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A Century of Progress: Reading Interventions for Students in Grades 4–12, 1914–2014

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Abstract

The history of research on interventions for struggling readers in Grades 4 through 12 dates back to 19th-century case studies of seemingly intelligent children who were unable to learn to read. Physicians, psychologists, educators, and others were determined to help them. In the process, they launched a century of research on a wide variety of approaches to reading intervention. As shown in this systematic narrative review, much has changed over time in the conceptualization of reading interventions and the methods used to determine their efficacy in improving outcomes for struggling readers. Building on the knowledge gathered over the past 100 years, researchers and practitioners are well-poised to continue to make progress in developing and testing reading interventions over the next 100 years.

Keywords

struggling readers; reading disabilities; history of reading interventions

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The history of reading interventions began with the desire to solve a mystery. In the late 19th century, physicians and teachers discovered that some children with average or above-average IQs and normal vision and hearing were unable to learn to read. This discovery launched a quest to learn the reasons why and to develop ways to treat this enigmatic condition. One pioneer, physician W. Pringle Morgan, wrote about the case of a bright, 14-year-old boy with a near-complete inability to read in an article in the *British Medical*

Journal that he titled “Congenital Word Blindness” (Morgan, 1896). Noting that adults with damage to the left angular gyrus of the brain found it difficult or impossible to read, Morgan assumed that his patient suffered from a congenital defect in the same area. He adopted the term *word blind* from Adolph Kussmaul, a German physician who had used it nearly 20 years earlier to describe patients who had lost the ability to read due to a brain injury or stroke (Kussmaul, 1877).

From the turn-of-the-20th-century case studies such as Morgan’s that documented attempts to understand and treat reading disabilities to 21st-century large-scale randomized control trials (RCTs), the history of reading interventions has been a colorful one. Theories of etiology and corresponding treatments from the nascent days of the field may seem puzzling at best when viewed from the perspective afforded by decades of hindsight. However, synthesizing this history provides contemporary researchers and practitioners with valuable insight into how the field arrived where it is today—including the origin of some prevailing practices. Knowing this history allows contemporary researchers and practitioners to understand those whose shoulders we stand on and the thought processes and field trials they undertook in attempts to help students who seemingly could not learn to read through typical classroom instruction.

Surprisingly, no history of reading interventions has been published since A. J. Harris (1967) summarized the highlights of intervention research published between 1916 and 1965 in an address to the International Reading Association. More recently, remedial reading has been included only as a subtopic in historical treatments of the teaching of reading such as Smith’s (2002) *American Reading Instruction.* A number of meta-analyses and systematic reviews are available that synthesize studies from the mid-1970s onward (e.g., Edmonds et al., 2009; Mastropieri, Scruggs, Bakken, & Whedon, 1996; Scammacca, Roberts, Vaughn, & Stuebing, 2015; H. L. Swanson, 1999; Wanzek et al., 2013). However, no systematic review of reading interventions has been published that traces the history of the field from the earliest efforts to understand reading disabilities to present-day randomized experimental investigations.

Given the ever-increasing importance of unlocking the mystery of reading disabilities and the need for continual improvement in developing and implementing interventions for struggling readers, especially beyond the primary grades, we undertook the task of synthesizing 100 years of published research on reading interventions for students in Grades 4 to 12. Our goal was to systematically review the published literature in a way that highlights the lessons of the past to inform present and future research and practice. We took a decade-by-decade approach, focusing on interventions for students in Grades 4 to 12 (ages 9–21) and seeking to document the theories and practices of reading interventions researched over the past century.

Older struggling readers—students in Grades 4 to 12 whose reading ability is below normative expectations—are the focus of our review because, historically, students in this age-group were the first to be targeted for intervention. The attention of pioneers in the field was riveted on upper elementary, middle, and high school students who did not benefit from typical reading instruction received in the primary grades despite having at least average

hearing, eyesight, and intellectual ability. Today, interventions aimed at helping struggling readers in Grades 4 to 12 remain critical to efforts to improve reading proficiency nationwide. The 2013 National Assessment of Educational Progress (NAEP) reading assessment determined that 65% of fourth graders and 64% of eighth graders were not proficient readers. These statistics improved little from the previous decades, with the 2003 NAEP reading assessment results showing that 69% of fourth graders and 68% of eighth graders scored below the proficient level, and the 1992 NAEP reading assessment, where 72% of fourth graders and 71% of eighth graders scored below proficient. A look back to the origins of reading interventions and at the paths that researchers and practitioners have traveled over the past 100 years presents an opportunity for 21st-century reading intervention researchers to press forward in areas that have been fruitful using the technological and methodological advances now available. Additionally, we present this 100-year review of reading interventions in honor of the 100th anniversary of the founding of the American Educational Research Association.

Analytical Approach

In determining our approach to synthesizing a century of research on reading interventions, we chose a systematic review for several reasons. First, the standards of measurement in place during the first 65 or so years of research are more amenable to summarization in a systematic review than a quantitative meta-analysis. Before 1980, researchers in nearly every published study of reading interventions reported their results using age-equivalent (AE) or grade-equivalent (GE) scores from standardized assessments. Since these studies were published, reporting results in this manner has fallen out of favor because AE and GE scores are not on an equal-interval scale (Berk, 1981). As a result, GE and AE scores cannot be averaged across individuals to produce an accurate mean score and pretest GEs or AEs cannot be subtracted from posttest GEs or AEs to compute meaningful gains, two practices commonly found in reporting of results in reading intervention studies from the 1910s to 1970s. This limitation of GE and AE scores and their prevalence in the early reading intervention literature meant that for nearly all of the studies located for this review that were published before 1980, no effect sizes could be calculated to compare their outcomes. Therefore, we believe that synthesizing their results in a narrative format was the most appropriate approach.

Additionally, synthesizing the history of reading interventions through a systematic narrative review complements the available meta-analyses that focus on reading interventions for struggling readers in Grades 4 to 12 between 1976 and 2011 (e.g., Mastropieri et al., 1996; Scammacca et al., 2015). These meta-analyses provide efficient quantitative syntheses of the effects of reading interventions; our historical review addresses the broader context in which these studies were conducted and synthesizes research from earlier decades when meaningful effect sizes cannot be computed. We synthesize the findings of previous meta-analyses as part of our narrative review and address the rise of meta-analysis as a theme in the history of reading interventions.

Furthermore, a systematic narrative review is the ideal way to address the heterogeneity in research methods, participants, treatment approaches, and other factors that is inevitably

present when looking at a century of research in any field of study. Research on reading interventions changed in substantial ways as it was affected by advances in medicine, psychology, statistics, measurement, technology, and other fields over the past 100 years. Within the United States, federal legislation and funding priorities also have exerted a substantial influence over the type of research conducted, especially over the past 20 years. When attempting to summarize a group of studies with a great deal of heterogeneity, a narrative systematic review is preferable (Petticrew & Roberts, 2006).

Finally, through this systematic review we expected to be able to answer the following research questions:

> **Research Question 1:** What types of interventions for struggling readers in Grades 4 to 12 have been researched over the past 100 years and which ones were shown to be effective in helping struggling readers?
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> **Research Question 2:** How has research on reading interventions evolved in theory, method, and results over the past 100 years?
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> **Research Question 3:** What can be gleaned from the past century of reading interventions research to inform and direct current and future researchers, educators, policymakers, and other stakeholders?

Method

Literature Search

To locate studies published between 1914 and 1975, we conducted a computer search of ERIC and PsycINFO. Descriptors or root forms of these descriptors (reading difficult*, learning disab*, LD, mild handi*, mild disab*, reading disab*, at-risk, high-risk, reading delay*, learning delay*, struggling reader, dyslex*, read*, comprehen*, vocabulary, fluen*, word, decod*, English Language Arts) were used in combinations to capture the greatest possible number of studies. Our initial search resulted in 2,557 abstracts. These abstracts were screened to determine if they met the inclusion criteria specified below. A search of other research syntheses was also done, and their reference lists along with seminal studies and monographs were reviewed to identify studies published in this time period that met the inclusion criteria.

The advent of *meta-analysis*, a term first coined by Glass (1976), represented a fundamental shift in the history of reading interventions research. The first published meta-analysis of reading interventions that included students in Grades 4 to 12 was Mastropieri et al. (1996). They included research published between 1976 and 1996. Listed in the order in which they were published, other meta-analyses followed: H. L. Swanson (1999); Elbaum, Vaughn, Hughes, and Moody (2000); Scammacca et al. (2007); Edmonds et al. (2009); Flynn, Zheng, and Swanson (2012); Wanzek et al. (2013); and Scammacca et al. (2015). These meta-analyses represent rigorous efforts to locate and synthesize available experimental and quasi-experimental research from 1976 to 2011. Therefore, to locate studies published in this time period for this systematic review, we searched the reference lists of these meta-analyses and selected all studies that met the inclusion criteria described below. To locate studies

published between 2012 and 2014, years that have not yet been included in a published meta-analysis, we applied the same search criteria used to locate studies published between 1914 and 1975 and included those that met our inclusion criteria.

Inclusion Criteria

Studies found through the literature search were included in this systematic review if they met all of the following criteria:

1. Participants were English-speaking struggling readers. Struggling readers were defined as those with low achievement in reading, unidentified reading difficulties, dyslexia, and/or with reading or learning disabilities (LDs). Studies also were included if disaggregated data were provided for struggling readers regardless of the characteristics of other students in the study.
2. Participants were in Grades 4 to 12 (age 9–21). When a sample also included older or younger students and it could be determined that the sample mean age was within the targeted range or that 50% or more of the participants were in the targeted age or grade range, the study was accepted. Studies also were included if disaggregated data were provided for students in Grades 4 to 12 even if older and/or younger students also participated in the study.
3. The study's research design used a multiple-group experimental or quasi-experimental treatment comparison design or a multiple treatment comparison design. Case studies and studies using a single-group pre/post design published from 1914 to 1975 were retained to better understand the theories and methods of treatment in the decades before multiple-group experimental and quasi-experimental designs were widely used. Had we not included these studies, very little research before 1976 would have met our inclusion criteria.
4. The intervention provided any focus for reading intervention, including word study, fluency, vocabulary, reading comprehension, or multiple components of reading instruction. We considered a study to have provided a reading intervention if the treatment was viewed as a remedy for reading disabilities at the time it was published.
5. Outcomes were assessed using at least one measure of one or more reading constructs and results for tests of effects on these measures were reported at the group level in group design studies.
6. The study was published in an academic journal, compilation of conference proceedings, or monograph. We limited our searched to published works due to the infeasibility of locating unpublished works across a 100-year time span.

See Table 1 for the number of studies included in this review by decade and research design.

Coding Procedures

The Vaughn, Elbaum, Wanzek, Scammacca, and Walker (2014) code sheet was used for coding studies that met the inclusion criteria and were published between 1976 and 2014. This code sheet includes elements specified in the What Works Clearinghouse (WWC)

Design and Implementation Assessment Device (Institute of Education Sciences [IES], 2008) and used in previous research (e.g., Scammacca et al., 2015; Wanzek et al., 2013). Data coded included participant characteristics, description of the methodology and intervention, indicators of study quality, properties of measures, and data for calculating effect sizes. Researchers with doctorate degrees and doctoral students with experience coding studies for other meta-analyses completed the code sheets. All coders had completed training on how to complete the code sheet and had reached a high level of reliability with others coding the same article independently. Two raters independently coded every study. When discrepancies were found, coders reviewed the article together and discussed the coding until consensus was reached. Code sheets for the period between 1980 and 2011 had been completed for earlier meta-analyses covering this time period (Scammacca et al., 2007; Scammacca et al., 2015; Wanzek et al., 2013). Code sheets for 2012 to 2014 were completed for the present review using the same procedures described above for the 1980 to 2011 studies.

We attempted to use the same code sheet and coding procedures for the studies meeting inclusion criteria for 1914 to 1975 but discovered that the nature of the research published during this period and the way in which it was reported in the literature did not fit a code sheet designed to capture details from more contemporary studies. The vast majority of the fields on the code sheet could not be coded due to lack of detail in the published studies and differences in reporting standards for journal articles over time. For the sake of coding efficiency, we developed a shortened version of the Vaughn et al. (2014) code sheet to capture the relevant details from the studies published between 1914 and 1975.

Results

In presenting the results, we take a decade-by-decade approach due to the historical nature of our systematic review. Our focus is on discussing the predominant themes that emerged in the research published in each decade. Taking this approach allowed us to trace the developments in the field in a way that shows how the research evolved over time based on both previous research and events that occurred in the historical context of each decade. In the periods 1914 to 1919 and 1920 to 1929, the field of reading interventions was in its infancy and few studies were published. Published research grew in volume beginning in the 1930s and the number of publications continues to expand through the present day. To capture the characteristics and outcomes of the corpus of studies that met our inclusion criteria without bogging down the narrative, we present the bulk of the studies included in our review in tables by decade. These tables are available as a supplement in the online version of this journal. They begin with Table S1 for the 1930s and continue through Table S9 for 2010–2014 (see Supplementary Tables S1–S9 in the online version of the journal).

1914–1919: Laying the Foundation

Several developments in the second decade of the 20th century focused attention on older struggling readers. Thorndike (1914) highlighted the need for accurate, normative assessments of reading to identify individuals who were struggling and presented experimental scales for measuring vocabulary and reading comprehension. In 1915, Kelly

developed the first standardized assessment of reading comprehension, the Kansas Silent Reading Tests, and published the measure the following year (Kelly, 1916). The assessment had forms for measuring the reading ability of children in Grades 3 to 5, 6 to 8, and 9 to 12. Gray (1916a, 1916b) also published tests of silent and oral reading with grade-level standards for students in Grades 1 to 8. These innovations in assessment allowed teachers to determine via a very brief, objective test whether students were performing as expected for their grade.

Uhl (1916) used findings from both the Kansas and Gray tests to individualize treatment for poor readers in a summer program for students in Grades 3 to 8. Uhl's report is one of the earliest published studies on the efficacy of a programmatic intervention for a group of struggling readers. Uhl also is credited with being the first to use the term *remedial* (Smith, 2002), which appeared in the title of his report, to describe a reading intervention. The Kansas test was used to screen all students enrolled in summer school; those with the lowest scores were then tested individually with the Gray Oral Reading Test to confirm that they were indeed struggling readers. Tutors worked with students daily for 6 weeks. The treatment involved 15-minute drills focused on the deficits observed in the test results. Tutors directed the student to work on remedying a specific aspect of oral reading, such as reading in meaningful words groups (e.g., phrases and sentences) instead of word-by-word, while absorbing the meaning of the text being read. The students were tested at the conclusion of summer school, and the growth of those in the reading program was compared to that of students who did not qualify for intervention and received classroom instruction only. Results indicated that the students who received intervention had similar pre–post gains as their peers who did not require intervention.

