IMPROVING ORAL READING FLUENCY: A BRIEF EXPERIMENTAL ANALYSIS OF COMBINING AN ANTECEDENT INTERVENTION WITH CONSEQUENCES

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A brief experimental analysis was used to evaluate the relative effectiveness of combining two consequences (contingent reinforcement or performance feedback) with an antecedent intervention (listening passage preview and repeated readings) on the oral reading fluency of 6 elementary students. The antecedent intervention increased the number of correctly read words per minute for all 6 students. For 4 of the students, pairing the antecedent intervention with either of the consequences resulted in higher reading rates over the antecedent intervention alone. Undifferentiated results were obtained for the remaining 2 participants. These results suggest that combining an antecedent intervention with consequences may enhance the oral reading fluency of students with reading problems. However, individual responsiveness to the different intervention components indicates that brief experimental analyses are warranted to identify the most effective intervention.

DESCRIPTORS: oral reading fluency, reading interventions, elementary students

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Empirical studies have consistently demonstrated a strong, positive correlation among oral reading fluency, reading decoding, reading comprehension, and on-task behavior (Carnine & Silbert, 1979; Collins, 1989; McDowell & Keenan, 2001; Shinn, Good, Knutson, Tilly, & Collins, 1992). Measures of oral reading fluency have diagnostic utility (Allington, 1983; Deno, Mir-

kin, & Chiang, 1982; Perfetti & Hogoboam, 1975; Strang, 1969), and an extensive literature has documented their reliability and validity (see Marston, 1989). Recent studies conducted by the National Center to Improve the Tools of Educators (Kameenui, 1996), the National Institute of Child Health and Human Development (Grossen, 1997), and the National Research Council (1998) have identified oral reading fluency and phonological awareness as fundamental skills of proficient early readers. As a result of the importance of oral reading fluency, researchers have examined a variety of inter-

ventions for improving oral reading in children who experience reading problems. Generally speaking, attempts to improve children's oral reading fluency can be divided into two categories: those involving some form of instruction in the form of modeling or practice (i.e., antecedent interventions) and those involving some form of reinforcement contingent on rapid and accurate reading (i.e., consequences).

Two antecedent oral reading interventions that have been shown to be effective are passage preview and repeated readings (e.g., Daly, Lentz, & Boyer, 1996). Passage preview provides students with an opportunity to read or listen to a passage prior to instruction. Research suggests that passage preview is an effective means of increasing oral reading fluency in a variety of populations, including students with learning disabilities and students with reading difficulties (Rose, 1984; Skinner et al., 1993; Skinner, Cooper, & Cole, 1997). Repeated readings require students to read a passage repeatedly until a prespecified criterion is achieved. Repeated readings have increased the reading accuracy, fluency, and intrapassage comprehension of students with learning disabilities (Dahl, 1979; Sindelar, Monda, & O'Shea, 1990), students with mental retardation (Samuels, 1979), transitional and other less skilled readers (Downhower, 1987; Herman, 1985), and nondisabled students (Carver & Hoffman, 1981; O'Shea, Sindelar, & O'Shea, 1985).

Research has indicated that many reading problems may result from a failure to exhibit behaviors that students possess (i.e., a performance deficit) rather than from skill deficits (Lentz, 1988). In these cases, programmed consequences for improved performance may enhance the efficacy of antecedent interventions. Two types of consequences that have been shown to improve students' reading performance are contingent reinforcement and performance feedback. Providing reinforcement (i.e., delivering preferred stimuli) contingent on accurate or increased oral reading responses has been shown to improve the reading performance of students in general and special education classrooms (Billingsley, 1977; Holt, 1971; Jenkins, Barksdale, & Clinton, 1978). Providing students with information about their behavior, or performance feedback, also has been demonstrated to be effective in improving the academic and behavioral functioning of elementary, secondary, and special education students (Kastelen, Nickel, & McLaughlin, 1984; Van Houten, Hill, & Parsons, 1975). Although it has been suggested that performance feedback will improve oral reading fluency (Lentz, 1988), only one study has investigated this hypothesis (Conte & Hintze, 2000).

