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The Impact of Motivational Reading Intervention on the Reading Achievement and Motivation of Students: A Systematic Review and Meta-Analysis
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The Impact of Motivational Reading Instruction on the Reading Achievement and Motivation of

Students: A Systematic Review and Meta-Analysis

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Abstract

This systematic review and meta-analysis explores the impact of motivational reading interventions on the reading achievement and reading motivation of school-age students. Results of preliminary searches for- and inspection of- the existing meta-analytic literature suggest that while there exist published meta-analyses on motivational reading interventions, these would benefit from inclusion of more recent research and narrower selection criteria (e.g., inclusion of a non-motivational control group, school-based). A systematic search of previous meta-analyses of motivational reading interventions identified 28 articles meeting inclusion criteria, while a systematic search of individual motivational reading intervention studies (2007-2020) identified a further 21 articles. A meta-analysis of the resulting 49 studies corrected by Hedge's g showed that motivational reading interventions were associated with an effect size of $g = .20$, $p < .001$ on reading achievement outcomes and an effect size of $g = .30$, $p < .001$ on reading motivation outcomes. However, analysis of funnel plots strongly suggested publication bias was present in reporting of reading achievement outcomes. Analysis of moderators indicated that effect sizes varied significantly depending on content approaches to intervention, intensity of training given to intervention providers, study quality, and type of measures used. However, effect sizes did not vary significantly depending on group size or student population (e.g., age, at-risk status). Implications for research and practice are discussed.

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The Impact of Motivational Reading Interventions on the Reading Achievement and Motivation of Students: A

Systematic Review and Meta-Analysis

It has been proposed that reading motivation is associated with reading development. Positive correlations have been

found between reading motivation and achievement (Park, 2011), and reading motivation has been found to

contribute unique variance to growth in reading comprehension when initial comprehension is controlled for

(Taboada, Tonks, Wigfield, & Guthrie, 2009). Intervention research further suggests that targeting motivation

during teaching may increase both reading performance and motivation (van Steensel, van der Sands, & Arends,

2017). For students who struggle with reading, low motivation may exacerbate difficulties, feeding into a cycle of

low achievement and motivation (Morgan, Fuchs, Compton, Cordray, & Fuchs, 2008). In line with this, it has been

suggested that to foster reading development, effective instruction should address both the cognitive and

motivational aspects of reading acquisition (Nelson & Manset-Williamson, 2006).

Various theories of motivation have sought to explain how motivation impacts achievement. Proponents of

Self-Determination Theory argue that for individuals to be motivated, they must be given opportunities to feel

autonomous, competent, and related to their environment (e.g., through strong teacher-student relationships) (Deci

& Ryan, 1985). Expectancy-Value Theory argues that individuals are motivated when they both expect to succeed

and see value in the tasks they are pursuing (Eccles et al., 1983). Goal orientation and attribution theories, for their

part, extend the understanding of motivation by arguing that students' achievement goals (e.g., whether they are

driven by a desire to master material or by competition) and attribution beliefs (e.g., whether they attribute success

to innate ability or to effort) contribute to motivation (Pintrich & Schunk, 1996). Interventions that aim to foster

motivation have done so by targeting one or more of the key motivational components identified by various theories,

including goals, attributions, self-efficacy beliefs, and value for reading.

The Need for Updated Meta-Analyses of Motivational Reading Interventions

The field of reading motivation research suggests that early declines in motivation may feed into a cycle of

low motivation and achievement (Morgan et al., 2008), emphasizing the need for instruction which fosters reading

motivation during school years. Intervention research provides the strongest test of the effectiveness of instructional

methods. A growing body of intervention research has examined the impact of motivational reading instruction on

reading outcomes, with promising results (Guthrie, McRae & Klauda, 2007). Among these investigations, a range of

different approaches to fostering reading motivation have been proposed (e.g., self-regulatory instruction, attribution training), justifying the need for research which synthesizes findings.

A review of the literature identified four previous meta-analyses which have sought to synthesize findings from intervention research on motivational practices in reading instruction (Dignath & Büttner, 2008; Guthrie et al., 2007; Unrau et al., 2017; van Steensel et al., 2017). However, both Dignath and Büttner (2008) and Guthrie et al. (2007) were published more than ten years ago, during which time novel approaches to motivational reading instruction are likely to have been proposed and evaluated. While van Steensel et al. (2017) and Unrau et al. (2017) include more recent studies, van Steensel's (2017) meta-analysis remains as of yet unpublished in a peer-reviewed format, and Unrau et al. (2017) examined the impact of reading interventions on self-efficacy beliefs, but not on other motivational outcomes. Further, several methodological issues justify the need for a new meta-analysis: all four reviews included studies which either did not include a non-motivational control group or did not specifically target a motivational construct during intervention (i.e., targeted only skills), while Dignath and Büttner (2008), Guthrie et al. (2007), and Unrau et al. (2017) all included studies which were not Randomised Control Trials (RCTs) or quasi-experimental designs (QEDs). While this has allowed previous meta-analyses to report associations between motivational instruction and reading outcomes, it limits their ability to causally examine the impact of motivational reading instruction. To establish an overall effect size of the impact of motivational reading intervention, further meta-analyses limited to studies reporting results from RCTs or QEDs that include a non-motivational control group are needed. Thus, this paper sought to contribute to the literature of reading motivation by presenting results from an updated systematic review and meta-analysis of motivational reading interventions for students of school-age (K-12). It sought to assess the impact of motivational reading interventions on reading achievement and motivation and to identify characteristics of effective interventions. To do so, the following questions were addressed:

(1) What are the characteristics of studies assessing motivation reading interventions (e.g., sample type, content approach, theoretical frameworks, etc.)?

(2) What is the impact of motivational reading interventions on reading achievement?

(3) What is the impact of motivational reading interventions on reading motivation?

(4) Which characteristics of motivational reading interventions moderate their impact on reading achievement and motivation?

Meta-Analysis: Motivational Reading Interventions

Method

Tertiary systematic review. First, a search of existing meta-analyses on motivational approaches to reading instruction was conducted. Meta-analyses have been argued to provide rigorous data because of the consistency in selection processes, evaluation of selected research, and synthesis of multiple information sources (Mulrow, 1994). An initial search was conducted on databases of systematic reviews and meta-analyses, including "The What Works Clearing House", "The EPPI Center", and "The Campbell Collaboration Library", as well as on "PyscInfo" and "ERIC", using the following search terms: set 1 - "meta-analysis", paired with set 2 - "intervention" OR "school-based intervention", set 3 - "motivation", "interest", "self-efficacy", "intrinsic motivation", "achievement motivation", "academic achievement motivation", and set 4 "reading", "dyslexia", "literacy", "reading comprehension", "reading achievement". As it has been argued that reading motivation may have the greatest impact on the reading outcomes of students with reading difficulties (Morgan et al., 2008), "dyslexia" was included as a search term in order to identify studies which examined the impact of motivational instruction on the reading of students at-risk for reading difficulties, in addition to studies with a general student population. Search terms were combined using the Boolean search terms "OR" within each set and "AND" between each set. Eligibility of meta-analyses was assessed using the following inclusion and exclusion criteria for the studies included in their samples. These were guided by the EPPI Center's guidelines for piloting systematic reviews.

Inclusion criteria.

- Studies that assessed motivational interventions for reading instruction

- Studies that measured the impact of interventions on reading skill (phonological awareness, fluency, vocabulary, reading comprehension) and/or reading motivation (self-efficacy, value for reading, intrinsic motivation, overall motivation)

- Studies whose research design included RCTs or QEDs

- Studies whose samples included students in grades K-12 (ages 5 to 18)

- Studies that provided data allowing effect sizes to be calculated for pre- to post-test gains across conditions (e.g., means and standard deviations for both intervention and control conditions, t-test statistics, F-test statistics).