An important development of this time period was the entry of the United States into World War I in 1917. The U.S. military discovered that thousands of soldiers were unable to comprehend simple written instructions, bringing the issue of older struggling readers to the forefront as a matter of national security (Smith, 2002). With the advent of standardized assessments and the initial publications of reading research, the 1910s laid the foundation for the 1920s to be a decade of progress in interventions for older struggling readers.

1920s: Progress and Innovation

The dawn of the 1920s saw the opening of the first clinic focused on reading disabilities, which was founded by Grace Fernald at the University of California, Los Angeles' University Training School (Smith, 2002). Here, she developed the kinesthetic approach to reading intervention that she described in a publication she coauthored with Helen Keller (Fernald & Keller, 1921). This kinesthetic intervention, which came to be known as the "Fernald method," was implemented for any students at the clinic who did not make progress when taught individually using typical instructional methods. It began with having students master one word at a time through first tracing the letters in the word written in cursive on a chalkboard with their fingers and then writing the word themselves from memory while pronouncing its syllables. Students progressed to learning to recognize the same word in print and then repeated the process with words combined into sentences and paragraphs and finally to independent silent reading. Fernald and Keller presented three case

studies in which non-readers achieved grade-level fluency and comprehension after four to six months of treatment.

Around the same time, Gray (1921), working with students at the University of Chicago's elementary school, advocated an approach to reading interventions that contained many elements of what is now called a response to instruction (RTI) framework. He called for universal screening of fluency and comprehension at the start of each school year to determine which students needed reading interventions. For those found to be struggling readers, he recommended small group instruction focused on remedying deficits detected through diagnostic assessments. Students who did not make adequate progress in small group instruction were referred to a reading specialist for individualized instruction.

Gray described his procedure for the diagnosis and treatment of children with reading disabilities and research findings in his 1922 monograph, *Remedial Cases in Reading: Their Diagnosis and Treatment*. In this work, he reported on the specific problems often seen in struggling readers, such as poor auditory memory, inadequate spoken vocabulary, lack of interest in reading, and insufficient knowledge of phonics. Believing that proper remediation could only be provided once an accurate understanding of the child's reading problem was achieved, Gray's treatment approach devoted much time at the beginning of a case to assessment and observation of the child's attempts at reading and other schoolwork to note the types of errors the child was prone to make. Additionally, Gray and his team gathered a careful history of the child's school experience, family life, and physical health. The information gathered guided the development of an individualized treatment plan. Gray noted that his approach was so individualized that it was not possible to describe the treatment in any general way; he referred readers to the case studies that comprise the bulk of his monograph to learn what was done to help each child. He did state that treatment included exercises to improve word and phrase recognition, story recall, and reading comprehension. Gray also emphasized the importance of choosing reading material that appealed to the student's interests. Many of Gray's suggestions remain key elements in reading interventions for struggling readers today.

While Fernald was treating students in Los Angeles and Gray in Chicago, another reading intervention pioneer was at work at Columbia University's Teachers College in Manhattan. In 1922, Arthur Gates produced a monograph based on his work in schools in the New York City area. Gates echoed Gray's call for thorough assessment to determine the specific nature of each child's reading problem. In the monograph, he documented his research on the causes of what he called "backwardness" in reading. These included inadequate reading instruction at school and/or home; lack of interest in reading leading to lack of effort; neurosis; uncorrected vision, hearing, speech, or motor problems; cognitive deficits that lead to problems with memory or perception, including congenital word blindness; and a combination of these and other undiscovered factors.

Five years later, Gates (1927) published the first of what would become three editions of his book *The Improvement of Reading: A Program of Diagnostic and Remedial Methods*. The intended audience was teachers and remedial reading specialists. Gates (1927) recommended strategies for remedying reading deficits in word recognition, vocabulary

acquisition, left-to-right eye tracking, and reading comprehension. He emphasized the importance of developing a complete understanding of a struggling reader's particular difficulties and designing an individualized intervention. In addition to providing guidance for diagnosing and intervening with struggling readers, Gates (1927) described the standardized oral and silent reading tests he had developed and published in 1926. The following year, Gates published diagnostic tests to help pinpoint the areas in which a student was struggling in order that the proper intervention could be applied. Gates's tests, along with Gray's measures, were used widely in research on interventions for struggling readers in the decades that followed and remain in use in updated forms today.

Gates and Gray represent the approach that educators and educational psychologists took to helping struggling readers in the 1920s. Physicians also studied reading disabilities during this era, but from a different angle. Whereas education researchers focused on developing tests that revealed skill deficits and finding teaching techniques to remedy them, physicians' first priority was to diagnose the underlying physical cause and then to develop treatments targeting it (A. J. Harris, 1967). One such physician of the 1920s was Samuel Orton.

Orton (1925) presented the case of a 16-year-old boy who was able to read very few words and had been diagnosed with congenital word blindness. To Orton, this diagnosis seemed to be a poor fit for the boy's symptoms, so he admitted the boy to the Iowa State Psychiatric Hospital for further evaluation. Orton noted that the boy often read words from right to left, scrambled syllables within words, and produced many reversals when asked to copy words. After assessing this boy and a number of other children with extreme reading difficulty, Orton noted that all could write about equally well with either hand and read text in a mirror with about the same number of errors as standard text. Other common traits noted among this group of children included a higher-than-average incidence of stuttering, being left-handed, and having motor coordination and balance issues. Additionally, 14 of the 15 students referred to Orton with severe reading difficulties were boys.

This constellation of factors, coupled with the knowledge available at the time on the function of various regions of the brain and the effects of destruction of a region in one or the other hemisphere of the brain, led Orton to an interesting conclusion about the source of severe reading difficulty in the cases he examined. Orton (1925) theorized that as youngsters begin learning the alphabet, the brain stores the letters in the correct orientation in the language-dominant hemisphere and stores the mirror image of the letters in the nondominant hemisphere. In the process of learning to read, the typical child learns to ignore the mirror images and focuses on the proper orientation of letters and words, and eventually, the memory trace to the mirror images disappears. However, in children with severe reading difficulty, neither hemisphere is dominant for language, and memory traces to both hemispheres remain active. As a result, the child who is reading disabled accesses letters and words both in correct and mirror image orientation at random. Orton thus rejected the notion of congenital word blindness and instead labeled this condition *strephosymbolia* from the Greek words for "twisted symbols."

Orton's (1925) theories concerning the etiology and treatment of reading disabilities were a watershed in the history of reading interventions. At a time when the dominant view in the

medical community was that a diagnosis of congenital word blindness implied permanent brain damage that could not be remedied, Orton convinced many researchers and physicians that there was hope for improvement among students with reading disabilities (Traxler, 1941). Strephosymbolia was seen as a functional impairment that would respond to treatment. One hemisphere of the brain could be trained to control reading using the correctly oriented letters. Orton recommended treating children with strephosymbolia using extensive drill and practice in phonics to build up the memory traces to the correct representations of words and letters and starve off the traces to the mirror images. He based this recommendation on case reports where this method was used successfully but emphasized that further research was needed. He would later revise his treatment recommendations to promote a kinesthetic approach.

During the 1920s, as more school districts implemented standardized tests of reading, superintendents became increasing aware that many of their students had reading deficits that needed attention (Smith, 2002). In recognition of this issue, the National Committee on Reading included a chapter titled “Diagnosis and Remedial Work” in the 24th Yearbook of the National Society for the Study of Education (Gray, 1925). This chapter summarized intervention strategies that had shown promise in case studies and other published and unpublished reports. The bulk of the chapter consists of a chart listing specific reading difficulties, such as hesitations or guessing of words while reading orally, lack of interest or effort in reading, emotional/behavior disturbances manifested when asked to read, and inability to retell what was read or to answer questions that demonstrate comprehension. The chart suggested an underlying reason for the difficulty and provided recommended teaching strategies to help the student overcome the problem. This report represented an attempt to synthesize early research on reading interventions for struggling readers. It also set in a motion changes in teachers’ views of strugglers readers and ways to help them that would be more fully realized in the next decade.

1930s: From the Lab to the Classroom

During the 1930s, reading intervention research moved from university labs to classrooms as teachers were increasingly viewed as the best professionals to help struggling readers (Traxler, 1941). One significant factor leading to this change was the 24th Yearbook of the National Society for the Study of Education (Gray, 1925), which, along with its chapter on remedial reading, emphasized the importance of continuing to teach reading in junior high and high school. Additionally, published case studies of successful remediation of reading problems in school settings gave teachers confidence that they could help the struggling readers in their classrooms (Traxler, 1941). Increased availability of materials for reading interventions also contributed to teachers’ ability and willingness to help struggling readers (Tinker, 1938). Popular among these was Gates’s 1935 edition of *The Improvement of Reading*, which became the standard textbook on remedial reading (A. J. Harris, 1967). Summaries of research on reading interventions that were published during the 1930s focused on giving teachers ideas and tools to help their students. Reviews by Tinker (1938) and Traxler (1941) emphasized putting the latest research findings into the hands of classroom teachers (A. J. Harris, 1967).

Although studies of interventions for struggling readers during the 1930s used several different approaches, one similarity among them was that they were universally successful in raising reading GE scores. As noted by Traxler (1941) in his review of 1930s research, whether the intervention occurred in a group or individually or with students with severe or moderate reading difficulties, results showed a great deal of improvement over the course of treatment. Tinker (1934, 1938) also noted that success was achieved across studies with varying treatment methodologies. In studies located for this review, the same universal success was noted despite marked differences in the approach taken in the intervention. Fernald and Keller's (1936) kinesthetic approach, also used by Regensburg (1930), resulted in gains of a year or more in GE scores in both studies after several months of treatment. Similarly, Gates and Bond (1936) reported impressive gains on a reading intervention provided to a remedial reading class using readers and workbooks developed to provide struggling readers with diverse and interesting material at their reading level in an "activity program" that also involved field trips to study topics in depth. In the Washington, D.C., public school system, Monroe (1937) implemented a broad remedial reading program with great success across elementary, junior high, and high schools. Her approach involved teachers instructing children in small groups while attending to the individual reading needs of each student as identified through various reading tests and the use of reading material that students would find interesting and be motivated to read.

Tinker (1934) explained the success of these different intervention approaches by pointing to a common end result. All approaches helped struggling readers to recognize words as whole units and to read words and lines of text from left to right. Additionally, he stated that experiencing success in reading likely improved students' attitudes toward reading and ameliorated emotional struggles with the learning situation and uncooperative behaviors that had developed due to previous experiences of failure. As a result, the struggling reader's motivation improved and the student remained engaged in the intervention. Tinker believed that motivation to cooperate with the intervention was the key element in the success of differing approaches to reading interventions.

Another emerging theme in the 1930s was the comorbidity of behavior/emotional problems and reading difficulties. An examination of case records of children with both reading and behavior problems (Damerau, 1934) showed that some students who had made marked gains in reading skills showed improvement in behavior also, whereas others did not. Those showing improvement in both areas typically received treatment for both problems, leading to the conclusion that treating reading problems in isolation was unlikely to resolve behavior issues. Robinson (1939) recommended beginning with the psychiatric intervention to reduce the child's anxiety and behavior problems so that the child would be better able to attend to the reading intervention. Interventions for struggling readers that targeted emotional and behavioral disturbances would be a major focus of research in the decade to come.

1940s: New Perspectives on Reading Disabilities

The presence of emotional and behavioral disorders in struggling readers received significant attention during the 1940s. In a widely cited report, Gates (1941) reported that three in four students with reading disabilities also had an emotional or behavioral

disturbance. He noted that the comorbid disorder likely caused the reading problem in 25% of cases. Many mental health clinicians believed Gates underestimated the causal role of psychological disorders in reading disabilities (A. J. Harris, 1967). Hildreth (1942) asserted that the nature of reading disabilities meant that psychologists could provide the most comprehensive assessment and treatment planning for struggling readers because they had an understanding of the mind. After a careful diagnosis, the psychologist could prescribe a reading intervention for a teacher to implement and other needed interventions for the mental health, physiological, and other needs of the student.

Other psychologists and psychiatrists of the 1940s brought the perspective of psychoanalytic theory to the treatment of reading problems. A number of psychoanalytic theories were proposed to explain the existence of reading disabilities and to prescribe treatment. These theories included the following:

- Because curiosity and the desire to explore motivate a child to learn to read, if parents discourage or punish young children for expressing these drives, anxiety arises out of fear of losing the parents' love (Sylvester & Kunst, 1943). Anxiety then interferes with the child's ability to learn to read.
- The effort that struggling readers expend to repress sadistic fantasies and aggressive urges toward their parents and teachers leaves them with too little energy to learn to read (Blanchard, 1946). Reprimands and punishments received for reading failure relieve the child's feelings of guilt over wanting to harm his or her caregivers.
- Girls are less likely than boys to have reading problems because they find it easier to identify with and attach to their (usually female) reading teachers (Bell, 1945). Boys, however, typically experience transference of their feelings toward their mothers onto their teachers. If those feelings are negative, boys will resist learning to read. Additionally, boys view reading as a female activity that requires them to surrender some of their masculine identity, stirring up guilt and anger. These reactions are especially severe in boys who have overidentified with their mothers or who are overly aggressive or overly submissive in their relationships with their fathers.

Psychoanalytic viewpoints on reading disabilities prescribed psychotherapy as the preferred intervention, either before or in addition to more traditional reading interventions. They also recommended that parents create a home environment that resolves the child's aggressive urges and/or anxiety. Bell (1945) encouraged teachers to learn about the home environments of struggling readers and be mindful of the key role of the student–teacher relationship in helping these students improve. He viewed this relationship as the most critical element of a reading intervention and noted that a strong bond between student and tutor may be the reason why different reading intervention strategies achieved positive results.

Outside the psychoanalytic camp, other researchers combined reading and psychological interventions to treat struggling readers with comorbid emotional/behavioral disorders. These efforts included a 6-week residential summer program where struggling readers received both psychotherapy and reading instruction using a non-directive approach that

followed the interests of the students (Redmount, 1948). Child guidance clinics of the 1940s used what is termed a “mental hygiene approach” (Ellis, 1949), which involved a social worker who managed the child’s case, worked with the child’s parents and teachers to improve the home and school environments, arranged individualized tutoring as prescribed by the clinic’s psychologist, and scheduled therapy sessions with the clinic’s psychiatrist if an emotional problem was evident.