Two recent studies compared the efficacy of these types of interventions via brief functional assessments. In the first study, McComas et al. (1996) used a multielement design to examine the effects of seven antecedent strategies on students' performance on spelling and reading comprehension exams. During each experimental session, a baseline condition was followed by two or more instructional strategies. The instructional strategies that produced the greatest improvement in academic responding were repeated to form a mini-reversal design. Results demonstrated that the brief experimental analysis was effective in identifying instructional strategies associated with enhanced academic responding.

In the second study, Daly, Martens, Hamler, Dool, and Eckert (1999) evaluated the effects of reading interventions grouped hierarchically. Students' oral reading fluency on instructional and high content-overlap material was examined. Following baseline, interventions were implemented in the following progression: contingent reinforcement; repeated readings; passage preview

plus repeated readings; and passage preview plus repeated readings in easier material. Once the introduction of a treatment component or components resulted in noticeable gains in reading fluency, a brief withdrawal was conducted to confirm the effects of the treatment package across reading passages. Results showed repeated readings alone to be most effective in increasing oral reading fluency on instructional passages for 2 participants, whereas passage preview plus repeated readings and passage preview plus repeated readings applied to easier passages were most effective for the other 2 participants. Contingent reinforcement alone did not increase reading fluency.

These results suggest that brief individualized assessments are useful for identifying intervention components for children who experience reading difficulties. In addition, for some students, combined interventions are more likely to improve oral reading fluency than single interventions. Furthermore, the relative efficacy of these interventions is idiosyncratic across children (Daly et al., 1999; McComas et al., 1996). Given this finding and the fact that teachers may prefer certain types of instructional strategies over others, it is important to conduct efficient, individualized assessments to identify the necessary and sufficient components of reading interventions. Although previous research has demonstrated efficient methods for identifying instructional strategies to improve children's oral reading fluency in classroom settings (Daly et al., 1999; Daly, Witt, Martens, & Dool, 1997; McComas et al., 1996), these methods have not been used to examine the separate and combined effects of antecedents and consequences. Analyzing the separate and combined effects of antecedents and consequences has proven helpful for other target responses (e.g., Richman et al., 2001). As such, the present study examined whether the effectiveness of an antecedent intervention could be enhanced by

combining it with either of two consequences (contingent reinforcement and performance feedback) for students with reading problems. It was hypothesized that adding contingent reinforcement and performance feedback to the antecedent intervention would increase oral reading fluency over baseline or the antecedent intervention alone. It also was hypothesized that participants would show individual differences in responding across the interventions.

METHOD

Participants and Settings

Participants were 6 elementary-school students (3 girls and 3 boys). Two of the participants, Hunter and Stephen, were enrolled in a combined second- and third-grade general education classroom that had been in session for 6 months. Both Hunter and Stephen had been identified by their respective classroom teachers as experiencing significant reading difficulties. A structured teacher interview indicated that reading decoding and reading comprehension were problematic for both students. Classroom-based instructional strategies included the use of modified curricular materials and abridged assignments. Neither student was receiving remedial or special education services; however, Stephen participated in an experimental analysis of reading that was reported previously in Daly et al. (1999). The remaining 4 participants were enrolled in general education classrooms that had been in session for 9 months. Bethany was a 7-year-old girl enrolled in a first-grade classroom. During a structured interview, her teacher indicated that she had not mastered first-grade reading material. Mason was an 8-year-old boy enrolled in a second-grade classroom. His teacher reported that he had not mastered first- or second-grade reading material. Alison and Vilna were 9-year-old girls enrolled in a third-grade classroom. Their teacher re-

ported that both students had mastered second-grade reading material but continued to demonstrate difficulty reading aloud. None of the participants received instructional modifications or specialized educational services.

Hunter and Stephen attended a large, urban elementary school. Of the students, 90% qualified for free or reduced-price lunch. Bethany, Alison, Mason, and Vilna attended a small, parochial elementary school. None of the students at the school qualified for free or reduced-price lunch. Experimental sessions for Hunter and Stephen were conducted in a room used specifically for testing (5 m by 5 m) or an open space adjacent to the hallway (8 m by 10 m). Both rooms were equipped with a small table and two chairs. Experimental sessions for the remaining participants were conducted in a room used specifically for tutoring (10 m by 10 m) or an empty classroom (40 m by 45 m). Both rooms were equipped with a table and two chairs. In all settings, audiotape equipment was present during a portion of the sessions to assess interscorer agreement and procedural integrity.

