

**Association between Reading Anxiety and Reading Achievement  
across World Populations: A Meta-Analysis**

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### **Abstract**

Reading is essential for daily life. Therefore, an inability to engage in reading due to either a lack of reading abilities or a fear of reading would be debilitating. Reading anxiety is the fear of reading and is theorized to be negatively associated with reading achievement. Research on reading anxiety has existed since the 1980's, however, it has been a quickly rising area of investigation in recent years. The goal of the present meta-analysis was to determine the strength of the association between reading anxiety and reading achievement. This preregistered meta-analysis was designed with the intention of being representative of world populations. Through systematic screening of the published and unpublished literature, 44 studies were identified to be included in the meta-analysis (totaling 113 effect sizes). The 9,114 participants from these studies came from a range of backgrounds. The included studies were conducted in 5 continents, 9 countries, and 7 languages. A moderate negative correlation was found between reading anxiety and reading achievement ( $r = -0.31$ ). Learning disability status, gender, reading domain, and age were not significant moderators and did not significantly account for the heterogeneity in the effect size. The association between reading anxiety and reading achievement may have practical implications for the fields of psychology and education, specifically for efforts to promote people's reading achievement while maintaining their socioemotional wellbeing. An important direction for future research will be to use longitudinal designs to

uncover how reading anxiety and reading achievement may co-develop. This would improve suggestions that can be made on how to support people struggling in their reading anxiety and reading achievement.

### **Public Significance Statement**

Reading anxiety is the fear of reading itself. This meta-analysis finds a moderate association between reading anxiety and reading achievement. We take this to conclude that those with higher reading anxiety have lower reading achievement, compared to those with lower reading anxiety who tend to have higher reading achievement. This occurs across world populations, including across countries, languages, ages, gender, reading domain, and reading abilities. This meta-analysis provides a better understanding of the fact that reading anxiety is a factor to consider in people's reading achievement, which will aid in future investigation into how to best support people in their cooccurring struggles with reading anxiety and reading achievement.

## **Association between Reading Anxiety and Reading Achievement across World Populations: A Meta-Analysis**

Reading is a critical skill in today's world as it provides access to information, communication, and everyday life. Indeed, reading achievement is predictive of many important life outcomes (e.g. economic success; Ritchie & Bates, 2013). With the reliance on reading in the modern world, reading cannot be avoided. However, many people experience varying levels of fear towards reading, which is referred to as reading anxiety (Jalongo & Hirsh, 2010). There is accumulating evidence that individual differences in reading anxiety are negatively associated with individual differences in reading achievement. In this meta-analysis, we examined the magnitude of the association between reading anxiety and reading achievement.

Psychology is the study of mind and behavior (American Psychological Association), and with this reading is highly relevant to the field of psychology. Reading achievement is a cognitive, linguistic, and socioemotional experience (Aaron et al., 2008; Orellana García & Baldwin Lind, 2018). Much of the field has been dedicated to investigating cognitive and linguistic predictors of reading achievement, including many meta-analyses on various cognitive (e.g., working memory (Peng et al., 2018) and rapid automatized naming (Araújo et al., 2015)) and linguistic factors' (e.g., phonological awareness (Melby-Lervåg et al., 2012), oral comprehension (Clinton-Lisell, 2022) and vocabulary (Hwang et al., 2022)) relation to

reading achievement. Various socioemotional factors have been found to predict reading ability above what is already accounted for by cognitive and linguistic factors (Grills-Taquechel et al., 2013; Carroll & Fox, 2017; Denton et al., 2021).

Socioemotional factors in reading are often categorized into positive affect (e.g., motivation and self-efficacy) and negative affect (e.g., anxiety and avoidance). Positive affect refers to positive feelings and approach towards reading. Negative affect refers to negative feelings and avoidance of reading (Diener et al., 1985). Positive and negative reading affect are not two ends of one continuous socioemotional scale, thus an increase in one does not constitute a decrease in the other (Dowker et al., 2016).

Much of the existing work on the associations between socioemotional factors and reading outcomes has been dedicated to positive reading affect, with meta-analyses finding positive correlations between reading outcomes and positive reading affect components including motivation ( $r = 0.22$ ; Toste et al., 2020), attitudes toward reading ( $r = 0.31$ ; Petscher, 2010), and engagement ( $r = 0.24$ ; Lindström et al., 2021). Historically, less attention has been paid to constructs of negative reading affect such as reading anxiety. However, it is theorized that negative reading affect would have a larger influence on reading outcomes than positive affect. According to negativity bias, negative emotions are more detrimental than positive emotions are beneficial in their psychological impact (Baumeister et al., 2001). Ramirez et al., (2019) supported this, finding that reading

achievement was more strongly associated with reading anxiety than it was with positive reading affect.

Reading anxiety has become a quickly growing area of research over the past five years. Reading Anxiety is a specific anxiety, separable from general anxiety, and is different but related to other similar specific academic anxieties such as math anxiety and foreign language reading anxiety (FLRA) (Jalongo & Hirsh, 2010; Piccolo et al., 2017; Pollack et al., 2021; Macdonald et al., 2021). Reading anxiety occurs across cultures, languages, age groups, and reading achievement levels (Piccolo et al., 2017). The goal of this meta-analysis was to determine the strength of the relation between reading anxiety and reading achievement. Finally, we investigated the extent to which the relation between reading anxiety and reading is moderated by disability status, gender, reading domain, and age.

### **The Reading Anxiety - Reading Achievement Link**

Although no meta-analytic synthesis has been done yet, generally it is found that there is a low to moderate correlation between reading anxiety and reading achievement (e.g., Zbornik & Wallbrown, 1991; Ramirez et al., 2019; Macdonald et al., 2021). However, the underlying nature of this relation is unknown, although there are various theoretical perspectives that support different directional explanations. For example, it has been theorized that early poor reading achievement leads to later reading anxiety (reduced competency view; Maloney et al., 2010), higher reading anxiety leads to poorer reading achievement (disruption account; Ashcraft & Faust,

1994; Park et al., 2014), or that there is a bidirectional feedback cycle (Gunderson et al., 2018; Ramirez et al., 2018). Additionally, some constructs have been proposed as moderators of the association between reading anxiety and reading achievement.

