

*IMPROVING READING OUTCOMES FOR CHILDREN WITH  
LEARNING DISABILITIES: USING BRIEF EXPERIMENTAL ANALYSIS  
TO DEVELOP PARENT-TUTORING INTERVENTIONS*

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The present study assessed the effects of summer parent tutoring on 3 children with learning disabilities using empirically derived reading interventions. Brief experimental analyses were used to identify customized reading fluency interventions. Parents were trained to use the intervention strategies with their children. Parents implemented the procedures during parent-tutoring sessions at home and results were measured continuously in high-word-overlap and low-word-overlap passages to determine whether generalization occurred. Parent and child satisfaction with the procedures was assessed. Results demonstrated generalized increases in reading fluency in both high-word-overlap and low-word-overlap passages as a function of parent tutoring. Also, acceptability ratings by children and their parents indicated that they viewed the interventions as acceptable and effective. Results are discussed in terms of structuring reading fluency interventions that promote generalization and maintenance of treatment effects.

DESCRIPTORS: brief experimental analysis, generalization, learning disability, parent tutoring, reading fluency

Learning to read is critical for a child's current and future well-being (National Reading Panel, 2000), yet many children struggle to learn to read. A recent study of the prevalence of reading disability found that as many as 17% of the population may suffer from a disability (Shaywitz & Shaywitz, 2003). The problem is compounded by academic losses experienced by students over the summer months. Summer has been correlated with a significant decrease in reading performance (Schacter, 2003). Children with disabilities are subject to even greater declines in academic performance during summer vacation (Alexander, Entwisle, & Olson, 2001; Cooper, Nye, & Charlton, 1996), presumably because of an absence of practice with

the very skills that set their more competent peers apart from them.

One option to counteract adverse effects of decreased reading during the summer months is to assist parents in implementing empirically based interventions. Duvall, Delquadri, Elliott, and Hall (1992) found that parent tutoring during the summer produced marked increases in reading rates that generalized from home to school. Parent-directed academic interventions provide opportunities to extend the learning environment beyond the school walls and academic calendar (Christenson & Sheridan, 2001). Children can benefit, however, only if parents are guided in the selection and application of appropriate reading interventions for their children.

Brief experimental analysis has recently emerged as an approach for selecting academic interventions. Brief experimental analysis methods have been developed and investigated in the areas of reading, writing, spelling, and math (Daly, Martens, Dool, & Hintze, 1998; Daly, Martens, Hamler, Dool, & Eckert, 1999; Eckert, Ardoin, Daly, & Martens, 2002).

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Investigations of brief experimental analyses have shown that the effects of interventions may be idiosyncratic across students (Daly *et al.*, 1998, 1999), yet are stable over time (Eckert *et al.*). Brief experimental analysis is characterized by single-case design elements with truncated phases (when response increases are not obtained) and brief replications. The purpose for making the analyses brief is so that clinicians can conduct the assessments efficiently.

Brief experimental analyses may be particularly useful in helping behavior analysts choose academic interventions for parents who wish to tutor their children. In several recent studies, brief experimental analysis have been conducted to identify customized reading interventions prior to parent tutoring (Daly, Shroder, & Robinson, 2001; Persampieri, Gortmaker, Daly, Sheridan, & McCurdy, 2006; Valleley, Evans, & Allen, 2002). However, only Persampieri *et al.* examined parent tutoring during the summer months. Prior to treatment, Persampieri *et al.* assessed participants' differential responsiveness to combinations of reward and instructional strategies through brief experimental analysis. The parents then applied the selected treatment repeatedly over time during the summer. Generalized reading fluency increases to high-word-overlap (HWO) passages were obtained. However, the treatment involved numerous steps, and a component analysis was never conducted. A simpler intervention may have been equally effective. Also, generalization of effects beyond the HWO passages was not examined.

Brief experimental analysis can be used to identify simpler and more efficient reading intervention packages by eliminating unnecessary instructional or motivational components. One way in which investigators have done this is to progressively add intervention components until no further performance increases are observed (Daly *et al.*, 1999; Daly & Murdoch, 2000). The last phase associated with a performance increase is used as the basis for selecting

reading interventions before conditions are replicated for experimental control purposes. The other approach to identifying efficient combinations of reading intervention components is to begin the analysis with a complete treatment package and dismantle it through a component analysis (Barnett, Daly, Jones, & Lentz, 2004). Intervention components are sequentially withdrawn until the fewest components necessary to improve reading performance are identified (Daly, Persampieri, McCurdy, & Gortmaker, 2005). The advantage of the dismantling approach is that the initial treatment package can serve as a benchmark against which reduced numbers of treatment combinations can be evaluated. For example, Daly *et al.* (2005) conducted brief experimental analyses that examined the individual contribution of instructional and reward strategies after having examined their combined effects on student performance. The results were used as the basis for generating customized reading interventions that were then applied over time for both participants. This same strategy may be beneficial for parent-implemented treatments to ensure that interventions are no more complicated than they need to be.

One of the weaknesses of reading intervention research is the lack of generalized improvements in student outcomes (Lyon & Moats, 1997). Results are often measured in the materials in which instruction is carried out. As such, the effects may not be generalizable beyond the training conditions. Martens, Daly, Begeny, and VanDerHeyden (*in press*) describe two ways in which stimulus generalization can be observed for oral reading. First, with effective instruction learners should come to read newly learned words in novel texts. In this case, the learner generalizes word reading to new stimulus conditions (*i.e.*, identical words across texts with novel arrangements of words). Second, learners should come to read words that were not directly taught during instruction. In this case, the newly acquired words do not share

identical stimulus properties with those instructed, but may come from a stimulus set that is functionally equivalent (e.g., along the lines of difficulty level, frequency of usage in curricula, or predictable phonetic properties).

If generalization is conceptualized in terms of proximity to original stimulus conditions during training, these forms of stimulus generalization represent two points along a continuum of conditions in which newly acquired responses may appear. Some recent studies have attempted to hold treatments to a higher standard by measuring stimulus generalization of treatment effects (Daly et al., 1999; Daly, Martens, Kilmer, & Massie, 1996). Manipulating the amount of word overlap between training and assessment passages is how these investigations have operationalized stimulus generalization. Two passages that contain many of the same words but that are written as different stories are HWO passages. Two passages that contain fewer of the same words but that are of approximately equal difficulty and come from the same or a similar curriculum series are low-word-overlap (LWO) passages. Operationalizing stimulus generalization in this way makes it possible to investigate the degree of generalized performance increases across different points in the continuum of properties shared between training and assessment conditions (Martens et al., in press). Use of HWO passages provides a sensitive method for estimating the degree to which instruction produces generalized increases to training conditions that contain a relatively larger proportion of identical stimuli used during training. Use of LWO passages provides a method for estimating the degree to which instruction produces generalized increases to training conditions that contain functionally equivalent but independent stimuli to those used during training.

The purpose of the present study was to extend the literature that has assessed the impact of summer parent tutoring. Brief experimental

analyses were used to identify the most effective and parsimonious treatment for 3 children with learning disabilities in reading using empirically derived reading interventions. Once the treatment was identified, parents were trained to use it. Next, parents conducted an instructional trial as a part of the brief experimental analysis to determine whether the parent was able to achieve the same effect as the experimenter prior to independent parent tutoring. Parents then implemented the procedures during parent-tutoring sessions at home, and results were measured continuously in HWO and LWO passages. Finally, parent and child satisfaction was measured.