Materials

Reading passages were selected from the first-, second-, and third-grade levels of the Silver, Burdett, and Ginn, Inc. (1991) reading series using standard procedures for developing curriculum-based measurement passages (Shapiro, 1996). For each potential passage, a readability index was calculated using procedures outlined by Spache (1953). Only reading passages with similar readability indexes for each grade level were used. For each grade level, 15 passages of at least 80 words were retyped onto a separate sheet of paper to eliminate the effects of pictures on oral reading performance. The average passage length was 89 words for the first-grade passages (range, 44 to 117), 99 words for the second-grade passages (range, 81 to 121), and

107 words for the third-grade passages (range, 88 to 124). The average number of sentences was 12.60 for the first-grade passages (range, 6 to 15), 10.36 sentences for the second-grade passages (range, 6 to 18), and 8.96 sentences for the third-grade passages (range, 6 to 23). Mean readability scores were 1.7 (range, 1.2 to 1.9) for the first-grade passages, 2.6 (range, 2.1 to 2.9) for the second-grade passages, and 3.5 (range, 3.0 to 3.9) for the third-grade passages.

Response Measurement and Reliability

The number of words read correctly per minute (WRCM) was calculated for each session after the number of errors was subtracted from the total number of words read. A word was scored as correct if the participant read the word correctly in 3 s or self-corrected a mispronounced word within 5 s. A word was scored as an error if the student mispronounced a word, substituted another word, omitted a word, or did not read a word within 3 s. In addition, if an entire line of text was skipped, the number of words contained within the line was subtracted from the total number of words read and one error was recorded. Data were collected by trained experimenters. The experimenter recorded the participant's performance on the experimenter's copy of the passage by marking errors with a slash. At the end of 1 min, the experimenter placed a closed bracket after the last word read and allowed the student to finish reading the rest of the passage. Results were based on the participant's performance during the 1st minute of the last reading of the text. That is, the participant orally read a novel passage in each baseline session, and the 1st minute of that reading was used for data-collection purposes. In each of the four intervention conditions, the participant read the passage three times, and the 1st minute of the third reading was used for data-collection purposes.

Interscorer agreement data were collected during 50% of the sessions for Hunter and Stephen and during 30% of the sessions for Bethany, Mason, Alison, and Vilna. Audiotaped recordings were used for the purposes of collecting interobserver agreement data by having a second, independent observer record the students' oral reading responses. Comparisons were conducted between the second observer's responses and the experimenter's responses on a word-by-word basis. Interscorer agreement was calculated as the total number of agreements divided by agreements plus disagreements multiplied by 100%. The mean agreement coefficient for WRCM was 98% (range, 94% to 100%).

Procedural integrity was conducted during 40% of the sessions for Hunter and Stephen and during 30% of the sessions for Bethany, Mason, Alison, and Vilna. An independent observer evaluated the experimenter's audiotaped performance using a procedural integrity checklist. Procedural integrity was monitored for the following areas: correct presentation of the materials, correct delivery of the experimental instructions, and accurate recording of time. Across all participants, procedural integrity was 100%.

Curriculum-Based Assessment

A curriculum-based assessment was conducted prior to the analysis to determine each student's instructional reading level using methods described by Shapiro (1996). Each participant was asked to read nine passages of at least 100 words, which represented material from the first-, second-, and third-grade levels of the Silver, Burdett, and Ginn, Inc. (1991) basal reading series. The participant was instructed to read each passage aloud to the experimenter. The procedures used to monitor and record each student's oral reading were identical to those described above. Data on WRCM were compared with reading placement criteria

(Fuchs & Deno, 1982) to identify instructional material for each participant. Results indicated that Stephen was instructional in second-grade material (range, 32 to 51 WRCM), Hunter was instructional in third-grade material (range, 58 to 65 WRCM), Bethany was instructional in first-grade material (range, 24 to 50 WRCM), Mason was instructional in second-grade material (range, 45 to 83 WRCM), and Alison and Vilna were instructional in third-grade material (range, 62 to 88 WRCM).

