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Achievement attributions are associated with specific rather than general learning delays

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Abstract

The causal attributions that children make for success and failure have been associated with later reading motivation and ability perceptions, which have the potential to impact future task engagement. Few studies have investigated whether such attributions are domain specific, that is linked with the specific skill in question, or a general motivational set. Even fewer studies have examined these relationships among diverse racial and ethnic subgroups. The present study examined differences in success and failure attributions among children with and without reading delay (RD) and general language impairments (LI), in a predominately Hispanic and African American sample. Participants were 1311 children, 8 to 15 years old. Significant differences in ability attributions were observed between participants with and without RD and LI, with no additive effect for cases with co-occurring reading and language impairments. When reading and vocabulary were evaluated continuously, significant and substantial positive relationships were observed between skill and ability attributions in situations of success, and negative associations observed in situations of failure. Weaker relationships were observed for vocabulary, though vocabulary did function as a moderator in the relationship between reading skill and ability attributions, with stronger associations at higher vocabulary levels. Overall, the findings suggest that ability attributions for reading success and failure are linked with reading skill and/or deficits, and not with general language impairments.

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1. Introduction

Personal experiences with success and failure influence reading motivation and perceptions of ability that may in turn impact future achievement (Schiefele, Schaffner, Möller, & Wigfield, 2012; Weiner, 2010). Outside of the educational literature, investigations into the role that motivation plays in learning and instruction have become less prevalent. In the case of reading achievement, for example, more proximal factors have been identified that demonstrate profound explanatory power, including phonological awareness, letter-sound knowledge, elements of oral language, or naming speed (e.g., Elwér, Keenan, Olson, Byrne, & Samuelsson, 2013; Furnes & Samuelsson, 2010). While a significant proportion of the variance in reading skill can be explained by these factors, there is still a large portion that is unaccounted for. Motivation in the context of reading has been gaining attention as one factor that may fill this gap. Investigations of children's achievement motivation, including attributions, have the potential to contribute to understanding of learning mechanisms, but also can contribute at the system level by informing instructional design (Toland & Boyle, 2008). Causal attributions are one element of motivation given their relevance to prior learning experiences that may play an important role in future task choice and commitment (Pintrich, 2000; Weiner, 2010). How children perceive their experiences of success and failure in reading has implications for how and whether they choose to engage in similar tasks later (Wigfield & Eccles, 2002).

The present study examined relationships between reading-related causal attributions and reading achievement among students with a range of reading skills (i.e., those with and without reading challenges). One principle of achievement motivation that has emerged over the past several decades is that motivation is domain specific (Marsh, Walker, & Debus, 1991; Wigfield & Eccles, 2000). Given this, and the metacognitive nature of attributions (i.e., the explicit assignment of specific causes to success or failure), our investigation was also concerned with how attributions functioned differentially within a domain-specific (i.e., reading) and a domain non-specific (i.e., specific language) disability. Are causal attributions for reading specifically related to reading (and reading disability) itself, or do they extend more generally to vocabulary (and language disability)? Extant achievement motivation theory in which competence and/or self-efficacy is a central construct would predict the former (Guthrie, Wigfield, Metsala, & Cox, 1999; Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2007).

1.1. Attribution theory and reading achievement

Attributions refer to the causes that individuals associate with a previous behaviour or event. A psychological theory of attributions was initially proposed by Heider (1958) and was further developed by Weiner (1986, 2010), making contributions to achievement motivation research. Weiner's framework consists of a set of three attribution dimensions: stability, locus of causality, and controllability (internal control and external control). Stability refers to the likelihood that an attributable cause may change over time. The second dimension, locus of causality, describes perceived causes as being either internal (e.g., skill) or external (e.g., task difficulty) to the individual (Rotter, 1966; Weiner, 2010). Finally, the third

dimension of controllability is concerned with whether the cause of an event is controllable (e.g., degree of effort being more easily controlled than luck).

Different types of attributions vary along these three dimensions. For instance, effort is often considered to be a relatively less stable, internal, and more controllable attribute. Past research has characterized particular attributions according to their adaptive functions in learning situations. Adaptive attribution styles are often described as those that associate learning outcomes with controllable causes (Pintrich, 2003). Similarly, Dweck's (1999, 2006) work on *implicit theories of intelligence* proposes a comparable framework suggesting that the way we view intelligence can be more, or less, adaptive. The entity theory views intelligence more as a measurable capacity for learning, and as more static. The more adaptable incremental theory encourages growth and views intelligence as a malleable trait that can be developed over time with strategy and effort (also see Yeager & Dweck, 2012; Muenks & Miele, 2017). Also relevant are how one views relationships between constructs such as ability and effort. A review by Muenks and Miele (2017) suggests that ability may be increased with greater effort. Alternatively, one may believe that greater effort is required due to limited ability. The former is arguably more adaptive by encouraging behaviours that support achievement. For instance, Romero, Master, Paunesku, Dweck, and Gross (2014) found that students who viewed intelligence as malleable, possibly via effort, had significantly higher grades in middle school and were more likely to take on advanced classes that were more challenging.

Attributions are indicative of future behaviour via associations with what Weiner (2010) described as psychological consequences, or the emotions (e.g., pride, guilt, hope) linked to perceived causes of success and failure. For instance, a learner who is successful in reading and associates performance with good reading ability is more likely to feel confident in abilities and in turn may show greater persistence with future reading tasks (for an example, see Núñez et al., 2005). Mean-while, the opposite may be true for a reader who experiences failure and develops negative academic self-concepts less engagement with reading-related tasks in the future (see also Hulleman, Barron, Kosovich, & Lazowski, 2016). This contrast in achievement attribution pathways has been reported in past research comparing students with and without learning difficulties as well as in intervention work suggesting that altering negative or less adaptive attributions is associated with changes in behavioural and in turn performance outcomes (e.g., Berkeley, Mastropieri, & Scruggs, 2011; Borkowski, Weyhing, & Carr, 1988; Hulleman et al., 2016; Lazowski & Hulleman, 2016).

1.2. Motivation and attributions of individuals with learning difficulties

The Diagnostics Statistical Manual of Mental Disorders (DSM-5, American Psychiatric Association, 2013) identifies difficulties with performing learning and academic skills as specific learning disorders, including reading disabilities. Profound reading impairment, identified as dyslexia within some fields, is a neurodevelopmental disorder associated with core deficits in phonological processing (Bishop & Snowling, 2004; McArthur & Castles, 2013; Snowling, 1987; Snowling, 2013). Shared learning deficits across dyslexia and specific language impairment (SLI), particularly in areas of phonological and auditory processing, have led to research on the complex associations between the two disorders

(Bishop & Snowling, 2004; Fraser, Goswami, & Conti-Ramsden, 2010; McArthur & Castles, 2013). SLI is characterized by a lag in oral language development (Bishop & Snowling, 2004; Leonard, 1998). A general language deficit may lead to broad learning impairments; however, research is needed into the neuropsychological, linguistic and motivational factors that may be shared across domains of delay (Pennington, 2006).

Learning difficulties have been associated with poor motivation, such as negative academic self-concept or task avoidance (Bender & Wall, 1994; Lee & Zentall, 2012; Roberts, Torgesen, Boardman, & Scammacca, 2008). Existing attribution studies have suggested that individuals with learning difficulties demonstrate less adaptive attribution styles (e.g., attributions to internal, stable, or uncontrollable causes such as ability in situations of failure and fewer attributions to controllable causes such as effort; Chodkiewicz & Boyle, 2014; Tabassam & Grainger, 2002). This may lead to feelings of limited control over future learning outcomes and a general perception of helplessness (Chapman, 1988; Chapman & Tunmer, 2003). However, not all studies have shown that lower achievement is associated with maladaptive or helpless attribution styles (e.g., Kistner et al., 1988; Núñez et al., 2005), suggesting that further investigation into individual differences in reading-related attributions is warranted.

While some research exists on the domain-specificity of some motivational processes (e.g., self-concept; interest; Marsh et al., 1991), there is much less research that addresses how generalized versus specific attributional effects are across skill areas. It is an open question whether the presence of general learning impairments is associated with domain-specific attributions. Moreover, if domain-specific attributions, such as reading, are associated with the presence of more general impairments (i.e., language), are there possible additive effects of multiple learning impairments in relation to the development of maladaptive attribution styles? Attribution retraining programs focus on teaching an understanding of how ability and effort are connected, often through strategy use, so that students learn metacognitive dialogue that expresses control over one's learning outcomes (Borkowski et al., 1988; Chodkiewicz & Boyle, 2014; Perry, Chipperfield, Hladkyj, Pekrun, & Hamm, 2014; Toland & Boyle, 2008). This framework suggests a supporting role for language skill in the formation of attributions. Language, and by extension, impairments in language, may then also be associated with the formation and maintenance of causal attributions. Both this metacognitive nature of attributions and the presence of co-occurring reading and language impairments make investigating the role of language in the context of reading-related attributions of particular interest.

