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Reading interventions for struggling readers in the upper elementary grades: a synthesis of 20 years of research

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Abstract

A synthesis of the extant research on reading interventions for students with reading difficulties and disabilities in fourth and fifth grade (ages 9–11) is presented. Thirteen studies with treatment/comparison study designs and eleven single group or single subject studies were located and synthesized. Findings from the 24 studies revealed high effects for comprehension interventions on researcher-developed comprehension measures. Word recognition interventions yielded small to moderate effects on a range of reading outcomes. Few studies were located implementing vocabulary and multi-component interventions.

Keywords

Reading intervention; Reading difficulties; Learning disabilities

Introduction

Considerable research conducted over the past 30 years provides extensive knowledge regarding early intervention for young readers with reading difficulties (Blachman et al., 2004; Denton, Fletcher, Anthony, & Francis, 2006; Felton, 1993; Fletcher, Lyon, Fuchs, & Barnes, 2007; Jenkins & O'Connor, 2002; Lovett et al., 2000; Mathes et al., 2005; McMaster, Fuchs, Fuchs, & Compton, 2005; Torgesen et al., 1999; Vellutino et al., 1996). These reports indicate that the highest student effects result when explicit, systematic instruction is provided in both foundation skills such as phonological awareness and phonics as well as higher level reading tasks, such as fluency, with increased attention to word meaning and understanding text (National Reading Panel, 2000). Incorporating these elements of instruction has been associated with reducing the incidence of reading difficulties (Torgesen, 2000).

In addition, recent syntheses have examined the efficacy of methods to improve reading outcomes for older students with reading difficulties that persist into grades 4–12 (Edmonds

et al., 2009; Kamil et al., 2008; Scammacca et al., 2007; Torgesen et al., 2007). These reports indicate positive reading outcomes for older students when providing explicit instruction in (a) word study strategies to decode words, (b) word meanings and strategies for deriving the meanings of unknown words, and (c) comprehension strategy instruction. These findings hold specifically for students with reading difficulties (Edmonds et al., 2009) and learning disabilities (Scammacca et al., 2007) as well. Furthermore, recent reviews indicate that providing ample opportunities to practice and receive corrective feedback during instruction are associated with improved academic outcomes (Hattie & Timperley, 2007; Shute, 2008).

Thus, the necessary components of effective reading instruction have been identified and synthesized for students in the younger grades (K-3) who struggle with reading acquisition, and the groundwork has been laid for research regarding effective reading intervention for students who struggle to read and comprehend in the secondary grades. Although a few studies in the previous syntheses of reading instruction for older readers have included students in grades 4–5, the findings largely reflect studies conducted with students in grades 6–12. Typically, there is an underlying assumption that 4th and 5th grade students are more similar to secondary students than elementary students. Kamil et al. (2008) best explained this assumption in a recently published Institute of Education Sciences practice guide document, “The panel purposefully included students in 4th and 5th grades within the realm of adolescents because their instructional needs related to literacy have more in common with those of students in middle and high school than they do with students in early elementary grades” (p. 1).

While there is some evidence from the previous syntheses that upper elementary students in grades 4–5 can benefit from the same interventions designed to meet the needs of students in grades 6–12, the findings for students in the upper elementary grades (4th–5th) have not previously been disaggregated and the recommended practices have been based mainly on studies conducted with students in grades 6–12. Furthermore, a synthesis focusing on reading interventions for students in grades 4 and 5 has not previously been conducted.

Teaching reading in the upper elementary grades: the unique needs of teachers

Unfortunately, despite our knowledge regarding effective instruction for young readers in the early elementary grades, it is estimated that 69% of fourth grade students cannot read at proficient levels with 36% of the fourth grade population unable to read at or above basic levels of understanding (National Center for Educational Statistics, 2005). In the upper elementary grades, a shift from “learning to read” to “reading to learn” typically occurs. Thus, in addition to expectations that students have adequately mastered the basic reading skills such as decoding accurately and fluently, there are also expectations that students understand word meanings and are able to read text with comprehension (Chall, 1983). The focus on these comprehension skills may be difficult for struggling readers who may still be learning to accurately and fluently decode grade level text. In addition, as early as fourth grade, students are presented with the supplementary challenge of transitioning from reading and understanding narrative text to reading and understanding content area expository text (Grigg, Daane, Jin, & Campbell, 2003).

With the decreased emphasis on learning to read in the upper elementary grades, students who do not read proficiently by the end of the early elementary grades (K-3) may face serious consequences. Chall and Jacobs (1983) noted that many low income third graders reading at grade level experience a sudden drop in normative reading scores by the fourth grade, referring to this phenomenon as the “fourth grade slump”, indicating not that students go “backwards” in reading, but instead that they fail to thrive and cannot meet grade level expectations. The increased demands placed on students beginning in fourth grade may cause a slowing of reading growth relative to expected growth for some students who previously seemed on track in their reading growth. Teachers must be able to detect when a student is not thriving and intervene

before the gap widens even more. Therefore, upper elementary teachers are often faced with the challenge of providing intervention not only for students with previously identified reading difficulties that have not been adequately remediated, but also students whose reading difficulties have manifested in the upper elementary grades.

Additionally, the trajectory of a young person's academic success begins in the elementary grades, making it even more crucial to find ways to intervene and remediate deficits that persist into the upper elementary grades. When students experience a lack of success starting in elementary school, they may begin to disengage from school and be more inclined to drop out in the future (Dynarski et al., 2008). It is necessary to determine appropriate methods to intervene with students in the upper elementary years before they reach the secondary grades and are then faced with a multitude of additional academic and social challenges.

Rationale and research question

We conducted this synthesis to examine the effects of reading interventions for students with reading difficulties and disabilities in the upper elementary grades including students in grades 4–5. The findings are expected to contribute to the research and practice knowledge regarding interventions for students who struggle with reading beyond third grade. We addressed the following research question: How effective are reading interventions on reading outcomes for students with reading difficulties and disabilities in fourth and fifth grade?

