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Review

# Effects of additions to independent silent reading on students' reading proficiency, motivation, and behavior: Results of a meta-analysis

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## ABSTRACT

One often used approach to increase students' reading frequency is investing in independent silent reading (ISR) at schools: regularly scheduling time during which students read silently in books of their own choice. However, evidence for the impact of ISR is inconclusive and there appear to be important barriers to its effects on students' reading frequency, motivation, and proficiency: particularly struggling readers have difficulties choosing appropriate books, simply allotting time for reading does not guarantee that students read, ISR lacks accountability, and students are not always given the opportunity to interact about what they read. The aim of the current meta-analysis was to test whether additions to ISR that aim to overcome these barriers contribute to the effects of ISR on students' reading. Using outcomes of 51 effect studies covering 56 samples of students in primary and secondary education, we established a small but significant positive short-term intervention effect on overall reading proficiency (Cohen's  $d = 0.27$ ). We additionally found that additions to ISR were particularly effective for students at risk of reading failure; for stronger readers, effects were absent. Finally, we found a negative effect of help or instruction by the teacher, which suggests that activities during reading might interfere with students' engagement with texts.

## 1. Introduction

Reading ability is known to be a strong predictor of general educational success and even of general life success (Snow, Porche, Tabors, & Harris, 2007). This makes it worrisome that the reading performance of students in many countries across the world is decreasing (Avvisati, 2020). A probable reason for this is a decline in reading frequency. In countries such as the Netherlands, the time young people spend on reading is diminishing: a nationally representative diary study by the Netherlands Institute for Social Research (Wennekers et al., 2018) showed that the share of young people (aged 12–19) who consecutively read at least 10 min a week in a book,

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newspaper, magazine, or (longer) online text, decreased from about 65 per cent in 2006 to about 40 per cent in 2016. Although reading performance is supported by effective instruction (Duke et al., 2011, 2021; Edmonds et al., 2009; Scammacca et al., 2015), reading is also a skill that requires practice: if students read infrequently, this incites a negative cycle that has unfavorable consequences for reading proficiency (Mol & Bus, 2011; Stanovich, 1986). Educational policy makers and practitioners are looking for ways to counter the negative trend toward infrequent reading. One often used approach to increase reading frequency is investing in independent silent reading (ISR) at schools: regularly scheduling time during which students read silently in books of their own choice. However, evidence for the impact of ISR is inconclusive and there appear to be important barriers to its effects on students' reading frequency, motivation, and proficiency (National Reading Panel, 2000; Reutzel et al., 2010; Yoon, 2002). In the current meta-analysis, we test the effects of additions to ISR that aim to overcome such barriers.

### 1.1. Independent silent reading

The practice of ISR developed particularly during the second half of the twentieth century, in response to an educational tradition in which reading was mainly done orally. As Pearson and Goodin (2010) describe, this shift can be explained by various factors: a change in the functions of reading in education, the increased availability of and access to children's literature, and the assumption that silent reading is superior to oral reading in terms of speed and comprehension. The hypothesized effects of ISR are further grounded in research conducted in the 1980's and 1990's, indicating the importance of book exposure and reading motivation for reading development (Allington, 1977; Anderson et al., 1988; Nagy et al., 1985; Stanovich, 1986; Taylor et al., 1990; Wigfield & Guthrie, 1997). Stanovich (1986) described reading development as a process of reciprocal causation: students who read frequently have more opportunities to practice their reading skills, leading to increased proficiency; increased proficiency results in more interest in reading; and more interest, in turn, contributes to more frequent reading. In other words, students who read frequently, enter a virtuous cycle that is beneficial to reading development. Wigfield and Guthrie (1997) underlined the importance of choice: feelings of autonomy are a main determinant of the (intrinsic) motivation to engage in activities such as reading; children who can control their own reading activities (e.g., by choosing books of their own interests) are more inclined to view reading as an attractive activity. ISR aims to contribute to a virtuous reading cycle by providing time for frequent reading in self-selected books.

ISR is known by many names (e.g., Daily Independent Reading, Drop Everything And Read, Extensive Reading, Free Voluntary Reading, Super Quiet Reading Time, Sustained Silent Reading, Uninterrupted Silent Reading) and has a number of key elements (Cuevas et al., 2014; Garan & DeVoogd, 2008; Kelley & Clausen-Grace, 2006; Manning et al., 2010; Reutzel et al., 2010): (a) students read independently and silently; (b) students read books or other texts of their own choice; (c) both students and teachers read: teachers act as reading models; (d) a daily established period of time (usually 15–30 min) during the school day is reserved for reading; (e) the primary aim of ISR is to promote reading enjoyment; and (f) students are not held accountable for how much and what they read. In many countries, ISR is a regular component of the curriculum. Results from the international PIRLS study, for instance, showed that, across all participating countries, 95 per cent of the fourth-grade teachers who filled in the questionnaire, indicated they ask students to read silently at least once or twice a week; 65 per cent do this (nearly) every day (TIMSS & PIRLS International Study Center, 2016). In countries such as the US and the Netherlands, the latter percentage is even higher (85% and 87 %, respectively).

### 1.2. Effects and limitations of ISR

Despite its assumed benefits and widespread use, conclusions on the impact of ISR on students' reading development are mixed. In 2000, the National Reading Panel summarized the then available research on the effects of ISR. Although often misinterpreted as proof that ISR is ineffective (Garan & DeVoogd, 2008), the authors decided that "... given the evidence that exists, the Panel cannot conclude that schools should adopt programs to encourage more reading if the intended goal is to improve reading achievement. It is not that studies have proven this cannot work, only that it is yet unproven" (National Reading Panel, 2000, pp. 3–27). The National Reading Panel observed that among the 14 effect studies they identified, too few were of sufficient methodological quality; hence, a proper effect estimate through meta-analysis was not possible. Those studies that were deemed adequate, found no gains in reading proficiency because of ISR. Similar observations were made in a recent systematic review by Erbeli and Rice (2022): overall, they found no evidence for meaningful, positive effects of independent silent reading on reading outcomes, but they also concluded there was a lack of high-quality studies. Yoon (2002) did perform a meta-analysis and came to a different conclusion. She summarized the outcomes of ten studies testing ISR effects on reading comprehension and seven studies testing effects on reading attitude, and found significant, positive effects on both variables: effect sizes were 0.11 and 0.12, respectively. Yoon did not specify the type of effect size but suggested this implied that for more than half of the students exposed to ISR, the comprehension and attitude scores exceeded those of the control students. In a recent study from the Netherlands, differential effects of ISR were found. Van der Sande et al. (2019) examined the time Grade 3–5 teachers weekly spend on ISR and students' growth in book knowledge over a school year (as measured by a title recognition test). The authors found a positive interaction effect of time spent on ISR and pretest book knowledge on posttest book knowledge, implying that students who were frequent readers at the start of the school year expanded their book knowledge because of increased time for ISR, whereas infrequent readers' book knowledge decreased; for the latter students, ISR seemed to be counterproductive.

Reutzel et al. (2010) suggested some important limitations to ISR. A first limitation is that, although ISR capitalizes on self-selection, particularly struggling readers are usually not capable of choosing appropriate books. Because these students lack reading experience, they often rely on superficial selection strategies, based, for example, on physical features such as book cover or length (Hopper, 2005; Merga, 2016; Merga & Roni, 2017; Mohr, 2006; Van der Sande et al., 2022). Consequently, they often choose books that do not match their interests and reading level, which can turn ISR into a negative experience. A second limitation is that

simply allotting time for reading does not guarantee that students read: Reutzel et al. (2010) refer to observations of students pretending to read or avoiding reading by spending most of ISR time searching for books. A third limitation is that because of the lack of accountability in ISR some students miss a stimulus for reading. Additionally, accounts of students' reading, for instance in the form of reading logs, can be a means for teachers to monitor students' progress and gain insight into possible difficulties students have, allowing them to provide better individual support. A fourth limitation is that, because ISR requires students to read independently and quietly, they are not always given the opportunity to interact about what they read. Reutzel et al. suggest that the effectiveness of reading is increased when interactions around text are an integral part of ISR. Such interactions can be both between students themselves and between teachers and students and are expected to contribute to the reading process because they encourage students to think about what they read and thus support active processing. Additionally, student-teacher conferences provide teachers with the chance to assess students' comprehension and give on-the-spot instruction if necessary.

Over the years, various adaptations to ISR have been proposed that aim to meet limitations such as those described above. One example of such an adaptation is Scaffolded Silent Reading (ScSR; Reutzel et al., 2008; 2010). In ScSR, students are supported in making appropriate book selections: teachers arrange the classroom library in such a way that students can choose books that suit their reading levels (e.g., using color codes), and they teach students book selection strategies (e.g., how to use the 'three/five finger rule' for deciding if a book is too difficult). Teachers additionally encourage students to read from different genres to ensure they are exposed to a wide range of texts. ScSR also connects ISR with instruction: each ScSR session starts with a short lesson that, for instance, includes an explanation and modeling of a comprehension strategy (e.g., how to use fix-up strategies when comprehension fails). Finally, teachers conduct frequent student-teacher conferences during reading. In these conferences, teachers: ask students to read aloud from their books while making a running record analysis; engage in brief discussions with students to monitor comprehension; together with students set goal dates for finishing their books; and suggest students to share their books with other students.

### 1.3. Research Questions

The aim of the current meta-analysis was to test whether additions to ISR such as those included in ScSR contribute to the effects of ISR on students' reading. More specifically, we were interested in answering these two questions.

1. Do additions to ISR that meet the limitations such as those described by Reutzel et al. (2010) positively contribute to students' reading proficiency, reading motivation, and reading behavior?
2. Does the size of the effects of such additions depend on (a) intervention characteristics (i.e., on the nature of the additions to ISR), (b) sample characteristics, and (c) study and measurement characteristics?

With respect to Research Question 2b, we were particularly interested to assess whether additions to ISR had larger effects for students at risk of reading failure. After all, barriers to the effects of ISR might particularly hold for these students (Reutzel et al., 2010; Van der Sande et al., 2019).

## 2. Method

### 2.1. Search strategy and study selection criteria

A search was conducted in five electronic databases: ERIC Ovid, PsycINFO Ovid, Web of Science SCI-EXPANDED & SSCI, Scopus, and Google Scholar. We combined three groups of keywords, reflecting: (a) labels for independent silent reading (e.g., *Sustained Silent Reading*, *Independent Reading*) and relevant program names, such as ScSR (see above), DEAR (Drop Everything And Read), and R<sup>5</sup> (Read, Relax, Reflect, Respond, and Rap); (b) possible dependent variables (e.g., *reading proficiency*, *reading motivation*, *reading behavior*); and (c) the target group (e.g., *children*, *students*). We were assisted by an information specialist who designed a search strategy using the Exhaustive Search Method (ESM; Bramer et al., 2018). ESM improves the sensitivity of a search by using an optimization method: this method examines publications that were indexed with thesaurus terms, but of which the titles and abstracts lack the synonyms already used in the search strategy. Relevant terms from titles and abstracts are then added to a new search strategy, to maximize the chance that all relevant studies are obtained. The search syntax is in Appendix A. In addition to peer-reviewed journal articles, we included other publications (dissertations, research reports, conference papers) to create a complete overview of available information as well as to prevent and examine effects of publication bias.