1.3. Motivation and attributions among diverse learner populations

Due to limitations of convenience sampling methods, the complexities of reading attributions and motivation relationships among diverse racial subgroups are profoundly understudied (Cox & Yang, 2012; Frijters et al., 2018; Guthrie, Coddington, & Wigfield, 2009; Usher & Pajares, 2006). Graham (1994) conducted a review of achievement motivation literature with African American samples, finding that most research with minority populations was limited to mean comparisons of motivation scores between African American and Euro-American (hereafter white) students. An exception is a more

recent study by Swinton, Kurtz-Costes, Rowley, and Okeke-Adeyanju (2011) who explored academic attributions of African-American adolescents, and demonstrated significant gender differences relative to achievement. Girls were more likely to attribute success to ability in the academic domain of English, while a similar trend was found for boys, but within the academic domain of math. Another exception is the work of Cox and Yang (2012) who investigated associations between achievement, stability attributions, and collectivism among a predominantly Hispanic student sample. However, comparative studies are still more generally prevalent, particularly in studies of African American and white students (e.g., Guthrie et al., 2009; Guthrie, Wigfield, & Klauda, 2012; Usher & Pajares, 2006).

Studies that consider how race and ethnicity contribute to differences in attributions and achievement motivation might aid in understanding specific motivation profiles relative to participant demographics. However, given that minority populations are often over-representative of lower socioeconomic backgrounds this approach may be limited (Graham, 1994). There is a need to also account for demographic or social factors to expand beyond mere racial comparisons in achievement and motivation. With few studies investigating reading motivation among minority student populations (Cox & Yang, 2012; Usher & Pajares, 2006), further investigations of the complex relationships between reading motivation, including attributions, and achievement are needed among ethnically diverse student populations while also considering SES.

1.4. The present study

Within the context of a large ethnically- and racially-diverse sample of children, the present study details the relationships between reading skills and attributions for experiences of reading success and failure relative to the presence of reading delay (RD) and general language impairments (LI). Based on past research (e.g., Chapman & Tunmer, 2003; Tabassam & Grainger, 2002), it was expected that lower performing students would have the least adaptive attributions in comparison to those without identified impairments. This was expected to include fewer attributions to controllable causes, especially in situations of failure, as well as a greater tendency to attribute failure to lack of ability and generally more attributions to external causes. Aligned with Weiner's (1986, 2010) attribution theory, we proposed that reading-related attributions are contextually and specifically linked to previous experiences with reading. However, we sought to investigate whether the pattern of reading-related attributions would differ in the presence of reading, or language impairments, or both. We hypothesized that reading-related attributions would be most strongly related to reading skill compared to general language impairment given the role of specific learning experiences in forming attributions (Weiner, 1986, 2010). Specifically, those who met criteria for RD, either alone or comorbid with general language impairments, were expected to have less adaptive attribution styles in comparison to either the typical group or those with general language impairments alone given the presence of greater learning difficulties. It was also hypothesized that this pattern may be more evident among those meeting criteria for both RD and LI reading and language, suggesting an additive effect of having impairments in more than one domain associated with learning and achievement.

To address the issue of limited studies of reading motivation with minority student populations, this work also investigated whether race and/or language background was a contributing factor in achievement attributions in the context of reading. Rather than comparing racial groups on reading attribution scores, we opted to model the attribution-achievement dynamics within each significant group within the sample, African American children and individuals with a Hispanic language background. We hypothesized that while attributions may vary in relation to cultural differences, they would be better explained by reading and language skills above and beyond demographics.

2. Methods

2.1. Participants

The present study was part of the larger multi-site [AUTHOR CIT-ATION]. Participants included 1311 children aged 8 to 15 years old; who were primarily of African and Hispanic/Latino/a racial/ethnic heritage. Participants were enrolled using community, school and clinic-based recruitment from seven sites across the United States, Canada, and Puerto Rico. Participants with RD were initially screened via telephone and were considered eligible if they had a history of poor reading skills, school or clinical assessments which suggested they would likely have a reading disability, documented skills falling below expected age or grade level, and/or had provision of special services targeting reading skill. Referrals for inclusion as a participant with typical reading ability were parent or teacher reports of “competent reading skills”. This was identified as reading achievement above current grade expectations and above the 40th percentile on standardized school and/or clinical assessments. After referral, the reading skills of both participants with and without reading difficulties were assessed as described below, to confirm a child’s group assignment. While this was initially conceived as a case:control study, with clear demarcation between participants with and without disabilities, recruitment challenges led to more open recruitment. As a result, the final sample is representative of the full spectrum of reading ability, with oversampling of lower achieving children.

Exclusion criteria was set to be consistent with other studies of reading impairments, to ensure that global developmental issues were not driving the presence of significant difficulties acquiring age-appropriate reading skills. These consisted of: ages falling outside of the target sample age range, foster care placement; preterm birth (defined as < 36 weeks gestation); prolonged stay in the NICU after birth (defined as greater than five days); history of diagnosed or suspected significant cognitive delays, significant behavioural problems, or frequent school absences; history of serious emotional/psychiatric disturbances(i.e., major depression, psychotic or pervasive developmental disorder, Autism) or chronic neurologic condition (i.e., seizure disorder, developmental neurological conditions, Tourette or other tic disorders, acquired brain injuries), and documented vision or hearing impairment.

After obtaining informed parental consent and informed assent from youth participants, each participant began the test battery, which took place during one session and took approximately 2 h to complete. Upon completion participants received a \$35.00 gift card. Post-hoc examination of demographics suggest that the overall sample was representative of the general population. For example, mother’s education was available for much of the

sample (78.2%): 18.9% of mothers did not complete high school, 34.6% had earned a high school diploma or GED, 20.6% had completed some college coursework beyond high school, and 27.6% had completed college or held an additional graduate degree. The sample is generally comparable to the educational background of women (i.e., not divided by race or ethnicity) in the United States, according to 2012 U.S. Census data, which reported that 11.3% of women did not complete high school, 29.4% were high school graduates, 27.8% had completed some college coursework beyond high school, and 31.4% had completed college or held an additional graduate degree (U.S. Census, 2012). All procedures were done in compliance with HIPAA regulations and with approval from all individual Institutional Review Boards. Table 1 provides descriptives of the sample, including performance on reading and language measures.

2.2. Measures

2.2.1. Attributions—The Sydney Attribution Scale (SAS) is a well-validated self-report measure for assessing achievement attributions (Marsh, 1984). Participants were presented with a series of 13 scenarios with context of success or failure in reading related activities (e.g., “Suppose the teacher awarded a gold star for today’s reading work and you got it.”). Each scenario was scored on a Likert-type response scale with five degrees of endorsement (1 = false to 5 = true). Item responses were categorized into three subgroups for both success and failure - ability, effort, and external causes - resulting in a total of six attribution scales. For each scenario, participants provide three ratings: 1) ability (e.g., “It was because ... your reading is good”), 2) effort (e.g., “... you earned it by working hard”), and 3) an external cause (e.g., “... you were lucky”).

Cronbach’s coefficient alpha has been widely used to estimate reliability by providing an index of internal consistency for self-report scales, but it has also been recently criticized (see Revelle & Zinbarg, 2009; Sijtsma, 2009) for inefficient properties in the case of unevaluated unidimensionality. Alternatives are available (e.g., glb, omega, Guttman’s lambda 2), but general agreement has not been reached on relative performance of each in different scenarios. With sufficient sample size (i.e., > 1000; Ten Berge & So an, 2004), the greatest lower bound (glb) reliability provides a reliability estimate that does not systematically under-or over-estimate, and is interpreted on the same scale as other reliability coefficients (see Revelle, 2014). This index was computed to assess reliability for each subscale using the *glb.algebraic* procedure from the *psych* library in R (Revelle, 2014). The glb for the SAS subscales were as follows: success to ability = 0.90; success to effort = 0.82; success to external = 0.76; failure to ability = 0.83; failure to effort = 0.71; failure to external = 0.59. All subscales with the exception of failure to external causes demonstrated acceptable to good reliabilities. The source for the inadequate reliability of the final scale may have been two items for failure to external causes (e.g., “...the teacher doesn’t like you”; “...the story is boring”), which demonstrated a low correlation with the total scale. Values for subscales were computed as the mean endorsement across all scale items within an attribution type, with all original items contributing to the scale mean.

2.2.2. Reading skill—Subtests from two measures were used to assess reading skill: the Test of Word Reading Efficiency (TOWRE) and the Woodcock Johnson (WJ)-III Tests of

Achievement. From the TOWRE, the Sight Word Efficiency and Phonetic Decoding Efficiency subtests were used (TOWRE; Torgesen, Wagner, & Rashotte, 1999). Participants are presented with a series of either real words (Sight Word Efficiency) or pseudo-words (Phonetic Decoding Efficiency) that gradually increase in difficulty. They then have 45-s to read as many words correctly as quickly as they can, resulting in a score of total words read correctly. Alternate-form reliability exceeds 0.88 for Sight Word Efficiency and 0.91 for Phonemic Decoding Efficiency. From the WJ-III Tests of Achievement the Word Attack and Word Identification tasks were used (Woodcock, McGrew, & Mather, 2001). For the Word Attack subtest participants decode a series of nonsense pronounceable words that become progressively harder. For the Word Identification task participants read a list of real words, increasing in difficulty. Standard scores were used for reading delay criteria; however, raw scores were entered in primary analyses while also controlling for age. Reliability for these two tasks within the age range of the sample are 0.81–0.92 and 0.89–0.96, for Word Attack and Letter-Word Identification respectively.