Method

Selection of studies

Studies were identified through a two-step process. First, we conducted an electronic search of ERIC and PsychInfo for studies published in the last 20 years (1988–2007). Key disability search terms and roots (*reading difficult**, *disab**, *dyslex**, *special education*) were used in combination with key reading terms and roots (*reading*, *phonics*, *fluency*, *vocabulary*, *compreh**) to capture relevant articles. Second, we conducted a hand search of nine major journals (Exceptional Children, Journal of Educational Psychology, Journal of Learning Disabilities, Journal of Special Education, Learning Disabilities Quarterly, Learning Disabilities Research and Practice, Reading and Writing, Remedial and Special Education, and Scientific Studies of Reading) from 2006 through 2007 to ensure that all recently published studies meeting criteria were identified.

A total of 24 studies met selection criteria for the synthesis. Studies were selected based on the following criteria:

1. More than 50% of the participants in the study were enrolled in 4th or 5th grade, or were 9–11 years old. Studies with less than 50% of the participants in 4th/5th grade were included if data were disaggregated for the 4th/5th grade population.
2. Participants were struggling readers. Struggling readers were defined as low achievers, students with unidentified reading difficulties, dyslexia, and/or with reading, learning or speech/language disabilities. Studies also were included if disaggregated data were provided for struggling readers regardless of the characteristics of other students in the study.
3. The interventions targeted reading instruction and articles were published in English.
4. Reading intervention was provided for 15 sessions or more to ensure students with reading difficulties and disabilities received a sustained intervention prior to measurement of outcomes.

5. A reading intervention including word study, fluency, vocabulary, comprehension, or a combination of these was provided as part of school programming. Home teaching, clinic, or camp programs were excluded.
6. The research design was treatment-comparison, single-group, or single-subject.
7. Reading or reading related outcomes were measured.

Coding procedures

An extensive coding document was developed and used to organize essential information about each study. The code sheet was based on code sheets used in previous research (Edmonds et al. 2009; Vaughn et al. 2003) as well as the What Works Clearinghouse Design and Implementation Assessment Device (Institute of Education Sciences, 2003).

The pertinent information coded included the following: (a) participants, (b) methodology, (c) intervention and comparison information, (d) clarity of causal inference, (e) measures, and (f) findings. There were 3 coders for the articles. Interrater reliability was established by having each coder independently code a single article. Responses from each coder were used to calculate the percentage of agreement (i.e., agreements divided by agreements plus disagreements). Interrater reliability was calculated separately for each codesheet category (e.g., participants, design, etc.). An interrater agreement of 90% or above was achieved for each category (range 90–100%). Each study was then independently coded by 2 raters. If disagreements occurred, meetings were held to discuss the coding with final judgments reached by consensus.

Effect size calculation

In order to provide additional quantitative information for this systematic review of the literature, effect sizes were calculated where data were available. For studies with treatment and comparison groups, effect sizes were calculated adjusting for pre-test differences using a procedure by Bryant and Wortman (1984). The quantity of the pretest treatment mean minus the pretest comparison mean was divided by the quantity of the pretest comparison standard deviation. This quantity was subtracted from the quantity of the posttest treatment mean minus the posttest comparison mean divided by the posttest comparison standard deviation. Thirteen of the 24 studies in this synthesis used a treatment/comparison design (9 experimental and 4 quasi-experimental). Data for calculation of effect sizes were available in 10 of these 13 studies.

Results

Experimental and quasi-experimental studies

Nine experimental studies (Mason, 2004; Mathes & Fuchs, 1993; Miranda, Villaescusa, & Vidal-Abarca, 1997; O'Connor et al., 2002; O'Connor, White, & Swanson, 2007; Therrien, Wickstrom, & Jones, 2006; Takala, 2006; Torgesen et al., 2001; Xin & Rieth, 2001) and four quasi-experimental studies (Das, Mishra, & Pool, 1995 [Study 1 and 2]; Das-Smaal, Klapwijk, & van der Leij, 1996; Lederer, 2000) examined reading interventions for students with reading difficulties and disabilities in the fourth and fifth grade. Summaries of the study characteristics and findings are presented in Tables 1 and 2. We present the effects of these studies by the type of intervention that was implemented in the study (e.g., word recognition, fluency).

Vocabulary and comprehension—Five studies implemented interventions with a focus on comprehension skills and strategies (Lederer, 2000; Mason, 2004; Miranda et al., 1997; Takala, 2006; Xin & Rieth, 2001). All of these studies measured outcomes with researcher-developed measures that measured the specific skills taught in the intervention; no norm-referenced measures were administered. In one experimental study, Mason compared the

effects of a self-regulated strategy (Think before you reading, think While reading, think After reading [TWA]) to a second treatment of reciprocal questioning for students with both reading difficulties and disabilities. There was no business as usual or typical instruction control group. Students in the TWA intervention were taught to think about the author's purpose, think about what they already know, and think about what they want to learn prior to reading. During reading, students were taught to think about their reading speed, linking knowledge, and rereading sections. Finally, students developed the main idea for each paragraph and summarized the information after reading. In the reciprocal questioning condition, students were taught to generate questions for the teacher about the passage read as well as answer questions about the text from the teacher. Effects were higher at posttest for the TWA intervention on researcher-developed measures assessing main ideas, summarizing, and retell (mean ES = .99). Effects in favor of TWA were similar when measures were administered 3 weeks following intervention (mean ES = .90).

Miranda et al. (1997) also compared the relative effects of two interventions with a comprehension focus, self-instruction and self-instruction plus attribution training, to a control group that did not receive either of the interventions. Students with learning disabilities were identified for participation in the interventions. Self-instruction included training and practice in strategies for activating previous knowledge, previewing text, self-questioning, clarifying unknown words, and mapping main ideas. Students were also taught a general self-instruction procedure to follow when completing a reading task (i.e., Stop, Think and Decide, Check, Confirm, Evaluate). The self-instruction plus attribution condition consisted of all the elements in the self-instruction condition plus teacher modeling and student practice using positive attributions in relation to their work. As a result of the time spent on attribution training this treatment group spent less time on the comprehension skills and strategies. Students in the self-instruction condition outperformed students in the control condition at posttest on researcher-developed measures assessing main ideas, recall, and cloze (mean ES = 3.46). Students in the self-instruction plus attribution training also outperformed the control group on the posttest measures (mean ES = 2.63). Two months following the completion of intervention the same measures were administered with mean effect sizes of 1.98 and 2.09 for the self-instruction group and the self-instruction plus attribution training group respectively.

