Reading Comprehension Interventions for Students with Learning Disabilities or Reading Difficulties in Grades 3-12: A Literature Review, 2006-2011

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Reading Comprehension Interventions for Students with Learning Disabilities or Reading Difficulties in Grades 3-12: A Literature Review

The skill of reading is used in nearly all classes in school from music and art classes to physics and government classes. A deficit in reading will therefore negatively and dramatically impact a student's entire academic endeavor. Eighty is the percentage frequently cited for the number of students with learning disabilities (LD) who have significant reading problems (Antoniou & Souvignier, 2007; E. A. Polloway, personal communication, September 26, 2011; Department of Education, 2011; LD Online, n.d.), which makes it critical to identify effective strategies that these students with LD can apply to extract useful meaning from text. Research toward this end has been ongoing for over three decades (Berkeley, Scruggs, & Mastropieri, 2010; Garner & Reis, 1981; National Reading Panel, 2000; Senf & Comrey, 1975) and has found that "a variety of interventions are very effective in improving reading comprehension of students with LD" (Berkeley et al., 2010, p. 433).

Some of these interventions have sufficient accumulated evidence to be labeled as evidence-based practice (EBP) for increasing reading comprehension in students with learning disabilities, for instance, cognitive strategy instruction for expository text reading (Jitendra, Burgess, & Gajria, 2011). Other interventions, such as self-monitoring, may have significant research showing positive outcomes in reading comprehension for students with LD but not yet be labeled as EBP (Joseph & Eveleigh, 2011). Still other interventions have been mainly studied for effect on reading comprehension in students without disabilities yet show a promising outlook for students with disabilities. For instance, in their meta-analysis of effects of classroom discussion on text comprehension, Murphy, Wilkinson, Soter, Hennessey, and Alexander (2009) found that "use of … discussion approaches appears to be more potent for students of below average ability

than for students of average or above-average ability" (p. 760). Continued analyses of the intervention literature add to the body of evidence necessary to identify certain strategies as EBP. Increasingly, the label of EBP is required as a justification for trying certain educational interventions, but more importantly, it is being used as a guide in making instructional planning decisions so that limited instructional time is efficient and most likely to result in successful outcomes.

Three recent comprehensive syntheses of research in reading comprehension interventions with students with learning disabilities covered periods through 2005 or 2006. Sencibaugh (2007) produced a meta-analysis (spanning the years 1985-2005) of reading comprehension interventions for students with learning disabilities. He classified the research into two categories: visually dependent strategies (e.g., text enhancements; n=3); and auditory/language dependent strategies (e.g., summarization; n=12). Berkeley et al. (2010) created a meta-analysis (spanning the years 1995-2006) of reading comprehension instruction for students with learning disabilities. They classified the research into three categories: copyrighted fundamental reading skills programs, text enhancements (e.g., graphic organizers, video vocabulary instruction), and teacher-questioning/strategy instruction. Both of these two meta-analyses concluded that nearly any systematic comprehension instruction will have statistically significant positive outcomes. Gajria, Jitendra, Sood, and Sacks (2007) published a research synthesis (spanning the years 1978-2005) of comprehension instruction for expository texts for students with learning disabilities. They divided the research studies into two categories: content enhancement and cognitive strategy instruction, and found that both had large effect sizes though strategy instruction interventions were higher (1.06 to 2.07).

This current review of reading comprehension strategies covers the years since the three previous syntheses and classifies the studies in the review into two categories: student-directed and teacher- or computer- directed (i.e., requiring external assistance beyond a paper prompt). Although the student-directed strategies included various types (e.g., story maps, previewing, self-questioning and answering, self-monitoring of strategy use, activating prior knowledge) and the teacher- or computer- assisted strategies had varied formats (e.g., practicing words or text to fluency, learning vocabulary, identifying motivation and interest, providing simultaneous audio broadcast of text, providing computerized story maps with drop-down menu choices), the salient difference between the two groups was whether or not the strategy could be generalized to future situations in which the student had no external tools or assistance.

The purpose of this review is to summarize recent scientific studies of various reading comprehension interventions for students with reading difficulties in grades 3-12 in order to provide a quick reference for administrators and educators who are interested in the latest research on reading comprehension interventions. Additionally, research findings are presented on how to increase the frequency of effective instruction of reading comprehension in the classroom.

Selection Criteria and Design

During the months of September and October 2011, EBSCO Host was used to search the ERIC and Education Research Complete databases for studies. Filters were set to peer-reviewed journals published during 2006 through October 2011. Searches included different combinations of the terms *reading comprehension, strategies, strategy instruction,* and *learning disabilities* and the returned articles were examined for relevance.

Selection Criteria

Sencibaugh's meta-analysis (2007) was chosen as a design model for the current review. The Sencibaugh analysis used five inclusion criteria for selection: participants in grades K-12; participants identified with either a learning disability based on the ability (i.e., IQ) versus achievement (i.e., standardized test) discrepancy model, or a reading disability based on below average reading scores on a standardized test; a reading comprehension measure in place to assess effects of an intervention; an experimental design; and sufficient information to calculate effect size (p.10). The current review adapted some of the Sencibaugh guidelines, establishing the following four criteria for inclusion (which are elaborated below):

1. Participants in grades 3-12.
2. Participants identified with either a learning disability or significant reading difficulty.
3. Reading comprehension measure.
4. Experimental design

Participants in grades 3-12. Comprehension interventions for students in grades 3-12 are the topic of this study. In grades K-2, the instructional focus is on *learning to read* (decoding) versus *reading to learn* (comprehension) and the students in the few studies found which otherwise met selection criteria tended to be "at risk" for a future reading disability, rather than already identified (e.g., Berninger, Abbott, Vermeulen, & Fulton, 2006; Ryder, Tunmer, & Greaney, 2008; Torgesen, Wagner, Rashotte, Herron, & Lindamood, 2010).