Procedure

Sessions for Hunter and Stephen, each approximately 15 min, occurred twice per week. The analysis was conducted over an 8-week period, with one experimental condition conducted during each session. Sessions for the remaining participants were conducted over a 6-week period, with two sessions occurring during the same school day. At the beginning of each session, the student was told, "Here is a story that I would like you to read. When I say, 'Begin,' start reading aloud at the top of the page and read across the page. Try to read each word. If you come to a word you don't know, I'll tell it to you. Be sure to do your best reading." Assistance was provided by the experimenter if the participant did not read a word within 3 s. As soon as the participant read the first word in the passage, the experimenter started the stopwatch. Both copies of the reading passage were collected at the end of the session.

Baseline. During this condition, no instructional intervention was provided.

Antecedent intervention (AI). Listening passage preview and repeated readings procedures were implemented with all participants except Stephen. Each student was required to listen to the experimenter read the passage aloud and then practice reading the same passage aloud for three successive trials. No programmed consequences were present-

ed during the condition. For Stephen, this condition consisted of only one intervention, repeated readings, because results of a previous assessment indicated that his performance did not benefit from combining the two antecedent-based interventions (Daly et al., 1999).

Antecedent intervention and contingent reinforcement (AI+CR). Each participant's antecedent intervention was implemented as described above. Prior to the last passage reading, the participant was asked to select an educationally relevant reinforcer (e.g., pencil, ruler, eraser) from a pool of approximately 10 items. The participant was informed that the preferred item would be provided if his or her reading rate exceeded the initial passage reading rate by 5%. If the participant read the passage at the prespecified criterion level, the preferred item was provided. For the purposes of delivering the consequences, performance data were collected during each reading.

Antecedent intervention and performance feedback (AI+PF). The experimenter and participant developed reading goals (i.e., number of mistakes, reading time) prior to implementing the antecedent intervention as described above. To create goals, the experimenter reviewed the participant's performance during the previous session and reported these data to him or her. Next, the experimenter identified reasonable goals, which represented a 1% to 5% improvement in performance over the previous session, for the participant to consider. If the participant did not accept the proposed goals, he or she consulted with the experimenter until a reasonable modification was reached. These reading goals were inserted on two reading performance graphs. One graph depicted the number of mistakes. The second graph depicted the number of minutes in which the participant read the passage. Following each passage reading, the experimenter informed the participant of his or her performance.

The student then recorded the number of mistakes and reading time on each graph. For the purposes of delivering the consequences, performance data were collected during each reading.

Antecedent intervention, performance feedback, and contingent reinforcement (AI+PF+CR). The experimenter and participant developed reading goals (i.e., number of mistakes, reading time) prior to implementing the antecedent intervention using procedures identical to those described above. After each passage reading, the student recorded his or her performance on the graph. Prior to the last passage reading, the participant was asked to select an educationally relevant item (e.g., pencil, eraser) from a pool of approximately 10 items. The participant was informed that the preferred item would be provided if his or her reading rate exceeded the initial passage reading rate by 5%. If the participant read the passage at the prespecified criterion level, the preferred item was provided. For the purposes of delivering the consequences, performance data were collected during each reading.

Experimental Design

Baseline and treatment conditions were alternated in a multielement design. The conditions were presented sequentially for Stephen and Hunter. For the remaining participants, the conditions were presented in a randomized order, with each condition occurring equally often in each order.

