directly disruptive to text comprehension but instead may interfere with cognitive processes that support comprehension. Notably for school psychologists, children with RD tend to report stress in the contexts of teacher interactions and performance testing (Alexander-Passe, 2007), both of which are central to academic functioning in general, and reading instruction in particular.

In their review of the research literature, Mugnaini et al. (2009) note that Attention-deficit hyperactivity disorder (ADHD) co-occurring with RD increases risk for developing emotional-behavioral problems. This poses a clinical challenge, given that co-occurrence between RD and ADHD ranges from 25 to 40% (e.g., Willcutt, Pennington, Olson, & Hulslander, 2005). RD is more strongly linked with inattention than with hyperactivity/impulsivity (Kempe, Gustafson, & Samuelson, 2011; Massetti et al., 2008; Willcutt & Pennington, 2000a, 2000b; Willcutt et al., 2005), and some have suggested that inattention contributes uniquely to increasing the risk for individuals with RD to develop emotional-behavioral problems (Carroll, Maughan, Goodman, & Meltzer, 2005; Maughan, Rowe, Loeber, & Stouthamer-Loeber, 2003). Along these lines, Willcutt and Pennington (2000b) found that while RD is associated with both internalizing and externalizing problems among children, but only the association between RD and internalizing problems remained significant after controlling for co-occurring ADHD symptoms, suggesting that internalizing problems may be uniquely associated with RD.

Emotional Expression and Gender

Gender has been found to impact the expression of internalizing and externalizing emotions in children. A large body of evidence indicates that preadolescent girls tend toward internalizing emotions, whereas preadolescent boys tend toward externalizing emotions (see Chaplin & Aldao, 2013, for meta-analytic review). There is also evidence that, although boys tend toward more externalizing emotions than girls in the early and middle childhood years, that trend reverses in adolescence, such that girls tend toward more externalizing emotional expressions than boys (Chaplin & Aldao, 2013). However, these differences may be less pronounced among nonreferred community samples (i.e., children who have not been referred for clinical and/or specialized educational services; Biederman et al., 2005).

Gender may play a moderating role in the relation between emotional-behavioral problems and text comprehension. As in the general population, there is evidence that internalizing problems are relatively higher among girls with RD while externalizing problems are relatively higher among boys with RD (Trzesniewski, Moffitt, Caspi, & Taylor, 2006; Willcutt & Pennington, 2000a, 2000b). Given the differences in how boys and girls express emotions and the evidence that emotional problems can disrupt text comprehension, it is conceivable that gender interacts with emotional expression in a manner that impacts the tendency for emotional-behavioral problems to disrupt text comprehension.

Study Purpose and Hypotheses

The purpose of this study was to examine the moderating effect of gender on the impact of emotional modulation on reading comprehension in a group of elementary school children with both RD and ADHD. We studied the impact of emotional expression and gender on reading comprehension in this population because (a) the high co-occurrence of these disorders makes this an important clinical population and (b) the combined risk factors for the two common childhood disorders allowed us to capture a broad range of variance in reading ability and emotional-behavioral problems. We did not examine the moderating effect of gender in relation to ADHD subtypes (i.e., predominantly inattentive, predominantly hyperactive/impulsive, combined).

We hypothesized that gender would moderate the relation between emotional-behavioral problems and text comprehension in children with both ADHD and RD. Finding gender to be an important moderator would extend previous studies (Calvo & Carreiras, 1993; Calvo & Eysenck, 1996) by uniquely linking gender, emotion, and text comprehension in a highly at-risk population. Tentatively, it was also expected that internalizing problems would be associated with text comprehension among girls but not boys, whereas externalizing problems would be associated with text comprehension among boys but not girls.