Exclusion Criteria.

- Studies that were not school-based

- Non-intervention studies, qualitative studies, single participant studies, ABA designs, other matched studies

- Studies that did not address subcomponents of motivation directly

- Studies focused on other academic subjects (e.g., science, math)

- Studies that did not include a control group

- Studies that did not include students of school age (grades K-12)

- Studies that did not provide data allowing calculation of effect sizes of pre- to post-gains across conditions

Search procedures. The initial search identified three meta-analyses from ERIC: Guthrie et al. (2007), Dignath and Büttner (2008), and Unrau et al. (2017). As the search only returned three articles, it was broadened to include meta-analyses presented at conferences. Through this procedure, a fourth meta-analysis was identified from the proceedings of the 24th annual meeting of the Society for the Scientific Study of Reading and a follow-up search of the author's biographical page: van Steensel et al. (2017).

Meta-analyses. Guthrie et al. (2007) conducted a meta-analysis of 10 studies investigating the impact of Concept-Oriented Reading Instruction (CORI) on motivational processes, cognitive abilities, and reading comprehension of students in upper elementary grades. CORI is a reading program based on self-determination theory, social cognitive theory, and goal theory, which draws upon five instructional practices to promote motivation: (1) relevance (2) choice (3) success (4) collaboration, and (5) thematic units. The authors reported a mean effect size of $d = 0.30$ on combined measures of reading motivation, including curiosity, self-efficacy, and time spent reading for pleasure. The mean effect size reported for reading comprehension was $d = 0.91$ based on five studies that included standardized tests of reading comprehension. Three studies could not be retrieved (i.e., 2 conference proceedings and 1 submitted but unpublished paper).

Dignath and Büttner (2008) reviewed 74 intervention studies which aimed to foster self-regulated learning at the primary and secondary level, including 26 studies that included reading and/or writing outcomes. The aim of self-regulatory instruction being to foster students' autonomy and self-efficacy beliefs, it was deemed to be within the scope of motivational instruction. The mean effect of self-regulation interventions on academic reading and writing performance was $d = 0.44$ for primary school students and $d = 0.92$ for high school students. The mean effect size on general academic motivation was $d = 0.75$. Two studies were redundant with Guthrie et al. (2007), five studies were in German, and one study could not be retrieved.

van Steensel et al. (2017) conducted a meta-analysis of 88 intervention studies examining the impact of motivational interventions on the reading outcomes of students of primary and secondary school age. The authors identified positive effects on both reading motivation, $d = 0.28$, and reading comprehension, $d = 0.40$. Moderator analyses indicated that interventions which supported interest, autonomy, social motivation, and goal setting had the greatest effects on reading comprehension. Nine of these studies were redundant with those identified by Dignath & Büttner (2008) and Guthrie et al. (2007).

Finally, Unrau et al. (2017) conducted a meta-analysis of 30 studies examining the impact of reading interventions on reading self-efficacy. The authors reported an overall effect size of $g = 0.33$ on reading self-efficacy. The analysis included studies among students in elementary school through college, including 19 studies with a treatment and control group design whose sample included students in grades K-12. Four studies were redundant with Guthrie et al. (2007), Dignath and Büttner (2008), and/or van Steensel et al. (2017).

The initial search identified 119 studies. To ensure the search comprehensively identified motivational approaches to reading instruction, it was further extended to individual studies.

Research article search. To further identify relevant articles, a literature search of well-executed individual studies was conducted. The same inclusion criteria as those to identify meta-analyses were used, with the additional inclusion of a limited time frame (2007-2020). A PRISMA flow diagram summarizing inclusion, search, and coding procedures is provided in Figure 1. Articles were restricted to those published in English after 2007 to update findings from previous meta-analyses of motivational interventions by Guthrie et al. (2007) and Dignath & Büttner (2008). Included articles were restricted to RCTs and QED designs, which have been argued to be the most rigorous for assessing the efficacy of interventions (Torgerson, 2003). The search was conducted within three main educational databases; ERIC (242), PsycInfo (33), and Education Full Text (48), in May 2020. The following search terms were used: set 1 - "motivation", "interest", "intrinsic motivation", "achievement motivation", "academic achievement motivation", "self-efficacy", paired with set 2 - "intervention", "school-based intervention" and set 3 - "reading", "dyslexia", "literacy", "reading comprehension", "reading achievement". Search terms were combined using the Boolean search terms "OR" within each set and "AND" between each set. After screening for duplicates and triplicates, this search process identified 301 articles. Hand searches of journals relevant to research in reading instruction were then conducted. After screening titles and removing duplicates, this identified a further 8 articles. The search was widened to include unpublished theses and dissertations, using the same databases, which identified

a further 144 articles once duplicates and triplicates were removed. Finally, reference lists of selected articles were examined to identify further relevant articles. A further 27 articles were identified based on titles. Articles identified through individual article searches, hand-searching of relevant journals unpublished dissertations and snowballing of reference lists were combined with the 119 studies identified from previous meta-analyses, leading to a combined sample of 599 articles.

Coding procedures. Titles and abstracts were screened only by the primary researcher. Articles were excluded if they met one or more of the following criteria: didn't concern reading, didn't describe an intervention, wasn't a QED or RCT, didn't concern students in grades K-12, not school-based. The majority of articles were excluded because they did not concern reading and/or did not describe an intervention, and most articles that were excluded during this process met more than one of the criteria above. Based on this screening process, 111 articles were selected to be included in the full text-review. The primary author coded all 111 articles for inclusion/exclusion criteria. The second author independently coded 25% of all inspected articles to establish reliability. The inter-rater kappa for inclusion and exclusion criteria was = 1, showing perfect agreement. A sample of 49 articles met inclusion criteria, including 15 RCTs and 34 QEDs.

Coding included articles for quality. The 49 included articles were first coded for quality, based on guidelines from CONSORT (Consolidated Standards for Reporting Trials; CONSORT, 2010). Following these guidelines, it was assessed whether the study reported (1) method of allocation (e.g., randomization, cluster randomization), (2) sample size justification or power estimate, (3) Intention to Treat Analysis (ITT; i.e., if the groups were statistically analyzed according to the original n, disregarding subsequent attrition), (4) blinded assessment of outcome, (5) a description of training or professional development, (6) evidence of reliability and validity, and (7) assessment of treatment integrity. The first author coded all 49 articles, and the second author independently coded 40% of these to establish inter-rater reliability. The coding reliability kappa was 0.81. 70% of disagreements were related to differences in operationalization of key terms such as evidence of treatment integrity, reliability, or training. Differences in operationalization were resolved through discussion, and papers where subsequently reanalyzed by both coders. The remaining 30% of disagreements were resolved by identifying the evidence for a specific decision until consensus was reached. Only two studies included justification of sample size, five described ITT, six described blinding of outcomes, and 19 provided strong evidence of reliability or validity.

Most described sampling procedures, all provided statistical evidence of impact on outcomes, and more than half provided evidence of training and/or treatment fidelity. Quality is summarized in Appendix A.