2.2.3. Language skill—The Peabody Picture Vocabulary Test—Third Edition (PPVT-3; Dunn & Dunn, 2007) and the Vocabulary subtest from the Wechsler Intelligence Scale for Children—Third Edition (WISC-III; Wechsler, 2003) were used to assess language related ability. The PPVT-3 is an untimed measure of receptive vocabulary skills. After a word was presented orally participants were asked to identify one of four pictures that best represent the meaning of the stimulus word. The test-retest reliability for the PPVT-3 exceeds 0.91 within this age range. The WISC-III vocabulary task asks participants to define a series of words presented to them. Standard scores were used for general language impairment criteria. However, raw scores were entered in regression analyses, but controlled for age. Reliability for this subtest is 0.89, but higher with special groups within the normative sample such as learning difficulties at 0.92.

2.2.4. Covariates—Each analysis controlled for age, sex, race, SES and a performance factor of intelligence. Two race/ethnicity variables were entered, African American and Hispanic backgrounds, established using a parent questionnaire. A yes/no response was indicated for each race/ethnicity variable (i.e., Hispanic and African American). This allowed for a child to identified with either Hispanic or African American racial/ethnic heritage, or both. Participation in one or more of any government assistance programs was used to distinguish between one of two SES groupings. The WISC-III - Matrix Reasoning subtest was entered as a measure of intellectual ability. The Matrix Reasoning subtest assesses fluid intelligence where children are asked to identify a picture that best matches a related array of images (Wechsler, 2003). While IQ is not included in contemporary definitions of RD or SLI, its inclusion in the regression models was to assess whether related intelligence performance would contribute to achievement attributions.

3. Results

The original sample consisted of 1432 participants; however, 120 cases were excluded because of missing data across all outcome variables, and one case was deleted for missing data across reading measures. This resulted in the present sample of 1311 participants. Together there was an insignificant amount of missing data (< 5%). Analysis of missing data

with Little's MCAR test (Little, 1988) did not support systematic associations between missingness and the analysis variables ($\chi^2(70) = 86.560, p = .09$). Missing data was primarily categorical and thus pairwise deletion was used given that the MCAR assumption was supported (Tabachnick & Fidell, 2007). Data was screened for the presence of univariate and multivariate outliers and no extreme cases with significant influence were found. Further preliminary analyses determined that all other necessary assumptions including univariate and multivariate normality, homogeneity of variance and covariance (for MANOVAs reported below), multicollinearity, and heteroscedasticity (for regression analyses reported below) were satisfied.

3.1. Establishing ability groupings

Cut off criteria used to identify significant delay on a given measure of either reading or language ability were set to be 15 standard score points (i.e. 1 standard deviation) below a norm-referenced average standard score of 100. Additionally, we subtracted one standard error of measurement as defined by test normative documentation and stratified by age. This additional step of subtracting the standard error of measurement reduced the likelihood that measurement error alone could misidentify a participant as delayed in either reading or language acquisition.

The above-mentioned measures of reading skill (TOWRE and WJ-III subtests) and language skill (PPVT-4 and WISC-IV) were used to establish grouping criteria for those participants with and without difficulties across reading and language. Participants were identified with reading delay if they met standard score criteria (< 85 and 1 SEM) on both Word Reading Efficiency composite for the TOWRE as well as Basic Reading composite for the WJ-III. Participants were classified with LI if they met standard score criteria on the PPVT (< 85 and 1 SEM) and WISC-Vocabulary (< 7 and 1 SEM) subtests. These criteria resulted in 140 participants classified as RD, 95 as LI, 83 with comorbid RD and LI, and the remaining ($n = 988$) as typical with neither reading nor language impairments. A total of 988 individuals were not classified with either RD or LI, while 83 individuals met criteria for both representing a proportion of comorbid learning delay within the established ability groupings. See Table 1 for further information on the distribution of these groups including performance on related reading and language scores.

3.2. Group differences in reading related attributions

A multivariate analysis of covariance (MANCOVA) was used to test whether there were significant group differences between mean scores of reading-related attributions between ability-based groups (i.e., typical, RD, LI, or comorbid RD and LI). All six attribution subscales (i.e. ability, effort, and external for both situations of success and failure) were entered in the model as dependent variables. Race/ethnicity (African American and Hispanic American), sex, age, and WISC-MR were entered as covariates. Pillai's trace is considered to be the most powerful and robust among alternatives (Field, 2013) and was therefore selected given the nature of the sample size and number of groups being examined. Consistent with our hypothesis that achievement, not sociodemographic variables, would drive variation in causal attributions, the covariates race, SES, and sex were not significantly associated with attributions. Both age and WISC-MR were significant predictors of

attributions (see Table 2). Controlling for all of these factors, the model also indicated a significant multivariate main effect for ability grouping on the six combined attribution subscales, $F(6, 1259) = 6.565, p < .001$; Pillai's Trace = 0.095.

3.2.1. Univariate analyses of reading achievement attributions—ANOVAs were used to extend significant main effects found at the multivariate level. Results are discussed below and listed in Table 3. The homogeneity of variance assumption at the univariate level was satisfied for each attribution outcome. Significant effects were found for two of the six covariates: age and WISC-MR. For age, univariate analyses demonstrated statistically significant differences in mean attribution levels for all attribution subscales, with the exception of failure to external causes. Follow-up analyses indicated that age was negatively related to all attributions in situations of success, and positively related to all attributions in situations of failure. These correlations ranged from 0.08 to 0.27 ($p < .01$). A negative relationship was found between WISC-MR and effort attributions in both situations of success and failure. WISC-MR was also significantly associated with attributions to external causes; demonstrating a negative association in situations of success, and positive in situations of failure. These correlations ranged from 0.08 to 0.12 ($p < .01$). Mean age and scores on the WISC-MR for each ability group can be found in Table 1. Subsequently, differences in mean attribution scores were also found in relation to ability group membership (i.e., typical, RD, LI, comorbid RD and LI). These differences reached significance for all attribution subscales with the exception of attributions to effort in situations of reading success.

3.2.2. Helmert post-hoc contrasts: Ability-based group differences in attributions—Helmert post-hoc contrasts were employed to follow-up the significant main effects of the ability grouping variable on attributions. The typical group demonstrated higher attributions to ability in situations of success, lower attributions to external causes in situations of success, and lower attributions to ability, effort, and external causes in situations of failure. Table 4 and Fig. 1 detail and illustrate these effects. When comparing the comorbid group to the remaining two groups no differences were observed. Finally, comparisons between the RD and LI groups revealed significantly different attributions for the ability dimension only (e.g., “you are a good reader” vs. “you are a poor reader”). Mean attribution scores revealed that cases with RD were *less* likely to attribute reading success to their ability in comparison to cases with LI. The opposite effect was found for situations of reading failure (e.g., “I am poor at reading”) with greater scores observed for the RD group.

3.3. Linear regression analyses: Assessing reading and vocabulary continuously

The categorical approach implemented in the preceding univariate and multivariate ANOVAs is relevant when reading and language delay are considered as clinical cut-offs; however, the categorization approach almost always results in the loss of distributional information. Given this, a second set of analyses was conducted utilizing linear regression to examine whether the effects of disability grouping would hold when both reading skill and vocabulary were measured as continuous dimensions. Differences in reading-related attributions comparing RD and LI groups were found *only* for those related to ability.

Therefore, the two dependent variables that were considered were attributions of ability to success and attributions of ability to failure.

Each regression contained the previously used set of covariates (i.e., race/ethnicity, sex, age, and WISC-MR). Reading, vocabulary (PPVT-4) and the interaction between vocabulary and reading were also entered as the substantive explanatory predictors. The four measures of reading ability were investigated as predictors in separate regression models: Phonemic Decoding and Sight Word Efficiency subtests from the TOWRE, as well as the Letter-Word Identification and Word Attack subtests from the WJ-III tests of achievement. As summarized in Table 5, a series of eight regression analyses were conducted: four models that varied according to reading measure with success attributions as the outcome; four models again varying by reading measure with failure ability attributions as the outcome. Prior to analyses, continuous variables were z-score standardized and categorical predictors were dummy-coded. Presented in Table 5 are the unstandardized beta coefficients for each regression. Separate regressions were conducted, one per reading measure, since including all four indices of reading ability would have resulted in substantial multi-collinearity within the regression model ($M_{\text{correlation}} = 0.84$). A significant interaction between reading and vocabulary across each reading index would then be considered a replication of the effect, strengthening the potential conclusions from the analyses.

