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How and to What Extent Do Two Cover, Copy, and Compare Spelling Interventions Contribute to Spelling, Word Recognition and Vocabulary Development?

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To the Graduate Council:

I am submitting herewith a dissertation written by Kathryn Jaspers entitled "How and to What Extent Do Two Cover, Copy, and Compare Spelling Interventions Contribute to Spelling, Word Recognition and Vocabulary Development?." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Education.

Robert Williams, Major Professor

We have read this dissertation and recommend its acceptance:

David Cihak, R. Steve McCallum, Christopher Skinner

Accepted for the Council:
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Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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A Dissertation
Presented for the
Doctor of Philosophy
Degree
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Kathryn E. Jaspers

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ABSTRACT

The purpose of this study was to examine the impact of two spelling interventions on spelling acquisition, word reading, vocabulary development, and spelling maintenance. The first intervention, called Cover, Copy, and Compare (CCC), involved having the participant look at a word, cover it, write it, and then compare the written response to the original stimulus. The second intervention (CCC+SD) included the CCC technique, but the experimenter also used the word in a sentence and provided a brief definition just before the participant engaged in the CCC technique of each word. Instructional time was held constant across conditions. Daily spelling performance for three first-grade students was measured using an alternating treatment design. In addition, participants were tested before and after the study to determine levels of change in word reading and vocabulary. Results indicated that both interventions increased the participants' spelling at a functionally equivalent rate, which was greater than a control condition. Because the rate of spelling words learned was equivalent across the two interventions, these interventions may be considered equally efficient methods of improving spelling accuracy. Only 1 of the 3 participants was better able to define words assigned to the CCC+SD condition, relative to words assigned to CCC and control conditions. All 3 participants showed greater gains in word reading in the two interventions than in the control condition.

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CHAPTER I

LITERATURE REVIEW

Introduction

This study was designed to examine the relations between spelling instruction and improvements in spelling, word reading, and vocabulary development. In recent years, researchers have extensively studied spelling instruction, focusing on effective methods and their outcomes. Although a number of researchers have found techniques that are effective in improving students' spelling skills (e.g., Gordon, Vaughn, & Shumm, 1993) and demonstrated the relations between spelling and other literacy variables (Graham, Harris, & Fink-Chorzempa, 2002; Noell, Connell, & Duhon, 2006), fewer researchers have examined the *differential* effectiveness of spelling interventions on other related variables. This chapter first describes the Cover Copy Compare intervention for improving students' spelling accuracy and then discusses the impact of spelling instruction on other literacy variables (i.e., reading, vocabulary).

Cover Copy Compare

Cover Copy Compare (CCC) is a research-based instructional technique that was shown to be effective across an array of subject areas and with children of various ages and abilities (Skinner, McLaughlin, & Logan, 1997). Studies using the CCC technique have been conducted with students across academic subjects, including spelling (Murphy, Hern, Williams, & McLaughlin, 1990), mathematics (Skinner, Turco, Beatty, & Rasavage, 1989), and geography (Skinner, Belfiore, & Pierce, 1992). Children ranging

from elementary school (Murphy et al., 1990; Nies & Belfiore, 2006) to high school (Hubbert, Weber, & McLaughlin, 2000) have engaged in CCC interventions. CCC also was effective for children with mild intellectual disabilities (McLaughlin & Skinner, 1996), emotional and behavioral disorders (Hubbert et al., 2000; Grskovic & Belfiore, 1996; Skinner et al., 1992), and learning disabilities (Nies & Belfiore, 2006).

Skinner et al. (1997) described the CCC process as looking at the stimulus, covering the stimulus, copying the stimulus, and comparing the written copy to the original stimulus. If the student determines that the response and stimulus match, he or she progresses to the next item. If the student's response was incorrect, the student writes the correct response a set number of times. Correction procedures may involve copying the word following an error only once or copying the word multiple times. Overcorrection (i.e., copying the word several times) procedures may increase accuracy because the child performs the correct response multiple times (Skinner et al., 1997). A number of researchers have studied the CCC intervention with spelling. The following sections describe the instructional components of the CCC intervention used to effectively increase spelling performance.