The second analysis conducted to ascertain the quality of the studies was the Weight of Evidence (WOE) analysis. WOE is a global quality assessment whose aim is to identify whether studies fit the inclusion criteria for a meta-analysis and answer the question addressed by the meta-analysis (Gough, 2007). The WOE analysis evaluates study quality based on three questions: (WOE A) *Did the reported findings answer the research question in the study and was it internally consistent?;* (WOE B) *Did the author design their research appropriately for the review questions?;* and (WOE C) *Is the focus of the study relevant to the review question?* Answers to WOE A, B, and C are used to determine the study's overall rating, called WOE D, which can be "high", "medium", or "low". WOE D is obtained by calculating the average score for WOE A, B, and C. However, if a study receives a "low" rating on WOE A, it is rated as "low" on WOE D. Formal inter-rater analysis was again conducted on 40% of all articles. Comparison of individual scores produced a reliability kappa of 0.87. Disagreements mainly concerned discrepancies in the concepts behind WOE questions (i.e., overall fit vs. methodological quality). These were resolved by discussion, referring to the source of decision in the initial paper, and re-analysis by both coders until consensus was reached. Following analysis, 13 studies were rated Low WOE, 34 Medium WOE, and two High WOE. All studies provided appropriate statistical analyses of their impact on reading outcomes, however most studies lacked one or more elements of design that would qualify them for a high empirical rating. WOE ratings are presented in Appendix B.

Outcome measures. The present analysis sought to assess the impact of motivational interventions on reading achievement and motivation. Studies reported a range of reading motivation and reading achievement outcomes, which were grouped into two overarching outcome categories: (1) reading achievement and (2) reading motivation. 109 effect sizes were reported for reading achievement (including 68 effect sizes for reading comprehension, 20 effect sizes for fluency, 11 for reading accuracy, 7 for phonological awareness, and 3 for a more general reading measure, that provides a score based on performance on multiple reading tasks), and 57 effect sizes were reported for reading motivation (including 10 for intrinsic motivation, 20 for self-efficacy, 14 for value, and 13 for overall motivation). Intrinsic motivation was defined as motivation that is internally driven (i.e., reading for the sake of reading itself), and was operationalized in different ways (e.g., as a composite of reading efficacy, challenge, curiosity, involvement and importance, or as a composite of stimulation, accomplishment, and knowledge). Self-

efficacy was defined as beliefs in one's ability as a reader and was measured using e.g., a Likert scale rating of how capable students felt completing a task. Value was defined as importance placed on reading, and included measures evaluating both interest and/or attitudes towards reading. Finally, overall motivation was measured using assessments that measured a combination of intrinsic and extrinsic motivation, self-efficacy and social motivation. Overall effect sizes, confidence intervals, Z values and p values for each study are reported in Table 1. Specific outcome measures for each study and associated effect sizes are presented in Appendix C.

Candidate moderators. Candidate moderators were identified by looking at moderators frequently used within the selected sample of studies: Content approaches to motivational intervention, Group size, Type of instructor, Level of training, Experimental design, Type of measure, Study quality, Student sample, and Student age. Interventions were delivered during whole-class teaching in 30 studies and in small groups for 18 studies. One study did not specify group size. In 27 studies, the intervention was delivered by the classroom teacher, in 17 studies it was delivered by a researcher (either the primary author, research assistants, and/or outside trainers), while in three studies it was delivered by a mix of teachers and researchers. Two studies did not provide data on who delivered the intervention. Of the 34 studies that described the training process for intervention providers, 17 described intensive training (e.g., over more than 2 weeks) and 17 described short training (e.g., over the course of a single session/day). Of the 45 papers that assessed achievement, 28 used standardized measures and 17 used researcher-developed measures. Of the 30 papers that assessed motivation, 16 used standardized measures and 14 used researcher-developed measures. The samples of 30 papers included a general student population (including both students who were typically-developing as readers and students at-risk for reading difficulties), 18 studies included only students at-risk for reading difficulties, and one study did not specify the type of students in the sample. Most studies defined being at-risk for reading difficulties as showing delays in reading development (e.g., scoring at least two grade levels below their current grade). Three studies only included high school students, six included both elementary school students, and the remaining 38 included only elementary students. To compare the effects between educational levels, only high school and elementary samples were contrasted in moderator analyses. Only three studies were dissertations, and only two of these measured both motivation and achievement outcomes. Thus, publication status was not included as a moderator. Characteristics of studies are described in Appendix D.

Content approaches to motivational intervention. Diverse approaches to motivational intervention were found within the sample of reviewed studies. The most frequently used approach was self-regulatory instruction

(used in 14 studies). Interventions using self-regulatory instruction trained students to use cognitive and/or metacognitive strategies, as well as plan, monitor and evaluate their learning and/or motivation (e.g., using goal setting, progress tracking). Six studies evaluated the impact of motivational practices aiming to enhance student interest, including studies that used authentic or interesting texts or enhanced relevance through hands-on activities (e.g., science experiments, readers' theater). Five studies examined the impact of achievement goal/attribution training approaches, which trained students to see success or failure as due to factors within their control (e.g., by teaching them to recognize positive vs. negative talk or use self-talk, or through providing process-oriented feedback). The remaining 24 studies assessed the impact of motivational interventions that combined multiple approaches, including seven studies that evaluated CORI specifically and 17 studies that incorporated the above and/or autonomy-supportive practices (e.g., giving students choice over texts to read, enrichment activities, or formats in which they can demonstrate knowledge).

Theoretical background. Of the final sample of 49 articles, 19 studies mentioned using one or more theory of motivation as a framework, including seven that mentioned Self-Determination Theory (SDT), five that mentioned Goal Theory, four that cited the Reading Engagement Model, two that mentioned Expectancy-Value Theory (EVT), two that mentioned Motivation Theory broadly speaking, two that mentioned Attribution Theory, and one that mentioned the Goal Congruence Model. The remaining 30 articles made no mention of motivational theory. Of studies that did include a motivational theory, the majority did not comprehensively describe how theory guided instructional design or interpretation of results, making it difficult to compare the benefits of various theoretical approaches to one another. One notable exception are studies that assessed CORI, which has a thorough theoretical concept (detailed above).

Training length. The shortest interventions were delivered by Zentall and Lee, (2012) and Schaffner and Schiefele (2007), who both trained students during a single session. The longest interventions involved training students over a full academic year. The remainder of interventions lasted between 2 weeks and 6 months.

Sample size. Sample sizes ranged from small ($n = 22$) to large ($n = 2019$), with an average of $n = 275$. The largest sample size was reported by Little et al. (2014) with 2019 students (treatment $n = 1188$, control $n = 831$).

Meta-analysis

First, effect sizes were calculated for all included studies using the standardized mean differences method, to estimate the difference in pre- to post-test changes between treatment and control conditions. To obtain an

impartial assessment of effect size, these were converted to the Hedge's g statistic (Borenstein, Hedges, Higgins, & Rothstein, 2011). Included effect sizes were those which assessed reading achievement (reading comprehension, fluency, accuracy, phonological awareness, and overall reading) and those which assessed reading motivation (intrinsic motivation, reading self-efficacy, value for reading, overall reading motivation). When multiple contrasts were included in a study, only contrasts between motivational conditions and non-motivational conditions were included. Analyses were conducted using the ProMeta3 software for meta-analysis (available in the public domain by IDoStatistics; https://idostatistics.com/prometa3/) using a random-effect model. Random-effect models assume that effect sizes are comparable among studies, in contrast to fixed-effect models which assume effect sizes are uniform across studies (Morris, 2008).

Many of the studies measured the effectiveness of motivational interventions through several instruments measuring multiple constructs. Statistically dependent effect sizes may be present in studies which measure multiple effect sizes using the same sample (e.g., including multiple measures of reading comprehension, or several subscales of motivation rather than an overall scale) or when multiple effect sizes for different treatment conditions compared to the same control group are calculated. To avoid studies with multiple effect sizes having a larger impact on the analysis, effect sizes were aggregated per study and per construct (Slavin, 1996) using ProMeta3's "combine for analysis" function.