Across each model, race, sex, and WISC-MR did *not* significantly predict attributions. As shown in Table 5 and fully consistent with the MANCOVA results, age was a significant covariate, demonstrating negative associations in situations of success and positive associations in situations of failure between reading skills and ability attributions. SES negatively predicted ability attributions, but only in the case of failure with slightly greater values for those not receiving government assistance. Across all models, reading skill was positively and strongly (0.30 to 0.43) related to ability attributions for success; similarly, reading skill was negatively and strongly (-0.27 to -0.36) related to ability attributions for failure. Vocabulary demonstrated inconsistent and substantially smaller (0.09 & 0.12) positive relationships with ability attributions for success (two of four reading indices), and inconsistent and substantially smaller (-0.08 to -0.11) negative associations with ability attributions for failure (three of four reading indices).

Despite the weaker predictive ability of vocabulary, this factor served as a significant moderator of the reading-attribution relationship, with interactive effects observed for every model in which attributions of ability for success was the outcome. For example, when WJ-III Letter-Word Identification was used as the reading index predicting ability attributions for success, the interaction with vocabulary was significant ($B = 0.16$, $SE = 0.03$, $p < .001$). A simple slopes analysis indicated stronger positive associations between reading skill and ability attributions for success when vocabulary was high. Fig. 2a presents the slope at mean levels of vocabulary, as well as ± 1 SD. This figure also illustrates that the only participants who reported very low levels of ability attributions to success were those both of low reading skill *and* high vocabulary. To characterize this varying relationship, Fig. 2b presents the continuously estimated relationship between reading and ability attributions for success, along the full range of vocabulary skill (X-axis). Vertical reference lines are placed to indicate regions of significance, estimated according to the Johnson-Neyman technique (see

Hayes, 2013; Preacher, Curran, & Bauer, 2006). This analysis indicates that the attribution-reading relationship was negative, and significantly different from zero, when vocabulary was lower than 49.9; in contrast, this relationship was positive, and significantly different from zero, when vocabulary was > 104.5 . Though not presented here, an identical interaction pattern was replicated across each of the regression models, with the three other reading predictors.

A moderating effect of vocabulary was also observed when ability attributions to failure was the outcome, across all regression models. For example, when WJ-III Letter-Word Identification was used as the reading index predicting ability attributions for failure, the interaction with vocabulary was significant ($B = -0.07$, $SE = 0.03$, $p = .01$). As illustrated in Fig. 3a, stronger negative associations between reading skill and ability attributions for failure were found for cases with higher vocabulary scores. This figure also illustrates very low variability in ability attributions for failure when reading skill is high, regardless of vocabulary skill. As above, these relationships were explicitly tested via a Johnson-Neyman analysis, to indicate which regions of vocabulary skill were associated with significant moderation effects. Fig. 3b presents the continuously estimated relationship between reading and ability attributions for failure (Y-axis) along the full range of Vocabulary (X-axis). The attribution-reading relationship was negative at all levels of vocabulary, but only significantly different from zero when vocabulary scores were above 86.1. In summary, reading skill was a positive predictor of ability attributions in situations of success, but reading skill was a negative predictor of ability attributions for failure. In every case vocabulary moderated this relationship with stronger associations among individuals with greater vocabulary.

4. Discussion

4.1. Group differences in attributions: Typical, RD, LI, and RD + LI

Given the co-occurrence of developmental RD and LI (Bishop & Snowling, 2004; McArthur & Castles, 2013) this study investigated whether achievement attributions for reading-related outcomes were specific to reading, or perhaps more closely associated with the general presence of learning deficits. In addition, it was also considered whether there would be additive effects (i.e., RD + LI) in predicting less adaptive attributions. Beginning with an investigation of group differences in attributions (typical, RD, LI, and comorbid RD + LI), our results demonstrated a significant main effect for ability grouping. This was followed by post-hoc comparisons, which indicated significant differences in reading-related attributions between groups with and without reading and language impairments. Typically-achieving participants significantly differed across all dimensions of attributions, apart from effort attributions in situations of success. The typically-achieving group was the most likely to attribute reading success to ability; which partially supports our hypothesis that better performing students would have the most adaptive attribution styles. However, while these children were the least likely to associate lack of ability as a cause of reading failure, they did not have the greatest attributions to controllable causes (i.e., effort). Attributing positive events of reading success to ability, and not to external causes, as well as making attributions

to controllable causes (i.e., effort) for both success and failure were considered to represent an adaptive attribution style.

Similar to typical cases, all impairment groups had relatively high mean scores (ranging from 3.98 to 4.08) for attributions to effort in situations of reading success. One explanation is that typical students are aware of and utilize strategies that promote reading success; while more exhaustive effort is used among students with learning impairments for similar experiences of success. As per the disability-focused attribution literature, we hypothesized that lower performing students would have the least adaptive attribution styles, specifically with fewer attributions to controllable causes such as effort. It is possible that when coupled with fewer attributions to ability in situations of success, these controllable effort attributions may be related to less adaptive perceptions of ability. A recent review of by Muenks and Miele (2017) has suggested that some students may believe that greater effort is required if one has low ability. Those with learning impairments may be compensating for limited capacity with increased effort in situations of success. These students may not identify lack of effort as a cause of failure, given the belief that great effort is required for success. However, effort attributions for reading failure were low across all groups, include those without identified impairments.

For attributions to external causes, the typically-achieving group had the lowest mean scores for both reading success and failure; however, no differences were observed between the other ability groups for this dimension. It is possible that as students' attributions change with age (Frijters et al., 2018; Muenks & Miele, 2017; Nicholls, 1979) and have greater exposure to success and failure, they become more likely to assume internal responsibility for their learning outcomes. This may also be supported by the significant main effect found for age and findings that suggest a shift from task-focused orientations to those that are more self-focused overtime (Wigfield, 1988).

4.1.1. Comparing reading-related attributions between groups with learning impairments—Post-hoc comparisons revealed significant differences in ability attributions between cases with reading difficulties and general language impairments. The RD group made fewer attributions to ability in situations of success (e.g., “your reading is good”) and greatest attributions to ability in situations of failure (e.g., “you are a poor reader”). It is particularly notable that despite a global, and arguably equally deleterious learning disability (McArthur, Hogben, Edwards, Heath, & Mengler, 2000), participants with LI did not show the same negative pattern of attributions to ability as participants with RD. The results did not support our prediction that the presence of both reading and language impairments would result in the least adaptive attributions. No significant differences were found between participants with co-occurring RD and LI in comparison to the RD or LI exclusive groups, suggesting no additive effect of impairments on reading-related attributions.

Unlike ability attributions, it is noteworthy that there were no significant differences in attributions to either effort or external causes between RD and LI groups. This may be due to individual differences or the variability of attributions in different contexts. For instance, while a students' ability is closely associated with specific tasks, effort may be more constant across domains of learning. The present study assessed attributions in the context of

reading only. This does not allow for the consideration of person-oriented factors that may explain attribution patterns from one context to another. Some students may be more likely to engage in effortful learning while others are not. Muenks and Miele (2017) highlight contextual differences (e.g. competitive social comparisons compared to mastery-oriented learning tasks) may result in changing perceptions of ability and effort. While low reliability for the failure attributions to external causes subscale may be a contributing factor, it is possible that other individual or contextual factors may also explain these results. However, these investigations were beyond the scope of this study and further research is needed to examine individual differences in attributions.

The nature of group differences between those with and without impairments replicated those of previous research (e.g., Cuevas, Irving, & Russell, 2014; Marsh, 1984; Tabassam & Grainger, 2002). For instance, Tabassam and Grainger (2002) found that students with reading and attention difficulties had poorer self-concept and less adaptive attributions relative to peers without learning difficulties. Similar to the present study, Tabassam and Grainger also examined motivational differences related to the presence of more than one learning impairment. When comparing students with learning difficulties alone and students with both learning and attention difficulties, they found no evidence to support an additive effect of compound difficulties on attributions. Our results indicated that there were differences between exclusive disability groups for ability attributions only, but similarly suggest no additive effect for co-occurring impairments. This may be explained by the specificity of ability attributions. Ability attributions may be more closely associated with specific tasks, in comparison to attributions related to behaviours like effort or persistence and external factors such as luck or teacher support.

4.2. Interactions between reading skill and vocabulary for success and failure attributions

Regression analyses identified positive associations between reading skills and ability attributions in the event of reading success and negative associations in the event of failure. As children have more experiences of reading success, they may as a result develop a greater sense of reading competency. Accordingly, these results also support related studies on attributions of struggling learners, which propose that continued experiences of failure may lead to negative ability perceptions (Chan, 1994; Chapman, 1988; Chapman & Tunmer, 2003).

Fewer studies have considered shared deficits in RD and LI by examining these relationships with interaction effects between reading and language sub-skills. Scores on PPVT moderated relationships between reading subskills and ability attributions with stronger associations as language ability increased, for both situations of success and failure. These effects were replicated across the four regression analyses per reading index, each demonstrating stronger associations between reading skill and ability attributions among those with greater vocabulary skill. Both categorical and continuous results argue that more profound learning difficulties, including comorbid populations, may not necessarily equate with a greater risk of poor achievement motivation. This suggests that the role of language in the expression of achievement attributions may be as follows: low vocabulary may act as a

buffer against negative motivation outcomes such as poor academic self-concept. As illustrated in Fig. 3a, the children that were most likely to attribute reading failure to lack of ability were those with low reading ability and high vocabulary. This may be unique to attributions, relative to other motivation constructs, given the meta-cognitive processes involved in attributions, including reflecting on personal experiences with success and failure and their causes.