A third experimental study investigated student understanding of text with a focus on teaching target vocabulary words in two conditions (Xin & Rieth, 2001). Students with learning disabilities in both conditions read the same passages, were taught the same target vocabulary words to aid understanding of the passage, and completed the same comprehension activities. However, one group received video-assisted instruction, watching chapters of a videodisc with content related to the topic and including the target words while the second group received instruction using only printed texts. The video instruction group outperformed the nonvideo group on researcher-developed measures of word definitions and cloze using the vocabulary words taught during instruction (mean ES = .58). There were no differences between the groups on a researcher-developed measure of comprehension on the content taught in the interventions (ES = .02). Follow-up measures were administered 2 weeks following intervention with effects: (a) maintained in favor of the video instruction group for word definitions (ES = .53), (b) decreased for sentence cloze with the target words (ES = .16), and (c) consistent to the posttest for passage comprehension (ES = -.04).

The final two studies examined reciprocal teaching as an intervention for students with disabilities (Lederer, 2000; Takala, 2006). Lederer implemented reciprocal teaching in social studies instruction for students with learning disabilities in inclusive classrooms while Takala investigated the intervention for students with language and reading disabilities in special education classrooms in Finland. Neither study provided disaggregated data for the student participants meeting criteria for this synthesis that would allow for calculation of effect sizes.

However, Lederer ran analyses on disaggregated data for the students with learning disabilities and reported no significant differences between the treatment and control groups on researcher-developed comprehension measures of answering questions and generating questions. Students with learning disabilities in the treatment group significantly outperformed students in the control group on composing summaries ($p < .05$). Takala reported no significant differences between pretest and posttest scores for students with disabilities on researcher-developed measures of selecting the best title and main idea, and generating a question.

Fluency—Two experimental studies implemented interventions with a focus on fluency instruction (Mathes & Fuchs, 1993; O'Connor et al., 2007). Both studies examined treatment conditions using repeated reading of text or sustained/continuous reading of text along with a control condition. Mathes and Fuchs implemented the intervention with classwide peer-mediated instruction in special education resource rooms. Students with reading difficulties and disabilities in the O'Connor et al. study met one-on-one with an adult listener. In both studies, the number of minutes spent reading text was kept constant, with 9 min. of reading in the Mathes and Fuchs study (as well as 9 min. of listening to a peer) three times a week for 10 weeks, and 15 min of reading for the O'Connor et al. study implemented three times a week for 14 weeks. However, in the repeated reading condition of each study students reread the passages three times each. In the sustained or continuous reading conditions the students continuously read the text without repeating. In each condition either peers (Mathes & Fuchs) or the adult (O'Connor et al.) corrected errors during reading.

In the Mathes and Fuchs (1993) study, effects were low for the treatment conditions in comparison to the control condition across measures of fluency and comprehension (repeated reading mean ES = .08; sustained/continuous reading mean ES = .03). In contrast, higher effect sizes were found for both treatment conditions in the O'Connor et al. (2007) study across norm-referenced measures of fluency, word reading, and comprehension (repeated reading mean ES = .71; sustained/continuous reading mean ES = .69).

Word recognition—Four studies focused on word reading instruction as an intervention (Das et al., 1995 [Study 1 and Study 2]; Das-Smaal et al., 1996; Torgesen et al., 2001). In an experimental study, Torgesen et al. examined two treatment conditions for students with learning disabilities that differed in the extent of instruction in phonemic awareness and phonemic decoding skills. No control group was included in the design of this study. In the auditory discrimination in depth (ADD) condition students spent approximately 95% of the lesson working with sounds and individual words including introduction to individual phonemes, practice reading and spelling individual words regular words and instruction of irregular words. Students then practiced reading with decodable text. Alternatively, the students in the embedded phonics (EP) condition spent about 50% of the instructional time on sounds and individual words and 50% in connected text activities. Explicit instruction was provided in phonics and reading/spelling words along with ample opportunities for students to practice reading connected text using trade books and basals. The students were introduced to sounds and practiced reading and spelling regular and irregular words. The students practiced reading with trade books and the basal and wrote sentences containing words from their sight word lists. A number of standardized measures were administered at posttest, 1 year follow-up, and 2 year follow-up to assess phonological awareness, word reading, comprehension, fluency, spelling, and expressive and receptive language (see Table 2 for measures). A mean effect size of .16 on these norm-referenced measures was found at posttest in favor of the ADD group. These effect sizes increased for the ADD group at 1 year (mean ES = .29), and for the 2 year follow-up were consistent with posttest (mean ES = .13).

In two studies conducted by Das et al. (1995), the Planning, Attention, Simultaneous, and Successive Remedial Program (PREP) was implemented for students with reading disabilities.

Study 1 examined the full program including global (strategies such as rehearsal, categorization, and prediction for successive or simultaneous processing) and bridging (extending these strategies to word identification) components. In Study 2, one group of students received intervention in the global components only and, thus, practiced the strategies without words (e.g., sequencing geometric shapes) while a second group received intervention in the bridging components only and, thus, practiced the strategies only with words and text (e.g., sequencing letters to form a word and then reading the word). A control group in Study 1 became the treatment groups in Study 2 while the treatment group in Study 1 became the control group in Study 2. Thus, all students in Study 2 had received some form of PREP (global, bridging, or previously instructed combined program). In Study 1, students receiving PREP outperformed students in the no treatment control group on the word attack and word identification subtests of the Woodcock Reading Mastery Test (mean ES = .70). In Study 2, effect sizes on the same measures favored the global (mean ES = .10) and bridging (mean ES = .34) groups over the control group of students who had previously received the combined PREP program in Study 1.