Publication bias. Journals are typically more likely to accept studies with significant results and reject those with non-significant results, which may lead to an overestimation of the true effect size, or publication bias (Torgerson, 2003). To assess publication bias, a funnel plot of effect sizes was created for both outcomes, with effect size placed on the x axis and standard error placed on the y axis (see Figures 2 and 3). On both figures, standard error is represented using an inverse scale (i.e., studies with larger standard errors at the bottom and those with smaller standard errors at the top). For reading motivation, the funnel plot indicates that studies with smaller standard errors yielded a range of effect sizes on either side of g = zero, whereas those with largest effect sizes tended to show effect sizes clustered near g = zero. Thus, it was concluded that the studies in the present meta-analyses showed no evidence of publication bias. However, for reading achievement, the funnel plot indicates that while larger studies (i.e., those with a low standard error) tend to cluster near to g = zero, small and medium-sized studies (i.e., those with a higher standard error) tend to have positive effect sizes far from g = zero, including some

with large and unrepresentative effect sizes. This indicates that publication bias was present for reading achievement outcomes in the studies included in the meta-analysis.

Results

    Reading achievement. A first meta-analysis was run including effect sizes for all reading achievement measures. Results of the analysis showed that the studies were heterogeneous, $Q = 175.09$, $df = 43$, $p < .001$. All effect sizes were positive. The smallest effect size was $g = 0.02$, and the largest was $g = 1.59$. The overall observed effect size reported was $g = 0.37$ ($CI = .29-.45$), $SE = .04$, $p < .001$. To reduce the impact of publication bias, Duval and Tweedie's (2000) trim and fill method was applied to estimate the true effect size, using ProMeta's trim and fill function. The trim and fill method aims to reduce funnel plot asymmetry caused by underreporting of non-significant or negative effect sizes by removing effect sizes from one side of the funnel plot until symmetry is achieved, and then filling the funnel plot back in using imputed observations (Duval & Tweedie, 2000). This process occurs iteratively, until the analysis estimates no more missing effect sizes are present. It has been deemed appropriate in small meta-analytic data sets, under the strict assumption that the missing studies are those with the smallest or most negative effect sizes (Vevea & Woods, 2005). The funnel plot for reading achievement outcomes showed asymmetry with a rightward bias, suggesting underreporting of small or negative effect sizes. The trim and fill analysis trimmed 15 studies, and yielded an estimated unbiased effect size of $g = .20$ ($CI = .11-.29$), $SE = .05$, $p < .001$.

    Comparison of moderators indicated that the impact of intervention on reading achievement varied significantly depending on intensity of training provided to interventionists, $Q = 5.89$, $df = 1$, $p = .015$. Larger effect sizes were found for studies that included intensive training ($g = .40$, $CI = .25 - .56$, $SE = .08$, $p < .001$) than for those that did a short training ($g = .18$, $CI = .08 - .27$, $SE = .05$, $p = .001$). Results varied significantly depending on type of measure used, $Q = 20.21$, $df = 1$, $p < .001$, with larger effect sizes found for researcher-developed tools ($g = .70$, $CI = .50-.89$, $SE = .10$, $p < .001$) than for standardized tools ($g = .21$, $CI = .15-.28$, $SE = .03$, $p < .001$). There was also a significant difference in effect sizes for reading achievement depending on WOE quality, $Q = 27.66$, $df = 2$, $p < .001$, with larger effect sizes found for studies with Low WOE quality ($g = .51$, $CI = .33-.70$, $SE = .10$, $p < .001$) and Medium WOE quality ($g = .34$, $CI = .24-.45$, $SE = .05$, $p < .001$), than for those with High WOE quality ($g = .09$, $CI = .03-.16$, $SE = .03$, $p = .005$). While all content approaches to motivational intervention yielded significant effects on reading achievement, there was a significant difference in effect sizes depending on content approach to

motivational intervention (Q = 11.26, df = 3, p = .010). Largest effect sizes were found for studies using attribution training (g = .78, CI = .46-1.10, SE = .16, p < .000) and interest-based practices (g = .65, CI = .27-1.03, SE = .19, p = .001), while smaller effect sizes were present for studies using self-regulatory instruction (g = .35, CI = .21-.48, SE = .07, p < .000) or the more general multi-component type of intervention (g = .28, CI = .17-.38, SE = .07, p < .000). No significant differences were observed depending on group size (Q = 1.20, df = 1, p = .27), whether students were in high school or elementary school (Q = 1.33, df = 1, p = .249), whether or not the study cited a theory of motivation (Q = .02, df = 1, p = .882), type of instructor (Q = 5.02, df = 2, p = .081), publication type (Q = 1.90, df = 1, p = .168), experimental design (Q = 3.37, df = 1, p = .066), or type of students included in the sample (Q = .07, df = 1, p = .796).

An overall effect size was calculated by combining all achievement measures. Analyses conducted for individual achievement components indicated that motivational interventions had a significant overall effect on reading comprehension (g = .40, CI =.31 - .50, SE = .05, p < .001), fluency (g = .21, CI =.08 - .34, SE = .07, p < .001), word reading/accuracy (g = .24, CI =.07 - .40, SE = .08, p = .005), and overall reading (g = .13, CI = .03-.23, SE = .05, p = .012), and a small but non-significant effect on phonological awareness (g = .20, CI = -.03 - .44, SE = .12, p = .092).

Reading motivation. A second meta-analysis was run including all reading motivation measures. Final results of the analysis showed that the studies were heterogenous, Q = 103.78, df = 27, p < .001. All effect sizes were positive. The smallest effect size was g = .00, and the largest was g = 1.96. The overall effect size reported was g = .30 (CI = .20-.41), SE = .05, p < .001.

Moderator analyses indicated there was a significant difference in effect sizes for reading motivation depending on WOE quality, Q = 16.41, df = 2, p < .001. Larger effect sizes were found for studies with a Medium WOE quality (g = .41, CI = .26-.56, SE = .08, p < .001) than for those with High WOE (g = .24, CI = .11-.36, SE = .07, p < .001) or Low WOE quality (g = .07, CI = -.02-.15, SE = .04, p = .112). Study design was found to significantly moderate effect sizes, Q = 6.49, df = 1, p = .011, with larger effect sizes for quasi-experimental studies (g = .42, CI = .24-.59, SE = .09, p < .001) than for randomized control trials (g = .17, CI = .11-.24, SE = .03, p < .001). The content approach to intervention had a significant impact on effect sizes for reading motivation (Q = 10.61, df = 3, p = .014). All content approaches to intervention had an impact on reading motivation, with effect sizes of g = 1.35, CI = .13-2.57, SE = .62, p = .030 for attribution training, g = .37, CI = .22-.51, SE = .07, p = .001

for the general type of multi-component intervention, $g = .15$, $CI = -.01$-$.30$, $SE = .07$, $p = .042$ for interest-based interventions, and $g = .13$, $CI = -.04$-$.23$, $SE = .05$, $p = .007$ for self-regulatory interventions. No significant differences were observed depending on whether or not a theoretical framework was cited ($Q = .00$, $df = 1$, $p = .944$), group size ($Q = 1.69$, $df = 1$, $p = .194$), intensity of training ($Q = 1.65$, $df = 1$, $p = .199$), whether students were in elementary or high school ($Q = .04$, $df = 1$, $p = .849$), instructor ($Q = 2.50$, $df = 1$, $p = .11$), type of measure used ($Q = .18$, $df = .1$, $p = .672$), or type of students included in the sample ($Q = .84$, $df = 1$, $p = .359$).