Method

Participants

The participants in this study were 187 elementary school children in grades 2–5 ($n = 115$ boys, 72 girls), recruited for a larger study at two sites (i.e., University of Texas Health Science Center at Houston, Cincinnati Children's Hospital Medical Center). The sample was primarily recruited from schools, with some participants recruited from clinics and the community. About 78% of the sample was African American and about 69% was economically disadvantaged. Table 1 displays demographic information by gender and indicates few significant gender differences. Although the percentage of boys and girls in grades 2 through 4 did not differ between genders, there was a greater percentage of girls in the fifth grade relative to the percentage of boys in the fifth grade. Consistent with the broader literature (American Psychiatric Association, 2013), there was a greater percentage of girls than boys diagnosed with ADHD Predominantly Inattentive Type, whereas there was a greater percentage of boys than girls diagnosed with ADHD Combined Type or Conduct Disorder. We examined differences in parent levels of education and detected only one significant difference between genders; specifically, girls had a higher percentage of both mothers and fathers with graduate degrees than boys ($p = .020$, $p = .009$, respectively). We also examined whether basic reading skills (Basic Reading Composite from the Wechsler Individual Achievement Test, 3rd Edition [WIAT-III]; Wechsler, 2009) and reading comprehension (WIAT III Reading Comprehension) differed as a function of parent education and found that basic reading skills and reading comprehension did not differ as a function of parent education for either boys or girls.

Procedure

Participants were recruited across seven cohorts over the course of 5 years. Cohort recruitment coincided with the academic calendar so that some cohorts were recruited in August–October and others were recruited in December–February. A one-way multivariate analysis of variance revealed no significant cohort effects ($ps>.05$). Assent from children and consent from parents and/or legal guardians were obtained prior to participation. All procedures were approved by Institutional Review Boards at both sites.

As part of the larger study, children were administered a battery of assessments, and parents and teachers completed several rating scales. Baseline data were utilized in the current analyses. Measures included measures of reading, internalizing and externalizing problems, and two cognitive-linguistic processes that are strong predictors of reading proficiency—PA and rapid automatized naming of letters (RAN letters). Children who were on medication for ADHD were washed off medication for 2 weeks and tested off medication.

Inclusion Criteria—Each participant met diagnostic criteria for DSM-IV ADHD (Combined Type or Predominantly Inattentive Type) based on the *Diagnostic Interview Schedule for Children, Version IV* (DISC-IV; Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000) interview completed with the parent, supplemented by teacher ratings on the Swanson, Nolan, and Pelham (SNAP-IV; Swanson, Nolan, & Pelham, 1992) rating scale where necessary, following procedures established in the Multimodal Treatment Study of ADHD (MTA Cooperative Group, 1999). Children taking medications for ADHD were required to still be symptomatic (more than four positive inattention symptoms) as rated by a parent when “on” medication to be eligible at screening. RD was operationally defined as low achievement on at least one of two reading skills (i.e., word identification, phonological decoding) that are known to be central to reading development. Specifically, children had a standard score equal to or lower than 90 (i.e., the 25th percentile) on either the Letter Word Identification or Word Attack subtests or the Basic Reading Skills composite score of the Woodcock–Johnson Tests of Achievement–Third Edition (Woodcock, McGrew, & Mather, 2001). Table 2 illustrates that, on average, participants were impaired in both basic reading skills and reading comprehension. Although official identification as having a learning disability was not required for participation, all participants had impaired word reading or phonological decoding, and 26% of boys and 15% of girls had identified disabilities. In addition, only children with a Composite IQ estimate equal to or higher than 70 based on the *Kaufman Brief Intelligence Test, Second Edition (KBIT-II)* (Kaufman & Kaufman, 2004) were included.

Exclusion Criteria—Any documented or suspected bipolar disorder or other severe emotional disturbance as indicated by a positive diagnosis on the DISC-IV or the presence of developmental disability or autism by parent report was excluded. Other exclusion criteria were a history of or current cardiovascular problems, chronic tics, treatment with concomitant medication that could impact ADHD, or not receiving reading instruction in English.

