

KENTUCKY READING RESEARCH CENTER

A Systematic Review of Literature on Multisyllabic Word Reading Interventions for Students in Grades 4-9

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A Systematic Review of the Literature on Multisyllabic Word Reading Interventions for Students in Grades 4-9

Abstract

At present, no published review of reading intervention studies has focused specifically on multisyllabic word reading interventions for adolescent students. The present systematic review included multisyllabic word reading intervention studies published between 2008 and 2024 with participants in grades four through nine. Eight randomized controlled trials, four quasi-experimental studies, and two single-case design studies met criteria for inclusion. Findings revealed significant positive effects on word reading for interventions that combined word reading and word meaning instruction and those that implemented explicit word study instruction in grapheme-phoneme correspondences and letter combinations as well as syllabication and morphemic analysis.

Introduction

Around third grade, most reading instruction shifts from a focus on word reading strategies to an emphasis on comprehension. Because of this, older students who struggle with word reading often lack sufficient opportunities to develop the skills they need to read multisyllabic words accurately and efficiently (Boardman et al., 2008). This is critically important, as struggling readers represent the majority in U.S. public schools. According to the 2024 National Assessment of Educational Progress, just 31% of fourth graders and 30% of eighth graders scored at the proficient level (NCES, 2024) in reading. It is unclear precisely how many of these readers struggle with word reading specifically, but research suggests that adolescent students with reading difficulties are likely to demonstrate deficits in word reading, reading fluency, and reading comprehension (Cirino et al., 2012).

As they transition to the upper elementary grades, learners begin to encounter texts containing increasingly complex academic vocabulary, often in the form of multisyllabic words (e.g., Heggie & Wade-Woolley, 2017; Toste et al., 2019; Wanzek et al, 2010). Although proficiency with decoding single syllables is a clear prerequisite, multisyllabic word reading requires additional skills adolescents are unlikely to have gained simply through learning to read monosyllables (Cunningham, 1998; Kearns, 2015). Multisyllabic words are less likely to demonstrate the grapheme-phoneme consistency observed in

monosyllabic words (Hiebert et al., 2005), and they pose greater challenges related to working memory, vowel pronunciation, word stress, and morphological complexity (Heggie & Wade-Woolley, 2017). Historically, most word reading and literacy acquisition research has focused on monosyllabic words (e.g., Enderby et al., 2021; Yap & Balota, 2009). Thus, many research-based word reading instructional strategies do not address the unique characteristics of longer words.

Though the goal of reading instruction is for learners to glean information and meaning from texts (i.e., comprehension), the importance of ongoing word reading instruction should not be underestimated. Comprehension strategies cannot support learning if word reading skills are not intact (Archer et al., 2003; Edmonds et al., 2009; Perfetti, 2007), so it is critical to identify characteristics of effective multisyllabic word reading instruction for adolescent learners. There are currently no published meta-analyses, syntheses, or systematic reviews of the research on multisyllabic word reading interventions for readers in grades 4-9. However, four reviews examining adolescent reading interventions more broadly have included word reading components and are discussed in the following section.

In their meta-analysis of interventions for struggling adolescent readers, Scammacca and colleagues (2007) examined interventions aimed at improving reading fluency, vocabulary, and comprehension, as well as word study interventions targeting reading accuracy with unfamiliar words. They included 31 studies examining interventions for students in upper elementary, middle school, and high school. Of these, effect sizes were calculated for four studies of interventions including a word study component. These interventions were determined to have moderate overall effects, with effect sizes of 0.60 on all measures and 0.68 on standardized measures. Their effects on reading comprehension were smaller, 0.40, and potentially not different from zero. Thus, word study interventions were found by these authors to be appropriate for adolescent students who struggle with word reading but were not recommended for supporting comprehension. Edmonds et al. (2009) demonstrated similar findings through their synthesis of the effects of reading interventions on comprehension for struggling readers in grades 6-12. These authors found small to moderate effects of word reading interventions on comprehension (d = 0.34) but emphasized the importance of teaching word-level skills to enable students to access more complex texts. Wanzek et al. (2010) conducted a synthesis of reading interventions in the upper elementary grades. Of the nine experimental or quasi-experimental studies included in the synthesis, four examined the effects of word reading interventions and demonstrated small to moderate effects. A more recent synthesis (Wanzek et al., 2013) of the literature on extensive interventions for students with reading difficulties in grades 4-12 calculated effects on word reading outcomes. Although these authors did not report results specific to interventions targeting word reading, the mean effect size estimate for all included reading intervention studies on word reading outcomes was small (0.15). Importantly, these authors note that although stronger gains are seen with early intervention, word recognition and word

reading fluency may be improved through the use of intensive interventions in adolescence (Wanzek et al., 2013).

Taken together, the results of previous syntheses indicate some promise for word reading interventions in grades 4-9, but none have focused specifically on word reading instruction. Given the critical role of accurate word reading on academic success, an examination of the effects of interventions targeting word reading for adolescent students is needed. The present review centers on multisyllabic word reading interventions and addresses three research questions.

1. What instructional and intervention characteristics and student characteristics have been tested as part of multisyllabic word reading interventions?
2. What does the research say about the effectiveness of multisyllabic word reading instruction in improving adolescent reading outcomes for readers in grades 4-9?
3. What features of instructional interventions (e.g., type of instruction, duration, grade level) are associated with improved outcomes? Do these features differ according to student characteristics?

Method

Study Eligibility Criteria

The present review included studies of adolescent multisyllabic word reading instruction based on the following criteria:

1. Participants were students in fourth through ninth grade (ages 9 years 0 months through 15 years 11 months).
2. The study was published in English between January 2008 and December 2024 and took place in the United States and its territories, Canada, Australia, Ireland, New Zealand, or the United Kingdom.
3. The study was published in a peer reviewed journal. Conference papers and dissertations were not eligible.
4. The study investigated a practice or curriculum implemented with children, not related to teacher professional learning, teacher preparation, textbook design, or school reform.
5. The study included at least one outcome related to intervention, instruction, strategy, curriculum, program, or treatment on multisyllabic word reading.
6. The study utilized an experimental design.

Search Strategy

Studies included in the present review were identified in two steps. First, the terms (multi syllabic OR multisyllabic OR syllabic OR syllable) AND (read* OR literacy) AND

(intervention OR teach OR instruct*) were used to conduct a search of four electronic databases: (1) Academic Search Complete, (2) APA PsycINFO, (3) ERIC, and (4) Education Full Text. The database search returned 1,331 unique records, of which, eight studies met criteria for inclusion. Next, an ancestral search of all references cited within the included studies was conducted and a forward search of all articles citing the included studies. Of these, 17 records for full-text screening were retrieved, six of which met criteria for inclusion. Reasons for exclusion are displayed in Figure 1.

Coding Procedure

Information relevant to the present review was extracted using a detailed code sheet and organized according to the following categories: research design, implementer, participants, setting, independent variable, and dependent variables. Eligible research designs included randomized controlled trials, quasi-experimental designs, and single-case designs. Implementers in the reviewed studies included researchers, special education teachers, general education teachers, and hired interventionists. Participant demographic data included grade level, multilingual status, disability status, and at-risk status. Independent variables were coded according to name, description, whether a curriculum was used, whether it was researcher developed, the unit of delivery, duration, intensity, and fidelity. Finally, dependent variables were coded according to name, description, and effects.

