KENTUCKY READING RESEARCH CENTER

A Review of the Reading-Writing Connection: Meta-Analytic Evidence for Integrated Literacy Instruction in Kindergarten Through Third Grade

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Abstract

This synthesis examined 20 meta-analyses and systematic reviews to understand the reciprocal relationship between reading and writing for students in kindergarten through third grade. Reading and writing develop interdependently through shared foundational skills including phonological awareness, orthographic knowledge, and the alphabetic principle. Writing instruction, particularly transcription skills such as handwriting and spelling, improved reading outcomes for struggling students, with spelling instruction producing significant effects on word reading (BC-SMD=1.52 in individualized settings). Reading instruction improved writing outcomes (ES=0.57), with phonological awareness and phonemic segmentation instruction transferring strongly to writing. Balanced literacy approaches produced reading outcomes equivalent to reading-only programs while additionally improving writing. The most effective interventions included Self-Regulated Strategy Development (ES=0.67-1.89), technology-based handwriting (ES=0.85), and individualized spelling instruction for students with learning disabilities. Explicit, systematic instruction proved essential across all domains. Struggling students and students with disabilities required more intensive instruction with greater total hours, smaller groups, and explicit connections between reading and writing. The synthesis provides evidence-based guidance for integrating reading and writing instruction in K-3 classrooms to improve literacy outcomes for all students.

Introduction

Kindergarten through third grade represents a foundational period when children acquire essential literacy skills that support all subsequent learning. During these years, students transition from learning to read and write to using reading and writing as tools for learning, communication, and self-expression. Despite the fundamental importance of literacy skills, student achievement data reveal significant challenges. In the United States, less than one-third of students ultimately perform at or above the “proficient” level in writing on the National Assessment of Educational Progress, and approximately two-thirds score at or below the basic level by 8th and 12th grade (National Center for Educational Statistics, 2012). These figures have remained largely stagnant since the early 1990s, leading the National Commission on Writing (2003) to label writing a “neglected skill” in American schools.

The consequences of inadequate early literacy instruction are far-reaching. Students who exit third grade without proficient skills face significant challenges throughout their educational careers. Limited abilities in the early grades predict later difficulties with academic performance across content areas and ultimately restrict opportunities for education and employment. Most importantly for young learners, writing serves as an essential tool for learning across the curriculum. When primary-grade students write about materials read or presented in class, they enhance their understanding of that content (Bangert-Drowns, Hurley, & Wilkinson, 2004; Graham & Hebert, 2011), making early literacy instruction critical not only for developing competence but also for supporting learning in all subject areas.

What is the Reading-Writing Connection?

For children in kindergarten through third grade, writing develops alongside reading as an interconnected literacy skill. Both are highly complex, cognitive, self-directed activities that develop from foundational skills and progress to increasingly sophisticated applications. The reciprocal relationship between reading and writing operates through shared foundational skills: phonological awareness (identifying and manipulating sounds in words), orthographic knowledge (understanding letter patterns and how letters represent sounds), the alphabetic principle (recognizing that letters represent sounds systematically), and automaticity (performing skills quickly without conscious attention). When students receive instruction in one domain, they simultaneously strengthen underlying abilities that support the other domain.

This reciprocal relationship is particularly powerful during K-3 because both skills are developing simultaneously. Common knowledge bases and complementary learning experiences create mutually reinforcing development. When kindergarten students attempt to spell words using invented spelling, they practice phonemic segmentation and apply letter-sound knowledge essential for reading. When first graders read decodable texts containing taught sound-spelling patterns, they reinforce the same patterns used when writing. When second graders read mentor texts and identify features of good writing, they develop criteria applicable to their own

compositions. When third graders write summaries of texts they've read, they deepen comprehension while practicing text structure and composition skills. This bootstrapping relationship means development in one area accelerates development in the other (Shanahan, 2006).

Building on Previous Research

The National Reading Panel (2000) established evidence-based principles for five essential components: phonemic awareness, phonics, fluency, vocabulary, and text comprehension. The What Works Clearinghouse subsequently published practice guides synthesizing post-2000 research on foundational reading skills (Foorman et al., 2016) and elementary writing instruction (Graham et al., 2012). However, neither the National Reading Panel nor early practice guides thoroughly examined connections between reading and writing instruction. Since these foundational reports, researchers have conducted multiple meta-analyses examining the bidirectional relationship, substantially advancing our understanding of how instruction in one domain supports development in the other.

Rationale for This Synthesis

The relationship between reading and writing involves multiple intersecting factors including directionality of effects, various skill domains, diverse instructional approaches, developmental progressions across K-3, and student characteristics. This complexity means any single study examines only a small portion of the reading-writing relationship. High-quality meta-analyses have already synthesized dozens of primary studies using rigorous systematic review procedures.

This review employs a meta-synthesis approach, synthesizing existing meta-analyses focused on reading-writing connections in grades K-3. This approach offers comprehensive coverage by examining the connection from multiple angles, enhanced statistical power by drawing on meta-analyses that synthesize hundreds of primary studies, quality assurance through peer-reviewed published work, and practical utility by identifying consistent patterns across multiple studies. Rather than duplicating extensive work already completed, this synthesis builds on existing meta-analyses to provide integrated understanding of what the collective evidence reveals about reading-writing connections.

This synthesis complements and extends existing What Works Clearinghouse practice guides by explicitly examining connections between reading and writing that receive limited attention in domain-specific guides, providing evidence that instruction in one literacy domain supports development in the other and identifying opportunities for integrated instruction that may be more efficient and effective than teaching reading and writing separately.

Factors Affecting the Reading-Writing Connection

The reading-writing connection operates through multiple interrelated factors spanning student characteristics, instructional practices, implementation approaches, and intervention design (Shanahan, 2006). Understanding these factors is essential for leveraging the reciprocal relationship to improve literacy outcomes.

Student-Level Factors

Phonological and phonemic awareness represent foundational skills directly supporting both reading and writing development (Graham & Santangelo, 2014). Students with strong phonological awareness more effectively segment phonemes during spelling and blend phonemes during decoding, creating mutually reinforcing relationships between domains (Chandler et al., 2025). Alphabetic knowledge and letter-sound correspondence serve as shared knowledge bases students apply in both reading and writing (Graham et al., 2018). Letter-sound relationships learned through phonics transfer immediately to spelling, while spelling instruction emphasizing phoneme-grapheme mapping strengthens decoding skills (Wanzek et al., 2016).

Vocabulary knowledge and oral language skills provide the semantic and syntactic foundation for both reading comprehension and written expression (Shanahan, 2006). Students with robust oral language draw on this knowledge when composing and more easily comprehend written language mirroring oral structures (Graham, 2018a). Prior literacy experiences shape understanding of reading-writing connections—children who are frequently read to and who observe adults writing develop stronger print and text structure concepts benefiting both domains (Graham, 2018a). Age and developmental stage matter because the reciprocal relationship manifests differently across K-3 (Kim et al., 2021). In kindergarten and first grade, transcription skills like handwriting and spelling provide particularly strong connections to reading, while in later grades, comprehension and composition processes become more prominent (Shanahan et al., 2025).

Instructional Factors

Explicit, systematic instruction emerges as the most consistently effective approach across all reviews (Graham & Santangelo, 2014; Santangelo & Graham, 2016). Students benefit when teachers clearly explain reading-writing connections, model strategies, and provide structured feedback (Graham et al., 2012). Integration of reading and writing activities is central—explicit connections between decoding and encoding, using texts as writing models, and employing writing to deepen comprehension develop more complete literacy skills than isolated instruction (Graham, Gillespie, & McKeown, 2013).

Opportunities for practice and application allow students to consolidate learning across domains. Students need substantial practice in both areas, with particular emphasis on foundational skills in early grades (Case-Smith, 2002; Graham & Santangelo, 2014). Decodable and connected texts support the connection by containing phonics patterns students are learning to spell (Foorman et al., 2016). Writing about texts strengthens comprehension through active processing while providing authentic purposes for writing (Graham & Hebert, 2011). Teaching word-reading strategies emphasizing systematic letter-sound relationships reinforces spelling instruction approaching the same relationships from production rather than reception (Chandler et al., 2025).

Spelling and encoding instruction provide a powerful pathway to improved reading outcomes, especially for struggling students (Shanahan et al., 2025). Explicit instruction in segmenting phonemes and representing them with graphemes strengthens the same knowledge required for decoding (Graham & Santangelo, 2014). Multicomponent interventions addressing multiple literacy aspects simultaneously produce stronger outcomes than single-skill interventions (López-Escribano et al., 2022), demonstrating that connections should be taught explicitly together rather than in isolation.

Implementer Factors

Teacher knowledge and expertise about the reading-writing connection are critical (Graham, 2018a). Teachers who understand interdependent literacy development, know evidence-based practices for both domains, and can make explicit connections implement more effective instruction. This encompasses both content knowledge about literacy and pedagogical knowledge about teaching connections to diverse learners (Brindle et al., 2016).

Professional development provides the mechanism for building expertise (Graham, 2018a). High-quality PD—characterized by sustained duration, active learning, collective participation, and coherence with school goals—effectively changes practices and improves outcomes (Harris et al., 2012). However, many teachers report inadequate preparation in both preservice and in-service contexts (Brindle et al., 2016; Kiuhara et al., 2009). Scripted programs provide structure for less experienced teachers, but may constrain flexibility and responsiveness (Graham, 2018a).

Paraprofessionals, interventionists, and technology expand instructional capacity. Trained paraprofessionals can effectively deliver specific interventions under supervision (Graham et al., 2012), technology-based tools (particularly for handwriting) provide effective practice with immediate feedback (Santangelo & Graham, 2016), and specialists deliver intensive instruction for students with significant needs (Graham & Santangelo, 2024). These implementers extend teachers' capacity to provide differentiated support across the reading-writing continuum.

Intervention Characteristics

Dosage—frequency, duration, and intensity—critically influences effectiveness (Case-Smith, 2002; Shanahan et al., 2025). Handwriting interventions require a minimum of 20 practice sessions (Case-Smith, 2002), and writing instruction for struggling students shows larger effects with greater total hours (Shanahan et al., 2025). However, intensity and quality often matter more than duration. Short-term intensive interventions can equal longer interventions (Graham & Santangelo, 2024), suggesting concentrated, focused instruction may be more beneficial than extended lower-intensity instruction.