### **Reduced Competency View: Reading Achievement → Reading Anxiety**

According to the reduced competency view, those who experience low reading achievement go on to develop a fear of reading (Maloney et al., 2010). According to this view, reading anxiety develops along the principles of classical conditioning, in which a stimulus (e.g., reading) is repeatedly paired with a noxious stimulus (e.g., judgment and ridicule from teachers and peers that then causes negative emotions and lowered self-esteem) (Jalongo & Hirsh, 2010). Those with low reading achievement in early education often have reading repeatedly paired with emotionally painful stimuli, in the form of judgment from teachers and peers and develop feelings of shame about their low reading achievement (Jalongo & Hirsh, 2010). As a result, those with low reading achievement learn to associate reading with painful socioemotional feelings and experiences, an association that is reinforced over time as they continue to have these negative experiences when reading (Hinton et al., 2008).

This reduced competency view is descriptive of the reading experiences of struggling readers, such as those with learning disabilities (LDs). People with learning disabilities often experience early and repeated



reading struggles throughout life (Goldberg & Cornell, 1998; Guay et al., 2010; Seyed et al., 2017). In response to their low reading achievement, they receive frequent judgment from their peers and teachers (Beckmann & Minnaert, 2018; Livingston et al., 2018). Thus, learning disability status may act as a moderator of the association between reading anxiety and reading achievement.

Following this same logic, it has been presumed that gender may moderate the correlation between reading achievement and reading anxiety, as there are stereotypes that boys are expected to be better at math and worse at reading compared to girls (Hartley & Sutton, 2013; Quinn & Wagner, 2015). Supporting this, some studies have found that high reading anxiety was more detrimental to the reading achievement of boys than girls (Ramirez et al., 2019; Pollack et al., 2021). With this meta-analysis we plan to test the assumption that the correlation between reading anxiety and reading achievement is stronger for boys than girls.

### **Disruption Account: Reading Anxiety → Reading Achievement**

Alternatively, the Disruption Account suggests that high reading anxiety contributes to greater barriers to reading, leading to lower reading achievement (Ashcraft & Faust, 1994; Park et al., 2014). Attentional Control Theory builds on the Disruption Account, further suggesting that anxiety reduces one's cognitive capacity to process information and that feelings of reading anxiety may lower attention to the reading task at hand, resulting in lower reading achievement (Eysenck & Derakshan, 2011). Reading is a

complex cognitive task that relies on many cognitive skills being engaged at once (Elleman & Oslund, 2019), cognitive resources that may be consumed by reading anxiety and thereby not be available for use while reading.

Intrusive thoughts and ruminations (Papageorgiou, 2006) over the experienced fear towards reading would consume cognitive resources needed for reading (such as working memory and attention) (Ramirez et al., 2018). Therefore, reading anxiety is thought to lead to lower reading achievement due to lowered cognitive skills (e.g., working memory and attention) that are necessary in order to successfully read text.

In line with Attentional Control Theory, reading anxiety is presumed to be more detrimental to reading achievement in contexts that required more cognitive skills for successful reading. For example, reading comprehension is a cognitively complex skill and requires greater cognitive resources (e.g., language skills, decoding skills, background knowledge, and working memory) than word reading (Elleman & Oslund, 2019). Thus, reading anxiety is hypothesized to be more strongly (negatively) correlated with reading comprehension than word level reading domains (MacDonald et al., 2021), as word level reading requires fewer cognitive resources and thus would be less affected by a reduction in cognitive resources available. MacDonald et al (2021) found some support for this in a sample of struggling readers in fourth and fifth grade, but this has otherwise not been systematically studied. Specifically, they (MacDonald et al., 2021) found that reading anxiety predicted both reading comprehension and word

reading fluency, but not word reading accuracy, when controlling for working memory and verbal abilities. With this meta-analysis we further investigate if reading domain moderates the correlation between reading anxiety and reading achievement.

### **PRAX Model: Reading Achievement ↔ Reading Anxiety**

Finally, there could be a bidirectional association between reading anxiety and reading achievement. The Poor Reading-Anxiety (PRAX) model suggests a loop is occurring wherein low reading achievement leads to higher reading anxiety via mediation through lower reading self-concept and negative peer relations, and that reading anxiety may lead to low reading achievement via mediation through lower cognitive skills such as attention (McArthur, 2020). This model suggests that there is a dynamic and complex relation between reading anxiety and reading achievement. Ramirez and colleagues (2019) found support for a bidirectional association, finding that reading achievement predicted later reading anxiety, and reading anxiety predicted later reading achievement. Though it is noted that both were significant, the association between reading achievement and later reading anxiety was stronger than the association between reading anxiety and later reading achievement.

The reading context of young children aligns with the PRAX model (McArthur, 2020), which suggests that reading anxiety and reading achievement reinforce one another via mediation through self-concept, peer relations, and cognitive skills. In early childhood, reading is new and

requires much effort (use of cognitive skills that are still developing) to learn, also children's reading achievement is constantly being evaluated and reading is often done out loud in front of peers and teachers (Ivey, 1999; García & Cain, 2014). It is possible that the strength of the relation between reading achievement and reading anxiety would be greater in younger individuals compared to older individuals. However, Ramirez et al (2019) found age did not significantly moderate the association between reading achievement and reading anxiety. Additionally, reading comprehension is more commonly assessed in older ages, whereas younger children are more often assessed on word level reading (Petscher et al., 2020). As stated previously, it has been proposed that reading anxiety is more strongly associated with reading comprehension than word-level reading (MacDonald et al., 2021), which would suggest a stronger correlation for those older individuals.