Findings

Characteristics of Reviewed Studies and Participants

Fourteen studies met criteria for inclusion in the present review. Two single-case design studies (SCD; Saqui et al., 2019; Wu, 2020), eight randomized controlled trials (RCT; Filderman & Toste, 2002; Toste et al., 2019; Vaughn et al., 2010; Vaughn et al., 2011; Vaughn et al., 2012; Vaughn et al., 2016; Vaughn et al., 2019; Wanzek & Roberts, 2012), and four quasi-experimental design studies (QED; Austin et al., 2022; Diliberto et al., 2008; Lovett et al., 2012; O'Connor et al., 2017) examined multisyllabic word reading interventions for students in grades 4-9 conducted between 2008 and 2024. All included intervention programs were researcher-created, and dosage ranged from 4 hours to 133 hours. A total of 1,872 participants enrolled in grades 4-9 are represented. The studies that reported disability status included 1,476 participants, 44% of whom (*n* = 643) had an identified disability. The studies that reported emergent bilingual (EB) status included 658 participants, 40% of whom (*n* = 265) were identified as EB students. An overview of study and participant characteristics is presented in Table 1.

Independent Variables: Components of Interventions Examined in Synthesis

Phonics and Word Study

All fourteen included studies implemented one or more elements of *phonics* (i.e., instruction focused on sound-symbol relationships) or *word study* (i.e., instruction targeting word-level reading skills). Table 2 displays the instructional components utilized in each intervention study.

Vaughn and colleagues (2010, 2011, 2012) conducted a three-year, multi-component, tiered intervention for middle school students with serious reading difficulties. At Tier 2, interventionists used *REWARDS Intermediate* (Archer et al., 2005a) and *REWARDS Plus Social Studies* (Archer et al., 2005b) to address phonics and multisyllabic word reading by teaching letter sounds, letter combinations, and affixes. The authors found statistically significant differences between groups on word attack following Tier 2 intervention (Vaughn et al., 2010). At Tier 3, interventionists worked with smaller groups and implemented the *Wilson Reading System* (Wilson, 1996), a multisensory word study program. Although the authors did not find significant effects on word attack skills following the Tier 3 intervention, there were statistically significant differences between the intervention and control groups on letter-word identification (Vaughn et al., 2012). In contrast, Wanzek and Roberts (2012) also investigated a multicomponent reading intervention that included implementation of the *Wilson Reading System* (Wilson, 1996) and found no statistically significant effects on word attack or word identification. In a subsequent study of a multicomponent intervention for fourth grade students with significant reading difficulties, Vaughn et al. (2016) implemented a word study component focused on developing phonics skills with multisyllabic words. Students received instruction and practice opportunities with individualized lists of multisyllabic words, high frequency words, and word patterns. The authors did not find significant treatment effects for letter-word identification.

In their work with fourth and fifth grade students with dyslexia, Austin et al. (2022) adapted and implemented a word reading intervention initially developed and examined by Vaughn and colleagues (2019). The word study portion of the intervention consisted of explicit instruction in grapheme-phoneme correspondences, vowel patterns, and word parts, including affixes. Both studies demonstrated small, positive effects of word study instruction on word reading outcomes, and Vaughn et al. reported significant effects on a researcher-developed measure of two-syllable word reading.

Diliberto et al. (2008) examined the *Syllable Skills Instruction Curriculum* with struggling middle school readers. The curriculum included instruction in syllable types, syllabication steps and rules, and accenting patterns for multisyllabic words. The authors found statistically significant differences between treatment and control groups favoring the intervention in word identification and word attack outcomes.

Toste et al. (2019) and Filderman and Toste (2022) investigated the effects of a multisyllabic word reading (MWR) intervention with the following word study components: review of vowel patterns, explicit instruction on affixes, and structural analysis. In the 2019 study, Toste and colleagues compared the effects of delivering the MWR intervention on its own to the effects of combining the MWR intervention with motivational beliefs training. They found that both conditions produced statistically significant treatment effects on both word identification and word attack. In the 2022 study, Filderman and Toste compared the effects of delivering the MWR intervention with initial customization (IC-only; i.e., assigning participants to groups customized to their skill profiles) to the effects of also using data-based decision-making (IC+DBDM) to deliver qualitative adjustments to the intervention. They found that the delivery of the intervention without the use of DBDM resulted in outcomes similar to business-as-usual (BAU) on measures of word identification and word attack.

In their examination of reading remediation for high school students with reading disabilities, Lovett et al. (2012) investigated the PHAST PACES program. The program included a phonological and orthographic knowledge track which focused on decoding deficits and taught specific word identification strategies. Specifically, participants were taught to use knowledge of grapheme-phoneme correspondence to sound out unfamiliar words, utilize rhyming to identify words by analogy, separate affixes from base words to decode and then blend individual word parts, try alternate pronunciations when unsure of vowel sounds, and to identify smaller known words within larger unfamiliar words. The researchers found significant fixed effects for the intervention condition on both word identification and word attack outcome measures.

O'Connor et al. (2017) investigated the effects of *Building Reading Interventions Designed for General Education Subjects* (BRIDGES) on reading outcomes for eighth grade U.S. History students. The intervention included five minutes of word study per session, during which teachers delivered explicit instruction on strategies for breaking down and blending together multisyllabic words. The intervention was delivered in three 12-day cycles across one semester of U.S. History, and the main effect on decoding accuracy was statistically significant in all three cycles favoring the intervention condition.

In their SCD study of reading intervention using curricular science texts with fourth and fifth grade participants, Saqui et al. (2019) embedded multisyllabic word decoding strategies within reading fluency instruction. Interventionists noted the multisyllabic words participants read incorrectly during timed fluency readings and then modeled using syllabication (i.e., breaking the word into individual syllables) or morphemic analysis (i.e., dividing the word into individual units of meaning) to decode the missed words. Although word reading accuracy improved within sessions from the first reading of a passage to the third reading of the same passage, gains between sessions were not statistically significant for any participant.

In another SCD study that implemented syllabication as an error correction procedure, Wu et al., (2019) investigated the effects of a multicomponent fluency intervention with middle school students. When participants read a word incorrectly during fluency practice, the researcher selected an error correction procedure that matched the nature of the participant's error. One such correction procedure was a syllable segmentation drill in which the researcher modeled correct pronunciation of the missed word before directing the participant to divide the word into syllables and blend those syllables to read the word correctly. When students were unable to read syllables accurately in the syllable segmentation drill, the researcher explicitly taught the necessary prerequisite reading skills such as letter sounds and letter sound combinations. Non-overlap of all pairs (97%-100% across participants) indicated large effect sizes on reading fluency from baseline to intervention and from withdrawal back to intervention, indicating an increase in word reading accuracy.

Vocabulary

Although ten of the intervention studies included in the current review (Austin et al., 2022; Lovett et al., 2012; O'Connor et al., 2017; Vaughn et al., 2010; Vaughn et al., 2011; Vaughn et al., 2012; Vaughn et al., 2016; Vaughn et al., 2019; Wanzek & Roberts, 2012; Wu et al., 2020) contained a vocabulary component, just one (Austin et al., 2022) compared word reading conditions with and without vocabulary instruction. Based on correlational indicators that word meaning knowledge predicts word reading achievement, Austin et al. (2022) examined whether vocabulary instruction would improve word reading. Building upon the word reading (WR) condition described in the previous section, the word reading plus word meaning (WR+WM) condition added explicit vocabulary instruction. Specifically, the interventionist presented the word, a student-friendly definition, and a corresponding picture on a word meaning card and asked questions to check for understanding. The addition of this component resulted in a statistically significant increase in word reading accuracy, word reading fluency, and word meaning knowledge immediately following intervention and at posttest compared to the WM condition, demonstrating a positive association between vocabulary instruction and improved word reading accuracy.