Group size significantly affects outcomes (Chandler et al., 2025; Shanahan et al., 2025). Individual instruction produces the largest effects, particularly for students with learning disabilities, allowing precise targeting and immediate feedback (Chandler et al., 2025). Small-group instruction shows larger effects than whole-class instruction for struggling students (Shanahan et al., 2025), providing individualization while remaining feasible. Whole-class instruction can be effective for average-achieving students with high implementation quality and differentiation (Graham, Gillespie, & McKeown, 2013), though struggling students typically require additional support.

Tier of support determines intensity and specialization. Tier 1 should include integrated reading-writing for all students, Tier 2 targets specific needs with intensive small-group instruction, and Tier 3 provides individualized, highly explicit instruction for students with significant difficulties. The evidence base is stronger for Tiers 2 and 3 than Tier 1, suggesting a need for additional research on whole-class implementation (Graham et al., 2012).

Specific programs vary in effectiveness. Self-Regulated Strategy Development (SRSD) demonstrates the strongest effects for writing instruction (Graham et al., 2012; Kim et al., 2021), balanced literacy programs show positive effects on both domains (Graham, Gillespie, & McKeown, 2013), and technology-based handwriting programs show high effectiveness (Santangelo & Graham, 2016). Instructional techniques like graphic organizers, peer collaboration, and goal setting show promise (Graham et al., 2012) but require explicit instruction rather than simply providing tools (Graham & Hebert, 2011).

Barriers

Understanding barriers that impede effective use of the reading-writing connection is essential for successful implementation.

Student-Level Barriers

Insufficient foundational skills in phonemic awareness and letter knowledge create weak foundations affecting both domains (Foorman et al., 2016). Without strong phonemic awareness, students cannot segment phonemes during spelling or blend them during reading,

preventing reciprocal reinforcement (Graham & Santangelo, 2014). Reading or writing disabilities (dyslexia, dysgraphia) require more intensive, explicit, and individualized instruction (Galuschka et al., 2020; Graham & Santangelo, 2024). Students with dyslexia need systematic phonics and orthographic instruction in both reading and spelling to develop phoneme-grapheme knowledge (Galuschka et al., 2020), while students with dysgraphia may need assistive technology enabling expression despite motor difficulties (Santangelo & Graham, 2016).

Language differences, particularly for English learners without appropriate support, impede the connection because students lack the oral language foundation supporting both comprehension and expression (Graham, Collins, & Ciullo, 2024). Limited vocabulary and oral language restrict what students can comprehend and express, creating ceilings on literacy development that require systematic vocabulary instruction integrated with reading and writing (Shanahan, 2006). Lack of engagement or motivation prevents students from investing sustained effort, indicating a need for instruction that builds self-efficacy, interest, and purpose for both domains (Graham, 2018a).

Teacher-Level Barriers

Insufficient knowledge of literacy development, particularly understanding how reading and writing develop interdependently through shared skills, prevents teachers from making explicit connections that help students apply knowledge across domains (Graham, 2018a). When teachers view reading and writing as separate subjects, they miss opportunities to leverage reciprocal relationships and create artificial boundaries (Brindle et al., 2016).

Lack of training in explicit instruction is significant. Evidence consistently shows explicit, systematic instruction produces strongest effects (Graham & Santangelo, 2014), yet many teachers lack training in providing clear explanations, modeling strategies, structuring practice, and providing feedback (Brindle et al., 2016). Limited professional development opportunities restrict teachers' ability to acquire needed knowledge and skills (Kiuhara et al., 2009). PD for writing instruction is notably limited in many districts, and PD specifically addressing the reading-writing connection is rarer still (Graham, 2018a).

Inadequate understanding of reading-writing connections represents a specific knowledge gap (Graham, 2018a). Teachers with strong knowledge about reading or writing separately may not understand mechanisms through which these support one another, preventing them from designing instruction that leverages connections (Brindle et al., 2016). This pedagogical content knowledge gap means teachers may miss opportunities to reinforce reading through writing and vice versa, reducing efficiency and effectiveness (Graham, Gillespie, & McKeown, 2013).

Systemic and Instructional Barriers

Inappropriate curricular materials that fail to integrate reading and writing, lack systematic foundational skills progression, or do not provide explicit guidance on making connections create significant obstacles (Graham, 2018a). When curriculum materials treat reading and writing as entirely separate subjects with different scope and sequence, no shared instructional time, and no explicit connections, teachers must independently create connections, requiring additional time and expertise many lack (Graham, 2018a).

Overreliance on context-based strategies without explicit instruction is less effective than explicit, systematic instruction, particularly for struggling students (Graham & Santangelo, 2014). When students must infer reading-writing connections or discover patterns independently rather than receiving explicit teaching, many fail to develop complete understanding that allows flexible knowledge application (Graham et al., 2012). Separation of reading and writing instruction into distinct subjects with different instructional time, different teachers, and no coordination creates artificial boundaries working against integrated literacy skills (Graham, Gillespie, & McKeown, 2013).

Insufficient time for foundational skills, particularly in early grades when transcription skills develop, prevents students from achieving automaticity in handwriting and spelling that frees cognitive resources for higher-level processes (López-Escribano et al., 2022). When schools reduce handwriting and spelling instruction assuming natural development, they create bottlenecks impeding both writing and reading development (Santangelo & Graham, 2016). Lack of systematic phonics and spelling instruction making decoding-encoding connections explicit represents a related barrier (Graham & Santangelo, 2014)—when phonics and spelling use different terminology and emphases, students may fail to recognize they're learning the same phoneme-grapheme correspondences from different directions (Chandler et al., 2025).

Inadequate assessment to guide instruction prevents teachers from identifying specific needs and monitoring progress in component skills supporting both domains (Graham et al., 2012). When assessment focuses only on one domain or emphasizes only higher-level skills while neglecting foundational skills like phonological awareness, spelling, and handwriting, teachers lack information to target instruction effectively (Foorman et al., 2016). Insufficient intensity for struggling learners—manifested through groups too large, intervention time too limited, or instruction insufficiently explicit—prevents vulnerable students from receiving needed support (Shanahan et al., 2025). Evidence demonstrates struggling students require more intensive instruction than average-achieving students, with smaller groups, more instructional hours, greater explicitness, and more explicit reading-writing connections (Graham & Santangelo, 2024), yet many schools lack resources or structures to provide this intensity (Graham, 2018a).

Understanding both facilitating factors and barriers allows educators, administrators, and policymakers to make informed decisions about structuring literacy instruction, allocating resources, designing professional development, and supporting student learning. Evidence demonstrates the reading-writing connection represents a powerful lever for improving literacy

outcomes when instruction leverages this reciprocal relationship (Graham & Hebert, 2011; Graham et al., 2018), but numerous factors must align and barriers must be addressed for students to realize full benefits of integrated instruction (Graham, Gillespie, & McKeown, 2013).

Research Questions

This review synthesizes findings from meta-analyses examining reading-writing connections for students in kindergarten through third grade, addressing three research questions:

- Research Question 1: What instructional and intervention characteristics (e.g., multicomponent instruction, intervention dosage, group size, implementer, student characteristics) have been tested as part of instruction and interventions focused on the reading-writing connection?

- Research Question 2: What does the research say about the effectiveness of reading instruction in improving writing outcomes and writing instruction in improving reading outcomes for K-3 students?

- Research Question 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

- ### Eligible Populations

  This review focused on the following populations:

  - **Grade Range.** Eligible participants include students in kindergarten through third grade (ages 5 years 0 months through 9 years 11 months), or any subset within these grades. Meta-analyses including additional grades were included if results were disaggregated for students within the eligible grades or if students in eligible grades represented the majority of the overall sample. If the number of students per grade was not specified, a study was included if at least 50% of the grade levels represented in the sample fell within the eligible range. For meta-analyses reporting only a mean age, inclusion required a mean greater than 5 years 0 months and less than 9 years 6 months.
  - **Location.** Meta-analyses must have been written in English and focused on studies conducted in one of the following locations: the United States (including territories), Canada, Australia, Ireland, New Zealand, or the United Kingdom. Acceptable

settings included schools (public or private), classrooms, early childhood centers, homes, or clinics.

Eligible Interventions

This review included meta-analyses of comprehensive or supplemental curricula and replicable instructional strategies for teaching reading, writing, spelling, and handwriting to students in kindergarten through third grade. Interventions could be implemented by teachers, reading coaches, paraprofessionals, tutors, parents, or through technology. Meta-analyses must have described intervention characteristics including targeted skills, instructional approach, delivery format, duration and intensity, and personnel responsible for implementation.
Included intervention types encompassed curricula (structured sets of activities and materials designed for primary or supplemental instruction) and practices (named, well-defined approaches cited by multiple research teams). The review excluded meta-analyses focused solely on professional development, teacher preparation, or textbook design, as well as interventions unrelated to instructional practice such as comprehensive school reform. Both branded (commercial or published) and nonbranded interventions were eligible.

Eligible Research

The following parameters defined eligible meta-analyses and systematic reviews:

- **Topic.** Meta-analyses must have examined instructional strategies, curricula, or interventions focused on reading, writing, spelling, or handwriting skills, with particular attention to studies examining connections between reading and writing domains.

- **Time Frame.** Meta-analyses must have been published between 2008 and 2025, covering primary studies from the 1970s through 2024.

- **Sample.** Meta-analyses must have included at least some studies with K-3 participants meeting the criteria outlined in "Eligible Populations," or must have provided separate analyses for K-3 students.

- **Language.** Meta-analyses must have been published in English.

- **Publication Type.** Only peer-reviewed, published meta-analyses and systematic reviews were included. Conference papers and dissertations were excluded.

Search Strategy

Meta-analyses and systematic reviews were identified through multiple search strategies. Electronic searches were conducted in education and psychology databases including ERIC, PsycInfo, and Education Research Complete using search terms combining literacy domains (reading, writing, spelling, handwriting) with methodological terms (meta-analysis, systematic review, synthesis). Manual searches examined reference lists of identified meta-analyses and relevant practice guides. Forward citation searches identified more recent reviews citing foundational meta-analyses. Searches were conducted through December 2024.