Immediate feedback. The CCC intervention provides students with immediate corrective feedback on performance. Researchers have demonstrated the importance of interventions that provide immediate corrective feedback rather than traditional spelling instruction approaches, which generally involve practice without checking whether the practice is accurate (e.g., Grskovic & Belfiore, 1996; Nies & Belfiore, 2006). In one study, Nies and Belfiore (2006) compared the CCC strategy to a copy-only strategy. In the copy-only condition, students were asked to say the word, point to the word, repeat

the word, and copy the word. This method differed from CCC in that it did not require the child to cover the word while writing it and compare the original stimulus to his or her own response. Nies and Belfiore found that CCC was more effective than the more traditional copy-only spelling strategy in increasing spelling performance (words learned and words retained). These results indicated that the self-evaluation component (when the student compares his or her response to the stimulus) and/or the cover component (when the student tries to recall the spelling of the word while it is covered) embedded in the CCC method were important aspects of the intervention that lead to both increased learning and retention.

Research on spelling interventions (and not just CCC interventions) supports the use of immediate feedback to facilitate performance. For example, Grskovic and Belfiore (1996) compared the spelling performance of students with learning disabilities using a traditional condition (writing the word three times) and a feedback condition (writing the word, receiving teacher feedback, and correcting the word). Grskovic and Belfiore found that the feedback condition led to more words learned and fewer trials to mastery. Similarly, Hubbert et al. (2000) compared CCC to a traditional spelling intervention (using the word in a sentence and copying the word three times) in an adolescent with Conduct Disorder. Hubbert et al. found a higher level of spelling accuracy when their participant was completing the CCC method than when the student was completing the more traditional spelling intervention.

Okyere, Heron, and Goddard (1997) taught students four proofreading symbols and how to use these symbols when comparing their spelling to a model in order to evaluate and self-correct their work. Okyere et al. noted that students demonstrated

improved spelling of target words, greater maintenance, and greater generalization of the target words to other environments (e.g., home). In a follow-up study, McGuffin, Martz, and Heron (1997) demonstrated that self-correcting at the whole-word level can be as effective as the letter-by-letter correction approach used in the earlier Okyere et al. study.

Bosman, Huygevoort, and Verhoeven (2006) examined more closely at the instructional components of feedback that improve performance. Their study compared two types of feedback: knowledge-of-results and informational feedback. In the knowledge-of-results condition, the students were informed whether the answer was correct or incorrect. In the informational feedback condition, the students were informed of the correct spelling of the word in addition to being told the word was incorrect. Bosman et al. found that students having difficulty with spelling performed better under the informational feedback condition, and high-performing spellers performed equally well under both conditions. Thus, informational feedback is particularly important for struggling spellers.

Daily practice. Another important aspect of CCC interventions for spelling is that the interventions are carried out on a daily basis, rather than a traditional Monday presentation and Friday test. In a traditional approach, children tend to have a fixed list of weekly spelling words. At the end of the week, children are tested on those words. McLaughlin, Reiter, Mabee, & Byron (1991) compared fixed lists of spelling words to flow lists. Flow lists can be tested daily, and once a child has spelled a word correctly a set number of times (typically 2 or 3 consecutive days), the word is replaced by a new word (see McLaughlin et al., 1991, for a description of the Add-A-Word spelling program). Mastered words can be retested to measure maintenance. This approach has

been shown to more effectively improve students' spelling than a traditional weekly approach (McLaughlin et al., 1991; Murphy et al., 1990).

Efficiency and Generalization

The previously described research demonstrated that CCC improved spelling performance. Once a skill has been mastered, subsequent goals include maintenance over time and generalization to new situations and skills (Haring & Eaton, 1978). Yet, few of the studies mentioned earlier have considered how the different interventions generalized over time or across skills. Generalization is particularly complex when researchers consider the efficiency and effectiveness of an intervention. For example, it is possible that one intervention might take slightly longer than another intervention but demonstrate greater generalizability to other variables. In this case, these are costs and benefits associated with either approach.