### **The Current Study**

The goal of the current study was to carry out a meta-analysis on the association between reading anxiety and reading achievement. Based on the theories previously discussed, we hypothesized that we would find a moderate negative relation between reading anxiety and reading achievement. In addition to determining the average weighted effect size, we also estimated the amount of variability in effect sizes across studies and determined the extent to which variability in effect sizes was accounted for by moderators. Past research and theory provided a rationale to investigate

disability status, gender, reading domain, and age as possible moderators of the relation between reading anxiety and reading achievement.

## **Methods**

### **Transparency and Openness**

This meta-analytic study was conducted following the recommendations of the PRISMA checklist for systematic reviews (Page et al., 2021). This meta-analysis was preregistered. All the open science materials (e.g., preregistration, dataset, codebook, R statistical code, and supplemental analyses) are available on a LDbase project page we created for this meta-analysis (Johnson et al., 2023 <https://doi.org/10.33009/ldbase.1675106668.fef3>).

### **Inclusion and Exclusion Criteria**

To be included in the meta-analysis the study had to have quantitative measures of reading anxiety and reading achievement. Measures of reading related skills that were not explicitly reading achievement (e.g. RAN, phonological awareness, working memory, and oral language) did not meet criteria for inclusion. We had no exclusion requirements for age of participants, year of publication, or publication status. Studies were included regardless of the written and oral languages that were used. However, both the reading achievement and reading anxiety measure had to be in participants' first language. If the manuscript was not published in English, we emailed the authors of the study requesting a translated

description of the key pieces of information we needed. This proved effective, with us having 3 studies returned to us in this way.

### **Screening Studies**

When studies were identified for screening, they were put into Zotero for management and then into Covidence for sorting, screening, and coding. Before each new part of the screening procedure, an in-person training was conducted with the three coders. At every step of screening, every paper was screened by two of the three coders individually for reliability. In any cases of conflict (in which a study was included by one coder and excluded by the other) a meeting was had between the two coders to resolve the conflict. A PRISMA flow chart of the screening of studies for the identification process of included studies in the paper can be found in *Figure 1*. In the end, a total of 44 studies were included in the meta-analysis.

### **Initial Search**

Before conducting the first search, we identified 5 key studies as a test sample that was used as a check to ensure that our subsequent search strategy was covering the existing literature without missing key studies. On 14<sup>th</sup> of October 2022 a full search of studies was done in PubMed, PsychINFO, and ERIC. PsychINFO and ERIC was done through the ProQuest platform. The following search terms were used: (“reading anxiety”) OR (“anxiety in reading”) OR (“anxiety about reading”) OR (“anxiety towards reading”). These terms could appear anywhere in the

text. All 5 of the key studies identified were captured by this search strategy, thus it was determined that this was an effective search strategy. We first eliminated studies by screening the titles and abstracts of each of the reports. Then the full-texts of the remaining studies were screened. In this step there were only 7 cases of conflict (in which a study was marked as a yes by one coder and a no by another coder on if it should be included). Most of the studies excluded were foreign language reading anxiety papers without measures of first language outcomes.

### **Additional Search Methods**

We took care to search for gray literature to include in the meta-analysis, which resulted in the inclusion of 8 additional unpublished studies. To do this, we first searched the preprint servers (i.e., PsyArXiv, EdArXiv, and OSF preprints) using the same search terms and strategy as the initial search. Next, we focused on finding any unpublished data. The author team directly emailed researchers in the field, to ask if they had unpublished data to include. Third, we did a public call for unpublished data on reading anxiety via Twitter, Facebook groups, newsletters, and list serves (e.g., CogDevSoc list serve, Applied Linguistics Research Methods international research group, and the Motivation special interest group of the American Education Research Association).

To identify any missed studies, the reference list of each included study was searched as well as every study that had cited one of the included studies. The searching through papers citing included papers was updated

last on April 28<sup>th</sup>, 2024, ensuring our search was capturing the recent literature.

Several of the studies identified as meeting eligibility for inclusion in this meta-analysis did not report the needed Pearson correlations. Emails were sent to the authors of the studies that were missing correlations requesting correlations. Each author was emailed three separate times. With a 64% response rate, we were able to obtain the missing correlations of 7 studies. In the end, 4 papers had to be excluded from the final meta-analysis due to the lack of reported correlations.

### **Coding Procedures**

Two coders were tasked with coded the information to be extracted from each included study. Every study was double coded by these two coders. At the beginning of the coding stage, a meeting was had to train the coders using Stock's 8 Steps (Stock, 1994). First, an overview of the goal and plan for the meta-analysis was provided (step 1). In step 2 coders were provided an overview of the whole coding process this included what is done for coding and in what order, in addition to how to fill in the coding forms. In step three of the training, each item on the coding form was gone over. In step 4 three studies were chosen for practice coding. Then in step 5 both coders coded all three of those three selected practice studies on their own during the week. Then in step 6, all the coders got together and compared their coding. Based on results of initial study coding, the coding procedure was revised as necessary (step 7). Finally, step 8 was to continue



this process until consensus was met. This was achieved with the first three practice studies.

### **Interrater Reliability**

All the studies were coded by both coders. Reliability was determined by calculating the agreement rate between the two coders on the reported correlation coefficient of each effect size. We performed an intraclass correlation using two-way random effects. There was an agreement rate of 92.9% for the 113 included effect sizes. There was an intraclass correlation two-way effect of 0.96 ( $p < .001$ ).

### **Measures Information**

The created dataset is available on our LDbase project page (Johnson et al., 2023 <https://doi.org/10.33009/ldbase.1675106668.fef3>), along with the coding sheets used and a codebook for the dataset. Demographic information was recorded on each included sample (e.g., language, country, age, gender, and disability status). Characteristics of the reading anxiety measures used in each study were recorded (e.g., who reading anxiety was reported by (e.g., self-report vs parent-report), Cronbach alpha, number of items, and who read the questions (e.g., read to or read the questions themselves). The correlation coefficient between reading anxiety and reading achievement was recorded, specifying what the reading domain and specific reading achievement measure used. Finally, we assessed each study on 14 quality indicators selected from a suggested list by Protogerou and Hagger (2020).