## METHOD

### *Participants and Setting*

Participants were 3 students who had completed third grade and were entering fourth grade in the fall and their biological mothers. Rachel was a 9-year 5-month-old biracial girl. Angel was a 9-year 3-month-old Caucasian girl who had been diagnosed with attention deficit hyperactivity disorder. Misty was a 9-year 8-month-old Caucasian girl. All students had been previously identified with a learning disability in reading through a psychoeducational evaluation that determined that the children qualified according to state eligibility criteria.

The first author conducted all analyses. Initial assessments occurred in the school psychologist's office at the elementary school for all children. Further assessments and training sessions occurred at the participants' homes in order to accommodate the parents' scheduling and transportation constraints. Parents carried out the intervention procedures in their homes.

### *Instructional and Assessment Materials*

*Instructional passages.* Passages were taken from three basal reading series: the Ginn reading series (Clymer, Indrisano, Johnson,

Pearson, & Venezky, 1987); the Silver, Burdett, and Ginn reading series (Pearson *et al.*, 1989), and from each child's basal reading series used in their school curriculum during the previous spring semester (*i.e.*, Houghton & Mifflin, 2004). Materials were retyped and adapted to reflect the level at which each student had been instructed during the previous school year. Readability scores were computed using the Spache formula (1974). Average readability across all passages was 2.5 (range, 2.0 to 3.2) for Angel and 3.1 (range, 2.1 to 4.0) for Rachel and Misty. All passages were approximately 100 to 250 words in length.

*HWO passages.* Each basal reading passage (Clymer *et al.*, 1987; Houghton & Mifflin, 2004; Pearson *et al.*, 1989) was rewritten to create a passage that had many of the same words but constituted a different story. Therefore, each instructional passage had a single corresponding HWO passage. In this way, generalization of training effects could be measured. To determine the percentage of word overlap, the number of words appearing in both passages was divided by the total number of words in the instructional assessment passage. Average word overlap was 87% for Angel (range, 83% to 93%) and 90% for Rachel and Misty (range, 83% to 96%). Average readability of HWO passages was 2.6 (range, 2.3 to 3.2) for Angel and 3.0 (range, 2.1 to 4.0) for Rachel and Misty.

*LWO passages.* LWO passages were passages that were independent of instructional and HWO passages and were used to monitor progress. Passages were taken from Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Good & Kaminski, 2002). The average readability of LWO passages was 2.6 (range, 2.4 to 2.7) for Angel and 2.9 (range, 2.8 to 3.1) for Rachel and Misty.

### *Dependent Variables*

*Reading fluency.* Correctly read words (CRW) per minute and errors per minute served as dependent variables. A word was scored as an

error each time it was omitted, mispronounced, or substituted, or if the student paused for 3 or more seconds. CRW per minute is a reliable and valid measure of oral reading fluency (Shinn, Good, Knutson, & Tilly, 1992).

*Consumer satisfaction.* Parents' subjective ratings on the Behavior Intervention Rating System (BIRS; Von Brock & Elliott, 1987) were used to assess social validity at the end of the study. The BIRS is a 24-item Likert-type scale that yields the following factors: acceptability, effectiveness, and time to effect. The reliability and construct validity of the BIRS were investigated by Von Brock and Elliott. Alpha coefficients of .97 were reported for the total scale, and .97, .92, and .87 for the acceptability, effectiveness, and time to effect factors, respectively. Children were given a modified version of the Child's Intervention Rating Profile (CIRP) at the end of the study. The modification involved adding pictures of a popular cartoon character. The CIRP is a five-item questionnaire and uses a 5-point Likert-type scale of children's acceptability rating ranging from 1 (*I disagree very much*) to 5 (*I agree very much*) (Elliott, 1988). The CIRP has an average coefficient alpha of .86 (Elliott).

### *Interrater Agreement*

The first author scored the reading probes. An independent trained observer scored reading probes for interrater agreement purposes. Agreement was achieved when both observers scored the same word as either correctly or incorrectly read. Interrater agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. Verbal and written explanations of the definitions of reading accuracy, fluency, and errors were given to the independent observer, who then coded sample tapes of curriculum-based measurement reading probes for CRW per minute. The observer had to demonstrate at least 90% interrater agreement with the experimenter on the training tapes before proceeding

to code the children's reading for the study. The independent observer listened to 34% of the audiotaped reading assessments (randomly chosen) conducted by the experimenter. The mean interrater agreement was 92% (range, 61% to 100%).

### *Experimental Conditions*

In addition to a baseline condition, reward and instructional components were used both in the brief experimental analysis and during parent tutoring. Reward and instruction were initially combined in the brief experimental analysis. A component analysis, involving only some of the reading strategies, also was conducted as a part of the brief experimental analysis. The simplest yet most effective package for each student was used for parent tutoring. The following is a description of each of the conditions.

*Baseline.* Baseline served as a control condition. No instruction was provided. Assessment was conducted in a LWO passage.

*Reward.* Tangible items (e.g., pens, balls, small games, candy, etc.) were offered for achieving accuracy and fluency performance goals (Daly et al., 2005). A reward bag containing these items was presented by the researcher, and the participant was allowed to choose an item. Individual goals were determined based on the child's best performance in a given passage to date. To earn a reward, the participant was told that she was required to beat her last score, which meant that she had to read at least 30% more CRW per minute than her previous best performance and commit three or fewer errors. When reward was combined with instruction, assessment and reward were carried out in a passage that had HWO with the instructional passage immediately after instruction. When there was no instruction prior to assessment, reward was carried out in a LWO passage.

Rewards also were given for compliance with tutoring procedures. Each family was given

stickers and a calendar of the treatment dates. The child was rewarded by her mother with a sticker on the calendar each day they practiced readings for 10 to 15 min.

*Instruction.* Instruction consisted of listening passage previewing (LPP), repeated readings (RR), phrase drill (PD) error correction, and syllable segmentation (SS) error correction; these were applied to instructional passages. LPP and RR were always delivered together. During the LPP/RR condition, the story was read to the student while she followed along with her finger (LPP; Daly & Martens, 1994). The student then reread the passage three times (RR; Rashotte & Torgesen, 1985). PD and SS also were always delivered together. PD was administered after the first reading of a passage, and SS was administered after the second reading. During the PD/SS condition, the experimenter or parent highlighted any errors made by the student and read the word to the student. The student read each word aloud to the experimenter or parent. The student then read the sentence containing the error word three times aloud (PD; O'Shea, Munson, & O'Shea, 1984). When one or more words were read incorrectly during the child's second reading of a passage, an index card was used to cover words read incorrectly. The syllables in each word were uncovered and read to the student. Next, the student read each of the syllables as they were uncovered. Finally, the syllables and the blended word were read independently (SS; Daly et al., 2005).

### *Brief Experimental Analysis*

After screening to identify HWO and LWO passages of equal difficulty, the experimenter or parent conducted teaching trials (using the strategies described above) in instructional passages. Immediately following each teaching trial, the experimenter assessed the student's performance on HWO and LWO passages.

