Empirical Article

Instruction in Metacognitive Strategies to Increase Deaf and Hard of Hearing Students’ Reading Comprehension

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The purpose of this intervention study was to examine the use of a metacognitive strategy, the Comprehension, Check, and Repair strategy, on strategic reading behavior, nonstrategic reading behavior, and reading comprehension of students who are deaf or hard of hearing (D/HH). A multiple baseline design was used across 3 teacher–student dyads. Frequency data were collected on students’ strategic reading behavior. Reading comprehension was assessed by counting the number of details the students retold after reading a content area passage. Results showed (a) an increase in strategic reading behavior for Students A, B, and C; and (b) an increase in reading comprehension for Student A, and possibly for Student B. Social validity data indicated high acceptability of the intervention. Teachers not only continued to use the strategy with their students after the study ended, but also introduced it to other students with whom they worked. Instruction in metacognitive strategies to increase strategic reading behavior may be an effective means by which to increase reading comprehension for D/HH students.

Reading comprehension is an ongoing concern for students who are deaf or hard of hearing (D/HH). The median performance scores of D/HH students who participated in Gallaudet Research Institute’s national norming of the Stanford Achievement Test, 9th Edition indicated less than partial mastery of the knowledge and skills necessary in reading to satisfactorily complete grade-level work and advance to the next grade (Traxler, 2000). According to the Office of Special Education Programs (2009), approximately 85% of the entire group of D/HH students in a nationally representative sample scored below the 50th percentile in reading comprehension during the 2000–2001 school year.

Reading comprehension difficulties are not exclusive to D/HH students; however, the achievement gap remains large and the trend of the data does not indicate that the gap is closing (Qi & Mitchell, 2012). While some D/HH students are making adequate progress in reading, normative and criterion-referenced state-level data indicate that the performance of D/HH students in reading continues to lag behind that of hearing students (Antia, Jones, Reed, & Kreimeyer, 2009; Easterbrooks, 2010). Variables such as degree of hearing loss, mode of communication, and educational placement do not adequately predict the academic performance of D/HH students. More reliable predictors include delays in vocabulary, language, and metacognitive development (Marschark & Hauser, 2008; Marschark, Lang, & Albertini, 2002; Marschark et al., 2009; Marschark, Sapere, Convertino, & Pelz, 2008; Marschark & Wauters, 2008).

Frequently D/HH students lack the understanding that the goal of reading is comprehension (Andrews & Mason, 1991; Strassman, 1992). Poor readers fail to use metacognitive strategies to monitor and resolve problems with comprehension, and instructional practices tend not to support the development of metacognitive knowledge and control (Ness, 2011; Strassman, 1997). The purpose of this study was to examine the use of a

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strategy, designated for purposes of this research, as the Comprehension, Check, and Repair (CC&R) strategy. The strategy included the following components identified by the National Reading Panel (NRP; National Institute of Child Health and Human Development [NICHD], 2000a) as effective for teaching reading comprehension: comprehension monitoring; question generation; and question answering. Research across the fields of reading instruction (Duke & Pearson, 2002), cognitive strategy instruction (Conley, 2008; Harris & Pressley, 1991; Snyder & Pressley, 1995), and function-based assessment (FBA) and intervention (Umbreit, Ferro, Liaupsin, & Lane, 2007) provided the framework around which the lead author (Benedict) developed the CC&R strategy. Components of the strategy and the steps that teachers followed to instruct students in the use of the strategy are based on the work of Harvey and Goudvis (2005, 2007, 2008), McLaughlin and Allen (2009), and Gear (2006, 2008).

The purpose of the CC&R strategy was to teach D/HH students with at least average skills in word reading fluency, how to monitor and resolve problems with comprehension. The following questions guided the investigation:

- Does the CC&R strategy influence reading behavior of D/HH students? Reading behavior was defined as observable strategic and nonstrategic behaviors in which students engage during oral reading.
- Does the CC&R strategy influence reading comprehension of D/HH students? Reading comprehension was defined as the number of details students retell in 1 min following oral reading.

Instructional Practices in Reading

At the request of Congress, the NRP convened in 1997 to examine the scientific evidence on five areas of reading instruction: alphabetic, fluency, comprehension, teacher education, and computer technology (NICHD, 2000a). In the area of comprehension, the NRP conducted extensive analyses of the literature in three subareas: vocabulary instruction, text comprehension instruction, and teacher preparation (NICHD, 2000b). The instructional practices that the NRP found were effective for increasing reading comprehension included comprehension monitoring, cooperative learning, graphic and semantic organizers, question answering, question generation, and summarization. The NRP also found that instruction that emphasizes purposefully selecting and combining multiple strategies is more effective than instruction that emphasizes using any one strategy alone.

Schirmer and McGough (2005) reviewed reading instruction research in education of D/HH students and compared their findings to the NRP’s in the areas of alphabetic, fluency, comprehension, and computer technology. Of the seven instructional practices that the NRP found were effective for increasing reading comprehension, Schirmer and McGough found research on four: comprehension monitoring, story structure, question answering, and question generating. They concluded that D/HH readers have weak abilities in the area of comprehension monitoring and that story structure and question answering are effective instructional practices for improving reading comprehension for D/HH students.

Easterbrooks (2005) conducted a review of research relative to 15 categories of instructional practices in literacy for D/HH students. She found that, although the categories of literacy that the NRP identified as effective instructional practices in reading are among those better researched, the existing research base was insufficient to establish these practices as effective for D/HH students. She also concluded that integrated instruction in comprehension, strategy use, and content areas is an important means by which teachers can promote D/HH students’ literacy skills. She suggested that instruction in reading should continue past Grades 4 and 5, the grades at which formal instruction in reading typically ends. More recently, Luckner and Handley (2008) reviewed the research on reading comprehension and concluded that interventions with positive outcomes for D/HH students included explicit comprehension strategy instruction, story grammar instruction, and modified directed-thinking activities.