The search initially yielded 7430 titles; after deduplication, 5472 remained. We decided to exclude studies published before 2001, because we assumed that particularly after the publication of the report of the National Reading Panel (2000)—which found insufficient support for the effects of ISR—adjustments to ISR were made. This resulted in a database of 2473 studies. In addition to publication date, we applied the following inclusion criteria.

1. The study involved a program that included these basic elements of ISR (see section 1.1): students read independently and silently, students read books or other texts of their own choice, a daily established period of time during the school day is reserved for reading, and the primary aim is to promote reading enjoyment.
2. The study involved a program that included additions to regular ISR that were assumed to meet the afore-mentioned limitations (see section 1.2). These additions had to be directly related to/of relevance to ISR; studies in which ISR and additions were independent components of a program were not included.

3. The study focused on students in primary and/or secondary education.
4. The study followed a (quasi-)experimental design, comparing an experimental condition of students exposed to a program that included the basic elements of ISR and additions to ISR (as explained under criteria [1] and [2]) with a control condition of students exposed only to ISR (as explained under criterion [1]). If a study evaluated two interventions or two versions of the same intervention, we included both experimental groups (this only occurred in two cases: Allen & Hancock, 2008; Cuevas et al., 2014).
5. Program effects were assessed on reading-related variables: reading proficiency, reading motivation, and/or reading behavior.
6. The study provided effect sizes or information (e.g., means, standard deviations, *ns*, statistical tests) allowing effect sizes to be calculated.

Studies that were not written in English, studies that focused exclusively on students with special educational needs (e.g., students with cognitive or physical impairments), and studies in which students had to read specific contents (e.g., science texts) or foreign language texts were excluded.

In the first selection round, the titles, abstracts and, in some cases, full texts (i.e., when title and abstract contained too little information to take even a preliminary decision) of all 2743 studies were screened by the first author. The first 500 studies were also screened by both the second and third author. The second and third author then each screened 50 per cent of the remaining studies. All studies were thus screened by at least two of the authors. The authors compared and discussed their selections, resulting in a set of 370 studies that were likely candidates for inclusion or that were doubtful but could not be dismissed based on title and abstract. In the second selection round, these 370 studies were screened by all three authors using the same criteria as during the first round, but now using the full text. If for a study a full text was not available, we tried to contact the authors; in only one case, a full text was sent by the authors. This second round of screening resulted in a set of 84 studies. To make sure that we did not overlook possibly relevant studies, we additionally conducted a search in reference lists of five review articles (Erbeli & Rice, 2022; Garan & DeVoogd, 2008; Manning et al., 2010; Reutzel et al., 2010; Yoon, 2002). Only one relevant study referred to in these papers was not generated by our initial search, whereas 26 studies were; this outcome largely supports the validity of the ESM procedure we used. The extra study (Shannon et al., 2015) was added to our database. The database thus included 85 studies, that were then coded. During the coding process, an additional 34 studies were excluded. Often, the latter involved studies in which some statistical information was missing (e.g., means of experimental and control conditions were provided, but no standard deviations); in these cases, we tried to contact authors during the coding phase, but often the missing information could not be retrieved.

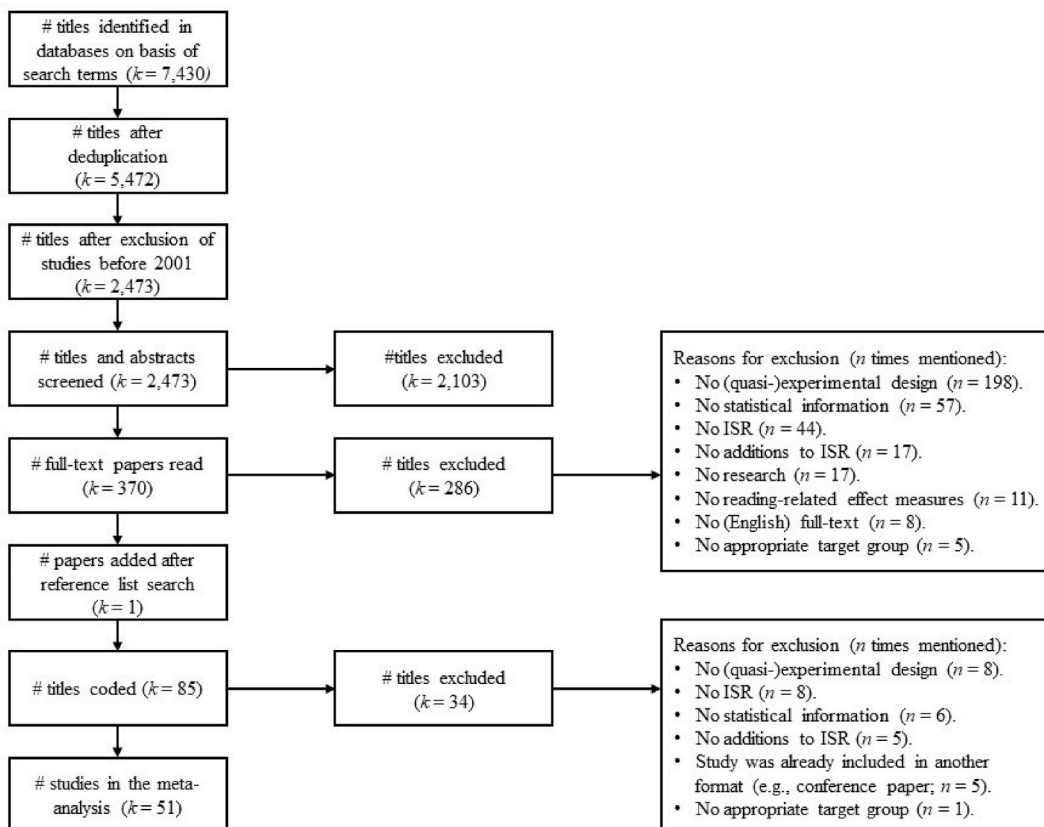


Fig. 1. Flowchart of the selection process.

The final database thus included 51 studies, covering a total of 53 different interventions and 56 samples. The selection process is visualized in Fig. 1.

For the first phase of the first selection round (first 500 titles), the interrater reliability of the three authors was Krippendorff's  $\alpha = 0.42$ , which is below the norm of 0.67 (Hayes & Krippendorff, 2007). Based on a discussion of this first selection phase, we further refined our in-/exclusion criteria; mostly, this meant a clearer description/explanation of the criterion (e.g., a specification of what we meant by 'special educational needs'). We applied these refined criteria during the second phase of the first selection round. The result was positive: the Krippendorff's alphas were 0.82 (Authors 1–2) and 0.88 (Authors 1–3) and thus well above the norm. For the second selection round, the interrater reliability of the three authors was Krippendorff's  $\alpha = 0.65$ . The main two reasons for the fact that the latter alpha was somewhat below the norm is the occurrence of 'borderline' cases of ISR interventions and study designs. An example of the former are studies in which ISR was offered in an after-school educational program. Where one rater excluded such studies based on the general definition of ISR as described in section 1.1, another was hesitant to exclude them because of the disputable boundary between ISR in school and ISR in an educational program outside the school context; in these cases, we decided to stick to our definition of ISR and excluded ISR in after-school programs. An example of the latter were studies in which no strict intervention-control distinction was made, but where the effects of intervention dosage were assessed (e.g., where the number of Accelerated Reader 'points' was related to student outcomes). Where one rater excluded such studies based on the fourth inclusion criterion, another rater was hesitant to exclude them because such designs might still give an indication of intervention effects; in these cases, we decided to stick to our inclusion criterion and excluded studies using such designs. At the end of each round, all discrepancies in selections were discussed and a collective decision was made on the in- or exclusion of studies.

## 2.2. Coding scheme

All studies were coded according to a standardized coding scheme with the following sections: article information, program characteristics, sample characteristics, study characteristics, measurement characteristics, and program effects.

### 2.2.1. Article information

This section included title, author name(s), publication year, and source name.

### 2.2.2. Program characteristics

In this section, we registered the total duration of the program (in weeks), the duration of individual sessions (in minutes), and the number of sessions. Further, we registered the following additions to ISR, that might meet the limitations described by Reutzel et al. (2010).

1. Limiting book selection: were students allowed boundless choice or was their choice limited, for instance based on their reading level?
2. Support of book selection: did the teacher or a librarian support students' book choice, for instance by recommending books that matched students' reading level or interests?
3. Accountability: did students have to account for their reading, for instance during student-teacher conferences or by having students take short tests about their book?
4. Reading logs: did students have to keep a log about what they were reading? We also coded whether reading logs were explicitly used as a form of accountability.
5. Help/instruction by the teacher: did the teacher support students' reading, for instance by student-teacher conferences to resolve comprehension problems or by additional instruction?
6. (Social) interaction: were opportunities created for interaction, for instance in the form of student-student talks or class discussions about the books students were reading?

We assumed that Additions (1) and (2) would meet the first limitation described by Reutzel et al. (many students, particularly struggling readers, are not capable of choosing appropriate books), that Additions (3) and (4) would meet the third limitation (lack of accountability in ISR), and that Additions (5) and (6) would meet the fourth limitation (lack of opportunities for interaction). Finally, we assumed that all additions would increase the chance of students being focused on reading during ISR (Reutzel et al.'s second limitation).

During coding, we came across three other program characteristics, which we added to the coding scheme.

7. Reward/competition: were rewards provided for reading, that is, could students obtain credits for reading or physical compensation, such as candy or pizza parties?
8. Technological support: did the program include technological facilities, for instance to aid students' book selection or support them during reading (e.g., in the form of explanations about texts being read).
9. Home activities: did the program actively promote the home use of books read during ISR?

Additionally, we coded whether teachers (or other program deliverers) received training or coaching before or during program execution to improve implementation.