Selection Criteria for Reviews

Meta-analyses were screened in two stages. Initial screening reviewed titles and abstracts to exclude reviews not focused on K-3 literacy instruction or lacking relevant outcomes. Full-text review determined whether reviews met all eligibility criteria. To be included, meta-analyses must have examined interventions or instructional practices, included quantitative synthesis with effect sizes, focused at least partially on K-3 populations, and reported outcomes relevant to reading or writing achievement. Twenty meta-analyses and systematic reviews met all criteria and were included in this synthesis.

Synthesis and Analysis Procedures

This synthesis systematically extracted, analyzed, and integrated findings from 20 meta-analyses and systematic reviews examining writing, spelling, and handwriting interventions for K-3 students, with particular attention to evidence leveraging the reciprocal relationship between reading and writing.

Extraction of Key Findings

Key findings were systematically extracted from each review using a structured template. For each review, the following information was documented: study characteristics, intervention components tested, effect sizes for relevant outcomes, and critical features associated with improved outcomes.

Extraction focused on K-3 students, even when reviews included broader grade ranges. When reviews examined both reading and writing interventions, findings related to the reciprocal relationship received particular attention. The extraction emphasized identifying not only what interventions were effective, but also why they were effective and for whom, requiring attention to mechanisms, moderating variables, and implementation considerations.

Analysis of Effect Sizes

Effect sizes were analyzed to determine magnitude and consistency of intervention effects. Effect sizes were documented using original metrics without conversion, as different metrics are appropriate for different designs and populations. Standard interpretation benchmarks were applied to determine magnitude of intervention effects.
Effect sizes were examined for patterns across intervention types, student populations, and grade levels. When reviews reported ranges or effects for multiple subgroups, both were documented to capture variability and enable examination of differential effects.

Examination of Moderating Variables

The synthesis systematically examined variables moderating intervention effects. Moderating variables were organized into four categories: student characteristics, grade level, intervention characteristics, and implementation factors.

- **Student characteristics** examined included achievement level, disability status, language status, and writing ability. Reviews were analyzed to understand how optimal instructional approaches differed by population and what intensity of instruction was required for different student groups.

- **Grade level** emerged as an important moderator. Effects of text structure instruction, spelling instruction's impact on phonological awareness, and the balance between transcription and composition instruction were examined across grade levels.

- **Intervention characteristics** moderating effects included type of instruction (explicit vs. implicit approaches), intensity, dosage, grouping (individualized, small-group, or whole-class), and integration (integrated reading-writing approaches vs. separate instruction).

- **Implementation factors** examined included implementation quality and fidelity, teacher training and support, and use of technology.

- **Attention to Population Differences.** Given substantial evidence that optimal approaches differ by student population, the synthesis paid particular attention to findings specific to different K-3 student groups: struggling readers and writers, students with learning disabilities, students with dyslexia, average-achieving students, and differences across grade levels within K-3.

- **Integration Across Reviews.** Integration across reviews involved identifying converging evidence, resolving apparent contradictions, and developing a comprehensive understanding of effective practices.

- **Converging evidence** was identified across multiple reviews on key instructional approaches and their effectiveness across domains and populations.

- **Apparent contradictions** were examined to determine whether they reflected genuine inconsistencies or differences in populations examined, outcome measures used, or inclusion criteria. Variations in effect sizes and optimal instructional approaches were analyzed to understand whether they represented true contradictions or differential effectiveness for specific populations.

- **Gaps in the evidence base** were identified, including areas where research was limited or absent.

This integration process produced a comprehensive synthesis documenting what works, for whom, under what conditions, and why, forming the foundation for practice recommendations and discussion in subsequent sections.

Results

This synthesis examined 20 meta-analyses and systematic reviews of writing, spelling, and handwriting interventions for K-3 students, with particular emphasis on the reciprocal relationship between writing and reading development. The reviews covered interventions spanning from the 1970s through 2024.

Characteristics of Reviewed Studies

The 20 included reviews employed various methodologies: 13 meta-analyses of group-design studies, 3 meta-analyses combining both group and single-case designs, 2 meta-analyses of single-case designs, and 2 systematic reviews without meta-analytic synthesis.

Six reviews focused exclusively or primarily on K-3 students. The remaining reviews included broader grade ranges but provided specific K-3 findings or subgroup analyses. Most reviews included international studies, though several focused specifically on English-language instruction.

Multiple reviews specifically targeted students with writing difficulties, reading difficulties, or those identified as at-risk. Graham et al. (2012) included 29% of studies with struggling writers, while Kim et al. (2021) examined effects for both struggling and typical writers in K-3. Shanahan et al. (2025) focused exclusively on students with literacy difficulties.

Six reviews focused on students with disabilities. Graham and Santangelo (2024) examined learning disabilities research across 39 studies, while Chandler et al. (2025) synthesized spelling interventions for students with learning disabilities across 59 trials with over 2,200 students. Galuschka et al. (2020) examined spelling interventions for students with dyslexia across 34 trials. Graham, Collins, and Ciullo (2024) explicitly included second language learners in their comprehensive K-5 writing meta-analysis.

Research Question 1: Instructional and Intervention Characteristics Tested

Writing Intervention Components

Self-Regulated Strategy Development (SRSD) was the most extensively studied writing intervention approach for K-3 students. SRSD typically includes explicit instruction in writing strategies, self-regulation procedures, goal setting, and self-monitoring. Graham et al. (2012) examined SRSD across multiple studies with 2nd-3rd graders, with effect sizes ranging from 0.67 to 1.89.

Studies also examined:

- Text structure instruction (teaching organizational patterns for different text types)
- Prewriting activities (planning before drafting using graphic organizers and brainstorming)
- Peer assistance (collaborative writing arrangements)
- Comprehensive writing programs (packaged curricula addressing multiple components)
- Goal setting and self-regulation interventions

Transcription Intervention Components

- **Handwriting Approaches.** Multiple studies tested different approaches to teaching letter formation and handwriting fluency. Santangelo and Graham (2016) examined individualized handwriting instruction, technology-based handwriting instruction, traditional handwriting instruction, and motor instruction alone (found ineffective). López-

Escribano et al. (2022) examined timed transcription training, multicomponent handwriting treatments, and performance feedback. Case-Smith (2002) found that effective interventions required actual handwriting practice with a minimum of 20 practice sessions.

- **Spelling Approaches.** Chandler et al. (2025) identified the most effective spelling approaches for K-3 students with learning disabilities: whole word study (explicit teaching of complete words with attention to orthographic patterns), multilinguistic approaches (integrating sounds, spelling patterns, and word parts), and phonemic approaches (emphasizing phoneme segmentation and phoneme-grapheme correspondences).

  Galuschka et al. (2020) found that for K-3 children with dyslexia, effective spelling instruction included phonics instruction, orthographic instruction (teaching graphotactic rules and orthographic-phonological spelling rules), and morphological instruction, while memorization strategies showed no significant effect.

Reading-Writing Integration Components

Graham and Hebert (2011) examined multiple approaches to having students write about texts they read:

- Writing personal reactions to text
- Writing summaries of text
- Writing notes about text
- Answering questions about text in writing
- Teaching writing skills and processes

Graham, Gillespie, and McKeown (2013) examined balanced literacy programs integrating reading and writing instruction through integrated phonics and spelling instruction, connected reading-writing activities, shared instructional time, and explicit connections between reading and writing.

Intervention Dosage, Duration, and Implementation

Case-Smith (2002) established that effective handwriting interventions required a minimum of 20 practice sessions. López-Escribano et al. (2022) examined interventions with varied dosages, with most effective programs providing regular practice 3-5 times per week over multiple weeks. Graham and Santangelo (2014) emphasized that effective spelling instruction required multiple opportunities to practice with new words over time.

The reviews found that intervention intensity (concentration and focus of instruction) and quality (use of evidence-based practices with fidelity) were often more important than simple duration. Graham and Santangelo (2024) found that short-term intensive interventions were equally effective as longer interventions for students with learning disabilities. Shanahan et al. (2025) found that greater total hours of writing instruction showed descriptively larger effects on reading outcomes for struggling K-3 students.

Most interventions were implemented by general education or special education teachers who received training, though many studies involved researchers or graduate students. Some interventions were delivered by trained paraprofessionals, technology, or trained tutors.

Grouping Arrangements and Student Characteristics

Chandler et al. (2025) found particularly strong effects for individual instruction in single-case designs. Shanahan et al. (2025) found that small-group writing instruction showed descriptively larger effects on reading outcomes compared to whole-class or individual instruction for struggling students. Graham, Gillespie, and McKeown (2013) found that balanced literacy programs delivered to whole classes were effective for both average and struggling students when implementation quality was high.

Multiple reviews provided grade-specific findings. Kim et al. (2021) found that effects varied by grade level within K-3, with different patterns emerging between early grades (K-2) and Grade 3.

Research Question 2: Effectiveness of Interventions

Writing Instruction Effects on Reading

Graham and Hebert (2011) provided comprehensive evidence that writing instruction improves reading, analyzing studies from grades 2-12. The meta-analysis found strong evidence that having students write about material they read enhances reading comprehension and that teaching writing improves students' reading skills.

For elementary students specifically, writing about text improved reading comprehension through multiple types of writing activities. Writing personal reactions improved comprehension by deepening engagement and requiring reflection. Writing summaries was particularly effective because summarization requires identifying main ideas and synthesizing information. Writing notes improved comprehension through active processing. Answering questions in writing was more effective than oral responses.

Teaching writing skills and processes improved students' reading abilities. When students learned the writing process, they developed metacognitive awareness of how texts are

constructed, which transferred to reading comprehension. Teaching specific writing skills provided knowledge students could apply when reading. Teaching writing, particularly when instruction included transcription skills, produced gains in word reading and decoding.

Shanahan et al. (2025) provided the most direct evidence of writing instruction improving reading outcomes for struggling students, focusing exclusively on PreK-Grade 5 students with literacy difficulties. The meta-analysis included 19 studies with 72 effects and found that writing instruction improved reading outcomes with an overall small but statistically significant positive effect. **Most importantly, transcription instruction—teaching handwriting and spelling—produced the largest effects on reading outcomes among all types of writing instruction examined.** Effect sizes for transcription instruction were notably larger than those for composition instruction.

The overall effect of writing instruction on reading for struggling K-3 students was smaller than those typically observed for typically developing students, indicating that struggling students need explicit, intensive writing instruction to realize reading benefits. Small-group writing instruction showed descriptively larger effects on reading outcomes, and greater total hours of writing instruction also showed descriptively larger effects.