*Treatment package and component analysis.* Each child was first administered a treatment consisting of reward plus instruction. If it was

effective, a component analysis of the treatment was performed until the most robust, yet least intrusive, intervention was determined. The next two teaching trials occurred in random order to determine if the child exhibited a skill or performance deficit (i.e., 1 child received reward first, and the other 2 children received instruction first). The instruction condition was administered to determine if the child exhibited a skill deficit, and reward was administered alone to determine if the child exhibited a performance deficit. If reward alone was as effective as reward plus instruction, then a performance deficit was hypothesized. If instruction alone was as effective as reward plus instruction, then a skill deficit was hypothesized.

If instruction was found to be the most effective and efficient treatment, then the components were further analyzed. Because it was hypothesized that the participants would display reading fluency difficulties, the strategies that had the least effect on opportunities to respond were omitted first. Therefore, the error-correction procedures (PD/SS) were taken out of the package and an RR/LPP condition was administered. The most effective condition was then replicated along with a baseline condition. If the child improved her fluency during the replication trial, the least intrusive condition was recommended to the parent as a potentially effective intervention.

*Parent validation.* The final part of the brief experimental analysis was to determine whether the parent could achieve the same performance increase as the experimenter for the treatment identified as the simplest but most effective in the prior portion of the brief experimental analysis. Each parent conducted an instructional trial after being thoroughly trained in the intervention (see *Parent Training* below). Once the validation procedures were complete, the experimenter then assessed student performance in an HWO passage to determine the effectiveness of the prescribed treatment as implemented by the parent. Scores were graphed and the

effect was deemed significant if CRW per minute in the HWO passage surpassed performance in the baseline condition and when it reached a level similar to the effects achieved by the experimenter.

### *Parent Training*

The first author trained parents individually. Training was conducted in one session at the children's homes. The experimenter trained each parent to implement the customized reading package. Training was conducted in three steps with both parent and child present. First, the experimenter verbally described the components of the intervention and answered any questions the parent had. Second, the experimenter modeled the intervention with the child using passages that would not be used during any other portion of the study. Finally, the parent implemented the procedures with her child as the experimenter observed. Performance feedback was provided to parents as the training was in progress. Parents were required to perform the intervention with 100% accuracy in the presence of the researcher before training ceased. A structured protocol, which also served as a treatment integrity checklist, was provided to the parents. Parents were instructed to engage in the tutoring procedures 3 to 5 days per week for 10 to 15 min per session.

### *Experimental Design and Procedure for Parent Tutoring*

A multiple-probe design across tasks (reading passages) was used to evaluate the results of the reading program for each student with four HWO passages that were rewritten from the children's curricular reading series (Houghton Mifflin, 2004). Repeated measurements were carried out across HWO passages initially to obtain baseline measurements on all passages. Then, repeated measurements across passages continued while treatment was introduced sequentially across passages, but never concurrently. When treatment was terminated for

a given passage, repeated measurements revealed maintenance of treatment effects for that passage. Experimental control was demonstrated if the child's reading fluency increased in HWO when and only when treatment was introduced. Improvement in HWO passages was considered an indicator of stimulus generalization.

The generality of treatment effects was also examined experimentally within a multiple baseline across participants design. LWO passages (i.e., DIBELS passages) were administered repeatedly to participants during baseline and parent tutoring. Introduction of parent tutoring was staggered across participants. Experimental control was demonstrated if the children's reading fluency increased in LWO when and only when treatment was introduced. Improvement in LWO passages was considered an indicator of stimulus generalization. The procedures in each phase of the experimental design are presented below.

*Baseline.* No instruction (parent tutoring) was provided during baseline. The children read all four HWO passages and a randomly selected LWO passage for 1 min to the experimenter.

*Parent tutoring.* Once parent training and the brief experimental analysis were complete, the parents were instructed to conduct tutoring sessions 3 to 5 days per week for 4 weeks. Tutoring consisted of the interventions derived from the brief experimental analysis. For Rachel, reward plus instruction was chosen. Therefore, in addition to repeated tutoring throughout the week, Rachel received a reward at the end of the week for exceeding her fluency goal. For Angel and Misty, instruction was chosen. Instruction occurred in one story per week following the procedures described previously. The experimenter provided a new intervention protocol, tape, and story materials after each weekly assessment. Assessments were conducted separately by the experimenter three times per week at the children's homes. Performance in HWO passages was used to

evaluate tutoring across each of four instructional passages (i.e., one passage per week), and performance in LWO passages was used to evaluate the tutoring package across participants. Each participant plotted her data on LWO passages following each assessment.

#### *Treatment Integrity*

All brief experimental analyses were audiotaped by the experimenter, and all home sessions were audiotaped by the parents. An independent trained evaluator scored treatment integrity of the brief experimental analysis, and the experimenter scored treatment integrity of parental implementation. Treatment protocols (available from the first author) were written in a checklist format, and the person scoring treatment integrity indicated whether each step was followed accurately or not. The independent evaluator checked 100% of all brief experimental analysis sessions. The mean percentage of correctly implemented treatment integrity steps was 97% (range, 92% to 100%). Tapes of parent-tutoring sessions were reviewed by the experimenter and compared to the intervention protocol. The experimenter listened to 60% of all parent-tutoring sessions. The treatment integrity of parental implementation was 89% (range, 60% to 100%).

## RESULTS

### *Brief Experimental Analysis and Parent Validation*

Results of the brief experimental analyses are displayed in Figure 1. Rachel's fluency increased from 62 CRW per minute in baseline to 88 CRW per minute in reward plus instruction. Next, reward and instruction were examined separately. Although both interventions increased Rachel's fluency more than baseline, neither intervention achieved the magnitude of effects of reward plus instruction. Therefore, the component analysis was terminated and reward plus instruction was replicated. During the second trial Rachel surpassed her previous improvements (107 CRW per min-