The 1940s also saw collaboration between public schools, universities, and mental health clinics to address reading problems. Tulane University created a course to train in-service teachers in reading intervention strategies (Font, 1942) as part of an effort to introduce interventions for struggling readers into the New Orleans public school system for the first time. In another example of collaboration, the staff of a community mental health clinic worked with the school district to establish a school-based summer program for struggling readers referred to the clinic for treatment (Ullmann, 1949). After the program, clinic staff helped school leaders connect children with medical issues to health professionals and also helped district educators develop a more comprehensive understanding of the needs of struggling readers.

A turning point in reading intervention research occurred in the late 1940s, when reading intervention researchers began using experimental research designs that implemented quantitative methods such as analysis of variance that had not been widely used in education research. Burt and Lewis (1946) conducted two experimental studies to compare the kinesthetic, visual/whole-word, phonics, and mixed-methods approaches. In the first study, struggling readers were randomly assigned to one of the four treatment types. In the second study, a randomized blocks design was implemented. The results of both studies indicated larger gains for the visual approach and smaller gains for the phonics approach. Burt and Lewis encouraged other researchers to follow their example in comparing the effects of different interventions in an experimental framework to remedy the confusion resulting from studies where each approach, tested on its own without a comparison group, showed positive results.

1950s: From Exploration to Efficacy

The 1950s brought a burst of new thinking and research on interventions for struggling readers. One major factor came out of U.S. involvement in World War II. As with World War I, the military again discovered that many soldiers were functionally illiterate (Smith, 2002). With the war over and prosperity returning to America, universities had the resources to open or expand reading clinics and begin new graduate programs to train reading specialists in hopes of improving instruction for struggling readers (A. J. Harris, 1967).

Researchers in the 1950s increased the rigor of their investigations, moving the field forward by testing new research questions. Curr and Gourlay (1953) designed a quasi-experimental study to determine if the positive results from previous studies that did not include a comparison group were due to practice effects and regression to the mean rather than true gains in reading skills. To address this research question, they tested the effects of their reading intervention against a comparison group. Treatment students were selected and then matched to control students on reading ability, IQ, gender, and classroom teacher. Their

results suggested that practice and regression effects likely played a role in the positive findings of previous research. Schonfield (1956) sought to expand the knowledge base on reading interventions by examining the impact of differences in the frequency of intervention sessions and the initial reading level of participants. Results indicated that students with AE scores of 8.5 or better at the start of treatment made the greatest gains and that frequency of sessions did not make a difference. In a randomized experimental study, Seeman and Edwards (1954) compared the effects of a psychotherapeutic experience provided at school for fifth and sixth graders with both reading and emotional/behavioral problems to a business-as-usual (BAU) control group. At the conclusion of the study, the average reading gain for children who received treatment was greater than that of the matched comparison group.

In another new twist on reading intervention research, Freed, Abrams, and Peifer (1959) conducted an experimental study to determine if combining a reading intervention with an anti-psychotic medication improved the results of the intervention. Their results indicated that all students who received reading instruction made statistically significant gains, but those given both reading instruction and medication had larger gains than those who received either a placebo or medication only. Freed et al. attributed the results to the calming effect of the medication, which they believed mollified the emotional and behavioral disturbance at the root of the child's reading disability, allowing the child to benefit from instruction.

Despite the emergence of more experimental approaches to reading intervention research, some psychiatrists continued to view reading disabilities from the perspective of untested psychoanalytic theories that viewed family dysfunction as the cause. After reviewing children's records from a public school, a child guidance clinic, a foster child placement agency, a children's psychiatric unit, and a clinic for children with delinquent behavior, Fabian (1955) declared that pathological home environments caused reading disabilities. Kunst (1959) saw reading problems as a symptom of a neurosis involving anxiety about learning. She attributed the anxiety to parents who push their child too hard to learn, unloving or rejecting parents who fail to inspire their child to learn, worries about an issue going on in the child's home, or some other disturbance in the parent–child relationship. Both Kunst and Fabian saw psychotherapy as a necessary part of a reading intervention and believed that teachers could prevent reading problems if they understood the psychodynamics of children and created warm relationships with them. However, they did not test their theories with experimental or quasi-experimental research.

The most significant watershed of the 1950s was Flesch's (1955) publication of a book on reading problems in children that was directed primarily toward parents rather than educators or researchers. *Why Johnny Can't Read* placed the blame for reading disabilities on schools and teachers who had embraced the whole-word or look/say approach to reading instruction and abandoned phonics. As the book became a best seller, parents began to realize that their child's reading problem might not be due to the child's IQ or effort—the school's curriculum might be to blame, leading parents to demand that schools do more to help struggling readers (A. J. Harris, 1967). Flesch's denunciation of the whole-word method was harsh and used rhetoric to win the argument that phonics was the answer to

America's reading problems (Smith, 2002). His critics pointed out that reading disabilities existed in countries where phonics were taught exclusively and where languages had more regular grapheme/phoneme correspondence than English (A. J. Harris, 1967). Nevertheless, Flesch succeeded in changing the conversation about reading disabilities from theories that pointed to child- and family-centered causes to one that also questioned the efficacy of teaching methods and asked schools to do more to help struggling readers.

1960s: Expanding in New Directions

The public awareness and debate around reading disabilities that Flesch began with his 1955 best seller proliferated during the 1960s. One example of the ongoing discussion was an article published in *The New Yorker* (Tomkins, 1963) that traced theories of the etiology of reading problems, the debate over phonics versus whole-word instruction, and the challenges schools faced in finding money to hire reading specialists. Tomkins (1963) concluded that students with reading disabilities who received appropriate interventions could improve their reading skills dramatically but that few had access to the kind of individualized interventions they needed.

Despite Tomkins's (1963) pessimism, the 1960s were a decade of expansion in new directions of research and thinking about how to help struggling readers. More phonics-based interventions were developed and tested, perhaps in response to Flesch's (1955) treatise. These included interventions by Grover (1962) and Brown (1967), both of whom found that phonics-based interventions produced meaningful growth in struggling readers. Other researchers, such as Shedd (1968) and Kline, Kline, Ashbrenner, and Calkins (1968), integrated phonics instruction with other approaches to reading interventions with positive results.

In marked contrast to the psychoanalytic theory that influenced reading interventions in the 1940s and 1950s, the 1960s brought new research on reading interventions that reflected behaviorist theories of learning and implemented operant conditioning protocols. Researchers tried out operant conditioning approaches involving positive reinforcement and avoidance conditioning (McKerracher, 1967) and token reinforcements provided by a teacher who only communicated with students via headphones to give instructions and dispensed tokens that students could save and trade for highly reinforcing items (Haring & Hauck, 1969). These early efforts produced positive results for the struggling readers they sought to help, but the interventions were not tested with experimental designs.

Another innovation for treating struggling readers was proposed by Delacato (1963). Criticizing education researchers for focusing on treating reading disabilities symptomatically instead of discovering and treating the neurological cause, he argued that reading disabilities shared the same underlying cause as speech problems: lack of proper neurological organization. Delacato agreed with Orton who had proposed in the 1920s that reading problems were the result of mixed hemisphere dominance; however, he thought Orton was misguided in attempting to treat the problem with a reading intervention. Delacato's treatment involved having the reading-disabled child sleep in a prescribed position, spend time daily crawling and eventually walking with opposite hand and leg movements, practice visual exercises to encourage dominance in the eye and hand of the

same side of the body, listen to music and learn to discriminate between tones, jump on a trampoline, and avoid using the limbs on the nondominant side of the body.

One more development of the 1960s bears mention for its broad and long-lasting impact on reading intervention research and practice: the passage of the Elementary and Secondary Education Act of 1965. This act provided funding to schools serving low-income children that allowed them to provide reading interventions and other supports. However, trained reading specialists were in short supply, leaving many schools without qualified personnel to implement interventions (A. J. Harris, 1967). As a result, reading was added to the areas of study that could receive federal support under the National Defense Education Act of 1958, leading to the creation of many new training programs and fueling an even greater expansion of research on interventions for struggling readers in the decades that followed (A. J. Harris, 1967).

1970s: A Time of Transition

In the early 1970s, researchers continued to explore many of the avenues of research that had been launched during the 1960s. Phonics interventions continued to be tested, especially as interventions for students with no or very low reading ability. In 1974, A. Lane tested a phonics intervention that used the Initial Teaching Alphabet as a transitional tool to break the cycle of reading failure for a group of sixth-grade students with severe reading disabilities, with positive results. E. Richardson and Collier (1971) also had success with a phonics intervention that consisted of very brief sessions focused on teaching a progression of decoding skills.

Another continuing theme from the 1960s was the application of behaviorist principles to reading interventions, albeit in new and subtler ways than operant conditioning studies of the 1960s. Behaviorist techniques were used to help struggling readers resolve their reading anxiety, which was seen as resulting from viewing the reading teacher as a source of stress (Cameron, Borst, Fifer, LaVigne, & Smith, 1972) or from a phobic response to being asked to read aloud (Word & Rozynko, 1974). More traditional applications of behaviorism were implemented in other studies of reading interventions, such as Camp and van Doorninck's (1971) randomized experiment in which students who received tokens for completing drill-and-practice exercises scored significantly higher than a comparison group that was reinforced only for correct responses during pre- and posttesting. Applied behavior analysis also was tested as a treatment for struggling readers in the 1970s, with some success (Lovitt, 1975).

Other researchers tested Delacato's (1963) approach to remedying reading disabilities and the efficacy of perceptual and motor skills interventions overall. Balow (1971) reviewed research on the Delacato exercises and noted that most studies found that they were not effective in remediating reading problems. However, the research conducted in the 1970s was equivocal. Some studies demonstrated benefits from adding perceptual and motor skills activities to a reading intervention (Meikle & Kilpatrick, 1971; Van Osdol, Johnson, & Geiger, 1974), whereas others found no differences between interventions with a movement component compared to more traditional remedial reading instruction (Jackson & Dando,

1976; Sullivan, 1972). Jackson and Dando (1976) directly compared the Delacato program to phonics instruction and found no benefit to the Delacato approach.

In addition to expanding on areas of research from previous decades, researchers in the 1970s also broke new ground in reading interventions that focused on improving comprehension. Research conducted prior to the 1970s tended to focus predominantly on oral reading fluency and decoding. In the 1970s, researchers increasingly focused on reading comprehension when studying the teaching of reading to the general population as well as interventions for struggling readers (Smith, 2002). Research on reading comprehension led to a growth in interest in helping struggling readers develop the metacognitive processes involved in understanding text. In an influential study, Torgesen (1977) compared the cognitive strategy use of fourth-grade students with reading disabilities and their non-disabled peers. Before any instruction was provided, the groups differed in their spontaneous use of strategies to recall a set of pictures, with students with reading disabilities being less likely to use a strategy and to recall the pictures correctly. However, after receiving strategy instruction their recall improved to the point that their scores were not significantly different from the nondisabled group. As the 1970s drew to a close, Torgesen's conclusion that it was possible to teach students with reading disabilities to use metacognitive strategies effectively would lead to additional rigorous research on interventions that targeted metacognitive processes in struggling readers in the 1980s and beyond.

1980s: Influence of Cognitive Psychology

Though building on the knowledge gained over the preceding decades, the research on interventions for struggling readers in Grades 4 to 12 in the 1980s represented a significant shift from all that preceded it. As cognitive psychologists became more interested in studying reading, their theories influenced education researchers to develop new approaches to reading interventions (Smith, 2002). This influence began in the late 1970s but grew rapidly in the 1980s. A widely cited study by Torgesen (1982) helped apply cognitive psychology theories to the work of designing reading interventions. He summarized research showing that students with reading disabilities tended to take a passive approach to learning, failing to employ cognitive strategies to help themselves recall information or tie concepts together to make meaning from text. However, he believed that research showed that these students had the potential to become more active learners, and he challenged researchers to develop interventions that would teach strategies that could be applied to multiple learning tasks.

Other researchers responded to this call, developing interventions to teach cognitive strategies to struggling readers. Reading comprehension interventions focused on teaching strategies such as self-questioning (e.g., Wong & Jones, 1982), self-monitoring (e.g., Graves & Levin, 1989), and rehearsal (e.g., Borkowski, Weyhing, & Carr, 1988). Other metacognitive interventions of the 1980s focused on vocabulary and taught cognitive strategies that included semantic feature analysis (e.g., Anders, Bos, & Filip, 1984) and mnemonics to teach struggling readers how to acquire new vocabulary words (e.g., Mastropieri, Scruggs, Levin, Gaffney, & McLoone, 1985). Another approach involved the use of advance organizers and graphic organizers (e.g., Darch & Gersten, 1986). These

interventions yielded positive effects for the reading comprehension and vocabulary learning outcomes they targeted. However, researchers typically measured these outcomes on unstandardized measures that were proximal to the intervention, leaving open the question of whether struggling readers transferred the metacognitive strategies to more distal reading tasks. For more details on these studies, see Supplementary Table S6 in the online version of this journal.

Additionally, in the 1980s the number of studies conducted using random assignment to conditions or matching of treatment and comparison group participants to determine the efficacy of their reading interventions expanded considerably. More experimental and strong quasi-experimental designs were implemented in the 1980s than in the prior 65 years combined. Also around this time, GE and AE scores felt out of favor as researchers such as Farr and Tuinman (1972) pointed out that statistical tests of effects require scores with equal-interval scales and that any quantitative analysis of AE and GE scores is inappropriate and should not be published. These advancements in methodology allowed for greater precision in measuring effects and for more robust conclusions to be drawn about the relative effectiveness of different interventions. However, small sample sizes remained a limitation that attenuated the statistical power of the research designs.

1990s: Intensive Focus on Comprehension

Reading intervention research during the 1990s further developed many of the areas of focus from the 1980s. Interventions that targeted building reading comprehension skills in struggling readers became almost a singular focus of researchers in the 1990s, with many more experimental studies devoted to comprehension skills. Reading comprehension interventions of the 1990s continued to concentrate on teaching metacognitive strategies such as self-questioning (e.g., K. S. Chan, 1991), summarizing (e.g., Gajria & Salvia, 1992), creating a cognitive map (Boyle, 1996), identifying the theme of a reading passage (Williams, Brown, Silverstein, & de Cani, 1994), and increasing depth of cognitive processing (Bos & Anders, 1990). Results of these studies generally indicated positive effects for the treatment group. Standardized measures used in several of these metacognitive strategy studies indicated smaller effects than those seen on researcher-developed measures.