Learning disability or significant reading difficulty. The wide variety in diagnostic criteria for learning disabilities among states (and countries) required that some measure of reading difficulty also suffice for inclusion in the review. For the purposes of this study, reading difficulties were defined as having grade-equivalent scores of at least 0.5 year behind grade level in elementary school, 1 year behind grade level in middle school grades, or 2 years behind grade

level in high school grades as measured by a standardized reading test. For instance, although Ridge and Skinner (2011) otherwise met the selection criteria and they identified their three students as having "reading skills deficits" (p. 46), the 9th grade students had grade-equivalent scores of 8-5, 8-7, and 9-0 on the *Wechsler Individual Achievement Test, Second Edition (WIAT-II) comprehension subtest*, which caused the study to be eliminated from this review.

A study that researched an intervention on participants without disabilities could qualify for this review if it included data that was broken out for participants identified with either a learning disability or with reading difficulties (as defined by this current review).

Reading comprehension measure. To be included the study must have contained a measure of reading comprehension that was used for both the comparison and the treatment group. A study by Wade, Boon, and Spencer (2010) was eliminated because although they named their measure as a reading comprehension measure, the measure actually was comprised of identification of nine story grammar elements; for the purposes of this study, comprehension questions needed to show that the knowledge could be generalized from identifying the story grammar to answering questions about the content.

Experimental Design. "The study must involve a treatment-comparison design" (Sencibaugh, p. 10). Although Bråten, Amundsen, and Samuelstuen (2010) measured comprehension success in students with dyslexia, they did not implement a treatment but rather surveyed strategies already used by the students; therefore, they were not included in this review.

Effect size. Calculation of effect size was not included as a selection criterion because the aim of this paper is a literature review and not an analysis. Therefore, it was not necessary to require sufficient information to compute statistical effect sizes.

Research Selected

Twenty articles were found that met the selection criteria and they were divided into two categories: (1) interventions which could, once mastered, be applied by the student alone, with little or no external support (e.g., no more than a paper prompt sheet, which could theoretically be faded out eventually) (n=11; Table 1), and (2) interventions which required external support (i.e., either in the form of teacher questioning/instruction or computer assistance) (n=9; Table 2). This division, in part, was chosen because it produced the most even distribution between categories but there is a practical aspect to this division as well: which are strategies that students with learning disabilities can take with them as internal tools and have available in nearly any situation and which are not?

Interventions: Self-directed Strategies

Eleven of the twenty studies used interventions that taught combinations of self-directed strategies such as previewing, setting a purpose, self-questioning, summarizing, self-monitoring and using story map prompts independently (see Table 1). All studies except one (which used a standardized comprehension measure) contained a reading comprehension measure that was composed of criterion-referenced questions which were either researcher developed (n=6) or were from the curricular materials (n=4). The time frame for interventions ranged from three days to one year. Where effect size is described, terms follow Cohen's definintion: .20 = small, .50 = medium, and .80 = large or significant. The studies are each briefly discussed below.

Antoniou and Souvignier (2007) created a program, which included an explicit teacher manual and specialized student workbooks, to train forty-five 5^{th}-8^{th} grade students with LD who had reading deficits at least two years below grade level in large group classes (both segregated

and inclusive) in several cognitive and metacognitive strategies for reading comprehension. The five units of the program covered: the value of a systematic and strategic approach; recognizing prior knowledge, identifying narrative vs. expository text structures, and predicting; monitoring for comprehension and finding meaning of unknown words; summarizing based on text genre; and self-regulation via a checklist plan. The year-long program showed that students who received the specialized instruction significantly outperformed students who received only the regular curriculum on a researcher-developed reading comprehension measure (seven multiple choice and five open-ended questions).

Berkeley, Marshak, Mastropieri, and Scruggs (2011) found different results when a self-questioning strategy was taught to an inclusive 7th grade social studies class over three class periods. The strategy used a worksheet prompt with spaces for the student to write in a heading, subheadings, a self-generated question about each, and a column in which to circle *yes* or *no* in answer to "Can you answer your question?" (p. 109). Five students with LD were divided between the class receiving the strategy instruction and the class receiving the typical instruction. Although the students without disabilities who received the strategy instruction in the treatment class made significant gains when compared to their peers in the control class, the students with LD in the two classes had similar gains to each other on the researcher-developed comprehension measure.

In another study by Berkeley, Mastropieri, and Scruggs (2011), thirty-nine 7th-9th grade students in an LD segregated program were taught six reading comprehension strategies (i.e., setting a purpose, previewing, activating background knowledge, self-questioning, summarizing, and strategy monitoring; p. 23) over the course of twelve 30-minute sessions. These students showed moderate and large effect size gains in maintenance (6 week posttest) over the students in

the same program who received only the typical curriculum (i.e., Read Naturally) in measures of summarization on a researcher-developed test. However, in measures of passage-specific content knowledge on a researcher-developed test, both groups improved with no significant differences between them. Berkeley et al. theorized that these results mean that the Read Naturally curriculum "was also effective for helping students recall answers to questions related to specific factual content" (p. 29).

The Learning Strategies Curriculum (LSC) was added to the curriculum of 365 sixth and ninth grade students with grade-equivalent scores at least two years below grade level on the *Group Reading and Diagnostic Evaluation (GRADE)* in a study by Cantrell, Almasi, Carter, Rintamaa, and Madden (2010). The LSC, which was comprised of six strategies instruction (i.e., "word identification, visual imagery, self-questioning, LINCS vocabulary strategy, sentence-writing, and paraphrasing;" p. 260) was taught daily over the course of a year. While the 6th grade students who had received the additional treatment showed a small effect size improvement on the *GRADE* versus the 6th graders who had received only the typical curriculum, the 9th grade students did not show any differences between the treatment and control group outcomes on the *GRADE*. Cantrell et al. proposed that these outcomes reflect the fact that basic comprehension strategies like decoding and vocabulary retention made a difference for 6th graders in accessing comprehension but that 9th graders already had some of these basic strategies in place.

Crabtree, Alber-Morgan, and Konrad (2010) taught three 12th grade students with LD across sixteen 15-30 minute sessions (including baseline probes) to pause during text reading and use a story map prompt. All three students improved from baseline scores of 0-60% on a short-answer researcher-developed comprehension test to maintenance (less explicit story map prompt) scores of at least 80%.