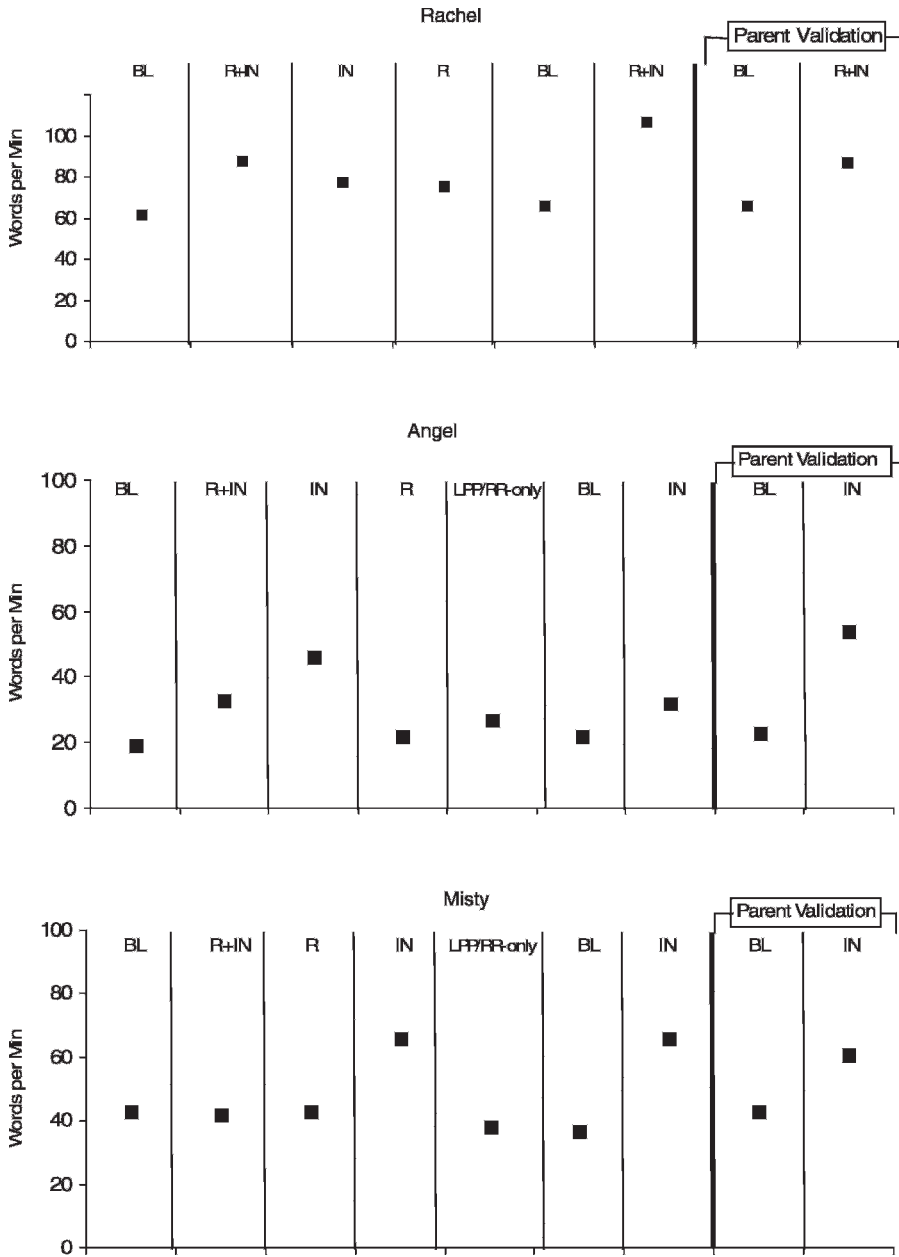


Figure 1. Correctly read words per minute during the brief experimental analysis and parent validation for Rachel, Angel, and Misty. BL = baseline; R+IN = reward plus instruction; IN = instruction; R = reward; LPP/RR = listening passage preview plus repeated readings.

ute). It was concluded that she benefited from a treatment that included components for both skill and performance deficits. Similar results were found when her mother implemented the intervention. With her mother as the tutor,

Rachel's reading performance increased to 87 CRW per minute in reward plus instruction during the brief experimental analysis. Baseline results remained stable throughout the brief experimental analysis.



Angel's performance in reward plus instruction led to considerable improvement. Her fluency increased from 19 CRW per minute in baseline to 33 CRW per minute in reward plus instruction. Next, reward and instruction were examined separately. In instruction, Angel's performance improved to 46 CRW per minute, whereas minimal changes occurred in reward (22 CRW per minute). Because the results for instruction exceeded the results for the combined treatment (i.e., reward plus instruction), the components of the instructional package were further analyzed to assess effects of instruction without the error-correction procedures (LPP/RR). Little improvement was made during the LPP/RR condition (27 CRW per minute), suggesting that all instructional components, including error correction, were needed to improve Angel's performance. The original instruction condition was replicated and, again, her reading fluency improved (33 CRW per minute). Angel also increased her reading performance after the parent instructional trial. Following the parent-delivered instruction, performance increased to 54 CRW per minute. As with Rachel, baseline was stable throughout the brief experimental analysis.

During Misty's brief experimental analysis, no improvement was detected following reward plus instruction. Misty read 43 CRW per minute in baseline and 42 CRW per minute in reward plus instruction. Next, reward and instruction were examined separately. No increase was found in the reward condition (43 CRW per minute). In the instruction condition, her fluency increased to 66 CRW per minute. Because the greatest results were achieved in instruction, the components were further analyzed to assess effects of instruction without error correction (LPP/RR). No improvement was found in this condition (38 CRW per minute). The instruction condition was replicated, and Misty displayed similar gains (66 CRW per minute). It was hypothe-

sized that all instructional components were needed for greatest improvement. When Misty's mother conducted an instructional trial, her fluency increased to 61 CRW per minute. Results for baseline remained low in both cases. Again, as with the others, her baseline was stable throughout the brief experimental analysis.

Positive results were obtained for all 3 participants by both the experimenter and parents. Interestingly, all 3 were reading at somewhat different levels during the initial screening. Angel, who was the least proficient reader, showed the highest relative performance increase during parent validation. All parents obtained performance increases with the empirically derived interventions, closely matching those of the experimenter. Confidence in experimental control is strengthened by the fact that for all participants three replications of the chosen intervention produced similar results.

#### *Effects of Parent Tutoring*

*HWO assessments.* Rachel's results are displayed in Figure 2. Rachel read an average of 65.5 CRW per minute with 3.4 errors during baseline across all passages. Based on the results of the brief experimental analysis, reward plus instruction was delivered during parent tutoring. An immediate increasing trend and level occurred for CRW per minute for all HWO passages. Although there are slight increasing trends in baseline, all of the treatment data points clearly exceeded all of the subsequent baseline data points. Average CRW per minute was 108.8, and average number of errors per minute was 2.0. Treatment effects were maintained across all passages once intervention was removed.

Angel's results are displayed in Figure 3. Angel read an average of 27.2 CRW per minute with 12.8 errors during baseline across all passages. Based on the results of the brief experimental analysis, instruction was delivered during parent tutoring. Although Angel was not rewarded for an increase in fluency, she received reinforcement for completion of the parent-