Comprehension

Seven of the intervention studies included in the present review (Lovett et al., 2012; O'Connor et al., 2017; Vaughn et al., 2010, Vaughn et al., 2011, Vaughn et al., 2012, Vaughn et al., 2019, Wanzek & Roberts, 2012) contained an instructional component targeting reading comprehension. Alongside the phonological and orthographic knowledge track described previously, Lovett et al. (2012) implemented a text knowledge track and a comprehension strategy track. Five comprehension strategies were taught: predicting, activating prior knowledge, clarifying, evaluating through questioning, and summarizing. The authors found significant fixed effects for the intervention condition on passage comprehension. O'Connor et al. (2017) embedded instruction in three comprehension strategies within their U.S. History reading intervention: main idea, compare and contrast,

and cause and effect. In all three comprehension areas, outcomes on researcher-developed measures indicated the main effect for class condition was significantly related to posttest scores favoring the intervention condition. In addition to teaching word study skills, Vaughn et al. (2019) included instruction in comprehension strategies for expository, narrative, and hybrid texts. Participants were instructed to stop and summarize previous sections during reading. They were also cued by the interventionist after reading to monitor their own comprehension of the text. The authors did not find significant treatment effects on comprehension measures. In their three-year, tiered middle school intervention study, Vaughn et al. (2010, 2011, 2012) explicitly taught expository and narrative text comprehension strategies. In the first year of the intervention, treatment effects were not observed at Tier 2 for comprehension. However, in the second year of intervention, statistically significant differences between intervention groups and the comparison were evident at Tier 3 on a standardized measure of reading comprehension. Similarly, the third-year Tier 3 intervention also resulted in significant between-group differences in reading comprehension. Wanzek and Roberts (2012) utilized *Collaborative Strategic Reading* (CSR; Klingner et al., 2001) with expository science texts. Four comprehension strategies were explicitly taught: (1) Preview, (2) Click and Clunk, (3) Get the Gist, and (4) Wrap Up. The authors did not find any statistically significant differences between groups on measures of comprehension. Because studies included in the current review did not compare word reading intervention with and without comprehension strategy instruction, effects of comprehension instruction on multisyllabic word reading cannot be evaluated.

Fluency

Nine of the intervention studies included in the present review (Austin et al., 2022; Filderman & Toste, 2022; Saqui et al., 2019; Toste et al., 2019; Vaughn et al., 2010, Vaughn et al., 2011, Vaughn et al., 2016, Vaughn et al., 2019; Wu et al., 2020) contained an instructional component targeting reading fluency. Austin et al. (2022) included reading fluency practice through the use of timed and repeated readings in both their WR and WR+WM conditions. They found statistically significant differences between groups immediately after intervention and at posttest on word reading fluency favoring the WR+WM condition. Filderman and Toste (2022) embedded choral reading, timed reading, and repeated reading components in both conditions (IC-only and IC+DBDM) included in their study of a MWR intervention. Participants in both intervention conditions underperformed on fluency measures compared to those in the BAU condition. Similarly, Toste et al. (2019) used the same choral reading, timed reading, and repeated reading components and found no differences between treatment groups and the control group on a measure of word reading fluency. Saqui et al. (2019) included five reading fluency components in their science reading intervention: verbal cueing, repeated reading, goal setting, modeling, and performance feedback. Their visual and statistical analyses demonstrated a strong degree of overlap in reading fluency data between baseline and intervention, indicating there was likely no functional relationship between the intervention and reading fluency gains. Vaughn et al. (2019) incorporated three

instructional components targeting reading fluency: previewing key words related to the main idea, repeated readings, and using key words to summarize the text. They found significant differences between intervention and BAU conditions on a measure of reading fluency. In their three-year, tiered middle school intervention and their fourth-grade intervention, Vaughn and colleagues (2010, 2011, 2012, 2016) implemented fluency instruction and practice through the use of repeated reading and timed reading. They did not find significant treatment effects on standardized measures of reading fluency. The multicomponent reading fluency intervention investigated by Wu et al. (2020) included four repeated readings within each session. Non-overlap of all pairs (97%-100% across participants) indicated large effect sizes on reading fluency from baseline to intervention and from withdrawal back to intervention.

Writing

Six of the intervention studies included in the current review (Diliberto et al., 2008; Filderman & Toste, 2022; Toste et al., 2019; Vaughn et al., 2010; Vaughn et al., 2011; Vaughn et al., 2019) contained an instructional component targeting written spelling. In the Syllable Skills Instruction Curriculum investigated by Diliberto et al. (2008), written spelling was taught at the syllable level using nonsense words and low frequency words using the following sequence. The teacher read five words, participants spelled them in their workbooks, then errors were discussed and corrected. Although, the authors did not measure any spelling outcomes, syllable-level written spelling practice may have contributed to the statistically significant increases in word identification and word attack achievement. The MWR intervention examined by Toste et al. (2019) and Filderman and Toste (2022) included written spelling practice in which participants used affixes from the lesson to generate and write multisyllabic words. Interventionists then provided corrective feedback, calling attention to the spellings of affixes, vowels, and other word parts. Though Filderman and Toste (2022) did not measure spelling as an outcome and did not find significant effects on word identification or word attack, Toste et al. (2019) found significant differences between groups on measures of spelling and decoding favoring the intervention group. Vaughn et al. (2019) included a spelling routine in which participants practiced writing sound patterns in isolation as well as within words. Reteaching was provided when a participant provided two incorrect responses on the spelling quiz. Results were not significant on measures of spelling and word identification. In the first two years of their multi-tiered middle school intervention, Vaughn et al. (2010, 2011) implemented word study instruction with a written spelling application component. They did not find significant effects of intervention on a standardized spelling outcome measure.

Instructional Techniques

All fourteen included studies utilized explicit instruction that included clear modeling of new skills with targeted practice opportunities. Ten studies specifically noted the inclusion of a review of previously taught material. An additional group of ten studies reported that

interventionists provided immediate feedback and/or error correction. For example, the repeated reading intervention implemented by Wu et al. (2020) relied on participant errors to drive the content of instruction. Interventionists delivered skills instruction via error correction procedures contingent upon the types of errors observed within a reading trial. Three studies (Austin et al., 2022; Filderman & Toste, 2022; Toste et al., 2019) included the use of games. Table 2 details the instructional components included in each study. It should be noted that some instructional components may have been present in a given study but not be indicated within the table because they were not described in the published article.

Student Characteristics

The present review aimed to identify student characteristics that have been tested as part of multisyllabic word reading interventions and to identify characteristics associated with improved outcomes. Findings are described in the following sections.

Emergent Bilingual Students

Four studies (Filderman & Toste, 2022; Toste et al., 2019; Vaughn et al., 2011, Wanzek & Roberts, 2012) reported results for EB students. The present review uses the term *EB* in place of English Language Learner (ELL), English Learner (EL), and Limited English Proficiency (LEP) to emphasize that these participants are in the process of becoming bilingual rather than primarily being deficient in English language skills. No study included in the present review found statistically significant word reading differences between groups associated with EB status. However, Vaughn et al. (2011) reported that although EB participants had lower reading comprehension scores than non-EB participants, they outperformed their non-EB peers in phonemic decoding. Similarly, Wanzek and Roberts (2012) reported that EB participants showed evidence of "accelerated learning" in the areas of word recognition and word attack.