Other researchers who focused on metacognitive strategies also incorporated reciprocal teaching, where students acquire proficiency in key reading comprehension practices and then take turns assuming the role of the teacher in guiding other students in their use (Alfassi, 1998; Moore & Scevak, 1995). Expansions of reciprocal teaching interventions tested in the 1990s focused on special populations and also addressed reading comprehension in collaborative groups (e.g., Klingner & Vaughn, 1996). These studies yielded few significant differences between treatment and comparison groups, though pre–post gains were found for the treatment group. Additional research focused on building fluency (e.g., Homan, Klesius, & Hite, 1993) and on word study to improve decoding (e.g., Abbott & Berninger, 1999). The interventions focusing on vocabulary instruction that were common in the 1980s all but disappeared from the experimental literature of the 1990s,

though vocabulary-building activities were incorporated in some interventions along with reading comprehension instruction.

Though research reviews and syntheses were published beginning in the 1930s, the first meta-analyses of reading intervention studies appeared in the late 1990s and represented a significant step forward in understanding the relative efficacy of different approaches to helping struggling readers. Mastropieri et al. (1996) used meta-analysis to synthesize reading comprehension interventions for students identified with LD in elementary, middle, and high school, calculating effect sizes for 68 interventions published between 1976 and 1996. The mean effect size for these studies was 0.98, though for results based on standardized measures only the mean effect was smaller, 0.40. Larger effects were associated with studies that taught self-questioning strategies compared to those that enhanced the text or provided general reading comprehension skills instruction. Mean effect sizes from studies targeted at students older and younger than 152 months were similar in magnitude.

A second meta-analysis of reading interventions, conducted by H. L. Swanson (1999), included studies published through 1997 that sought to improve word recognition or reading comprehension in students with LD. The sample-weighted mean effect size for the 54 studies that measured word recognition was 0.57; for the 58 studies that measured comprehension, the weighted mean effect size was 0.72. Mean effects were smaller for both word recognition (0.62) and comprehension (0.45) when results from only standardized measures were meta-analyzed. The weighted mean effect for word recognition was somewhat larger for students under age 12 (0.73) than for those ages 12 to 17 (0.44); the effects for comprehension were similar for both groups. H. L. Swanson concluded that direct instruction was the most effective approach for improving word recognition, with a mean effect of 0.70, while a combination of direct instruction and strategy instruction yielded the largest mean effect, 1.15, for comprehension.

A third meta-analysis (Elbaum et al., 2000) synthesized effects from one-on-one reading interventions for at-risk readers in elementary grades conducted between 1975 and 1998. Just five studies in this meta-analysis involved students in Grades 4 to 6; their weighted mean effect size was 0.06. Over the next 15 years, more meta-analyses would be published focused on honing in on the effect of reading interventions targeted specifically for struggling readers in Grades 4 to 12 and investigating variables that moderated their effectiveness. For more details on the reading interventions for students in Grades 4–12 included in the meta-analyses cited above, see Supplementary Table S7 in the online version of this journal.

2000s: Legislative Impacts on Intervention Research

In the first decade of the new millennium, the U.S. Congress shaped research on reading interventions with passage of the Education Sciences Reform Act of 2002 and the Individuals With Disabilities Education Improvement Act (IDEIA) of 2004. The Education Sciences Reform Act led to the creation of the IES, which set out to fund educational research meeting high standards of rigor and established the WWC that developed requirements for the research IES would support. In its 2005 Biennial Report to Congress,

IES noted that it would prioritize funding for educational research that conducted RCTs similar to those found in science and medicine (IES, 2005). As a result, after 2005 many more RCTs of reading interventions were published, sample sizes increased, and the use of standardized measures became more prevalent.

The other landmark legislation of the 2000s, the passage of IDEIA in 2004, allowed schools to identify students for special education services through a multitiered instructional approach known as response to instruction/intervention, thus changing the framework for providing reading interventions as both prevention and remediation. Now, all students not responding to general education instruction, rather than just those identified with LD, could receive interventions characterized by evidence-based curriculums, smaller group sizes, increased dosage, and greater individualization (D. Fuchs, Fuchs, & Vaughn, 2014). This framework changed the landscape of reading intervention research in two ways: Students qualifying to participate in research could include all those not responding to general education curriculum (not just those with a discrepancy between IQ and achievement test scores) and schools were now implementing interventions with a larger percentage of students, thus changing the nature of the BAU comparison condition in many intervention studies (Scammacca et al., 2015).

Along with these legislative changes, there was a growing awareness in the 2000s of the critical need to improve the reading proficiency of students in Grades 4 to 12, including a consensus report by experts about the need for an action plan guiding reading comprehension for students at and after Grade 4 (Biancarosa & Snow, 2006). Following up on Biancarosa and Snow's (2006) report, two meta-analyses distilled the findings of research on reading intervention for students in Grades 4 to 12 from 1980 through 2004: Scammacca et al. (2007) and Edmonds et al. (2009). Scammacca et al. (2007) reported a weighted mean effect size of 0.95 across 31 reading interventions and a somewhat smaller 0.42 mean effect based on a subset of findings that assessed outcomes using standardized measures from the 11 studies that included such measures; results were similar when only comprehension measures were included in the analysis. They found that intervention type was a significant moderator of effect size, with comprehension strategy and vocabulary interventions having the largest mean effects and word study and multicomponent interventions having moderate effects. Effects also were larger for students in Grades 4 to 8 than those in Grades 9 to 12. Edmonds et al. (2009) meta-analyzed 13 interventions that sought to improve reading comprehension in struggling readers in Grades 6 to 12. They found a weighted mean effect size of 0.89 on comprehension measures, with a smaller effect of 0.47 when only standardized measures were included in the analysis. Both meta-analyses provided convincing evidence that interventions for older struggling readers could result in substantive improvements in reading ability for these students.

2010–2014: Rapid Expansion, Declining Effects

The federal legislation passed in the 2000s continued to impact research into the 2010s. Table 2 summarizes characteristics of the group comparison experimental and quasi-experimental studies included in this review. These findings are reported here because they are not available in published documents referenced in the previous decades. The 5 years

between 2010 and 2014 stand apart from any preceding decade in both the rigor and the intensity of the intervention studies published. The total number of studies exceeds those published in any previous decade, the average sample size in these studies is triple that of the 2000s, 50% of studies used only standardized measures, and 60% provided more than 25 hours of intervention. The continued effect of IDEIA also is seen in changes in the participants in intervention research. The percentage of intervention studies focused only on students with LD has decreased from 83% of studies in the 1980s to 57% in the 1990s, 29% in the 2000s, and just 7% of studies published between 2010 and 2014.

As noted by Scammacca et al. (2015), this change in target population, along with the increased rigor in research designs and a shift toward standardized measures that followed the founding of IES in 2002, may be partly responsible for the declining effect sizes seen in their meta-analysis of interventions for struggling readers that included research published between 1980 and 2011. They found a significant effect for year of publication in a metaregression of effect sizes from interventions for struggling readers in Grades 4 to 12, with more recent studies having smaller effect sizes. The weighted mean effect size for studies published between 2005 and 2011 was 0.49, compared to 0.95 for studies published between 1980 and 2004; a decline in magnitude also was seen when comparing effect sizes from standardized measures only (from 0.42 to 0.21), though year of publication was not a statistically significant predictor of effect sizes from standardized measures.

Scammacca et al. (2015) also pointed to changes in the nature of the comparison group over time as a possible reason for the decline in effect sizes. As shown in Table 2, researchers have increasingly used a “business-as-usual” comparison group since group comparison designs became more prevalent beginning in the 1980s. In this review, we coded studies as BAU when the comparison group did not receive any treatment from researchers but received reading instruction provided by the school independent of the researchers’ involvement. For studies published between 2010 and 2014, these types of comparison groups were used 80% of the time. However, the nature of BAU reading instruction has changed over time due to RTI paradigms that call for research-based interventions for students who are not responding adequately to classroom reading instruction. In at least some cases, contemporary experimental interventions are being compared to a BAU condition that involves an alternate treatment that has already demonstrated efficacy. As a result, effect sizes from these studies would be smaller than those from studies that compared an experimental intervention to no intervention (see Lemons, Fuchs, Gilbert, & Fuchs, 2014, for further discussion of this issue).

A number of recent meta-analyses have struggled to find moderator variables other than year of publication that explain variation in effect sizes from the corpus of studies they sought to synthesize. In a meta-analysis of outcomes from standardized measures in 12 studies aimed at students with reading disabilities in Grades 5 to 9, Flynn et al. (2012) found a weighted mean effect size of 0.41, but the statistically significant heterogeneity associated with the mean effect could not be explained by the focus or length of the intervention, student age, or grade level. Wanzek et al. (2013) included a larger corpus of studies, including all those that provided 75 or more sessions of intervention to struggling readers in Grades 4 to 12, but found statistically significant heterogeneity only when meta-analyzing 22 effect sizes from

reading comprehension measures. This heterogeneity could not be explained by differences in number of hours of intervention, number of students in the instructional group, or grade level.

All of the studies in Wanzek et al. (2013) were included in Scammacca et al. (2015), along with additional studies of the same population that provided fewer than 75 sessions of intervention. Scammacca et al. found statistically significant heterogeneity in effect sizes from studies published between 2005 and 2011 only when looking across effect sizes from standardized and unstandardized outcomes combined. LD status of participants, grade level, number of hours of intervention, and whether a researcher or teacher implemented the intervention were all examined as possible moderators, but no differences based on these variables were found. The only statistically significant moderator variable was intervention type, with comprehension interventions having a significantly larger mean effect size than multicomponent interventions.

Intervention research in the 2010s continues to be influenced by research syntheses and meta-analyses that have concluded that improving reading comprehension outcomes for older readers is best accomplished through interventions that include a reading comprehension component, as compared to those that focus on word-level skills (Scammacca et al., 2015; Wanzek, Wexler, Vaughn, & Ciullo, 2010). More than 80% of the 2010 to 2014 studies focused on comprehension strategies or included comprehension in multicomponent interventions. No studies focused solely on word study, and just 7% focused solely on fluency. An emphasis on comprehension instruction in reading interventions is a trend that began in the 1970s and 1980s and appears likely to continue into the next century of reading intervention research.

Discussion

Efforts to improve outcomes for students with reading disabilities have been under way for more than a century. Over the past 100 years, there has been considerable change in the way in which reading disabilities are perceived, the hypothesized causes and consequences, and the types of treatments thought to improve outcomes. In concluding this narrative review, we highlight key themes and discuss the implications of a century of progress in research in reading interventions for researchers, practitioners, and policymakers of today and tomorrow.

Multidisciplinary Involvement

The history of interventions for struggling readers reflects the contributions of researchers and practitioners from multiple disciplines. Pioneers in developing methods to help struggling readers included physicians, neurologists, ophthalmologists, psychologists, psychiatrists, education researchers, and teachers. Some of their theories and treatments may seem misguided with 21st-century hindsight, reflecting the limited nature of the knowledge base available before innovations such as desktop computers and brain imaging were commonplace. However, the differences in perspective afforded by professionals with diverse specialties helped move the field forward by highlighting the multicausal nature of reading disabilities and allowing for experimentation with treatments that varied from visual

training exercises to psychotherapy to phonics drills. The cooperation between university researchers and local schools that began in the 1920s and 1930s continues to be critical to the development and testing of new interventions and the training of teachers, reading specialists, and other professionals.

Advances in research by neuroscientists and cognitive psychologists support the continued importance of a multidisciplinary approach to helping struggling readers succeed. For example, recent neuroimaging research has found changes in the structure and functions in the brain following reading interventions (e.g., Barquero, Davis, & Cutting, 2014; Krafnick, Flowers, Napoliello, & Eden, 2011). Cognitive psychologists are contributing theoretical frameworks that call for reading interventions to focus on underlying deficits in the reading process instead of teaching discrete skills (e.g., Compton, Miller, Elleman, & Steacy, 2014). Maximizing the effectiveness of reading interventions over the next century will require an ongoing dialogue with and a continued appreciation for the contributions of researchers and practitioners from many different fields.

Shift to Standardized Group Interventions

In recent decades, structured, standardized group interventions associated with RCTs and other more rigorous designs have largely replaced individualized interventions typically implemented as case studies. Throughout the early history of reading intervention research, pioneers such as Gray (1922), Gates (1927), and others emphasized the importance of tailoring a reading intervention to the specific strengths and needs of each struggling reader in one-on-one interventions. They developed diagnostic tests specifically for the purpose of guiding individually developed and provided interventions. This focus also can be seen in the plethora of case studies published from 1914 to 1960, when the focus began to shift toward more structured, group-based interventions. Although case studies and single-subject designs continue to be published and play a key role in testing new approaches to reading intervention, the most recent 10 years of research have been marked by rapid growth in the number of RCTs published. The establishment of more rigorous requirements for research-based interventions to be used in schools and for federally funded education research to embrace large-scale randomized trials fueled the growth in structured approaches to helping struggling readers.

However, the WWC notes that there is strong research evidence to recommend that individualized instruction be made available to struggling readers who need more help than can be provided in more standardized group-based interventions (Kamil et al., 2008). This is especially true for students who do not respond adequately to reading interventions. Research aimed at understanding the cognitive attributes of these low responders (e.g., Cho et al., 2015; Miciak et al., 2014) and determining how best to address their severe and seemingly unyielding reading difficulties (e.g., Pyle & Vaughn, 2012) is currently on the frontier of reading intervention research. More individualized interventions, like those tested in earlier decades, might hold clues for contemporary researchers seeking to understand how to help students who benefit little from a standardized approach.

Increased Focus on Reading Comprehension

Over the past century, interventions have evolved to focus more attention on reading comprehension. Interventions tested during the first two thirds of the 20th century focused primarily at the word level, emphasizing improving struggling readers' word recognition and oral reading fluency. Given that the original diagnosis of reading disability was congenital word blindness, it is not surprising that word-reading skills were the predominant focus of early research. However, beginning in the 1970s, teaching struggling readers to make meaning from text became more of a priority. Cognitive psychology contributed theories on the ways in which mental schema are built from vocabulary and background knowledge and on the metacognitive abilities that are key to constructing meaning from text. These theories led education researchers to test new interventions that taught strategies for acquiring and using vocabulary and background knowledge to aid comprehension.

More recently, meta-analyses and syntheses have highlighted the effectiveness of interventions that either include a reading comprehension component or focus exclusively on comprehension over those at the word level. Additionally, contemporary researchers are focusing more attention on providing reading interventions and supports in content area classes such as social studies and science as a means of helping struggling readers improve their reading comprehension (e.g., Boardman, Klingner, Buckley, Annamma, & Lasser, 2015; Kaldenberg, Watt, & Therrien, 2015; E. Swanson et al., in press). With the Common Core Standards (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010) requiring students to comprehend more complex texts and master more advanced academic vocabulary, interventions will increasingly be needed across the school curriculum to help struggling readers reach proficiency in these areas.