The study by Das-Smaal et al. (1996) implemented a computer-based program for students to practice detecting multi-letter units in words in Dutch. Students assigned to the control group received computer-based training in mathematical exercises similar to the cognitive and motor exercises of the training program provided to the treatment group. Posttest measures assessed student accuracy and speed on the computer tasks, detecting units that were trained and untrained, and reading real and pseudowords. The treatment group performed significantly better than the control group on reaction time for detecting units and reading pseudowords ($p < .05$). No significant differences were reported on the accuracy of detecting units or reading real words. No norm-referenced measures were administered.

Multi-component—Two experimental studies examined the effects of a multi-component intervention for students with reading difficulties and disabilities (O'Connor et al., 2002; Therrien et al., 2006). O'Connor et al. included phoneme awareness, word recognition and spelling, fluency, and comprehension in a 30 min, one-on-one intervention. Students were randomly assigned to receive this treatment with text matched to their reading level (reading level matched), receive the treatment using text from the classroom (classroom matched), or a control condition. Both treatment conditions outperformed the control condition on norm-referenced measures of phonemic awareness, word reading, comprehension, and fluency (reading level matched mean ES = 1.56; classroom matched mean ES = 1.26).

Therrien et al. (2006) incorporated fluency and comprehension components in 10–15 min one-on-one intervention. Students in the treatment condition read a new passage 2–4 times with feedback to reach a pre-established number of correct words per minute. This fluency instruction was followed by scaffolded assistance answering factual, inferential, and story structure questions. The treatment group demonstrated higher effects in comparison to the no-treatment control group in oral reading fluency (ES = .44) and general reading achievement as measured by the Broad Reading scale of the Woodcock-Johnson Achievement Test III (ES = .37).

Single group and single subject studies

Eleven studies examined the effects of reading interventions for single groups or individual students with reading difficulties and disabilities by examining student improvement (Bruce & Chan, 1991; Butler, 1999; Daly & Martens, 1994; Ferkis, Belfiore, & Skinner, 1997 [Study 1 and 2]; Gillon & Dodd, 1997; Mason, Snyder, Sukhram, & Kedem, 2006; Rich & Blake, 1994; Taylor, Alber, & Walker, 2002; Thaler, Ebner, Wimmer, & Landerl, 2004; Wright & Mullan, 2006). We describe these studies and their outcomes by intervention type.

Comprehension—Four single subject studies implemented interventions with a comprehension focus (Bruce & Chan, 1991; Mason et al., 2006; Rich & Blake, 1994; Taylor et al., 2002). Following up on the experimental study of the self-regulated strategy TWA described earlier, Mason et al. implemented a single subject study of the TWA reading strategy instruction combined with PLANS (Pick goals, List ways to meet goals, And, make Notes and Sequence notes) writing strategy instruction. Three instructional groups of 3 students each were included in the study. Participants with both reading difficulties and disabilities were included. Reading outcome measures consisted of oral and written retells of expository science or social studies passages. Students were scored according to the number of information units included in the retell as well as the quality of the retell. Quality was rated on a 7-point scale (0 points to 6 points) researcher-developed scale based on the student capturing the main ideas of the passage in the retell. Mean increases in information units from baseline to postinstruction ranged from 5.34–5.86 for oral retell and 8.23–18.87 for written retell across the three instructional groups. Mean increases in quality scores ranged from 2.17 to 3.00 for oral retell and 2.47–3.00 for written retell.

Rich and Blake (1994) also implemented a comprehension intervention that included instruction in self-regulated learning. Students with language/learning disabilities received instruction in identifying main ideas, self-questioning, and paraphrasing with the teacher reading the expository text. During the intervention, students kept daily journals evaluating their cognitive and affective behaviors. Reading outcomes were measured with expository passages excerpted by the researchers from informal reading inventories and students responded to 8 questions about each passage. The authors report that all 5 students made improvements from the pretest to the posttest in listening comprehension with scores on the outcome measure ranging from 56–100% (2 students below 75% on posttest). Four of the students also improved from pretest to posttest in reading comprehension with scores ranging from 63–100% on the posttest measure (1 student below 75% on posttest).

However, Bruce and Chan examined reciprocal teaching in the resource room as well as techniques for assisting students with reading difficulties in generalizing strategies learned to the general education classroom. Student's total comprehension scores on measures that included main ideas and passage details increased to 75–90% accuracy (with average baseline levels ranging from 16–20%). However, no unprompted transfer of skills was reported and student levels were lower in the transfer phase than in the resource room instructional phase.

Taylor et al. implemented an alternating treatments design to examine the effects of story mapping, self-questioning, and no intervention for individual students with learning disabilities. The accuracy of students' responses during each phase of instruction was collected. Two of the students in this study met criteria for inclusion for this synthesis. One student, Joseph, demonstrated slightly higher comprehension scores in the self-questioning and story mapping conditions over the no intervention phase. The second student, Michelle, had some overlap in scores between the no intervention and intervention phases initially with scores improving further during the intervention phases. Accuracy was high for both students in each of the intervention conditions (80.9 and 86.4% for Joseph and Michele in story mapping; 88.2 and 94.6% for Joseph and Michele in self-questioning).

Fluency—One fluency intervention with students with learning disabilities utilized a single subject study (Daly & Martens, 1994). A multi-element design was used to compare student accuracy and fluency under 3 pre-reading conditions: (1) subject passage preview with the student doing a first read of the passage without help from the teacher, (2) taped words with the student reading a word list of words from the passage along with an audio tape speeded at 80 words per minute, or (3) listening passage preview with the subject following along in the text while listening to the passage read on audiotape. Following each of these prereading

conditions, the student read the passage for assessment. The largest increases for oral reading accuracy and fluency were seen under the listening passage preview. However, no discernible differences between baseline and the three conditions could be seen on word list reading.