RESULTS

Figure 1 displays the participants' WRCM during the baseline and treatment conditions. For all participants, oral reading fluency increased under the antecedent intervention condition. Specifically, the students read between 1.3 and 2.4 times as many words correctly per minute on average during the antecedent intervention condition
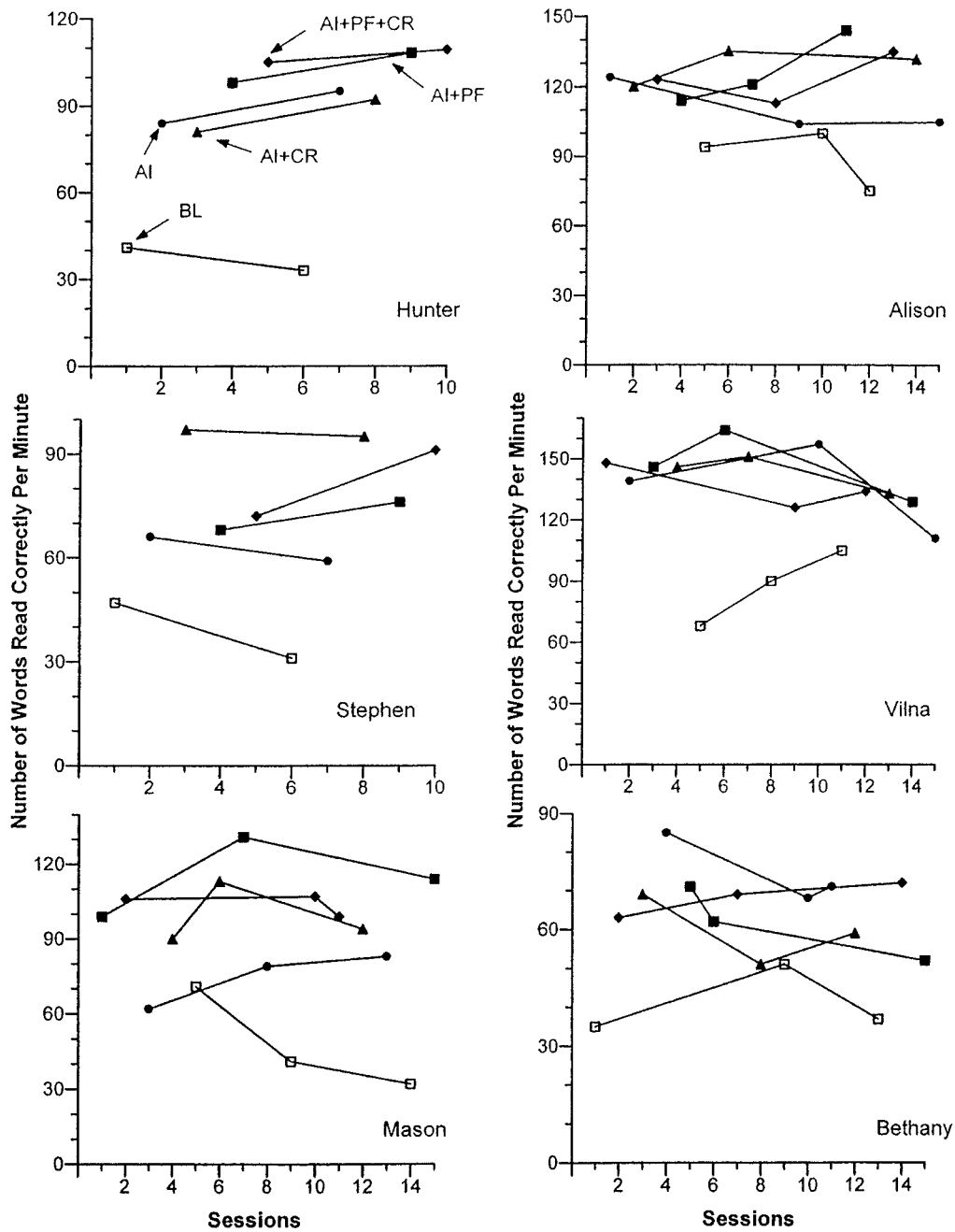
Figure 1. Number of words read correctly per minute across experimental conditions. BL = baseline, AI = antecedent intervention, AI+CR = antecedent intervention and contingent reinforcement, AI+PF = antecedent intervention and performance feedback, AI+PF+CR = antecedent intervention, performance feedback, and contingent reinforcement.

than during baseline. The effectiveness of the antecedent intervention was enhanced for 4 of the 6 participants by combining it with one or both consequences. Consistently high reading rates were observed for Hunter when either the AI+PF or AI+PF+CR con-

ditions were presented. For Stephen, the greatest improvements in reading fluency were observed during the AI+CR condition. Improvements over the antecedent intervention condition also were observed in Stephen's reading fluency during the AI+PF and AI+PF+CR conditions. Mason demonstrated consistent increases in WRCM when the AI+PF condition was presented. Although Mason's fluency levels during both the AI+CR and AI+PF+CR conditions also were higher than during antecedent intervention alone, these two conditions were undifferentiated. Alison demonstrated similar increases in WRCM across the three combined conditions relative to antecedent intervention alone, whereas for Vilna similar rates were observed under all interventions. Although Bethany showed an improvement under the AI+PF+CR condition relative to the other combined interventions, similar results were obtained when antecedent intervention was implemented alone.