Reading Comprehension and the Role of Metacognition

Poor readers, regardless of hearing status, tend to be skill-oriented, participate passively in reading activities, and depend largely on others to monitor and resolve
problems with comprehension. Moreover, like their hearing counterparts who struggle with various types of text, struggling D/HH readers’ repertoires of comprehension strategies are often deficient. For example, D/HH readers have been observed to use background knowledge to construct meaning. However, when attempts to do so fail, they do not realize that lack of background knowledge contributed to their inability to construct meaning (Schirmer, 2003; Schirmer, Bailey, & Lockman, 2004). In addition, when D/HH readers refer back to text for clarification, research has shown that they do so as a visual-matching technique, not necessarily as a metacognitive strategy (LaSasso, 1985).

D/HH learners who lack sufficient strategies for understanding text may benefit from instruction in metacognitive strategies (Andrews & Mason, 1991; LaSasso, 1985; Martin, 1993; Schirmer, 2003; Schirmer et al., 2004; Strassman, 1997). Interventions designed to further develop existing strategies and explicitly teach additional, more efficient strategies have shown to be effective for increasing reading comprehension for hearing students with and without disabilities. Brigham, Berkeley, Simpkins, and Brigham (2007) found that instruction in metacognitive strategies is specifically beneficial to students who lack background knowledge and reading decoding skills.

Mainstream reading research includes a wealth of theoretical and empirical literature on the contribution of metacognitive awareness and strategy use to reading comprehension. Duke and Pearson (2002) and Pressley (2000) suggested that facility in accurate and automatic decoding contributes to comprehension. Comprehension, in turn, depends on decoding because readers who are capable decoders have the metacognitive ability to draw meaning from text. Proficient readers compare the meanings of words as decoded to the meaning of the text in its entirety (Pressley, 2000). Thus, learning to read text and learning to understand text is a mutually beneficial relationship. Researchers have shown the effectiveness of instruction in metacognitive strategies for increasing reading comprehension (Mastropieri, Scruggs, Bakken, & Whedon, 1996; Mastropieri, Scruggs, & Graetz, 2003; Swanson & Sachse-Lee, 2000; Talbott, Lloyd, & Tankersley, 1994). Three decades’ worth of research has shown that providing instruction in higher-order cognitive thinking skills (e.g., activating prior knowledge, making predictions, drawing inferences, and summarizing) improves students’ reading comprehension (NICHD, 2000b). The findings across various bodies of research are consistent: Explicit and integrated instruction in decoding, comprehension, and metacognitive strategies improves student outcomes in reading (Samuels, Ediger, Willcutt, & Palumbo, 2005).

Approaching complex cognitive tasks such as reading with metacognitive knowledge and skill increases the likelihood of accomplishing such tasks efficiently and effectively. Students who actively and constructively engage with text are more likely to understand what they read. When proficient readers approach text, they activate their metacognitive knowledge and control, often unknowingly. The integration of higher-order cognitive processes to construct coherent mental representations of text facilitates comprehension (Mahapatra, Das, Stack-Cutler, & Parrila, 2010; Strassman, 1997).

The process of learning to read for understanding involves knowledge, experience, thinking, and teaching (Fielding & Pearson, 1994). “Development of comprehension abilities is best thought of as a long-term developmental process” (Pressley, 2000, p. 551). The process is neither linear nor sequential; students do not first learn to decode and then learn to comprehend. Although understanding text may begin with accurately pronouncing words, reading instruction does not end once proficiency in word reading fluency is obtained (Pressley, 2000). Reading instruction should include explicit teaching in decoding, comprehension, and strategy use (Duke & Pearson, 2002; Gear, 2006). Furthermore, instruction should “externalize the thinking processes of skilled readers” (Fielding & Pearson, 1994, p. 65) to ensure the authenticity of instruction.

Theoretical and empirical literature on the links between metacognitive awareness, strategy use, and reading suggests that D/HH students who rely on others to monitor and resolve problems with comprehension may do so due to deficits in metacognitive knowledge and skills (Andrews & Mason, 1991; LaSasso, 1985; Martin, 1993; Schirmer, 2003; Schirmer et al., 2004; Strassman, 1997). Researchers have found that explicit, integrated instruction in metacognition
and comprehension positively influences D/HH students’ literacy skills (Akamatsu, 1988; Jonas & Martin, 1984; Martin, 1993; Martin, Craft, & Sheng, 2001; Strassman, 1997). The purpose of teaching metacognitive awareness is to empower students with knowledge and control over thinking that proficient readers employ during reading (Beckman, 2002; Strassman, 1997). Insufficient knowledge of the purpose of reading and difficulty distinguishing between understanding and misunderstanding fosters dependent reading behaviors in students.

Researchers have shown that all types of learners can learn to use metacognitive strategies to construct meaning from text (Beckman, 2002; Garner, 1990; Reid, 2006). Instruction in metacognitive strategies should include not only what metacognitive strategies are, but also why, when, and how to use them to monitor and resolve problems with comprehension. As early as the primary grades, students can learn to confidently approach the task of reading by developing metacognitive awareness of their abilities in reading. By the intermediate and more advanced grades, students can develop knowledge of personally effective strategies, and apply and regulate their use of strategies with proficiency and automaticity (Griffith & Ruan, 2005). Instruction in metacognitive strategies is feasible and results in both short- and long-term gains (Pressley, Symons, McGoldrick, & Snyder, 1995).

The CC&R Strategy

Reading instruction often entails teachers asking students to read a passage and then questioning them about the content of the passage. Answers to comprehension questions can provide information about the extent of students’ understanding of passages. However, questioning students after reading does not teach students how to monitor their own comprehension; nor does it teach them how to resolve problems with comprehension.

The purpose of the CC&R strategy is to teach students how to use a self-questioning technique to monitor their own comprehension. The strategy is designed to be used with content-area text, allowing for integrated instruction in content, reading comprehension, and metacognition. Students monitor comprehension by periodically stopping during reading to ask themselves whether they understood what they read and if they were already familiar with the information in the passage. If they do not understand, they ask themselves questions about the material, think aloud about where they might find the answer, and look for the answer as they read the remainder of the text. The teacher models the strategy and makes the steps of the strategy explicit by using think-alouds. Following the model, the teacher scaffolds the students’ learning of the strategy by providing opportunities for practice, gradually removing prompts until the students can use the strategy independently. Detailed steps of the strategy are provided in Figure 1.