Students with Disabilities

Only one included study (Vaughn et al., 2011) analyzed and reported results for participants with identified disabilities. They found statistically significant disadvantages for students with disabilities compared to those without disabilities on measures of word attack and reading comprehension in all three of their study conditions. Four additional studies (Austin et al., 2022; Lovett et al., 2012; O'Connor et al., 2017; Wu et al., 2020) included only students with disabilities. Austin et al. (2022) reported statistically significant effects on word reading accuracy for students with reading disabilities when word meaning instruction was included in a word reading intervention. Lovett et al. (2012) found significant gains in multisyllabic word identification for high school students with reading disabilities who received a multicomponent intervention combining decoding, text knowledge, and comprehension tracks. O'Connor et al. (2017) reported significant effects on decoding accuracy for eighth grade students with disabilities who received multisyllabic word reading instruction combined with instruction in vocabulary and

comprehension strategies through a multicomponent reading intervention in their U.S. History classes. Finally, Wu et al. (2020) demonstrated large effects on reading accuracy of a multicomponent repeated reading intervention that included syllable segmentation, error correction, and instruction in prerequisite reading skills for fifth and seventh grade students with disabilities.

Discussion

The present review aimed to address a gap in the research examining the effects of reading interventions for older students. Specifically, no systematic review of the literature has synthesized studies focused on multisyllabic word reading for students in grades 4-9. This is critical because although the majority of fourth grade students do not meet standards for proficient reading (NCES, 2024), their opportunities to receive word reading instruction after third grade are limited (Boardman et al., 2008). Therefore, there is a need to identify intervention characteristics and components associated with improved word reading outcomes.

This systematic review addressed three questions: (1) What instructional and intervention characteristics and student characteristics have been tested as part of multisyllabic word reading interventions? (2) What does the research say about the effectiveness of multisyllabic word reading instruction in improving adolescent reading outcomes for readers in grades 4-9? (3) What features of instructional interventions (e.g., type of instruction, duration, grade level) are associated with improved outcomes, and do these features differ according to student characteristics?

Discussion of Component Effectiveness

All studies in the present review included a phonics or word study component and reported generally positive findings for word reading outcomes. Significant effects on word reading were identified for interventions that explicitly taught grapheme-phoneme correspondences, letter combinations/vowel patterns, and affixes. Additionally, findings indicated statistically significant improvements in word reading outcomes associated with interventions that provided instruction in syllabication and morphemic analysis. Promising strategies included teaching syllable types, syllable segmentation, identifying smaller units of meaning within longer words, and blending word parts together to accurately read multisyllabic words. There is also evidence that including explicit instruction of academic vocabulary in word reading interventions may improve word reading accuracy. Effective vocabulary instruction included presenting the word, a student-friendly definition, and a corresponding picture, then providing practice opportunities and asking questions to check for understanding. Studies that included instruction in fluency, comprehension, and spelling also demonstrated positive effects on word reading outcomes. However, it is unclear whether there is a relation between these components and improved word reading. Additional research is warranted.

Subgroup analysis:

Several studies presented results for EB participants. These included non-significant findings that EB students demonstrated somewhat stronger outcomes than their peers on measures of phonemic decoding (Vaughn et al., 2011) as well as word recognition and word attack (Wanzek & Roberts, 2012). The authors hypothesized that EB students may have benefited specifically from the small group structure of the intervention and that they may have had a stronger understanding of the sound structure of written English after intervention. They did not find significant differences between groups based on EB status on word reading outcome measures, nor did they identify treatment conditions that resulted in significant effects for EB students.

One study (Vaughn et al., 2011) analyzed results for students with disabilities as a subgroup. Across treatment conditions, they found that students without disabilities significantly outperformed those with disabilities on word attack. This indicates that students identified with disabilities may be distinct from their peers with reading difficulties in their responsiveness to word reading intervention.

Implications for Practice

Based on the combined evidence from these fourteen interventions, the clearest implication for practice is that research indicates benefits for word reading intervention with adolescent struggling readers. Across grade levels and across Tier 2 and Tier 3 studies, results indicated that it is not too late to intervene on word reading skills. Rather than focusing exclusively on comprehension instruction in the upper grades, there is an opportunity to engage in ongoing word study of multisyllabic academic vocabulary at Tier 1 and to utilize screening procedures to identify students who do not yet meet grade level expectations for word reading in grades 4-9. Results from the present review indicate that instruction for older readers who require supplemental intervention should be grounded in explicit instructional practices and include word meanings, grapheme-phoneme correspondences, letter combinations/vowel patterns, and affixes as well as syllabication and morphemic analysis. To achieve meaningful outcomes, the commitment to implementing word study in the upper grades cannot be confined to individual classrooms or special education departments. Buy in at the campus and district level is essential to ensure the necessary resources are allocated for teacher training, screening, data analysis, and scheduling of interventions.

Limitations

Several notable limitations are relevant to the present review. First, differences in study designs (e.g., RCT, QED, SCD), outcome measures (researcher-created vs. standardized), and participant populations present a challenge in comparing and synthesizing findings. Care should be taken to consider the results from this review in the context of the fourteen original studies. Secondly, the relatively small number of studies identified for inclusion in this review limit opportunities to draw generalizable conclusions. It is possible

that studies containing a multisyllabic word reading component were missed in the search and screening process, and researcher bias may have impacted decisions about study inclusion. This review represents a small piece of the existing knowledge base on multisyllabic word reading interventions for adolescent students.

Future Research

The intervention studies included in this review provide evidence of promising practices in word reading intervention for older students. Based on this existing evidence, there is an opportunity to examine the effects of the constituent components within multicomponent interventions to determine which targeted practices are associated with specific gains for students after third grade. Findings from the present review indicate EB students likely differ from their non-EB peers in their response to word reading interventions. Opportunities exist to investigate the practices that are most effective for EB students, including EB students with disabilities. Finally, there is some evidence that students with disabilities may not receive the same benefits from word reading interventions as their peers who have reading difficulties but have not been identified with a disability. There is an opportunity to explore the differences in response to word reading intervention between these groups of students in order to design more effective instruction.

Conclusion

Although students who have not developed proficient reading skills by fourth grade are commonly understood to be at greater risk for poorer outcomes, evidence from upper elementary, middle school, and high school level interventions demonstrates that older struggling readers can make significant gains in multisyllabic word reading, given explicit, systematic word study instruction. Early intervention is ideal, but it isn't always possible. Addressing skill deficits in the upper grades by teaching foundational reading skills requires creativity in allocating resources, including time and training, but these results suggest there is good reason to invest in ongoing word reading instruction for struggling older readers.