Measures

WIAT-III (Wechsler, 2009)—The Word Reading and Pseudoword Decoding subtests from the WIAT-III are untimed measures of isolated word reading and pronounceable pseudoword reading (respectively). Pseudoword Decoding measures the ability to use phonics to decode unknown words that follow English spelling patterns. Scores from the Word Reading and Pseudoword Decoding subtests were combined to form the Basic Reading Composite. The Reading Comprehension subtest involves reading sentences and longer passages aloud or silently and then answering factual and inferential comprehension questions. Split-half reliability for Word Reading and Phonetic Decoding for second through fifth graders are .96 and test–retest reliability .93 (Wechsler, 2009). For both the Basic Reading Composite and the Reading Comprehension subtest, standardized scores ($M = 100$; $SD = 15$) were used in the statistical analyses.

Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001)—The parent version of the CBCL for youth aged 6-18 years was utilized, and more specifically, the Attention, Externalizing, and Internalizing Problems scales. The Externalizing Problems Scale includes Aggressive Behavior and Rule-Breaking Behavior, and the Internalizing Problems Scale includes Anxious/Depressed, Withdrawn Depressed, and Somatic Complaints. Attention, Externalizing, and Internalizing Problems scales have adequate reliability, with *alpha* coefficients equaling .86, .94, and .90, respectively. Standardized *T*-scores ($M = 50$, $SD = 10$) were used in the analyses.

Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999)—The CTOPP was used to measure important phonological processes that have been shown to be strong predictors of the development of reading proficiency—PA and RAN of letters. The Elision subtest was administered to assess PA. It requires participants to delete phonemes within spoken words presented by a tape recording (e.g., say *blend* without saying /l/: *bend*). The Rapid Letter Naming subtest was administered as a measure of efficiency of retrieval of phonological information from long-term memory (Wagner et al., 1999). The child names letters presented on a card with four rows of nine letters as quickly as possible. Time to completion is the dependent variable. Both the Elision and Rapid Letter Naming subtests have adequate reliability, with coefficient alphas in the ages of interest ranging from .86 to .91 and .70 to .87, respectively. Scaled scores ($M = 10$, $SD = 3$), were used in the analyses.

KBIT-II (Kaufman & Kaufman, 2004)—The KBIT-II is a brief standardized measure used to provide an estimate of intelligence. Both Verbal and Nonverbal scales were administered to participants, which were combined to produce a composite score. The Verbal and Nonverbal scores have excellent test–retest reliability. Internal Consistency reliabilities in the age of interest all exceed .90. The KBIT-II manual (Kaufman & Kaufman, 2004) reports correlations among the KBIT-II and multiple editions of the Wechsler Intelligence Scale for Children (WISC; 3rd and 4th Editions) that exceed .75. The IQ Composite standardized score ($M = 100$; $SD = 15$) was used in the analyses.

Approach to Data Analysis

A series of Pearson chi-square analyses were performed to examine potential differences in demographic variables between genders. A series of one-way analyses of variance (ANOVA) were performed to examine gender differences on all eight variables (i.e., IQ, Reading Comprehension, Basic Reading Composite, Rapid Letter Naming, Elision, Attention Problems, Internalizing Problems, and Externalizing Problems). Then, bivariate correlations among all eight variables were calculated separately for each gender. Finally, a moderated hierarchical regression analysis examined whether interactions between gender and both Externalizing and Internalizing Problems explained unique and significant variance in WIAT-III Reading Comprehension above and beyond main effect variables of gender, emotional-behavioral problems (CBCL Internalizing Problems and Externalizing Problems), IQ, basic reading skills (WIAT-III Basic Reading Composite), phonological processing measures (CTOPP Rapid Letter Naming and Elision), and attention problems (CBCL Attention Problems). All individual variables were entered into Step One of the regression and the interaction terms (i.e., gender \times internalizing problems, gender \times externalizing problems) were entered into Step Two. This moderated regression analysis tested for the significance of two separate interaction terms (i.e., gender \times externalizing problems, gender \times internalizing problems) after controlling for the other variables in the models. G*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007) was used to perform a post hoc (Cohen, 1988) computation of statistical power, given alpha level (.05), sample size ($n = 187$), and effect size (small to medium = .10 using Cohen's 1988 classification definition). With a total of ten predictors entered into the multiple regression analysis, G*Power calculated a power ($1 - \beta$) coefficient of .84, considered to be adequate.