Method

The study used single-case experimental design (SCD). These designs are ideal for investigating interventions intended for use with heterogeneous, low-incidence populations of students. The defining feature of SCDs, that participants serve as their own individual controls, affords researchers a “methodologically clean and functionally relevant” (Bullis & Anderson, 1986, p. 345) option for empirically investigating the efficacy of instructional practices for D/HH students. A multiple baseline across participants design was used to determine the effect of the CC&R strategy on students’ reading behavior and reading comprehension.

During baseline the teacher–student dyads engaged in “business-as-usual” reading instruction. After baseline data were obtained, teachers were trained to use the CC&R strategy. During the study, teachers provided instruction in the CC&R strategy using commercial content area reading passages supplied by the researcher, which were at each student’s instructional reading level. Following each baseline and intervention teaching session, students independently read a passage, also at the student’s instructional reading level, and selected by the researcher.

The dependent variables in the study were reading behavior and reading comprehension. Reading behavior included observable strategic and nonstrategic behaviors in which students engaged during reading that facilitated or detracted from the process of comprehension, respectively. For purposes of this study, strategic
The CC&R Strategy

1. At the end of each segment of text, the reader asks aloud, “Do I understand what I just read?”

2. If the answer is yes, the reader
   - “thinks-aloud” a comment about the text
   - selects an “I knew that” or an “I didn’t know that” sticky note
   - records the comment on the sticky note
   - places the sticky note next to the appropriate segment of text
   - resumes reading aloud

3. If the answer is no, the reader
   - “thinks-aloud” a question about the text
   - selects an “I wonder” sticky note
   - records the question on the sticky note
   - places the sticky note next to the appropriate segment of text

4. Before resuming reading, the reader
   - determines where the answer to the question might be found
   - selects a Question-Answer Response (QAR) card, and if necessary a text connection card
   - resumes reading

5. When an answer to a question is found during reading, the reader
   - verbalizes the answer
   - records the answer on the corresponding sticky note
   - moves the sticky note from the place in the text where the question was asked, to the place in the text where the answer was found
   - resumes reading aloud

Figure 1  The Comprehension, Check, and Repair strategy.

reading behavior was defined as following the steps of the CC&R strategy. The operational definition of non-strategic reading behavior varied for each student and was determined using the principles of FBA (Umbreit et al., 2007). The operational definition for reading comprehension was the number of details students retold in 1 min, following oral reading of instructional-level, content-area text.

Participants

Three student–teacher dyads from three suburban public school districts participated in the study. Student eligibility criteria included (a) enrollment in Grades 4–8; (b) documented bilateral hearing loss of any degree; (c) documentation of discrepant skills in fluency and comprehension; and (d) the provision of one-to-one services in vocabulary, reading, and/or written language from a teacher of D/HH for a minimum of 120 min/week. To determine discrepancy between word reading and comprehension, the first author reviewed each student’s educational records and assessed each student for word reading fluency and reading comprehension prior to initiating study procedures. The Test of Silent Word Reading Fluency (TOSWRF; Mather, Hammill, Allen, & Roberts, 2004) was used to measure each student’s ability to recognize printed words accurately and efficiently. Expository passages from the Qualitative Reading Inventory-4 (QRI-4; Leslie & Caldwell, 2006) were used to obtain an estimate of each student’s independent, instructional, and frustration reading comprehension levels.

Each student attended elementary school and spent the majority of the school day in a general education classroom. Each teacher held a master’s degree and state certification in education of D/HH students. Within their respective districts, the teachers were responsible for providing itinerant services to students in kindergarten through Grade 12, across an average of eight campuses. Researcher observations indicated that the quality of communication between student and teacher within each dyad was appropriate and the working rapport productive.

Dyad A. Student A was 10.9 years old, enrolled in Grade 5, and met with his teacher of D/HH for 60 min
a day, 4 days a week. He had a profound, sensorineural hearing loss bilaterally and used a cochlear implant consistently. Expressively, Student A communicated orally in conversational settings and in the general education classroom. For receptive communication, Student A was provided either voice and sign simultaneously or sign language interpretation. Student A demonstrated fourth- to fifth-grade skills in word reading fluency based on the TOSWRF and first- to second-grade skills in comprehension of content-area text based on the QRI-4. Teacher A had approximately 13 years of experience as a teacher of D/HH students in a variety of educational settings, including residential programs and self-contained and resource rooms within public schools. Observations by the researchers indicated that Teacher A signed fluently.

**Dyad B.** Student B was 9.2 years old, enrolled in Grade 4, and received services from the teacher of D/HH 30 min a day, 4 days a week. Student B had a profound, sensorineural hearing loss across all frequencies for the right ear and a moderate, sensorineural hearing loss across all frequencies for the left ear. He communicated orally. Student B used behind-the-ear hearing aids consistently. In one-to-one and large group situations, he used a frequency modulation (FM) system coupled to his hearing aids. Student B demonstrated fourth-grade skills in word reading fluency based on the TOSWRF and third-grade skills in comprehension of content-area text based on the QRI-4. Teacher B had approximately 22 years of experience working with D/HH students.

**Dyad C.** Student C was 10.8 years old, enrolled in Grade 5, and received services from the teacher of D/HH 45 min a day, 3 days a week. She had a mild, sloping to moderate-severe sensorineural hearing loss bilaterally. Student C used behind-the-ear hearing aids consistently, but rarely used the FM system that the school provided. Student C primarily used spoken English, although both English and Spanish were used in the home. Her records indicated that she was proficient in spoken English. Student C demonstrated fifth-grade skills in word reading fluency based on the TOSWRF and third- to fifth-grade skills in comprehension of content-area text based on the QRI-4. Teacher C had 29 years of experience as a teacher of D/HH students.