Reading Instruction Effects on Writing

Graham, Liu, et al. (2018) conducted a comprehensive meta-analysis examining whether reading interventions improve writing from preschool through Grade 12. For K-3 students specifically, teaching reading strengthened writing overall with a moderate effect size. The impact varied by specific writing outcome: writing quality showed the strongest effect, words written showed a smaller effect, and spelling showed a substantial effect.

Several specific types of reading instruction proved particularly effective at improving K-3 writing outcomes:

- Phonemic segmentation instruction strengthened students' ability to encode words during spelling and composition
- Phonological awareness instruction improved students' capacity to map sounds to letters during writing
- Early literacy programs that integrated multiple reading components showed positive effects on writing development
- Reading fluency instruction produced gains in writing

Importantly, positive effects of reading instruction on writing maintained over time, indicating that gains were not merely short-term artifacts but represented meaningful and durable improvements in writing ability.

Balanced Literacy Programs

Graham, Gillespie, and McKeown (2013) found that literacy programs balancing reading and writing instruction produced positive effects on both reading and writing outcomes. Effect sizes for balanced programs on reading outcomes were comparable to those achieved by reading-only programs, indicating that integrating writing instruction does not detract from reading development**.** Importantly, balanced programs produced the additional benefit of improving writing outcomes, which reading-only programs did not address.

For elementary students in K-3, balanced literacy programs proved particularly effective when they included integrated phonics and spelling instruction, connected reading and writing activities, shared instructional time for activities developing both domains, and explicit connections between reading and writing. The meta-analysis found that balanced programs produced reading outcomes equivalent to reading-only programs while additionally improving writing, demonstrating that teachers need not choose between reading and writing instruction. However, effectiveness depended on thoughtful implementation. Simply alternating between reading lessons and writing lessons without explicit connections did not produce the same benefits as truly integrated approaches.

Handwriting Instruction Effectiveness

Santangelo and Graham (2016) examined K-12 students with multiple K-3 studies included. For K-3 students, teaching handwriting improved:

- Legibility
- Fluency
- Writing quality
- Writing length

Different handwriting approaches showed varying effectiveness. Technology-based handwriting instruction demonstrated the largest effect, followed by individualized handwriting instruction and traditional handwriting instruction. Motor instruction alone showed essentially no effect or was counterproductive.

López-Escribano et al. (2022) focused specifically on K-6 students with emphasis on handwriting fluency rather than only legibility (31 studies, 2,030 students). Most effective approaches included timed transcription training, multicomponent handwriting treatments, and performance feedback. The review emphasized that early grades are most critical for developing automatic handwriting.

Spelling Instruction Effectiveness

Graham and Santangelo (2014) found that spelling instruction in K-3 improved spelling performance, phonological awareness, reading performance, and spelling while writing. All seven studies examining whether spelling instruction improved phonological awareness were conducted with K-1 students, demonstrating that formal spelling instruction enhanced phonological awareness in early grades when more than half of instructional time was devoted to recoding sounds into letters.

Sayeski and Paulsen (2024) examined 81 studies across K-12, finding group design studies showed small effects and single-case designs showed moderate effects. Spelling instruction proved better than no instruction but was most effective for taught words with limited generalization to untaught words.

Chandler et al. (2025) provided particularly strong evidence for K-3 students with learning disabilities across 59 trials with over 2,200 students. In group design studies, spelling outcomes showed small but significant effects and word reading outcomes showed small effects. Single-case design studies demonstrated substantially larger effects: spelling outcomes showed large effects and word reading outcomes showed large effects.

Most effective approaches for K-3 students with learning disabilities included whole word study, multilinguistic approaches integrating sounds, spelling patterns, and word parts, and phonemic approaches. Critically, spelling instruction not only improved spelling but also strengthened word reading skills in early elementary grades.

Galuschka et al. (2020) examined 34 controlled trials and found that for K-3 children with dyslexia, phonics instruction, orthographic instruction, and morphological instruction all showed moderate to high impact, while memorization strategies showed no significant effect.

Writing Intervention Effects by Type

- **Self-Regulated Strategy Development** demonstrated the strongest and most consistent effects for K-3 writing instruction. Graham et al. (2012) found effect sizes ranged from 0.67 to 1.89 across studies with 2nd-3rd graders. Kim et al. (2021) identified SRSD as most effective approach for K-3 students overall.

- **Text structure instruction** showed strong effects for Grade 2 full-range students but smaller effects for Grade 3 full-range students.

- **Prewriting activities** demonstrated substantial effects for grades 2-3 full-range students and for Grade 3 students specifically.

- **Peer assistance** in Grade 2 showed moderate to large effects.

- **Comprehensive writing programs** yielded effect sizes ranging from small to moderate in Grade 1 and from small to large in Grades 2-3.

Rogers and Graham (2008) found that for K-3 students with learning disabilities, goal setting proved effective across grade levels. Graham and Santangelo (2024) confirmed that small-group interventions outside the general classroom proved more effective than whole-class instruction for students with learning disabilities.

Research Question 3: Features Associated with Improved Outcomes

Type of Instruction

Across all domains—writing, spelling, and handwriting—explicit and systematic instruction emerged as the most consistently effective approach for K-3 students. Graham and Santangelo (2014) identified explicit and formal instruction in spelling strategies as essential. This principle extended across writing interventions, where SRSD and other strategy instruction approaches incorporated explicit teaching of strategies with modeling and guided practice.

For handwriting, Santangelo and Graham (2016) found that explicit instruction with adequate practice time proved effective, while indirect approaches like motor exercises alone or sensory training without writing practice showed minimal to no effects. Graham and Hebert (2011) found that explicit, systematic instruction in writing strategies produced larger reading comprehension gains than simply assigning writing activities without explicit instruction.

Characteristics of effective explicit instruction included:

- Clearly stated instructional goals
- Teacher modeling and demonstration
- Guided practice with feedback
- Gradual release of responsibility
- Chunking information into manageable parts
- Systematic sequencing from simple to complex
- Clear and timely corrective feedback

Graham, Gillespie, and McKeown (2013) found that truly integrated approaches—where teachers explicitly connect reading and writing activities—produced superior outcomes to simply alternating between separate reading and writing lessons.

Duration, Intensity, and Practice

Case-Smith (2002) established specific minimum requirements: handwriting interventions required a minimum of 20 practice sessions to produce improvements. Graham and Santangelo (2024) found that short-term interventions were equally effective as longer interventions for students with learning disabilities, suggesting that intensity matters as much as or more than total duration.

Shanahan et al. (2025) found that greater total instructional hours in writing instruction showed descriptively larger effects on reading outcomes for struggling K-3 students. However, the relationship between dosage and outcomes was complex, with quality and intensity often more important than simple duration.

Graham and Santangelo (2014) emphasized that effective spelling instruction required multiple opportunities to practice with new words distributed over time rather than massed practice. Kim et al. (2021) found that effects varied by grade level within K-3, suggesting that optimal dosage and intensity should shift across primary grades.

Grouping Arrangements

- **Individual instruction** proved particularly effective for students with significant learning needs. Chandler et al. (2025) found that single-case designs (one-on-one instruction) showed substantially larger effects than group design effects. Santangelo and Graham (2016) found individualized handwriting instruction showed strong effects.

- **Small-group instruction** emerged as highly effective, particularly for struggling students. Shanahan et al. (2025) found that small-group writing instruction showed descriptively larger effects on reading outcomes compared to whole-class or individual instruction for struggling students. Graham and Santangelo (2024) found that small-group interventions outside the general classroom proved more effective than whole-class instruction for students with learning disabilities.

  Small groups allowed teachers to provide differentiated instruction, ensure active engagement, provide more frequent feedback, monitor individual progress closely, and adjust instruction based on student responses.

- **Whole-class instruction.** Graham, Gillespie, and McKeown (2013) found that balanced literacy programs delivered to whole classes were effective for both average and struggling students when implementation quality was high. However, struggling students often benefited from additional small-group or individual support beyond core whole-class instruction.

Optimal grouping varied by student need: struggling students and students with disabilities benefited most from individual or small-group instruction for intensive intervention, average-achieving students benefited from high-quality whole-class instruction supplemented with differentiation, and mixed-ability groups could be effective with balanced literacy approaches and flexible grouping.

Technology and Implementation Quality

Santangelo and Graham (2016) found technology-based handwriting instruction demonstrated the highest effect size among all handwriting interventions for K-3 students. Effective technology-based approaches included computer programs or tablet applications providing handwriting practice, immediate feedback on letter formation, adaptive difficulty adjusting to student performance, engaging formats with game-like elements, and multisensory learning experiences.

Technology appeared most effective when used to supplement or enhance explicit teacher-led instruction rather than replace it entirely. Technology's effectiveness may stem partly from its ability to provide individualized practice and feedback impossible for teachers to provide to whole classes.

Graham, Gillespie, and McKeown (2013) found that balanced literacy programs required teachers to receive professional development in how to effectively integrate reading and writing instruction. The effectiveness of interventions depended heavily on implementation quality.

Discussion

The Reciprocal Relationship Between Reading and Writing

This synthesis of 20 meta-analyses provides compelling evidence that reading and writing development in K-3 students is fundamentally interconnected. This reciprocal relationship operates bidirectionally: writing instruction improves reading outcomes, and reading instruction improves writing outcomes. Graham and Hebert (2011) demonstrated that having students write about texts enhances reading comprehension and that teaching writing improves reading skills.

Graham et al. (2018) found that reading interventions strengthened writing, while Shanahan et al. (2025) found that writing instruction improved reading for struggling PreK-Grade 5 students. The magnitude of cross-domain effects varied by component and student characteristics.

Transcription instruction—teaching handwriting and spelling—produced the strongest effects. Shanahan et al. (2025) found that transcription instruction produced the largest reading gains among all writing instruction types, directly improving word reading and decoding for K-3

struggling readers. Chandler et al. (2025) corroborated this finding: spelling instruction for K-3 students with learning disabilities produced substantial word reading gains, demonstrating that teaching encoding strengthens the same phoneme-grapheme correspondences needed for decoding.

The reciprocal relationship operates through shared foundational skills—phonological awareness, orthographic knowledge, alphabetic principle, and automaticity. When instruction develops these shared foundations through both reading and writing activities, students apply knowledge flexibly in both domains, creating efficiency and depth of learning.