Figure 1. PRISMA diagram

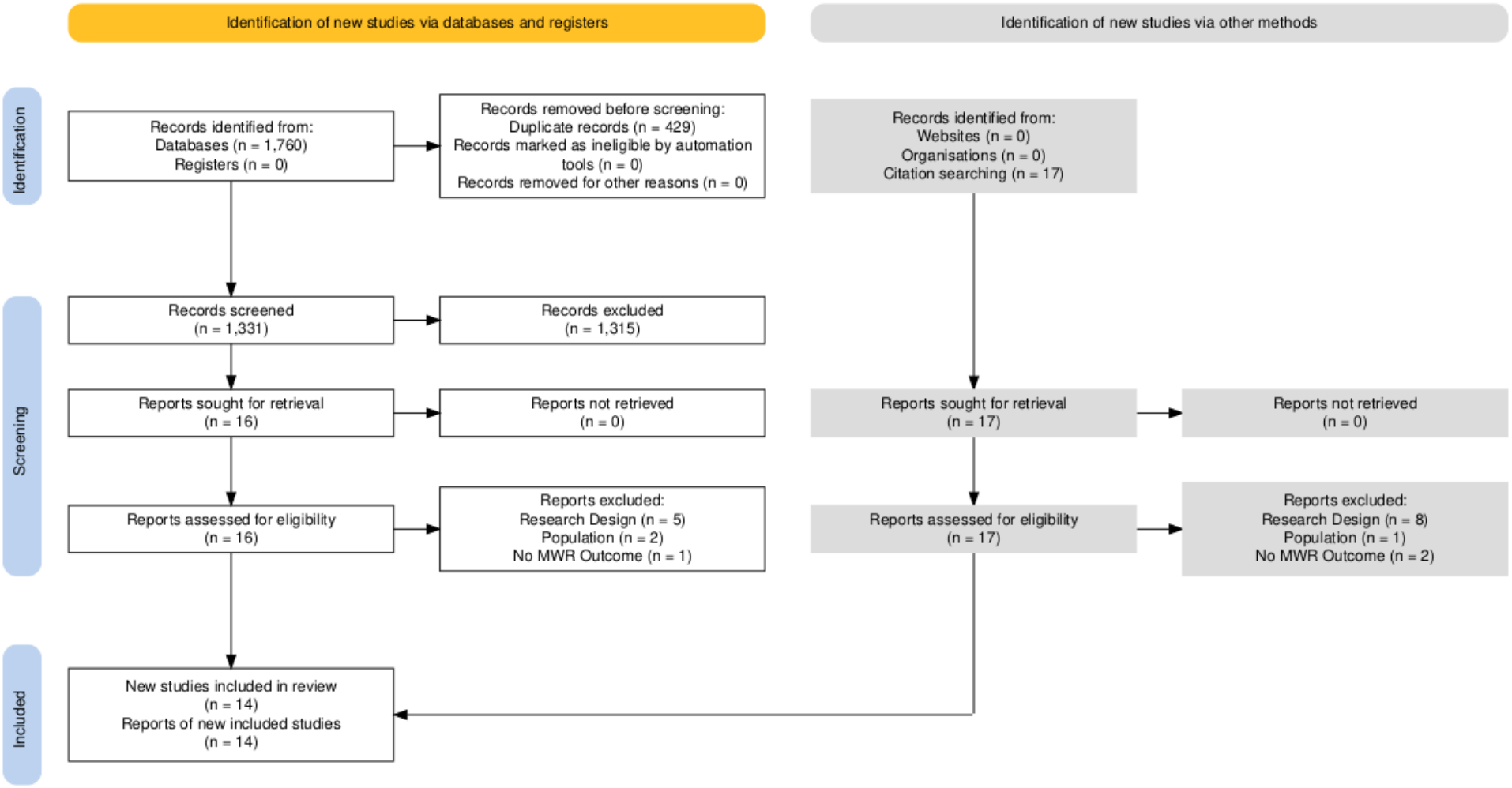


Table 1.

Study Overview and Demographics

Study	Design	Students	Implementation	Dosage	RC?	Name of Curriculum
Austin et al. (2022)	QED	*N* = 22 Grades (59% 4th, 41% 5th) 100% dyslexia or SLD in BR EB (NR)	HI	12 sessions 45 minutes each (9 hours)	Yes	N/A
Diliberto et al. (2008)	QED	*N* = 83 Grades (31% 6th, 38% 7th, 31% 8th) 51% high incidence disability EB (*n* = 2) 2.4%	TI	60 sessions 15 minutes each (15 hours)	Yes	Syllable Skills Instruction Curriculum
Filderman & Toste (2022)	RCT	*N* = 88 Grades (53% 4th, 47% 5th) 22% received special education services EB (*n* = 48) 55%	HI	38-40 sessions, 30-40 minutes each (~23 hours)	Yes	N/A
Lovett et al. (2012)	QED	*N* = 351 Grades (76% 9th) 100% reading disability EB (*n* = 160) 46%	TI	60-70 hours	Yes	PHAST PACES
O'Connor et al. (2017)	QED	*N* = 34 Grades (100% 8th) 100% received special education services EB (*n* = 15) 44%	TI	36 sessions 30-34 minutes each (~19 hours)	Yes	Building Reading Interventions Designed for General Education Subjects (BRIDGES)

Study	Design	Students	Implementation	Dosage	RC?	Name of Curriculum
Saqui et al. (2019)	SCD	*N* = 4 Grades (75% 4th, 25% 5th) None received special education services EB (*n* = 0) 0%	RI	16 sessions 15 minutes each (~4 hours)	Yes	N/A
Toste et al. (2019)	RCT	*N* = 109 Grades (54% 4th, 46% 5th) 100% word reading difficulties, not already receiving intervention EB (*n* = 29) 27%	HI	40 sessions 40 minutes each (~27 hours)	Yes	N/A
Vaughn et al. (2010)	RCT	*N* = 327 Grades (100% = 6th) Included students with disabilities, but no *n* was reported EB (NR)	HI	99.6 hours	Yes	N/A
Vaughn et al. (2011)	RCT	*N* = 182 Grades (7th and 8th, no *n* reported) 36% received special education services EB (*n* = 41) 23%	HI	160 sessions 50 minutes each (~133 hours)	Yes	N/A
Vaughn et al. (2012)	RCT	*N* = 41 Grades (100% 8th) 27% received special education services EB (*n* = 13) 32%	HI	Daily session 50 minutes each Total dosage NR	Yes	N/A

Study	Design	Students	Implementation	Dosage	RC?	Name of Curriculum
Vaughn et al., (2016)	RCT	*N* = 484 Grades (100% 4th) 14% received special education services EB (NR)	HI	23.4 hours	Yes	N/A
Vaughn et al. (2019)	RCT	*N* = 280 Grades (4th and 5th, no *n* reported) 14% received special education services EB (NR)	HI	68 lessons, 30-45 minutes each (~ 44 hours)	Yes	N/A
Wanzek & Roberts (2012)	RCT	*N* = 87 Grades (100% 4th) Included students with disabilities, but no *n* was reported EB (*n* = 54) 62%	HI	85-114 sessions 30 minutes each (~50 hours)	Yes	N/A
Wu et al. (2020)	SCD	*N* = 3 Grades (33% 5th, 67% 7th) 100% received special education services EB (NR)	RI	2 sessions per week for 3.5-4.5 months, 25-30 minutes each (~15 hours)	Yes	N/A

BR Basic reading*; EB* Emergent Bilingual (described by study authors as EB, EL, ELL, or LEP); HI= Implemented by Hired Person, *NR* Not Reported; RI= Researcher Implemented; *SLD* Specific Learning Disability; TI= Teacher Implemented