Results

Descriptive and Correlational Analyses

Table 2 displays means, standard deviations, ranges, and distributional properties for standardized measures by gender. Of the variables shown in Table 2, reading comprehension was the only variable in which boys and girls differed in a statistically meaningful way; boys ($M = 79$) had a relatively lower mean standardized score than girls ($M = 83$).

Bivariate correlations among standardized measures by gender are reported in Table 3. For both boys and girls, IQ, basic reading skills, and PA were positively and moderately correlated with text comprehension. Among boys, rapid naming was positively and moderately correlated with text comprehension. Moreover, among girls, externalizing problems correlated significantly and negatively with text comprehension, whereas no such correlation was observed among boys. Also notable were significant positive correlations of moderate strength among attention problems, internalizing problems, and externalizing problems, observed similarly among both boys and girls.

Moderated Hierarchical Regression Analyses—Table 4 displays results from the moderated hierarchical regression. Regression results showed that all variables (i.e., IQ, basic reading skills, phonological processing variables, attention problems, internalizing problems, externalizing problems, and gender) entered into Step 1 accounted for 38.9% of

the variance in text comprehension. Among the variables entered in Step 1, significant beta values were observed for the following: KBIT-II IQ Composite, WIAT-III Basic Reading Composite, CTOPP Rapid Letter Naming, and gender. Among interaction effects entered in Step 2, a significant beta value was observed for “gender \times externalizing” but not for “gender \times internalizing.” The moderating effect of gender, as reflected by a significant interaction between gender and externalizing problems [$\beta = -.891$; effect size = .02 (sr^2)] within Step 2, is consistent with zero-order correlations noted above wherein externalizing problems correlated moderately and negatively with text comprehension among girls ($r = -.33$) whereas no such correlation was observed among boys ($r = .01$). Within the regression analysis, the effect size associated with the “gender \times externalizing” predictor may be classified as small but not trivial (Cohen, 1988).

Discussion

The results of this study contribute to and extend extant literature (e.g., Alexander-Passe, 2007; Calvo & Carreiras, 1993; Calvo & Eysenck, 1996; Grills-Taquechel et al., 2012; Halonen et al., 2006; Mugnaini et al., 2009; Nelson & Harwood, 2011) by identifying gender as a moderating variable in the association between emotional-behavioral problems and text comprehension among school-age children with both RD and ADHD. Although the overarching hypothesis of gender being a moderating variable was supported, the results did not support our more tentative hypothesis that internalizing problems would be associated with text comprehension among girls, but not boys. Instead, results showed an association between externalizing problems and text comprehension among girls, but not among boys. Notably, the extent of both internalizing and externalizing problems reported by parents did not differ significantly between boys and girls with both ADHD and RD. These results suggest the dynamic relationship between emotional-behavioral problems and text comprehension differed across gender in a manner not attributable to one gender having (on average) more emotional-behavioral problems than the other. Moreover, the association between externalizing problems and text comprehension among girls was not due to differences in attentional problems, given that attention was entered as a covariate in the regression analysis. Collectively, the results indicate that gender moderates the disruptive effects of emotional-behavioral problems on text comprehension. These results do not show that emotional-behavioral problems cause RD, nor do they show that reading comprehension difficulties cause externalizing problems; instead, the findings highlight a facet of the reading-emotion association that may shape new thinking in this line of research. Results are discussed briefly in terms of their implications for reading comprehension, as well as their implications for clinical conceptualizations.