Word reading—Six single group or single subject studies examined student outcomes from interventions focusing on word reading instruction (Butler, 1999; Ferkis et al., 1997 [Study 1 and 2]; Gillon & Dodd, 1997; Thaler et al., 2004; Wright & Mullan, 2006). Four of the studies incorporated training in sight word reading: students practicing reading unknown words to mastery with a peer (Butler), an adult (Ferkis Study 1 and 2), or a computer (Thaler et al.). Butler reported an increase in word reading on words taught from 50–79% for students with reading disabilities. Similarly, Ferkis et al. reported students with learning disabilities mastered 12–14 words taught in each condition of Study 1 and 2, with one student obtaining mastery of 21–23 words taught during the intervention phases. Study 1 consisted of 2 conditions, one with 1 correct response per word required in each training session and a second condition requiring 5 correct responses per word during training. Study 2 continued with similar conditions to Study 1 except that students practiced the set of words three times. No discernible differences in the number of words learned based on the number of repeated responses required during training in either Study 1 or Study 2 were noted. Thaler et al. measured the reading time on trained words following intervention for students with reading difficulties and found that students showed decreases in reading time for the words following intervention. The students who pretested with higher reading times made the most gains in decreasing their reading times.

Two of the word reading interventions taught phonological skills to students with reading disabilities and measured students' phonological awareness, reading accuracy, and comprehension using standardized measures of general skills in these areas (Gillon & Dodd, 1997; Wright & Mullan, 2006). All students made gains in each area from pretest to posttest. The largest gains appeared on the phonological measures for both studies.

Discussion

The primary purpose of this research synthesis was to determine the effectiveness of reading intervention for students in the upper elementary grades (fourth and fifth grade) on reading outcomes. We prioritized this grade group because previous syntheses have examined extensively the effectiveness of reading practices for students in grades K-3 (e.g., McCardle & Chhabra, 2004) and more recently reading interventions for older students (e.g., Edmonds et al., 2009; Scammacca et al., 2007) leaving many upper elementary teachers unclear about how these findings apply to their instruction. In addition, considerable evidence suggests that student's reading comprehension takes a negative turn in the upper elementary grades, often referred to as the "fourth grade slump" (Chall & Jacobs, 2003), and determining research-based practices for intervening is important.

Overall, the number of experimental studies available for analysis was relatively few ($n = 9$) and represented a range of treatment foci that included comprehension, word reading, fluency, vocabulary, and two that were multi-component addressing multiple elements of reading. The largest number of experimental studies ($n = 5$) addressed reading comprehension or vocabulary development and all of these studies used researcher-developed measures to address outcomes. We think it is encouraging that the majority of outcomes for the comprehension and vocabulary treatments yielded effects that were moderate to large in size. However, it is typical for researcher-developed measures to yield higher effect sizes (Swanson, Hoskyn, & Lee, 1999). This provides support for the influence of vocabulary and comprehension interventions on improving students' understanding of text. However, the confidence in these findings would be more robust if the studies had not relied solely on researcher-developed measures. For vocabulary treatments, it is common that researcher-developed measures are used to tap the

extent to which students learn the vocabulary words taught (Scammacca et al., 2007). The rationale is that most vocabulary interventions are not perceived as being powerful enough to influence more broadly acquisition of untaught vocabulary which is what would be measured on more normative vocabulary measures (Scammacca et al.). The use of researcher-developed measures for comprehension is less necessary and it would be expected that researchers would use norm-referenced measures either solely or in combination with researcher-developed measures to assess the effects of treatment. Considering these caveats, we have learned from both the experimental studies and single-subject studies that for upper elementary students, comprehension practices that provided opportunities for students to preview text and connect with their knowledge, use self-questioning and self-regulating practices while reading, and summarize what they are learning were associated with moderate to high outcomes. It may be that these practices enhance the language functioning of target students with reading comprehension problems, many of whom are likely to also demonstrate low language (Nation, Clarke, Marshall, & Durand, 2004). These findings are in line with a previous research syntheses on reading comprehension outcomes with older students (Edmonds et al., 2009; Scammacca et al., 2007).

Two of the studies addressed fluency in which repeated reading of text was compared with continuous reading. The amount of time students read the text was held constant but in one treatment condition students read the text only one time and continuously (sustained/continuous treatment) and in the other condition the text was read three times (repeated reading). Findings in one of the studies (Mathes & Fuchs, 1993) yielded very low effects for both treatment conditions using peers, whereas in the second study (O'Connor et al., 2007) moderate to large effects for fluency and comprehension resulted when students were paired with adults. Because these two studies do not provide converging outcomes for students with reading difficulties and disabilities, we would suggest that teachers integrate both repeated reading and continuous reading into their interventions and monitor students' progress to determine effectiveness. Also, it appears as though an adult or very able reader as a model is associated with improved fluency outcomes (Daly & Martens, 1994).

Word study interventions that assisted students in learning to map the sounds of language to letters and words were associated with small to moderate effects for fourth and fifth graders. In contrast to the comprehension interventions that may have inflated effects due to the administration of researcher-developed outcome measures, the three word recognition studies providing data for effect size calculation administered norm-referenced measures at posttest. The Edmonds et al. (2009) meta-analysis examining interventions for secondary students with reading difficulties also revealed that reading comprehension outcomes were positively affected by word study treatments; however as with the current studies, the results were small to moderate. These findings are similar to previous research that suggests for many students oral language proficiency as well as phonological knowledge relates to their course of reading development (Nation & Snowling, 2004).

It also likely that many students with reading difficulties or disabilities in fourth and fifth grade may continue to have word recognition difficulties; whereas other students suffering from the "fourth grade slump" may struggle more specifically with the increased vocabulary and understanding the variety of complex texts in the content areas. Thus, a word recognition treatment may have a greater effect for students who continue to struggle with word recognition. None of the studies synthesized has examined differential effects for students participating in the interventions based on level of reading, but investigation in this area may help further explain effects.

Only two studies in this synthesis examined multi-component reading interventions. The findings of these two studies revealed that treatments that included two or more components

of reading (e.g., word study and comprehension) were associated with moderate to large effects. The value of multi-component interventions for older students was confirmed in three syntheses examining the effects of treatments with secondary students (Kamil et al., 2008; Scammacca et al., 2007; Torgesen et al., 2007). Our interpretation of these findings is that older students may benefit when interventions focus on more than one element of reading. However, given the very small number of multi-component studies for students in grades 4–5 as well as the range of effects reported, additional research is needed to confirm the positive effects for multi-component interventions.