DISCUSSION

Results of this study suggest that assessing the relative contribution of antecedent intervention and consequences in a brief analysis was useful for identifying the necessary and sufficient components of a reading intervention. For 4 participants, combining the antecedent intervention with either of the two consequences produced the greatest improvements in oral reading fluency. The consequences that resulted in the greatest increases in performance varied across participants. Whereas Stephen's reading fluency increased the most when contingent reinforcement was added, Mason's and Hunter's reading fluency increased with performance feedback only. Alison's reading fluency was influenced equally by both interventions. No participant's performance increased even further when the two consequences were combined. For the remaining

2 participants (Vilna and Bethany), the antecedent intervention alone was sufficient to improve reading fluency.

It should be noted that the improvements in reading fluency were specific to the passages that were practiced during the repeated readings component of the treatment, and little or no generalized improvement in oral reading was noted. That is, if repeated reading of the passages used during instruction leads to generalized improvements in oral reading, then one would expect increases in correct words read over time in the baseline probes (in which a novel passage was read each time). Only Vilna showed an increasing trend in WRCM in the successive baseline probes, and it is not clear whether this was a result of the reading instruction or variables outside the experiment.

A number of limitations should be described. One problem is that responding was relatively undifferentiated across the interventions for several participants. This may be due to the fact that the contingent reinforcement condition contained elements of the performance feedback condition, and vice versa. That is, the contingent reinforcement condition had a feedback component because the reinforcer was provided contingent on performance that exceeded a criterion. Similarly, the feedback provided in the performance feedback condition may have functioned as a reinforcer when the participant met his or her goal. The participants' baseline skill levels also may have influenced the results. Participants who responded differentially across the conditions (Hunter and Stephen) had low baseline rates that could be indicative of reading at the acquisition stage of the instructional hierarchy (Hanson & Eaton, 1978). Conversely, participants who demonstrated minimal differentiation across the intervention conditions (Alison and Vilna) had relatively high baseline rates that could be indicative of reading at the fluency stage of the instructional hierarchy.

The high baseline rates may have placed a ceiling on the amount of incremental improvement. Finally, lengthier exposure to the intervention components may have been needed to observe differences in responding.

The possible existence of unidentified sources of variability in responding also limits the reliability of the analyses. Variability across sessions may have been due to at least two factors. First, a reinforcer preference assessment was not conducted. As a result, the functional properties of the reinforcers were unknown at the outset of the study and may have affected student responding. Second, passage difficulty may have varied from session to session (Daly & Murdoch, 2000). Although attempts were made to control for this factor, readability indexes varied by almost one grade level in second- and third-grade passages. Other limitations of the study were that the effects of consequences alone and increases in performance across time and passages were not examined.

In conclusion, the results of this study extend previous research by demonstrating that the inclusion of consequences in a brief experimental analysis of reading can assist in the identification of necessary and sufficient intervention components. This finding is important, considering that one goal of classroom instruction is to maximize active student responding in the presence of academic materials (Heward, 1994). Presently, these types of analyses allow educators to identify how instructional variables interact with indvidual student skills. As analyses of these types are further extended and refined, greater control over unidentified sources of variability may be obtained, and a usable technology of analysis and remediation techniques for reading problems may emerge. Future studies should attempt to examine unidentified sources of variability as well as the generalized effects of selected treatments across time and reading passages.

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STUDY QUESTIONS

1. How were correct responses and errors defined?

2. What two-step process was used to identify task materials for each participant?

3. What portions of participants' performance during reading passages were used for data-collection purposes during baseline and intervention phases?

4. Describe the three intervention components. How were these components combined?

5. Briefly summarize the results for all participants.

6. What data do the authors offer in support of their conclusion that intervention effects were specific to the repeated reading passages?

7. What functional similarities were noted between the contingent reinforcement and performance feedback conditions? Also, although not discussed by the authors, how might the performance feedback component be considered a form of antecedent intervention?

8. What is the general value of conducting an experimental analysis of instructional procedures such as that illustrated in this study?

Questions prepared by Claudia Dozier and Jessica Thomason, The University of Florida