Researchers (Cates et al., 2003; Skinner, Belfiore, & Watson, 1995) have investigated instructional efficiency by measuring the amount of time an intervention requires to demonstrate effectiveness. For example, Cates et al. (2003) found that two interventions were equally effective when keeping number of trials constant, yet the faster intervention was far more efficient. This is an important practical consideration in the field of education because of limited instructional time in school. Although some researchers (e.g., Cates et al., 2003; Skinner et al., 1995) have evaluated this aspect of instructional efficiency, these researchers failed to determine how the instructional techniques impact generalizability to other variables (e.g., word reading or vocabulary).

Spelling, Word Reading, and Vocabulary

There is an expanding body of research demonstrating the relationship between spelling and other related abilities. Spelling has been linked to both reading ability (e.g., Noell et al. 2006) and writing ability (e.g., Berninger et al., 2002). For example, Uhry and Shepherd (1993) examined the impact of spelling and segmenting instruction on reading variables. In their study, students in the experimental group received instruction in spelling and segmenting (i.e., isolating sounds) of words, while students in the control condition received training in the reading of letters, words, and text. Students in the experimental condition demonstrated greater gains in spelling, segmenting, word reading, nonsense word reading, and passage reading. In another study evaluating segmenting, reading, and spelling, Foorman and Francis (1994) studied students' patterns of reading and spelling abilities. Foorman and Francis found that correct spelling of a word predicted correct reading of that word, though the converse was not as clearly evident (i.e., reading a word did not necessarily predict correct spelling of the word). Thus, spelling correlates with other literacy skills.

De Rose, de Souza, and Hanna (1996) taught students a set of words by having them match the printed word to dictated words and construct the words with movable tiles. They found that students were more likely to generalize their learning to new words in the condition during which they moved letter tiles to construct words than the condition in which they matched the printed word to dictated words. In this case, the new words were constructed by recombining the phonemes of the original words to create new words; thus, the students demonstrated generalizability to words with similar

structure. This study indicated that children learn more information about reading and spelling when the task involved word construction (e.g., spelling with tiles) than when the task involves only reading the word.

Graham et al. (2002) studied the effects of spelling instruction on spelling, reading, and writing. They found that children who participated in 48 20-minute sessions to improve spelling skills showed greater gains in spelling, writing fluency, and word-attack skills (i.e., word reading) than a control group who received mathematics instruction. A 6-month maintenance probe showed that only the spelling gains remained for most students, but students who scored poorly on the pretest continued to demonstrate gains in word recognition at the 6-month follow-up probe.

Noell et al. (2006) taught the spelling of three sets of 10 irregular words. Students were taught to spell the first set of words and to read the second set of words. The third set was used as a test-only control. Noell et al. measured the generalization of the spelling words to reading and the reading words to spelling. They found some generalization from reading to spelling and from spelling to reading, even when spelling words were taught orally without the child ever seeing or writing the word.

The Current Experiment

The previously described studies demonstrated that spelling and other literacy variables are linked; however, researchers who have focused on instructional efficiency have generally ignored the question of generalizability to similar variables (in this case, word reading and vocabulary). The current study compares the effects of two spelling interventions on students' spelling word accuracy and retention, as well as the impact of

the interventions on word reading and vocabulary development. For the first intervention in this experiment, all participants engaged in the CCC technique. The second intervention also included the CCC technique and required the experimenter to provide a short definition and use the word in a sentence for each word as the word was presented, just before the participants engaged in the CCC technique for that word. These two techniques were chosen because they both involve a research-based technique (CCC), but the second intervention provides additional information. Because the student will hear the word used in a sentence and will be given a definition, the student may show increases in vocabulary and have a deeper understanding of the word. In fact, using the word in a sentence or giving a definition has often been embedded in spelling interventions as either a task for the student to practice (e.g., Murphy et al., 1990) or for the teacher to use when giving a spelling test (e.g., Gskovic & Belfiore, 1996; McGuffin et al., 1997), yet none of these studies provided research supporting the use of a sentence or definition. There are logical (although not empirically supported) benefits for using a sentence or definition, such as providing context, encouraging generalization, and increasing vocabulary; however, providing this additional information has the potential to increase instructional time per word, consequently making the intervention less efficient.