4.2.1. Covariates of reading-related ability attributions—Attributions related to one's ability have demonstrated the most consistent and strongest effects in previous research relative to other causes (e.g., Cuevas et al., 2014; Marsh, 1984). Developmentally, the perception of ability and effort as separate constructs becomes evident around the start of formal schooling (Nicholls, 1979). Of the covariates, age was the strongest multivariate predictor of attributions, demonstrating a substantial association with attributions in both situations of success and failure. At the univariate level, age was negatively correlated with attributions in situations of success: older children were less likely to rate these attributions highly. Older children also tended to provide greater endorsement for attributions to ability and effort in situations of failure. This trend was replicated when testing continuous interactions for ability attributions. This finding may provide additional support for the inverse relationship between ability and effort attributions (Muenks & Miele, 2017). If ability is malleable relative to degree of effort, attributions over time may shift to recognize a greater importance of effort. The positive association for failure may represent an internal conflict among students who continue to experience reading difficulties. Over time students are likely to increasingly encounter learning challenges and as result may question their ability during these times and try to compensate with effort. Though, our results showed that overall failure attributions often fell below the midpoint.

Together, results suggest the possibility that attributions follow a developmental course linked with reading experiences: over time individuals gain a greater understanding of their learning competencies and are exposed to a variety of learning experiences. While a full follow-up on these effects are beyond the scope of this study, Frijters et al. (2018) have recently demonstrated, using a quantile regression framework, that the relationships between reading achievement and attributions depend on the developmental level of the child. Attribution theory indicates that learning experiences should shape future motivation, and so it is not surprising that age (i.e., as a proxy for cumulated experiences) is correlated with attributions.

With a minority youth sample this study also explored the contributions of race/ethnicity and SES. Race and/or ethnicity did *not* account for variance or group differences in reading-related attributions. This is not surprising given Graham's (1994) extensive review of motivation among minority students; which stated that there is limited evidence suggesting racially driven differences in attributions that would be associated with negative motivational consequences. Rather, she argued that African American and white students are not likely to differ in their ability to form adaptive attribution styles and future work should focus more on other determinants of behavioural and motivational outcomes. Consistent with this view, we found that race and/or ethnicity were not significant factors in explaining reading attributions. Instead, there were significant associations between achievement and

attributions, with more adaptive patterns for students without learning difficulties. These adaptive patterns for typically-achieving readers are similar to those found in previous research on reading motivation with predominantly white student samples (e.g., Baird, Scott, Dearing, & Hamill, 2009; Carr, Borkowski, & Maxwell, 1991; Lee & Zentall, 2012). This and a lack of significant race and ethnicity contributions provide partial support for the hypothesis that attributions may be more closely associated with specific learning experiences. In our study, the covariates sex and the one measure of intelligence were not significantly associated with ability attributions. In addition, SES was not associated with group differences in attributions. However, regression analyses revealed that SES was a significant contributor when predicting ability attributions in situations of failure. Specifically, average SES had slightly greater attributions to ability for reading failure. Thus, a student's SES may be important when faced with reading failure, but limited motivation research has investigated direct associations with sociocultural factors such as SES. One study has addressed the issue. Vogler and Bakken (2007) found greater goal orientation beliefs for reading among lower SES participants; however, this effect was not observed *within* school-based clusters suggesting the instructional context played a more important role than SES.

4.3. Limitations and directions for future research

Although the present study supports the importance of personal learning histories in the presentation of reading-related attributions, a few limitations must be considered. While the advantage of having multiple age cohorts is valuable for testing a range of age and skill contributions, the cross-sectional design prevents the ability to draw developmental and causal conclusions. Longitudinal analyses that examine causal associations between attributions and achievement, as well as the stability of attributions overtime are needed to address this gap.

A major contribution of this paper was the diversity of the sample given that previous research on reading motivation has predominantly reported on white samples. This work also included SES as a covariate to account for overrepresentation of low SES in Hispanic and African American populations (Graham, 1994). Results demonstrated that neither race nor SES significantly contributed to group differences in reading-related attributions. However, SES was a significant covariate for failure attributions suggesting that this factor may provide important context to understanding attributions that the present study could not address with its limited demographic detail. Future research should more deeply explore these and other demographics to add to this discussion.

While the criteria for reading delay incorporated composite measures of reading performance, general language delay criteria were limited to vocabulary assessments. As such, vocabulary was used as a proxy for cumulated general language development. While strong associations have been demonstrated between vocabulary and general language development, vocabulary is dependent on the nature of input/ exposure to language and is therefore vulnerable to systemic, familial, and intrapersonal confounds (Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991). Further work on associations between attributions, and more broadly motivation, among individuals with language delay should investigate

combined risk factors of speech and language deficits (Nelson, Nygren, Walker, & Panoscha, 2006). This may include measures of familial risk, auditory processing or measures of both receptive and expressive language delay (Bishop, 2006; Nelson et al., 2006). In addition, future work should continue to explore differences in motivation that consider implications of co-occurring deficits or disorders.

4.4. Implications for research and practice

Support for incorporating motivational elements in instruction has been previously documented (Shelton, Anastopoulos, & Linden, 1985; Toland & Boyle, 2008; Zentall & Lee, 2012). Struggling readers can develop a tendency to avoid engaging with texts, in turn reducing opportunities to practice and improve their performance (Guthrie et al., 2007; Roberts et al., 2008). Furthermore, the risk of learned helplessness poses a threat among those with a history of repeated failure (Gibb et al., 2006). Adaptive attribution profiles that identify learning outcomes as controllable (Gibb et al., 2006; Hamm et al., 2013; Hamm, Perry, Clifton, Chipperfield, & Boese, 2014; McClure et al., 2011) are important for fostering positive self-concept and persistence for struggling learners. Training and interventions that incorporate metacognitive strategies that teach positive self-talk and effortful strategy use may support students by creating a sense of control over their learning experiences and become more positively motivated readers (e.g., Guthrie, Wigfield, & VonSecker, 2000; Perry et al., 2014). Instructional elements that could support this include modelling of adaptive attributions and use of formative feedback (Chodkiewicz & Boyle, 2014). In addition, establishing positive perceptions of ability are important, including viewing ability as malleable via internal and controllable causes such as effort and strategy use. In addition, positive emotions associating ability to reading success should be reinforced to promote positive self-concept and related achievement (Marsh & Martin, 2011).

Recent research has re-introduced the consideration of motivation as both a contributor to and outcome of learning experiences and achievement. However, the development of achievement motivation beliefs, as well as their stability over time or across learning environments is understudied. Examining the relationship between motivation and later achievement after controlling for cognitive ability and reading sub-skills should be further explored (see Kirby, Ball, Geier, Parrila, & Wade-Woolley, 2011). These investigations should further examine contributions of motivation over time and across the lifespan. Evidence of motivation as a significant predictor of reading ability even after controlling for fundamental sub-skills would suggest an independent contribution to the variance in reading ability.

5. Conclusions

Significant associations between motivation and achievement suggest that attending to motivational elements in instructional design has the potential to promote academic skill growth. The small effect sizes in predicting attributions are consistent with those observed in previous reading motivation literature; however, this work demonstrated moderate to strong associations for these relationships among children with high vocabulary. Collectively, our

results demonstrated that children with learning delays tended to have less adaptive attribution styles in comparison to those without impairments. Given the presence of reading and/or language impairments, disability groups were less likely to attribute success to their ability and had greater attributions to external causes for situations of reading success; and had greater attributions in situations of reading failure. This may be related to a history of learning difficulties and failure (Chapman & Tunmer, 2003; Gibb et al., 2006). Across group-based and regression-based analyses that included reading and vocabulary as continuous, impairments in reading-related causal attributions to ability were specifically associated with reading ability/disability, and *not* strongly associated with vocabulary and language impairments. Moreover, when comparing groups with RD to those with LI, differences were *only* observed for ability attributions. It is possible that some attributions may be more variable across domains than others. It is notable that the relationship between reading skills and vocabulary was strongest for those with high vocabulary, suggesting the role of language in forming attributions about ability. Investigations of the attributional dimensions of motivation among disability and struggling learner populations are warranted to further refine remedial architectures and enhance educational supports (e.g., Lee & Zentall, 2012; Logan, Medford, & Hughes, 2011; Morgan, Fuchs, Compton, Cordray, & Fuchs, 2008; Wolters, Deton, York, & Francis, 2014).