Table 2.
Instructional Components

	Pillar: Phonics and Word Study				Pillar: Vocabulary		Pillar: Comprehension		Pillar: Fluency			Writing	Instructional Techniques			
Study	Syll	VP	GPC	Aff	WM	AV	ICS	Summ	RR	TR	CR	Written Spelling	Exp. Inst.	FB	Rev	Games
Austin et al. (2022)		☒	☒	☒	☒	☒			☒	☒			☒	☒		☒
Diliberto et al. (2008)	☒	☒		☒								☒	☒	☒	☒	
Filderman & Toste (2022)	☒	☒		☒					☒	☒	☒	☒	☒	☒	☒	☒
Lovett et al. (2012)	☒	☒		☒	☒	☒	☒	☒					☒	☒	☒	
O'Connor et al. (2017)		☒		☒	☒	☒	☒	☒					☒	☒	☒	
Saqui et al. (2019)	☒								☒	☒			☒	☒		
Toste et al. (2019)	☒	☒		☒					☒	☒	☒	☒	☒	☒	☒	☒
Vaughn et al. (2010)	☒	☒	☒	☒	☒	☒	☒	☒	☒			☒	☒		☒	
Vaughn et al. (2011)	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒		☒	☒		☒	
Vaughn et al. (2012)					☒	☒	☒	☒					☒			
Vaughn et al. (2016)					☒	☒			☒	☒			☒	☒	☒	
Vaughn et al. (2019)		☒	☒	☒		☒	☒	☒	☒			☒	☒		☒	
Wanzek & Roberts (2012)	☒	☒	☒	☒	☒	☒	☒						☒	☒	☒	
Wu et al. (2020)	☒		☒		☒				☒	☒			☒	☒		

Syll Syllabication, *VP* Vowel patterns; *GPC* Grapheme-Phoneme Correspondence; *Aff* Affix instruction; *WM* Word meaning; *AV* Academic vocabulary instruction; *ICS* Informational text comprehension strategies; *Summ* Summarization; *RR* Repeated reading; *TR* Timed reading; *CR* Choral reading; *Exp Inst* Explicit instruction; *FB* Immediate feedback / error correction; *Rev* Review of previous learning

Table 3.

Tier 2 Intervention Studies

Study and design	Participants	Intervention conditions	Comparison condition	Outcome domain and reported findings	Dosage
Filderman & Toste (2022) RCT	*N* = 88 Grades (53% 4th, 47% 5th) 22% received special education services EB (*n* = 48) 55%	**T1**: intervention customized at an initial timepoint only (IC-only) **T2**: initial customization plus data-based decision-making (IC + DBDM). Both conditions included the delivery of a multisyllabic word reading intervention with the following components: (1) review of vowel patterns, (2) explicit instruction in affixes, (3) games adding affixes to base words, (4) timed readings, (5) encoding, (6) oral reading of high frequency words, and (7) text reading. Participants in both groups were assigned to tutoring groups customized to their skill profiles. Those in the IC + DBDM group also received adjustments to the intervention based on DBDM procedures.	Participants in BAU engaged in a variety of literacy activities including independent reading, reteach of previously taught skills, Leveled Literacy Intervention, IXL, assignments to prepare for the state standardized assessment, or homework.	**WJ-III Word Identification:** T1 vs. C, no difference between groups: $\beta = -0.65$, t (85) = −0.26, $p = 0.81$. T2 vs. C, no difference between groups: $\beta = -0.57$, t (85) = −0.29, $p = 0.81$. **WJ-III Word Attack:** T1 vs. C, no difference between groups: $\beta = 2.99$, t (85) = 0.99, $p = .40$. T2 vs. C: $\beta = 7.68$, t (85) = 2.66, $p = .00$. **WJ-III Passage Comprehension:** T1 vs. C, no difference between groups: $\beta = 3.29$, t (85) = 1.06, $p = .37$. T2 vs. C, no difference between groups: $\beta = 1.05$, t (85) = .35, $p = .80$. **TOSREC:** T1 vs. C: $\beta = -8.30$, t (85) =−4.28, $p = .00$. T2 vs. C: $\beta = -4.50$, t (85) = −2.37, $p = .03$. **Fastbridge CBM-R:** T1 vs. C, no difference between groups: $\beta = -6.99$, t (85) = −1.55, $p = .16$. T2 vs. C, no difference between groups: $\beta = -3.42$, t (85) = −0.79, $p = .50$.	38-40 sessions, 30-40 minutes each (~23 hours)

Study and design	Participants	Intervention conditions	Comparison condition	Outcome domain and reported findings	Dosage
Saqui et al. (2019) SCD	*N* = 4 (75% 4th grade, 25% 5th grade) None received special education services.	One-on-one reading fluency instruction combined with modeling of multisyllabic word reading strategies.	In the six baseline sessions, participants read unfamiliar science passages and DIBELS ORF passages and were assessed on ORF and multisyllabic word reading accuracy.	**Oral Reading Performance (1st and 3rd reads of science passages):** Trend was statistically significant for P1: $p = 0.002$; P2: $p < 0.001$; and P3: $\tau = 0.54$, $p < 0.001$. For P4, effect size was small and not statistically significant $p = 0.052$. **Generalized Oral Reading (DIBELS):** There was no evidence of a functional relationship between the intervention and generalized fluency gains **Multisyllabic Word Decoding Accuracy (1st and 3rd reads of science passages):** τ values were negligible to small and not statistically significant for all participants. **Multisyllabic Word Decoding Accuracy (DIBELS):** Values were negligible to small and not statistically significant for all participants.	16 sessions, 15 minutes each (~4 hours)

Study and design	Participants	Intervention conditions	Comparison condition	Outcome domain and reported findings	Dosage
Toste et al. (2019) RCT	*N* = 109 Grades (54% 4th, 46% 5th) 100% word reading difficulties, not already receiving intervention EB (*n* = 29) 27%	**T1**: multisyllabic word reading (MWR) Both conditions included the delivery of multisyllabic word reading instruction with the following components: (1) review of vowel patterns, (2) explicit instruction in affixes, (3) games adding affixes to base words, (4) timed readings, (5) encoding, (6) oral reading of high frequency words, and (7) text reading. **T2**: multisyllabic word reading instruction plus motivational beliefs training (MWR + MBT) Participants identified reading strengths and needs, developed reading goals, and used positive self-talk to support progress toward their goals.	Participants in the control group received small-group instruction and had independent work time typically focused on test preparation, guided reading, silent reading, or computer-based assignments.	**WJ-III Word Identification:** Significant treatment effect favoring intervention (β = 2.45, $p < .05$, ES = .29). **WJ-III Word Attack:** Significant treatment effect favoring intervention (β = 3.09, $p < .01$, ES = .43). **TOWRE:** No difference between groups **Gates-MacGinitie - Reading Comprehension:** Significant treatment effect favoring intervention (β = 2.04, $p < .05$, ES = .26). **WJ-III Passage Comprehension:** No difference between groups (β = 0.05, $p = .96$, ES = .01). **WJ-III Spelling:** Significant treatment effect favoring intervention (β = 2.65, $p < .05$, ES = .25). No statistically significant differences between T1 and T2 on any measured outcome.	40 sessions, 40 minutes each (~27 hours)
Vaughn et al. (2010) RCT	*N* = 327 Grades (100% = 6th) Included students with disabilities, but no *n* was reported EB (NR)	Participants received 6-7 weeks of daily intervention focused on word study and fluency, 17-18 weeks focused on vocabulary and comprehension, and 8-10 weeks applying vocabulary and comprehension skills to expository texts.	Participants in the comparison group received Tier 1 instruction from content area teachers trained by the research team to deliver evidence-based instruction in	**WJ-III Word Identification:** No significant effect for treatment F (1, 298) = 3.74, p = .054, **WJ-III Spelling:** Significant main effect for treatment, $p < .0126$, d = 0.22. **GRADE Passage Comprehension:**	99.6 hours