**Reading Passages**

The lead author provided the teachers with brief passages of content-area text at students’ respective instructional reading levels for assessment and instructional purposes. These passages were selected from commercial, leveled reading curricula. Although the passages were leveled by grade, the lead author conducted random readability checks to confirm the readability levels of the passages using the Flesch–Kincaid formula. The Flesch–Kincaid formula uses the number of words, syllables, and sentences to calculate the readability of text and is used for assessing upper-elementary reading materials by educational publishing companies.

Each teacher received a minimum of 30 assessment passages, averaging 200 words in length. The teachers used the assessment passages to repeatedly measure reading comprehension across baseline, intervention, and follow-up phases. Each teacher received a minimum of 15 instructional passages, averaging 500 words in length. They used the instructional passages to instruct students in the use of the CC&R strategy during the intervention phase. Student–teacher dyads completed one instructional passage per session when students were familiar with the content, or in two sessions if students were not familiar with the content.

**Assessments**

**FBA of reading behavior.** FBA is a method for systematically examining environmental stimuli to determine the function of a child’s behavior (Umbreit et al., 2007). The theory behind FBA is that each behavior serves a particular purpose or function. These functions typically include obtaining or deflecting attention; obtaining access to or avoiding tangibles or activities; or obtaining or avoiding sensory stimulation.

To conduct the FBA, the lead author interviewed each teacher to obtain information about her student’s reading behavior. The interview included questions about the reading strategies used by the student, and behaviors that the student used to avoid reading.
Following the interview the lead author conducted an observation of each dyad using the Antecedent-Behavior-Consequence model. These observations occurred during a typical session when teachers provided students with the reading instruction to which they were accustomed. The lead author documented the strategies the teachers used most frequently (e.g., questioning) and the behaviors in which students engaged while reading aloud and answering comprehension questions. Each time students engaged in behavior that detracted from the process of comprehension (e.g., stopping at an unfamiliar word and looking at the teacher), the antecedents and consequences (e.g., teacher pronounced/defined words for the students) surrounding the behavior were recorded.

The interview and observation data were used to (a) identify students’ nonstrategic reading behaviors; (b) operationally define these behaviors; (c) determine antecedent conditions under which the behaviors occurred; and (d) identify consequences that affected future occurrences of the behaviors (Umbreit et al., 2007). Analysis of interview and observation data collected prior to initiating baseline procedures enabled the lead author to determine the function of each student’s nonstrategic behavior (e.g., assisted student in avoiding reading instruction or in gaining attention during reading instruction). These data were used to determine the appropriate antecedent conditions, reinforcements, and consequences for each student and to use this information to help teachers implement the intervention effectively.

Assessment of reading comprehension. Following each instructional session, teachers assessed students for comprehension. Students were provided an assessment passage and instructed to think about the main idea, the important details, and the order in which events in the text occurred as they read the passage aloud one time. Students were permitted to read each assessment passage aloud one time.

Although difficulty with word reading was not anticipated, teachers were permitted to provide students minimal assistance with word reading (not meaning). When students came to the end of a passage, the passage was removed from view. Teachers told the students that they had 1 min to retell everything they remembered reading, and that for every detail retold, they would receive one point. The teachers used a timer to signal students when it was time to start (and stop) retelling details, and provided one prompt to continue if students stopped with time remaining.

Retelling procedures were video recorded for the lead author to later review, transcribe, and score. Transcriptions were analyzed for the number of details retold. For every complete detail included, whether explicit or inferred, students received one point. The definition of one complete detail was a meaningful unit of thought related to the main idea, or important details that supported the main idea.

Interobserver Agreement

Interobserver agreement (IOA) data were collected throughout the course of the study on reading behavior and reading comprehension. IOA data for strategic and nonstrategic reading behavior were recorded for 20% of the total number of video-recorded retelling procedures (5 of 22 baseline sessions, 9 of 43 intervention sessions, and 3 of 7 follow-up sessions). For reading comprehension, the first two authors analyzed 100% of the total number of retelling transcriptions (72) across phases. IOA was calculated by dividing the number of agreements by the sum of agreements and disagreements, and multiplying the result by 100. The minimum acceptable value for reading behavior and reading comprehension was 85%. IOA ranged from 91% to 100% for reading behavior and 95% to 100% for reading comprehension.
Procedures

The same general procedures were followed for each baseline, intervention, and follow-up session. Student–teacher dyads met in the same area, at the same time, and for the same length of time, that they routinely met. During the first 5–10 min of each session, teachers and students reviewed material from the previous session and previewed material for the day’s session. For the next 20–30 min, teachers provided instruction. During the baseline phase and the follow-up phase, teachers provided instruction using the methods and materials they routinely used. During the intervention phase, teachers provided instruction using the methods and materials provided by the lead author using the CC&R strategy. For the last 5–10 min of each session across each phase of the study, students read the assessment passage and completed the retelling procedure. For each student participant, each dependent variable was measured a minimum of five times during the baseline phase (instruction-as-usual); a minimum of nine times during the intervention phase (instruction of the CC&R strategy); and a minimum of two times during the follow-up phase.

Baseline phase. All three student–teacher dyads initiated baseline procedures simultaneously. At each baseline session, students received the instruction they were accustomed to receiving (i.e., instruction-as-usual). During the last 10 min of the session the student read aloud the assessment passage provided by the researcher and completed the retelling. After each student’s baseline data reflected stability, the lead author initiated intervention procedures across each student–teacher dyad in a staggered fashion. Student A was the first student to receive the intervention. Students B and C continued to receive instruction-as-usual until the number of details Student A retold increased and remained stable. Student C continued to receive instruction-as-usual until the number of details Student B retold increased and remained stable.

Intervention phase. The researcher provided each teacher a minimum of two one-hour training sessions at the beginning of each dyad’s respective intervention phase. The researcher provided the teachers with one-to-one training using discussion, role play, video, and Power Point presentations. The training included the CC&R strategy and its components; the lesson plan to follow while teaching the CC&R strategy; materials for previewing the vocabulary and concepts associated with the CC&R strategy; and procedures for monitoring student progress.