Declining Effect Sizes

Interventions prior to the mid-1970s typically did not report results using equal-interval scores and rarely included a counterfactual condition, making it difficult to know if early reading interventions showed larger or smaller effects than more recent ones. Studies from this time period in the published literature generally reported positive effects in case studies and single-group design research, with some reporting dramatic gains in reading skills. However, experimental and quasi-experimental studies from the 1980s through the 2010s produced effect sizes that have declined sharply and consistently over the decades. This finding seems counterintuitive; one might expect interventions to demonstrate larger effects over time as a benefit of learning from previous research and refining procedures to isolate those that best improve outcomes for struggling readers. However, many aspects of intervention research (e.g., designs, measures) have changed in ways that could account for the decline in observed effects.

In the 1980s and 1990s, interventions generally were brief and involved small samples; as a result, only a large treatment effect would have resulted in sufficient power to yield a statistically significant difference in outcomes between the treatment and comparison groups. Therefore, it may be that other studies with small sample sizes where treatment effects were smaller were not published because of null results. More recent studies were adequately powered to detect statistically significant small effects as a result of having large

sample sizes. Additionally, during in the late 20th century, researchers most often determined treatment effects using researcher-developed, unstandardized measures rather than standardized measures. As funders began to require more rigorous methodologies in the 2000s, researchers increasingly used standardized measures to estimate effects. As noted by Willingham (2007), the content of researcher-designed measures often aligns more closely to the content of the intervention, meaning these measures are more proximal estimates of the treatment effect. Standardized measures typically require some degree of transfer of learning and/or generalization to new types of content, making them more distal to the intervention and likely to show a smaller effect.

Additionally, smaller effects from more recent interventions may be in part the result of federal legislation allowing schools to broaden the population of students who qualified for reading interventions to include those who did not respond adequately to general education instruction. This change in population may have altered the sample in ways that both yielded a more intractable group of students with reading disabilities and a comparison group provided more robust reading treatments compared to studies in the 1980s and 1990s. Students randomized to the comparison group in studies completed in the past 10 years typically received the school's BAU reading intervention rather than no or minimal instruction as was common in earlier research. Therefore, effect sizes from more recent studies reflect the extent to which the experimental intervention outperforms an existing intervention.

Finally, the increasing prominence of reading comprehension also may explain some of the decrease in effects. The largest effects seen in intervention research from 1980 to 2011 were found in early studies of vocabulary interventions (Scammacca et al., 2015). Findings from these studies indicated that students who were taught the meanings of words typically learned these meanings, but generalization to improved reading was not often documented. More recently, vocabulary instruction has been incorporated into multicomponent interventions, with very few experimental studies of a purely vocabulary-focused intervention published in the past 10 years. Instead, reading comprehension interventions and multicomponent interventions with a reading comprehension component predominate, with comprehension effects seen as a key outcome when intervening with students in Grades 4 to 12. Results from the meta-analysis by Scammacca et al. (2015) indicate that 47 studies published between 2005 and 2011 reported reading comprehension outcomes, compared to 25 studies published between 1980 and 2004. The mean effect size for more recent studies was 0.24 for all types of measures and 0.19 for standardized measures, indicating that effects of interventions on reading comprehension outcomes tend to be relatively small. Therefore, the increased focus on reading comprehension may be a significant factor that, when combined with other changes noted above, may account for the declining effect sizes seen over time.

Implications for Future Research, Practice, and Policy

One might argue that the most compelling reason for studying history is to inform the future —to build on its successes and avoid repeating its mistakes. In this vein, the history of reading interventions has much to say to current and future researchers, practitioners, and

policymakers who will carry on the work of researching and implementing interventions for struggling readers over the next 100 years. In an effort to speak specifically to each of these stakeholders, we discuss the implications for research, practice, and policy separately below. However, many of our conclusions are relevant to more than one of these groups.

Implications for Researchers—The history of the past century of reading interventions yields a number of suggestions for future research. One important issue for researchers to address is the trend of declining effect sizes observed over the past 35 years. A number of possible reasons have been suggested in this review, but further research is needed to determine if these declining effect sizes represent true diminished benefits from reading interventions or reflect changes in the school environment (e.g., overall improved classroom instruction), the rigor of contemporary research (e.g., RCTs vs. case studies), or other factors. The use of standardized measures and reporting of pretest standard scores by intervention researchers can aid future reviewers of research in determining if changes in study participants' preintervention reading ability are occurring over time and playing a role in diminishing treatment effects. Additionally, more detailed description of fidelity of implementation and of the BAU instruction provided in the counterfactual condition also would be helpful in determining the relative strength of the intervention the treatment and comparison groups received.

Another avenue that future researchers should explore is a less standardized treatment approach that aims to improve the knowledge and skills of tutors/teachers so that they can use student data to understand struggling readers' needs and implement more impactful treatments. This type of tailored intervention approach was fairly common in the early decades of research and demonstrated effectiveness, but it is found infrequently in contemporary studies. Future intervention studies also might consider testing protocols that adjust treatments to better align with students' reading and learning needs on an ongoing basis. These types of studies can be more difficult to carry out as an RCT than using the case study and single-group design methodologies that proliferated in the past, but testing this approach to intervention using a robust research design is critical to determining its efficacy.

Contemporary researchers should consider the example of reading researchers of the past who embraced insights and developments in diverse fields of study and tested their efficacy in reading interventions. Some of these efforts may seem questionable in hindsight, but others, such as the insights gained from cognitive psychology around metacognition, have borne fruit. Although early researchers sought explanations for reading problems in the psyches of youngsters without much success, it is important to consider ways to further investigate related psychosocial and behavioral issues such as the role of attention, motivation, self-efficacy, self-regulation, family dynamics, and other psychosocial and behavioral factors that are often associated with reading problems. History shows that there is much to gain in embracing a principle of openness to learning from and collaborating with scholars outside one's own area of study. Exploring the efficacy of a reading intervention designed by education researchers paired with a social-emotional learning intervention developed and implemented by psychologists or school counselors is one example of a research partnership that might yield new insights.

Finally, for those who continue to research the efficacy of reading interventions and will create the history of the next century, there are still issues to resolve in determining why some children do not benefit sufficiently from classroom reading instruction in the primary grades and how to help them become proficient readers. In a similar vein, more research is needed to develop interventions for struggling readers who do not respond adequately to evidence-based interventions provided with high treatment fidelity. Also, remediating reading difficulties in high school students needs additional attention as few experimental studies have been published focused on this age-group and treatment effects in these studies have tended to be quite small. Researchers also must continue to explore the impact of changes in government policy, such as the introduction of the Common Core Standards, on struggling readers and test interventions to help these students meet expectations for proficiency in reading across the curriculum and throughout upper elementary, middle school, and high school.

Implications for Teachers and Other Practitioners—Perhaps history's greatest lesson is that the need for reading interventions and the opportunity to learn to read proficiently does not end after the primary grades; students in Grades 4 to 12 who are not reading at the level expected can also grow in their reading skills. There is much in the past century of reading interventions research to suggest that students with reading difficulties can make measureable and meaningful progress when given appropriate interventions. Although the effects may be small, it is reasonable to expect that their cumulative impact over time would have meaningful practical benefits. Therefore, teachers and others who work closely with struggling readers should persevere in implementing evidence-based interventions even when student gains are incremental. Some struggling readers may require interventions over a long period of time and may benefit more from individualized interventions. With a history that dates back to William Gray's work in the 1920s, the RTI framework allows for increasingly intensive interventions when students do not respond adequately to initial efforts to intervene, something that students with significant reading difficulties may need.

Teachers and those who train future teachers should be knowledgeable about frameworks such as RTI as well as about what the history of reading interventions reveals about the content of effective interventions. Much of the early history of reading interventions focused on word-level skills to improve fluency. More contemporary research has demonstrated the importance of instruction focused on comprehension strategies with word-level instruction included as needed for students who have not mastered decoding. Therefore, teachers of students in Grade 4 and above need to be prepared to help students learn word-level skills, rather than expecting that students would have mastered them in the primary grades. For those students struggling with reading comprehension, content area teachers can play an important role in helping students learn strategies to make meaning from the texts that they expect students to comprehend in order to learn the subject matter being taught.

Additionally, teachers and other practitioners should be aware of what the history of reading interventions has to say about the importance of psychosocial factors in the effectiveness of reading interventions. Early research suggested that the relationship between the reading instructor and student played a part in the efficacy of interventions. Our historical review

documented that factors such as motivation to read, anxiety around reading, the need to overcome mental blocks created by previous experiences of reading failure, and considering students' interests when choosing reading materials are important when intervening with struggling readers. The comorbidity of behavior disorders and reading difficulties also requires teachers to attend to factors beyond the instructional components of an intervention and calls for the involvement of other professionals who can assist in formulating a comprehensive approach to helping a struggling reader. Undoubtedly, the emotional, relational, and instructional aspects of a reading intervention are all important to helping struggling readers become more proficient.

Implications for Policymakers—Another important lesson from the history presented here is the role the U.S. government plays in prioritizing reading interventions and shaping the nature of intervention research. From raising the issue to national prominence during World Wars I and II, to the Elementary and Secondary Education Act of 1965 that allocated funds under Title I to provide reading interventions, to the Education Sciences Reform Act of 2002 that created IES and raised the bar for experimental research on reading interventions, to the IDEIA of 2004 that expanded access to reading interventions in schools, the U.S. government has had a hand in the ways in which the field of intervention research has grown and changed over the past century. It is unlikely that the research currently available on how to help struggling readers would be available if not for government support of reading intervention research. Government regulations also have raised the quality of the research that has been conducted in the 2000s and 2010s.

For those who will write or influence the legislation of the future, the lessons of history provide guidance for considering focusing future funding on issues such as the mechanisms for identifying and intervening with struggling readers across the age span and designing and evaluating treatments for students who respond inadequately to current reading interventions. Additionally, policymakers might prioritize studies addressing the dearth of longitudinal research on the additive effects of treatment over multiple years and the outcomes associated with robust early treatments and their long-terms effects. Few studies over the past century have followed students to determine if treatment effects are maintained over time periods longer than a few months after the conclusion of an intervention. Replication studies, which also are infrequently seen in the history presented here, also are important to fund to further validate the effectiveness of reading interventions that show promise.

Finally, keeping in mind the role legislation has played across the history of reading interventions research, policymakers should be cognizant of the potential implications of present, past, and future regulations and policies on new research and its outcomes. For example, many of the factors discussed above as possible reasons for the decline in effect sizes over time stemmed from federal legislation and policies. Judging the size of treatment effects found in current research by comparing them to the effects of past, less rigorous studies would ignore the effects of these regulations. The impacts of newer policies like the Common Core Standards and legislation such as the Every Student Succeeds Act of 2015 have yet to be realized, but the lessons of history suggest that both will change the landscape of research on reading interventions for students in Grades 4 to 12.

The Next Century

Between 1914 and 2014, the research on reading interventions for students in Grades 4 to 12 grew from initial efforts to diagnose and treat struggling readers on a case-by-case basis to large-scale experimental trials of multicomponent interventions. Undoubtedly, fresh insights will be discovered over the next 100 years through further research on new ways to help struggling readers, wisdom gained from teachers and others who work closely with students, and public policy that encourages progress in the field. Developments on the near horizon include potential advances in neuroscience, genetics, psychology, education, and other fields that may reveal more about the underpinnings of reading disabilities, document neurological and/or genetic differences in students' response to evidence-based interventions, address questions surrounding the malleability of reading disabilities, and develop treatments that are effective for students who have attention or behavior disorders or who struggle in math as well as reading. The story of the next century of progress likely will be shaped by other developments that are as unforeseeable to contemporary researchers as large-scale RCTs yielding data analyzed with sophisticated statistical modeling would have been to pioneers such as William Gray and Grace Fernald. However, throughout history the guiding purpose of intervention research has remained the same: to help struggling readers overcome their difficulties and achieve reading success.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

References marked with an asterisk indicate intervention studies included in the narrative review.

*. Abbott SP, Berninger VW. It's never too late to remediate: Teaching word recognition to students with reading disabilities in Grades 4–7. Annals of Dyslexia. 1999; 49:223–250. DOI: 10.1007/s11881-999-0025-x

*. Alfassi M. Reading for meaning: The efficacy of reciprocal teaching in fostering reading comprehension in high school students in remedial reading classes. American Educational Research Journal. 1998; 35:309–332. DOI: 10.3102/00028312035002309

*. Allinder RM, Dunse L, Brunken CD, Obermiller-Krolikowski HJ. Improving fluency in at-risk readers and students with learning disabilities. Remedial and Special Education. 2001; 22:48–45. DOI: 10.1177/074193250102200106

*. Amble BR, Butler G. Phrase-reading training and the reading achievement of slow learners: An experimental study. Journal of Special Education. 1966; 1:119–123. DOI: 10.1177/002246696600100203

*. Anders, PL., Bos, CS., Filip, D. The effect of semantic feature analysis on the reading comprehension of learning-disabled students. In: Niles, JS., Harris, LA., editors. Changing perspectives on reading/language processing and instruction. Rochester, NY: The National Reading Conference; 1984. p. 162-166.

*. Atkinson JK, Cochrane KJ, Elkins J. Retarded readers at high school start: An investigation in diagnosis and treatment. Slow Learning Child. 1968; 15:67–83. DOI: 10.1080/0156655680150202

*. Balow B. The long-term effect of remedial reading instruction. The Reading Teacher. 1965; 18:581–586.

Balow B. Perceptual-motor activities in the treatment of severe reading disability. The Reading Teacher. 1971; 24:513–525.

Barquero LA, Davis N, Cutting LE. Neuroimaging of reading intervention: A systematic review and activation likelihood estimate meta-analysis. PloS one. 2014; 9:e83668. [PubMed: 24427278]

*. Bartlet D, Shapiro MB. Investigation and treatment of a reading disability in a dull child with severe psychiatric disturbances. British Journal of Educational Psychology. 1956; 26:180–190. DOI: 10.1111/j.2044-8279.1956.tb01378.x

Bell JE. Emotional factors in the treatment of reading difficulties. Journal of Consulting Psychology. 1945; 9:125–131.

*. Bemboom CM, McMaster KL. A comparison of lower- and higher-resourced tier 2 reading interventions for high school sophomores. Learning Disabilities Research & Practice. 2013; 28:184–195. DOI: 10.1111/ldrp.12020

Berk, RA., editor. Educational evaluation methodology: The state of the art. Baltimore, MD: Johns Hopkins University Press; 1981.

*. Berkeley S, Mastropieri MA, Scruggs TE. Reading comprehension strategy instruction and attribution retraining for secondary students with learning and other mild disabilities. Journal of Learning Disabilities. 2011; 44:18–32. DOI: 10.1177/0022219410371677 [PubMed: 21335506]

*. Bhat P, Griffin CC, Sindelair PT. Phonological awareness instruction for middle school students with learning disabilities. Learning Disability Quarterly. 2003; 26:73–87.