An overall effect size was calculated by combining all motivation outcomes. Analyses conducted on each measure of motivation indicated that motivational interventions had a significant overall effect on self-efficacy ($g = .29$, $CI = .13$ - $.45$, $SE = .08$, $p < .001$), value ($g = .27$, $CI = .10$ - $.43$, $SE = .09$, $p = .002$), and overall motivation ($g = .43$, $CI = .24$ - $.62$, $SE = .10$, $p < .001$), and a non-significant effect on intrinsic motivation ($g = .17$, $CI = -.03$ - $.38$, $SE = .11$, $p = .100$).

Reading motivation and achievement. Of the 24 studies that included both motivation and achievement outcomes, only four conducted a mediation or correlation analysis examining the relationship between motivation and achievement outcomes (Aro et al., 2018; Schunk and Rice, 1989; Orkin, 2013; Spörer and Schünemann, 2014). Aro et al. (2018) found that changes in self-efficacy beliefs about reading fluency accounted for significant variation in reading fluency gains from pre- to post-test among students having received a self-efficacy intervention, while Schunk and Rice (1989) found positive correlations between post-test efficacy and reading comprehension. Orkin (2013) further found a positive relationship between students' goal orientations, self-reported motivation and phonemic awareness. Conversely, Spörer and Schünemann (2014) did not find any significant mediation effects of motivation on reading comprehension. To further evaluate the relationship between motivation and achievement outcomes, a regression analysis was conducted with effect sizes for motivation included as a moderator in the 24 studies that reported both types of outcomes. Results of the regression analysis indicated no significant association between effects on motivation and effects on achievement, $F(1, 20) = 3.22$, $p = .088$, $r^2 = .139$.

Discussion

The systematic review and meta-analysis presented here sought to describe the characteristics of motivational reading interventions, evaluate the impact of such interventions on the reading achievement and motivation of school-aged students, and examine which characteristics of interventions moderate their impact. A review of previous meta-analyses of motivational reading interventions identified several gaps, including

methodological concerns and the need for inclusion of more recent research. The present research aimed to provide an updated synthesis of findings from the intervention literature on motivational reading practices in school-aged students. Well-designed intervention studies were identified through a thorough search of the motivational intervention field. Analysis of all effect sizes showed an overall estimated effect size of $g = .20$ on reading achievement, which was significantly different from zero at $p < .0001$, and an overall effect size of $g = .30$ on reading motivation, which was significantly different from zero at $p < .001$.

It is worth noting that for reading achievement outcomes, the most frequent outcome assessed was reading comprehension. This may have somewhat biased results by overestimating effect sizes on other reading achievement outcomes. However, analysis of effect sizes run by type of achievement outcome indicate modest but significant effect sizes on multiple aspects of reading achievement, including fluency, comprehension, and word reading. Additionally, analysis of effect sizes run by type of motivation outcome indicated a significant effect on self-efficacy, value and a more general motivation construct. Interestingly, a significant effect was not found on intrinsic motivation outcomes. It has been argued that intrinsic motivation is a key component of reading motivation, and it has been significantly linked to both reading behaviors (e.g., frequency, strategy use) and achievement (Schiefele, Schaffner, Möller, & Wigfield, 2012). Thus, the finding that motivational interventions led to gains in achievement but not in intrinsic motivation is somewhat surprising. However, as intrinsic motivation is defined as motivation to read that arises from students seeing reading as satisfying in its own right, it is possible that it is less amenable to school-based intervention (i.e., that intrinsic motivation is difficult to significantly increase during intervention taking place in a school context). Additionally, a significant effect was identified on value for reading, which is commonly identified as contributing to intrinsic motivation. It is thus possible that school-based motivational interventions led to gains in some aspects of intrinsic reading motivation, which may in turn have contributed to some of the gains in achievement reported here. While additional meta-analyses examining each subcomponent is needed, this tentatively suggests that motivational interventions may positively impact multiple aspects of both reading achievement and reading motivation.

A review of content approaches to motivational interventions identified several approaches, including self-regulatory instruction, instruction aiming to promote reading interest or value, and instruction aimed at retraining students' attributions to help them adopt a flexible mindset. Additionally, approximately half of the studies in the sample combined multiple approaches to promoting motivation in their interventions, including the above as well as

autonomy-supportive practices. All approaches to motivational intervention yielded significant effects on both achievement and motivation outcomes. While the heterogeneity in the types of approaches used and the small number of studies in each category make it difficult to draw strong conclusions concerning the efficacy of one approach over another (e.g., effect sizes for attribution training are based on only two studies), findings nonetheless suggest that multiple approaches to motivational instruction can support reading development effectively, and support the general argument that addressing both motivational and skills-based components of reading during instruction is more effective than only targeting reading skills (Nelson & Manset-Williamson, 2006). Potentially, intervention programs that integrate these components within a single, cohesive program may have a beneficial outcome on the reading achievement and motivation of students. However, further investigations that compare different single-component approaches to other single- and multi-component approaches are needed to assess this.

Further, analysis of candidate moderators provides some insight into the characteristics of motivational interventions that may modulate their effectiveness. Larger effect sizes were found for achievement for researcher-developed measures than for standardized measures and effect sizes for both motivation and achievement were found to vary significantly depending on study quality. It should be noted that only two of studies included in this sample had a High overall WOE rating. To obtain a High rating, studies had to be internally consistent, appropriately designed for the review questions, and relevant to the questions assessed in this meta-analysis. The lack of High rated studies may limit the generalizability of results and highlights the need for more studies with a rigorous experimental design and validated measures which explicitly examine the impact of motivational practices on reading outcomes. Among studies that described the training process, those with intensive training for intervention providers prior to intervention delivery showed a larger effect on achievement outcomes than those that didn't, emphasizing the need for thorough training to promote optimal outcomes. No significant differences in effects on either achievement or motivation were found depending on group size (i.e., small-group vs. whole classroom interventions), instructor (teachers vs. researchers), type of students in the sample (i.e., general student population vs. only students at-risk for reading difficulties), or age of students (i.e., whether they were in elementary or high school). This tentatively suggests that motivational interventions that are effective in a small-group setting may also be effective when delivered during regular classroom instruction, and that motivational reading instruction may have a beneficial effect on the reading outcomes of students of different ages and reading levels. It should however be noted that only three studies only included high school students.

In interpreting the results presented here, it should also be noted that analysis of the funnel plot for reading achievement outcomes strongly indicated the presence of publication bias (i.e., studies with larger standard errors reported larger effect sizes). Publication bias may reflect under-publication of papers that report non-significant or negative effect sizes, either because these are rejected by editors and reviewers or because these are never submitted in the first place (e.g., Ferguson & Heene, 2012). Lack of inclusion of such results may result in a biased meta-analytic sample that overestimates the true effect size of motivational reading interventions on reading achievement outcomes. The trim and fill correction for publication bias (Duval & Tweedie, 2000) was applied here to provide a better estimate of the true effect size. However, caution should be used in interpreting this effect. Indeed, simulations of different approaches to reducing publication bias in meta-analyses (e.g., trim-and-fill, *p*-curve, *PET-PEESE*) have observed that different approaches yield inconsistent results depending on characteristics of the meta-analytic sample (e.g., sample size, research practices), and that attempts to triangulate different approaches fail to converge on a "true" value (Carter, Shönbrodt, Gervais, & Hilgard, 2019). This lack of consensus in approaches to correct for publication bias makes it difficult to confidently interpret results from meta-analyses that indicate the presence of publication bias. This suggests the effect size reported above for reading achievement outcomes should not be interpreted as being conclusive. Instead, the present results emphasize the need for future research that counters publication bias, e.g., through larger, more robust intervention research and publication of studies with non-significant or negative effect sizes.