## **Moderators**

The following information was collected for the investigation of moderators. **Domain of reading achievement** was investigated as a moderator, comparing across reading comprehension, fluency, and accuracy. Second, the average **age** of participants in each sample (as a continuous measure) was investigated as a moderator. Additionally, each effect size was categorized into age groups (i.e., early elementary school [kindergarten through 2<sup>nd</sup> grade/5-7 years old], late elementary school [3<sup>rd</sup> through 5<sup>th</sup> grade/ 8-10 years old], middle school [6<sup>th</sup> through 7<sup>th</sup> grade/12-13 years old], high school [9<sup>th</sup> through 12<sup>th</sup> grade/14-18 years old], adulthood/over 18 years old). **Gender** was coded as the percentage of each sample that was male. **Disability status** was investigated as a moderator by the percentage of each sample that was reported to have a learning disability as well as an additional moderator analysis for the percentage of each sample classified as struggling readers. In the cases in which categorical variables (e.g., reading domain and age group) were found to be significant, dummy coding was used to conduct pairwise comparisons. The following additional moderators were investigated and included in the supplemental analyses: (1) study quality, the (2) measure creation (i.e., was it an existing reading anxiety measure, a modification of an existing measure, or a new researcher created measure), (3) measure reliability, and (4) number of items for in the reading anxiety measure, (5) who read the reading anxiety questions, and (8) year of publication.

## **Analytic Plan**

The analytic plan was preregistered, and the analyses were conducted in R statistical software (R Core Team, 2020). The preregistration of the analytic plan and the R code for the analyses are available on our LDbase project page (Johnson et al., 2023 <https://doi.org/10.33009/ldbase.1675106668.fef3>). As a first step, the Pearson correlations were converted to Fisher's  $z$  scores for analysis. Then a random effects model was used to fit the data and determine the average overall effect size. We assumed that the effect sizes included in this meta-analysis were not estimates of a single population effect size but instead were estimates of a distribution of effect sizes in the population. This assumption was examined by investigating the amount of between-study heterogeneity using the  $Q$  statistic and  $I^2$  statistic.

Several studies in our meta-analysis contained multiple correlation coefficients, violating the assumption of independent effect sizes. To account for the dependent nature of these effect sizes, we used robust variance estimation. Robust variance estimation was implemented using the metafor package in R statistical software followed by clubSandwich (Viechtbauer, 2010). Restricted maximum likelihood estimation was used.

## **Publication Bias**

We used several methods to check for potential publication bias. We did this by looking to see if the effect sizes (along with their sample sizes) were distributed symmetrically around the average effect size found. We

first checked this visually, by creating a funnel plot that visually maps the distribution of each effect size by its sample size. We also investigated this statistically using the Egger test.

Next, we did a trim-and-fill to determine how many studies are estimated to be missing from our analysis, specifically studies with small sample sizes and effect sizes. If missing studies were found, we would add in what those missing study effect sizes would be and calculate a new estimate of the average effect size. Finally, we used Fail-Safe-N to determine how many “file drawer” studies (unidentified unpublished studies with small nonsignificant effect sizes) would need to exist for the effect size determined in the current meta-analysis to be nonsignificant and there to be truly no association between reading anxiety and reading achievement. These inspections were used to determine how well the gray literature was covered and if any missing studies were missing in the analysis.

### **Sensitivity Analysis**

Finally, we ran both a random effects model and a fixed effects model. This told us if we had made a different decision to use the other model (the fixed effects model instead of the random effects model) how the different results would have been.

### **Results**

The final analytic sample included 44 studies, totaling 113 effect sizes. There were 9,114 participants across the 44 studies. The largest of the studies had a sample of 1,050 people and the smallest of the studies had a

sample of 6 people. Of the studies included, most (93%) measured reading anxiety as self-reported by participants. Additionally, studies calculated the reading anxiety scores using factor scores ( $k = 2$ ), average scores ( $k = 11$ ), and sum scores ( $k = 25$ ). The included studies were from 9 countries (U.S.  $k = 26$ , Australia  $k = 3$ , Belgium,  $k = 1$ , Brazil  $k = 1$ , Canada  $k = 1$ , China  $k = 4$ , Haiti  $k = 1$ , Israel  $k = 4$ , and Turkey  $k = 3$ ). All studies measured participants' reading achievement and reading anxiety in their first language; across studies there were 7 languages (English  $k = 30$ , Chinese  $k = 4$ , Dutch  $k = 1$ , Haitian Creole  $k = 1$ , Hebrew  $k = 4$ , Portuguese  $k = 1$ , Turkish  $k = 3$ ).

We found an average weighted correlation of  $r = -0.31$  ( $p < 0.001$ ,  $SE = 0.03$ ,  $CI = -0.38$  to  $-0.26$ ), indicating there is a significant negative correlation between reading anxiety and reading achievement. The  $I^2$  was 84.49% meaning that 84.49% of the variability in effect sizes across studies not attributable to sampling error.  $Q$  was 828.77 ( $p < .001$ ,  $df = 112$ ), thus there was significantly more heterogeneity in the effect sizes than would be expected due to sampling error. This finding supported our planned use of the random effects model and of testing to see whether variability in effect sizes across studies was accounted for by moderators.

The results of moderator analyses are reported in Table 1. Participants ranged in age from 6 to 21 years old (mean = 9.95 years old, early elementary school  $k = 10$ , late elementary school  $k = 22$ , middle school  $k = 6$ , high school  $k = 0$ , adult  $k = 5$ ). Age was not a significant

moderator when measured continuously nor by age group (see Table 1). Gender was not a significant moderator of the association between reading anxiety and reading achievement. Only 9 studies reported on what percentage of their sample had learning disabilities and 12 studies reported the percentage of their sample that was classified as struggling readers. Neither the percentage of learning-disabled participants nor struggling readers were found to be significant moderators. None of the supplemental moderators (study quality, creation, reliability, and number of items for the reading anxiety measure, who read the reading anxiety questions, and year of publication) were significant (see supplemental Table s1 on our LDbase page; Johnson et al., <https://doi.org/10.33009/ldbase.1675106668.fef3>).