*. Bhattacharya A, Ehri LC. Graphosyllabic analysis helps adolescent struggling readers read and spell words. Journal of Learning Disabilities. 2004; 37:331–348. [PubMed: 15493405]

Biancarosa, C., Snow, CE. Reading next—A vision for action and research in middle and high school literacy: A report to Carnegie Corporation of New York. 2nd. Washington, DC: Alliance for Excellent Education; 2006.

*. Biggs MC, Homan SP, Dedrick R, Minick V, Rasinski T. Using an interactive singing software program: A comparative study of struggling middle school readers. Reading Psychology. 2008; 29:195–213. DOI: 10.1080/02702710802073438

*. Billingsley BS, Wildman TM. The effects of prereading activities on the comprehension monitoring of learning disabled adolescents. Learning Disabilities Research. 1988; 4:36–44.

Blanchard P. Psychoanalytic contributions to the problems of reading disabilities. Psychoanalytic Study of the Child. 1946; 2:163–187. [PubMed: 20293630]

*. Block C, Parris SR, Reed KL, Whiteley CS, Cleveland MD. Instructional approaches that significantly increase reading comprehension. Journal of Educational Psychology. 2009; 101:262–281. DOI: 10.1037/a0014319

*. Bloomer RH. Progressive choice reading techniques in a remedial reading clinic. Journal of Educational Research. 1964; 57:486–488.

Boardman AG, Klingner JK, Buckley P, Annamma S, Lasser CJ. The efficacy of Collaborative Strategic Reading in middle school science and social studies classes. Reading and Writing. 2015; 28:1257–1283. DOI: 10.1007/s11145-015-9570-3

*. Bookbinder KF, Flierl NT. A plan for teaching pupils with severe reading disability. Journal of Learning Disabilities. 1968; 1:140–147. DOI: 10.1177/002221946800100207

*. Borkowski JG, Weyhing RS, Carr M. Effects of attributional retraining on strategy-based reading comprehension in learning-disabled students. Journal of Educational Psychology. 1988; 80:46–53. DOI: 10.1037/0022-0663.80.1.46

*. Bos CS, Anders PL. Effects of interactive vocabulary instruction on the vocabulary learning and reading comprehension of junior-high learning disabled students. Learning Disability Quarterly. 1990; 13:31–42.

*. Bos CS, Anders PL. Using interactive teaching and learning strategies to promote text comprehension and content learning for students with learning disabilities. International Journal of Disability, Development and Education. 1992; 39:225–238. DOI: 10.1080/0156655920390305

*. Bos CS, Anders PL, Filip D, Jaffe LE. The effects of an interactive instructional strategy for enhancing reading comprehension and content area learning for students with learning disabilities. Journal of Learning Disabilities. 1989; 22:384–390. [PubMed: 2738473]

*. Boyle JR. The effects of a cognitive mapping strategy on the literal and inferential comprehension of students with mild disabilities. Learning Disabilities Quarterly. 1996; 19:86–98.

*. Brailsford A, Snart F, Das JP. Strategy training and reading comprehension. Journal of Learning Disabilities. 1984; 17:287–290. DOI: 10.1177/002221948401700508 [PubMed: 6726071]

*. Brown RI. A remedial reading program for the adolescent illiterate. Journal of Special Education. 1967; 1:409–417. DOI: 10.1177/002246696700100411

*. Buerger TA. A follow-up of remedial reading instruction. The Reading Teacher. 1968; 21:329–334.

*. Burns MK, Hodgson J, Parker DC, Fremont K. Comparison of the effectiveness and efficiency of text previewing and preteaching keywords as small-group reading comprehension strategies with middle-school students. Literacy Research and Instruction. 2011; 50:241–252. DOI: 10.1080/19388071.2010.519097

*. Burt C, Lewis RB. Teaching backward readers. British Journal of Educational Psychology. 1946; 16:116–132. [PubMed: 20278005]

*. Butler SR. Reading program—remedial, integrated, and innovative. Annals of Dyslexia. 1991; 41:119–127. DOI: 10.1007/BF02648081 [PubMed: 24233760]

*. Calhoon M. Effects of a peer-mediated phonological skill and reading comprehension program on reading skill acquisition for middle school students with reading disabilities. Journal of Learning Disabilities. 2005; 38:424–433. DOI: 10.1177/00222194050380050501 [PubMed: 16329443]

*. Calhoon M, Sandow A, Hunter CV. Reorganizing the instructional reading components: Could there be a better way to design remedial reading programs to maximize middle school students with reading disabilities' response to treatment? Annals of Dyslexia. 2010; 60:57–85. DOI: 10.1007/s11881-009-0033-x [PubMed: 20087694]

*. Cameron JL, Borst CA, Fifer WP, LaVigne GL, Smith SA. Remedial reading: A psychoanalytic and operant approach. British Journal of Medical Psychology. 1972; 45:273–278. DOI: 10.1111/j.2044-8341.1972.tb02209.x [PubMed: 5085689]

*. Camp BW, van Doorninck WJ. Assessment of "motivated" reading therapy with elementary school children. Behavior Therapy. 1971; 2:214–222.

*. Cantrell S, Alamsi J, Carter J, Rintamaa M, Madden A. The impact of a strategy-based intervention on the comprehension and strategy use of struggling adolescent readers. Journal of Educational Psychology. 2010; 102:257–280. DOI: 10.1037/a0018212

*. Chan LK, Cole PG. The effects of comprehension monitoring training on the reading competence of learning disabled and regular class students. Remedial and Special Education. 1986; 7:33–40. DOI: 10.1177/074193258600700407

*. Chan LK, Cole PG, Morris JN. Effects of instruction in the use of a visual-imagery strategy on the reading-comprehension competence of disabled and average readers. Learning Disability Quarterly. 1990; 13:2–11. DOI: 10.2307/1510388

*. Chan KS. Promoting strategy instruction generalization through self-instructional training in students with reading disabilities. Journal of Learning Disabilities. 1991; 24:427–290. [PubMed: 1895011]

Cho E, Roberts GJ, Capin P, Roberts G, Miciak J, Vaughn S. Cognitive attributes, attention, and self-efficacy of adequate and inadequate responders in a fourth grade reading intervention. Learning Disabilities Research & Practice. 2015; 30:159–170. http://dx.doi.org/10.1111/ldrp.12088. [PubMed: 26997755]

*. Clarke PJ, Snowling MJ, Truelove E, Hulme C. Ameliorating children's reading-comprehension difficulties: A randomized controlled trial. Psychological Science. 2010; 21:1106–1116. DOI: 10.1177/0956797610375449 [PubMed: 20585051]

*. Coleman JC. Results of a 'total-push' approach to remedial education. Elementary School Journal. 1953; 53:454–458. DOI: 10.1086/458523

*. Collyer MA. Improving reading in the ninth grade. The English Journal. 1940; 29:37–43.

Compton DL, Miller AC, Elleman AM, Steacy LM. Have we forsaken reading theory in the name of "quick fix" interventions for children with reading disability? Scientific Studies of Reading. 2014; 18:55–73.

*. Conte R, Humphreys R. Repeated readings using audiotaped material enhances oral reading in children with reading difficulties. Journal of Communication Disorders. 1989; 22:65–79. [PubMed: 2715381]

*. Cowin P, Graff V. Comprehensive treatment of the older disabled reader. Bulletin of the Orton Society. 1969; 19:100–112. DOI: 10.1007/BF02653566

*. Curr WM, Gourlay N. An experimental evaluation of remedial education. British Journal of Educational Psychology. 1953; 23:45–55.

*. Damerau R. Influence of treatment on the reading ability and behavior disorders of reading disability cases. Smith College Studies in Social Work. 1934; 5:160–183.

*. Darch C, Eaves R. Visual displays to increase comprehension of high school learning-disabled students. Journal of Special Education. 1986; 20:309–318.

*. Darch C, Gersten R. Direct setting activities in reading comprehension: A comparison of two approaches. Learning Disability Quarterly. 1986; 9:235–243.

*. Darch CB, Kameenui EJ. Teaching LD students critical reading skills: A systematic replication. Learning Disability Quarterly. 1987; 10:82–91. DOI: 10.2307/1510215

Delacato, CH. The diagnosis and treatment of speech and reading problems. Springfield, IL: Thomas; 1963.

*. DiCecco VM, Gleason MM. Using graphic organizers to attain relational knowledge from expository texts. Journal of Learning Disabilities. 2002; 35:306–320. [PubMed: 15493240]

*. Diliberto JA, Beattie JR, Flowers CP, Algozzine RF. Effects of teaching syllable skills instruction on reading achievement in struggling middle school readers. Literacy Research and Instruction. 2009; 48:14–27. DOI: 10.1080/19388070802226253

Edmonds MS, Vaughn S, Wexler J, Reutebuch C, Cable A, Tackett KK, Schnakenberg JW. A synthesis of reading interventions and effects on reading comprehension outcomes for older struggling readers. Review of Educational Research. 2009; 79:262–300. DOI: 10.3102/0034654308325998 [PubMed: 20072704]

Education Sciences Reform Act of 2002. Pub. L. No. 107–279, § 116, Stat. 1941 (2002).

Elementary and Secondary Education Act of 1965. Pub. L. No. 89–10, § 79, Stat. 27 (1965).

Elbaum B, Vaughn S, Hughes MT, Moody S. How effective are one-to-one tutoring programs in reading for elementary students at risk for reading failure? A meta-analysis of the intervention research. Journal of Educational Psychology. 2000; 92:605–619. DOI: 10.1037/0022-0663.92.4.605

*. Ellis A. Results of a mental hygiene approach to reading disability problems. Journal of Consulting and Clinical Psychology. 1949; 13:56–61.

*. Englert CS, Mariage TV. Making students partners in the comprehension process: Organizing the reading "posse". Learning Disability Quarterly. 1991; 14:123–138. DOI: 10.2307/1510519

Every Student Succeeds Act of 2015. Pub. L. No. 114–95, § 1000 et seq., Stat. 1814 (2015).

Fabian AA. Reading disability: An index of pathology. American Journal of Orthopsychiatry. 1955; 25:319–329. [PubMed: 14376497]

*. Faggella-Luby M, Wardwell M. RTI in a middle school: Findings and practical implications of a tier 2 reading comprehension study. Learning Disability Quarterly. 2011; 34:35–49.

Farr R, Tuinman JJ. The dependent variable: Measurement issues in reading research. Reading Research Quarterly. 1972; 7:413–423.

Fernald GM, Keller H. The effect of kinaesthetic factors in the development of word recognition in the case of non-readers. Journal of Educational Research. 1921; 4:335–377.

Fernald, GM., Keller, H. On certain language disabilities: Their nature and treatment. Baltimore, MD: Williams & Wilkins; 1936.

*. Fleisher LS, Jenkins JR. The effect of word- and comprehension-emphasis instruction on reading performance. Learning Disability Quarterly. 1983; 6:146–154. DOI: 10.2307/1510792

Flesch, RF. Why Johnny can't read and what you can do about it. New York, NY: Harper; 1955.

Flynn LJ, Zheng X, Swanson HL. Instructing struggling older readers: A selective meta-analysis of intervention research. Learning Disabilities Research & Practice. 2012; 27:21–32. DOI: 10.1111/j.1540-5826.2011.00347.x

*. Font MM. Orientation in clinical approach through remedial reading instruction. American Journal of Orthopsychiatry. 1942; 12:324–334.

*. Forlano G, Writestone JW. Measuring the effectiveness of special reading instruction in selected vocational high schools. High Points. 1956; 38:31–36.

*. Freed H, Abrams J, Peifer C. Reading disability: A new therapeutic approach and its implications. Journal of Clinical and Experimental Psychopathology & Quarterly Review of Psychiatry and Neurology. 1959; 20:251–259. [PubMed: 13824702]

Fuchs D, Fuchs LS, Vaughn S. What is intensive instruction and why is it important? Teaching Exceptional Children. 2014; 46:13–18. DOI: 10.1177/0040059914522966

*. Fuchs LS, Fuchs D, Kazdan S. Effects of peer-assisted learning strategies on high school students with serious reading problems. Remedial and Special Education. 1999; 20:309–319.

*. Gajria M, Salvia J. The effects of summarization instruction on text comprehension of students with learning disabilities. Exceptional Children. 1992; 58:508–516. [PubMed: 1592077]

Gates, AI. Teachers College contributions to education: Vol. 129. The psychology of reading and spelling with special, reference to disability. New York, NY: Teachers College; 1922.

Gates, AI. The improvement of reading. 1st. New York, NY: Macmillan; 1927.

Gates, AI. The improvement of reading. 2nd. New York, NY: Macmillan; 1935.

Gates AI. The role of personality maladjustment in reading disability. Journal of Genetic Psychology. 1941; 59:77–83.

*. Gates AI, Bond GL. Some outcomes of instruction in the Speyer Experimental School (P.S. 500). Teachers College Record. 1936; 38:206–217.

*. Given BK, Wasserman JD, Chari SA, Beattie K, Eden GF. A randomized, controlled study of computer-based intervention in middle school struggling readers. Brain and Language. 2008; 106:83–97. DOI: 10.1016/j.bandl.2007.12.001 [PubMed: 18657684]

Glass GV. Primary, secondary and meta-analysis of research. Education Researcher. 1976; 10:3–8.

*. Gormly J, Nittoli MJ. Rapid improvement of reading skills in juvenile delinquents. Journal of Experimental Education. 1971; 40:45–48.

*. Graves AW. Effects of direct instruction and metacomprehension training on finding main ideas. Learning Disabilities Research. 1986; 1:90–100.

*. Graves AW, Duesbery L, Pyle NB, Brandon RR, McIntosh AS. Two studies of tier II literacy development: Throwing sixth graders a lifeline. Elementary School Journal. 2011; 111:641–661. DOI: 10.1086/659036

*. Graves AW, Levin JR. Comparison of monitoring and mnemonic text-processing strategies in learning disabled students. Learning Disability Quarterly. 1989; 12:232–236. DOI: 10.2307/1510693

Gray WS. Methods of testing reading: I. Elementary School Journal. 1916a; 16:231–246.

Gray WS. Methods of testing reading: II. Elementary School Journal. 1916b; 16:281–298.

Gray WS. Diagnostic and remedial steps in reading. Journal of Educational Research. 1921; 4:1–15.

Gray, WS. Remedial cases in reading: Their diagnosis and treatment. Chicago, IL: University of Chicago; 1922.

Gray, WS., editor. Report of the national committee on reading (24th yearbook of the National Society for the Study of Education, Part 1). Bloomington, IL: Public School Publishing; 1925.