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References

- American Psychiatric Association (2013). Diagnostic and statistical manual of mental disorders (5th ed.). Arlington, VA: American Psychiatric Publishing.
- Baird GL, Scott WD, Dearing E, & Hamill SK (2009). Cognitive self-regulation in youth with and without learning disabilities: Academic self-efficacy, theories of intelligence, learning vs. performance goal preferences, and effort attributions. *Journal of Social and Clinical Psychology*, 28(7), 881–908.
- Bender WN, & Wall ME (1994). Social-emotional development of students with learning disabilities. *Learning Disability Quarterly*, 17(4), 323–341.
- Berkeley S, Mastropieri MA, & Scruggs TE (2011). Reading comprehension strategy instruction and attribution retraining for secondary students with learning and other mild disabilities. *Journal of Learning Disabilities*, 44(1), 18–32. [PubMed: 21335506]
- Bishop DVM (2006). What causes specific language impairment in children? *Current Directions in Psychological Science*, 15(5), 217–221. [PubMed: 19009045]
- Bishop DVM, & Snowling MJ (2004). Developmental dyslexia and specific language impairment: Same or different? *Psychological Bulletin*, 130(6), 858–886. 10.1037/0033-2909.130.6.858. [PubMed: 15535741]
- Borkowski JG, Weyhing RS, & Carr M (1988). Effects of attributional retraining on strategy-based reading comprehension in learning-disabled students. *Journal of Educational Psychology*, 80(1), 46–53.
- Carr M, Borkowski JG, & Maxwell SE (1991). Motivational components of underachievement. *Developmental Psychology*, 27(1), 108–118.
- Chan LKS (1994). Relationship of motivation, strategic learning, and reading achievement in grades 5, 7, and 9. *Journal of Experimental Education*, 62(4), 319–339.

- Chapman JW (1988). Learning disabled children's self-concepts. *Review of Educational Research*, 58(3), 347–371.
- Chapman JW, & Tunmer WE (2003). Reading difficulties, reading-related self-perceptions, and strategies for overcoming negative self-beliefs. *Reading & Writing Quarterly*, 19(1), 5–24.
- Chodkiewicz AR, & Boyle C (2014). Exploring the contribution of attribution retraining to student perceptions and the learning process. *Educational Psychology in Practice*, 30(1), 78–87.
- Cox CB, & Yang Y (2012). Getting off on the wrong foot: Longitudinal effects of Hispanic students' stability attributions following poor initial test performance. *Learning and Individual Differences*, 22(1), 123–127. 10.1016/j.lindif.2011.09.008.
- Cuevas JA, Irving MA, & Russell LR (2014). Applied cognition: Testing the effects of independent silent reading on secondary students' achievement and attribution. *Reading Psychology*, 35, 127–159. 10.1080/02702711.2012.675419.
- Dunn LM, & Dunn LM (2007). *Peabody Picture Vocabulary Test (fourth edition)—PPVT-4*. Circle Pines, MN: American Guidance Service.
- Dweck CS (1999). *Self-theories: Their role in motivation, personality, and development*. Philadelphia: Taylor and Francis/Psychology Press.
- Dweck CS (2006). *Mindset: The new psychology of success*. New York: Random House LLC.
- Elwér A, Keenan JM, Olson RK, Byrne B, & Samuelsson S (2013). Longitudinal stability and predictors of poor oral comprehenders and poor decoders. *Journal of Experimental Child Psychology*, 115, 497–516. 10.1016/j.jecp.2012.12.001. [PubMed: 23528975]
- Field AP (2013). *Discovering statistics using IBM SPSS statistics: And sex and drugs and rock 'n' roll (4th ed.)*. London: Sage Publications.
- Fraser J, Goswami U, & Conti-Ramsden G (2010). Dyslexia and specific language impairment: The role of phonology and auditory processing. *Scientific Studies of Reading*, 14(1), 8–29. 10.1080/10888430903242068.
- Frijters JC, Tsujimoto KC, Boada R, Gottwald S, Hill D, Jacobson LA, ... Bosson-Heenan J. (2018). Reading-related causal attributions for success and failure: Dynamic links with reading skill. *Reading Research Quarterly*, 53(1), 127–148. [PubMed: 29391653]
- Furnes B, & Samuelsson S (2010). Predicting reading and spelling difficulties in transparent and opaque orthographies: A comparison between Scandinavian and US/ Australian children. *Dyslexia*, 16, 119–142. 10.1002/dys.401. [PubMed: 20440743]
- Gibb BE, Alloy LB, Walshaw PD, Comer JS, Shen GHC, & Villari AG (2006). Predictors of attributional style change in children. *Journal of Abnormal Child Psychology*, 34(3), 425–439. 10.1007/s10802-006-9022-2. [PubMed: 16619141]
- Graham S (1994). Motivation in African Americans. *Review of Educational Research*, 64(1), 55–117.
- Guthrie JT, Coddington CS, & Wigfield A (2009). Profiles of reading motivation among African American and Caucasian students. *Journal of Literacy Research*, 41(3), 317–353. 10.1080/10862960903129196. [PubMed: 19960100]
- Guthrie JT, Hoa LW, Wigfield A, Tonks SM, Humenick NM, & Littles E (2007). Reading motivation and reading comprehension growth in the later elementary years. *Contemporary Educational Psychology*, 32, 282–313. 10.1016/j.cedpsych.2006.05.004.
- Guthrie JT, Wigfield A, & Klauda SL (2012). *Adolescents' engagement in academic literacy (Report No. 7)*. Retrieved from www.corilearning.com/researchpublications.
- Guthrie JT, Wigfield A, Metsala JL, & Cox KE (1999). Motivational and cognitive predictors of text comprehension and reading amount. *Scientific Studies of Reading*, 3(3), 231–256.
- Guthrie JT, Wigfield A, & VonSecker C (2000). Effects of integrated instruction on motivation and strategy use in reading. *Journal of Educational Psychology*, 92(2), 331.
- Hamm JM, Perry RP, Clifton RA, Chipperfield JG, & Boese GD (2014). Attributional retraining: A motivation treatment with differential psychosocial and performance benefits for failure prone individuals in competitive achievement settings. *Basic and Applied Social Psychology*, 36, 221–237. 10.1080/01973533.2014.890623.
- Hamm JM, Stewart TL, Perry RP, Clifton RA, Chipperfield JG, & Heckhausen J (2013). Sustaining primary control striving for achievement goals during challenging developmental transitions: The

role of secondary control strategies. *Basic and Applied Social Psychology*, 35, 286–297. 10.1080/01973533.2013.785404.

- Hayes AF (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford Press.
- Heider F (1958). *The psychology of interpersonal relations*. New York: Wiley.
- Hulleman CS, Barron KE, Kosovich JJ, & Lazowski RA (2016). Student motivation: Current theories, constructs, and interventions within an expectancy-value framework *Psychosocial skills and school systems in the 21st century* (pp. 241–278). Springer International Publishing.
- Huttenlocher J, Haight W, Bryk A, Seltzer M, & Lyons T (1991). Early vocabulary growth: Relation to language input and gender. *Developmental Psychology*, 27(2), 236.
- Kirby JR, Ball A, Geier BK, Parrila R, & Wade-Woolley L (2011). The development of reading interest and its relation to reading ability. 34(3), 263–280. 10.1111/j.1467-9817.2010.01439.
- Kistner JA, Osborne M, & LeVerrier (1988). Causal attributions of learning-disabled children: Developmental patterns and relation to academic progress. *Journal of Educational Psychology*, 80(1), 82–89.
- Lazowski RA, & Hulleman CS (2016). Motivation interventions in education: A meta-analytic review. *Review of Educational Research*, 86(2), 602–640.
- Lee J, & Zentall SS (2012). Reading motivational differences among groups: Reading disability (RD), attention deficit hyperactivity disorder (ADHD), RD + ADHD, and typical comparison. *Learning and Individual Differences*, 22, 778–785. 10.1016/j.lindif.2012.05.010.
- Leonard LB (1998). *Children with specific language impairment*. Cambridge, MA: MIT Press.
- Little RJ (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association*, 83(404), 1198–1202.
- Logan S, Medford E, & Hughes N (2011). The importance of intrinsic motivation for high and low ability readers' reading comprehension performance. *Learning and Individual Differences*, 21, 124–128. 10.1016/j.lindif.2010.09.011.
- Marsh HW (1984). Relationships among dimensions of self-attribution, dimensions of self-concept and academic achievements. *Journal of Educational Psychology*, 76, 1291–1308. 10.1037/0022-0663.76.6.1291.
- Marsh HW, & Martin AJ (2011). Academic self-concept and academic achievement: Relations and causal ordering. *British Journal of Educational Psychology*, 81(1), 59–77. [PubMed: 21391964]
- Marsh HW, Walker R, & Debus R (1991). Subject-specific components of academic self-concept and self-efficacy. *Contemporary Educational Psychology*, 16(4), 331–345.
- McArthur G, & Castles A (2013). Phonological processing deficits in specific reading disabilities and specific language impairment: Same or different? *Journal of Research in Reading*, 36(3), 280–302. 10.1111/j.1467-9817.2011.01503.x.
- McArthur GM, Hogben JH, Edwards VT, Heath SM, & Mengler ED (2000). On the “specifics” of specific reading disability and specific language impairment. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, 41(7), 869–874.
- McClure J, Meyer LH, Garisch J, Fischer R, Weir KF, & Walkey FH (2011). Students' attributions for their best and work marks: Do they relate to achievement? *Contemporary Educational Psychology*, 36, 71–81. 10.1016/j.cedpsych.2010.11.001.
- Morgan PL, Fuchs D, Compton DL, Cordray DS, & Fuchs LS (2008). Does early reading failure decrease children's reading motivation? *Journal of Learning Disabilities*, 41(5), 387–404. 10.1177/0022219408321112. [PubMed: 18768772]
- Muenks K, & Miele DB (2, 2017). Students' thinking about effort and ability: The role of developmental, contextual, and individual difference factors. *Review of Educational Research*, 1–29.
- Nelson HD, Nygren P, Walker M, & Panoscha R (2006). Screening for speech and language delay in preschool children: Systematic evidence review for the US preventive services task force. *Pediatrics*, 117, 298–319.
- Nicholls JG (1979). Development of perception of own attainment and causal attributions for success and failure in reading. *Journal of Educational Psychology*, 71(1), 94–99. [PubMed: 438417]