Reading domain was not a significant moderator (see Table 1). Reading anxiety had an average correlation of -0.33 with reading comprehension ( $k = 39$ ,  $r = -0.32$ ,  $p < .001$ ,  $SE = 0.05$ ), -0.26 with fluency ( $k = 31$ ,  $r = -0.25$ ,  $p < .001$ ,  $SE = 0.04$ ), -0.28 with accuracy ( $k = 20$ ,  $r = -0.27$ ,  $p < .001$ ,  $SE = 0.04$ ), and -0.36 with general reading skills ( $k = 20$ ,  $r = -0.35$ ,  $p < .001$ ,  $SE = 0.06$ ). Reading anxiety was not significantly associated with letter-naming with an effect size of -0.04 ( $r = -0.04$ ,  $p = .30$ ,  $SE = 0.02$ ), however it should be noted that there were only 3 effect sizes for letter naming.

We had originally planned to include all the significant moderators in a meta-regression, however as none of the moderators were found to be significant, a meta-regression was not performed.

### **Publication Bias**

We were systematic in locating any existing unpublished studies to include in this meta-analysis; we were successful in these efforts. In the end 20 out of the 44 included studies (46%) were unpublished (journal publications  $k = 24$ , dissertations  $k = 13$ , unpublished manuscripts  $k = 2$ , raw data  $k = 5$ ). Publication status was not a significant moderator (see Table 1). A funnel plot is presented in Figure 2. It is symmetrical which does not suggest the presence of publication bias. The Egger test was used to statistically test for publication bias. Asymmetry was found using the Egger test ( $z = -2.14$ ,  $p = .033$ ). A forest plot can be found in Figure 3, which displays each effect size with its confidence interval.

Next, trim-and-fill analyses reported an estimated zero studies (specifically studies with low effect sizes and small effect sizes) were missing ( $SE = 0.02$ ). With the trim-and-fill analyses, none of the estimations changed as no studies were found to be missing and then added in that would change the estimations. additionally, the fail-safe-N estimated that 49,259 file drawer studies (unpublished studies with null effects) would need to exist in order for the population effect size to be statistically nonsignificant and there to thus be a null correlation between reading anxiety and reading achievement ( $p < .001$ ).

### **Sensitivity Analysis**

Finally, we ran the main model results again using the fixed effects model (still accounting for dependent effects). The fixed effect model has an average effect size of  $r = -0.25$  ( $p < 0.001$ ,  $SE = 0.05$ ,  $CI = -0.26$  to  $-0.24$ ).

### **Discussion**

Studies of the association between reading anxiety and reading achievement began in the 1980's, but the number of studies has increased rapidly over the past five years, highlighting the recent importance of the relation in the literature. We found a significant, moderate, negative correlation between reading anxiety and reading achievement ( $r = -0.31$ ). Reading anxiety is thought to be experienced at higher levels in situations in which reading is more likely to be paired with a negative stimulus, such as situations in which reading takes more effort or there is increased fear of receiving judgment by others (Maloney et al., 2010). Furthermore, reading anxiety is thought to be associated with reading achievement as it takes up cognitive resources required to read thus making reading harder (Ashcraft & Faust, 1994; Park et al., 2014). Thus, reading anxiety is expected to be more strongly associated with reading achievement in contexts in which reading is more difficult. Thus, we hypothesized that the association between reading anxiety and reading achievement would be moderated by disability status, gender, reading domain, and age. However, in opposition to our hypotheses, all four of these moderators were not statistically significant.



We did not find disability status to be a significant moderator. This was in contradiction to our hypothesis and existing theory that proposed that the association between reading anxiety and reading achievement may be stronger for learning disabled and struggling readers compared to their typically developing peers. Our nonsignificant findings are similar to that of a meta-analysis on reading motivation and reading achievement (Toste et al., 2021), whose authors concluded their nonsignificant moderator by learning disability status should be interpreted with caution as there was likely insufficient power to detect an effect. There currently exists no studies that have directly compared people with and without learning disabilities in their associated reading anxiety and reading achievement. With the existing theoretical reasoning and the current lack of conclusive empirical evidence from our meta-analysis, the learning-disabled population is a clear future direction for the reading anxiety field.

It has been suggested that the association between reading anxiety and reading achievement may be stronger for boys than girls (Pollack et al, 2021). However, with this meta-analysis we found that, reading anxiety does not appear to be differentially associated with the reading achievement of girls versus boys. This aligns with meta-analyses of the correlation between math anxiety and math achievement, that also found gender to not be a significant moderator (Ma, 1999; Barroso et al., 2021). Thus, we conclude that the association between reading anxiety and reading achievement is the same for girl and boys.

With this meta-analysis, we found that reading anxiety is negatively correlated with reading achievement overall, but also specifically with reading comprehension, fluency, and accuracy. It has been theorized that reading anxiety would be more strongly associated with reading comprehension than word reading, as reading comprehension is more cognitively complex than word reading (Elleman & Oslund, 2019). However, contrary to our hypothesis, reading domain was not a significant moderator. It appears reading anxiety is equally associated with reading achievement across reading skills, including their reading comprehension as well as how quickly and accurately they can read words.

We found that age was not a significant a moderator of reading anxiety and reading achievement. However, it is important to note that this finding is based on cross-sectional samples. There currently only exists one longitudinal study on reading anxiety (i.e., Ramirez et al, 2019). In that study, while both directions were significant, beginning-of-the-year reading achievement was a stronger predictor of end-of-year reading anxiety, than vise-versa. To compare alternative theories that explain the association between reading anxiety and reading achievement, additional and ideally multi-year longitudinal studies are needed.