Faggella-Luby, Schumaker, and Deshler (2007) compared two treatment conditions to a baseline for 14 students with LD in 9th grade inclusive literature classes over nine days. The first condition taught the Embedded Story-Structure (ESS) Routine (i.e., "self-questioning before reading, story structure analysis during reading, and summarizing" after reading; Fagella-Luby et al., p. 135), and the second condition taught Comprehension Skill Instruction (CSI; i.e., LINCS vocabulary strategy before "reading, Question-Answer Relationships during reading, and semantic summary mapping after reading;" p. 136). Although students in both conditions showed large improvements from baseline, students in the ESS condition showed significantly more improvement than students in the CSI condition on a unit-comprehension test.

Four 11th grade students with LD in reading comprehension receiving large group instruction in a resource class were taught a story mapping strategy (i.e., how to use a variety of blank story maps effectively) in a study by Fore, Scheiwe, Burke, and Boon (2007). Over approximately 28 sessions, including baseline, the mean percentage correct on short-answer textbook comprehension questions improved from 62% at baseline to 83% in posttests, and individual scores maintained at least 80% accuracy in subsequent intermittent probes.

Fritschmann, Deshler, and Schumaker (2007) studied the effect of inference strategy instruction (i.e., predict, question, clarify, summarize) in one-hour sessions over approximately 15 hours on seven 9th grade students with LD. Large posttest gains were made both on measures of researcher-developed criterion-based comprehension questions and grade-equivalency scores on the *GRADE Reading Comprehension subtest* (e.g., mean grade-level score increased by 2.8). However, in follow-up tests for six students after eight months *without* continued practice or review, students performed on the *GRADE* at levels comparable to their baselines. Later, in

follow-up tests for four students 12 months since posttest and *with* a brief review and practice, the students performed at levels closer to their posttest scores on the *GRADE*.

A study by Manset-Williamson, Dunn, Hinshaw, and Nelson (2008) examined the effect of a modified FIST strategy instruction. FIST stands for: **F**irst sentence is read, **I**ndicate a question that can be made from the sentence, **S**earch for the answer, **T**ie the answer to the first sentence with a paraphrase (Clark et al., 1981, as cited by University of Nebraska, n.d.). The researchers adapted the formula, as indicated by the following instructions which were given to the students:

> Use the FIST strategy as you read. When you reach the FI, make a question with the first sentence. When you see ST, survey the paragraph for answers and tie the answers into the question in one sentence. If the paragraph doesn't answer the question, say a question the paragraph does answer. (p. 128)

The study participants were six students with reading disabilities (defined as at least a 50% discrepancy between grade level and level of comprehension on *Woodcock-Johnson Tests of Achievement III – Passage Comprehension*) in 5^{th}-8^{th} grades who attended a summer reading clinic four days per week for six weeks. The researchers added the question-survey-answer strategy to the text-reader software that the students were already using (words were highlighted on the computer as they were read by the computer; the pace was adjustable; and the computer only read one sentence at a time before requiring the student to click a button in order for the reading to continue). The gains made by the six students were inconclusive: although three of the students showed significant improvement using the modified FIST strategy, the other three showed results that were comparable to those of their baseline text-reader-only probes.

Stagliano and Boon (2009) researched the self-regulated use of a story map (i.e., filling out a blank story map during reading as an aid for comprehension) by three 4th grade students with LD who had grade-equivalent scores at least two grades behind on the *Qualitative Reading Inventory-4*. Students were taught individually in a resource room for the first 15-30 minutes of their regularly scheduled reading instruction across approximately 12 sessions including baseline. The students made significant improvement on comprehension questions from the Read Naturally manual (i.e., from baseline individual means between 7%-27% to intervention and maintenance (2 weeks without practice) individual means above 86%).

A similar text-mapping procedure was taught to two 9th grade students with emotional and behavioral disorders (who qualified for inclusion in this review because of grade equivalent scores of 2.2 and 4.0, respectively, below grade level on the *Wechsler Individual Achievement Test – Reading Comprehension*) by Stone, Boon, Fore, and Bender (2008). Like Stagliano and Boon's study (2009), the students were individually taught in a resource room during language arts class for about 20 sessions including baseline sessions. Going beyond the independent use of text maps, these students learned to generate their own text maps in addition to using them independently. Both students made significant improvement on comprehension measures (fill-in-the-blank questions from the curriculum assessment manual) when baseline probes were compared to maintenance probes (independent text map generation).

Interventions: Teacher- or Computer- directed

Nine of the twenty studies identified by the stated criteria used interventions which required external assistance, whether from a teacher or a computer, for application (see Table 2). Most of the studies used a comprehension measure from a standardized test (n=5). Of these, one also used a researcher-developed test, and one also used a test from textbook materials. Two

studies used only tests from textbook materials and one study did not specify the source of the comprehension measure. The time frames for interventions ranged from two days to 32 weeks. The studies are each briefly discussed below.

Burns, Hodgson, Parker, and Fremont (2011) compared two treatment conditions per student to a baseline for nineteen 8th grade students with a mean reading score one standard deviation below the national mean on *Measures of Academic Progress.* During the first condition, *previewing*, students received priming of their prior knowledge, a synopsis of the text passage, and index cards with the major characters and their descriptions printed on them. During the second condition, *keywords*, students were taught to read three or four selected key words from the passage until fluency for these selected words was achieved via a flashcard system. After receiving each condition, students silently read a passage, and then answered comprehension questions (five explicit and five implicit) from the *Qualitative Reading Inventory-4*. Both conditions resulted in significant and similar improvement from baseline scores. However, the keyword condition used approximately half of the instruction time that the previewing condition did, therefore making it a more efficient strategy.

Denton, Wexler, Vaughn, and Bryan (2008) provided fundamental skills instruction (i.e., explicit, systematic, responsive instruction focusing on word-level reading skills and fluency and somewhat less instruction on comprehension strategies and vocabulary; p.83) in daily 40-minute small group sessions for 13 weeks. Twenty students in grades 6th-8th who were in remedial or special education reading classes and had grade-equivalent scores 1-3 grades below average on the *Dynamic Indicators of Basic Early Literacy Skills (DIBELS)* received the study treatment while a comparison group continued to receive the regular remedial or special education classroom

curriculum. After 13 weeks, neither group showed any improvement on the *Woodcock-Johnson Tests of Achievement III Passage Comprehension* subtest (a sentence-level cloze procedure).