Thus, this study was designed to answer a number of research questions. First, which intervention is more effective for learning to spell, when controlling for efficiency (i.e., instructional time)? Secondly, how do these interventions affect word reading and vocabulary development? Finally, how do these interventions differentially impact word retention (spelling, word reading, and definitions) over time?

CHAPTER II

METHOD

Participants and Setting

Participants for this study were three first-grade African-American male students who participated in the Young Men's Christian Association (YMCA) after-school program at an urban elementary school in the southeast. Approximately 30 children from the local elementary school, grades Kindergarten through fifth, participated in the after-school program each day. Parents could enroll their children in the after-school program, often at the recommendation of a child's teacher or case worker with the local Department of Children and Families. The after-school program cost $61 per week, but more than 90% of the children pay less than the full amount due to need-based financial assistance. The program was designed to provide a safe and structured after-school setting for children who were from a low-income area. During the after-school program, children worked on homework, participated in group athletic games (e.g., basketball, catch, tag), colored, wrote, played with toys or board games, or read under the supervision of three to four YMCA employees and volunteers. The child-to-adult ratio was approximately 8:1.

Participants for this study were recruited by first discussing the spelling intervention with the after-school program director. The program director provided the names of first-grade students who attended the after-school program regularly. The program director provided a consent form to the parent of each child. The experiment

was conducted at a table in the office of the after-school program director, next to the room in which the children participated in the after-school program.

Each participant chose a pseudonym for himself, which was used on all experimental materials. The three names chosen were Kirk, Manny, and Mike. Each child was six years old at the onset of the study. The study occurred late in the school year, so all 3 participants had nearly completed first grade. Because this was a YMCA-run after-school program, teachers could not be contacted in order to access participants' grades and classroom performance; therefore, the spelling and word-reading sections of the Woodcock-Johnson III Tests of Achievement (WJ-III; Woodcock, McGrew, & Mather, 2001) were administered as a pretest in order to measure each participant's normative ability in spelling and word reading. Kirk scored 100 on the Spelling subtest and 92 on the Word-Reading subtest. Manny scored 97 on the Spelling subtest and 105 on the Word-Reading subtest. Mike scored 96 on the Spelling subtest and 97 on the Word-Reading subtest. Thus, each participant's performance on both subtests was in the average range.

Materials

Materials used in this study included a stopwatch, pencils, CCC worksheets, index cards (used to cover the target word), pretest and posttest worksheets, word lists, and assessment worksheets. The CCC worksheet was an 8 x 11 inch sheet of paper with five columns. The first column provided a space for the spelling word (written by the experimenter), and the second column provided a space for the child to write the spelling

word. The final three columns were used if the child needed to re-write the word as an overcorrection.

Word lists were comprised of unknown words from Graham, Harris, and Loynachan (1993). The word list by Graham et al. was designed by examining four studies of the most frequently written words, four lists of the most frequently read words, and one list of the most frequent spelling words. Thus, this list included 850 words that were most frequently found in children's early reading, writing, and spelling. Graham et al. then assigned each word to a grade level by examining when children first used the word in writing, when children most commonly used the word in writing, the difficulty of spelling the word, grade placement of the word by current spelling programs, and grade placement on the four reading word lists. Graham et al. identified 94 first-grade words and 296 second-grade words, which were eligible for use in this study. The methods used to identify each participant's unknown words are described in the procedures section.

Data Collection and Dependent Measures

Permanent product recording was used in the form of a prepared worksheet. Data were collected during all phases of the study: daily assessments, daily interventions, pretests, and posttests. Data were collected individually. Each day, two 6-min sessions (CCC and CCC+SD) were conducted. Trials per session varied, depending on the participants' speed of studying and writing their words. The following sections describe the data collected during each of these phases.

Daily assessments and interventions. The primary dependent variable was the acquisition of spelling words. Participants were presented with a spelling list comprised

of six words. The rate of acquiring spelling words correctly was recorded for each participant and graphed cumulatively. Each day, participants were assessed on the previous list of words. When the participant spelled a word correctly for 2 consecutive days on this assessment, the word was replaced with another unknown word. Following the daily assessment, participants engaged in both the CCC and the CCC+SD interventions. During the intervention, data were collected on (a) the total number of trials in each session, (b) the number of spelling errors in each session, and (c) the number of words spelled correctly in each session (trials correct the first attempt).