Externalizing Problems, Text Comprehension, and Gender

The association between text comprehension and externalizing problems among girls, but not boys, was surprising. The effect size of the association between externalizing problems and text comprehension among girls is small but nontrivial. There are several potential explanations for this unexpected pattern. Research on gender differences in the etiology of externalizing problems suggests that familial factors (e.g., maternal anger, paternal control strategies) and broader environmental factors differentially influence the manifestation of

externalizing problems in youth (e.g., Crick & Zahn-Waxler, 2003; Zahn-Waxler & Polanichka, 2004). Specifically, researchers have found that girls often display distinct forms of problematic behavior within the externalizing spectrum, such as covert and relational forms of aggression (e.g., lying, ostracizing peers, spreading rumors) whereas boys more often exhibit overt behaviors, such as physical violence (Olson et al., 2013). This general pattern was reflected in the present sample wherein a greater percentage of boys met diagnostic criteria for Conduct Disorder than did girls (14%, 4%, respectively). Furthermore, trajectories of risk for school failure appear to differ between boys and girls as a function of early externalizing problems. For example, Dodge, Greenberg, Malone, & The Conduct Problems Prevention Research Group (2008) found that early externalizing problems and lack of school readiness were predictive of school failure for boys, but the opposite pattern emerged for girls such that peer relations and early parenting problems (not early externalizing problems or school readiness) predicted school failure for girls. Whether these patterns hold for text comprehension, or reading problems more broadly, is unknown; yet it does raise the question as to whether differences in how boys and girls express externalizing emotions plays a role in linking externalizing emotions with text comprehension among girls but not among boys. School psychologists are in a unique position to observe such patterns, particularly for students currently receiving reading remediation. For example, a school psychologist providing reading intervention to girls with both ADHD and RD may consider integrating externalizing problems in their clinical conceptualization, particularly if the child is struggling with text comprehension. Girls with both ADHD and RD may benefit from being in smaller reading remediation groups so as to reduce the likelihood of externalizing emotional expressions, perhaps more one-on-one intervention where intervention to support emotional regulation can be integrated directly into reading intervention.

A notable aspect of the present sample is that boys and girls did not display the commonly reported pattern in which boys manifest more externalizing behaviors and girls tend toward internalizing behaviors (e.g., Trzesniewski et al., 2006; Willcutt & Pennington, 2000a, 2000b). In fact, in the present sample, boys tended to demonstrate somewhat higher scores on parent report measures of both externalizing and internalizing problems; this difference in average scores, however, did not reach statistical significance. The roughly comparable profile of externalizing and internalizing problems between genders in this study may be attributable to sample characteristics. First, our sample included only children with both ADHD and RD, who may differ from other populations in their manifestation of internalizing and externalizing behaviors. In addition, our sample consisted primarily of children who were African American and children from low-income backgrounds. Given the equivocal evidence for measurement equivalence of the CBCL (e.g., Jastrowski Mano, Davies, Klein-Tasman, & Adesso, 2009) and other measures of psychological problems among African-American samples (Paalman, Terwee, Jansma, & Jansen, 2013), it may be that the CBCL differentially captures the behavioral and emotional difficulties experienced by African-American youth. This possibility is consistent with research suggesting that there may be ethnic/racial differences in the *expression* of psychopathology (McLaughlin, Hilt, & Nolen-Hoeksema, 2007)—differences that likely result from the combined effects of contextual influences such as cultural values and socioeconomic status.