Graham, Pegg, and Alder (2007) investigated the effects of a QuickSmart Literacy program with *Computer-Based Academic Assessment System (CAAS)* on 47 Australian year 7 students who had "low literacy scores" (p.227) on the standardized *Progressive Achievement Tests*. QuickSmart is an explicit, intensive curriculum that teachers are trained for and which focuses on "practice and recall strategies" to build up the skills of "word recognition, vocabulary knowledge, fluent reading and comprehension strategy use" (p. 228). The *CAAS* is a computer component of this program which delivers explicit instruction to the student, high numbers of opportunities to practice, and immediate feedback (e. g., the student speaks her answer into a computer microphone and the program adjusts the feedback and subsequent instruction accordingly). After 30-minute small group sessions three times a week for 32 weeks (three school terms), the students showed improvement on the sentence comprehension test of *CAAS* (i.e., from a mean accuracy of 87% pretest to a mean accuracy of 96% posttest; p. 230) and highly significant improvement on the *Progressive Achievement Tests* reading comprehension scores.

Guthrie et al., (2009) studied the effects of Concept-Oriented Reading Instruction (CORI) on forty-one 5th grade students who had a group mean of 3.0 grade-equivalent on the *Gates-MacGinitie Comprehension* test. The students were taught using CORI in daily 90-minute heterogeneous large group sessions with 30-minute pull-asides for the lowest achievers over 12 weeks while a comparison group received typical heterogeneous large group instruction. The CORI method focused on student choice (e.g., choice of text), relevance (e.g., hands-on activities directly aligned with text information), success (e.g., books at reading level), collaboration (e.g., partner discussions or fluency practice), thematic units (e.g., enabling "students to…become

'experts'" by means of ongoing themes; p. 202), fluency instruction (e.g., modeling, choral practice, and 1:1 practice with teacher), and reading comprehension strategies (e.g., self-monitoring comprehension and fix-up strategies) (pp. 202-203). On the comprehension measure of the *Gates-MacGinitie,* students who received CORI performed significantly higher than comparable students who received typical instruction. However, on the inference measure (true-false researcher-developed questions), which presumably requires higher level thinking, Guthrie et al. found no significant difference in performance between the two groups.

Similar to the research by Burns et al. (2011), Hawkins, Hale, Sheeley, and Ling (2011) included a component in their study to test whether isolated word fluency alone could increase reading comprehension. Hawkins et al. compared two treatment conditions to a baseline for six 10^{th}-11^{th} grade students with LD who were reading between 4^{th} and 8^{th} grade levels. During baseline, students read an instructional-level passage orally and then answered multiple choice comprehension questions (5 factual and 5 inferential) which were obtained from textbook materials. During the first treatment condition, *reread,* students read an instructional-level passage orally; then, using flashcards, they practiced till fluency the words from the passage which they had misread; then they reread the passage orally a second time and took the assessment test. During the second treatment condition, *preview vocabulary plus reread,* the students first learned selected vocabulary words from the passage via flashcards (learning both definition and fluent pronunciation); after which, they read the passage orally for the first time; then, as in the first condition, using flashcards, they practiced the words they had misread till fluency was achieved; then they reread the passage orally a second time and took the assessment test. Each session was 10-20 minutes long and each student completed approximately 15 sessions, including baseline sessions. Both treatment conditions showed very large effect sizes compared to oral reading alone,

and although some of the scores showed significantly larger effect sizes for the *preview vocabulary plus reread condition* (n=3), overall, the results were mixed for effect size between the two treatments.

In a study by Kim et al. (2006), a Computer Assisted Collaborative Strategic Reading (CACSR) program was implemented over a 12-week period with 16 middle school students with LD who had grade-equivalent scores at least one year below grade level in reading comprehension on either the *Woodcock Reading Mastery Test-Revised (WRMT-R)* or *Gates-MacGinitie Reading Test;* comparison groups received either their regular resource reading instruction or their regular language arts instruction. Students in the CACSR program received sessions twice a week, with whole class explicit instruction, but worked in pairs on the computer. The CACSR uses computer software to teach students the CSR method (which uses collaborative peer work to apply previewing strategies before reading; comprehension monitoring, fix-up strategies, and *get the gist* strategies during reading; and review strategies after reading), but the teacher also maintains active oversight and feedback throughout. On measures of the *WRMT-R Passage Comprehension* test, the CACSR group made gains of a medium effect size in comparison to the typical instruction groups; however, on measures of both CSR fourth-grade reading level *Gist* and *Question* items and CSR instructional reading level *Gist* and *Question* items, the CACSR group showed gains with a large effect size compared to the typical instruction groups.

Schmitt, Hale, McCallum, and Mauck (2011) compared the comprehension outcomes of listening-while-reading (LWR) grade-level material using text-to-speech technology on the computer (words were highlighted as they were read at a default pace) to the comprehension outcomes of silent reading on a computer monitor of grade-level material by twenty five 6^{th}-8^{th} grade students who scored at least two grade-levels behind on the *Scholastic Reading Inventory*.

Students received each of the conditions, one per day, across two days. No differences were found in the outcomes on multiple choice question assessments (5 factual and 5 inferential from the textbook).

In Stetter and Hughes's study (2011), after having learned story mapping with a paper instructional script, six 9th graders with LD filled in story maps on a computer (complete with drop-down menus from which to choose answers) while a comparison group (three 9th graders with LD) continued working only with a paper instructional script. The computer group received two initial sessions of explicit instruction by the teacher and subsequent five-minute small-group feedback sessions at the beginning of each of the remaining 28 sessions. The computer group showed no differences on daily multiple-choice comprehension quizzes compared to either their own baseline or the comparison group (paper script). Additionally, only the comparison group (paper script) showed consistent improvement on the *Gates-MacGinitie comprehension* posttest, whereas one third (2 of 6) of the computer group participants actually showed poorer performance on the *Gates-MacGinitie comprehension* posttest. The authors hypothesized possible reasons including lack of motivation, lack of sufficient teacher oversight and explicit feedback, and passive engagement facilitated by drop-down menu choices.