At the beginning of the intervention phase, the teachers met with their students and completed the previewing activities. Previewing activities included discussion of the reading strategies the students already knew (e.g., previewing vocabulary, predicting what a book may be about based on its title and cover) and when they used them (before, during, or after reading). Discussion also included the importance of reading and its purpose. The teachers reminded the students of their purpose for participating in the study (i.e., to assist the lead author in determining if strategies that help some students improve comprehension, help them improve their own comprehension). Previewing activities concluded with the teachers letting the students know that the next time they met they would begin learning the CC&R strategy.

At the beginning of each intervention session, teachers (a) named the strategy, (b) listed the steps of the strategy, and (c) modeled the strategy. As students became familiar with the strategy and its components, their responsibility for naming and explaining the strategy at the beginning of each session increased. As the intervention phase progressed, the number of times each session that students read aloud while using the strategy also increased. By the end of the intervention phase, when a review of the strategy itself was no longer necessary, sessions consisted of teachers and students previewing the content of the instructional passage, and students taking primary responsibility for reading aloud and using the strategy. As students read the instructional passages and used the strategy, teachers continued to provide the appropriate consequences and reinforcements.

Students completed the retelling procedure at the end of each intervention session as they did at the end of each baseline session, with one addition. Teachers provided the students not only an assessment passage, but also the following materials: coded sticky notes,
Question–Answer Response (QAR) cards, and text connection cards to use during the retelling procedure should the students elect to do so.

Systematic implementation of the intervention began approximately 3 weeks following initiation of the baseline phase for Student A, 4½ weeks for Student B and 6 weeks for Student C. Students A, B, and C participated in 5, 7, and 10 baseline sessions, respectively; and 19, 15, and 9 intervention sessions, respectively.

Follow-up phase. A follow-up phase was included to measure whether students maintained intervention performance in reading behavior and comprehension after a break from formal instruction and practice in the CC&R strategy. Due to time constraints at the end of the school year, follow-up procedures were initiated 10 days, 3 days, and 2 days following the conclusion of the intervention phase for Students A, B, and C, respectively. During this phase, teachers returned to instructing students using the methods and materials they routinely used. Toward the end of each session, instruction ended and students read an assessment passage and completed the retelling procedure. Three data points were obtained for Student A during follow-up, while two data points were obtained on Students B and C.

Treatment Integrity

The researchers and teachers collected treatment integrity data across components and sessions using a treatment integrity checklist. Researchers independently measured the degree to which each teacher implemented the intervention by direct observation of recorded intervention sessions. The lead author observed a minimum of 20% of the total number of sessions for each student–teacher dyad across all phases. The second author observed 20% of the sessions observed by the first author in order to obtain IOA data. Additionally, the teachers were asked to provide information on the degree to which they implemented the intervention by self-report at the end of every intervention session.

The researchers marked components of the intervention procedure that they observed teachers implement and left blank those components of the procedure that teachers did not implement during the session.

A per-session integrity percentage was obtained for each teacher by dividing the number of components the teacher completed by the total number of components, and multiplying the result by 100. A per-component integrity percentage was obtained by dividing the number of sessions in which the teacher implemented a specific component by the total number of sessions, and multiplying the result by 100.

Social Validity

The first author interviewed teachers and students prior to the baseline phase and again during the follow-up phase to measure the social validity of the intervention. The teachers and the students completed the same interview protocol pre- and postintervention. Interview data provided participants’ overall perceptions of the intervention as well as their level of acceptance of the intervention and its outcomes. Furthermore, interview data served as a supplemental measure of student performance in reading comprehension and reading behavior prior to and after learning the CC&R strategy.

Data Analysis Procedures

To determine whether changes in reading behavior and reading comprehension were a function of instruction in the CC&R strategy, visual analyses of the data were completed as recommended by Horner et al. (2005) and Kratochwill et al. (2010). The level, trend, and variability of the data for each dependent variable within and between phases were assessed, and medians, means, and standard deviations (SDs) for each phase were calculated. The split-middle method for estimating the trend of variable data patterns (Gast & Spriggs, 2010) was used to estimate the trend of each data series. The immediacy of effect and overlap were examined. To determine immediacy of effect, the researcher compared the extent to which the level, trend, and variability of the last three data points in the baseline phase were discernibly different from the first three data points in the intervention phase as suggested by Kratochwill et al. (2010). Overlap was examined by calculating the percentage of nonoverlapping data points (PND) between the baseline and intervention phases and (for reading comprehension) the percentage of data points exceeding the median of the baseline (PEM).
Results

Figures 2 and 3 graphically display baseline, intervention, and follow-up data for each student in reading behavior and reading comprehension, respectively. Tables 1 and 2 present the median, mean, SD, range, and the PND for each student in strategic and nonstrategic reading behavior. Table 3 presents the median, mean, SD, SMD, PND, and the PEM for each student in reading comprehension.

Reading Behavior

Data points in Figure 1 represent the frequency of strategic and nonstrategic reading behaviors in which students engaged during oral reading and retelling during each baseline, intervention, and follow-up session. Observation of reading behavior provided information about students' ability to use the components of the strategy. Tables 1 and 2 respectively present the median, mean, SD, range, and the PND for each student in strategic and nonstrategic reading behavior.
Student A. The mean level of Student A’s performance in strategic reading behavior during baseline was 1.0 with a SD of 1.0. Baseline data revealed a slightly decelerating trend. The effect of the intervention...
on strategic reading behavior was seen within five sessions. The median level increased between baseline and intervention, from 1.0 to 16.0. Intervention data although variable, revealed a steep, accelerating trend. Data for the first follow-up session showed a sudden decrease in strategic behavior. By the second follow-up session, strategic behavior returned to intervention levels and showed a sharp, accelerating trend. The PND for strategic behavior was 79.0%, suggesting a fair outcome. Collectively, analyses of level, trend, immediacy of effect, and PND suggest that the CC&R strategy was highly effective and positively influenced Student A’s strategic reading behavior during oral reading of content-area text.