Writing Instruction as Pathway to Reading Improvement

Writing instruction—particularly transcription instruction—represents a viable pathway to improving reading outcomes for K-3 students, especially those who struggle. Shanahan et al. (2025) demonstrated that for struggling PreK-3 students, writing instruction improved reading, with transcription instruction producing the largest effects. While this effect is smaller than typical reading-focused interventions, it demonstrates that writing instruction can serve as an alternative or supplemental route to improving reading, particularly for students who have not responded to traditional reading interventions.

The mechanism is well-supported. When students receive spelling instruction, they learn to segment words into phonemes and map orthographic patterns to those sounds (Graham & Santangelo, 2014). This same phonological and orthographic knowledge is essential for decoding. Wanzek et al. (2016) provided direct evidence: encoding instruction for K-3 students with learning disabilities increased alphabetic principle knowledge, developed phonemic awareness, and produced growth in both reading and spelling skills simultaneously.

Handwriting instruction similarly improves reading through multiple mechanisms. Students practicing letter formation attend to distinctive visual features, strengthening letter recognition (Santangelo & Graham, 2016). Handwriting automaticity frees cognitive resources during both writing and reading (López-Escribano et al., 2022). Case-Smith (2002) found that effective handwriting interventions required actual handwriting practice—minimum 20 sessions—with motor exercises alone failing to produce benefits.

Reading Instruction as Foundation for Writing Development

Reading instruction provides a strong foundation for writing development. Graham et al. (2018) found that for K-3 students, teaching reading strengthened writing, demonstrating that approximately half a standard deviation improvement in writing outcomes resulted from reading instruction. This finding has important implications: time devoted to reading instruction benefits both reading and writing, creating efficiency in literacy instruction.

The types of reading instruction most effective for writing transfer are those developing shared foundational skills. Phonemic segmentation and phonological awareness instruction improved K-3 writing outcomes (Graham et al., 2018), likely by strengthening students' ability to segment words into sounds during spelling. Reading fluency instruction also produced writing gains by freeing cognitive resources and developing understanding of sentence structure through repeated exposure to written language models (Graham et al., 2018).

Discussion of Components' Effectiveness

Most Effective Approaches

Strategy Instruction. Self-Regulated Strategy Development demonstrated the strongest effects for writing quality and composition. Graham et al. (2012) found effect sizes ranging from 0.67 to 1.89 across studies with 2nd-3rd graders. These large effect sizes position SRSD among the most effective educational interventions in literacy research. SRSD's effectiveness stems from integrating multiple evidence-based components: explicit instruction in writing strategies, self-regulation procedures, and systematic instruction including teacher modeling, guided practice, and gradual release of responsibility (Graham & Harris, 2018).

Transcription Instruction. Transcription instruction—handwriting and spelling—emerged as critical for K-3 literacy development, with particular importance for struggling readers. Effectiveness operated through multiple mechanisms and produced effects on both writing and reading outcomes.

For handwriting, Santangelo and Graham (2016) found that teaching handwriting improved legibility, fluency, writing quality, and writing length. These effects demonstrate that handwriting instruction benefits not only letter formation but also higher-level writing processes. When students develop automatic letter formation, they free cognitive resources for composition processes (Berninger & Swanson, 1994).

Technology-based handwriting instruction demonstrated the highest effect among all handwriting interventions (Santangelo & Graham, 2016), suggesting that computer programs or tablet applications providing practice with immediate feedback, adaptive difficulty, and engaging formats can be highly effective. However, technology appeared most effective supplementing explicit teacher-led instruction rather than replacing it.

The ineffectiveness of motor instruction alone provides important guidance (Santangelo & Graham, 2016). Motor exercises without actual handwriting practice do not transfer to handwriting. Handwriting instruction must include substantial actual writing practice in meaningful contexts.

For spelling, evidence demonstrated both direct effects on spelling and important cross-domain effects on reading. Graham and Santangelo (2014) found that spelling instruction improved

spelling performance, phonological awareness, reading performance, and spelling while writing. All seven studies examining whether spelling instruction improved phonological awareness were conducted with K-1 students, demonstrating that formal spelling instruction enhances phonological awareness when more than half of instructional time is devoted to recoding sounds into letters.

Cross-domain effects of spelling on reading were particularly strong for students with learning disabilities. Chandler et al. (2025) found that in single-case studies (highly individualized instruction), spelling instruction produced very large effects on both spelling and word reading. These effect sizes are among the largest documented in literacy intervention research.

Most effective spelling approaches for K-3 students with learning disabilities included whole word study, multilinguistic approaches integrating sounds, spelling patterns, and word parts, and phonemic approaches emphasizing phoneme segmentation and phoneme-grapheme correspondences (Chandler et al., 2025). These approaches share a common characteristic: they explicitly teach systematic relationships between sounds and spellings, helping students understand orthographic principles rather than relying on rote memorization.

Writing About Text. Graham and Hebert (2011) identified writing about text as effective for improving reading comprehension. Writing summaries, personal reactions, notes, and answers to questions all proved effective. Effectiveness stems from active processing. When students write summaries, they must identify main ideas, distinguish important from unimportant information, synthesize information, and condense while maintaining meaning—all processes enhancing comprehension.

However, Graham and Hebert (2011) emphasized that simply assigning these activities without explicit instruction produced smaller gains than explicitly teaching strategies. Students need explicit instruction in how to identify main ideas, distinguish important from unimportant information, organize notes, and support opinions with evidence. For struggling students, explicit instruction and scaffolding are particularly essential.

Ineffective Approaches

Multiple reviews identified approaches that failed to produce benefits. For handwriting, motor instruction alone was essentially ineffective (Santangelo & Graham, 2016). Motor exercises without actual handwriting practice did not transfer to handwriting. The implication is clear: handwriting instruction must include substantial actual writing practice in meaningful contexts.

For spelling, memorization strategies showed no significant effect for students with dyslexia (Galuschka et al., 2020). Rote memorization without understanding orthographic principles was ineffective. Spelling instruction should teach patterns, rules, and logic underlying the English spelling system, not rely on memorization alone.

Graham and Hebert (2011) found that simply assigning writing activities without explicit instruction in strategies produced smaller gains than explicit teaching. Students need explicit instruction in how to use writing strategies effectively.

Graham, Gillespie, and McKeown (2013) found that simply alternating between reading lessons and writing lessons without explicit connections did not produce same benefits as integrated instruction. Integration requires more than scheduling; teachers must explicitly help students understand how reading and writing skills connect and reinforce each other.

Implications for Practice

General Implications for K-3 Literacy Instruction

Integration of Reading and Writing. K-3 literacy instruction should integrate reading and writing rather than treating them as separate subjects. Graham et al. (2013) demonstrated that balanced literacy programs produced reading outcomes equivalent to reading-only programs while additionally improving writing. Effective integration requires explicitly connecting decoding and encoding activities, using spelling instruction to reinforce phonics, developing handwriting and letter recognition simultaneously, and using composition to support comprehension.

Emphasis on Explicit, Systematic Instruction. Across all domains, explicit and systematic instruction emerged as more effective than implicit or discovery-based approaches. Effective explicit instruction includes clearly stated instructional goals, teacher modeling and demonstration, guided practice with feedback, gradual release of responsibility, systematic sequencing from simple to complex, and clear and timely corrective feedback.

Adequate Practice Opportunities. K-3 students require substantial, focused practice opportunities. Case-Smith (2002) established minimum requirements: handwriting interventions required a minimum 20 practice sessions. For spelling, Graham and Santangelo (2014) emphasized that effective instruction requires multiple opportunities to practice with new words distributed over time.

Balance Between Transcription and Composition. Evidence demonstrates that both transcription skills (handwriting, spelling) and composition skills are important, but optimal balance differs based on student characteristics and grade level. For struggling readers and writers, particularly in grades K-2, transcription instruction should be prioritized as it produces the largest reading gains (Shanahan et al., 2025). For average-achieving students across K-3, balanced attention to both transcription and composition within integrated literacy programs is appropriate (Graham et al., 2013).

Implications for English Learners, Students with Disabilities, and Students At Risk
Prioritize Transcription Instruction. For struggling readers and writers, transcription instruction—particularly spelling—should be prioritized as a core literacy intervention

component. Shanahan et al. (2025) found that transcription instruction produced the largest reading effects. These findings suggest educators working with struggling K-3 readers should allocate substantial instructional time to explicit, systematic spelling instruction, viewing it not merely as a writing skill but as a critical reading intervention.

Increase Intensity and Explicitness. For struggling K-3 students, simply providing some integrated reading-writing instruction is insufficient. Shanahan et al. (2025) found that struggling students needed explicit, intensive writing instruction to achieve reading gains. Intensity can be increased through greater total hours, longer sessions, smaller groups, or more focused content. Chandler et al. (2025) found substantially larger effects in single-case designs compared to group designs, suggesting that highly individualized instruction produces the largest gains.

Highly Individualized Instruction for Students with Learning Disabilities. For K-3 students with learning disabilities, highly individualized instruction produced substantially larger effects than group instruction. Chandler et al. (2025) found that single-case studies showed very large effects while group studies showed small to moderate effects. This dramatic difference suggests students with learning disabilities benefit substantially from instruction precisely tailored to their specific gaps and taught at a pace matched to their learning rate.

Explicit, Systematic Approaches Essential. For students with learning disabilities and dyslexia, explicit and systematic instruction is particularly essential. Galuschka et al. (2020) found that for K-3 children with dyslexia, phonics, orthographic, and morphological instruction showed moderate to high impact, while memorization strategies showed no effect. For students with learning disabilities, discovery learning or implicit instruction is insufficient.

Small-Group Outside General Classroom. Graham and Santangelo (2024) found that small-group interventions outside the general classroom proved more effective than whole-class instruction for students with learning disabilities. Small-group settings allow instruction precisely targeted to students' specific needs, more active student engagement, more individualized feedback, and fewer distractions.

Implications for Teacher Preparation and Professional Development

Teachers require specialized knowledge to implement integrated reading-writing instruction effectively. Graham et al. (2013) found that balanced literacy programs depended critically on implementation quality, and teachers needed professional development in how to effectively integrate reading and writing. Teachers need understanding of the reciprocal relationship between reading and writing, knowledge of how to make explicit connections between reading and writing activities, understanding of shared foundational skills and how to develop them through both domains, and skill in differentiating instruction based on student needs.