Like Burns et al. (2011) and Hawkins et al. (2011), Vandenberg, Boon, Fore, and Bender (2008) also studied the effect of fluency on comprehension but, instead of targeting a few selected words to master, the design of their study required that the entire passage be read at fluency criterion before moving on. The treatment conditions were compared to baseline for three 10th-11th grade students with LD in 1:1 instructional sessions over as many sessions as necessary to achieve fluency on five instructional-level passages. During baseline, the student read a passage orally and then took a comprehension assessment test (10 multiple choice literal and inferential

questions). During treatment conditions, a student read a passage orally, then reviewed up to ten errors in pronunciation she had just made by writing the words on note cards and practicing pronouncing them. This process was repeated until fluency criterion (i.e., 90% of the student's fluency rate while reading a passage two grade-levels below his reading comprehension level) was reached, at which point, the student took the assessment test. After completing five passages, the student "continued to participate in …[baseline] conditions that assessed maintenance of the intervention" (p. 14) but the maintenance data was not reported for comprehension measures. Though the three students made only small (yet consistent) improvements on comprehension assessments during intervention phases, the authors theorize that the small gains may have been due to the ceiling effect of an assessment with only 10 questions.

Discussion

In this review, 20 scientific studies published between 2006 and 2011 which sought to determine the effects of particular interventions on reading comprehension have been briefly described. Among these interventions, the ones that taught a self-directed strategy were more likely to have larger effect sizes than interventions that required teacher or computer guidance. One factor in this difference may be the assessment used: most of the self-directed strategy interventions used a researcher-developed or textbook material criterion-based comprehension measure, whereas most of the externally-guided interventions used a standardized comprehension measure. Previous research has found larger effect sizes in studies that used researcher-developed or textbook criterion-based measures when compared to those that used a standardized measure (Scammacca et al., 2007, as cited in Denton et al., 2008, p.80; Talbot et al., 1994 as cited in Berkeley et al. 2010, p.424).

Self-directed Interventions

Of the eleven interventions which taught a self-directed comprehension strategy, about half taught how to use either a story map or a text map (n=3, n=2) and the remaining half (n=6) taught strategies which used systematic self-questioning as a key component. However, it could be argued that filling out a story map or a text map involves a certain amount of self-questioning; in which case, all of the studies could be described as using self-questioning.

Eight of the studies showed significant improvement in posttest outcomes with no correlation to type of intervention (Antoniou & Souvignier, 2007; Berkeley, Mastropieri, et al., 2011; Crabtree et al., 2010; Faggella-Luby et al., 2007; Fore et al., 2007; Fritschmann et al., 2007: Stagliano & Boon, 2009; Stone et al., 2008). Two studies showed mixed results: Cantrell et al. (2010) showed a small effect size of the year-long multiple strategy program LSC on 6th graders but not on 9th graders; while Manset-Williamson et al. (2008) showed that a question-survey-answer technique taught during a summer reading clinic showed improvements for only half of the students when compared to a control. Both of these two mixed-results studies were done with participants who had reading difficulties but no diagnosis of LD.

The one intervention that showed no treatment effect (Berkeley, Marshak, et al., 2011) was taught to an inclusive class with a small number of students with LD over only three class periods and this may be concluded to be in line with evidence that students with LD need smaller group instruction (Swanson et al., 1999 as cited in Swanson, 2008). However, Faggella-Luby et al.'s intervention (2007), which was also taught to an inclusive class, though over nine days, showed large gains by students with LD.

Teacher- or Computer- Directed Interventions

Of the nine interventions which required either teacher or computer guidance, five showed significant improvement outcomes: two brief strategic-word fluency interventions (Burns et al., 2011; Hawkins et al., 2011); one three-month computer-taught CSR intervention (Kim et al., 2006); one three-month multi-dimensional intervention (Guthrei et al., 2006); and one eight-month intensive fundamental skills intervention (Graham et al., 2007). One whole-passage fluency intervention (Vandenberg et al., 2008) showed small but not significant improvement. Three studies showed no differences in outcomes: Stetter and Hughes's intervention (2011) of a computerized story map with drop-down menu answers compared to paper story map; Schmitt et al.'s intervention (2011) of listening while reading text on a computer monitor compared to silent reading text on a computer monitor; and Denton et al.'s intervention (2008) of a fundamental word-level reading instruction with a lesser degree of comprehension strategies instruction.

The results of the three fluency interventions suggest that targeting a few (i.e., 3-5) selected words to practice to fluency before reading a passage can result in as great or greater improvement on comprehension measures than additionally studying the definitions of the selected words, receiving a summary and main character identification of the passage to be read, or practicing the entire passage to oral fluency. Since practicing only a few words requires less instructional time, this may be a valuable tool to use in the classroom where time is a limited commodity.

Kim et al. (2006) studied the effects of a computer-taught CSR program (CACSR) and found significant benefit compared to groups receiving typical instruction. A valuable future research project might compare CACSR to exclusively teacher-taught CSR to assess whether the addition of the computer program was significantly beneficial.

Schmitt et al. (2011) studied the effects of listening while reading grade-level text on a computer monitor and found no significant benefit compared to reading the text without audio accompaniment; however, each student only received each condition one time. It might take longer than one session for students to adjust to focusing on hearing/listening at the same time as reading, and once they are familiar with the condition, the outcomes might be different between the two scenarios. Further research might explore this possibility.

Stetter and Hughes (2011) found no benefit to using a computer program to instruct students in story mapping while Kim et al. (2006) found significant benefits to using a computer program to teach CSR. Although Kim et al. compared the treatment group to a group receiving typical instruction rather than a group receiving CSR instruction from a teacher and Stetter and Hughes compared the treatment group to a group learning the same strategy without a computer, other factors in the two studies might be more significant in explaining the differences. Stetter and Hughes noted that one possible explanation for the poor results was that after two initial explicit instructional session with the teacher, students were mostly on their own for the rest of the 28 sessions, with little accountability and little engagement required. In contrast, in Kim et al.'s study the teachers maintained continual oversight of the students' progress with the computer program and provided frequent feedback.