This meta-analysis answers the question of the magnitude of the association between reading anxiety and reading achievement. However, this meta-analysis still leaves unanswered the question of what the direction of the association is between reading anxiety and reading achievement. At

this time there are several leading theories for why low reading achievement may lead to high reading anxiety (reduced competency view) and why high reading anxiety may lead to low reading achievement (Disruption Account). The Poor Reading-Anxiety (PRAX) model posits a bidirectional association between the two, such that low reading achievement leads to high reading anxiety via lowered self-concept and high reading anxiety may lead to low reading achievement via reduced cognitive resources (McArthur 2020). However, a meta-analysis of the association between reading anxiety and reading achievement is not sufficient to distinguish among these three competing views. Multi-year longitudinal studies are a means for future research to build on this meta-analysis and further our understanding of the nature of the association between reading anxiety and reading achievement.

### **Strengths and Limitations**

A strength of this meta-analysis is that it included studies from across the world and studies capturing the variance of reading anxiety occurring in a range of people with varying backgrounds and personal characteristics. From this meta-analysis we observe that variance in reading anxiety occurs across the world populations, including studies conducted in North America, South America, Central America, Asia, Europe, Australia, and the Middle East. In total the studies were from 9 countries and conducted in 7 languages. We went to lengths to contact authors of reading anxiety papers that were not written in English to obtain translations of the results to

include such studies in this meta-analysis. Of course, even with these efforts, it is possible that our search terms would not have picked up on some studies not written in English. We combatted this by searching the references and cited-by lists of all included papers, but it is possible a paper was missed as a result of our search terms being in English.

The whole African continental region is noticeably missing from this meta-analysis. We did make direct efforts to confirm our search results were correct in that there were no existing reading anxiety studies from Africa. We did this by sending out calls on listservs known to be used by reading researchers in Africa and directly contacting several reading researchers in Africa, who confirmed they were unaware of anyone researching reading anxiety in Africa. A major strength of this paper is the range of world regions captured in this study, however more reading anxiety research is needed from the global South, and specifically Africa, in order for our knowledge of reading anxiety to be truly representative of the global population.

With any meta-analysis there is always the possibility that a paper was missed that should have been included. We made all efforts to locate all existing papers on reading anxiety. We did this by searching through the reference lists of all included studies and all studies that cited included studies. Reading anxiety is a quickly growing area of research, thus we made efforts to identify papers that were in progress as well. We were successful in our efforts to locate unpublished studies, with over 40% of our

included studies being unpublished. We are confident that publication bias was not an issue in this meta-analysis, with our trim-and-fill estimating zero studies were missing and our fail-safe-N estimating that there would need to be 49,259 missing studies with null results for our main effect to be nonsignificant.

In our systematic search, we came across many studies that met inclusion criteria but did not provide the required correlations. In line with our preregistered search strategy, we did email the authors of such studies (with a 64% success rate). However, there were 4 studies for which we were unable to obtain the correlations for and thus could not be included despite meeting the inclusion criteria. Our included studies dated back to 1982 and this issue of missing correlations was mainly an issue of these older studies, as the authors for many of these studies had retired.

We investigated the moderators of disability status, gender, reading domain, and age along with the additional moderators of study quality, reliability, and number of questions in the reading anxiety measure, who read the reading anxiety questions, and how the reading anxiety measure was created (included in the supplemental materials. It is possible that there were factors that we did not include that moderate the main effect. For example, we would have liked to investigate socioeconomic status and race as a moderator but were unable to due to the few numbers of studies that reported such information.

## **Conclusion**

Reading achievement is associated with a number of cognitive, linguistic, and socioemotional constructs. Historically there has been greater attention on the cognitive and linguistic factors related to reading achievement. This meta-analysis adds to a growing body of research investigating the socioemotional factors in reading achievement, specifically in the emotions people feel towards reading. Our finding of a correlation of  $r = -0.31$  is in-line with meta-analyses on the positive association of reading achievement with positive reading affect (motivation  $r = .22$ , Toste et al., 2020; attitudes toward reading  $r = .31$ , Petscher, 2010; and engagement  $r = .24$ ; Lindström et al., 2021). Additionally, our effect size is comparable to that found in meta-analyses on math anxiety and math achievement ( $r = -0.28$ ; Barroso et al., 2021). In considering our meta-analysis in the context of these other meta-analyses, reading achievement appears to be moderately correlated ( $r = .22$  to  $.31$ ) with socioemotional factors (positive and negative reading affect) in reading.

We conclude that reading is an emotional experience. People around the world appear to have varying levels of fear towards reading (in the form of reading anxiety). As reading is essential for everyday tasks, being unable to engage in reading due to low reading achievement or high reading anxiety creates an issue of access and would be debilitating. With this meta-analysis, it appears that low reading achievement is associated with higher levels of reading anxiety. Future research is needed to determine how reading anxiety develops alongside reading achievement and how to

support people in their struggles with reading anxiety and reading achievement, so that access to the fundamental skill of reading may be improved. Such efforts will require insights from both the fields of psychology and education, so that we may uncover how to enhance people's reading achievement while maintaining their socioemotional wellbeing.