Study and design	Participants	Intervention conditions	Comparison condition	Outcome domain and reported findings	Dosage
			vocabulary and comprehension.	No main effect of treatment F (1, 323) = 1.00, negligible ES **WJ-III Passage Comprehension**: No significant main effect for treatment, F (1, 298) = 3.26, p = .072, d = 0.19. **TOWRE SWE:** No significant main effect for treatment, F (1, 298) = 1.93, p = .05 **TOWRE PDE:** No significant main effect for treatment, F (1, 298) = 3.29, p = .071.	
Vaughn et al. (2016) RCT	N = 484 Grades (100% 4th) 14% received special education services EB (NR)	Participants received reading intervention aligned with their social studies content focused on vocabulary, text-based reading, and word study.	Participants in the comparison group received school-based reading interventions provided by teachers and support staff.	**WJ-III Word Identification:** No significant main effect for treatment F (1, 400) = 3.31, p = 0.07. **WJ-III Spelling:** No significant main effect for treatment	23.4 hours

Study and design	Participants	Intervention conditions	Comparison condition	Outcome domain and reported findings	Dosage
				F (1, 399) = 2.24, p = 0.14 **WJ-III Passage Comp:** No significant main effect for treatment F (1, 400) = 0.03, p = 0.86 **Gates-MacGinitie Comprehension:** No significant main effect for treatment F (1,405) = 0.69, p = 0.41 **TOWRE SWE:** No significant main effect for treatment F (1, 399) = 0.01, p = 0.92 **TOSREC:** No significant main effect for treatment F (1,414) = 0.32, p = 0.57)	

Study and design	Participants	Intervention conditions	Comparison condition	Outcome domain and reported findings	Dosage
Vaughn et al. (2019) RCT	*N* = 280 Grades (4th and 5th, no *n* reported) 14% received special education services EB (NR)	Phase 1 intervention focused on systematic decoding instruction and reading fluency. Phase 2 and 3 interventions focused on text-based reading, comprehension strategies, systematic instruction in morphology, and automaticity instruction.	Participants in the BAU group participated in typically assigned activities during the schools' scheduled intervention time.	**WJ-III Letter Word Identification:** No significant main effect for treatment F (1, 245) = 0.76, p = .385. **Experimental Word Reading List:** Significant treatment effect favoring intervention, F (1, 245) = 76.85, p < .001. **WJ-III Spelling:** No significant main effect for treatment F (1, 244) = 2.824, p = .095 **TOSREC:** No significant main effect for treatment F (1, 247) = 0.057, p = .811 **TOWRE SWE:** F (1, 244) = 0.794, p = .374 **AIMSweb CBM:**	68 lessons, 30-45 minutes each ~ 44 hours

Study and design	Participants	Intervention conditions	Comparison condition	Outcome domain and reported findings	Dosage
				Significant treatment effect favoring intervention, F (1,243) = 39.94, p < .001 **Gates-MacGinitie Comprehension:** No significant main effect for treatment F (1, 247) = 0.972, p = .326 **WJ-III Passage Comprehension:** No significant main effect for treatment F (1, 243) = 0.022, p = .883	
Wanzek & Roberts (2012) RCT	N = 87 Grades (100% 4th) Included students with disabilities, but no n was reported EB (n = 54) 62%	**T1**: *Word Recognition Emphasis* participants received instruction using the Wilson Reading System focused on word recognition and including instruction in vocabulary and comprehension. **T2**: *Comprehension Emphasis* participants received instruction focused on comprehension strategies with science texts. **T3**: *Responsive Emphasis* participants received either word recognition intervention or	Participants in the comparison group received school-provided supplemental intervention.	**WJ-III Word Identification:** No significant main effect for treatment F (3, 82) = .373, p = .773, d = .03–.24. **WJ-III Word Attack:** No significant main effect for treatment F (3, 82) = 1.271, p = .290, d = .04–.54 and **Gates-MacGinitie Vocabulary:**	85-114 sessions 30 minutes each (~50 hours)

Study and design	Participants	Intervention conditions	Comparison condition	Outcome domain and reported findings	Dosage
		comprehension intervention depending on their area of greatest need in the pretest.		No significant main effect for treatment F (3, 82) = .270, p = .847, d = .04–.17. **WJ-III Passage Comprehension:** No significant main effect for treatment F (3, 82) = .950, p = .421, d = .07–.54. **Gates-MacGinitie Comprehension:** No significant main effect for treatment F (3, 81) = 1.987, p = .123, d = .05–.84.	

BAU Business as usual; *CBM* Curriculum-based measurement; *DIBELS* Dynamic Indicators of Basic Early Literacy Skills; *EB* Emergent bilingual; *NAP* Non-overlap of all pairs; *NR* Not reported; *PDE* Phonemic Decoding Efficiency; *QED* Quasi experimental design; *RCT* Randomized controlled trial; *SCD* Single case design; *SWE* Sight Word Efficiency; *T1* Treatment condition 1; *TOSREC* Test of Silent Reading Efficiency and Comprehension; *TOWRE* Test of Word Reading Efficiency; *WJ-III* The Woodcock Johnson III Tests of Achievement

Table 4.

Tier 3 Intervention Studies

Study and design	Participants	Intervention conditions	Comparison condition	Outcome domain and reported findings	Dosage
Austin et al. (2022) QED	*N* = 22 Grades (59% 4th, 41% 5th) 100% dyslexia or SLD in BR EB (NR)	**T1**: Word Reading (WR) participants received explicit instruction in three areas: (1) grapheme-phoneme correspondences, (2) fluency, and (3) reading high-frequency words. **T2**: Word Reading + Word Meaning (WR+WM) participants received explicit instruction in the three WR areas followed by explicit vocabulary instruction focused on the word meaning.	There was no untreated control group in this study. All participants were assigned to one of the intervention conditions.	**TOWRE PDE:** $d = 0.65$ immediately following intervention; $d = 0.74$ at posttest favoring T2 over T1. **Accuracy and fluency reading target words:** $d = 0.43$ immediately following intervention; $d = 0.84$ at posttest favoring T2 over T1. **Word meaning knowledge of target words:** $d = 1.92$ immediately following intervention; $d = 1.03$ at posttest favoring T2 over T1.	12 sessions, 45 minutes each (9 hours)
Diliberto et al. (2008) QED	*N* = 83 Grades (31% 6th, 38% 7th, 31% 8th) 51% high incidence disability EB (*n* = 2) 2.4%	In addition to the school's typical tier 1 reading instruction, intervention lessons included four components: (1) group review, (2) new information, (3) word reading, and (4) written spelling. Vocabulary terms, syllable patterns, syllabication steps and rules, and accenting patterns were explicitly taught.	School's typical tier 1 reading instruction using the *Corrective Reading Decoding Program* (all 3 schools) and *Success Maker* (2 out of 3 schools).	**WJ-III Word Identification:** ($F = 5.20$, $p < .05$, $R^2 = .07$). **WJ-III Word Attack:** ($F = 51.18$, $p < .001$, $R^2 = .42$). **WJ-III Passage Comprehension:** ($F = 6.41$, $p < .05$, $R^2 = .07$) **Read Naturally Reading Fluency PM:** There was no statistically significant interaction effect for Reading Fluency ($F = 6.41$, $p < .05$, $R^2 = .07$).	60 sessions, 15 minutes each (15 hours)