Although Denton et al. (2008) reported that previous reviews of the research had found that word-level reading skills instruction can be beneficial to reading comprehension (Edmonds et al., in press and Scammacca et al., 2007 as cited in Denton et al.), their study revealed no improvements after "individualized," "explicit and systematic instruction in word-level reading skills as well as comprehension, vocabulary, and fluency" (p. 83). The authors note that due to student responses early on, the interventions were modified to focus mainly on word-level reading

skills and less on comprehension and vocabulary; this would partially explain the lack of impact on comprehension measures. Additionally, the comprehension measure was standardized rather than criterion-referenced which may require a longer time frame to reveal a change. The sessions were 40 minutes long and took place daily for approximately 13 weeks and Denton et al. proposed that perhaps more intensive sessions (e.g., two hours per day) and for a longer time period (e.g., two years) may be necessary for students with severe reading deficits to show significant improvement. Regardless, it is reasonable that since the intervention spent little time on comprehension skills instruction, measures of comprehension skills also showed little change.

One deficit in all of the studies in this review except Fritschmann et al. (2007) is the lack of long-term maintenance data. Although several studies included a maintenance measure, there was a wide range of how *maintenance* was defined. Some examples were: a less explicit story map prompt (Crabtree et al., 2010), two weeks without practice (Stagliano & Boon, 2009), and "student-generated text map" (Stone et al., 2008; p. 91). Fritschmann et al.'s encouraging findings pointed to the importance, usefulness, and relative ease of implementing a strategy review in order to achieve successful maintenance of improved text comprehension: the students who received a follow-up comprehension measure after eight months, and *had not* received any strategy review, performed at levels comparable to their baselines, whereas the students who took a follow-up test after 12 months, and *had received* a brief review beforehand, performed at levels similar to their posttest results.

Research to Practice Considerations

Overall, this review supports the findings of previous syntheses (Berkeley et al., 2010; Gajria et al., 2007; Sencibaugh, 2007) that systematic instruction of specific student-directed strategies (e.g., previewing, questioning and checking for an answer), using systematic content

enhancements (e.g., vocabulary instruction or word fluency practice), or systematically guiding instruction (e.g., CACSR) will have a positive impact on reading comprehension outcomes by students with learning disabilities. However, whether or not these interventions are effective is a moot question if teachers do not apply the findings in the classroom.

In Swanson's synthesis (2008) of studies that observed teacher behaviors, she determined that students with LD received "very little comprehension instruction" (p. 130); likewise, Ness's observations (2009) of 40 hours of classroom instruction in science and social studies classes over a three-month period, found that reading comprehension instruction was limited to only three percent of the total instructional time. Even when secondary school teachers were aware of the comprehension problems of their students, they did not provide reading comprehension strategies instruction but, rather, provided extra supports for content in the forms of "didactic instruction, multiple presentations of information through multiple modalities, alternate sources of texts, and heterogeneous grouping" (Ness, 2008; p. 91). Ness (2009) identified three reasons for middle and high school educators' reluctance to teach reading comprehension: "1) their belief that reading comprehension instruction would detract from content coverage and preparation for state testing, 2) their self-identification as content specialists, and 3) their lack of training and confidence regarding reading instruction" (p. 157). Fortunately, promising research (discussed below) has identified possible ways to meet the challenge of putting comprehension strategies instruction into effective practice.

Goodman (2005) found a way to increase teachers' instruction of comprehension strategies and observed a concurrent improvement on the beginning and end-of-year reading test scores. When Goodman realized that her weekly email literacy tips (which contained "random" effective literacy strategies including comprehension strategies; p. 12) to the district's language arts

teachers resulted in the teachers becoming "overwhelmed and inefficient, causing instruction to become hit or miss" (p. 12), she developed a more unified and targeted approach. A district-wide systematic staff development program taught five comprehension strategies in a staggered sequence to *all* teaching staff. Not only did the May reading test scores on the *Gates-MacGinitie* show an above-average improvement from the September scores, but the program also resulted in positive teacher and student reaction to the consistent strategies that they had practiced applying in varied classes such as music, physical education, and science.

Schoenbach, Greenleaf, and Hale (2010) cited positive evidence for their Reading Apprenticeship professional development program (i.e., "a set of inquiry-based professional development tools that leverage teachers' expertise as readers, writers, and thinkers in their own disciplines"; p. 39). In biology classes taught by teachers who had completed the Reading Apprenticeship (10 days over a two-year period), explicit instruction of comprehension strategies was more frequent compared to a control group. Additionally, the students in these classes performed significantly better "on state standardized tests in biology, reading comprehension, and English language arts" (p. 42) than the students in the control group.

Glassett (2009) compared the impact on comprehension strategies instruction between two models of professional development which taught the same strategies to content area teachers. One group learned via a professional learning community model (PLC) in which they had "assigned readings and written reflection of each meeting and reading assignment," (p. 19); met monthly as a group with the staff developer; and met weekly for four hours with content area peers. The other group learned via a traditional model in which they attended, as a group, one hour of professional development weekly. Results from the year-long study indicated that teachers in the PLC group were more comfortable with teaching strategies and taught them more

frequently than the teachers in the traditional group; additionally, the students of the teachers in the PLC group were “more aware of strategy use at the midpoint of the study than the traditional group students” (p. 22).

To summarize, extensive research has shown large effect sizes on reading comprehension of students with learning disabilities and reading difficulties when the students were given explicit instruction in comprehension strategies. Nevertheless, many classrooms fail to deliver this instruction in sufficient quantities or in efficient ways. This, then, is the next most critical challenge. Future studies should build on the encouraging research that has revealed models of professional development that increased the frequency of strategies instruction by both language arts and other subject teachers.