Study Implications

An important implication of the present results is that externalizing emotions may directly impact the reading process among girls in grades 2–5 insofar as they may perceive threats in difficult and salient evaluative situations (e.g., impending reading comprehension questions). Although externalizing problems manifest primarily as aggression, rule-breaking, and general delinquency, such problems nevertheless stem from core negative emotions such as anger, frustration, and futility, all of which conceptually overlap with threat. It may be that during reading, those types of negatively valenced emotions are more likely to be provoked among girls who are struggling with the complications of RD co-occurring with ADHD than among girls who do not have such co-occurring problems. Girls with both RD and ADHD are likely to be sensitive about their reading and attentional difficulties, and when confronted with the difficult task of reading for comprehension, may experience a rise in externalizing emotions, disrupting ongoing comprehension. In fact, on the basis of evidence reported by Calvo and Eysenck (1996), it is conceivable that negative emotions (e.g., anger, frustration) that underlie externalizing expressions interfere with higher cognitive systems (e.g., working memory) by depleting cognitive resources needed for text comprehension. Such mechanistic interpretations are speculative, but may explain the unique emotion-reading interplay among girls. What remains an empirical question is why such a mechanism would be apparent in girls but not boys. Perhaps, as noted above, the differences in how girls and boys express externalizing emotions (e.g., ostracizing peers and spreading rumors vs. physical fights, respectively) are meaningful enough to interact uniquely with cognitive processes in general and reading in particular. Notably, there is evidence showing that physiological responses predict real-time reading comprehension among middle-school students (Daley, Willett, & Fischer, 2013), which suggests that physiologically arousing emotions (e.g., threat, anger) may be directly related to text comprehension. Similar findings of emotion-reading interactions in real time are also reported in older students (Carroll & Iles, 2006). Graesser and D'Mello (2012) describe other emotions that may influence moment-to-moment reading, such as frustration and confusion.

The negative effects of emotion on reading processes may give rise to a type of reading phobia or reading anxiety. In discussing the concept of reading anxiety, Jalongo and Hirsh (2010) write that as children become overwhelmed by negative emotions, they may find themselves worrying about evaluative judgments from others (e.g., “What if the other kids laugh at me?”). Such evaluative thoughts (however inaccurate) may be particularly stirring for children with externalizing tendencies, as they may feel provoked to “act out” and retaliate against teachers, parents, and/or peers during reading activities. One model of the “anxiety-achievement” association suggests that children are likely to develop emotional-behavioral problems in response to repeated failure experiences within the classroom (Bryan, Sonnefeld, & Grabowski, 1983; Normandeau & Guay, 1998), highlighting the important role that teachers and peers play in reading development. It is conceivable that externalizing manifestations of negative emotions during reading interact with educational and family systems in a way that thwarts teachers, parents, and/or tutors from delivering reading remediation services further exacerbating RD. If readers with ADHD and RD, particularly girls, can learn to effectively manage their externalizing emotions, then reading

remediation programs that involve social interactions (e.g., peer mentoring, group reading, tutoring) may be more efficacious.

The association between text comprehension and emotional-behavioral problems leads to at least two implications. One potential implication is that directly remediating a child's reading abilities may in turn lead to an improvement in emotional functioning and/or sense of academic self-concept (see Burden, 2008 for discussion). A second and complementary implication is that existing reading remediation programs—particularly when administered to girls with both RD and ADHD—may need to be augmented with emotional-behavioral treatment modules. This implication is particularly relevant for school psychologists, as they may offer consultation to reading tutors or teachers on how emotion-reading associations manifest among girls with both RD and ADHD. Here, teaching children regulatory skills can reduce disruptive emotions and increase academic performance (Ader & Erktin, 2010). In fact, evidence suggests that earlier implementation of self-regulatory training is associated with better outcomes in terms of reducing the risk of developing school-related anxiety (Zelazo & Lyons, 2012). In a study of the Head Start REDI (REsearch-based, Developmentally Informed), Nix, Bierman, Domitrovich, and Gill (2013) found that preschool gains from training of social-emotional skills was associated with improvements in several kindergarten outcomes (e.g., reading achievement, learning engagement, positive social behavior), even after controlling for concurrent preschool gains in vocabulary and emergent literacy skills. These lines of research speak to the broader recognition that social-emotional skills and emotion regulation are important facets of early school readiness (Blair, 2002; Raver, 2002), especially for low-income, culturally diverse populations (Finlon et al., 2015). The field of school psychology may consider integrating school-based mental health into their advanced training programs so that school psychologists may be better prepared to deliver evidence-based social-emotional skills training alongside academic interventions.