- Núñez JC, González-Pianda JA, González-Pumariaga S, Roces C, Alvarez L, González P, ... Rodríguez S. (2005). Subgroups of attributional profiles in students with learning difficulties and their relation to self-concept and academic goals. *Learning Disabilities Research and Practice*, 20(2), 86–97.
- Pennington BF (2006). From single to multiple deficit models of developmental disorders. *Cognition*, 101, 385–413. [PubMed: 16844106]
- Perry RP, Chipperfield JG, Hladkyj S, Pekrun R, & Hamm JM (2014). Attribution-based treatment interventions in some achievement settings In Karabenick S, & Urdan T (Vol. Eds.), *Advances in motivation and achievement*. Vol. 18 Bingley, UK: Emerald Publishing 10.1108/S0749-742320140000018000.
- Pintrich P (2000). The role of goal orientation in self-regulated learning In Boekaerts M, Pintrich PR, & Zeidner M (Eds.). *Handbook of self-regulation* (pp. 451– 502). New York, NY: Academic.
- Pintrich PR (2003). A motivational science perspective on the role of student motivation in learning and teaching contexts. *Journal of Educational Psychology*, 93(4), 667–686.
- Preacher KJ, Curran PJ, & Bauer DJ (2006). Computational tools for probing interactions in multiple linear regression, multilevel modeling, and latent curve analysis. *Journal of Educational and Behavioral Statistics*, 31(4), 437–448.
- Revelle W (2014). *psych: Procedures for Personality and Psychological Research*. Evanston, Illinois, USA: Northwestern University <http://CRAN.R-project.org/package=psych,Version=1.4.5>.
- Revelle W, & Zinbarg RE (2009). Coefficients alpha, beta, omega and the glb: Comments on Sijtsma. *Psychometrika*, 74(1), 145–154. 10.1007/S11336-008-9102-Z.
- Roberts G, Torgesen JK, Boardman A, & Scammacca N (2008). Evidenced-based strategies for reading instruction of older students with learning disabilities. *Learning Disabilities Research and Practice*, 23(2), 63–69. 10.1111/j.1540-5826.2008.00264.x.
- Romero C, Master A, Paunesku D, Dweck CS, & Gross JJ (2014). Academic and emotional functioning in middle school: The role of implicit theories. *Emotion*, 14(2), 227. [PubMed: 24512251]
- Rotter JB (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied*, 80(1), 1–28.
- Schiefele U, Schaffner E, Möller J, & Wigfield A (2012). Dimensions of reading motivation and their relation to reading behavior and competence. *Reading Research Quarterly*, 47(4), 427–463. 10.1002/RRQ.030.
- Shelton TL, Anastopoulos AD, & Linden JD (1985). An attribution training program with learning disabled children. *Journal of Learning Disabilities*, 18(5), 261–265. [PubMed: 3989368]
- Sijtsma K (2009). On the use, the misuse, and the very limited usefulness of Cronbach's alpha. *Psychometrika*, 74(1), 107–120. 10.1007/s11336-008-9101-0. [PubMed: 20037639]
- Snowling MJ (1987). *Dyslexia: A cognitive developmental perspective*. Oxford, England: Blackwell.
- Snowling MJ (2013). Early identification and interventions for dyslexia: A contemporary view. *Journal of Research in Special Educational Needs*, 13(1), 7–14. 10.1111/j.1471-3802.2012.01262.x. [PubMed: 26290655]
- Swinton AD, Kurtz-Costes B, Rowley SJ, & Okeke-Adeyanju N (2011). A longitudinal examination of African American adolescents' attributions about achievement outcomes. *Child Development*, 82(5), 1486–1500. [PubMed: 21793818]
- Tabachnick BC, & Fidell LS (2007). *Using multivariate statistics* (5th ed.). Boston, MA: Allyn Bacon.
- Tabassam W, & Grainger J (2002). Self-concept, attributional style and self-efficacy beliefs of students with learning disabilities with and without attention deficit hyperactivity disorder. *Learning Disability Quarterly*, 25(2), 141–151.
- Ten Berge JMF, & So an G (2004). The greatest lower bound to the reliability of a test and the hypothesis of unidimensionality. *Psychometrika*, 69(4), 613–625. 10.1007/BF02289858.
- Toland J, & Boyle C (2008). Applying cognitive behavioural methods to retrain children's attributions for success and failure in learning. *School Psychology International*, 29(3), 286–302. 10.1177/0143034308093674.
- Torgesen JK, Wagner RK, & Rashotte CA (1999). *Test of word reading efficiency*. Austin, TX: Pro-Ed.

- Census Bureau US (2012). Educational attainment in the United States. <https://www.census.gov/data/tables/2012/demo/educational-attainment/cps-detailed-tables.html>.
- Usher EL, & Pajares F (2006). Sources of academic and self-regulatory efficacy beliefs of entering middle school students. *Contemporary Educational Psychology*, 31, 125–141. 10.1016/j.cedpsych.2005.03.002.
- Vogler JS, & Bakken L (2007). Motivation across domains: Do goals and attributions change with subject matter for grades 4 and 5 students? *Learning Environments Research*, 10(1), 17–33.
- Wechsler D (2003). Wechsler intelligence scale for children—Fourth edition (WISC-IV). New York: The Psychological Corporation.
- Weiner B (1986). *An attributional theory of motivation and emotion*. New York: Springer-Verlag.
- Weiner B (2010). The development of an attribution-based theory of motivation: A history of ideas. *Educational Psychologist*, 45(1), 28–36. 10.1080/00461520903433596.
- Wigfield A (1988). Children's attributions for success and failure: Effects of age and attentional focus. *Journal of Educational Psychology*, 80(1), 76–81.
- Wigfield A, & Eccles JS (2000). Expectancy–value theory of achievement motivation. *Contemporary Educational Psychology*, 25(1), 68–81. [PubMed: 10620382]
- Wigfield A, & Eccles JS (2002). The development of competence beliefs, expectancies for success, and achievement values from childhood through adolescence In Wigfield A, & Eccles JS (Eds.). *Development of achievement motivation* (pp. 91–120). San Diego, CA: Academic.
- Wigfield A, Eccles JS, Schiefele U, Roeser RW, & Davis-Kean P (2007). *Development of achievement motivation*. John Wiley & Sons, Inc.
- Wolters CA, Deton CA, York MJ, & Francis DJ (2014). Adolescents' motivation for reading: Group differences and relation to standard achievement. *Reading and Writing*, 27, 503–533. 10.1007/s11145-013-9454-3.
- Woodcock RW, McGrew KS, & Mather N (2001). *Woodcock-Johnson III*. Rolling Meadows, IL: Riverside Publishing.
- Yeager DS, & Dweck CS (2012). Mindsets that promote resilience: When students believe that personal characteristics can be developed. *Educational Psychologist*, 47(4), 302–314. 10.1080/00461520.2012.722805.
- Zentall SS, & Lee J (2012). A reading motivation intervention with differential outcomes for students at risk for reading disabilities, ADHD, and typical comparisons: “Clever is and clever does”. *Learning Disabilities Quarterly*, 35(4), 248–259. 10.1177/0731948712438556.

Fig. 1. Estimated marginal means for reading-related attributions compared across ability groups, error bars represent 95% confidence intervals.

Fig. 2.

a. WJ-III Word Identification predicting ability attributions in situations of reading success.

The slope is presented at mean levels of vocabulary, as well as ± 1 SD.

b. Continuously estimated relationship between reading (WJ-III Word Identification) and ability attributions in situations of reading success, as moderated along the full range of vocabulary skill (X-axis). Vertical reference lines are placed to indicate regions of significance: Vocabulary scores above 104.5 are associated with a positive relationship between word identification and attributions of ability to success; vocabulary scores below 49.9, a negative relationship.

Fig. 3.

a. WJ-III Word Identification predicting ability attributions in situations of reading failure.