Study and design	Participants	Intervention conditions	Comparison condition	Outcome domain and reported findings	Dosage
Lovett et al. (2012) QED	*N* = 351 Grades (76% 9th) 100% reading disability EB (*n* = 160) 46%	PHAST track, focused on decoding, included instruction in word identification strategies. Text Knowledge track, included instruction in narrative, expository, and graphical text structures. Comprehension Strategy track, included five strategies: (1) predicting, (2) activating prior knowledge, (3) clarifying, (4) evaluating through questioning, and (5) summarizing (PACES). The PHAST PACES intervention was delivered as a semester-long, credit-bearing course.	Waitlist control condition took a different course in the first semester and received the PHAST PACES intervention in the second semester.	**The Sound-Symbol Test - Sound Combinations:** Significant variation in final status (σ^2 1 = 6.40, p < .001) and rate of growth (σ^2 2 = 0.61, p < .01) **Challenge Words Test:** Significant variation in final status (σ^2 1 = 79.20, p < .001) and rate of growth (σ^2 2 = 2.34, p < .01) **WJ-III Word Attack:** Significant fixed effects γ01 = 6.45, t(345) = –4.23, linear growth, γ10 = 3.96, t(617) = 17.56, and the interaction of these effects, γ11 = 2.93, t(617) = –6.32, all ps < .0001. **WJ-III Word Identification:** Significant fixed effects γ01 = 4.03, t(345) = –2.6, growth, γ10 = 2.01, t(617) = 11.65, and their interaction, γ11 = 1.45, t(617) = –4.09, all ps < .001, produced significant fixed effects. **WJ-III Passage Comprehension:** Fixed effects, γ01 = –4.32, t (344) = –3.98, growth, γ10 = 3.86, t(614) = 12.45, and their interaction, γ11 = 2.24, t(614) = –4.09, all ps < .001.	60-70 hours
O'Connor et al. (2017) QED	*N* = 34 (100% 8th grade) 100% received special education services.	Within the context of their U.S. History classes, participants in the BRIDGES condition received explicit instruction in (1) decoding strategies, (2) academic vocabulary, (3) main idea, (4) compare and contrast, and (5) cause and effect.	BAU teachers did not explicitly teach any strategy related to decoding, BRIDGES vocabulary words, main idea, compare / contrast, or cause and effect.	**Researcher-Developed Decoding Accuracy Measure:** cycle 1: F (1, 30) = 8.67, p = .006; cycle 2: F (1, 30) = 13.66, p < .001; and cycle 3: F (1,29) = 67.80, p<.001. **Researcher-Developed Vocabulary - Expressive:** cycle 1: F (1, 29) = 13.70, p < .001; cycle 2: F, (1, 31) = 19.897, p < .000; and cycle 3: F (1, 28) = 13.69, p < .001. **Researcher-Developed Vocabulary Measure - Receptive:** cycle 1: F (1, 71) = 36.23 p <.001; cycle 2: F (1, 76)	36 sessions, 30-34 minutes each (~19 hours)

Study and design	Participants	Intervention conditions	Comparison condition	Outcome domain and reported findings	Dosage
				= 41.2, p <.001; and cycle 3: F (1, 72) = 19.64, p <.001. **Researcher-Developed Comprehension Measure - Main Idea:** Main effect for taught content; F [1, 47] = 9.81, p = .003) and transfer to untaught content F [1, 45] = 8.23, p = .006). **Researcher-Developed Comprehension Measure - Compare and Contrast:** Main effect for taught content F [1, 72]=13.48, p<.001 and transfer to untaught content F [1, 68] = 11.50, p <.001. **Researcher-Developed Comprehension Measure - Cause and Effect:** Treatment (M = 4.78, SD = 2.42) significantly outperformed control (M = 3.47, SD = 2.11) on taught passages and treatment (M = 5.04, SD = 1.91) outperformed control (M = 3.86, SD = 2.19) on untaught passages.	
Vaughn et al. (2011) RCT	N = 182 Grades (7th and 8th, no n reported) 36% received special education services EB (n = 41) 23%	**TI**: *Standardized Intervention Protocol* participants received 6-7 weeks of daily intervention focused on word study and fluency, 17-18 weeks focused on vocabulary and comprehension, and 8-10 weeks applying vocabulary and comprehension skills to expository texts. **T2**: *Individualized Intervention Protocol* participants received customized instruction based on test scores with flexible instruction in word	Participants in the comparison condition participated in elective classes during the intervention time.	**WJ-III Word Identification:** No statistically significant differences between groups (p > .05). **WJ-III Word Attack:** No statistically significant differences between groups (p > .05). **WJ-III Spelling:**	160 sessions 50 minutes each (~133 hours)

Study and design	Participants	Intervention conditions	Comparison condition	Outcome domain and reported findings	Dosage
		study, vocabulary/morphology, and comprehension/text reading.		No statistically significant differences between groups ($p > .05$). **TOWRE SWE:** No statistically significant differences between groups ($p > .05$). **TOWRE PDE:** No statistically significant differences between groups ($p > .05$). **WJ-III Passage Comprehension:** The treatment groups collectively outperformed the comparison ($\Delta x^2 = 6.50$, $p < .01$).	
Vaughn et al. (2012) RCT	$N = 41$ Grades (100% 8th) 27% received special education services EB ($n = 13$) 32%	Interventionists used data-based decision-making to design and implement lessons tailored to participants' needs related to phonics, word reading, fluency, vocabulary, and comprehension.	Participants in the comparison condition participated in elective classes during the intervention time.	**WJ-III Word Identification:** Significant treatment effect favoring intervention, F (1, 36) = 6.564, $p = .015$. **WJ-III Word Attack:** No statistically significant differences between groups ($p > .05$). **Gates-MacGinitie Comprehension:** F (1, 37) = 12.475, $p = .001$.	50-minute sessions, number of sessions and total dosage NR

Study and design	Participants	Intervention conditions	Comparison condition	Outcome domain and reported findings	Dosage
				TOSREC: No statistically significant differences between groups ($p > .05$). **WJ-III Passage Comprehension:** No statistically significant differences between groups ($p > .05$). **TOWRE SWE:** No statistically significant differences between groups ($p > .05$). **TOWRE PDE:** No statistically significant differences between groups ($p > .05$).	
Wu et al. (2020) SCD	$N = 3$ Grades (33% 5th, 67% 7th) 100% received special education services EB (NR)	During intervention sessions, participants received a repeated reading package including four components: (1) preview of behavioral expectations, (2) four repeated readings, (3) error correction in the form of prerequisite skills instruction, grammar instruction, segmentation drills, and phrase drills, and (4) contingent reward (candy).	During baseline and withdrawal, participants read passages for 1 minute without feedback or assistance.	**AIMSweb (Pearson 2012) Words Correct Per Minute:** Reading fluency increased for all participants. P1: Large effect sizes from baseline to intervention (NAP = 100%) and from withdrawal to intervention (NAP = 100%). P2: Large effect sizes from baseline to intervention (NAP = 97%) and from withdrawal to intervention (NAP = 100%). P3: Large effect sizes from baseline to intervention	2 sessions per week for 3.5-4.5 months, 25-30 minutes each (~15 hours)

Study and design	Participants	Intervention conditions	Comparison condition	Outcome domain and reported findings	Dosage
				(NAP = 100%) and from withdrawal to intervention (NAP = 100%).	

BAU Business as usual; *CBM* Curriculum-based measurement; *DIBELS* Dynamic Indicators of Basic Early Literacy Skills; *EB* Emergent bilingual; *NAP* Non-overlap of all pairs; *NR* Not reported; *PDE* Phonemic Decoding Efficiency; *QED* Quasi experimental design; *RCT* Randomized controlled trial; *SCD* Single case design; *SWE* Sight Word Efficiency; *T1* Treatment condition 1; *TOSREC* Test of Silent Reading Efficiency and Comprehension; *TOWRE* Test of Word Reading Efficiency; *WJ-III* The Woodcock Johnson III Tests of Achievement

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