Summary of implications and further research

This synthesis of research for students with reading difficulties and disabilities in the upper elementary grades suggests: (a) instruction in comprehension strategies for application before, during, and after reading produces increased comprehension outcomes on researcher-developed measures, (b) mixed results for fluency interventions, (c) limited evidence (one study) for the effects of vocabulary instruction, and (d) multi-component interventions demonstrate promise for increasing student outcomes on a variety of measures. Fourth graders who struggle with reading can demonstrate a range of distinctive patterns of performance that contribute to their low reading comprehension difficulties and represent variation in performance on word identification, phonemic awareness, comprehension, vocabulary, rate of reading and expression (Buly & Valencia, 2002). Future research may implement interventions that consider the type of reading comprehension problem and mapping interventions to specific comprehension problems.

Based on the current research, we also conclude that further research is needed to examine the effects of comprehension interventions on broad comprehension outcomes with standardized measures. Furthermore, we located only one vocabulary study and two multi-component studies for students with reading difficulties in the upper elementary grades. While previous syntheses have reported large effects for vocabulary interventions for secondary readers (Kamil et al., 2008; Scammacca et al., 2007) and moderate effects for multi-component interventions (Edmonds et al., 2009; Scammacca et al., 2007), additional work is needed to determine the effects of these interventions for upper elementary students.

E.D. Hirsch (2003) states, “We’re finding that even though the vast majority of our youngest readers can manage simple texts, many students—particularly those from low-income families—struggle when it comes time in grade four to tackle more academic texts.” (p. 10). This synthesis was designed to reveal those instructional practices that research documents are associated with improved outcomes for upper elementary students with reading difficulties. While this synthesis, like many in education, is only as good as the extant research, we believe that the findings from this report provide initial guidance to teachers and educators about practices that they can integrate into their interventions.

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Table 1

Summary of study characteristics

Study	N	Grade/age	Duration	Implementer	Design
Vocabulary and comprehension					
Bruce & Chan (1991)	2 SR	5th	18, 30 min sessions	Researchers	Single subject
Lederer (2000)	25 LD	4th–6th*	15–17, 45 min sessions	Researcher	Quasi-experimental
Mason (2004)	32 SR (2 LD)	5th	11–15, 20 min sessions	Researcher	Experimental
Mason et al. (2006)	9 SR (2 LD)	4th	18 + sessions	Researcher	Single subject
Miranda et al. (1997)	60 LD	5th–6th*	20, 50 min sessions	Researcher	Experimental
Rich & Blake (1994)	5 LI	4th–5th	16, 45 min sessions	Teachers	Single subject
Takala (2006)	16 SLI	4th	15, 45–90 min sessions	Teacher & Researcher	Experimental
Taylor et al. (2002)	2 LD	10–11 years	5, 40 min sessions	Teacher	Single subject
Xin & Rieth (2001)	76 LD	4th–6th*	18, 30 min sessions	Teachers	Experimental
Fluency					
Daly & Martens (1994)	3 LD	10–11 years	21 sessions	Teacher & Researcher	Single subject
Mathes & Fuchs (1993)	67 LD	4th–6th*	30, 25–40 min sessions	Teachers	Experimental
O'Connor et al. (2007)	37 SR (16 LD)	2nd, 4th*	~42, 15 min sessions	Researchers	Experimental
Word recognition					
Butler (1999)	10 LD	4th–5th	30–37, 15 min sessions	Teacher	Single subject
Das et al. (1995): Study 1	51 RD	8–11 years*	15, 50–60 min sessions	Researchers	Quasi-experimental
Das et al. (1995): Study 2	51 RD	8–11 years*	15, 50–60 min sessions	Researchers	Quasi-experimental
Das-Smaal et al. (1996)	33 RD	9–10 years	16, 30 min sessions	Researchers	Quasi-experimental
Ferkis et al. (1997): Study 1	3 LD	4th	23–27 sessions	Researcher	Single subject
Ferkis et al. (1997): Study 2	2 LD	4th	12–17 sessions	Researcher	Single subject
Gillon & Dodd (1997): Experimental 2	10 RD	10–11 years	12–20 h	School support staff	Single group
Thaler et al. (2004)	3 SR	4th	11–25, 15 min sessions	Researcher	Single group
Torgesen et al. (2001)	60 LD	8–10 years*	80, 50 min sessions	Researchers	Experimental
Wright & Mullian (2006)	10 RD	9–11 years	mean of 23.4 h	Researcher	Single subject
Multi-component					
O'Connor et al. (2002)	46 SR (25 LD)	3rd–5th*	~65, 30 min sessions	Researcher	Experimental

Study	N	Grade/age	Duration	Implementer	Design
Therrien et al. (2006)	30 SR (16 LD)	4th–8th*	50, 10–15 min sessions	Researchers	Experimental

SR Struggling readers; LD learning disabilities; RD reading disabilities; LI language impaired; SLI speech/language impaired