The nonstrategic reading behavior in which Student A engaged was responding, “I don’t know” (linguistically or nonlinguistically) when asked to retell details from content-area text. The mean level of Student A’s performance during baseline was 3.8 with a SD of 1.3. Baseline data showed a slightly accelerating trend and stability (with the exception of the third data point). The effect of the intervention was immediate; after three intervention sessions, the mean level of Student A’s nonstrategic behavior decreased by half. The median level of nonstrategic behavior between baseline and intervention decreased from three to zero. Intervention data showed low variability initially, quickly stabilized, and revealed a flat trend that continued throughout the remainder of the intervention and follow-up phase. The PND was 89.5%, suggesting the CC&R strategy was a highly effective means by which to reduce, and almost eliminate Student A’s nonstrategic reading behavior.

Student B. The mean level of Student B’s performance in strategic reading behavior during baseline was zero. Baseline data were stable with a slightly decelerating trend that flattened as the baseline phase progressed. The effect of the intervention on strategic reading behavior was seen after five intervention sessions. Although the effect of the intervention was not immediate, the median level of Student B’s strategic behavior increased between baseline and intervention from 1.0 to 16.0. The frequency of Student B’s
strategic behavior remained high during the second half of the intervention phase. Data on strategic behavior during the intervention phase were variable with an accelerating trend. Follow-up data continued to show a high frequency of strategic behavior. The PND for Student B’s strategic reading behavior was 73.3%, suggesting a fair outcome. Collectively, data analyses reveal that the CC&R strategy was a means by which to increase Student B’s strategic reading behavior during oral reading of content-area text.

The nonstrategic reading behavior in which Student B engaged was stopping during oral reading, looking up from the text (or alternatively, keeping eyes on the text), and not resuming reading until the teacher provided assistance. Student B’s frequency of nonstrategic behavior was minimal during baseline, with a mean level 1.0 but variable, with a slightly accelerating trend. The effect of the intervention was fairly immediate, as the mean level of nonstrategic behavior for the first three intervention sessions (compared to the mean level for the last three baseline sessions) decreased from 2.0 to 0.7. While the median level of nonstrategic behavior was zero for both baseline and intervention, the range of the data-point values decreased from 4 during baseline to 2 during intervention. Intervention data were stable and revealed a flat trend that continued into the follow-up phase. The PND for nonstrategic behavior was zero (despite visual evidence of an intervention effect) as four of the seven baseline data-point values were at zero. Without the zero baseline data-point values, the PND was 93.3%. Collectively, data analyses revealed that the CC&R strategy was a moderately effective means by which to decrease Student B’s nonstrategic reading behavior.

**Student C.** The mean level of Student C’s performance in strategic reading behavior during baseline was 0.6. Baseline data were stable and revealed a flat trend. The effect of the intervention was fairly immediate. The median level increased between baseline and intervention, from 0.0 to 3.0. Intervention data although variable, revealed an accelerating trend. Two data points were recorded for Student C during the follow-up phase; the first showed a high frequency of strategic behavior, while the second showed a low frequency of strategic behavior. Although visual inspection and calculation of median and mean levels suggest a fairly positive influence of the CC&R strategy on Student C’s strategic behavior during oral reading of content-area text, the PND of 66.7% revealed that Student C was able to use the strategy but not consistently at a high level.

The nonstrategic reading behavior in which Student C engaged was stopping during oral reading, looking up from the text (or alternatively, keeping eyes on the text), and not resuming reading until the teacher provided assistance. Student C’s frequency of nonstrategic behavior was low during baseline, with a mean level 1.9. Baseline data were somewhat variable with a decelerating to flat trend. The effect of the intervention, although immediate, was minimal in reducing nonstrategic reading behaviors. The median level of nonstrategic behavior decreased from 1.5 during baseline to 1.0 during intervention. Data recorded for the intervention phase were slightly less variable than baseline and revealed a flat trend. The data-point value for the first follow-up session indicated a low frequency of nonstrategic behavior, while the data-point value for the second follow-up session indicated a high frequency of nonstrategic behavior. The PND for Student C was zero as 2 of the 10 baseline data-point values were at 0. Without the zero baseline data-point values, the PND was 44.4%. Student C did not substantially decrease his use of nonstrategic reading behavior as a result of the intervention.

**Reading Comprehension**

Data points in Figure 3 represent the number of details each student retold following oral reading of an assessment passage, at baseline, intervention, and follow-up sessions. Table 3 provides information on summary measures for each student during each phase.

**Student A.** The median and mean levels of Student A’s performance in reading comprehension during the baseline phase were 1.0 and 1.4 details, respectively. Baseline data were stable and showed a fairly flat trend. The intervention had an immediate effect on Student A’s comprehension. The median number of details retold between baseline and intervention tripled. Reading comprehension data during intervention,
although variable, showed an accelerating trend that continued through the follow-up phase. The PND and PEM for Student A in comprehension were 63.2% and 89.5%, respectively. Figure 3 depicts the increase in the mean level and the accelerating trend, suggesting the CC&R strategy had a positive influence on Student A’s comprehension of content-area text.

**Student B.** Median and mean levels of performance in reading comprehension for Student B during the baseline phase were 7.0 and 7.6 details, respectively. Baseline data were fairly stable with an accelerating trend. The effect of the intervention on Student B’s comprehension was not immediate. Intervention data were variable but showed an accelerating trend, with the number of details retold ranging from 6 to 17. The PND for reading comprehension was 60.0% and the PEM was 86.7%, reflecting the variability of the intervention data. Examination of Figure 3 shows that while the mean level of Student B’s performance did not increase between intervention and follow-up, it did not return to baseline levels. Figure 1 depicts the increase in the mean level, the similarity between baseline and intervention trends, and the moderately positive influence of the CC&R strategy on Student B’s comprehension of content-area text.

**Student C.** Median and mean levels of Student C’s performance in reading comprehension between baseline and intervention increased from 3.0 to 9.0 and from 4.1 to 8.3, respectively. The intervention appeared to have an immediate effect on Student C’s comprehension. Comprehension data for Student C were highly variable throughout the study. Split-middle analysis revealed an accelerating baseline trend, and a decelerating intervention trend that returned to accelerating during follow-up. Although the mean level of Student C’s performance did not increase between intervention and follow-up, it did not return to baseline levels. The PND and PEM for Student C in comprehension were 11.1% and 88.9%, respectively. One low outlying intervention data point at Session 9 accounted for the overlap between intervention and baseline data. Examination of Figure 3 suggests the CC&R strategy may not have consistently influenced Student C’s comprehension of content-area text.