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Table 1. Self-directed Interventions [1]

Study	n/ age	Participant Characteristics	Reading Comp. Measure(s)	Intervention	Results
Antoniou & Souvignier (2007)	T=45 C=28 5th-8th grade (Germany)	learning disabilities & reading deficits at least 2 years below grade	7 multiple choice and 5 open-ended questions about a passage; researcher-developed	T: cognitive & metacognitive reading strategies and self-regulation techniques C: regular special education curriculum F: special education school, whole class explicit instruction per researcher-developed handbook, one full year, 29 academic hours	T long-term large effect size vs. C
Berkeley, Marshak, et al. (2011)	5* T=2 or 3 C=2 or 3 7th grade *5 *total* Ss in T and C groups	learning disabilities	multiple choice & open-ended; researcher developed	T: Self-Questioning instruction/materials in addition to textbook C: Textbook only F: one inclusive class period for three days	T made similar gains vs. C, (however, rest of class, i.e., Ss w/o LD, exposed to T made significant gains vs. rest of class in C)
Berkeley, Mastropieri, et al. (2011)	T=39 C=20 7th -9th grade	mild disabilities receiving special education services through the school LD program; mean at least 4 years below grade level (*Stanford Diagnostic Reading Test)*	Summarization test (criterion – referenced generic open-ended questions) Passage-specific content test (open-ended and multiple choice; explicit and implicit; researcher-developed)	T1: Reading Comprehension Strategies (6 total: setting a purpose, previewing, activating background knowledge, self-questioning, summarizing, & strategy monitoring) T2: Reading Comprehension Strategies plus Attribution Retraining C: Read Naturally program F: 12 30-minute sessions across 4 weeks	Summary test: T1 &T2 large effect size vs. C in posttest; moderate and large effect sizes, respectfully, vs. C in maintenance (6 weeks) Passage-specific content: all three groups improved with no significant differences among them
Cantrell et al. (2010)	T=171 C=131 6th grade T=194 C=159 9th grade	at least 2 grade-equivalent levels below grade level (*Group Reading and Diagnostic Evaluation; GRADE*)	*GRADE*	T: additional *Learning Strategies Curriculum (LSC)*: a set of six strategies instruction: word identification, visual imagery, self-questioning, LINCS vocabulary, sentence-writing, & paraphrasing (p. 260) C: regular language arts curriculum only F: 50-60 min. sessions per day over one year	6th grade T outperformed C but small effect size 9th grade T showed no difference from C

(table continues)

Study	n/ age	Participant Characteristics	Reading Comp. Measure(s)	Intervention	Results
Crabtree et al. (2010)	3 12th grade	learning disabilities	10 short-answer, researcher-developed	T: Self-monitoring with story map chart prompt C: Baseline F: Staggered T initiations, 15-30 min. sessions 4 days/week, approximately 16 sessions total including Baseline sessions	T showed significant and maintained improvement vs. C (Maintenance verified by elimination of within-text pause prompts and less detailed story map chart; all Ss improved from baseline scores between 0%-60% to maintenance scores always at least 80%)
Faggella-Luby et al. (2007)	T1=7 T2=7 9th grade	learning disabilities	unit comprehension test (40 short-answer or fill-in-the-blank)	T1: Embedded Story-Structure (ESS) Routine (three strategies for: pre-reading, during reading, and post-reading strategies) T2: Comprehension Skill Instruction (CSI) (three strategies: LINCS vocabulary strategy, Question-Answer Relationships, and semantic summary mapping) C: Baseline F: Whole class (inclusive) instruction, one period for nine days	T1 showed significantly more improvement than T2 (both showed very large improvements from C)
Fore et al. (2007)	4 11th grade	specific Learning disabilities in reading comprehension	6-10 short-answer questions from textbook	T: Story mapping strategy C: Baseline F: Resource classroom, large group instruction; 28 sessions including baseline	Mean % correct increased from 62% baseline to 83% after T; also, all gains were maintained in follow-up probes (i.e., story map prompt is removed)
Fritschmann et al. (2007)	7 9th grade	learning disabilities & at least 5 years behind grade level (*GRADE)*	Criterion-based 5 multiple choice questions (1 factual; 5 inferential); researcher-developed Standardized reading test (*GRADE*)	T: Inference Strategy instruction – predict, question,clarify,summarize C: Baseline F: 60-75 minute sessions, totaling approximately 15 hours	Large posttest gains both measures (mean grade-level increase 2.8) Poor maintenance after 8 months without continued practice/review, but good maintenance after 12 months with only a brief review immediately before the test

(table continues)

Study	n/ age	Participant Characteristics	Reading Comp. Measure(s)	Intervention	Results
Manset-Williamson et al. (2008)	6 Entering 5th-8th grade	reading disabilities: at least 50% discrepancy between grade level and measure of comprehension on *Woodcock-Johnson Tests of Achievement III – Passage Comprehension*	7 multiple choice inferential questions; researcher-developed	T: Text-reader software with FIST strategy (question, survey, answer) using grade-level or higher text C: Baseline, i.e., text-reader software only with grade-level or higher text F: Reading clinic 4 days/week over 6 weeks	Half T showed significant improvement vs. C while other half T showed results comparable to C
Stagliano & Boon (2009)	3 4th grade	learning disabilities & scored at least two grade equivalent levels below grade (*Qualitative Reading Inventory-4)*	5 questions (4 multiple choice & 1 short answer) from *Read Naturally* manual	T: Self-regulated use of story map C: Baseline F: 15-30 min. individual sessions in a resource room for approximately 12 total sessions including baseline	T showed significant improvement which was maintained after 2 weeks without practice (all Ss improved from a baseline mean between 7%-27% to intervention and maintenance means above 86%)
Stone et al. (2008)	2 9th grade	grade equivalent scores 2.2 & 4.0 below grade level (*Wechsler Individual Achievement Test – Reading Comprehension*) & emotional and behavioral disorders	10-20 fill-in-the-blank questions from the teacher text	T1: Teacher-generated/led text map T2: Student-generated text map (maintenance) C: Baseline F: 1:1 sessions	Both T1 & T2 resulted in significantly improved performance relative to C