* More than 50% of participants in 4th–5th grade or 9–11 years old

Table 2

Summary of study findings

Study/Intervention	Measures	Findings
Vocabulary and comprehension		
Bruce & Chan (1991)	Comprehension questions (RD)	Baseline T 0–30% 40–100%
<ul style="list-style-type: none"> • <i>T (Reciprocal Teaching)</i>: Teacher modeling of question generating, summarizing, clarifying, and predicting with text followed by student application in partners in resource room. Generalization prompting provided for homework reading and social studies settings 	<i>RD Measures</i>	ns
Lederer (2000)	Answering Questions	ns
<ul style="list-style-type: none"> • <i>T (Reciprocal Teaching)</i>: Questioning, summarizing, predicting, and clarifying taught then used in collaborative groups with social studies text 	Question generation	T > C ($p < .05$)
<ul style="list-style-type: none"> • <i>C (Control)</i>: Typical social studies instruction 	Summary composition	
Mason (2004)	<i>RD Measures</i>	Posttest F-U
<ul style="list-style-type: none"> • <i>T1 (Think Before Reading, While Reading, After Reading [TWA])</i>: Nine comprehension strategies taught with self-regulation strategies for use before, during, and after reading text with practice in pairs 	Main idea	1.88 1.08
	Summary	1.00 .94
	Oral retell quality	1.59 .82
	Oral retell information	1.25 .72
<ul style="list-style-type: none"> • <i>T2 (Reciprocal Questioning)</i>: Strategies for question asking taught. Question asking practiced in collaborative groups after silent reading 	Oral retell main ideas	1.11 .94
	Written retell quality	.09 na
	Written retell information	.63 na
	Written retell main ideas	.33 na
Mason et al. (2006)	<i>RD Measures</i>	Baseline Means Posttest Means
<ul style="list-style-type: none"> • <i>T (TWA + Pick Goals, List Ways to Meet Goals, And, Make Notes and Sequence Notes)</i>: TWA as described in Mason (2004), plus a strategy for writing essays 	Oral Retell Quality	.89–1.33 3.11–4.33
	Oral Retell Information	3.47–4.33 9.33–10.17
	Written Retell Quality	1.00–1.67 3.47–4.44
	Written Retell Information	3.44–5.08 11.67–22.67
Miranda et al. (1997)	<i>RD Measures</i>	T1 vs. C F-U T2 vs. C F-U
<ul style="list-style-type: none"> • <i>T1 (Self-instruction Training)</i>: 5 questions taught for regulating work. Activating knowledge, previewing, questioning, clarifying, and mapping also taught 	Main Idea	1.93 2.35 1.37 1.95
	Recall	5.89 2.01 4.67 3.24

Study/Intervention	Measures	Findings
<ul style="list-style-type: none"> • <i>T2 (Self-instruction plus Attribution Training)</i>: T1 plus training in giving positive attributes • <i>C (Control)</i>: No training 	Cloze	2.56 1.57 1.85 1.07
Rich & Blake (1994)	<i>RD Measures</i>	Pretest (8 total)
<ul style="list-style-type: none"> • <i>T (Strategy Training)</i>: Main idea, paraphrasing, self-questioning, and predicting/activating knowledge taught along with self-evaluation. Teachers read the text 	Listening Comp. Questions	1–6 4.5–8
Takala (2006)	Reading Comp. Questions	2–6 5–8
<ul style="list-style-type: none"> • <i>T (Reciprocal Teaching)</i>: Prediction, clarification, questioning, and summarizing strategies taught with whole group 	<i>RD Measures</i>	ns
<ul style="list-style-type: none"> • <i>C (Control)</i>: Typical instruction 	Summarizing	ns
Taylor et al. (2002)	Questioning	ns
<ul style="list-style-type: none"> • <i>T1 (Story Mapping)</i>: Taught story elements and story mapping procedure • <i>T2 (Self-Questioning)</i>: Taught self-questioning and answering procedure • <i>C (No Intervention)</i>: Assessment only 	Comp. Questions Correct (RD)	C 4–9 6–10 7–10
Xin & Rieth (2001)	<i>RD Measures</i>	Posttest
<ul style="list-style-type: none"> • <i>T (Video Instruction)</i>: Videos and class discussion used to teach content vocabulary 	Word Definitions	.64 .53
<ul style="list-style-type: none"> • <i>C (Traditional Instruction)</i>: Dictionaries and class discussion used to teach content vocabulary 	Sentence Cloze	.51 .16
Fluency	Passage Comprehension	.02 -.04
Daly & Martens (1994)		Baseline
<ul style="list-style-type: none"> • <i>T1 (Subject Passage Preview)</i>: Student read passage without help • <i>T2 (Taped Words)</i>: Student read word list with audiotape • <i>T3 (Listening Passage Preview)</i>: Student followed along in passage with audiotape 	Words Correct Passage	T1 55–70 58–80 55–73
Mathes & Fuchs (1993)	Words Correct List	34–45 45–58 46–58
<ul style="list-style-type: none"> • <i>T1 (Sustained Reading)</i>: Peer tutoring with text reading orally continuously • <i>T2 (Repeated Reading)</i>: Peer tutoring with text read 3x • <i>C (Control)</i>: Typical school instruction 	WCPM Passage	12–27 11–46 9–30 15–59
O'Connor et al. (2007)	WCPM List	4–11 5–24 7–26 6–18
	CRAB Words Correct	T1 vs. C .16 .12
	CRAB Questions Correct	.07 .20
	CRAB Mazes Correct	-.14 -.09
		T1 vs. C T2 vs. C