Pretest/posttest. Data from the WJ-III were collected prior to the onset of the CCC and CCC +SD interventions in order to determine participants' normative ability in spelling and word reading. Data also were collected from the original spelling word list. Pretest and posttest data yielded the total number of words spelled correctly, the percentage of words spelled correctly, and the percentage of letter sequences spelled correctly. Data on letter sequences were collected in order to provide a more sensitive measure of participants' progress. This was conducted by counting the number of correct consecutive letters in a word (see Shapiro, 2004, for a description of letter sequences correct). Additional pretest and posttest data included the percentage and the total number of words read correctly, and the percentage and the total number of words defined correctly. The percentage correct was measured because these data allow for a comparison of the two interventions to the control condition. The total number correct also was measured in order to provide a more accurate comparison of the total number of words learned within one intervention relative to the other. The experimenter collected posttest data immediately following the last day of the treatment (immediate posttest), 2

weeks after the last day of the treatment (2-week follow-up), and 4 weeks after the last day of the treatment (4-week follow-up).

Procedures

Pretest. The experimenter first administered the spelling and reading sections of the WJ-III in order to evaluate participants' normative spelling and reading abilities. Participants were then given a spelling pretest over the course of 2 days using the Graham, Harris, and Loynachan (1993) words in order to determine a list of unknown words. The pretest occurred across 2 days because a large number of unknown words (at least 60 per participant) were needed in order to carry out the intervention. Words that could not be easily defined (e.g., "of") or had multiple spellings (e.g., "be" versus "bee") were excluded from the spelling test (see Appendix 1 for a description of the procedures used to determine eligible words). For the spelling pretest, the experimenter read a word, and the participant wrote down the word on a sheet that had lines for 20 words per page. Participants were not given feedback during the spelling pretest. The spelling pretest was given to each participant individually. The experimenter recorded each participant's incorrect responses. Once the participant reached 60 unknown words, testing was stopped at the end of that page. The experimenter then scored the spelling pretest, and a list of incorrectly spelled (unknown) words was established for each participant.

Once a list of unknown spelling words was established, each participant was then given a word list of only his unknown words to read in order to establish baseline levels of word recognition. The participants were asked to read these words because it was possible that they might be able to recognize and read words but not correctly spell them.

In addition, participants were asked to give an oral definition of each word, which was audio taped for the purpose of scoring. A word was scored as correct if the participants' definition approximated the correct definition of the word (See Appendix 2 for the rules used to score participants' definitions). The unknown spelling words were then divided into three equivalent lists of spelling words. Stratified random assignment was used by separating words into lists based on (a) a word's grade placement level (in this case, first or second grade), (b) the number of letters in the word (ranging from two to seven), and (c) whether the participant was able to read and/or define the word (see Appendix 3 for each participant's word list).

Experimental conditions. Three conditions were used. Each condition included its own set of spelling words. These conditions were (a) Cover Copy Compare (CCC), (b) Cover Copy Compare plus Sentence and Definition (CCC+SD), and (c) control condition. Each condition began with six unknown target words. In the CCC condition, participants were given a CCC worksheet with the six target words listed. The experimenter read the first word to the participant three times, then had the participant look at the word, cover the word with an index card, write the word in the next column, and then compare his spelling to the correct spelling. If the participant spelled the word correctly, the experimenter and participant continued to the next word. If the participant incorrectly spelled the target word, the participant then wrote the correct spelling three times in the designated space on the CCC worksheet as an overcorrection technique.

In the CCC+SD condition, participants were given a CCC sheet identical to that used in the previous condition. Procedures in this condition were similar, except that after the experimenter said the word aloud to the participant, the experimenter then used the

word in a sentence and gave a brief definition. In the CCC and CCC+SD conditions, the experimenter stated the word three times in order to control for the number of times the child heard the word. The third condition was a test-only control condition. Participants were assessed over this third list of words but did not receive any intervention with this third set. This third word list examined for possible testing effects. In other words, this third list determines what a participant's rate of growth would be if he were to be tested without participating in any type of practice or intervention.