Implications for Curriculum and Materials

Schools and districts should prioritize curriculum materials facilitating integrated reading-writing instruction. High-quality resources for K-3 literacy should include integrated phonics and spelling instruction, opportunities for writing about texts students read with structured activities and explicit strategy instruction, mentor texts aligned with writing instruction, systematic handwriting instruction with adequate practice, and explicit guidance for teachers on differentiation.

The finding that technology-based handwriting instruction demonstrated the highest effect (Santangelo & Graham, 2016) suggests technology can play a valuable role when appropriately integrated. However, evidence suggests technology should supplement explicit teacher-led instruction rather than replace it.

Limitations

Limitations of Current Research Base

Research focused predominantly on intervention (Tiers 2-3) rather than core instruction (Tier 1). Most research examined small-group or individualized interventions for struggling students or students with disabilities. Less is known about how to effectively integrate reading and writing in high-quality core instruction serving all students.

Implementation quality and fidelity varied substantially across studies, making it difficult to determine whether modest or null effects reflected ineffective interventions or poor implementation. When interventions were implemented by researchers or by teachers with intensive training and coaching, effects tended to be larger than when implemented under typical school conditions.

Most studies examined immediate or short-term effects, with limited evidence on long-term outcomes. While Graham et al. (2018) found that effects maintained over time, few studies followed students across multiple years. Questions remain about whether early integrated instruction produces sustained advantages in later grades.

Dosage varied widely across studies, and the relationship between dosage and outcomes was complex. Case-Smith (2002) provided specific minimum requirements (20 sessions for handwriting), but for most interventions, optimal dosage remains unclear.

Some reviews did not report effects disaggregated by grade level or by specific student subgroups, limiting that ability to determine for whom specific interventions are most effective.

Limitations of Current Synthesis

This synthesis focused on meta-analyses and systematic reviews rather than individual studies, providing a broad overview but limited detail on specific instructional procedures. Secondary sources necessarily summarize and condense information from primary sources, potentially losing important implementation details.

Publication bias may affect meta-analyses, potentially leading to overestimation of effects if studies with null or negative findings are less likely to be published. While many meta-analyses include efforts to locate unpublished studies and examine publication bias, the possibility remains that documented effects overestimate true effects.

Synthesizing across 20 reviews with different populations, outcomes, and methodologies created challenges. Effect sizes were calculated using different metrics, making direct comparison difficult. Determining which specific components were responsible for effects in multicomponent interventions is challenging without component analyses.

Future Research

Based on identified limitations and gaps, several directions for future research would strengthen understanding and improve guidance for K-3 literacy instruction.

- **Research on Core Instruction.** Substantial research is needed on high-quality core reading-writing instruction in Tier 1 settings. Future research should examine the effectiveness of balanced literacy approaches with full implementation support in general education classrooms, including comparisons of integrated vs. separate reading and writing instruction.

- **Research on Optimal Integration.** While current evidence demonstrates that integration is beneficial (Graham et al., 2013), less is known about how to integrate these approaches most effectively. Future research should examine optimal time allocation between transcription and composition by grade level, sequencing of integrated activities, and methods for making connections explicit to students.

- **Research on Differential Effects.** More research is needed on how the reciprocal relationship varies by student characteristics. Future research should examine effects separately for students with different disability categories, multilingual learners with varying language proficiency levels, and students with co-occurring reading and writing difficulties vs. single-domain difficulties.

- **Research on Mechanisms.** While this synthesis identified multiple proposed mechanisms (shared knowledge bases, automaticity, metacognitive awareness), these

have been primarily inferred rather than tested directly. Future research should conduct direct tests through mediation analyses or experimental designs isolating specific mechanisms.

- **Research on Dosage and Intensity.** More systematic research on dose-response relationships is needed. While Case-Smith (2002) provided specific guidance for handwriting (minimum 20 sessions), similar guidance is lacking for other interventions.

- **Research on Technology Integration.** Given high effectiveness of technology-based handwriting instruction (Santangelo & Graham, 2016), research should examine whether technology-enhanced integrated reading-writing instruction produces superior outcomes to traditional instruction.

- **Research on Assessment.** A significant gap involves assessment—how educators can use assessment data to guide integrated reading-writing instruction. Research should examine formative assessments monitoring progress in shared foundational skills and assessment approaches for identifying students needing additional support.

- **Research on Family Engagement.** This synthesis revealed a significant gap: no included reviews provided evidence on how caregivers can support reading-writing connections at home. Research examining family-based activities integrating reading and writing would be valuable.

- **Research on Long-Term Outcomes.** Longitudinal research following students from early intervention through later grades is essential for understanding durability and cumulative effects of integrated literacy instruction.

Conclusion

This synthesis of 20 meta-analyses and systematic reviews provides compelling evidence for the reciprocal relationship between reading and writing in K-3 students. Writing instruction improves reading outcomes, with transcription instruction producing particularly strong effects on word reading and decoding for struggling students (Shanahan et al., 2025). Reading instruction improves writing outcomes, with phonological awareness and phonemic segmentation instruction transferring strongly to writing (Graham et al., 2018). Balanced literacy approaches produce reading outcomes equivalent to reading-only programs while additionally improving writing (Graham et al., 2013).

The reciprocal relationship operates through shared foundational skills: phonological awareness, orthographic knowledge, alphabetic principle, and automaticity. When instruction develops these shared foundations through both reading and writing activities, students can

apply knowledge flexibly in both domains, creating efficiency and depth of learning.

Significance for K-3 Literacy Instruction

Integration of reading and writing instruction represents an evidence-based approach leveraging fundamental connections between literacy processes. Substantial effect sizes for strategy instruction, technology-based handwriting, spelling for students with learning disabilities, and writing about text demonstrate that integrated instruction can produce meaningful improvements.

All K-3 students benefit from integrated literacy instruction, though optimal implementation differs by student characteristics. Struggling students require more intensive transcription instruction, more explicit connections, smaller groups, and greater total instructional time (Shanahan et al., 2025). Average-achieving students can benefit from high-quality whole-class balanced literacy instruction with moderate support (Graham et al., 2013). Students with learning disabilities benefit from highly individualized instruction, explicit and systematic teaching, and multicomponent interventions (Chandler et al., 2025; Galuschka et al., 2020).

The finding that transcription instruction produces the largest reading gains for struggling K-3 students (Shanahan et al., 2025) challenges traditional assumptions about reading intervention. Writing practice—specifically, explicit and intensive spelling instruction—provides an alternative and effective route to improving reading outcomes, expanding the toolkit available to educators working with struggling readers.

Moving Forward

Reading and writing are not separate subjects requiring separate knowledge, separate instruction, and separate time allocation, but rather interconnected literacy processes sharing common foundations and supporting each other's development. The traditional school structure treating reading and writing as separate subjects reflects administrative convenience rather than evidence about literacy development. Research synthesized here demonstrates that this separation is pedagogically counterproductive, missing opportunities to leverage reciprocal relationships that could accelerate literacy development.

Educators can integrate reading and writing instruction with explicit connections between domains, prioritize transcription instruction for struggling readers, and implement evidence-based practices with fidelity, including explicit and systematic instruction. School leaders can provide professional development supporting integrated literacy instruction, allocate resources supporting integrated instruction including curriculum materials and technology tools, and establish scheduling structures facilitating integration. Curriculum developers can create materials systematically integrating reading and writing instruction with explicit guidance for teachers. Policymakers can support implementation of evidence-based integrated literacy

approaches through policy and funding. Researchers can continue investigating optimal ways to leverage reading-writing connections.

The evidence for explicit, intensive transcription instruction as a pathway to reading improvement (Shanahan et al., 2025; Chandler et al., 2025) has particular importance for educational equity. Struggling readers who have not responded to traditional interventions require additional instructional approaches providing alternative routes to literacy. Spelling instruction represents such an alternative—approaching the same sound-symbol knowledge from a different direction, requiring active construction rather than passive recognition.

The future of K-3 literacy instruction should involve thoughtful integration of reading and writing, not separation into isolated domains. This integration requires sophisticated teaching—teachers must understand connections between reading and writing processes, make those connections explicit to students, implement evidence-based practices in both domains, differentiate based on individual needs, and continuously assess and adjust instruction. The professional knowledge and skill required exceeds what many teachers received in preparation programs, making ongoing professional learning essential.

However, the investment in professional learning and curriculum development supporting integrated instruction is justified by evidence. Integrated approaches can efficiently develop both reading and writing, producing reading outcomes equivalent to reading-only programs while additionally improving writing (Graham et al., 2013). For schools facing pressure to improve reading achievement while also developing writing proficiency, integrated approaches provide a solution rather than a tradeoff. For students who will need both strong reading and writing skills to succeed academically and professionally, integrated approaches develop both simultaneously rather than requiring choices about which to prioritize.

This synthesis demonstrates that scientific evidence supports a fundamental reconceptualization of K-3 literacy instruction—from viewing reading and writing as separate subjects to understanding them as reciprocally related literacy processes sharing common foundations. By leveraging the reciprocal relationships between reading and writing, K-3 educators can more efficiently and effectively develop the foundational literacy skills all students need for academic success and lifelong learning.

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Appendix A: Summary Tables

Table 1: Overview of Meta-Analyses Reviewed

Review	Year	Studies	Grade Range	Population	Design
Graham & Hebert	2011	~50	2-12	General + struggling	Group
Graham et al.	2012	115	K-12	General (29% struggling)	Group
Graham, Gillespie, & McKeown	2013	21	K-5	General	Group
Graham & Santangelo	2014	53	K-12	General	Group
Santangelo & Graham	2016	27	K-12	General	Group
Wanzek et al.	2016	11	K-3	Learning disabilities	Group
Graham, Liu, et al.	2018	55	PreK-12	General	Group
Galuschka et al.	2020	34	K-12	Dyslexia	Group
Kim et al.	2021	53	K-3	General + struggling	Group

Review	Year	Studies	Grade Range	Population	Design
López-Escribano et al.	2022	31	K-6	General	Group
Graham, Collins, & Ciullo	2024	21	K-5	General + EL	Group
Graham & Santangelo	2024	39	K-12	Learning disabilities	Mixed
Sayeski & Paulsen	2024	81	K-12	General	Mixed
Chandler et al.	2025	59	K-5	Learning disabilities	Mixed
Shanahan et al.	2025	19	PreK-5	Struggling readers	Group
Case-Smith	2002	8	PreK-6	General	Review
Rogers & Graham	2008	10	K-6	Learning disabilities	SCD
Joseph & Konrad	2009	10	K-12	Learning disabilities	SCD
Gillespie Rouse & Graham	2020	19	K-12	Learning disabilities	SCD
Collier-Meek et al.	2019	16	K-12	General	SCD

Note. Design types: Group = group design meta-analysis; SCD = single-case design meta-analysis; Mixed = both group and single-case designs; Review = systematic review without meta-analysis. EL = English learners.