**Treatment Integrity Data**

While reviewing each recorded intervention session, the researchers documented whether the teachers implemented the intervention as it was intended to be implemented. For each session reviewed, treatment integrity was obtained by adding the number of components implemented by the teacher, and dividing this number by the total number of components. The mean of session scores constituted the average treatment integrity percentage. The average overall treatment integrity for Teachers A, B, and C was 93%, 90%, and 70%, respectively.

Additionally, the integrity with which each component of the intervention procedure was implemented across sessions was obtained by adding the number of sessions during which the teacher implemented the component, and dividing this number by the total number of sessions. The mean of each component score constituted the average component integrity percentage. The average integrity with which each component of the intervention procedure was implemented across teachers is listed in Table 4. The intervention component that all three teachers implemented with 100% integrity was providing interactive, guided, and independent practice. As reported in Table 4, treatment integrity for most components was high for Students A and B. For Student C, several components were implemented only 50% of the time and at least one (withholding reinforcement) was not implemented at all.

**Social Validity Data**

Social validity was obtained from interviews and from teacher comments (through personal communication and email) throughout the study. Analysis of interview data, coupled with analysis of anecdotal recordings, revealed (a) teachers’ level of acceptance of the intervention and its outcomes; (b) teachers’ reflections of the instruction they provided students before and during intervention; (c) teachers’ perceptions of student progress; and (d) teachers’ perceptions of students’ acceptance of the intervention.
All three teachers indicated that the intervention improved the effectiveness of their reading instruction, not only with the students who participated in the study, but also with other students with whom they worked. One teacher shared, “I’m using think-alouds with my other students; a third grader and a fourth grader…even a first grader.” At the conclusion of the study, each teacher requested templates of the coded sticky notes, QAR cards, and text connection cards. When school resumed after summer vacation, one of the teachers contacted the researcher to inquire about obtaining additional materials. Social validity data further indicated that the teachers benefitted from learning instructional strategies such as think-alouds and “I wonder…” statements. One teacher reported, “Having the student stop and think aloud about what he read has been fabulous.” Another teacher commented that the vocabulary and language used to perform think-alouds provided “the perfect transition to getting the student to look more closely at questions he asks and to analyze the text even further.”

Teachers used think-alouds and “I wonder…” statements not only to model cognitive behavior, but also to decrease the number of questions they asked students during oral reading. Early in the intervention phase, one teacher reflected, “I forgot to preview the hard-to-pronounce words. When the student struggled and looked at me, I just pronounced the word for her.” The teacher added, “After I thought about it, I should have prompted the student to generate an ‘I wonder…’ statement. I just fed into the ‘look’ and gave her the pronunciation.” During the postintervention interview, one teacher commented, “All of my questioning wasn’t that great of a thing. I didn’t realize I was doing it so much.”

Social validity data further revealed teachers’ perceptions of the progress students made in learning how to use the CC&R strategy and in understanding content-area text. Whether or not the number of details students retold increased or remained stable, all of the teachers commented that the students’ retell quality improved. Toward the end of the intervention phase, one teacher commented, “Once the student realized that I wasn’t telling him he was doing something ‘wrong’ by asking him to revisit the passage, he seemed to ask more relevant questions.” During the postintervention interview, one teacher shared, “For him to know it’s ok to stop and make those comments, even when we’re reading other things like fiction…I’ve noticed it.” The teacher proceeded to share:

His fidgeting is less…he’s more relaxed now. I think he’s very comfortable with the whole process. When we are sitting together and we’re using the strategy I think he’s a really careful reader and he’s really reading to understand. I think he’s reading to understand instead of just reading, and without me having to ask a million questions. He’s reading because he knows he’s going to have to make a comment. So, I think he’s got it.

**Discussion**

The study examined the efficacy of instruction in metacognitive strategies for increasing school-aged
D/HH students’ understanding of content-area text. We examined the outcomes of the CC&R strategy on students’ use of strategic reading behaviors and reading comprehension. We found (a) increases in strategic reading behavior for Students A, B, and C; (b) decreases in nonstrategic reading behavior for Students A and B; and (c) increases in reading comprehension for Student A, and possibly for Student B.

Proficient readers approach text with a repertoire of compensatory strategies from which to monitor and resolve problems with comprehension (Griffith & Ruan, 2005). D/HH students’ repertoire of comprehension strategies can be deficient and as such, they use few strategies to assist with comprehension (Schirmer et al., 2004). In the present study, D/HH students as young as 9 and 10 years were able to learn a metacognitive strategy that enabled them to monitor their understanding of content-area text and resolve problems with comprehension when they arose. This finding supports research that suggests that elementary-aged students can learn strategies to monitor their understanding of text and further, that instruction in comprehension monitoring is appropriate for some students as early as the primary grades (Baker, 2005; NICHD, 2000b).

The data reveal an interesting relationship between treatment integrity, strategic reading behavior, and reading comprehension. Students A and B both showed decreases in nonstrategic reading behavior, and increases in both strategic reading behavior and reading comprehension. Treatment integrity data showed that the intervention was implemented with a high degree of integrity for these students. In contrast, Student C showed increases in strategic reading behavior, but not in reading comprehension. Furthermore, Student C did not show decreases in nonstrategic reading behavior. Treatment integrity data showed that the intervention was implemented with a lower degree of integrity for Student C. Table 4, for example, indicates that Teacher C received 50% or less in four of the five delivery of instruction components.