1 Note: T= Treatment group C= Comparison group F= Format for instruction Ss= Students
Where effect size is described, terms follow Cohen's definition: .20=small, .50=medium, .80=large or significant

Table 2. Teacher- or Computer- Directed Interventions[1]

Study	n/ age	Participant Characteristics	Reading Comp. Measure(s)	Intervention	Results
Burns et al. (2011)	19 8th grade	identified by school as struggling readers & mean reading standard score was one standard deviation below national mean on *Measures of Academic Progress*	10 open-ended questions (5 explicit & 5 implicit) from the *Qualitative Reading Inventory-4*	T1:Previewing: Ss received priming to their prior knowledge and a synopsis of the passage; also, major characters and descriptions were handed out on index cards T2: Keywords: 3-4 key words were identified and pre-taught to fluency using a flashcard system C: Baseline F: Each student received all three conditions once each; approximately 15 min. d/i T1 and 7 min. d/i T2 before passage reading and testing	Both T1 and T2 had significant and similar effects on performance vs. C (T2 only slightly larger effect) However, T1 required more than twice the instructional time than T2, making T2 significantly more efficient
Denton et al. (2008)	T=20 C=18 6th-8th grade	remedial or special education reading classes and 1-3 grade levels below (*Dynamic Indicators of Basic Early Literacy Skills; DIBELS*)	*Woodcock-Johnson Tests of Achievement III Passage Comprehension* subtest (sentence level cloze procedure)	T: Explicit, systematic, responsive instruction focusing on word-level reading skills and fluency, with lesser attention to vocabulary and comprehension strategies (p. 83) C: Remedial or special education classroom F: Small group daily 40-minute sessions over approximately 13 weeks	No improvement on scores in either T or C
Graham et al. (2007)	47 Year 7 (Australia)	low literacy scores on standardized *Progressive Achievement Tests* and teacher recommendation	*Progressive Achievement Test of reading comprehension* *Computer-Based Academic Assessment System (CAAS) sentence comprehension test*	T: QuickSmart Program with *CAAS* – explicit instruction in basic reading skills w/ focus on practice and feedback via computer C: Baseline F: Small group 30 min. sessions 3X/week for 32 weeks	Improved accuracy on Sentence Comprehension subtest of CAAS Highly significant increase in Progress Achievement Reading Test reading comprehension scores

(table continues)

Study	n/ age	Participant Characteristics	Reading Comp. Measure(s)	Intervention	Results
Guthrieet al. (2009)	T=41 C=22 5th grade	2.8-3.0 grade equivalent group mean on *Gates-MacGinitie Comprehension* (7% receiving special education services)	Comprehension section of *Gates-MacGinitie Reading Test* 6 inference (true-false) questions; researcher-developed	T: Concept-Oriented Reading Instruction (CORI): focus on Ss choice, motivation, interest, success, and peer collaboration in addition to self-monitoring and fix-up strategies C: Typical instruction F: 90 min. large group instruction with small group pull-asides (30 min.) for lowest achievers, daily sessions over 12 weeks	T performed significantly higher than C on comprehension measure No significant difference in performance on inference measure
Hawkins et al. (2011)	6 10th-11th grade	learning disabilities & reading between 4th and 8th grade levels	10 multiple choice questions (5 factual & 5 inferential); from textbook	T1: Oral read and reread with error correction by teacher T2: Pre-study 10 vocabulary words plus oral read and reread with error correction by teacher C: Baseline, i.e., oral read only F: 10-20 minute sessions (n=15), 3-5 times a week	T1 & T2 each showed very large effect sizes vs. C T2 showed large effect size vs. T1 for half of the participants but zero to medium effect size for the other half of the participants
Kim et al. (2006)	T=16 C1+C2=18 middle school	learning disabilities & at least 1 year below grade level in reading comprehension (*Woodcock Reading Mastery Test-Revised (WRMT-R) or Gates-MacGinities ReadingTests*)	*WRMT-R Passage Comprehension* *CSR Fourth-Grade Reading Level – Gist and Question items* *CSR Instructional Reading Level – Gist and Question items*	T: Computer Assisted Collaborative Strategic Reading (CA**CSR**) C1: resource reading instruction C2: language arts instruction F: Whole class instruction, explicit with feedback, 17-23 50-minute sessions across 12 weeks; students worked in pairs	T made larger gains than C, medium effect size by WRMT-R, large effect sizes by CSR
Schmitt et al. (2011)	25 6th-8th grade	at least 2 grade levels below grade on *Scholastic Reading Inventory (SRI)*	10 multiple choice questions (5 factual & 5 inferential); from textbook	T: listening-while-reading (LWR) grade-level text using text-to-speech assistive technology on computer C: silent reading (SR) grade-level text on computer F: small group, one condition per day across two days	No differences in outcomes

(table continues)

Study	n/ age	Participant Characteristics	Reading Comp. Measure(s)	Intervention	Results
Stetter & Hughes (2011)	T=6 C2=3 9th grade	learning disabilities in reading	20 multiple choice including factual, vocabulary, story grammar, and inference types daily quizzes; from textbook *Gates-MacGinitie Comprehension*	T1: Instructional script (story map) with modeling on computer C1: Baseline, i.e. script w/o modeling on computer C2: Instructional script w/o modeling on computer F: 2 sessions of explicit computer instruction; 5 minutes of feedback per other sessions (n=30)	Small to decreased gains across time No differences compared to C1 or C2 on daily quizzes Decreased performance on *Gates-MacGinitie Comprehension* posttest vs. increased performance by C2
Vandenberg et al. (2008)	3 10th-11th grade	learning disabilities	10 multiple choice questions (literal & inferential); unspecified source	T1: Repeated reading with error correction till reach fluency benchmark on instructional reading level passages C: Baseline F: 1:1 sessions; as many sessions as necessary to read 5 passages till fluency	Some increase on number of questions correct but not significant

1 Note: T= Treatment group C= Comparison group F= Format for instruction Ss= Students

Where effect size is described, terms follow Cohen's definition: .20=small, .50=medium, .80=large or significant