Study/Intervention	Measures	Findings
<ul style="list-style-type: none"> • <i>T1 (Repeated Reading)</i>: Students read each page 3 times • <i>T2 (Continuous Reading)</i>: Students read text continuously • <i>C (Control)</i>: Typical school instruction 	GORT 4 Fluency	.52
	GORT 4 Comprehension	.67
	WRMT Word ID	.41
Word recognition	WRMT WA	.61
	WRMT PC	.75
	WCPM	.88
	Sight Words Acquired (RD)	40–79 words
Butler (1999)		
<ul style="list-style-type: none"> • <i>T (Classwide-Peer Tutoring)</i>: Students worked in partners to teach/practice new sight words, taking turns as the tutor 	WRMT Word ID	.57
Das et al. (1995): Study 1	WRMT WA	.82
<ul style="list-style-type: none"> • <i>T (Planning, Attention, Simultaneous, and Successive Remedial Program [PREP])</i>: Sequencing, categorization, matching, and sound blending were practiced through global (without words) and bridging (with words) tasks • <i>C (No Treatment)</i> 	WRMT Word ID	T1 vs. C
Das et al. (1995): Study 2	WRMT WA	T2 vs. C
<ul style="list-style-type: none"> • <i>T1 (PREP Global tasks only)</i> • <i>T2 (PREP Bridging tasks only)</i> • <i>C (Control)</i>: Study 1 T students. No further intervention 	WRMT Word ID	-.24
Das-Smaal et al. (1996)	WRMT WA	.44
Das-Smaal et al. (1996)	<i>RD Measures</i>	
<ul style="list-style-type: none"> • <i>T (Unit Detection Training)</i>: Computer-based program for detecting multiletter units within words with feedback on speed and accuracy 	Trained Unit RT	T > C ($p < .05$)
<ul style="list-style-type: none"> • <i>C (Math)</i>: Computer-based program similar to T but with mathematical exercises provided 	Trained Unit Accuracy	ns
	Untrained Unit RT	T > C ($p < .05$)
Ferkis et al. (1997): Study 1	Untrained Unit Accuracy	ns
	Word RT	ns
	Word Accuracy	ns
	Flash Pseudowords	T > C ($p < .05$)
<ul style="list-style-type: none"> • <i>T1 (Single Response/SR)</i>: Practice each word 1x • <i>T2 (Repeated Response/RR)</i>: Practice incorrect words 5x 	<i>RD Measures</i>	T1
	Word Reading	13–14 words
	Training Time per Word	33.8–40.3 s
Ferkis et al. (1997): Study 2	<i>RD Measures</i>	T1
<ul style="list-style-type: none"> • <i>T1 (SR)</i>: 3 practice trials with 1 response per word 	Word Reading	13–23 words
		12–21 words

Study/Intervention	Measures	Findings
<ul style="list-style-type: none"> • T2 (RR): 3 practice trials with 5 responses per word 	Training Time per Word	45.3–52.2 s 89.1–98.1 s
Gillon and Dodd, Experiment 2, 1997	LAC	Pretest 44–88% Posttest 82–100%
<ul style="list-style-type: none"> • T (Phonological Processing Skills): Segmenting, manipulating, and blending sounds in syllables and integration to print 	NARA Accuracy (AE)	7.2–9.8 8.6–11.6
	NARA Comp. (AE)	7.1–10.6 7.8–12.3
Thaler et al. (2004)	Reading Time for Trained Words (RD)	All three students decreased reading time from pretest to posttest. 5 week follow-up showed an increase in time from the posttest, but still below pretest levels
<ul style="list-style-type: none"> • T1 (Passive): Words presented with computer pronunciation. Words then reappear with onset highlighted and pronounced followed by highlighting and pronunciation of each sound of onset. Student then reads word • T2 (Active): Same as T1 but student pronounced onset and graphemes 		
Torgesen et al. (2001)		T1 vs. T2 F-U 1 F-U 2
<ul style="list-style-type: none"> • T1 (Auditory Discrimination Depth): PA, encoding, and decoding taught with articulatory cues. Reading decodable text and questioning included 	WRMT WA	.91 .59 .36
	WRMT Word ID	-.09 .11 -.03
	WRMT PC	-.12 .05 -.26
<ul style="list-style-type: none"> • T2 (Embedded Phonics): Phonemic decoding and encoding taught. Reading in trade books, writing sentences with new words, and fluency of word reading included 	TOWRE PDE	.16 .38
	TOWRE SWE	-.09 .19 .13
	GORT-III Accuracy	.50 .56 .42
	GORT-III Rate	.44 .24 .18
	GORT-III Comp.	.46 .67 .54
	CELF Total	.33 .30 .38
	LAC	.72 .72 -.003
	CTOPP Elision	-.17 -.17 -.48
	KTEA Spelling	-.58 .16 -.09
	Developmental Spelling	-.35 .45 .16
Wright & Mullian (2006)	Phoneme Manipulation	Pretest 1–6 5–10
<ul style="list-style-type: none"> • T (Phono-Graphix): Phonics instruction including basic advanced code and multisyllabic word reading 	Segmentation	15–38 58–63
	Blending	7–14 13–15

Study/Intervention	Measures	Findings
Multi-component		
O'Connor et al. (2002)	Code Knowledge NARA (SS) Vernon Spelling Test (SS)	22-50 74-88 75-87 60-96 70-101 74-93
• <i>T1 (Reading-Level Matched)</i> : PA, phonics, reading text, fluency, and comprehension taught with text at students' reading level	CBM Segmenting	T1 vs. C 1.56 1.25
• <i>T2 (Classroom Matched)</i> : T1 with text from general class	WRMT Word ID	1.16 1.07
• <i>C (Control)</i> : Typical school instruction	WRMT WA WRMT Comp. WCPM ARI Comprehension DIBELS ORF	2.00 1.39 1.35 1.87 .44 1.76
Therrien et al. (2006)	WJ-III BRC	.37
• <i>T (Reread-Adapt and Answer-Comprehend [RAAC])</i> : Student reread the passage 2-4x to meet fluency criterion, then answered questions with scaffolding		
• <i>C (Control)</i> : No treatment		

T, Treatment; RD, Researcher-developed; WCPM, words correct per minute; C, comparison/control group; WRMT, Woodcock Reading Mastery Test-Revised; Word ID, word identification; WA, word attack; PC, passage comprehension; RT, response time; ns, non-significant; LAC, Lindamood Auditory Conceptualization Test; NARA, Neale Analysis of Reading Ability; AE, age equivalent; Comp., comprehension; F-U, Follow-up; na, not applicable; CRAB, Comprehensive Reading Assessment Battery; CBM, Curriculum-Based Measure; ARI, Analytical Reading Inventory; GORT-4, Gray Oral Reading Tests 4th Ed.; DIBELS, Dynamic Indicators of Basic Early Literacy Skills; ORF, oral reading fluency; WJ-III, Woodcock Johnson III: BRC, Broad Reading Cluster; TOWRE, Test of Word Reading Efficiency; GORT-III, Gray Oral Reading Test 3rd Ed.; CELF, Clinical Evaluation of Language Fundamentals; LAC, Lindamood Auditory Conceptualization Test; PDE, phonetic decoding efficiency; SWE, sight word efficiency; CTOPP, Comprehensive Test of Phonological Processing; KTEA, Kaufman Test of Educational Achievement; SS, standard score