While one reason that the intervention was not completely successful for Student C is that the teacher was not able to consistently implement the intervention, another is that we failed to accurately identify and operationally define Student C’s nonstrategic reading behaviors. After initial observations, Student C’s nonstrategic reading behavior was operationally defined as “stopping during oral reading, looking up from the text or alternatively, keeping eyes on the text, and not resuming reading until provided assistance.” During intervention our observations indicated that nonstrategic reading behavior for Student C might have been more appropriately defined as, “leaning back, looking around the room, stretching, and yawning.” While we documented these behaviors prior to baseline during informal observations, we did not identify them as nonstrategic until after implementation of the intervention. Therefore the teacher was not able to appropriately respond to Student C’s nonstrategic reading behavior. When Student C demonstrated the nonstrategic behavior, the teacher would respond with questions such as, “Why are you so tired? Did you stay up late?” As a result, the lesson was diverted from reading instruction to a personal discussion. The student’s nonstrategic behavior resulted in avoidance of reading. Treatment integrity might have been higher for Student C, had Student C’s nonstrategic reading behavior, and the consequences contributing to reoccurrence of the behavior, been more appropriately defined prior to intervention. This points out the importance of carefully examining and identifying nonstrategic behaviors so that they are not inadvertently reinforced and maintained.

At this point, we are comfortable stating that the research demonstrated a functional relationship between the teachers’ strategy instruction and students’ use of strategic reading behaviors. However, this study did not clearly demonstrate a functional relationship between strategy instruction and students’ reading comprehension. For reading comprehension, an effect was documented for Student A, a possible effect was documented for Student B, and a noneffect was documented for Student C. Reasons for concluding a possible effect for Student B include baseline data that reflected gains in performance, intervention data that reflected a latent effect, and overlapping baseline and intervention data points. For Student C, reasons for concluding a noneffect include baseline data that insufficiently demonstrated a clearly defined pattern from which to extrapolate projected performance and intervention data-point values that showed considerable range.
Limitations and Future Directions

In retrospect, some aspects of the study design revealed particular limitations. The decision to use the Flesch–Kincaid readability formula that relies on number of sentences and syllable count, may have underestimated the difficulty of content area text. It is possible that relying on other readability formulas such as the Dale-Chall or Spache that take into account familiarity of vocabulary may have resulted in selection of passages that more closely matched the students' reading level. Unfortunately, readability formulas tend to underestimate the difficulty of content-area text (Gallagher, Fazio, & Gunning, 2012). Future research may need to use multiple readability formulas to select the most readable text for individual students.

Another limitation, which the authors predicted a priori, is that intervention data-point values were highly variable across participants. The considerable range in the number of details each student retold might be the result of gaps in vocabulary knowledge. Hearing loss can create communication barriers that restrict access to incidental and formal learning opportunities. Restricted access to learning opportunities can influence vocabulary and language acquisition during various stages of learning. Gaps in vocabulary knowledge can negatively contribute to reading comprehension, specifically in content-areas. Thus, the possibility that barriers to communication contributed to gaps in vocabulary knowledge that in turn, contributed to varying levels of comprehension for these students cannot be ruled out.

Single-case methodology enabled the researchers to circumvent the challenges of empirically demonstrating the efficacy of an approach to teaching reading comprehension to a population of students described as heterogeneous and low-incidence. Until further investigations of instruction in metacognitive strategies to increase reading comprehension are conducted using single-case methodology, the degree of variability and the immediacy of effect to expect from measures of reading comprehension are unknown. The process of gaining facility in comprehension is a long-term process (Pressley, 2000); therefore, researchers should not anticipate intervention data to reflect changes in comprehension immediately following implementation of the intervention. The period of time in which students received instruction in the CC&R strategy may have been insufficient to influence reading comprehension. Thus future research might look at lengthening the duration of the intervention. Also, it may be that reading comprehension may only change after strategic reading behaviors are firmly established. Therefore we might expect latency between the consistent use of strategic reading behaviors and reading comprehension.

The use of a retelling procedure for measuring reading comprehension may pose inherent difficulties for students’ who are D/HH. For the purposes of the present study, the retelling procedure served as the reading comprehension measure. Reading comprehension was operationalized as the number of details retold in 1 min following oral reading of instructional-level, content-area text. While the retelling procedure appeared somewhat sensitive to changes in students’ comprehension, for some D/HH students, retelling may be negatively influenced by expressive language abilities. Thus alternative measures of comprehension should be considered. Researchers may want to consider the use of explicit and inferential comprehension questions in multiple-choice format as the primary reading comprehension measure in future studies as has been done in other studies with D/HH students (Schirmer, Schafer, Therrien, & Schirmer, 2012; Schirmer, Therrien, Schafer, & Schirmer, 2009; Trezek & Wang, 2006; Wang & Paul, 2011). We also do not know whether asking students to read the text silently instead of aloud would have contributed positively to comprehension. Future researchers might want to address this issue.

The teachers who participated in the present study stated that they found value in instructing students in the use of the CC&R strategy and its components. However, given the few effective instructional practices in reading from which teachers have to choose, it is possible that almost any intervention offered would have been met with approval. Prior to receiving training on the intervention, the teachers were not familiar with think-alouds, QARs, and text connections. We suspect that this finding is not exclusive to these particular teachers.

The high percentage of D/HH students who lack sufficient comprehension strategies suggests that they could benefit from instruction in a metacognitive strategy like the CC&R strategy. To assist teachers in
planning instruction specific to students’ unique learning needs, identifying the individual contributions of the various components and procedures of the strategy would be helpful. The present study did not account for measurement of the various individual components of the strategy (i.e., think-alouds, QARs, and text connections), or the teaching procedures used (i.e., direct instruction, modeling, interactive practice, and guided practice). Additional research is necessary to disentangle the various components and procedures that contributed to changes in students’ reading behavior and comprehension.

Additional research is also needed to explore the differential effects of instruction in metacognitive strategies (like the CC&R strategy) with and without self-monitoring. At the conclusion of the study, the researcher asked Student B’s teacher what concerns remained regarding Student B’s reading comprehension. The teacher responded, “I want him to realize that he can do it. I don’t think he really believes he’s a good reader.” When asked what could change that, Student B’s teacher stated, “For him to see how successful he is.” Research such as that conducted by Sawyer, Graham, and Harris (1992) who compared the differential effects of direct teaching, strategy instruction, and strategy instruction with self-monitoring on students’ writing performance could be used as a model for investigating the differential effects of instruction in metacognitive strategies with and without self-monitoring.

Conflicts of Interest

No conflicts of interest were reported.

References


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