Additionally, these findings suggest some lack of integration between theory and practice. Of the 49 papers included in this meta-analysis, only 19 made explicit mention of a motivational theory, and many of those that did mention a theoretical framework did not explicitly state how it was related to instructional design or interpretation. Additionally, multiple theories were cited throughout the literature, including Self-Determination Theory, Expectancy Value Theory, Goal Orientation Theory, and the Reading Engagement Model, with few examples of studies in each category, making it difficult to compare the benefits of one theoretical approach over another. This is in line with a previous review of the empirical literature on reading motivation, which included both correlational and intervention studies, that noted that many empirical investigations into reading motivation fail to specify a guiding theoretical framework, and that among those that do, a wide range of theories and definitions are cited (Conradi, Jang, & McKenna, 2014). While effect sizes were not found to be moderated by whether or not a theoretical framework was cited in the intervention design/interpretation of results, situating results within a

theoretical understanding is nonetheless important to gain insight into the mechanisms through which motivational instruction may impact reading achievement and guide effective practice. Snowling and Hulme (2011), for example, have argued that educational research must strive to create a "virtuous circle" between theory and practice, whereby theory provides recommendations for teaching practices, and empirical evaluations of theoretically-derived practices refine theory.

Finally, the findings presented here contribute to further refining the understanding of the relationship between reading motivation and achievement. Correlational research into reading motivation has suggested that reading motivation and achievement are strongly linked. For example, Morgan and Fuchs (2007) reviewed 15 studies addressing the relationship between reading and students' competency beliefs and goal orientations and found that reading motivation and reading achievement were moderately correlated, while other authors have found that motivation significantly predicts reading growth (e.g., Park, 2011). In contrast to this, the results presented here indicate that interventions that target motivational components of reading have a small effect on reading achievement and motivation outcomes, especially when correcting for the presence of publication bias. This may to a certain extent reflect a difficulty in modulating reading motivation, i.e., that while reading motivation and achievement are moderately linked, interventions' ability to modulate motivation is more modest. Additionally, caution is needed in interpreting gains in reading achievement as being due to gains in reading motivation. To assess this possibility, studies that include mediation analyses are needed. Of the 49 studies that met inclusion criteria, 24 reported both at least one motivation and one achievement outcomes, and only four conducted a mediation analysis. Regression analyses examining the relationship between effect sizes on motivation and effect sizes on achievement in these studies did not indicate a significant relationship between the two, suggesting that motivational interventions' impact on reading achievement may not be directly mediated by its effect on motivation. It is however possible that motivational interventions operated on achievement through their impact on a specific subcomponent of motivation or their impact on other learning behaviors, such as engagement. Engagement was only measured in five of the studies in this sample, meaning a mediation analysis was not possible. This further emphasizes the need for future research includes mediation analyses of various factors that may explain how motivational instruction leads to gains in achievement.

Limitations

Several limitations should be addressed in interpreting results. First, the quality of studies included in the meta-analysis was variable, with most studies rated either Low or Medium on the WOE analysis and the meta-analysis indicated that size of effects varied according to study quality. The variability in study quality may have led to either under- or overestimation of the true effect sizes, and underlines the need for more well-designed, tightly-controlled intervention research assessing the potential of motivational reading instruction. Second, discrepancies in the operationalization of reading motivation may have limited generalizability. In the studies reviewed, a range of motivational constructs were measured, including overall reading motivation, intrinsic motivation, self-efficacy for reading, and value for reading. It is likely that motivational instruction affects these different components in different ways. While differentiated measures of motivation are needed to examine how motivational intervention affects various subcomponents of motivation, additional studies examining the impact of motivational interventions on each of these subcomponents, as well as factorial analyses of how it impacts different subcomponents, is needed to gain a better understanding of the ways in which motivational interventions may impact reading development. Additionally, many of the interventions assessed in these studies include other instructional components that may contribute to both motivation and achievement (e.g., skills instruction, peer relationships, strategy instruction, etc.), making it hard to isolate the impact of motivational instruction per se. To help limit the impact of this, only studies that included a non-motivational control group were included in the sample (i.e., studies where the main contrast was the presence or absence of motivational practices). Nonetheless, it is possible that some non-motivational aspects of interventions also contributed to the effects reported here. Studies that tightly control for this are needed to draw stronger conclusions. In addition, this meta-analysis only included studies who had a quasi-experimental or RCT design, excluding case studies and other single subject designs. It is possible this may have led to greater exclusion of studies with students with special learning needs. However, this criterion was selected to more easily identify best practice and support generalizability of results. Finally, moderator analyses only examined whether effect sizes were moderated by whether the sample included a general student population or only students at-risk for reading difficulties, but not on the outcomes of students with other learning disabilities. This makes it difficult to draw firm conclusions about the effectiveness of motivational reading interventions for students with learning disabilities. Further research examining outcomes specifically in this population is needed to properly assess this.

Conclusions and future directions

Given the links between reading motivation and achievement, instructional practices that support reading motivation have important practical implications. Despite the above limitations, the findings presented here offer support for the potential of motivational reading instruction to improve both reading achievement and reading motivation. They further suggest several avenues that future research into motivational reading instruction should address. First, analysis of different approaches to motivational intervention suggests that several approaches, including self-regulatory instruction, interest-based practices, attribution training, autonomy-supportive practices and various combinations of these, may have beneficial effects on both reading achievement and motivation. Further research that compares the potential of different approaches and combinations of these is needed. Second, analysis of funnel plots suggested that publication bias was present in the reporting of the impact of motivational reading interventions on reading achievement. This highlights the need for larger, more robust intervention studies that better estimate population variance, as well as the need for more robust procedures to ensure publication of studies with non-significant results (e.g., through trial pre-registration). Third, most studies examined the impact of motivational reading intervention on reading comprehension, while relatively fewer examined its effect on other aspect of reading, such as fluency, accuracy, and phonological awareness. Future research that examines the impact of motivational intervention on multiple aspects of reading is needed to better understand the mechanisms through which motivational instruction may contribute to reading development. Finally, analysis of the relationship between gains in motivation and gains in achievement did not yield conclusive results, and a review of interventions indicated that few studies conducted mediation analyses between motivation and achievement. This highlights the need for future research that assesses the impact of motivational interventions on a range of motivational and behavioral components of learning (e.g., engagement, strategy use) and conducts mediation analyses to explore the pathways through which motivational intervention may contribute to reading development.

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Note: Studies marked with an asterisk were included in the meta-analysis

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Table 1.