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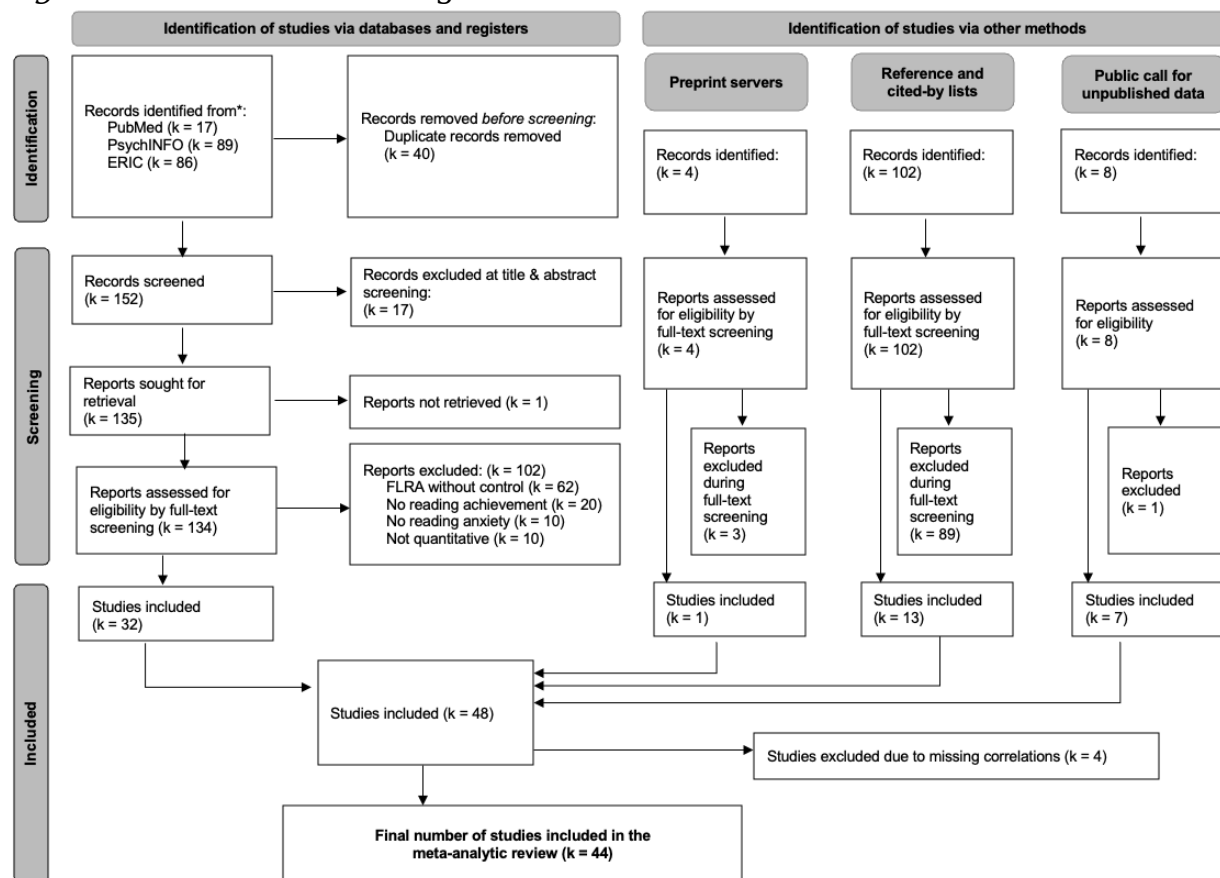
*Table 1.* Moderator effects

	k	F	Estimate	SE	p-value
Age (continuous)	108	0.13	-0.01	0.01	.746
Age group	113	0.61	-0.06	0.07	.376
Gender	102	0.70	<.01	<.01	.732
Reading domain	90	1.60	0.04	0.02	.155
Learning disabilities	27	1.57	<.01	<.01	.23
Struggling readers	36	<.01	<.01	<.01	.95
Publication status	113	0.16	0.03	0.06	.669

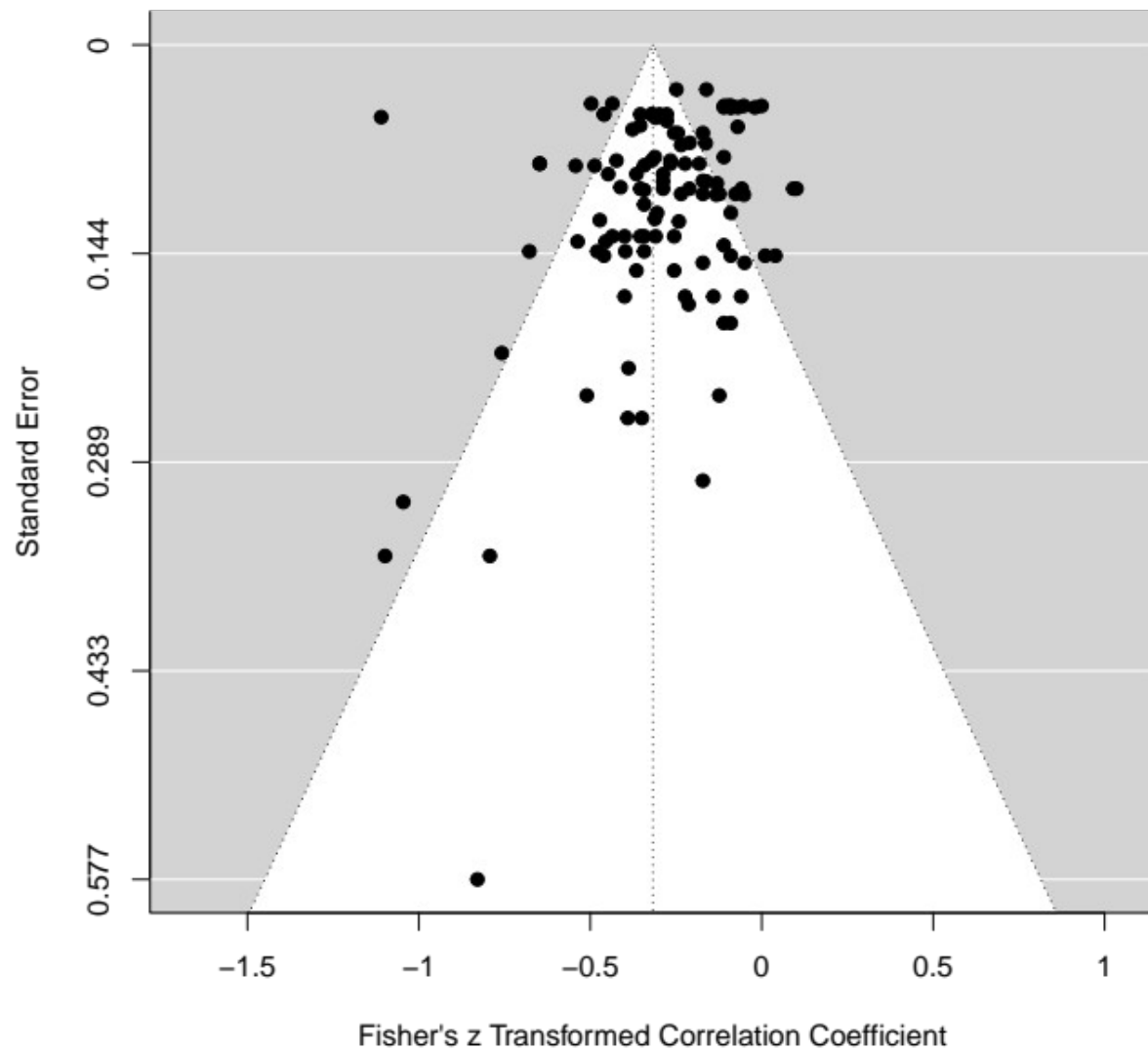
Note: the estimates reported are those after correcting for dependent effect sizes. *k* is number of effect sizes.