Experimental design and procedures. An adapted alternating treatment design (Sindelar, Rosenberg, & Wilson, 1985) was used to measure participants' learning rate in the two conditions. Intervention data were collected across 16 consecutive school days during the participants' after-school program. Each day the participants first completed an assessment of the previous day's words (six words from each condition and the control list, with word order randomized across the three lists) and then participated in both interventions (CCC and CCC +SD). Conditions were presented in a counterbalanced order in order to control for sequencing effects. Thus, the order of interventions was counterbalanced so that the same intervention did not always take place first or last (i.e., one day the CCC intervention was first, and the next day the CCC+SD was first). Sessions were conducted individually because each child had his own list of unknown words.

Except for the first day, each day began with an assessment probe of the words from the previous day's 18 words: 12 words from both CCC conditions and 6 from the control list. Once the participant spelled a word correctly on two consecutive assessment probes, the word was dropped and a new word was added. After the assessment, the

experimenter and participant completed the two interventions, with each intervention occurring for 6 min. Each of the 6-min sessions was timed using a stopwatch. The participant repeatedly practiced the same six words for the entire 6 min of the first intervention, and then practiced the second set of six words for the entire 6 min of the second intervention. Thus, the participant could go through his entire list multiple times during one intervention session. The entire intervention time (including both conditions and an assessment of the previous day's words and the control list) lasted approximately 20 min. Participants were not provided with any performance feedback or reinforcement contingent upon correct responding. Non-contingent reinforcement was provided in the form of praise (e.g., "Good job") and tangibles (e.g., pencils, stickers).

Posttests. Maintenance was measured 2 calendar days following the final session. During the first maintenance day, the participant spelled all words on the three word lists (CCC, CCC+SD, and control list). On the second maintenance day, the participants read the list of the words and provided an oral definition of the words. This was completed over the course of two days in order to keep the overall session time close to 20 min. Maintenance was measured again 2 weeks and 4 weeks after the final session. See Appendix 4 for the order of tasks carried out in the experiment.

Interrater Reliability and Procedural Integrity

The experimenter scored each CCC spelling sheet and daily test. A research associate scored 20% of the CCC sheets for each condition and 20% of the daily tests. Interrater reliability for the CCC sheets and daily tests was 100%. The experimenter audio taped the participants' oral definitions during the pretest and posttests. The

experimenter then typed all participants' oral definitions, and the research associate scored 50% of the definitions. Interrater reliability for participants' definitions was 94%. The research associate attended 3 of the 15 days of the experiment (20%) in order to check procedural integrity. The research associate had a procedural integrity checklist that listed the steps to be followed each day (see Appendix 5). The research associate checked each item on the procedural integrity checklist, in order, as the experimenter carried out the intervention. Procedural integrity proved to be 98%.

Data Analysis

Data were analyzed using visual analysis of trend differences of alternating treatment graphs. This analysis was conducted by graphing the number of words learned cumulatively (as measured by words spelled correctly on 2 consecutive days on spelling tests) under each condition on the y-axis and sessions on the x-axis. Each datum point on this graph represents a word spelled correctly for 2 consecutive days. This data representation constitutes an increasing-trend graph. The trends were compared by examining the rate of change (slope) for each data path to determine if the slopes were increasing at different rates. In addition, data were analyzed and an effect size was computed for the number of trials per session, errors per session, and trials correct the first attempt per session in each intervention (CCC and CCC+SD). The latter two variables were computed due to the added time involved when errors were made (caused by the overcorrection procedure), which could influence the total number of trials per session. Pretest and posttest comparisons were conducted on total words spelled correctly, vocabulary words defined correctly, and words read correctly. Finally,

maintenance probes were conducted 2 weeks and 4 weeks after the conclusion of the study, which determined the total number of words maintained across each condition.