### 2.2.3. Sample characteristics

In this section, we registered the number of students in the sample and per condition. Additionally, we registered what percentage of students in the sample were at risk of reading delays, because we assumed at-risk students might benefit more from additions to ISR (see 1.3). We distinguished four risk indicators: we registered whether a majority of the sample (>50%) had a low socio-economic status (SES), were member of an ethnic minority, were second language (L2) learners, or had low reading proficiency. We also registered which grades students were in. We used this information to distinguish between studies focusing on students in Grade 6 or below, studies focusing on students in Grade 7 or beyond, and studies focusing on both. In many countries, Grade 6 represents the final stage of primary education and Grade 7 the first stage of secondary education. Various studies have shown that students' reading motivation declines after entering secondary education (Eccles et al., 1993; Jacobs et al., 2002; Kush & Watkins, 1996; Lepper et al., 2005; Wigfield et al., 1997) and decreases even further during the middle and high school years (Kelley & Decker, 2009; Lau, 2009; Lepper et al., 2005; McKenna et al., 2012; Unrau & Schlackman, 2006; Wolters et al., 2014). Since secondary education appears such a vulnerable period for engagement in reading, we wanted to test whether secondary schoolers might benefit more from additions to ISR than primary schoolers. Finally, we registered the percentage of females in the sample. Gender is known to affect reading motivation, reading behavior, and reading proficiency: boys generally have lower reading motivation and proficiency than girls, and boys read less frequently (Hu et al., 2023; Logan & Johnston, 2009). It could thus be hypothesized that additions to ISR may be more beneficial for boys.

### 2.2.4. Study characteristics

In this section, we first registered the type of publication: we distinguished between articles published in peer-reviewed journals and other publications (mostly dissertations and research reports). We also coded whether randomization was applied and the level of randomization (individual, class, or school level). Finally, we assessed study quality based on guidelines by Austin et al. (2019). We made an index (minimum = 0, maximum = 6) based on three of their criteria, with per criterion three possible scores.

#### 1. Design:

- 2 points (exemplary): randomized design with a sufficiently large sample ( $\geq 20$ ).
- 1 point (acceptable): randomized design with an insufficient sample size ( $< 20$ ) or a nonrandomized design with a sufficiently large sample ( $\geq 20$ ) and evidence of pretest equivalence.
- 0 points (unacceptable): nonrandomized design with insufficient sample size ( $< 20$ ).

#### 2. Implementation fidelity:

- 2 points (exemplary): fidelity is reported, procedural fidelity is  $\geq 75\%$  and interobserver reliability is  $\geq 90\%$ .
- 1 point (acceptable): fidelity is reported, procedural fidelity is  $\geq 75\%$  and interobserver reliability is  $\geq 80\%$ .
- 0 points (unacceptable): fidelity is not reported or procedural fidelity is  $< 75\%$  and/or interobserver reliability is  $< 80\%$ .

#### 3. Statistical analyses:

- 2 points (exemplary): appropriate use of analysis matching the design of the study (e.g., ANCOVA when pre- and posttest data are available), the sample is sufficiently large ( $\geq 20$ ), and effect sizes are reported.
- 1 point (acceptable): appropriate use of analysis matching the design of the study, the sample is sufficiently large ( $\geq 20$ ), and effect sizes are not reported, but sufficient information is available to compute effect sizes.
- 0 points (unacceptable): inappropriate use of analysis or insufficient sample size ( $< 20$ ).

Austin et al. included a fourth criterion (Likelihood of Type I error in the case of multiple comparisons), but we did not incorporate this in the index, because (a) it was often not applicable, since many studies only included one comparison, and (b) there was little variability: hardly any studies, for instance, adjusted *p*-values in the case of multiple comparisons.

### 2.2.5. Measurement characteristics

For each measure, we registered which construct it assessed: reading proficiency, reading motivation, or reading behavior. We additionally included vocabulary as an effect measure because it occurred in several studies and because vocabulary is an important component of reading comprehension (Verhoeven & Van Leeuwe, 2008). Reading proficiency was subdivided into reading comprehension, reading fluency, and overall proficiency (usually a combination of comprehension and fluency). We also registered what type of measure was used (test, questionnaire, behavioral measure) and the timing of administration (direct posttest, follow-up). Finally, we registered whether the measure had been developed within the context of the study or independent of the study; standardized tests are an example of the latter. We particularly expected effects of the latter two variables: we expected smaller effects at follow-up, and we expected larger effects on measures developed within the context of the study, likely because such measures are more attuned to the contents of the intervention (Fikrat-Wevers et al., 2021; Okkinga et al., 2018; Sénéchal & Young, 2008; Swanson, 1999).

### 2.2.6. Program effects

We coded available statistical information to calculate effect sizes (means, standard deviations, *n*, *t*, *F*, etc.) and, if available, the effect sizes (Cohen's *d*,  $\eta^2$ ,  $R^2$  etc.) as reported by the researchers. We only used effect sizes provided by the authors, however, if no statistical information was given to calculate effect sizes ourselves. If both statistical information and effect sizes were available, we preferred the former so that we could be sure that effect sizes in the meta-analysis were computed in the same way.

### 2.3. Coding procedure

To test the coding scheme, all three authors first coded one study and subsequently five studies in parallel. The authors discussed possible differences in coding, took a common decision about the final codes, and adjusted the coding scheme where necessary. The first author then coded nearly all remaining (43) studies and the second and third author each coded about half of these studies (22/21), so that all studies were coded by two authors; due to circumstances, two additional studies were coded by the second and third author. For Authors 1–2, Krippendorff’s alpha was .72, for Authors 1–3, it was 0.75, which are both well above the norm of 0.67 (for Authors’ 2–3, the alpha was not computed, because they coded only 2 studies in parallel). All discrepancies in coding were discussed, and the authors took common decisions on the final codes.

### 2.4. Data-analysis

Data analysis was conducted using Comprehensive Meta-Analysis (CMA) 3.3.070 (Borenstein et al., 2005). Because some studies included multiple experimental conditions, multiple samples, or multiple measurement times, we used ‘experimental comparison’ as the basis for our analysis (see also Fikrat-Wevers et al., 2021; Van Steensel et al., 2011).

To analyze overall effects, we first computed one weighted effect size (i.e., the standardized mean difference: Cohen’s *d*) per dependent variable per experimental comparison.

If in a study multiple measures were used to assess a dependent variable, we computed the average of the effect sizes as well as their pooled variance, based on the formula suggested by Borenstein et al. (2021, p. 266). For the pooled variance (*V*) of two effect sizes *Y*<sub>1</sub> and *Y*<sub>2</sub>, this formula would be:  $(1/m)^2 * (V_1 + V_2 + (m * r * \sqrt{V_1 * V_2}))$ , where *m* is the number of variances and *r* is the correlation between the two variables (which, if unknown, was conservatively set to 0.30). Because combining multiple measures may present a validity risk—the measures might not assess the same construct—we made an analysis of the nature of the measures that were combined in each study. Of the 11 studies in which multiple measures were combined, the majority (*k* = 8) involved different subtests or subscales from the same instrument. In Assi (2016), for instance, the four motivational scales were all from the Reader Self Perception Scale (RSPS; Henk & Melnick, 1995) and they measured different dimensions of the same construct: reader self-efficacy. We therefore conclude that in most studies there was substantial agreement between the measures combined.

If present, we used both pretest and posttest measures for computing effect sizes. If no correlation between pre- and posttest scores was reported, we assumed a correlation of 0.30 to be able to compute the variance; although larger correlations have been reported in the literature (e.g., Cuijpers, 2016), we were more conservative. We used the standard deviations of the posttest scores for standardizing the effect size. Some studies did not report sample means and standard deviations; in these cases, we either computed effect sizes based on other available information, such as *t*- and *F*-values, combined with information about sample size, or—if such information was also not available—we used effect sizes as reported by the authors. CMA generates effect sizes automatically based on the statistical information entered; because the type of statistical information may vary, CMA uses several formulas, as presented in Table 1. The table also includes the numbers of cases in which a formula was used. In three instances, we used the effect sizes provided by the authors.

All analyses were based on the random effects model, taking both within- and between-study variance into account. To explain between-study variance, we conducted moderator analyses, based on (separate) subgroup analyses for categorical variables and meta-regression analyses for continuous variables. We applied Cohen’s (1988) guidelines for distinguishing small (*d* > .20), medium (*d* > 0.50), and large (*d* > 0.80) effects.

**Table 1**  
Formulas for computing effect sizes as applied in CMA.

Available data	Formula effect size	<i>N</i> effect sizes
Pre- and posttest means, SDs, and <i>ns</i>	Raw difference in mean change/pooled posttest SD	82
Posttest means, SDs, and <i>ns</i>	- Raw difference in mean change = $(M_{1, \text{post}} - M_{1, \text{pre}}) - (M_{2, \text{post}} - M_{2, \text{pre}})$ - Pooled posttest SD = $\sqrt{(((n_1 - 1) * SD_1^2) + ((n_2 - 1) * SD_2^2)) / (n_1 + n_2 - 2)}$ Raw difference in means/pooled posttest SD	37
Change scores, SDs, and <i>ns</i>	- Raw difference in means = $M_1 - M_2$ - Pooled posttest SD = $\sqrt{(((n_1 - 1) * SD_1^2) + ((n_2 - 1) * SD_2^2)) / (n_1 + n_2 - 2)}$ Raw difference in mean change/pooled change SD	21
<i>t</i> -value, <i>ns</i>	- Raw difference in mean change = $M_{1, \text{change}} - M_{2, \text{change}}$ - Pooled change SD = $\sqrt{(((n_1 - 1) * SD_{\text{change}1}^2) + ((n_2 - 1) * SD_{\text{change}2}^2)) / (n_1 + n_2 - 2)}$ $t / (\sqrt{((2 * n_1 * n_2) / (n_1 + n_2)) / 2})$	6
<i>F</i> -value, <i>ns</i>	$\sqrt{(F * ((n_1 + n_2) / (n_1 * n_2)))}$	13

### 3. Results

#### 3.1. Overview of program, sample, study, and measurement characteristics

Appendix B provides an overview of program, sample, study, and measurement characteristics per study.

##### 3.1.1. Program characteristics

Four programs were the subject of more than one study: Accelerated Reader was evaluated in 14 studies, Reading Plus in four studies, the Schoolwide Enrichment Model-Reading in three studies, and Scaffolded (Sustained) Silent Reading in two studies. The remaining programs (Be Excited About Reading [BEAR], Book Flood, Fast ForWord, Guided Library Selection Program, Guided Reading, I Compete by Reading, Instructional Sustained Silent Reading, IRLA and 100 Book Challenge, Reading Workshop, [Starfall.com](#)) were all evaluated once. In 17 studies, the programs were nameless.

Two program characteristics occurred relatively often (i.e., in more than half of the cases). In 35 of the 53 interventions (66%), the book selection was limited, for instance by first assessing students' reading level and then providing them with a selection of books matching their level. Thirty-one programs (58%) included accountability, often in the form of short quizzes in which students were asked to answer questions about the book they were reading. Other relatively frequent additions were the use of technology (27 programs, 51%) and help or instruction by the teacher (24 programs, 45%). Accelerated Reader is an example of a program in which technology plays an important role: it is a software system in which students answer questions about books they read; students' responses are then used to facilitate their book selection and monitor their reading development. Help or instruction by the teacher often took the form of brief student-teacher conferences, during which a teacher informally assessed students' progress through a book or provided instruction, for instance on the use of reading strategies. In about a quarter to a third of the programs.