Table 2: Effect Sizes by Outcome Domain

Intervention Type	Outcome	Effect Size	Source
Writing to Reading Effects			
Writing instruction overall (struggling PreK-3)	Reading outcomes	g = 0.27	Shanahan et al., 2025
Transcription instruction: handwriting + spelling (struggling PreK-3)	Reading outcomes	Largest effect	Shanahan et al., 2025
Writing summaries of text	Reading comprehension	Positive effects	Graham & Hebert, 2011
Writing personal reactions to text	Reading comprehension	Positive effects	Graham & Hebert, 2011
Writing notes about text	Reading comprehension	Positive effects	Graham & Hebert, 2011
Answering questions about text in writing	Reading comprehension	Positive effects	Graham & Hebert, 2011
Reading to Writing Effects			
Reading instruction overall (K-3)	Writing overall	ES = 0.57	Graham et al., 2018

Reading instruction overall (K-3)	Writing quality	ES = 0.63	Graham et al., 2018
Reading instruction overall (K-3)	Spelling	ES = 0.56	Graham et al., 2018
Reading instruction overall (K-3)	Words written	ES = 0.37	Graham et al., 2018
Phonological awareness instruction	Writing overall (K-3)	ES = 0.57	Graham et al., 2018
Phonemic segmentation instruction	Writing overall (K-3)	ES = 0.57	Graham et al., 2018
Reading fluency instruction	Writing quality (K-3)	ES = 0.63	Graham et al., 2018
Handwriting Instruction			
Technology-based handwriting (computer/tablet apps)	Legibility/fluency	ES = 0.85	Santangelo & Graham, 2016
Individualized handwriting (1-on-1 or small-group)	Legibility/fluency	ES = 0.69	Santangelo & Graham, 2016

Handwriting fluency instruction overall (K-3)	Writing fluency	ES = 0.64	López-Escribano et al., 2022
Traditional handwriting instruction (group lessons)	Fluency	ES = 0.63	Santangelo & Graham, 2016
Traditional handwriting instruction (group lessons)	Legibility	ES = 0.59	Santangelo & Graham, 2016
Timed transcription training (writing within time limits)	Writing fluency	ES = 0.49	López-Escribano et al., 2022
Multicomponent handwriting (formation + fluency + application)	Writing fluency	ES = 0.40	López-Escribano et al., 2022
Performance feedback (on speed and legibility)	Writing fluency	ES = 0.36	López-Escribano et al., 2022
Motor instruction alone (without actual writing)	Legibility	ES = 0.10	Santangelo & Graham, 2016
Motor instruction alone (without actual writing)	Fluency	ES = -0.07	Santangelo & Graham, 2016
Spelling Instruction			

Individualized spelling instruction (K-3 LD, single-case)	Spelling	BC-SMD = 2.47	Chandler et al., 2025
Individualized spelling instruction (K-3 LD, single-case)	Word reading	BC-SMD = 1.52	Chandler et al., 2025
Whole word study: explicit teaching with orthographic patterns (K-3 LD)	Spelling	g = 0.56	Chandler et al., 2025
Phonemic approaches: phoneme segmentation + phoneme-grapheme (K-3 LD)	Word reading	g = 0.45	Chandler et al., 2025
Multilinguistic: sounds + spelling patterns + morphemes (K-3 LD)	Spelling	g = 0.43	Chandler et al., 2025
Group spelling instruction (K-3 LD, group design)	Spelling	g = 0.33	Chandler et al., 2025
Group spelling instruction (K-3 LD, group design)	Word reading	g = 0.25	Chandler et al., 2025
Spelling instruction (K-3 general population)	Spelling performance	Positive effects	Graham & Santangelo, 2014
Spelling instruction (K-1 students)	Phonological awareness	Positive effects	Graham & Santangelo, 2014

Encoding instruction: phoneme-grapheme relationships (K-3 LD)	Reading + spelling	Positive effects	Wanzek et al., 2016
Phonics spelling instruction (K-3 dyslexia)	Spelling	Moderate-high	Galuschka et al., 2020
Orthographic spelling instruction: graphotactic rules (K-3 dyslexia)	Spelling	Moderate-high	Galuschka et al., 2020
Morphological spelling instruction (K-3 dyslexia)	Spelling	Moderate-high	Galuschka et al., 2020
Memorization strategies (K-3 dyslexia)	Spelling	No effect	Galuschka et al., 2020
Writing Strategy Instruction			
SRSD: explicit strategies + self-regulation (Grade 2)	Writing quality	ES = 1.89	Harris et al., 2006
SRSD: explicit strategies + self-regulation (Grades 2-3 struggling)	Writing quality	ES = 1.11	Harris et al., 2011
Text structure instruction: organizational patterns (Grade 2)	Writing quality	ES = 0.94	Graham et al., 2012
Prewriting: planning + brainstorming + graphic organizers (Grades 2-3)	Writing quality	ES = 0.88	Graham et al., 2012

Peer assistance: collaborative writing arrangements (Grade 2)	Writing quality	ES = 0.70	Graham et al., 2012
Prewriting: planning + brainstorming + graphic organizers (Grade 3)	Writing quality	ES = 0.56	Graham et al., 2012
Comprehensive writing programs: process approaches (K-3)	Writing quality	ES = 0.40	Graham et al., 2012
Text structure instruction: organizational patterns (Grade 3)	Writing quality	ES = 0.33	Graham et al., 2012
Balanced Literacy Programs			
Balanced literacy: integrated reading-writing (K-5)	Reading outcomes	Equivalent to reading-only	Graham et al., 2013
Balanced literacy: integrated reading-writing (K-5)	Writing outcomes	Positive effects	Graham et al., 2013

Note. ES = effect size (Cohen's d or Hedges' g); BC-SMD = between-case standardized mean difference; LD = learning disabilities; SRSD = Self-Regulated Strategy Development.

Table 3: Intervention Components Analysis

Component	Key Features	Implementation Considerations
Transcription Instruction		
Handwriting	Explicit letter formation instruction, actual handwriting practice, technology-enhanced practice, timed transcription training	Minimum 20 practice sessions required; motor exercises alone ineffective; technology shows highest effects (ES=0.85)
Spelling	Explicit phoneme-grapheme instruction, orthographic pattern teaching, morphological instruction, whole word study, multilinguistic approaches	Systematic instruction more effective than memorization; very large effects for individualized instruction with LD students; improves both spelling and reading
Composition Instruction		
Strategy Instruction (SRSD)	Explicit strategy teaching, self-regulation procedures, goal setting, self-monitoring, teacher modeling, guided practice	Most effective K-3 writing intervention (ES=0.67-1.89); effective across student populations; requires trained implementers
Text Structure	Explicit teaching of organizational patterns for narratives and informational texts, graphic organizers, models	Particularly effective in Grade 2 (ES=0.94); smaller effects in Grade 3 (ES=0.33); integrate with reading instruction

Prewriting	Planning before drafting, brainstorming, graphic organizers, idea generation	Strong effects in Grades 2-3 (ES=0.88); smaller effects in Grade 3 alone (ES=0.56); reduces cognitive load during drafting
Writing About Text		
Summarization	Identifying main ideas, distinguishing important from unimportant information, condensing text, synthesizing	Improves reading comprehension; requires explicit strategy instruction; struggling students need substantial scaffolding
Note-Taking	Using graphic organizers or templates, selecting key information, translating into own words	Promotes active processing; particularly effective for comprehension; provide structured templates for K-3 students
Personal Responses	Writing opinions about texts, making connections to experiences, supporting opinions with textual evidence	Deepens engagement with texts; requires teaching how to support opinions; use sentence frames for struggling students
Integration Components		
Integrated Phonics-Spelling	Teaching decoding and encoding simultaneously, explicit connections between reading and spelling, same patterns in both contexts	Essential for balanced literacy programs; develops shared phonological and orthographic knowledge

Connected Reading-Writing	Reading then writing about same texts, writing then reading mentor texts, explicit connections made by teacher	More effective than alternating between separate lessons; requires explicit teacher statements about connections
Shared Foundational Skills	Phonological awareness developed through both domains, orthographic knowledge taught through reading and writing	Creates efficiency; students apply knowledge in both reading and writing; particularly important for K-2

Note. Components listed in approximate order of importance based on effect sizes and consistency of findings.

Table 4: Findings by Student Population

Population	Most Effective Approaches	Critical Features
Struggling K-3 Readers	Transcription instruction (particularly spelling); small-group instruction; intensive handwriting practice; integrated phonics-spelling	Prioritize transcription over composition; explicit connections between encoding and decoding; greater total hours needed; small-group more effective than whole-class
Students with Learning Disabilities	Highly individualized spelling instruction (BC-SMD=2.47 for spelling, 1.52 for reading); whole word study; multilinguistic approaches	Individual or very small-group instruction produces dramatically larger effects; explicit teaching of sound-spelling relationships; multicomponent interventions
Students with Dyslexia	Phonics instruction; orthographic instruction (graphotactic rules); morphological instruction; systematic explicit approaches	Understanding orthographic principles rather than memorization essential; phonics, orthographic, and morphological instruction all effective; memorization shows no effect
Average-Achieving K-3 Students	Balanced literacy programs; SRSD for writing strategies; writing about text for comprehension; integrated phonics-spelling	High-quality whole-class instruction appropriate; balanced attention to transcription and composition; exposure to mentor texts important
Kindergarten-Grade 1	Heavy emphasis on transcription (handwriting, spelling, phonics); integrated phonics-spelling; basic composition with scaffolding	Develop foundational skills enabling later composition; spelling instruction enhances phonological awareness in K-1; build automaticity in letter formation

Grade 2	Text structure instruction (ES=0.94); continued transcription development; SRSD; peer assistance (ES=0.70); prewriting activities	Balance shifting toward more composition while maintaining transcription instruction; text structure particularly effective at this grade
Grade 3	Increasing emphasis on composition strategies; morphological spelling instruction; SRSD; writing quality focus; continued handwriting fluency	Balance allowing more focus on composition while maintaining transcription skills; morphological instruction becomes more appropriate; greater focus on writing quality

Note. BC-SMD = between-case standardized mean difference; ES = effect size; SRSD = Self-Regulated Strategy Development.