*. Grover VM. The suitability of small group teaching in cases of reading and spelling disability among young primary school children. Journal for Social Research. 1962; 13:19–28.

*. Günzburg HC. The unsuccessful reader. Mental Health. 1948; 8(2):34–37. [PubMed: 18106838]

*. Guthrie JT, McRae A, Coddington CS, Klauda S, Wigfield A, Barbosa P. Impacts of comprehensive reading instruction on diverse outcomes of low- and high-achieving readers. Journal of Learning Disabilities. 2009; 42:195–214. DOI: 10.1177/0022219408331039 [PubMed: 19264929]

*. Haring NG, Hauck MA. Improved learning conditions in the establishment of reading skills with disabled readers. Exceptional Children. 1969; 35:341–352. [PubMed: 5776244]

Harris, AJ. Five decades of remedial reading. Paper presented at the meeting of the International Reading Association conference; Seattle, WA. 1967 May.

*. Harris M, Schumaker J, Deshler D. The effects of strategic morphological analysis instruction on the vocabulary performance of secondary students with and without disabilities. Learning Disability Quarterly. 2011; 34:17–33.

*. Hasselbring TS, Goin LI. Literacy instruction for older struggling readings: What is the role of technology? Reading & Writing Quarterly. 2004; 20:123–144.

*. Hester KB. Dade County meets the reading problem. Elementary School Journal. 1946; 47:148–156.

*. Hicks RA, Hicks MJ, Kellogg M, Honnen R. Reading gains and instructional sessions. The Reading Teacher. 1968; 21:738–739. 744.

Hildreth G. The psychologist investigates reading disability. Journal of Consulting and Clinical Psychology. 1942; 6:212–217.

*. Homan SP, Klesius JP, Hite C. Effects of repeated readings and non-repetitive strategies on students' fluency and comprehension. Journal of Educational Research. 1993; 87:94–99.

Individuals With Disabilities Education Improvement Act of 2004. Pub. L. No. 108–446, § 118, Stat. 2647 (2004).

Institute of Education Sciences. What works: Clearinghouse study review standards. 2008. Retrieved from http://ies.ed.gov/ncee/wwc/pdf/reference_resources/wwc_version1_standards.pdf

*. Jackson M, Dando F. An evaluation of the Delacto method for the facilitation of reading behavior. The Exceptional Child. 1976; 23:113–118.

*. Jitendra AK, Hoppes MK, Xin YP. Enhancing main idea comprehension for students with learning problems: The role of a summarization strategy and self-monitoring instruction. Journal of Special Education. 2000; 34:127–139.

*. Johnson G, Gersten R, Carnine D. Effects of instructional design variables on vocabulary acquisition of learning disabilities students: A study of computer-assisted instruction. Journal of Learning Disabilities. 1987; 20:206–213. [PubMed: 3553400]

Kaldenberg E, Watt S, Therrien W. Reading instruction in science for students with learning disabilities: A meta-analysis. Learning Disability Quarterly. 2015; 38:160–173.

Kamil, ML., Borman, GD., Dole, J., Kral, CC., Salinger, T., Torgesen, J. Improving adolescent literacy: Effective classroom and intervention practices: A practice guide. Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education; 2008. NCEE #2008-4027

Kelly FJ. The Kansas silent reading tests. Journal of Educational Psychology. 1916; 7:63–80.

*. Kennedy KM, Backman J. Effectiveness of the Lindamood auditory in depth program with students with learning disabilities. Learning Disabilities Research & Practice. 1993; 8:253–259.

*. Kennedy MJ, Thomas CN, Meyer JP, Alves KD, Lloyd JW. Using evidence-based multimedia to improve vocabulary performance of adolescents with LD: A UDL approach. Learning Disability Quarterly. 2014; 37:71–86. DOI: 10.1177/0731948713507262

*. Kim A, Vaughn S, Klingner JK, Woodruff AL, Reutebuch C, Kouzekanani K. Improving the reading comprehension of middle school students with disabilities through computer-assisted collaborative strategic reading. Remedial and Special Education. 2006; 27:235–249. DOI: 10.1177/07419325060270040401

*. Kim JS, Samson JF, Fitzgerald R, Hartry A. A randomized experiment of a mixed-methods literacy intervention for struggling readers in Grades 4–6: Effects on word reading efficiency, reading comprehension and vocabulary, and oral reading fluency. Reading and Writing. 2010; 23:1109–1129. DOI: 10.1007/s11145-009-9198-2

*. Kline CL, Kline CL, Ashbrenner M, Calkins S. The treatment of specific dyslexia in a community mental health centre. Journal of Learning Disabilities. 1968; 1:456–465. DOI: 10.1177/002221946800100805

*. Klingner JK, Vaughn S. Reciprocal teaching of reading comprehension strategies for students with learning disabilities who use English as a second language. Elementary School Journal. 1996; 96:275–293.

Krafnick AJ, Flowers DL, Napoliello EM, Eden GF. Gray matter volume changes following reading intervention in dyslexic children. Neuroimage. 2011; 57:733–741. [PubMed: 21029785]

Kunst MS. Learning disabilities: Their dynamics and treatment. Social Work. 1959; 4:95–101.

Kussmaul, A. Cyclopedia of the practice of medicine: Vol. 14. Disturbances of speech: An attempt in the pathology of speech. von Ziemssen, H., editor; McCreery, JA., translator. New York, NY: William Wood; 1877.

*. Laffey R. A program in remedial reading. Elementary English. 1950; 27:230–239.

*. Lane A. Severe reading disability and the initial teaching alphabet. Journal of Learning Disabilities. 1974; 7:479–483. DOI: 10.1177/002221947400700803

*. Lane PR. Educational therapy for adolescent nonreaders. Intervention in School and Clinic. 1970; 6:155–159. DOI: 10.1177/105345127000600205

*. Lang L, Torgesen J, Vogel W, Chanter C, Lefsky E, Petscher Y. Exploring the relative effectiveness of reading interventions for high school students. Journal of Research on Educational Effectiveness. 2009; 2:149–175. DOI: 10.1080/19345740802641535

Lemons CJ, Fuchs D, Gilbert JK, Fuchs LS. Evidence-based practices in a changing world: Reconsidering the counterfactual in education research. Educational Researcher. 2014; 43:242–252. DOI: 10.3102/0013189X14539189

*. Lesaux NK, Kieffer MJ, Kelley JG, Harris JR. Effects of academic vocabulary instruction for linguistically diverse adolescents: Evidence from a randomized field trial. American Educational Research Journal. 2014; 51:1159–1194. DOI: 10.3102/0002831214532165

*. Lloyd J, Cullinan D, Heins ED, Epstein MH. Direct instruction: Effects on oral and written language comprehension. Learning Disability Quarterly. 1980; 3:70–76. DOI: 10.2307/1510677

*. Louden B, Arthur G. An application of the Fernald method to an extreme case of reading disability. Elementary School Journal. 1940; 40:599–606. DOI: 10.1086/457811

*. Lovell K, Johnson E, Platts D. A summary of a study of the reading ages of children who had been given remedial teaching. British Journal of Educational Psychology. 1962; 32:66–71. DOI: 10.1111/j.2044-8279.1962.tb01734.x

*. Lovett MW, Lacerenza L, De Palma M, Frijters JC. Evaluating the efficacy of remediation for struggling readers in high school. Journal of Learning Disabilities. 2012; 45:151–169. DOI: 10.1177/0022219410371678 [PubMed: 22183192]

*. Lovitt TC. Applied behavior analysis and learning disabilities: Part II: Specific research recommendations and suggestions for practitioners. Journal of Learning Disabilities. 1975; 8:504–518. DOI: 10.1177/002221947500800809

*. Macaruso P, Rodman A. Benefits of computer-assisted instruction for struggling readers in middle school. European Journal of Special Needs Education. 2009; 24:103–113. DOI: 10.1080/08856250802596774

MacGinitie, WH. Gates-MacGinitie Reading Tests. Toronto,, Ontario, Canada: Nelson; 1980.

*. Malone LD, Mastropieri MA. Reading comprehension instruction: Summarization and self-monitoring training for students with learning disabilities. Exceptional Children. 1992; 58:270–279.

*. Manset-Williamson G, Nelson JM. Balanced, strategic reading instruction for upper-elementary and middle school students with reading disabilities: A comparative study of two approaches. Learning Disability Quarterly. 2005; 28:59–74. DOI: 10.2307/4126973

Mastropieri MA, Scruggs T, Bakken J, Whedon C. Reading comprehension: A synthesis of research in learning disabilities. Advances in Learning and Behavioral Disabilities. 1996; 10B:201–227.

*. Mastropieri MA, Scruggs TE, Levin JR, Gaffney J, McLoone B. Mnemonic vocabulary instruction for learning disabled students. Learning Disability Quarterly. 1985; 8:57–63.

*. Mastropieri MA, Scruggs T, Mohler L, Beranek M, Spencer V, Boon RT, Talbott E. Can middle school students with serious reading difficulties help each other and learn anything? Journal of Learning Disabilities. 2001; 16:18–27.

*. Mathes PG, Fuchs LS. Peer-mediated reading instruction in special education resource rooms. Learning Disabilities Research & Practice. 1993; 8:233–243.

*. McCallum R, Krohn KR, Skinner CH, Hilton-Prillhart A, Hopkins M, Waller S, Polite F. Improving reading comprehension of at-risk high-school students: The Art of Reading program. Psychology in the Schools. 2011; 48:78–86. DOI: 10.1002/pits.20541

McGann M. Dramatic dialogues for simultaneous treatment of reading and personality problems. Journal of Educational Psychology. 1947; 38:96–104. DOI: 10.1037/h0055961 [PubMed: 20288920]

*. McKerracher DW. Alleviation of reading difficulties by a simple operant conditioning technique. Journal of Child Psychology and Psychiatry. 1967; 8:51–56. DOI: 10.1111/j.1469-7610.1967.tb02180.x [PubMed: 6033264]

*. McLoone BB, Scruggs TE, Mastropieri MA, Zucker SF. Memory strategy instruction and training with learning disabled adolescents. Learning Disabilities Research. 1986; 2:45–52.

*. Meikle S, Kilpatrick DL. Changes in perceptual, motor, and reading test scores in a remedial reading group. The Canadian Psychologist. 1971; 12:254–269.

*. Meyer BF, Wijekumar KK, Lin Y. Individualizing a web-based structure strategy intervention for fifth graders' comprehension of nonfiction. Journal of Educational Psychology. 2011; 103:140–168. DOI: 10.1037/a0021606

Miciak J, Stuebing KK, Vaughn S, Roberts G, Barth AE, Fletcher JM. Cognitive attributes of adequate and inadequate responders to reading intervention in middle school. School Psychology Review. 2014; 43:407–427. DOI: 10.17105/SPR-13-0052.1

*. Monroe, M. Remedial reading: A monograph in character education. Boston, NY: Houghton Mifflin; 1937.

*. Moore PJ, Scevak JJ. The effects of strategy training on high school students' learning from science texts. European Journal of Psychology of Education. 1995; 10:401–410.

Morgan WP. A case of congenital word blindness. British Medical Journal. 1896; 2(1871):1378.

National Defense Education Act of 1958, Pub. L. No. 85-864, § 72 Stat. 1580.

National Governors Association Center for Best Practices & Council of Chief State School Officers. Common Core State Standards. Washington, DC: Author; 2010.

*. Niedo J, Lee YL, Breznitz Z, Berninger VW. Computerized silent reading rate and strategy instruction for fourth graders at risk in silent reading rate. Learning Disability Quarterly. 2014; 37:100–110. DOI: 10.1177/0731948713507263 [PubMed: 24914248]

*. O'Brien FJ. A child guidance approach to the treatment of a severe reading disability. Understanding the Child. 1938; 7:22–26.

*. Orton ST. Word blindness in school children. Archives of Neurology and Psychiatry. 1925; 14:581–615.

*. O'Shea LJ, Sindelar P, O'Shea DJ. Effects of repeated readings and attentional cues on the reading fluency and comprehension of learning disabled readers. Learning Disabilities Research. 1987; 2:103–109.

*. Pany D, Jenkins JR, Schreck J. Vocabulary instruction: Effects on word knowledge and reading comprehension. Learning Disability Quarterly. 1982; 5:202–215. DOI: 10.2307/1510288

*. Penney CG. Teaching decoding skills to poor readers in high school. Journal of Literacy Research. 2002; 34:99–118.

Petticrew, M., Roberts, H. Systematic reviews in the social sciences: A practical guide. Malden, MA: Blackwell; 2006.

Pyle N, Vaughn S. Remediating reading difficulties in a response to intervention model with secondary students. Psychology in the Schools. 2012; 49:273–284. DOI: 10.1002/pits.21593 [PubMed: 23100631]

*. Rasinski T, Samuels S, Hiebert E, Petscher Y, Feller K. The relationship between a silent reading fluency instructional protocol on students' reading comprehension and achievement in an urban school setting. Reading Psychology. 2011; 32:75–97. DOI: 10.1080/02702710903346873 [PubMed: 26347186]

*. Redmount RS. Description and evaluation of a corrective program for reading disability. Journal of Educational Psychology. 1948; 39:347–358.

*. Regensburg, J. Retraining in reading: A new method. Paper presented at the annual meeting of the American Association of Psychiatric Social Workers; Boston, MA. 1930 Jun.

*. Richardson E, Collier L. Programmed tutoring of decoding skills with third and fifth grade non-readers. Journal of Experimental Education. 1971; 39:57–64.

*. Richardson DC, Havlicek LL. High school students as reading instructors. Elementary School Journal. 1975; 75:389–393. DOI: 10.1086/460922

*. Ritchey KD, Silverman RD, Montanaro EA, Speece DL, Schatschneider C. Effects of a tier 2 supplemental reading intervention for at-risk fourth-grade students. Exceptional Children. 2012; 78:318–334. DOI: 10.1177/001440291207800304 [PubMed: 22685347]

*. Roberts G, Vaughn S, Fletcher J, Stuebing K, Barth A. Effects of a response-based, tiered framework for intervening with struggling readers in middle school. Reading Research Quarterly. 2013; 48:237–254. DOI: 10.1002/rrq.47 [PubMed: 23997311]

Robinson H. Types of deficient readers and methods of treatment. Supplementary Educational Monographs. 1939; 49:159–169.