- Students' book selection was actively supported by a teacher or librarian (18 programs, 34%).
- Students kept a reading log (16 programs, 30%), which were in eight cases (15%) explicitly used as a form of accountability.
- There was a form of reward or competition (14 programs, 26%). For instance, students received credits for every book they read, which they could then redeem for a prize.
- Teachers received training or coaching (15 programs, 28%).
- Opportunities for social interaction were included (14 programs, 26%). This could involve 'partner reading' (two students read a book together) or freeing up time at the end of the reading period for students to share their reading experiences.

In only three programs (6%), ISR was combined with activities at home. In two programs, students were actively encouraged to read books at home, which was, for instance, monitored by a reading log ([Salters, 2008](#); [Smith, 2016](#)). In the former study, parents were also involved: they were assisted in supporting their children in applying reading strategies. In the third study ([Rogers, 2012](#)), students were encouraged to write book reviews at home. Because of this small number, this variable will not be included in further moderator analyses ([Kontopantelis & Reeves, 2010](#)).

On average, the programs lasted 71 h (range: 7–600 h), spread across, on average, 27 weeks (range 3–120 weeks) and 91 sessions (range: 14–200 sessions).

##### 3.1.2. Sample characteristics

In 24 of the 56 samples (43%), a majority of the students had an increased risk of reading failure according to one or more indicators, in nine samples (16%) this was not the case, and in 23 samples (41%) this could not be determined because of insufficient background data. We used four risk indicators: in 18 samples (32%) a majority of the students had an ethnic minority background, in 11 samples (20%) a majority were from low SES families, in five samples (9%) a majority had been diagnosed as struggling readers, and in one sample (2%) a majority were second language learners. Of the 56 samples, 38 (68%) involved students in Grade 6 or below, 16 (29%) involved students in Grade 7 or beyond, and two (4%) involved a combination of both. On average, there were 50 per cent girls in the samples (range 37–100); however, information on gender was only available for 28 samples.

##### 3.1.3. Study characteristics

Of the 51 studies, 18 (35%) were published in peer-reviewed journals; most of the remaining 33 (non-published) studies (65%) were dissertations. In 23 studies, there was random assignment: in 13 studies (25%), randomization occurred at the class level, in nine studies (18%) randomization occurred at the student level, and in one case (2%) it occurred at both levels. In the remaining 28 studies (55%), there was no randomization. The average score on the study quality index was 2.43 ( $SD = 1.59$ ). This relatively low score was particularly due to a low score on implementation fidelity: whereas the scores on design and statistical analyses were acceptable on average (1.00 and 1.24 with a possible range of 0–2), the score on implementation fidelity was not (0.20); 46 out of 51 studies were rated unacceptable in this respect, usually because implementation fidelity was not reported.

##### 3.1.4. Measurement characteristics

Seventy-eight of the 96 effect sizes extracted from the studies (81%) were based on the results of tests and 16 (17%) were based on the outcomes of questionnaires; in only one case (1%), the effect size was based on observations and in one case, the effect size was based on eye-tracking (1%). In nearly all cases (91 out of 96, 95%), effect sizes were based on study-independent measures: these measures (often, standardized tests) had been developed outside the context of the study.



### 3.2. Meta-analysis

#### 3.2.1. Overall effects

In a first step, we tested the overall effects of additions to ISR on the different categories of effect measures, that is, without distinguishing between different types of additions (see Table 2). We analyzed short- and long-term effects separately. We observed the largest short-term effect on overall reading proficiency: the effect was small, but statistically significant (Cohen's  $d = 0.27$ ,  $p < .001$ , 95% CI [0.17–0.38]). Effects on the other two reading proficiency measures were significant as well, but these did not pass the threshold of a small effect (comprehension: Cohen's  $d = 0.15$ ,  $p = .002$ , 95% CI [0.06–0.25]; fluency: Cohen's  $d = 0.13$ ,  $p = .024$ , 95% CI [0.02–0.24]). The latter was also true for the effects on vocabulary, reading motivation, and reading behavior, although only for motivation the effect was significant (Cohen's  $d = 0.18$ ,  $p = .026$ , 95% CI [0.02–0.33]). None of the long-term effects were significant, but these were tested in only three studies (Bell et al., 2020; Hunter, 2013; Smith, 2016). Additionally, only the three reading proficiency measures and reading behavior showed significant variability in effect sizes (as indicated by the  $Q$  statistics). Only for these variables it was relevant to test whether outcomes were moderated by program, sample, study, and measurement characteristics.

#### 3.2.2. Moderator analyses

In a next step, we analyzed whether variability in effect sizes could be explained by the moderators. Before conducting these analyses, we made three decisions.

1. Because even the most frequent effect measure (overall reading proficiency) was only used in a third of the comparisons, we combined effect measures to increase statistical power. More specifically, we decided to merge the outcomes of the three reading proficiency measures (overall proficiency, comprehension, fluency) and used these as the basis for our moderator analyses. The decision to merge comprehension and fluency measures can be justified based on a large body of research showing strong relations between comprehension and fluency (Jenkins et al., 2003; Kim et al., 2010, 2011, 2021; Kim & Wagner, 2015; Klauda & Guthrie, 2008; Sabatini et al., 2019). Kim and Wagner (2015), for instance, found large correlations between fluency and comprehension in Grade 1–4 students, ranging up to  $r = .91$ . We excluded the other measures (vocabulary, motivation, behavior), because of the small numbers of observations and the lack of variability in effect sizes.
2. Because hardly any of the studies tested long-term effects, we excluded long-term outcomes from further analyses.
3. Because there was hardly any variability in measurement characteristics—in nearly all cases, the instruments were (standardized) tests that had been developed outside the context of the study—, this moderator was excluded from further analyses.

Outcomes of the moderator analyses are presented separately for program characteristics (Table 3), sample characteristics (Table 4), and study characteristics (Table 5).

**3.2.2.1. Program characteristics.** Subgroup analysis of categorical moderators revealed only one significant effect (see Table 3): a negative effect of help or instruction by the teacher, implying that programs that included systematic help or instruction by the teacher resulted in a smaller (but still significant) effect on reading proficiency (Cohen's  $d = 0.11$ ,  $p = .001$ , 95% CI [0.05–0.18]) than programs in which such help or instruction was not included (Cohen's  $d = 0.35$ ,  $p < .001$ , 95% CI [0.17–0.53]).

We used meta-regression analyses to test associations between effect sizes and continuous program variables. We found no relations between effect size and program duration in weeks ( $B = -0.002$ ,  $p = .36$ ) and between effect size and program duration in minutes ( $B = 0.000$ ,  $p = .10$ ), but we did find a relation between effect size and number of program sessions ( $B = -0.002$ ,  $p = .01$ ). However, in the latter case the percentage of variance explained ( $R^2$ ) was 0. All in all, program characteristics related to dosage did not account for differences in program effects: longer or more intensive programs appeared not to be more (or less) effective than shorter, less intensive programs.

**Table 2**

Overall short-term and follow-up effects of additions to ISR on various outcomes.

Short term	$k$	$d$	$SE$	Variance	95% CI	$z$	$Q$	$I^2$
Overall reading proficiency	30	0.27	0.05	0.003	[0.17–0.38]	5.08***	219.94***	86.81
Reading comprehension	26	0.15	0.05	0.002	[0.06–0.25]	3.15**	91.34***	72.63
Reading fluency	11	0.13	0.06	0.003	[0.02–0.24]	2.26*	18.57*	46.14
Vocabulary	3	0.14	0.12	0.015	[-0.10–0.38]	1.13	3.35	40.31
Reading motivation	14	0.18	0.08	0.006	[0.02–0.33]	2.23*	21.15	38.54
Reading behavior	6	0.19	0.21	0.045	[-0.23–0.60]	0.90	28.82***	82.65
<b>Follow-up</b>								
Overall reading proficiency	2	-0.04	0.13	0.016	[-0.29–0.21]	-0.30	0.02	0.00
Reading comprehension	3	-0.07	0.11	0.012	[-0.28–0.15]	-0.60	0.82	0.00
Reading fluency	1	-0.25	0.20	0.041	[-0.64–0.15]	-1.22	–	–
Vocabulary	1	0.00	0.17	0.027	[-0.32–0.33]	0.20	–	–
Reading motivation	–	–	–	–	–	–	–	–
Reading behavior	–	–	–	–	–	–	–	–

Note. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

**Table 3**  
Moderator analyses: Program characteristics.

Reading proficiency measures combined	Yes				No				Q
	K	d	SE	95% CI	k	d	SE	95% CI	
Limiting book selection	36	0.22***	0.04	[0.14–0.30]	17	0.16*	0.07	[0.02–0.29]	0.68
Support book selection	18	0.22*	0.10	[0.04–0.41]	35	0.21***	0.04	[0.14–0.29]	0.01
Accountability	32	0.19***	0.04	[0.12–0.27]	21	0.27**	0.09	[0.09–0.45]	0.67
Help/instruction teacher	24	0.11**	0.03	[0.05–0.18]	29	0.35***	0.09	[0.17–0.53]	5.82*
(Social) interaction	13	0.14	0.09	[–0.03–0.31]	40	0.22***	0.04	[0.14–0.30]	0.77
Reward/competition	13	0.22*	0.10	[0.03–0.42]	40	0.19***	0.04	[0.11–0.26]	0.12
Technological support	27	0.24***	0.05	[0.14–0.34]	26	0.15**	0.05	[0.05–0.25]	1.61
Training/coaching	15	0.12*	0.05	[0.03–0.21]	38	0.25***	0.05	[0.16–0.35]	3.83

Reading log	Yes: accountability				Yes: activity				No				Q
	k	d	SE	95% CI	k	d	SE	95% CI	k	d	SE	95% CI	
Reading log	9	0.19	0.18	[–0.16–0.54]	8	0.23	0.18	[–0.13–0.58]	36	0.22***	0.04	[0.15–0.29]	0.03

Note. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

**Table 4**  
Moderator analyses: Sample characteristics.

Reading proficiency measures combined	Yes				No				Q
	k	d	SE	95% CI	k	d	SE	95% CI	
Predominantly low SES	10	0.41**	0.16	[0.10–0.72]	6	0.11	0.05	[0.01–0.20]	3.40
Predominantly other ethnicity	17	0.27	0.07	[0.13–0.40]	11	0.15	0.13	[–0.10–0.40]	0.63
Predominantly at-risk	23	0.27***	0.06	[0.15–0.39]	8	–0.02	0.12	[–0.26–0.22]	4.54*
	$\leq$ Grade 6				$\geq$ Grade 7				
Educational stage	36	0.21***	0.06	[0.10–0.32]	15	0.26***	0.07	[0.12–0.40]	0.35