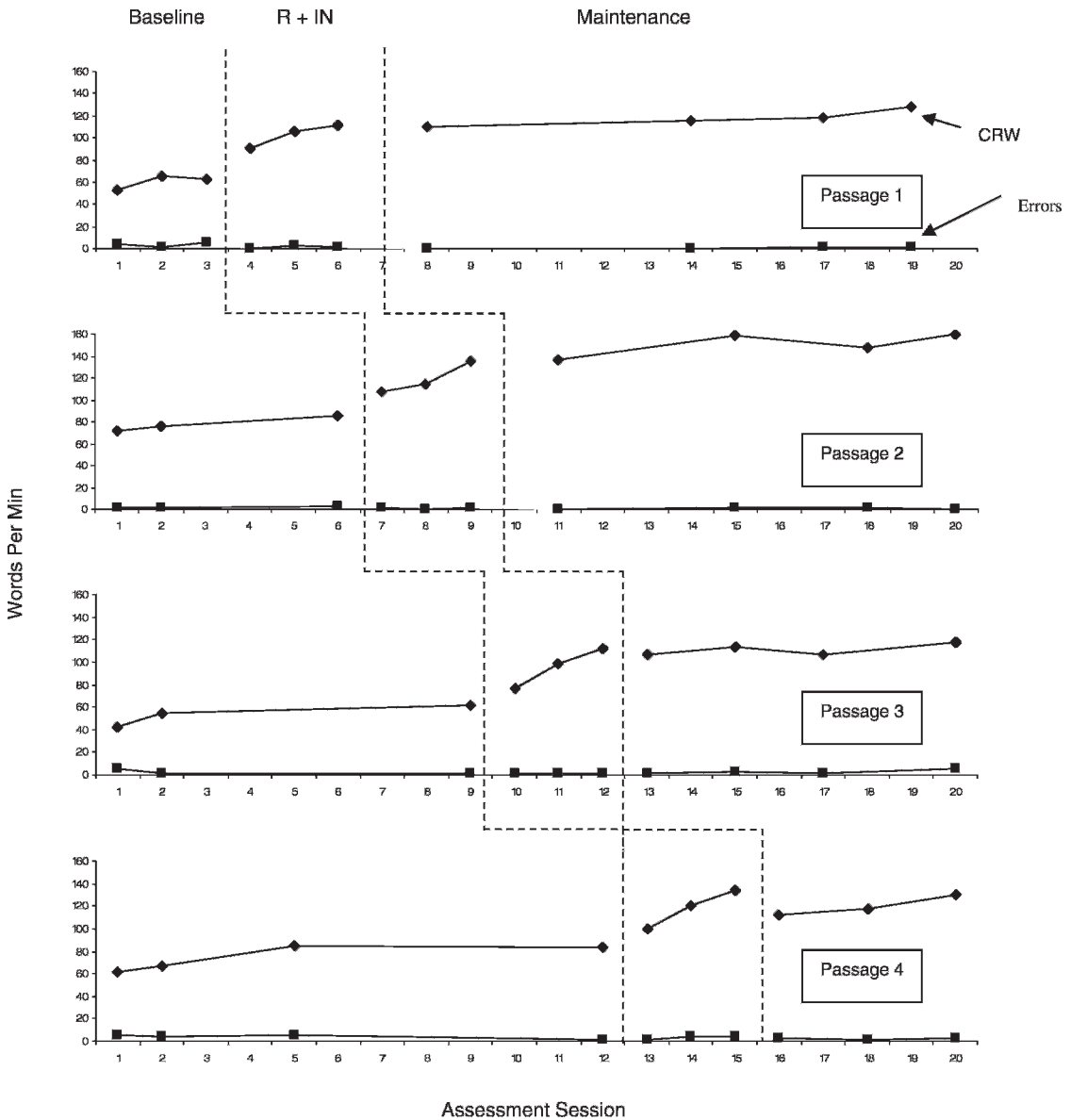


Figure 2. Correctly read words per minute and errors per minute in HWO passages for Rachel.

tutoring procedures. The behavior program was established due to Angel’s initial resistance to the home reading program. It was collaboratively decided with Angel and her mother that she would receive a prize (e.g., pens, balls, small games, candy, etc.) at the end of the week from the experimenter if she completed three or more parent-tutoring sessions, as denoted by her sticker chart. Immediate changes in level and

increasing trends occurred for CRW per minute for all four HWO passages. All of the treatment data points exceeded all of the baseline data points. Average CRW per minute was 51.2, and average number of errors per minute was 3.4. Once intervention was removed, treatment effects were largely maintained.

Misty’s results are displayed in Figure 4. She read an average of 42.5 CRW per minute and

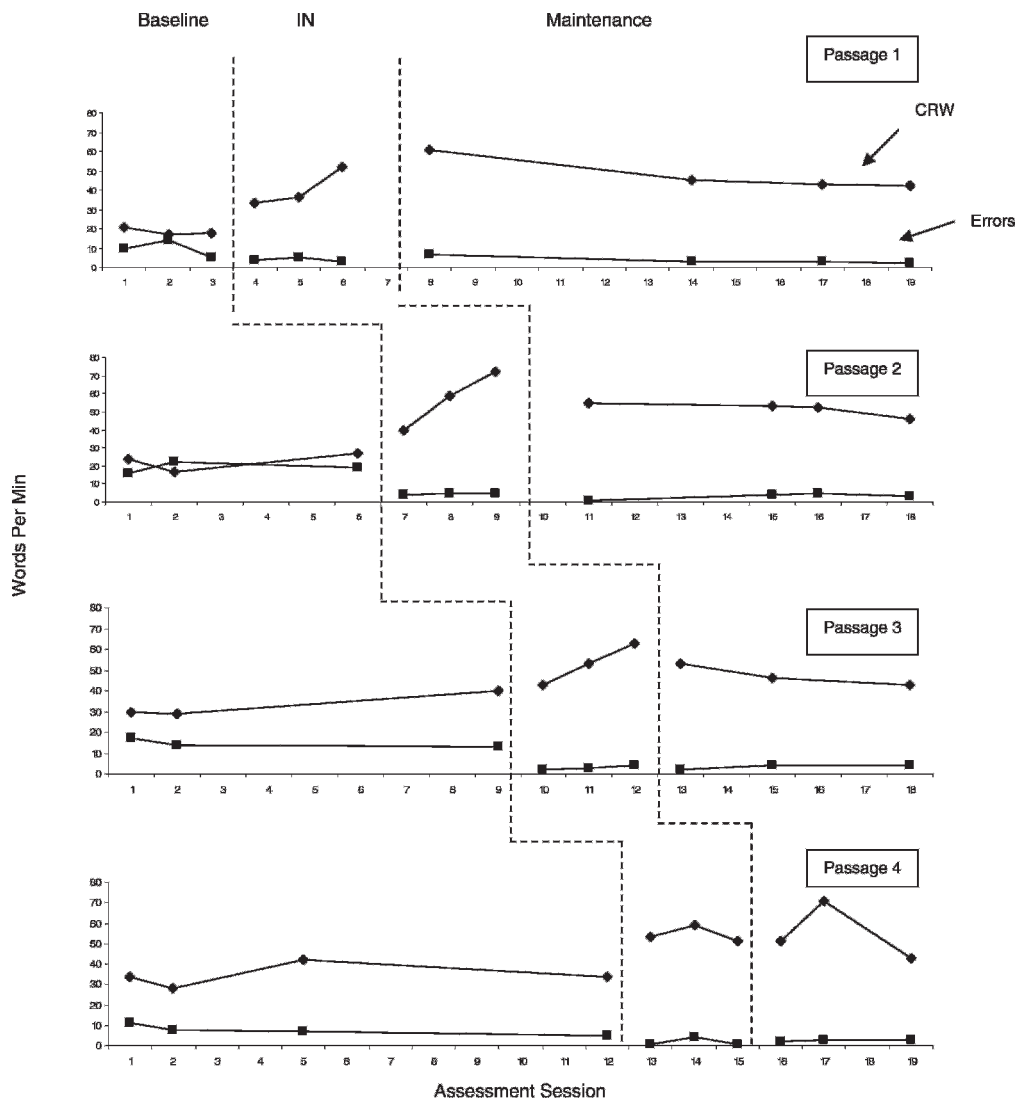


Figure 3. Correctly read words per minute and errors per minute in HWO passages for Angel.