*. Robinson, H. Clinical studies in reading. Vol. 1. Chicago, IL: University of Chicago Press; 1949. Problems of seriously retarded readers from the Chicago community; p. 114-173.Supplementary Educational Monograph, No. 68

*. Ryback D, Staats AW. Parents as behavior therapy-technicians in treating reading deficits (dyslexia). Journal of Behavior Therapy and Experimental Psychiatry. 1970; 1:109–119. DOI: 10.1016/0005-7916(70)90034-0

Scammacca, N., Roberts, G., Vaughn, S., Edmonds, M., Wexler, J., Reutebuch, CK., Torgesen, JK. Reading interventions for adolescent struggling readers: A meta-analysis with implications for practice. Portsmouth, NH: RMC Research Corporation, Center on Instruction; 2007.

Scammacca N, Roberts G, Vaughn S, Stuebing KK. A meta-analysis of interventions for struggling readers in Grades 4–12: 1980–2011. Journal of Learning Disabilities. 2015; 48:369–390. DOI: 10.1177/0022219413504995 [PubMed: 24092916]

*. Schonfield D. Special difficulties at a reading age of 8+ British Journal of Educational Psychology. 1956; 26:39–50.

*. Schworm RW. The effects of selective attention on the decoding skills of children with learning disabilities. Journal of Learning Disabilities. 1979; 12:639–644. [PubMed: 541546]

*. Seeman J, Edwards B. A therapeutic approach to reading difficulties. Journal of Consulting Psychology. 1954; 18:451–453. [PubMed: 13221713]

*. Shedd CL. Dyslexia and its clinical management. Journal of Learning Disabilities. 1968; 1:171–184. DOI: 10.1177/002221946800100302

*. Shippen ME, Houchins DE, Steventon C, Sartor D. A comparison of two direct instruction reading programs for urban middle school students. Remedial and Special Education. 2005; 26:175–182. DOI: 10.1177/07419325050260030501

*. Shippen ME, Morton RC, Flynt SW, Houchins DE, Smitherman T. Efficacy of a computer-based program on acquisition of reading skills of incarcerated youth. Remedial and Special Education. 2012; 33:14–22. DOI: 10.1177/0741932510362512

*. Silver AA, Hagin RA, Hersh MF. Reading disability: Teaching through stimulation of deficit perceptual areas. American Journal of Orthopsychiatry. 1967; 37:744–752. DOI: 10.1111/j.1939-0025.1967.tb00516.x [PubMed: 6033429]

*. Simpson SB, Swanson JM, Kunkel K. The impact of an intensive multisensory reading program on a population of learning-disabled delinquents. Annals of Dyslexia. 1992; 42:54–66. DOI: 10.1007/BF02654938 [PubMed: 24233868]

Smith, NB. American reading instruction. Newark, DE: International Reading Association; 2002.

*. Snider VE. Reading comprehension performance of adolescents with learning disabilities. Learning Disability Quarterly. 1989; 12:87–96.

*. Somers, M., Corrin, W., Sepanik, S., Salinger, T., Levin, J., Zmach, C. The enhanced reading opportunity study final report: The impact of supplemental literacy courses for struggling ninth-grade readers. Washington, DC: Institute of Educational Sciences, National Center for Education Evaluation and Regional Assistance, U.S. Department of Education; 2010.

*. Somerville DE, Leach DJ. Direct or indirect instruction? An evaluation of three types of intervention programme for assisting students with specific reading difficulties. Educational Research. 1988; 30:46–53. DOI: 10.1080/0013188880300106

*. Spencer S, Manis F. The effects of a fluency intervention program on fluency and comprehension outcomes of middle-school students with severe reading deficits. Learning Disabilities Research & Practice. 2010; 25:76–86. DOI: 10.1111/j.1540-5826.2010.00305.x

*. Staats AW, Minke KA, Goodwin W. Cognitive behavior modification: "Motivated learning" reading treatment with subprofessional therapy-technicians. Behavior Research and Therapy. 1967; 5:283–299. DOI: 10.1016/0005-7967(67)90020-4

*. Steiner R, Wiener M, Cromer W. Comprehension training and identification for poor and good readers. Journal of Educational Psychology. 1971; 62:506–513.

*. Stoddard K, Valcante G, Sindelar P, O'Shea L. Increasing reading rate and comprehension: The effects of repeated readings, sentence segmentation, and intonation training. Literacy Research and Instruction. 1993; 32:53–65.

*. Sullivan J. The effects of Kephart's perceptual motor-training on a reading clinic sample. Journal of Learning Disabilities. 1972; 5:545–551.

Swanson E, Wanzek J, Vaughn S, Fall AM, Roberts G, Hall C, Miller V. Middle school reading comprehension and content learning intervention for below average readers. Reading & Writing Quarterly. (in press).

Swanson HL. Reading research for students with LD: A meta-analysis in intervention outcomes. Journal of Learning Disabilities. 1999; 32:504–532. DOI: 10.1177/002221949903200605 [PubMed: 15510440]

*. Swenby C, Zielsdorf M. A remedial-reading program in a senior high school. The School Review. 1951; 59:350–357.

*. Sylvester E, Kunst MS. Psychodynamic aspects of the reading problem. American Journal of Orthopsychiatry. 1943; 13:69–76.

*. Thames DG, Reeves C, Kazelskis R, York K, Boling C, Newell K, Wang Y. Reading comprehension: Effects of individualized, integrated language arts as a reading approach with struggling readers. Reading Psychology. 2008; 29:86–115. DOI: 10.1080/02702710701853625

*. Therrien WJ, Wickstrom K, Jones K. Effect of a combined repeated reading and question generation intervention on reading achievement. Learning Disabilities Research & Practice. 2006; 21:89–97. DOI: 10.1111/j.1540-5826.2006.00209.x

Thorndike EL. The measurement of ability in reading. Teachers College Record. 1914; 15:1–70.

Tinker MA. Remedial reading for non-readers. School & Society. 1934; 40:524–526.

Tinker MA. Trends in diagnostic and remedial reading as shown by recent publications in this field. Journal of Educational Research. 1938; 32:293–303.

Tomkins C. A reporter at large: The last skill acquired. The New Yorker. 1963 Sep 14; 39(30):127–128.

Torgesen JK. Memorization processes in reading-disabled children. Journal of Educational Psychology. 1977; 69:571–578. [PubMed: 908783]

Torgesen JK. The learning disabled child as an inactive learner: Educational implications. Topics in Learning & Learning Disabilities. 1982; 2:45–52.

*. Torgesen, JK., Stancavage, F., Myers, D., Schirm, A., Stuart, E., Vartivarian, S., Haan, C. Closing the reading gap: First year findings from a randomized trial of four reading interventions for striving readers: Final report. Washington, DC: U.S. Department of Education; 2006.

*. Torgesen JK, Wagner RK, Rashotte CA, Alexander AW, Conway T. Preventive and remedial interventions for children with severe reading disabilities. Learning Disabilities. 1997; 8:51–61.

Traxler, AE. Ten years of research in reading: Summary and bibliography. New York, NY: Educational Records Bureau; 1941.

Uhl WL. The use of the results of reading tests as bases for planning remedial work. Elementary School Journal. 1916; 17:266–275.

Ullmann CA. A public health approach to improving community mental health through the schools. Public Health Reports. 1949; 64:1655–1660. [PubMed: 15402742]

*. Vadasy PF, Sanders EA. Benefits of repeated reading intervention for low-achieving fourth- and fifth-grade students. Remedial and Special Education. 2008; 29:235–249. DOI: 10.1177/0741932507312013

*. Van Osdol BM, Johnson DM, Geiger L. The effects of total body movement on reading achievement. Australian Journal of Mental Retardation. 1974; 3:16–19. DOI: 10.3109/13668257409018751

*. Vaughn S, Cirino P, Wanzek J, Wexler J, Fletcher J, Denton C, Francis D. Response to intervention for middle school students with reading difficulties: effects of a primary and secondary intervention. School Psychology Review. 2010; 39:3–21. [PubMed: 21479079]

Vaughn, S., Elbaum, BE., Wanzek, J., Scammacca, N., Walker, MA. Code sheet and guide for education-related intervention study syntheses. Austin, TX: The Meadows Center for Preventing Educational Risk; 2014.

*. Vaughn S, Klingner JK, Swanson EA, Boardman AG, Roberts G, Mohammed SS, Stillman-Spisak SJ. Efficacy of collaborative strategic reading with middle school students. American Educational Research Journal. 2011; 48:938–964. DOI: 10.3102/0002831211410305

*. Vaughn S, Wanzek J, Wexler J, Barth A, Cirino P, Fletcher J, Francis D. The relative effects of group size on reading progress of older students with reading difficulties. Reading and Writing. 2010; 23:931–956. DOI: 10.1007/s11145-009-9183-9 [PubMed: 21072131]

*. Vaughn S, Wexler J, Leroux A, Roberts G, Denton C, Barth A, Fletcher J. Effects of intensive reading intervention for eighth-grade students with persistently inadequate response to intervention. Journal of Learning Disabilities. 2012; 45:515–525. DOI: 10.1177/0022219411402692 [PubMed: 21512102]

*. Vaughn S, Wexler J, Roberts G, Barth AA, Cirino PT, Romain MA, Denton CA. Effects of individualized and standardized interventions on middle school students with reading disabilities. Exceptional Children. 2011; 77:391–407. [PubMed: 23125463]

*. Veit DT, Scruggs TE, Mastropieri MA. Extended mnemonic instruction with learning disabled students. Journal of Educational Psychology. 1986; 78:300–308.

*. Wanzek J, Roberts G. Reading interventions with varying instructional emphases for fourth graders with reading difficulties. Learning Disability Quarterly. 2012; 35:90–101. DOI: 10.1177/0731948711434047

*. Wanzek J, Vaughn S, Roberts G, Fletcher JM. Efficacy of a reading intervention for middle school students with reading disabilities. Exceptional Children. 2011; 78:73–87. [PubMed: 22485052]

Wanzek J, Vaughn S, Scammacca NK, Metz K, Murray CS, Roberts G, Danielson L. Extensive reading interventions for students with reading difficulties after grade 3. Review of Educational Research. 2013; 83:163–195. DOI: 10.3102/0034654313477212

Wanzek J, Wexler J, Vaughn S, Ciullo S. Reading interventions for struggling readers in the upper elementary grades: A synthesis of 20 years of research. Reading and Writing. 2010; 23:889–912. DOI: 10.1007/s11145-009-9179-5 [PubMed: 21072128]

*. Wexler J, Vaughn S, Roberts G, Denton CA. The efficacy of repeated reading and wide reading practice for high school students with severe reading disabilities. Learning Disabilities Research & Practice. 2010; 25:2–10. DOI: 10.1111/j.1540-5826.2009.00296.x [PubMed: 21076693]

*. Wilder AA, Williams JP. Students with severe learning disabilities can learn higher order comprehension skills. Journal of Educational Psychology. 2001; 93:268–278.

*. Williams JP, Brown LG, Silverstein AK, deCani JS. An instructional program in comprehension of narrative themes for adolescents with learning disabilities. Learning Disabilities Quarterly. 1994; 17:205–221.

Willingham DT. Ask the cognitive scientist: The usefulness of brief instruction in reading comprehension strategies. American Educator. 2007; 30(3):39–45. 50.

*. Wong BY, Jones W. Increasing metacomprehension in learning disabled and normally achieving students through self-questioning training. Learning Disability Quarterly. 1982; 5:228–240. DOI: 10.2307/1510290

*. Word P, Rozynko V. Behavior therapy of an eleven-year-old-girl with reading problems. Journal of Learning Disabilities. 1974; 7:551–554. DOI: 10.1177/002221947400700904

TABLE 1

Number of intervention studies reviewed by decade and type

Decade	Case study/ review of case records	Pre/post single-group	Whole-class/ whole-school/ whole-district	Treatment comparison experimental/quasi-experimental	Multiple treatments experimental/quasi-experimental	Total
1914–1919	0	1	0	0	0	1
1920s	2	0	0	0	0	2
1930s	4	0	2	0	0	6
1940s	6	3	1	0	1	11
1950s	2	1	1	3	1	8
1960s	3	8	0	3	3	17
1970s	2	4	1	6	1	14
1980s	0	0	0	15	8	23
1990s	0	0	0	14	7	21
2000s	0	0	0	21	3	24
2010–2014	0	0	0	27	3	30

TABLE 2

Summary of characteristics of experimental and quasi-experimental group-comparison studies, 1940–2014[a]

Study Characteristics	1940s, *k* =1	1950s, *k* = 4	1960s, *k* = 6	1970s, *k* = 7	1980s, *k* = 23	1990s, *k* = 21	2000s, *k* = 24	2010–2014, *k* = 30
Average sample size	80	106	57	37	39	44	123	382
Total hours of intervention, %								
≤5	0	0	17	14	39	43	4	3
6–15	100	0	33	29	30	24	21	27
16–25	0	0	17	0	0	5	29	10
>25	0	75	33	29	0	19	42	60
Not reported	0	25	0	29	30	10	4	0
Intervention type[b], %								
Vocabulary	0	0	0	0	30	5	0	10
Comprehension strategy	0	0	0	0	39	57	33	20
Fluency	0	0	0	0	9	10	13	7
Multicomponent	100	75	17	0	22	14	42	63
Word study	0	0	0	57	0	14	13	0
Multisensory[c]	100	0	17	57	0	14	4	0
Visual training[c]	100	0	17	29	0	14	0	0
Psychiatric/behavior/emotional treatment[c]	0	50	17	0	0	0	0	3
Other	0	25	83	43	0	0	0	0
Types of comparison group, %								
No treatment	0	50	33	29	9	19	4	3
Business as usual	0	25	0	29	9	24	58	80
Attention control	0	0	17	0	17	5	4	7
Absence of selected component	0	25	17	14	17	19	13	3
Different treatment	100	0	33	29	48	33	21	7
Types of outcome measures, %								
Standardized	0	50	67	29	4	19	46	50
Unstandardized	0	25	0	14	78	62	21	17
Both	0	25	33	43	17	19	33	3
Unclear	100	0	0	14	0	0	0	0

Study Characteristics	1940s, *k* =1	1950s, *k* = 4	1960s, *k* = 6	1970s, *k* = 7	1980s, *k* = 23	1990s, *k* = 21	2000s, *k* = 24	2010–2014, *k* = 30
Grades, %								
4–8	100	75	67	86	78	81	92	70
9–12	0	25	17	0	22	19	8	20
Other/not clear	0	0	17	14	0	0	0	10
LD status, %								
All LD	0	25	0	0	83	57	29	7
Some LD	0	0	0	0	9	19	33	30
No LD	0	0	0	0	0	5	13	10
Other/not clear	100	75	100	100	9	19	25	53

Note. LD = learning disability.

[a]No studies published before 1940 used a group comparison experimental or quasi-experimental design.

[b]Some studies contrasted more than one intervention type, leading to totals in excess of 100% for some decades.

[c]In addition to a reading intervention.