Note. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

**Table 5**  
Moderator analyses: Study characteristics.

Reading proficiency measures combined	k	d	SE	95% CI	k	d	SE	95% CI	Q
Peer-reviewed	Yes				No				0.15
	21	0.19***	0.03	[0.13–0.25]	32	0.21***	0.06	[0.10–0.33]	
Randomization	Yes				No				1.55
	27	0.27***	0.07	[0.14–0.40]	26	0.17***	0.04	[0.08–0.26]	
Level of randomization	Student				Class				6.68*
	12	0.11*	0.05	[0.01–0.21]	14	0.46***	0.12	[0.22–0.70]	

Note. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

**3.2.2.2. Sample characteristics.** In several cases, studies provided no or hardly any information on the backgrounds of participating students. For this reason, no moderator analyses could be performed for two background variables ('predominantly second language learners' and 'predominantly struggling readers'). Although for two other risk indicators ('predominantly low SES' and 'predominantly ethnic minority') we were able to perform moderator analyses, the available information was limited in these cases as well. For this reason, we decided to use the information on these four characteristics to construct a new variable: 'predominantly at-risk'. A study scored 'yes' on this variable if it scored 'yes' on at least one of the underlying four risk indicators. This combined variable was the only categorical variable that showed a significant moderator effect (see Table 4): additions to ISR appeared to have a larger effect on reading proficiency in studies in which the sample consisted mainly of at-risk students (Cohen's  $d = 0.27$ ,  $p < .001$ , 95% CI [0.15–0.39]) than in studies in which the sample comprised primarily non-at-risk students. In the latter case, the average effect did not significantly differ from zero (Cohen's  $d = -0.02$ ,  $p = .862$ , 95% CI [–0.26–0.22]). For the other risk indicators, no moderator effects were found (although the difference in effect sizes did go in the same direction). Additionally, the effect of additions to ISR was not dependent on educational stage ( $\leq$  Grade 6 vs.  $\geq$  Grade 7).

We used meta-regression analysis to test a possible association between the share of girls in the sample and effect size but found no significant moderator effect ( $B = -0.02$ ,  $p = .12$ ): in studies in which relatively many girls participated, students did not profit differently from additions to ISR than in studies in which relatively many boys participated.

**3.2.2.3. Study characteristics.** Subgroup analysis of categorical moderators showed only study characteristic that accounted for variability in program effects (see Table 5): when randomization had taken place at the level of individual students, the average effect

was significantly smaller (Cohen's  $d = 0.11$ ,  $p = .026$ , 95% CI [0.01–0.21]) than when randomization had taken place at the class level (Cohen's  $d = 0.46$ ,  $p < .001$ , 95% CI [0.22–0.70]). Additionally, meta-regression analysis did not reveal a moderator effect of study quality ( $B = 0.03$ ,  $p = .24$ ).

**3.2.2.4. Unique effects.** We conducted an additional analysis including the three moderators that were shown to be significant (help/instruction by the teacher, predominantly at-risk, and level of randomization). For this purpose, we changed the variables into dummies (help/instruction by the teacher: 1 = yes, 0 = no; predominantly at-risk: 1 = yes, 0 = no; randomization at student-level: 1 = yes, 0 = no) and included them in one meta-regression model. The model, which was based on 26 studies, indicated unique effects of help/instruction by the teacher ( $B = -0.28$ ,  $p = .017$ ) and predominantly at-risk ( $B = 0.37$ ,  $p = .003$ ), but not of randomization at student-level ( $B = -0.09$ ,  $p = .571$ ).

### 3.2.3. Publication bias

The risk of publication bias appears to be limited. First, the nonsignificant moderator effect of the peer-reviewed criterion (see Table 5) suggests an absence of publication bias (Borenstein et al., 2021). Second, we generated a funnel plot based on a combination of the three proficiency measures used for the moderator analyses (overall proficiency, comprehension, fluency). The plot, which is shown in Fig. 2, shows generally small effect sizes, that are quite evenly distributed around the mean. Note that the funnel plot also reveals an outlier (Weber, 2009); exclusion of this outlier hardly affected the outcomes of the meta-analysis. Finally, we conducted Egger's regression test: the non-significant intercept ( $B = 0.76$ ,  $p = .08$ ) additionally suggests a lack of publication bias.

## 4. Discussion

### 4.1. Summary and discussion

The aim of this meta-analysis was to examine the effects of additions to independent silent reading in schools. It was based on concerns raised by Reutzel et al. (2010) about the practice of ISR. Following their suggestions for improvement, we examined additions to ISR: (a) that aim to help students in choosing appropriate books, (b) that engage students in the reading activity, (c) in which students are accountable for how much and what they read, and (d) that increase opportunities for students to interact about what they read. Examination of the overall effects showed that such additions contribute to reading proficiency, especially for students at risk of reading failure. Additions to ISR seemed to have no effect on stronger readers: presumably, they do not need additional interventions to benefit from ISR (Van der Sande et al., 2019). Moderator analyses of addition types suggested that one addition is not necessarily more effective than the other, except for help or instruction by the teacher: this appeared to have a negative effect. The size of the effects was limited in a statistical sense: even the largest mean effect, on overall reading proficiency, could only be qualified as 'small' according to Cohen's (1988) guidelines. Still, such effects should be considered encouraging, particularly since nearly all the studies used tests developed outside the context of the study (often standardized tests). Naturally, such tests are likely to show smaller effects than tests designed specifically for the study (e.g., Okkinga et al., 2018). By definition, the content of these study-dependent tests corresponds to what students are offered in the programs under analysis. Put differently, effects on standardized tests suggest that outcomes can be generalized to knowledge and skills that transcend the context of the programs.

The negative effect of help or instruction by the teacher is unexpected. Brief, individual student-teacher conferences during ISR, for example, are thought to give teachers the opportunity to determine whether students understand what they read and to provide

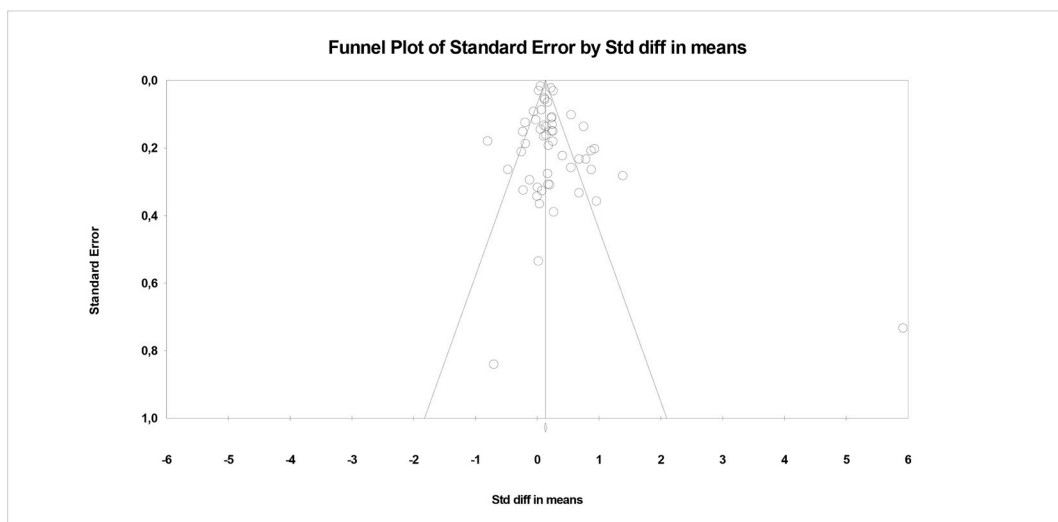


Fig. 2. Funnel plot of the overall reading proficiency, reading comprehension, and reading fluency effect sizes.

immediate support if students get stuck. How, then, should we interpret this effect? Unfortunately, our interpretation is somewhat hampered by the varied designs in which help/instruction was implemented. Moreover, in some studies, the form of help or instruction provided was only superficially explained. Notwithstanding these limitations, a possible explanation is that in some cases help/instruction occurred *during* reading and may have interrupted the reading process. Green and Brock (2000) coined the term ‘transportation into a narrative world’, which is a state of cognitive and emotional immersion in a text (Gerrig, 1993; Green, 2008; Green & Brock, 2002). Transportation is often viewed as critical to reading enjoyment (Green et al., 2004). Readers who are more transported into a text also have more positive attitudes towards that text and report higher levels of pleasure while reading (e.g., Green et al., 2004). It is possible that help or instruction by teachers during reading interferes with such transportation processes, thus disrupting students’ engagement with the text. We believe that additional research is needed to determine more precisely the circumstances under which giving help or instruction hampers or adds to the effects of ISR.

Finally, we found an effect of the level of randomization: when individual students were randomly assigned to conditions, program effects were significantly smaller than when randomization took place at the class level. In principle, individual randomization allows the most unbiased estimate of intervention effects: it is the best way to ensure that there is independence of observations. When classes instead of students are randomly assigned to conditions, students in a condition are no longer independent of each other because they are in the same class and thus share certain characteristics (e.g., they are taught by the same teacher). At the same time, individual randomization does not accurately reflect common practice in education: put differently, randomization at the class level offers higher ecological validity. In our sample, only a small proportion of studies (about 20%) were able to randomize at the individual student level.

#### 4.2. Limitations

Our meta-analysis has several limitations. A first limitation is that we found hardly any studies that examined longer-term effects. The question of whether such effects occur is relevant. One striking result of the meta-analysis is that additions to ISR were particularly effective for students at risk of reading failure. It is important to know whether this effect is sustainable, that is, whether these students enter a virtuous cycle (Mol & Bus, 2011; Stanovich, 1986): do additions such as limiting or supporting book selection lead to experiences of success and do those experiences of success result in increased self-confidence and motivation? Does increased self-confidence and motivation invite more reading, and does this contribute to growth in reading skills, which in turn leads to more frequent mastery experiences? More longitudinal research is needed to answer such questions.

A second limitation is that the effect measures more often involved reading proficiency than other variables. The assumption is that additions to ISR contribute to reading development by making students read more frequently, longer, more attentively, and with more motivation (Reutzel et al., 2010). However, effects on reading behavior and motivation were mapped significantly less frequently than effects on reading skills. To ascertain whether effects on reading skills stem from changes in reading frequency, duration, attention, and enjoyment, it is important to include those variables in future research as well.

A third limitation concerns the availability of information on sample characteristics. Our conclusion that additions to ISR are more effective for students at risk of reading failure is based on 31 of a total of 53 samples. In 22 cases, information was missing to determine whether the sample could be characterized as predominantly at-risk. Consequently, the ability to answer certain other questions was also limited. Importantly, this situation did not allow us to test whether the effects of certain additions to ISR differ between students at-risk and those not at-risk. The latter is highly relevant: given the suggestion that ISR raises specific barriers for struggling readers, it is important to assess what works best for these students.