Figure 1. PRISMA flow diagram

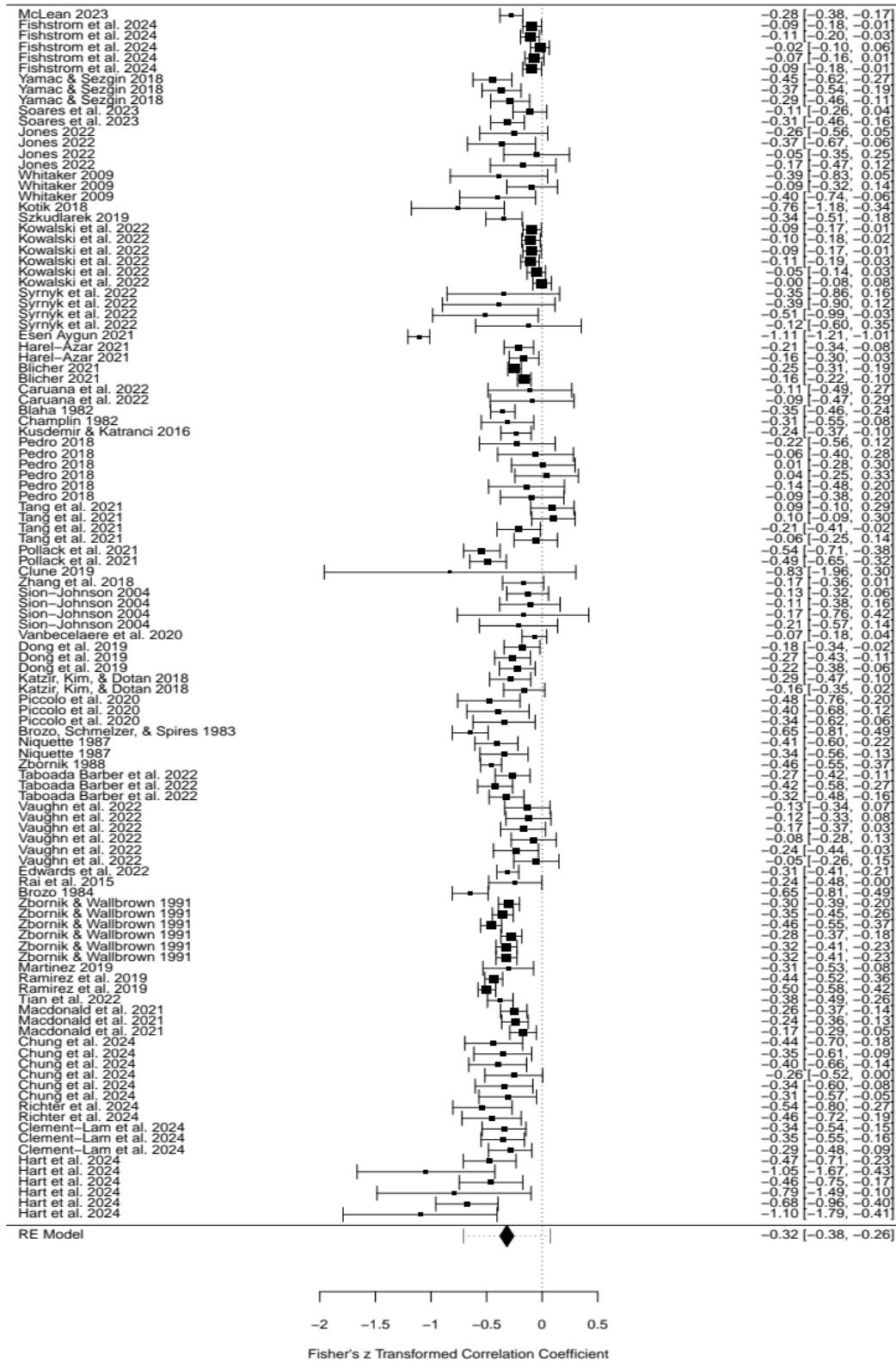


Note: This was the flow of studies through the screening process to determining the studies included in the meta-analysis. Presented is the number of studies ( $k$ ) identified, screened, excluded, and finally included in the final tally at each step and using each method of screening. Template adapted from Page et al. (2021)

*Figure 2. Funnel Plot*

Note: The dotted line is the average effect size. No studies in the bottom left with many studies on the bottom right would indicate potential publication bias; this is not observed here.

Figure 3. Forest plot



Note: The dotted line is the null effect. The size of the black box is the sample size. The black diamond at the bottom is our average effect size. The range on each is the confidence interval.