made 8.1 errors during baseline across all passages. Based on the results of the brief experimental analysis, instruction was delivered during parent tutoring. An immediate change in level occurred for CRW per minute for all four HWO passages, but the degree of increase varied across passages. Although an increasing trend was apparent in Passage 1 during baseline, all of the treatment data points exceeded all of the baseline data points, and a change in level and trend occurred. Misty showed the greatest performance increases in Passage 1. It is

interesting to note that these data were for the week during which the parent carried out the treatment three times. Smaller increases occurred in Passages 2, 3, and 4. During these weeks, her mother carried out only one or two sessions per week. Increases in trend and level are evident in Passages 1, 2 and 3, whereas only a change in level is shown in Passage 4. Average CRW per minute was 65.3, and average number of errors per minute was 2.3. Once the intervention was removed, treatment effects were maintained, with the exception of Passage

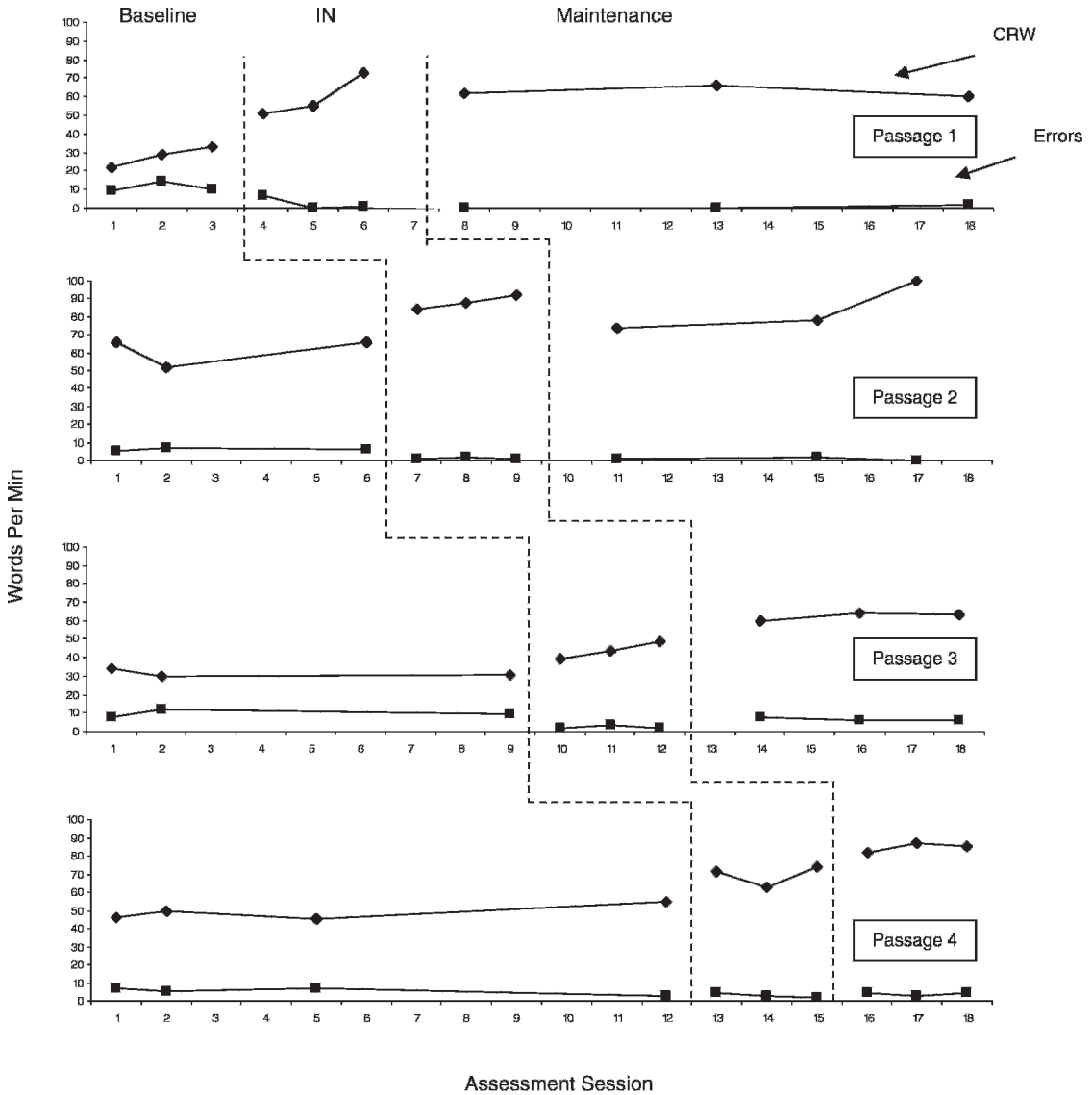


Figure 4. Correctly read words per minute and errors per minute in HWO passages for Misty.

2, in which slightly lower CRW per minute were observed. Errors decreased immediately for all four passages with the introduction of treatment.

All children showed increases in CRW per minute and decreases in errors across HWO passages. All participants maintained 100% nonoverlapping data from baseline to treatment in tutoring assessment passages for CRW per minute. Following the withdrawal of parent tutoring for each passage, levels of CRW per

minute were commensurate with or higher than treatment levels than during baseline.

*LWO assessment.* Results of parent tutoring in LWO passages appear in Figure 5. To accommodate the multiple baseline design, assessment of LWO passages began 1 to 2 weeks earlier than HWO assessments for Angel and Misty. Performance in baseline was relatively stable, with the exception of one extreme score in Misty’s baseline for CRW per minute. Reading rate increased and errors decreased during