One major aim of teaching children with both RD and ADHD emotion-regulation skills is to occasion opportunities for them to experience positive emotions during reading, which is important because children who experience positive emotions during academic activities are more likely to learn more, display greater interest in reading, and complete more challenging tasks (Ainley, Corrigan, & Richardson, 2005; Lewis, Huebner, Reschly, & Valois, 2009; Miller & Meece, 1999; Reschly, Huebner, Appleton, & Antaramian, 2008). Such ideas reflect the growing consensus that emotion is intertwined with the academic learning process (see Immordino-Yang & Damasio, 2007; Um, Plass, Hayward, & Homer, 2012, for discussions). An important topic for future inquiry will be how best to integrate emotion-regulation skills with cognitive development and academic achievement.

Study Limitations

There are at least two limitations of the present study worth noting. First, there was a greater percentage of girls than boys in the fifth grade. This was a limitation insofar as it meant an incomplete matching of boys and girls on all demographic variables. Moreover, parental education differed subtly between boys and girls, with girls being more likely to have a parent with a graduate education, although this latter issue did not affect the findings statistically. Crucially, however, boys and girls in the present sample were matched on age.

These limitations, and the tentative nature of the interpretations put forth, call for replication and laboratory based studies of cognition-emotion interactions within reading comprehension.

Conclusions

There is growing consensus that emotion contributes to academic functioning. This study extended current understandings of the relations among emotional expression and reading comprehension. Specifically, we found that gender moderates the relation between emotional expression and text comprehension. Our findings suggest a need for further research examining the impact of interventions that attempt to meet the unique needs of students who are struggling emotionally with RD. It is conceivable that the efficacy of evidence-based reading interventions may be improved by increasing our understanding of emotion-reading interactions.

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Table 1
Demographic and Clinical Characteristics of Participants by Gender

Variable	Boys (<i>n</i> = 115)	Girls (<i>n</i> = 72)	Pearson χ^2 <i>p</i> -Value
Age (years/months)	9/0	9/6	<i>p</i> = .250
Hispanic or Latino(a)	12%	13%	<i>p</i> = .820
Race			
Caucasian	26%	22%	<i>p</i> = .550
African American	76%	80%	<i>p</i> = .516
Other	5%	1%	<i>p</i> = .180
Grade			
Second grade	38%	25%	<i>p</i> = .061
Third grade	23%	21%	<i>p</i> = .775
Fourth grade	25%	24%	<i>p</i> = .804
Fifth grade	13%	29%	<i>p</i> = .007
Learning disability	26%	15%	<i>p</i> = .082
Receives special education	40%	26%	<i>p</i> = .044
ADHD-inattentive type	33%	66%	<i>p</i> < .001
ADHD-combined type	65%	33%	<i>p</i> < .001
Oppositional defiant disorder	33%	30%	<i>p</i> = .577
Conduct disorder	14%	4%	<i>p</i> = .022
Eligible for free lunch	69.6%	68.1%	<i>p</i> = .997
Preferred language of primary caregiver			
English	98%	99%	<i>p</i> = .575
Spanish	2%	1%	<i>p</i> = .575
Mother's education			
Junior high school	<1%	2%	<i>p</i> = .312
Partial high school	14%	12%	<i>p</i> = .661
High school graduate	32%	26%	<i>p</i> = .401
Partial college	33%	27%	<i>p</i> = .380
College graduate	9%	15%	<i>p</i> = .238
Graduate training	5%	15%	<i>p</i> = .020

Table 2

Descriptive Statistics by Gender

Variable	Boys (<i>n</i> = 115)		Girls (<i>n</i> = 72)		<i>F</i>	<i>p</i>
	<i>M</i> ± <i>SD</i>	Range	<i>M</i> ± <i>SD</i>	Range		
KBIT-II Composite IQ	87 ± 11	70–129	86 ± 10	70–124	.205	.651
WIAT-III Basic Reading Composite	73 ± 7	52–93	74 ± 6	60–91	.012	.912
WIAT-III Reading Comprehension	79 ± 11	44–111	83 ± 10	59–111	4.986	.027
CTOPP Rapid Letter Naming	7 ± 1	2–13	8 ± 2	4–16	2.508	.115
CTOPP Elision	6 ± 2	1–12	6 ± 1	3–12	.468	.495
CBCL Attention Problems	69 ± 9	50–100	70 ± 10	53–97	.332	.565
CBCL Internalizing Problems	59 ± 11	33–92	56 ± 9	33–75	3.527	.062
CBCL Externalizing Problems	61 ± 10	40–83	58 ± 11	34–81	3.140	.078