Appendix B: Glossary of Terms

Key Literacy Terms

- **Alphabetic Principle:** The understanding that written letters represent spoken sounds and that these sounds combine in systematic ways to form words.
- **Automaticity:** The ability to perform a skill (such as letter recognition or formation) quickly and effortlessly without conscious attention, freeing cognitive resources for higher-level processes.
- **Balanced Literacy:** An instructional approach that integrates reading and writing instruction, teaching both domains with explicit connections between them to leverage their reciprocal relationship.
- **Composition:** The process of generating and organizing ideas to create written texts, including planning, drafting, revising, and editing. Distinguished from transcription skills.
- **Decoding:** The process of translating printed letters and letter combinations into sounds to read words. The reading equivalent of encoding (spelling).
- **Encoding:** The process of translating sounds into printed letters and letter combinations to spell words. The writing equivalent of decoding (reading).
- **Grapheme:** A letter or combination of letters that represents a single sound (phoneme). For example, 'sh' is a grapheme representing the /sh/ sound.
- **Graphotactic Rules:** Rules governing which letter combinations are permissible in a language and where they can appear in words (e.g., 'ck' appears at the end of words, never at the beginning).
- **Morpheme:** The smallest unit of meaning in language. Examples include root words (run), prefixes (un-), and suffixes (-ing, -ed).
- **Morphological Instruction:** Teaching about meaningful word parts (prefixes, suffixes, root words) and how they affect both meaning and spelling of words.

- **Orthographic Knowledge:** Understanding of the visual patterns of letters and letter combinations in written words, including spelling patterns, rules, and conventions.

- **Phoneme:** The smallest unit of sound in spoken language. For example, the word 'cat' has three phonemes: /k/ /a/ /t/.

- **Phoneme-Grapheme Correspondence:** The relationship between sounds (phonemes) and the letters or letter combinations (graphemes) that represent them in written language.

- **Phonemic Awareness:** The ability to identify and manipulate individual sounds (phonemes) in spoken words, such as segmenting words into sounds or blending sounds to form words.

- **Phonemic Segmentation:** The ability to break spoken words into their individual sounds (phonemes). Essential for spelling.

- **Phonological Awareness:** A broad term encompassing awareness of all sound structures in language, including syllables, onset-rime, and phonemes. Phonemic awareness is a subset of phonological awareness.

- **Transcription:** The physical act of producing written language, including handwriting (or typing) and spelling. Distinguished from composition, which focuses on generating and organizing ideas.

Statistical Terms

- **BC-SMD (Between-Case Standardized Mean Difference):** An effect size measure used in single-case design research. Values above 0.20 are considered small, above 0.50 are moderate, and above 0.80 are large. The very large BC-SMD values (e.g., 2.47, 1.52) in this synthesis indicate substantial effects.

- **Cohen's d:** A standardized measure of effect size representing the difference between two groups in standard deviation units. Values of 0.20 are considered small, 0.50 moderate, and 0.80 large.

- **Effect Size (ES):** A quantitative measure of the magnitude of an intervention's impact, allowing comparison across studies. Common measures include Cohen's d, Hedges' g, and correlation coefficients.

- **Group Design Study:** Research comparing outcomes between groups of participants (e.g., intervention group vs. control group), typically using statistical analysis to

determine effectiveness.

- **Hedges' g:** An effect size measure similar to Cohen's d but with a correction for small sample sizes. Interpretation is the same as Cohen's d (0.20 = small, 0.50 = moderate, 0.80 = large).

- **Meta-Analysis:** A statistical method for combining results from multiple studies to determine overall effectiveness of an intervention and identify factors that moderate effects.

- **Single-Case Design (SCD):** Research methodology examining intervention effects for individual participants or very small groups through repeated measurements over time, establishing baseline performance before introducing intervention.

- **Systematic Review:** A comprehensive review of research literature using explicit, systematic methods to identify, select, and evaluate relevant studies on a specific question. May or may not include meta-analysis.

Intervention Approaches

- **Integrated Phonics-Spelling Instruction:** Teaching decoding (reading) and encoding (spelling) of the same sound-spelling patterns simultaneously, with explicit connections between the two processes.

- **Multilinguistic Approach:** Spelling instruction integrating multiple levels of word analysis: phonological (sounds), orthographic (spelling patterns), and morphological (meaningful word parts).

- **Multicomponent Treatment:** Intervention addressing multiple skill areas simultaneously (e.g., handwriting formation, fluency, and application in authentic writing).

- **Self-Regulated Strategy Development (SRSD):** An evidence-based approach to writing instruction that explicitly teaches writing strategies, self-regulation procedures, goal setting, and self-monitoring through teacher modeling and guided practice.

- **Timed Transcription Training:** Handwriting practice focused on building automaticity by having students write letters, words, or sentences within specified time limits to increase fluency.

- **Whole Word Study:** Explicit teaching of complete words with attention to orthographic patterns, as opposed to purely phonetic or memorization approaches.

Acronyms

- **BC-SMD:** Between-Case Standardized Mean Difference
- **EL:** English Learner
- **ES:** Effect Size
- **K-3:** Kindergarten through Grade 3
- **LD:** Learning Disabilities
- **SCD:** Single-Case Design
- **SRSD:** Self-Regulated Strategy Development

Appendix C: Additional Resources

Practice Guides and Implementation Resources

What Works Clearinghouse Practice Guides

The Institute of Education Sciences What Works Clearinghouse provides free, evidence-based practice guides for educators:

• *Teaching Elementary School Students to Be Effective Writers* - Provides practical recommendations for K-5 writing instruction based on research evidence.

• *Foundational Skills to Support Reading for Understanding in Kindergarten Through 3rd Grade* - Includes recommendations on phonological awareness, phonics, and fluency instruction.

Available at: https://ies.ed.gov/ncee/wwc/PracticeGuides

Self-Regulated Strategy Development (SRSD) Resources

The SRSD Online Professional Development website offers free resources for implementing evidence-based writing instruction:

• Video demonstrations of SRSD lessons

• Downloadable strategy charts and graphic organizers

• Implementation guides for different genres and grade levels

Available at: https://www.srsdevelopment.com/

Reading Rockets

A national multimedia project offering research-based literacy information, including:

• Articles on handwriting, spelling, and writing instruction

• Video examples of effective literacy instruction

• Printable resources for teachers and families

Available at: https://www.readingrockets.org/

Professional Development Resources

Handwriting Without Tears / Learning Without Tears

Provides professional development and curriculum materials for handwriting instruction with a developmental approach. Offers online training modules and in-person workshops.

Available at: https://www.lwtears.com/

Really Great Reading

Offers professional development on phonics and spelling instruction, with emphasis on orthographic patterns and the reading-spelling connection. Provides online courses and coaching.

Available at: https://www.reallygreatreading.com/

International Dyslexia Association (IDA)

Provides resources on structured literacy approaches, including explicit, systematic instruction in phonological awareness, phonics, spelling, and writing. Offers conferences, webinars, and fact sheets.

Available at: https://dyslexiaida.org/

The Reading League

Advances awareness, understanding, and use of evidence-based reading instruction. Provides professional learning opportunities, including conferences, online courses, and local chapter events.

Available at: https://www.thereadingleague.org/

Curriculum Evaluation and Selection Tools

EdReports

Provides independent, evidence-based reviews of K-12 instructional materials, including literacy programs. Reviews evaluate alignment with standards and usability.

Available at: https://www.edreports.org/

Student Achievement Partners Instructional Materials Evaluation Tool (IMET)

Provides rubrics and tools for evaluating the quality of literacy instructional materials, with specific criteria for foundational skills, writing, and integrated literacy instruction.

Available at: https://achievethecore.org/

Council of Administrators of Special Education (CASE) Evaluation Tool

Offers evaluation criteria specifically for programs serving students with disabilities, including considerations for explicit instruction, systematic progression, and evidence of effectiveness.

Available at: https://www.casecec.org/

Assessment Resources

Acadience Reading (formerly DIBELS)

Provides K-6 assessment of early literacy skills including phonemic awareness, phonics, and fluency. Offers benchmark and progress monitoring assessments. Free materials available.

Available at: https://acadiencelearning.org/

easyCBM

Free Curriculum-Based Measurement system for assessing reading and spelling progress. Provides benchmark and progress monitoring assessments for K-5.

Available at: https://easycbm.com

6+1 Trait Writing Assessment

Provides rubrics and scoring guides for assessing writing quality across multiple dimensions (ideas, organization, voice, word choice, sentence fluency, conventions). Training materials available.

Available through various publishers and at: https://educationnorthwest.org/

Research Organizations and Clearinghouses

Institute of Education Sciences (IES) What Works Clearinghouse

Reviews research evidence on educational interventions and provides ratings of effectiveness. Searchable database of programs and practices.

Available at: https://ies.ed.gov/ncee/wwc/

Best Evidence Encyclopedia (Johns Hopkins University)

Provides free summaries of research on effective programs in reading, writing, and other subjects. Includes effect sizes and quality ratings.

Available at: https://bestevidence.org/

Center on Instruction

Provides research-based resources on literacy instruction, including practice guides, research reviews, and instructional tools for K-12 educators.

Available at: http://www.centeroninstruction.org/

Technology Tools and Applications

Handwriting Apps for Tablets

Writing Wizard (Kids Learn to Write): Provides letter formation practice with immediate feedback and adaptive difficulty.

LetterSchool: Teaches letter formation through multisensory activities with engaging animations.

Handwriting Without Tears: Wet-Dry-Try App: Digital version of the evidence-based handwriting curriculum.

Spelling and Word Study Tools

Word Study Wizard: Supports systematic word study with sorting activities and pattern recognition.

SpellingCity: Provides spelling practice games and activities aligned with word lists.

Montessori Crosswords: Phonics-based spelling practice with manipulable letter tiles.

Writing Tools

Book Creator: Allows students to create digital books combining text, images, and multimedia.

Seesaw: Digital portfolio platform supporting writing across genres with teacher feedback tools.

Google Docs Voice Typing: Free speech-to-text tool supporting students with transcription difficulties.