A fourth limitation lies in the (im)possibilities of software packages such as CMA. In 11 studies, multiple measures were used to assess the dependent variables we were interested in (i.e., reading comprehension, fluency, motivation, and behavior). Following Borenstein et al. (2021), we averaged the effect sizes and sampling variances (applying a correction based on the number of variances included to prevent overestimation of standard errors). Alternative analysis strategies—particularly multilevel modeling—may be better suited to deal with possible within-study variance in effect sizes (Moeyaert et al., 2017), but such strategies are not offered in programs such as CMA.

#### 4.3. Implications and conclusion

It is expected that independent silent reading leads to more frequent and longer reading, more attentive reading, and more enjoyment of reading and therefore makes a beneficial contribution to reading development (Reutzel et al., 2010). Previous review studies were inconclusive about the effects of ISR (Erbeli & Rice, 2022; National Reading Panel, 2000; Yoon, 2002). Dutch research (Van der Sande et al., 2019) suggested that ISR is particularly beneficial for students who already have a reading routine but has a negative effect on students who do not have this routine. The results of this meta-analysis support the idea that additions to ISR can mitigate this negative effect: in particular, students at risk of reading failure seem to benefit from such additions.

We have no conflict of interest to disclose.

#### Data availability

Data will be made available on request.

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## Appendix A

### ERIC Ovid

(Silent Reading/OR Sustained Silent Reading/OR Independent Reading/OR Recreational Reading/OR Individualized Reading/OR (((silent OR Independent OR Self-selected OR Extensive OR Leisure OR Recreational OR Free OR Superquiet OR Voluntary OR Pleasure OR Quiet OR Uninterrupted OR Individualized OR Individualized) ADJ3 reading) OR Drop-Everything-and-Read OR Exposure-to-Text OR Book-Flood OR Accelerated-Reader OR Wonderful-Exciting-Books). ab,ti.) AND (Reading Habits/OR Reading Rate/OR Behavior/OR Child Behavior/OR Reading Motivation/OR Student Motivation/OR Motivation/OR Attitudes/OR Childrens Attitudes/OR Student Attitudes/OR Personal Autonomy/OR Competence/OR Self Concept/OR Expectation/OR Values/OR Reading Fluency/OR Vocabulary/OR Vocabulary Development/OR Vocabulary Skills/OR Reading development/OR Comprehension/OR Reading Comprehension/OR (behavior\* OR behavior\* OR motivat\* OR engagement\* OR attitude\* OR autonom\* OR competence\* OR relatedness OR self-concept OR self-efficac\* OR identit\* OR belonging\* OR goal\* OR expectan\* OR expectation\* OR value\* OR fluency OR vocabulary OR (reading ADJ3 (frequen\* OR habit\* OR proficiency OR competence OR skills OR ability OR comprehension OR rate OR achievement OR performance OR stamina OR activit\* OR amount OR development\* OR interest\* OR speed)) OR (book ADJ3 exposure) OR (literature ADJ3 appreciat\*)). ab,ti.) AND (exp Children/OR Elementary Education/OR Elementary School Students/OR High School Students/OR Middle School Students/OR Primary Education/OR Elementary Schools/OR Secondary Education/OR High Schools/OR Middle Schools/OR exp Adolescents/OR Adolescents/OR Adolescent Development/OR Puberty/OR (child\* OR schoolchild\* OR pupil\* OR ((primary OR elementary OR secondary OR middle OR high OR grade\*) ADJ (education OR school\* OR student\*)) OR grade\* OR adolescen\* OR teen OR teens OR teenage\* OR puberty OR young-adult\* OR girl\* OR boy\* OR youth\* OR year-olds). ab, ti.)

### PsycINFO Ovid

(Silent Reading/OR (((silent OR Independent OR Self-selected OR Extensive OR Leisure OR Recreational OR Free OR Superquiet OR Voluntary OR Pleasure OR Quiet OR Uninterrupted OR Individualized OR Individualized) ADJ3 reading) OR Drop-Everything-and-Read OR Exposure-to-Text OR Book-Flood OR Accelerated-Reader OR Wonderful-Exciting-Books). ab,ti.) AND (Behavior/OR Child Behavior/OR Motivation/OR Attitudes/OR Child Attitudes/OR Autonomy/OR Competence/OR Self-Concept/OR Expectations/OR Values/OR Vocabulary/OR Comprehension/OR Reading Comprehension/OR (behavior\* OR behavior\* OR motivat\* OR engagement\* OR attitude\* OR autonom\* OR competence\* OR relatedness OR self-concept OR self-efficac\* OR identit\* OR belonging\* OR goal\* OR expectan\* OR expectation\* OR value\* OR fluency OR vocabulary OR (reading ADJ3 (frequen\* OR habit\* OR proficiency OR competence OR skills OR ability OR comprehension OR rate OR achievement OR performance OR stamina OR activit\* OR amount OR development\* OR interest\* OR speed)) OR (book ADJ3 exposure) OR (literature ADJ3 appreciat\*)). ab,ti.) AND (100. ag. OR Elementary Education/OR Elementary School Students/OR High School Students/OR Middle School Students/OR Elementary Schools/OR Secondary Education/OR High Schools/OR Middle Schools/OR 100. ag. OR Puberty/OR (child\* OR schoolchild\* OR pupil\* OR ((primary OR elementary OR secondary OR middle OR high OR grade\*) ADJ (education OR school\* OR student\*)) OR grade\* OR adolescen\* OR teen OR teens OR teenage\* OR puberty OR young-adult\* OR girl\* OR boy\* OR youth\* OR year-olds). ab,ti.)

### Web of Science

TS=(((silent OR Independent OR Self-selected OR Extensive OR Leisure OR Recreational OR Free OR Superquiet OR Voluntary OR Pleasure OR Quiet OR Uninterrupted OR Individualized OR Individualized) NEAR/2 reading) OR Drop-Everything-and-Read OR Exposure-to-Text OR Book-Flood OR Accelerated-Reader OR Wonderful-Exciting-Books)) AND ((behavior\* OR behavior\* OR motivat\* OR engagement\* OR attitude\* OR autonom\* OR competence\* OR relatedness OR self-concept OR self-efficac\* OR identit\* OR belonging\* OR goal\* OR expectan\* OR expectation\* OR value\* OR fluency OR vocabulary OR (reading NEAR/2 (frequen\* OR habit\* OR proficiency OR competence OR skills OR ability OR comprehension OR rate OR achievement OR performance OR stamina OR activit\* OR amount OR development\*)) OR (book NEAR/2 exposure) OR (literature NEAR/2 appreciat\*))) AND ((child\* OR schoolchild\* OR pupil\* OR ((primary OR elementary OR secondary OR middle OR high OR grade\*) NEAR/1 (education OR school\* OR student\*)) OR grade\* OR adolescen\* OR teen OR teens OR teenage\* OR puberty OR young-adult\* OR girl\* OR boy\* OR youth\* OR year-olds))

### Scopus

TITLE-ABS-KEY (((silent OR Independent OR Self-selected OR Extensive OR Leisure OR Recreational OR Free OR Superquiet OR

Voluntary OR Pleasure OR Quiet OR Uninterrupted OR Individualized OR Individualized) W/2 reading) OR Drop-Everything-and-Read OR Exposure-to-Text OR Book-Flood OR Accelerated-Reader OR Wonderful-Exciting-Books)) AND ((behavior\* OR behavior\* OR motivat\* OR engagement\* OR attitude\* OR autonom\* OR competence\* OR relatedness OR self-concept OR self-efficac\* OR identit\* OR belonging\* OR goal\* OR expectan\* OR expectation\* OR value\* OR fluency OR vocabulary OR (reading W/2 (frequen\* OR habit\* OR proficiency OR competence OR skills OR ability OR comprehension OR rate OR achievement OR performance OR stamina OR activit\* OR amount OR development\*)) OR (book W/2 exposure) OR (literature W/2 appreciat\*)) AND ((child\* OR schoolchild\* OR pupil\* OR ((primary OR elementary OR secondary OR middle OR high OR grade\*) W/1 (education OR school\* OR student\*)) OR grade\* OR adolescen\* OR teen OR teens OR teenage\* OR puberty OR young-adult\* OR girl\* OR boy\* OR youth\* OR year-olds))

Google scholar

“silent|Independent reading” behavior|behavior|motivation|engagement|attitude|autonomy|competence|relatedness|“self concept|efficacy” child|schoolchild|pupil|“primary|elementary|secondary|middle|high education|school|student”

Appendix B

Table B.1 Program Characteristics (1)

No.	Authors, year	Name	Limiting book selection	Support of book selection	Accountability	Reading log: type	Help/instruction by the teacher	(Social) interaction
1	Allen & Hancock, (2008)	–	No	No	No	No	Yes	No
2	Allen (2017)	IRLA and 100 Book Challenge	Yes	No	No	No	No	No
3	Andrews (2017)	Book Flood	No	No	No	Yes: activity	No	Yes
4	Assi (2016)	–	No	No	No	No	No	No
5	Baker (2011)	Reading Workshop	Yes	No	Yes	No	Yes	Yes
6	Bell et al. (2020)	–	No	No	No	Yes: activity	Yes	No
7	Birmingham (2001)	–	Yes	Yes	No	No	Yes	No
8	Brannan (2020)	–	Yes	Yes	Yes	Yes: accountability	Yes	Yes
9	Brown (2008)	Accelerated Reader	Yes	No	Yes	No	No	No
10	Brown (2010)	Accelerated Reader	Yes	Yes	Yes	No	No	No
11	Caldwell (2013)	Starfall.com	Yes	No	Yes	No	No	No
12	Canty (2009)	–	Yes	Yes	No	No	Yes	No
13	Cheatham, Allor, & Roberts, (2014)	–	Yes	No	Yes	Yes: accountability	No	No
14	Cuevas et al. (2014)	–	Yes	No	Yes	No	No	No
15	Culmo (2009)	–	Yes	No	No	Yes: activity	Yes	Yes
16	De Primo (2015)	Fast ForWord	No	Yes	No	No	Yes	Yes
17	Gray (2012)	–	No	Yes	No	No	No	Yes
18	Holmes & Brown, (2003)	Accelerated Reader	Yes	No	Yes	No	No	No
No.	Authors, year	Name	Limiting book selection	Support of book selection	Accountability	Reading log: type	Help/instruction by the teacher	(Social) interaction
19	Horne (2014)	Accelerated Reader	Yes	Yes	Yes	No	Yes	No
20	Hunter (2013)	Accelerated Reader	Yes	No	Yes	No	No	No
21	Ibarra (2016)	–	No	Yes	Yes	Yes: activity	No	No
22	Little, McCoach, & Reis, (2014)	Schoolwide Enrichment Model-Reading	No	No	No	Yes: activity	Yes	No
23	Malloy (2008)	Instructional Sustained Silent Reading	No	Yes	No	No	Yes	Yes
24	Melton (2003)	Accelerated Reader	Yes	No	Yes	No	No	No
25	Morgan (2013)	–	No	No	No	No	No	Yes