The slope is presented at mean levels of vocabulary, as well as ± 1 SD.

b. Continuously estimated relationship between reading (WJ-III Word Identification) and ability attributions in situations of reading failure, as moderated along the full range of vocabulary skill (X-axis). Vertical reference lines are placed to indicate regions of significance: Vocabulary scores above 86.1 are associated with a negative relationship between word identification and attributions of ability to failure.

Table 1

Descriptive statistics including reading and language scores across ability groupings.

	Typical (N = 988)		RD (n = 140)		LI (n = 95)		Comorbid RD LI (n = 83)	
	M	SD	M	SD	M	SD	M	SD
Age	11.03	2.12	11.18	2.21	10.98	2.09	11.71	2.09
TOWRE Sight Word Efficiency SS ^a	99.06	11.40	78.91	8.25	93.24	9.56	76.17	9.63
TOWRE Phonetic Decoding Efficiency SS ^a	98.25	13.15	73.25	6.42	95.88	12.26	72.99	8.60
TOWRE Word Reading Efficiency SS ^a	98.37	13.74	71.29	7.37	93.43	11.98	69.42	9.29
WJ Word Attack SS ^a	98.47	9.13	79.22	7.02	94.68	7.67	75.87	9.50
WJ Word Identification SS ^a	100.81	10.62	77.20	7.21	91.76	8.56	72.01	11.30
WJ Basic Reading SS ^a	99.79	10.02	76.10	7.50	92.59	7.90	71.75	10.00
PPVT SS ^a	99.34	14.30	91.68	8.24	75.84	7.06	72.36	9.09
WISC Vocabulary SS ^b	9.87	2.57	7.56	1.87	5.05	1.10	4.31	1.51
Male (proportion)	509 (51.5%)		74 (52.9%)		49 (51.6%)		51 (61.4%)	
Hispanic American (proportion)	673 (69.2%)		70 (51.9%)		73 (79.3%)		54 (66.7%)	
African American (proportion)	343 (34.7%)		75 (53.6%)		27 (28.4%)		31 (37.3%)	

Note: SS = Standard Score; TOWRE = Test of Word Reading Efficiency; WJ = Woodcock Johnson; PPVT = Peabody Picture Vocabulary Test; WISC = Wechsler Intelligence Scale for Children.

^aStandard Score normed to $M = 100$, $SD = 15$

^bStandard Score normed to $M = 10$, $SD = 3$. Some participants were missing categorical demographic data (sex and race) resulting in proportions that were calculated with different group totals.

Table 2

Multivariate tests exploring differences in achievement attributions across ability grouping.

	<i>F</i> (6,1259)	<i>p</i>	Partial η^2
Race: African American	0.607	.725	0.003
Race: Hispanic American	0.241	.963	0.002
SES: Government Assistance	1.849	.086	0.009
Sex	0.894	.498	0.004
Age (in years)	27.789	<.001	0.165
WISC:MR Fluid Intelligence	2.883	.009	0.013
Ability Grouping (Typical, RD, LI, RD + LI)	6.565	<.001	0.032

Table 3

Univariate analyses exploring group differences in success and failure attributions.

		Age		WISC-MR		Ability Grouping	
		<i>F</i> (6, 1259)	<i>n</i> ²	<i>F</i> (1, 1259)	<i>n</i> ²	<i>F</i> (1, 1259)	<i>n</i> ²
ANOVAs	Success to ability	6.39**	0.01	2.32	<0.01	50.61***	0.05
	Success to effort	31.43***	0.05	1.24	<0.01	1.39	<0.01
	Success to external causes	20.53***	0.02	2.86*	<0.01	32.14***	0.04
	Failure to ability	37.67***	0.04	4.09*	<0.01	39.83***	0.04
	Failure to effort	53.51***	0.07	1.23	<0.01	8.57**	0.01
	Failure to external causes	1.83	<0.01	0.08	<0.01	5.43*	0.01

 $p < .001$ **
 $p < .001$ *
 $p < .05$.

Table 4

Post-hoc contrasts comparing ability groups on reading-related attributions.

	Typical vs. all other	groups		Comorbid vs. RD and LI			RD vs. LI		
	Contrast estimate	SE	<i>P</i>	Contrast estimate	SE	<i>P</i>	Contrast estimate	SE	<i>P</i>
Success to ability	0.408	0.062	<.001	– 0.008	0.116	.945	– 0.422	0.121	<.001
Success to effort	0.076	0.048	.112	– 0.038	0.090	.675	0.073	0.093	.431
Success to external causes	–0.392	0.057	<.001	0.169	0.106	.112	–0.141	0.111	.204
Failure to ability	–0.385	0.059	<.001	– 0.074	0.112	.509	0.252	0.116	.030
Failure to effort	–0.199	0.053	<.001	0.057	0.100	.566	0.042	0.104	.687
Failure to external causes	–0.160	0.050	.001	0.091	0.094	.333	– 0.050	0.097	.604

Table 5

Language and reading skills interactions: Predicting ability attributions.

		Phonemic Decoding					Sight Word Efficiency					Word Identification							
	Variable	B	SE	LCI	UCI	P	R ²	B	SE	LCI	UCI	P	R ²	B	SE	LCI	UCI	P	R ²
Attributions for success to ability							0.16						0.16						0
	(Constant)	1.26	0.21	0.84	1.67	< .001		1.52	0.22	1.09	1.95	< .001		1.48	0.22	1.06	1.91	< .001	
	Age	−0.12	0.02	−0.15	−0.10	< .001		−0.15	0.02	−0.18	−0.12	< .001		−0.15	0.02	−0.18	−0.12	< .001	
	Sex	−0.02	0.05	−0.13	0.08	.63		0.02	0.05	−0.08	0.12	.74		−0.01	0.05	−0.11	0.09	.84	
	Race H	0.02	0.12	−0.21	0.24	.89		0.02	0.12	−0.21	0.25	.87		0.03	0.12	−0.21	0.26	.82	
	Race AA	0.17	0.11	−0.05	0.39	.12		0.12	0.11	−0.12	0.34	.31		0.14	0.12	−0.09	0.37	.23	
	SES	0.04	0.05	−0.06	0.15	.45		0.05	0.05	−0.06	0.16	.34		0.06	0.05	−0.05	0.16	0.30	
	WISC-MR	−0.02	0.04	−0.09	0.05	.54		−0.04	0.03	−0.11	0.03	.22		−0.04	0.04	−0.11	0.03	.22	
	Reading	0.37	0.03	0.31	0.44	< .001		0.43	0.04	0.32	0.46	< .001		0.43	0.04	0.34	0.52	< .001	
	Vocabulary	0.09	0.03	0.01	0.16	.03		0.07	0.04	−0.03	0.12	.07		0.04	0.04	−0.05	0.12	.39	
Interaction	0.14	0.02	0.09	0.20	< .001		0.15	0.03	0.09	0.19	< .001		0.16	0.03	0.10	0.21	< .001		
Attributions for failure to ability							0.15						0.15						0
	(Constant)	−1.84	0.22	−2.28	−1.40	< .001		−2.06	0.23	−2.50	−1.61	< .001		−2.02	0.22	−2.45	−1.58	< .001	
	Age	0.18	0.02	0.15	0.21	< .001		0.20	0.02	0.17	0.23	< .001		0.20	0.02	0.17	0.23	< .001	
	Sex	0.01	0.05	−0.09	0.12	.81		−0.03	0.05	−0.13	0.08	.63		0.005	0.05	−0.10	0.10	.99	
	Race H	0.005	0.13	−0.26	0.26	.99		−0.003	0.13	−0.26	0.25	.98		−0.01	0.13	−0.27	0.25	.96	
	Race AA	−0.12	0.13	−0.37	0.13	.36		−0.08	0.13	−0.33	0.17	.53		−0.10	0.13	−0.35	0.16	.45	
	SES	−0.14	0.06	−0.25	−0.03	.02		−0.14	0.06	−0.25	−0.03	.01		−0.14	0.06	−0.25	−0.03	.01	
	WISC-MR	−0.03	0.03	−0.09	0.04	.46		−0.005	0.04	−0.07	0.06	.89		−0.01	0.04	−0.08	0.06	.81	
	Reading	−0.30	0.03	−0.36	−0.23	< .001		−0.36	0.04	−0.45	−0.29	< .001		−0.34	0.04	−0.42	−0.26	< .001	
	Vocabulary	−0.11	0.04	−0.19	−0.04	.003		−0.08	0.04	−0.16	−0.01	.03		−0.06	0.04	−0.15	0.02	.15	
Interaction	−0.07	0.03	−0.12	−0.01	.02		−0.06	0.03	−0.11	−0.001	.05		−0.07	0.03	−0.13	−0.01	.01		

Note. LCI=lower confidence interval and UCI=upper confidence interval with 95% confidence level. WISC-IV=Wechsler Intelligence Scale Matrix Reasoning subtest. Reading was defined by four different independent variables: TOWRE: Sight Word Efficiency and Phonemic Decoding as well as WJ-III Letter-Word Identification and Word Attack subtests. Language was defined by a measure of vocabulary using PPV.