Effect Sizes, Confidence Intervals, Z Values and p Values for the 49 Studies Included in the Meta-Analysis

Study name	Main outcomes	Hedge's g	Standard error	Variance	Lower limit	Upper Limit	P-Value
Aarnoutse & Schellings (2003)	Reading achievement	.02	.11	.01	-.20	.24	.862
	Reading motivation	.37	.11	.01	.15	.59	.001
Alhababha, Pandian, & Mahfoodh (2016)	Reading achievement	1.59	.28	.08	1.04	2.13	.000
	Reading motivation	.64	.14	.02	.36	.92	.000
Andreassen & Bråten (2011)	Reading achievement	.37	.14	.02	.10	.64	.007
	Reading motivation	.11	.14	.02	-.15	.38	.40
Antoniou & Souvignier (2007)	Reading achievement	.50	.24	.06	.02	.97	.04
	Reading motivation	.05	.24	.06	-.42	.51	.85
Aro et al. (2018)	Reading motivation	.52	.22	.05	.09	.96	.018
Belet Boyaci & Güner (2018)	Reading achievement	1.47	.33	.11	.83	2.12	.000
Benito et al. (1993)	Reading achievement	.79	.38	.14	.05	1.53	.035
Berkeley, Mastropieri, & Scruggs (2011)	Reading achievement	.53	.26	.07	.02	1.03	.040
Borkowski, Weyhing, & Carr (1988)	Reading achievement	.52	.23	.05	.06	.98	.026
Bråten, Johansen, & Strømsø (2015)	Reading achievement	.70	.19	.04	.33	1.08	.000
Cantrell et al. (2014)	Reading motivation	.02	.18	.03	-.34	.38	.918
	Reading achievement	.10	.07	.00	-.04	.23	.158
Cantrell, Almasa, Rintamaa, & Carter (2016)	Reading motivation	.24	.07	.00	.11	.37	.000
	Reading achievement	.12	.05	.00	.02	.23	.015
Cirino et al. (2007)	Reading motivation	.18	.06	.00	.05	.30	.005
	Reading achievement	.49	.25	.06	.00	.97	.049
Cosentino (2017)	Reading achievement	.15	.39	.15	-.61	.92	.694
Denton, Montroy, Zucker, & Cannon (2020)	Reading achievement	.15	.23	.05	-.31	.61	.521
Förster & Souvignier (2014)	Reading achievement	.13	.07	.01	-.01	.27	.061
	Reading motivation	.00	.06	.00	-.12	.12	.944
Guthrie et al. (1999)	Reading achievement	.28	.13	.02	.03	.54	.030
Guthrie et al. (2004)	Reading achievement	.38	.08	.01	.24	.53	.000
	Reading motivation	.37	.11	.01	.16	.58	.001
Guthrie et al. (2009)	Reading achievement	.31	.13	.02	.05	.57	.021

Study	Outcome					
Kettman Klingner, Vaughn, & Schumm (1998)	Reading achievement	.56	.17	.03	.90	.001
Kolić-Vehovec (2002)	Reading achievement	.73	.26	.07	1.24	.005
Little, McCoach, & Reis (2014)	Reading achievement	.09	.04	.00	.17	.017
Loranger (1997)	Reading achievement	.79	.36	.13	1.49	.029
Lutz, Guthrie, & Davis (2006)	Reading achievement	1.12	.25	.06	1.61	.000
Marinak (2013)	Reading motivation	.59	.19	.04	.96	.002
Marshall (2017)	Reading achievement	.10	.31	-.51	.71	.755
	Reading achievement	.59	.39	-.18	1.35	.131
Mason (2004)	Reading motivation	1.33	.27	.80	1.86	.000
	Reading achievement	.12	.30	-.46	.71	.683
Millin & Rinehart (1999)	Reading motivation	.79	.33	.14	1.44	.017
	Reading motivation	.07	.37	-.65	.79	.842
Nevo & Vaknin-Nussbaum (2020)	Reading achievement	1.42	.25	.93	1.92	.000
	Reading motivation	.57	.18	.23	.92	.001
Ng, Bartlett, Chester, & Kersland (2013)	Reading achievement	.35	.21	-.07	.76	.100
	Reading achievement	.09	.31	-.52	.71	.765
Orkin (2013)	Reading achievement	.10	.40	-.67	.88	.792
Orkin (2013)	Reading motivation	.44	.23	-.01	.89	.057
Orkin, Pott, Wolf, May, & Brand (2018)	Reading achievement	.11	.11	-.11	.34	.335
Reis et al. (2007)	Reading achievement	.18	.13	-.08	.44	.176
Reis et al. (2008)	Reading achievement	.07	.07	-.08	.21	.366
	Reading motivation	.03	.09	-.14	.20	.751
Reis et al. (2011)	Reading achievement	.09	.05	.00	.19	.075
Rhew, Piro, Goolkasian, & Cosentino (2008)	Reading motivation	1.96	.30	1.38	2.54	.000
Schaffner & Schiefele (2007)	Reading motivation	.19	.11	-.02	.41	.076
Schünemann, Spörer, & Brunstein (2013)	Reading achievement	.43	.12	.19	.68	.001
	Reading achievement	.29	.12	.04	.53	.021
Schunk & Rice (1989)	Reading achievement	1.07	.38	.32	1.82	.005
Shaunessy-Dedrick et al. (2015)	Reading achievement	.71	.37	-.01	1.43	.054
	Reading achievement	.09	.11	-.13	.30	.44
Souvignier & Mokhlesgerami (2006)	Reading achievement	.22	.10	.02	.42	.03
	Reading motivation	.15	.12	-.08	.39	.204
Spörer & Schünemann (2014)	Reading achievement	.02	.12	-.22	.25	.897
	Reading motivation	.15	.10	-.04	.35	.125
Taboada Barber et al. (2015)	Reading motivation	.29	.18	-.06	.64	.108

Study	Outcome						
Tijms (2018)	Reading achievement	.43	.21	.05	.01	.84	.045
	Reading motivation	.34	.21	.04	-.24	.44	.571
Toste et al. (2017)	Reading achievement	.25	.23	.05	-.19	.69	.270
Toste et al. (2019)	Reading achievement	.19	.16	.03	-.13	.51	.251
	Reading motivation	.10	.17	.03	-.24	.44	.571
Vauras et al. (1999)	Reading achievement	.98	.31	.10	.36	1.59	.002
Wigfield et al. (2008)	Reading achievement	.33	.16	.02	.02	.63	.002
Zentall & Lee (2012)	Reading achievement	1.08	.21	.04	.67	1.48	.000

Identification

Studies identified from meta-analyses: 119
Studies identified from research databases (ERIC, PsychInfo, Education Full Text): 373
n = 492

Additional studies identified through hand searches of relevant journals (Scientific Studies of Reading, Reading & Writing, Journal of Research in Reading, Journal of Educational Psychology, Journal of Learning Disabilities, Learning Disabilities Quarterly), unpublished theses and dissertations, snowballing of reference lists
n = 204

Records after duplicates and triplicates removed
n = 599

Screening

Titles and abstracts screened
n = 599

Articles excluded based on titles and abstracts
n = 488

Eligibility

Full-text articles assessed for eligibility
n = 111

Full articles excluded with reasons
n = 62

- Not school based (n = 2)
- No training of motivational components (n = 13)
- Didn't assess reading achievement or motivation outcomes (n = 2)
- Did not include a non-motivation control group (n = 18)
- Didn't include data allowing calculation of effect sizes for pre- to post-test gains across conditions (n = 8)
- Was not a QED or RCT (n = 5)
- Unable to retrieve (n = 14)