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Table B.1 (continued)

No.	Authors, year	Name	Limiting book selection	Support of book selection	Accountability	Reading log: type	Help/instruction by the teacher	(Social) interaction
26	Nichols (2013)	Accelerated Reader	Yes	No	Yes	No	No	No
27	Norris (2008)	–	Yes	No	No	Yes: activity	No	Yes
28	Nunnery, Ross, & McDonald, (2006)	Accelerated Reader	Yes	No	Yes	No	Yes	No
29	Pavonetti et al. (2002-2003)	Accelerated Reader	Yes	No	Yes	No	No	No
30	Perks (2010)	–	Yes	Yes	No	No	Yes	No
31	Rasinski, Samuels, Hiebert, Petscher, & Feller, (2011)	Reading Plus	Yes	No	Yes	No	Yes	No
32	Reis et al. (2007)	Schoolwide Enrichment Model-Reading	No	Yes	No	No	Yes	Yes
33	Reis et al. (2008)	Schoolwide Enrichment Model-Reading	No	Yes	No	No	Yes	Yes
34	Reutzel, Petscher, & Spichtig, (2012)	Scaffolded Sustained Silent Reading	Yes	Yes	Yes	Yes: activity	Yes	No
No.	Authors, year	Name	Limiting book selection	Support of book selection	Accountability	Reading log: type	Help/instruction by the teacher	(Social) interaction
35	Reutzel, Petscher, & Spichtig, (2012)	Reading Plus	Yes	No	Yes	No	No	No
36	Rogers (2012)	Be Excited About Reading	No	No	Yes	Yes: accountability	No	Yes
37	Salters (2008)	–	No	No	Yes	Yes: accountability	Yes	No
38	Seals (2013)	–	Yes	No	No	No	No	No
39	Shannon et al. (2015)	Accelerated Reader	Yes	Yes	Yes	No	Yes	No
40	Siddiqui, Gorard, & See, (2016)	Accelerated Reader	Yes	Yes	Yes	No	No	No
41	Smith (2016)	Accelerated Reader	Yes	No	Yes	Yes: accountability	No	No
42	Spichtig, Gehsmann, Pascoe, & Ferrara, (2019)	Reading Plus	Yes	No	Yes	No	No	No
43	Ünal & Uyar, (2020)	I compete by reading	No	No	Yes	Yes: accountability	No	No
44	VanAken (2014)	–	No	No	Yes	Yes: accountability	No	No
45	Waddell (2010)	Accelerated Reader	Yes	No	Yes	No	No	No
46	Weber (2009)	Guided Library Selection Program	Yes	Yes	No	Yes: activity	No	No
47	West (2010)	Scaffolded Silent Reading	Yes	Yes	Yes	Yes: accountability	Yes	Yes
48	Williams (2011)	–	No	No	No	No	Yes	Yes
49	Wilson (2020)	Accelerated Reader	Yes	No	Yes	No	No	No
50	WWC (2010)	Reading Plus	Yes	No	Yes	No	Yes	No
51	Young (2019)	Guided Reading	Yes	Yes	No	No	Yes	No

Note. WWC (2010) is a (secondary) report of another, primary study: Reading Plus (2008).

Table B.2 Program Characteristics (2)

No.	Authors, year	Reward/competition	Technological support	Home activities	Training/coaching	Duration (weeks)	Number of sessions	Total duration (minutes)
1	Allen and Hancock, (2008)	No	No	No	No	10	20	400
2	Allen (2017)	No	No	No	No	10	20	600
3	Andrews (2017)	No	No	No	Yes	40	200	12,000
4	Assi (2016)	No	No	No	No	12	60	900
5	Baker (2011)	No	Yes	No	No	20	–	–
		No	No	No	No	40	200	36,000

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No.	Authors, year	Reward/ competition	Technological support	Home activities	Training/ coaching	Duration (weeks)	Number of sessions	Total duration (minutes)
6	Bell et al. (2020)	No	No	No	Yes	4	20	2400
7	Birmingham (2001)	No	No	No	No	12	36	540
8	Brannan (2020)	No	No	No	No	–	–	–
9	Brown (2008)	Yes	Yes	No	No	40	–	–
10	Brown (2010)	Yes	Yes	No	No	120	–	–
11	Caldwell (2013)	No	Yes	No	No	3	48	2880
12	Canty (2009)	No	Yes	No	Yes	6	–	–
13	Cheatham et al. (2014)	No	No	No	Yes	10	50	1500
14	Cuevas et al. (2014)	No	No	No	No	18	14	840
		No	Yes	No	No	18	14	840
15	Culmo (2009)	No	No	No	No	12	60	1800
16	De Primo (2015)	No	Yes	No	No	40	200	12,000
17	Gray (2012)	No	No	No	No	12	60	1200
18	Holmes & Brown, (2003)	Yes	Yes	No	Yes	40	200	12,000
19	Horne (2014)	Yes	Yes	No	No	9	45	1350
20	Hunter (2013)	Yes	Yes	No	No	80	–	–
21	Ibarra (2016)	No	No	No	No	40	200	6000
22	Little et al. (2014)	No	No	No	Yes	32	160	7200
23	Malloy (2008)	No	No	No	No	12	60	1800
24	Melton (2003)	Yes	Yes	No	No	40	–	–
25	Morgan (2013)	No	No	No	No	40	200	6000
26	Nichols (2013)	Yes	Yes	No	No	40	–	–
27	Norris (2008)	No	No	No	Yes	16	80	1600
No.	Authors, year	Reward/ competition	Technological support	Home activities	Training/ coaching	Duration (weeks)	Number of sessions	Total duration (minutes)
28	Nunnery et al. (2006)	No	Yes	No	Yes	32	–	–
29	Pavonetti et al. (2002-2003)	Yes	Yes	No	No	–	–	–
30	Perks (2010)	Yes	No	No	No	40	–	–
31	Rasinski et al. (2011)	No	Yes	No	No	20	50	1900
32	Reis et al. (2007)	No	Yes	No	Yes	12	60	2700
33	Reis et al. (2008)	No	Yes	No	Yes	14	70	4200
34	Reutzel et al. (2008)	No	No	No	Yes	36	144	3600
35	Reutzel et al. (2012)	No	Yes	No	No	26	130	3900
36	Rogers (2012)	No	Yes	Yes	No	18	18	594
37	Salters (2008)	No	No	Yes	No	6	30	–
38	Seals (2013)	No	No	No	No	10	50	500
39	Shannon et al. (2015)	No	Yes	No	Yes	24	117	4319
40	Siddiqui et al. (2016)	Yes	No	No	No	20	100	4000
41	Smith (2016)	Yes	Yes	Yes	No	40	200	6000
42	Spichtig et al. (2019)	No	Yes	No	No	40	100	2500
43	Ünal & Uyar, (2020)	Yes	No	No	No	8	–	–
44	VanAken (2014)	No	Yes	No	Yes	40	20	500
45	Waddell (2010)	Yes	Yes	No	No	40	–	–
46	Weber (2009)	No	Yes	No	No	12	48	960
47	West (2010)	No	No	No	No	40	200	6000
48	Williams (2011)	No	No	No	Yes	16	80	–
49	Wilson (2020)	Yes	Yes	No	No	40	–	–
50	WWC (2010)	No	Yes	No	Yes	26	78	2340
51	Young (2019)	No	No	No	No	40	–	–

Table B.3

Sample Characteristics

No.	Authors, year	Low SES	Ethnic minority	L2 learners	Low reading proficiency	At-risk	Educational stage	% girls
1	Allen and Hancock, (2008)	–	–	–	–	–	≤ Grade 6	–
		–	–	–	–	–	≤ Grade 6	–
2	Allen (2017)	Yes	Yes	–	–	–	≤ Grade 6	53.00
3	Andrews (2017)	–	–	–	–	Yes	≤ Grade 6	55.26
4	Assi (2016)	–	Yes	Yes	–	Yes	≥ Grade 7	100.00
5	Baker (2011)	No	Yes	No	–	Yes	Both	47.68

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Table B.3 (continued)

No.	Authors, year	Low SES	Ethnic minority	L2 learners	Low reading proficiency	At-risk	Educational stage	% girls
6	Bell et al. (2020)	Yes	Yes	–	Yes	Yes	≤ Grade 6	48.00
7	Birmingham (2001)	–	Yes	–	–	Yes	≥ Grade 7	45.65
8	Brannan (2020)	–	–	–	–	–	≤ Grade 6	–
9	Brown (2008)	–	–	–	–	–	≥ Grade 7	–
10	Brown (2010)	–	–	–	–	–	≤ Grade 6	–
11	Caldwell (2013)	–	Yes	–	–	Yes	≤ Grade 6	40.00
12	Canty (2009)	Yes	No	–	–	Yes	≤ Grade 6	44.44
13	Cheatham et al. (2014)	–	–	–	Yes	Yes	≤ Grade 6	–
		–	–	–	No	No	≤ Grade 6	–
14	Cuevas et al. (2014)	Yes	Yes	No	No	Yes	≥ Grade 7	–
		Yes	Yes	No	No	Yes	≥ Grade 7	–
15	Culmo (2009)	No	Yes	No	No	Yes	≤ Grade 6	55.88
16	De Primo (2015)	–	No	–	No	No	≥ Grade 7	44.30
17	Gray (2012)	–	–	–	–	–	≤ Grade 6	64.29
18	Holmes & Brown, (2003)	–	–	–	–	–	≤ Grade 6	50.00
19	Horne (2014)	Yes	–	–	–	Yes	≥ Grade 7	–
20	Hunter (2013)	No	No	–	–	No	≤ Grade 6	46.00
21	Ibarra (2016)	Yes	Yes	No	–	Yes	≤ Grade 6	–
22	Little et al. (2014)	–	–	–	–	–	≤ Grade 6	–
		–	–	–	–	–	≥ Grade 7	–
23	Malloy (2008)	–	–	–	–	–	≤ Grade 6	–
24	Melton (2003)	–	No	–	–	No	≤ Grade 6	–
25	Morgan (2013)	Yes	Yes	–	No	Yes	≥ Grade 7	50.00