Note. KBIT-II = Kaufman Brief Intelligence Test–Second Edition; WIAT-III = Wechsler Individual Achievement Test, Third Edition; CTOPP = Comprehensive Test of Phonological Processing; CBCL = Child Behavior Checklist. The KBIT-II and WIAT-III are reported as standard scores (*M* = 100; *SD* = 15), the CTOPP is reported as scaled scores (*M* = 10; *SD* = 2), and the CBCL is reported as *T*-scores (*M* = 50; *SD* = 10).

Table 3
Zero-Order Correlations among Boys (n = 115) and Girls (n = 72)

Standardized Measures	1	2	3	4	5	6	7	8
1. <i>WIAT-III</i> Reading Comprehension	–	.25**	.34**	.24*	.16	-.19	-.13	-.33**
2. <i>KBIT-II</i> Composite IQ	.42***	–	-.05	.29**	.07	-.16	-.20*	-.29**
3. <i>WIAT-III</i> Basic Reading Composite	.60***	.30***	–	.30**	.08	-.06	.05	-.05
4. <i>CTOPP</i> Elision	.44***	.33***	.48***	–	-.02	.19	.07	.02
5. <i>CTOPP</i> Rapid Letter Naming	.32***	.03	.38***	.18*	–	-.09	-.01	.15
6. <i>CBCL</i> Attention Problems	.12	.19*	.10	.26**	.13	–	.42***	.51***
7. <i>CBCL</i> Internalizing Problems	-.02	.12	.02	.07	.02	.50***	–	.58***
8. <i>CBCL</i> Externalizing Problems	.01	.05	-.04	.08	.24**	.52***	.47***	–

Note. Correlations for girls are above the diagonal; correlations for boys are below the diagonal. *KBIT-II* = Kaufman Brief Intelligence Test-Second Edition, *WIAT-III* = Wechsler Individual Achievement Test, Third Edition, *CTOPP* = Comprehensive Test of Phonological Processing, *CBCL* = Child Behavior Checklist.

* $p < .05$;

**

$p < .01$;

$p < .001$.

Table 4
Moderated Regression Results Predicting WIAT-III Reading Comprehension (n = 187)

Variable	Step 1			Step 2			95% Confidence Interval (Step2)		Effect Size ^a
	B	SE	β	B	SE	β	Lower Bound	Upper Bound	
Constant	9.99	10.22		-3.56	15.11		-33.38	26.25	
Gender	2.80	1.39	.12*	12.81	8.75	.55	-4.45	30.09	.01
IQ Composite	.23	.06	.23***	.21	.06	.21**	.09	.34	.06
Basic Reading Composite	.58	.11	.35***	.58	.11	.36***	.37	.80	.13
Elision	.74	.39	.13	.73	.38	.13	-.03	1.49	.01
Rapid Letter Naming	.87	.36	.15**	.86	.36	.15*	.15	1.58	.03
Attention Problems	.01	.08	.01	.02	.08	.02	-.14	.18	.00
Internalizing Problems	-.03	.07	-.03	-.23	.21	-.22	-.66	.19	.00
Externalizing Problems	-.11	.07	-.11	.31	.21	.30	-.11	.73	.01
Gender × Internalizing				.15	.15	.41	-.15	.46	.00
Gender × Externalizing				-.31	.14	-.89*	-.60	-.02	.02
F-score (df1, df2)									
R ²									
F-score (df1, df2)									
R ²									
Adjusted R ²									

Note: WIAT-III = Wechsler Individual Achievement Test, Third Edition. ^aSquaredsemipartial correlation (sr^2).

* $p < .05$;

** $p < .01$;

*** $p < .001$.