Included

Articles included in final meta-analysis
n = 49

Figure 2. Publication bias funnel plot: Reading achievement
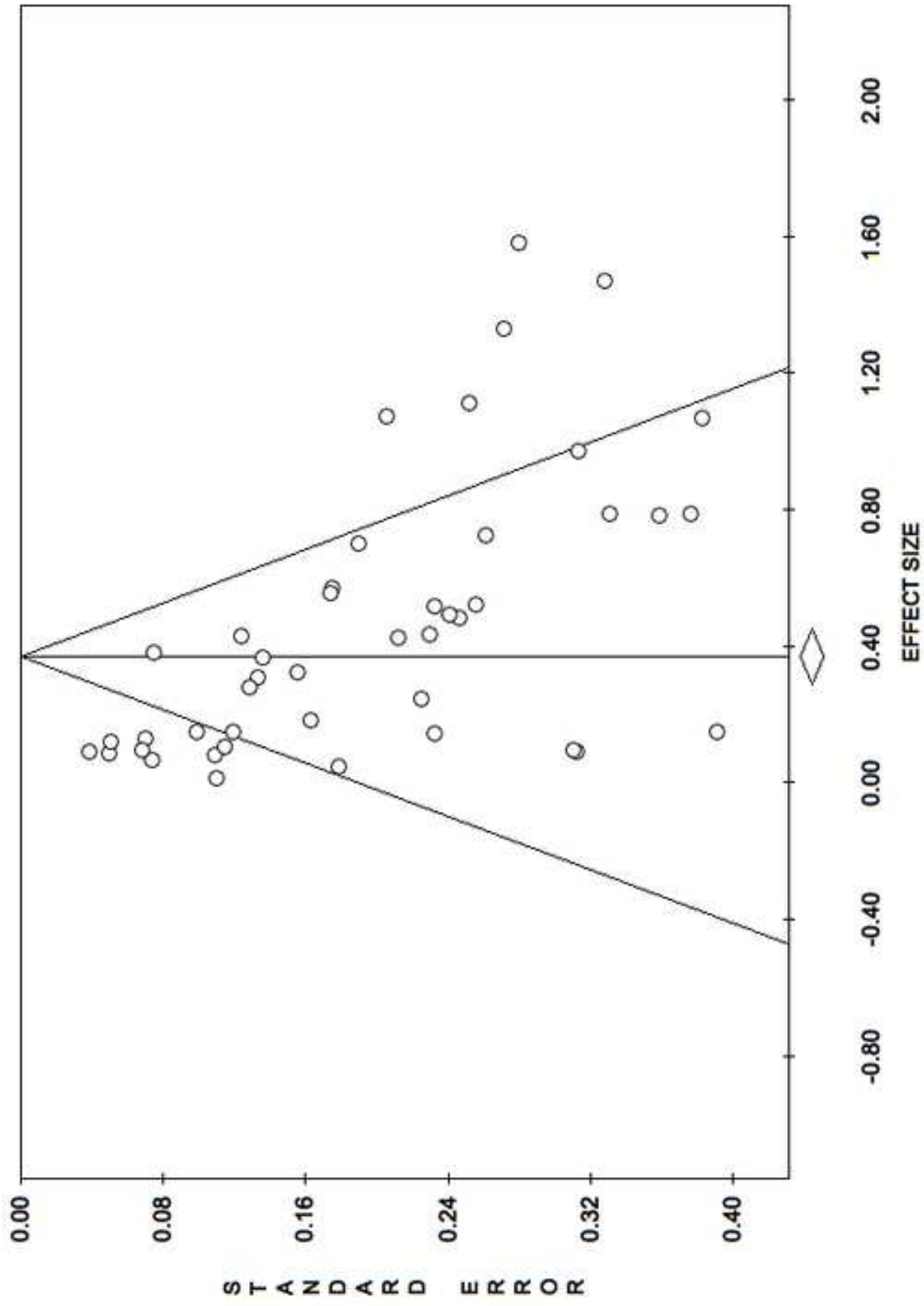
Figure 3. Publication bias funnel plot: Reading motivation

Appendix A. Quality code of articles
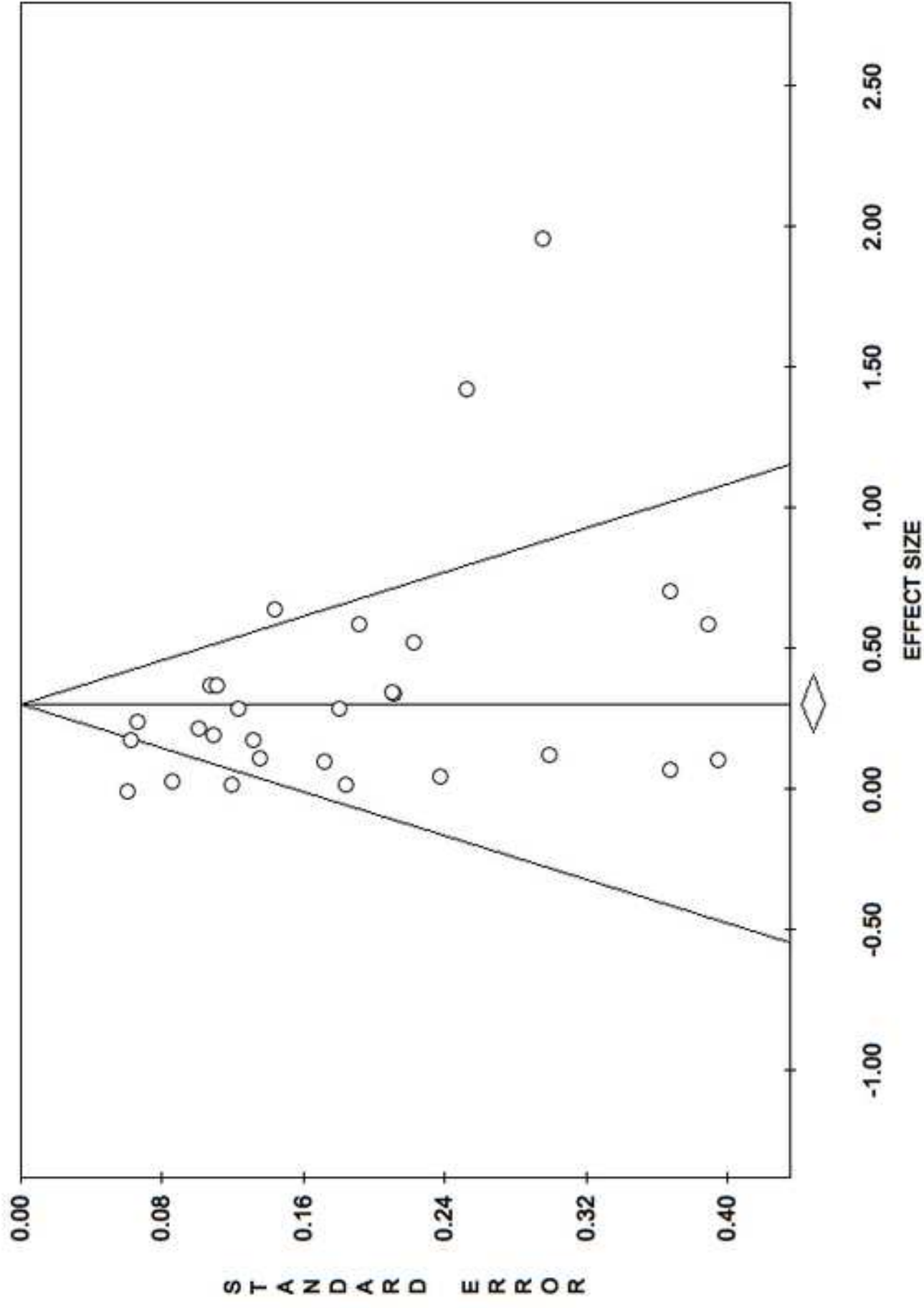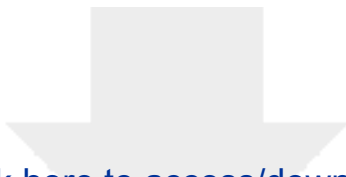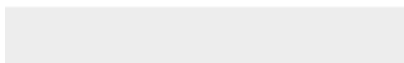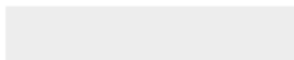
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Appendix C. Reading achievement and motivation outcomes

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