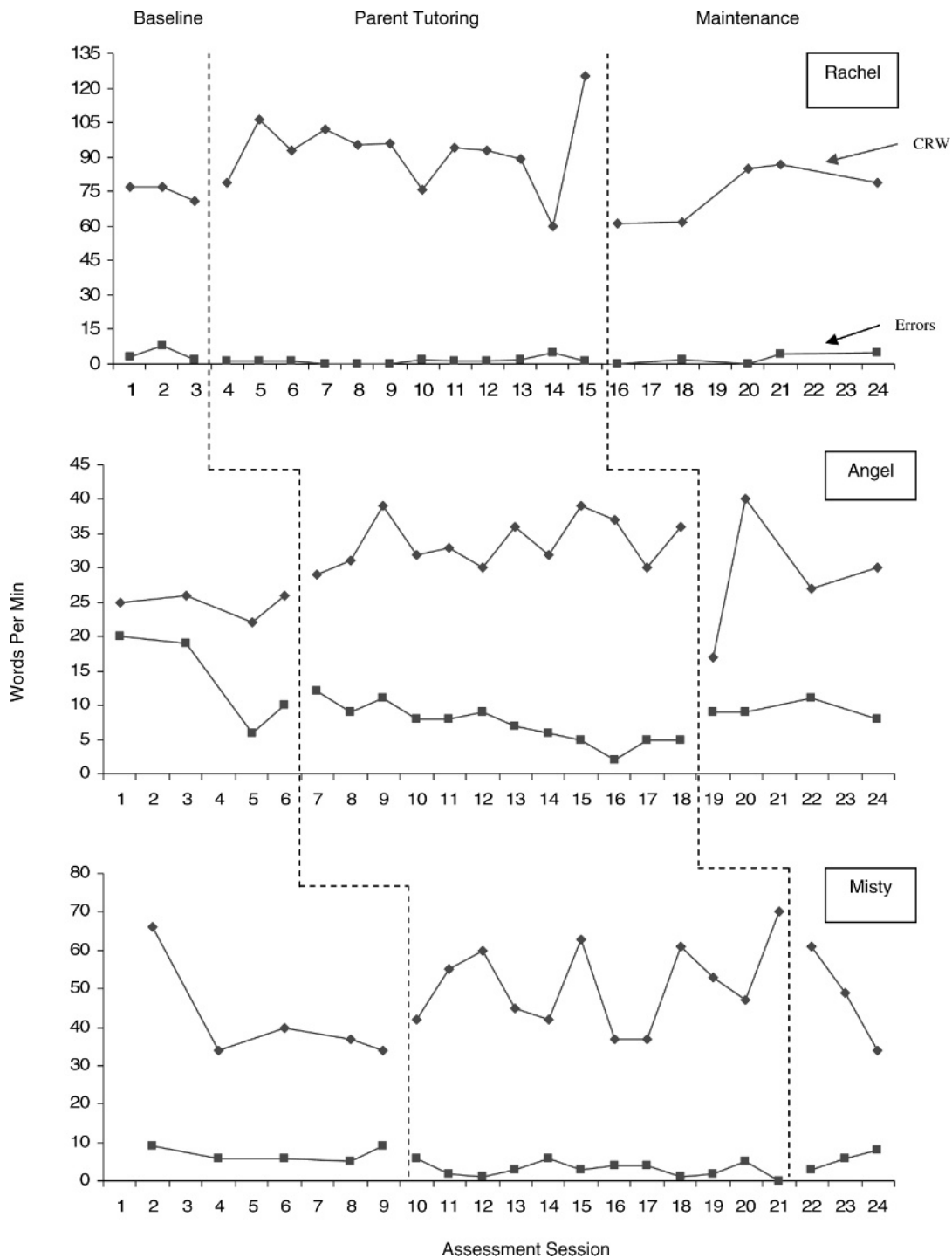


Figure 5. Correctly read words per minute and errors per minute in LWO passages for all participants.

parent tutoring for all participants. Changes in performance correlated with the introduction of treatment for each participant. Rachel read an average of 75.0 CRW per minute with 4.3 errors per minute during baseline, 92.3 CRW per minute with 1.3 errors per minute during parent tutoring, and 74.8 CRW per minute with 2.2 errors per minute during maintenance. Results during parent tutoring were characterized by a change in level for both CRW per minute and errors per minute, with the former increasing and the latter decreasing to near 0. Performance dropped off for CRW per minute during maintenance, and errors remained low.

Angel read an average of 24.8 CRW per minute with 13.8 errors per minute during baseline, 33.7 CRW per minute with 7.3 errors per minute during parent tutoring, and 28.5 CRW per minute with 9.3 errors per minute during maintenance. There were a steady increasing trend in CRW per minute and a decreasing trend in errors during treatment. Results during the maintenance phase were highly variable for CRW per minute. Errors remained at approximately the same level.

Misty read an average of 42.4 CRW per minute with 6.8 errors per minute during baseline, an average of 51.0 CRW per minute with 3.1 errors per minute during parent tutoring, and an average of 48.0 CRW per minute with 5.7 errors per minute during maintenance. There was an increasing trend in CRW per minute; however, the results were quite variable. There was a reduction in number of errors during parent tutoring. During maintenance, a downward trend in CRW per minute occurred, and an increasing trend in errors emerged.

*Consumer satisfaction.* Following completion of the study, each child completed the CIRP. The items on the CIRP were completed using a 5-point Likert scale, with 5 representing *very acceptable*. All children reported high acceptability of the reading intervention (mean item rating of 4.6 for Rachel, 5 for Angel, and 4.6 for Misty).

Each participant's mother completed the BIRS following the study. The items on the BIRS were completed using a 6-point Likert-type scale, with 6 representing *very acceptable* or *very effective*. The BIRS generated four ratings: acceptability, effectiveness, time to effect, and an overall score. In general, all participants' mothers reported that the procedures were very acceptable. Acceptability mean item scores were 5.73 for Rachel's mother, 5.93 for Angel's mother, and 4.8 for Misty's mother. Parents also perceived the treatment procedures to be very effective. Effectiveness mean item scores were 6 for Rachel's mother, 5.71 for Angel's mother, and 4.86 for Misty's mother. Parents reported that they quickly saw a positive change in their child's reading. Time to effect mean item scores were 6 for Rachel's mother, 5.5 for Angel's mother, and 5 for Misty's mother. Overall item ratings on the BIRS were 5.83 for Rachel's mother, 5.83 for Angel's mother, and 4.83 for Misty's mother.

## DISCUSSION

This study sought to increase oral reading fluency rates of 3 students with reading disabilities through parent tutoring using intervention strategies that were not only empirically supported but also empirically derived for each participant. All students received a customized intervention package during home-based parent tutoring after ensuring effectiveness of treatment through parent validation. A multiple-probe design across passages was used to examine the effects of parent tutoring on reading in passages that had high content overlap with instructional passages. A multiple baseline across participants design was used to examine tutoring effects in passages that had low content overlap with instructional passages. Results indicated that generalization to HWO and LWO reading materials occurred for all participants. Also, parents and children rated the efficiency and effectiveness of the treatment as well as the student outcomes positively.

Tutoring results were consistently positive across children and were strikingly similar to the results of the brief experimental analysis. For example, during the brief experimental analysis Angel read 21 CRW per minute and 20 CRW per minute in baseline with the experimenter and parent, respectively. During tutoring, Angel read 26 CRW per minute on average during baseline. She read 46 and 54 CRW per minute in the HWO passages during the brief experimental analysis with the experimenter and parent, respectively. During parent tutoring, she read 51 CRW per minute on average in the HWO passages. The same pattern occurred for the other participants. This finding supports previous research (e.g., Persampieri et al., 2006) that suggests that results of brief experimental analysis correlate with the magnitude as well as the direction of subsequent treatment outcomes.

Most previous parent-tutoring studies used a fixed multicomponent intervention for all participants (e.g., Duvall et al., 1992). More recently, studies have begun to use brief experimental analysis to validate an intervention package prior to parent tutoring (Persampieri et al., 2006; Valleley et al., 2002). The current study extends work on brief experimental analysis through the application of a dismantling procedure to identify the most parsimonious treatment package for each participant. Less intrusive treatment packages were directly compared with more complex treatments. Similar to results of other studies, individual differences were found across students, in that various combinations of antecedent and consequential components were effective (Bonfiglio, Daly, Martens, Lin, & Corsaut, 2004; Eckert et al., 2002). Rachel responded best to a treatment package that contained a combination of instructional and reward components. For Angel and Misty, the instructional package alone (without reward) sufficiently improved reading fluency. This failure to improve with an added reward condition may be best explained by Angel's and Misty's slower reading rates and

lower accuracy levels during baseline, perhaps suggestive of a skill deficit (as opposed to a performance deficit; Skinner, 1998). Anecdotally, Misty stated that she became extremely nervous when a reward was offered contingent on improved reading rate, suggesting that some intervention components may hinder treatment effects with some children and that the most elaborate intervention may not be the most functional. Thus, the results suggest that interventions derived from a brief experimental analysis and composed of the fewest components necessary may achieve at least the same effects as more complex interventions in some cases.