No.	Authors, year	Low SES	Ethnic minority	L2 learners	Low reading proficiency	At-risk	Educational stage	% girls
26	Nichols (2013)	–	No	–	–	No	≤ Grade 6	46.30
27	Norris (2008)	–	–	–	–	–	≥ Grade 7	–
28	Nunnery et al. (2006)	–	–	–	–	–	≤ Grade 6	–
29	Pavonetti et al. (2002-2003)	–	–	–	–	–	≥ Grade 7	–
30	Perks (2010)	–	–	–	–	–	≥ Grade 7	54.40
31	Rasinski et al. (2011)	–	–	–	–	–	≤ Grade 6	–
		–	–	–	–	–	≥ Grade 7	–
32	Reis et al. (2007)	–	–	–	–	–	≤ Grade 6	–
33	Reis et al. (2008)	–	–	–	–	–	≤ Grade 6	–
34	Reutzel et al. (2008)	–	–	–	–	–	≤ Grade 6	–
35	Reutzel et al. (2012)	–	Yes	No	Yes	Yes	≤ Grade 6	–
36	Rogers (2012)	Yes	No	–	–	Yes	≥ Grade 7	51.61
37	Salters (2008)	–	Yes	–	–	Yes	≤ Grade 6	44.68
38	Seals (2013)	–	Yes	–	–	Yes	≤ Grade 6	47.00
39	Shannon et al. (2015)	No	No	–	–	No	≤ Grade 6	48.00
40	Siddiqui et al. (2016)	No	No	No	Yes	Yes	≥ Grade 7	48.00
41	Smith (2016)	Yes	No	–	–	Yes	≤ Grade 6	42.22
42	Spichtig et al. (2019)	No	No	No	–	No	≤ Grade 6	50.47
43	Ünal & Uyar, (2020)	–	–	–	–	–	≤ Grade 6	–
44	VanAken (2014)	–	No	–	No	No	≤ Grade 6	51.16
45	Waddell (2010)	–	Yes	–	–	Yes	≤ Grade 6	46.15
46	Weber (2009)	–	–	–	–	–	≤ Grade 6	–
47	West (2010)	–	Yes	–	–	Yes	≥ Grade 7	57.57
48	Williams (2011)	No	No	–	–	No	≤ Grade 6	36.65
49	Wilson (2020)	–	–	–	–	–	≤ Grade 6	–
50	WWC (2010)	–	Yes	No	Yes	Yes	Both	–
51	Young (2019)	Yes	Yes	No	–	Yes	≤ Grade 6	37.50

Table B.4

## Study and Measurement Characteristics, Effect Sizes

No.	Authors, year	Peer-reviewed	Randomization: level	Study quality (0-6)	Construct	Type of measurement	Timing	Study-independent	Effect size
1	Allen and Hancock, (2008)	Yes	Yes: student	3	Compr.	Test	Direct	Yes	0.15
2	Allen (2017)	No	No	2	Compr. General	Test	Direct	Yes	0.24
3	Andrews (2017)	No	Yes: class	4	General prof.	Test	Direct	Yes	-0.23
4	Assi (2016)	No	Yes: class	2	Motivation Compr. Motivation	Questionnaire Test Questionnaire	Direct Direct Direct	Yes Yes Yes	0.66 -0.70 -1.16

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Table B.4 (continued)

No.	Authors, year	Peer-reviewed	Randomizat-ion: level	Study quality (0–6)	Construct	Type of measurement	Timing	Study-independent	Effect size
5	Baker (2011)	No	No	2	General prof.	Test	Direct	Yes	0.03
6	Bell et al. (2020)	Yes	No	5	General prof. Compr.	Test	Follow-up	Yes	-0.06
					Fluency	Test	Follow-up	Yes	0.08
							Follow-up	Yes	-0.25
7	Birmingham (2001)	No	No	2	General prof.	Test	Direct	Yes	0.20
8	Brannan (2020)	Yes	No	1	Motivation Compr.	Questionnaire	Direct	Yes	0.17
					Behavior	Observation	Direct	Yes	0.26
9	Brown (2008)	No	No	2	General prof.	Test	Direct	Yes	0.02
10	Brown (2010)	No	No	1	General prof.	Test	Direct	Yes	0.93
11	Caldwell (2013)	No	No	0	General prof.	Test	Direct	Yes	0.25
					Compr.	Test	Direct	Yes	0.19
12	Canty (2009)	No	Yes: class	4	General prof.	Test	Direct	Yes	-0.14
					Compr.	Test	Direct	Yes	0.41
					Behavior	Test	Direct	Yes	1.51
					Fluency	Test	Direct	Yes	1.46
13	Cheatham et al. (2014)	Yes	Yes: student	6	Fluency	Test	Direct	Yes	0.17
14	Cuevas et al. (2014)	Yes	Yes: student	3	General prof.	Test	Direct	Yes	0.01
								Yes	0.49
No.	Authors, year	Peer-reviewed	Randomizat-ion: level	Study quality (0–6)	Construct	Type of measurement	Timing	Study-independent	Effect size
					Compr.	Test	Direct	Yes	0.33
					Motivation	Questionnaire	Direct	Yes	0.41
					General prof.	Test	Direct	Yes	0.62
					Compr.	Test	Direct	Yes	0.48
15	Culmo (2009)	No	No	2	Motivation	Questionnaire	Direct	Yes	0.53
					General prof.	Test	Direct	Yes	0.00
					Motivation	Questionnaire	Direct	Yes	0.14
16	De Primo (2015)	No	No	2	Compr.	Test	Direct	Yes	-0.19
17	Gray (2012)	No	No	1	Fluency	Test	Direct	Yes	0.08
					Behavior	Questionnaire	Direct	Yes	-0.60
18	Holmes & Brown, (2003)	No	No	2	General prof.	Test	Direct	Yes	0.55
19	Horne (2014)	No	No	1	General prof.	Test	Direct	Yes	-0.02
20	Hunter (2013)	No	No	1	General prof.	Test	Direct	Yes	0.22
					Compr.	Test	Direct	Yes	0.00
					Vocabulary	Test	Direct	Yes	0.37
					General prof.	Test	Follow-up	Yes	-0.02
					Compr.	Test	Follow-up	Yes	-0.15
					Vocabulary	Test	Follow-up	Yes	0.00
21	Ibarra (2016)	No	No	2	Compr.	Test	Direct	Yes	0.06
22	Little et al. (2014)	Yes	Yes: class	4	Compr.	Test	Direct	Yes	-0.17
					Fluency	Test	Direct	Yes	0.05
					Compr.	Test	Direct	Yes	0.14
					Fluency	Test	Direct	Yes	0.10
23	Malloy (2008)	No	Yes: student	5	General prof.	Test	Direct	Yes	0.27
24	Melton (2003)	No	No	1	General prof.	Test	Direct	Yes	-0.80

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Table B.4 (continued)

No.	Authors, year	Peer-reviewed	Randomization: level	Study quality (0–6)	Construct	Type of measurement	Timing	Study-independent	Effect size
25	Morgan (2013)	No	No	1	General prof.	Test	Direct	Yes	0.89
26	Nichols (2013)	No	No	0	General prof.	Test	Direct	Yes	0.18
27	Norris (2008)	No	Yes: class	3	Compr.	Test	Direct	Yes	0.00
					Fluency	Test	Direct	Yes	0.08
					Vocabulary	Test	Direct	Yes	–0.16
					Motivation	Questionnaire	Direct	Yes	0.19
No.	Authors, year	Peer-reviewed	Randomization: level	Study quality (0–6)	Construct	Type of measurement	Timing	Study-independent	Effect size
28	Nunnery et al. (2006)	Yes	Yes: class	4	Behavior	Test	Direct	Yes	0.46
					General prof.	Test	Direct	Yes	0.17
29	Pavonetti et al. (2002-2003)	Yes	No	1	Behavior	Test	Direct	Yes	–0.05
30	Perks (2010)	No	Yes: class	3	Compr.	Test	Direct	Yes	0.26
					Motivation	Questionnaire	Direct	No	–0.10
31	Rasinski et al. (2011)	Yes	No	2	General prof.	Test	Direct	Yes	0.26
					General prof.	Test	Direct	Yes	0.22
32	Reis et al. (2007)	Yes	Yes: student	3	Compr.	Test	Direct	Yes	0.13
					Fluency	Test	Direct	No	0.10
					Motivation	Questionnaire	Direct	Yes	0.18
33	Reis et al. (2008)	Yes	Yes: student	3	Compr.	Test	Direct	Yes	0.07
					Fluency	Test	Direct	No	0.07
					Motivation	Questionnaire	Direct	Yes	0.03
34	Reutzel et al. (2008)	Yes	Yes: student	3	Compr.	Test	Direct	Yes	–0.47
35	Reutzel et al. (2012)	Yes	No	3	Fluency	Test	Direct	Yes	0.01
					General prof.	Test	Direct	Yes	1.20
36	Rogers (2012)	No	Yes: class	3	Compr.	Test	Direct	Yes	0.16
					General prof.	Test	Direct	Yes	
37	Salters (2008)	No	Yes: student	3	Compr.	Test	Direct	Yes	–0.12
38	Seals (2013)	No	Yes: class	4	Compr.	Test	Direct	Yes	0.79
					Fluency	Test	Direct	Yes	0.96
39	Shannon et al. (2015)	Yes	Yes: class	6	General prof.	Test	Direct	Yes	
40	Siddiqui et al. (2016)	Yes	Yes: mixed	2	Compr.	Test	Direct	Yes	0.24
41	Smith (2016)	No	No	0	Compr.	Test	Direct	Yes	–0.25
					Compr.	Test	Follow-up		–0.09
42	Spichtig et al. (2019)	Yes	Yes: student	6	Compr.	Test	Direct	Yes	0.10
No.	Authors, year	Peer-reviewed	Randomization: level	Study quality (0–6)	Construct	Type of measurement	Timing	Study-independent	Effect size
43	Ünal & Uyar, (2020)	Yes	Yes: class	3	Fluency	Eye-tracking	Direct	Yes	0.20
					Vocabulary	Test	Direct	Yes	0.08
					Compr.	Test	Direct	No	0.68
44	VanAken (2014)	No	Yes: class	4	Motivation	Questionnaire	Direct	Yes	0.74
					General prof.	Test	Direct	Yes	0.18
					Motivation	Questionnaire	Direct	Yes	–0.02
45	Waddell (2010)	No	No	0	Behavior	Questionnaire	Direct	No	0.00
					General prof.	Test	Direct	Yes	0.75
46	Weber (2009)	No	Yes: class	3	General prof.	Test	Direct	Yes	5.92
47	West (2010)	No	No	0	General prof.	Test	Direct	Yes	–0.47
					Motivation	Questionnaire	Direct	Yes	0.15

(continued on next page)

Table B.4 (continued)

No.	Authors, year	Peer-reviewed	Randomization level	Study quality (0–6)	Construct	Type of measurement	Timing	Study-independent	Effect size
48	Williams (2011)	No	No	2	Motivation	Questionnaire	Direct	Yes	0.06
49	Wilson (2020)	No	No	1	General prof.	Test	Direct	Yes	0.13
50	WWC (2010)	No	No	0	Compr.	Test	Direct	Yes	0.06
51	Young (2019)	Yes	No	3	General prof.	Test	Direct	Yes	0.79

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