Parent tutoring produced measurable, generalized increases in several ways. The brief experimental analyses conducted with each student revealed generalization of effects to HWO passages relative to the LWO passages associated with baseline for at least one treatment condition. During parent tutoring, students increased their overall fluency rates by an average of 29.4 CRW per minute and decreased their errors by 5.5 words per minute in materials that had already been instructed during school. In the LWO passages, fluency increases were not as striking. Nonetheless, the improvements of 17.5 CRW per minute for Rachel, 8.9 CRW per minute for Angel, and 8.6 CRW per minute for Misty during treatment are remarkable considering that the average learning-disabled student completing third grade would be expected to increase by 2 to 3 CRW per minute in 4 weeks during the course of the normal school year with a strong intervention in place (Deno, Fuchs, Marston, & Jongho, 2001).

The obvious question at this point is why students were able to generalize from parent tutoring. It appears that stimulus generalization is more likely when stimulus control extends across a broad array of stimulus conditions. Therefore, intervention components that promote stimulus control for oral reading (i.e.,

student reading is under the control of the text) within the natural context for reading (i.e., reading texts) and across texts are likely to improve generalization of responding. In the current study, several strategies were used, including differential reinforcement of fluent word reading for instances of generalization, teaching in the natural context (i.e., instructing students in passages), and frequent and repeated practice. Finally, every procedural effort was made to ensure effective practice at home. The brief experimental analysis served to guide selection of treatment and individually structure each participant's practice to produce the greatest reading gains. Explicit training of parent tutoring and repeated treatment integrity checks were used to increase proper implementation of the intervention.

Although participants' reading fluency increased in the LWO passages as a function of intervention, the fact that responding decreased following the withdrawal of instruction suggests that responding did not change purely as a function of discriminative control. One would expect that if increases in responding occurred only as a result of increased stimulus control, behavior would not decrease when the intervention was withdrawn. The only difference between the treatment and maintenance phases was the presence or absence of parent tutoring concurrent with assessment in the generalization passages by the experimenter. The tutoring sessions essentially functioned as an antecedent to student reading during assessment in LWO passages. The contingencies for reading, however, during these assessments were the same throughout all phases of the study.

Because changes between phases (baseline, treatment, maintenance) do not appear to be purely a result of discriminative control for the generalization passages, it is possible that the tutoring phase created an establishing operation (EO) that differentially affected responding across each phase. An EO is a motivational variable that momentarily alters the reinforcing

effects of a consequence without altering the contingency for the behavior (Michael, 1982). For example, if the tutoring sessions or participant display of results for the experimenter increased the reinforcing properties of assessment conditions, then generalized fluency increases may be expected during the tutoring phase and decreases may be expected during the maintenance phase when treatment was withdrawn (i.e., no prior display of results was available as an antecedent). Possible reinforcing consequences during the generalization assessment include parent attention and visible performance increases when the participant plotted the data. Another possible factor affecting the results could have been the frequency of assessments for each phase. It should be noted that this interpretation is preliminary and requires further confirmation. However, it raises intriguing questions for future research on the role of EOs in improving academic performance. For instance, what conditions are necessary during tutoring to evoke generalized academic improvements? What role does individualized adult attention play during a practitioner's assessment of academic skills? Does the school year create EOs that are absent during the summer, leading to declines in performance during the summer?

The pattern of improvement followed by a decline in LWO passages when tutoring was withdrawn may signal the need for sustained practice with children with reading disabilities to produce lasting and successful generalized effects. Summer programs may need to be extended throughout the entire summer to assure positive effects. For example, month-long summer reading programs may result in only temporary effects, and improvements may not be maintained when the program ends. Given the decreases in academic performance experienced by school-aged children during the summer months (Cooper, Nye, & Charlton, 1996; Schacter, 2003), especially in low-income families (Alexander *et al.*, 2001; Cooper *et al.*), these programs may be vital for helping some



students to become successful readers. Brief experimental analysis may provide educators with a methodology for identifying effective and manageable reading interventions that can be carried out by parents during the summer.

Although an increase in reading fluency was found for all participants, differences in magnitude of improvement were noted across participants. The number of tutoring sessions per week may have accounted for at least some of the effects. Rachel received an average of three tutoring sessions per week, but Misty received an average of two tutoring sessions per week. Furthermore, Angel's substantial improvements may also have been affected by the higher frequency of tutoring sessions (3.5 sessions per week on average). It should be noted that Angel also received reinforcement for completing three or more tutoring sessions per week. Therefore, the degree of generalized treatment effects that are obtained for parent tutoring may also be a function of students' baseline proficiency levels and the frequency of tutoring sessions, among other things.

Several limitations should be noted when interpreting the results. This study did not manipulate difficulty level of reading materials. Instead, students were tutored in stories they had been taught during the previous academic school semester. Different results may have been obtained with novel materials at different reading levels, but it is reasonable to assume that previous curricular materials were an excellent choice because (a) all children displayed dramatic improvements in oral reading rate and accuracy in HWO passages (in spite of the fact that they had previously received instruction in those passages) and (b) each child's fluency assessed with an independent reading series increased at greater magnitudes than expected for students with learning disabilities (Deno et al., 2001).

Another limitation of the study is that it did not examine effects on students' comprehension. As such, there is no guarantee that their ability to understand the texts they read was

improved. Furthermore, during the experimental analysis all combinations of treatments were not assessed with all students. Therefore, it is unknown whether the individualized treatment prescribed for each child was more effective than other possible treatment combinations. Other combinations of strategies that target children's various levels of responding, such as accuracy, fluency, and generalization, may have resulted in greater effects than the prescribed package. For example, each reading intervention could have been provided individually and then combined with other components to assess effects of all combinations of treatments. One drawback to this approach, however, is that it significantly prolongs the experimental analysis.

Students were frequently assessed on the same passages during parent tutoring, which increased opportunities to respond and may have increased treatment effects beyond those possibly obtained if not probed repeatedly on the same passage. In addition, the frequent number of home visits made by the experimenter may have encouraged increased tutoring sessions, in that each assessment provided a treatment integrity check. Although these frequent visits had obvious benefits for the participants, different results might have been obtained in situations in which fewer or no visits occur. Without such frequent visits, students and parents may have not been as motivated to implement tutoring sessions with such a high degree of treatment integrity. Although the assessment sessions were brief, they were frequent, which may not be feasible for the typical practitioner. Furthermore, although the home visits provided by the experimenter allowed participation by families without transportation, home visits are often not feasible in a school setting. It is possible, however, that the simplicity of the reading strategies may be readily carried out in homes without assessment from an outside source. Nonetheless, the results of this study strongly suggest that parent tutoring during the summer months may be a valuable approach to assisting children with reading

disabilities and that experimentally derived treatments may contribute to developing effective but manageable reading interventions.

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