CHAPTER III

RESULTS

The results chapter is divided into four sections. The first section summarizes all results from the daily assessments and interventions**:** cumulative spelling words mastered, trials per 6-min session, errors per session, and trials correct the first attempt per session. The second section details the quantitative comparisons of (a) the participants' pretest performance on spelling, word reading, and definitions (used as a vocabulary measure) to (b) their performance on an immediate posttest, 2-week follow-up, and 4-week follow-up. The third section provides a summary of the principal findings, and the fourth section provides data regarding treatment acceptability.

Daily Results

Figure 1 displays the cumulative number of words mastered for each participant. Visual analysis of Figure 1 indicated that the CCC and the CCC+SD spelling interventions resulted in a steady increasing trend for both interventions. Kirk mastered 15 words in both the CCC and CCC+SD conditions, Manny mastered 14 words in both the CCC and CCC+SD conditions, and Mike mastered 18 words in the CCC condition and 19 words in the CCC+SD condition. Meanwhile, the test-only condition remained near baseline level. Kirk, Manny, and Mike mastered none, one, and two words on their control lists, respectively. Therefore, the two interventions appeared effective in teaching spelling words to the 3 participants. The two interventions failed to fractionate from each other for any of the 3 participants, indicating that the CCC and CCC+SD interventions were equally effective.

The totals, mean numbers, standard deviations, and effect sizes (ES) for trials per 6-min session, errors per session, and trials correct the first attempt per session are displayed in Table 1. Graphs of the number of trials per session per condition are found in Figure 2. Kirk engaged in 3.23 more trials per session in the CCC condition than the CCC+SD condition. A moderate ES between these conditions was demonstrated for Kirk. Manny engaged in 0.87 trials per session more in the CCC condition than the CCC+SD condition, and Mike engaged in 1.3 trials per session more in the CCC+SD than the CCC condition. Although ES data indicated small differences for Manny and Mike, visual analyses indicated significant data overlap in the effectiveness of the CCC and CCC+SD conditions.

Results of errors per session are in Table 1 and Figure 3. The 3 participants ranged from 0 to 3 errors per session in each intervention, thus showing a fair amount of variability. Kirk and Mike made an approximately the same number of errors in the two conditions, and visual analyses of their error graphs show significant overlap in the number of errors per day in each condition. Manny committed 0.46 more errors per day in the CCC+SD condition than the CCC condition, a moderate ES.

Because errors could influence the number of trials (due to the overcorrection procedure for mistakes), the number of trials per session that were correct on the first attempt was computed. The results for trials correct on the first attempt can be found in Table 1 and Figure 4. These results were similar to those found in total trials, with Kirk averaging 3.15 more trials per session in the CCC condition than the CCC+SD (a small ES). Meanwhile, visual analysis of the graphs for Manny and Mike indicated equivalent

results for the number correct on the first attempt across the two conditions, although effect size data showed a small difference.

Pretest/Posttest Results

Each participant's pretest performance was compared to his performance on an immediate posttest, 2-week follow-up, and 4-week follow-up for the following variables: spelling, letter sequences correct, word reading, and definitions. These comparisons allowed for the evaluation of skill generalization of the two interventions to other variables and maintenance over time. Table 2 includes the percentages correct for spelling, letter sequences, word reading, and definitions on the pretest, immediate posttest, 2-week follow-up, and 4-week follow-up. See Table 3 for the total number correct for spelling, word reading, and definitions on the pretest, immediate posttest, 2-week follow-up, and 4-week follow-up.

Spelling. Participants spelled no words correctly in each condition at the pretest. Immediately following the intervention, Kirk spelled correctly a greater percentage of words in the CCC condition than in the CCC+SD condition or control condition. At the 4-week follow-up, Kirk's performance on the CCC list was similar to the CCC+SD list, which was slightly higher than the control list. In other words, most treatment effects for Kirk had washed out by this point

It is also important to look at *total* numbers of words because the total score could be higher even if the percentage was lower especially if the child practiced more words in one condition than the other. For Kirk, 21 words were provided in each condition.

Because Kirk practiced the same number of words in each condition, these results mirrored the results described previously for percentage of words spelled correctly.

Manny practiced a total of 20 words in the CCC condition and 18 words in the CCC+SD condition. Manny correctly spelled twice as many words in the CCC and CCC+SD lists than in the control lists, and these results were maintained at the 2-week and 4-week follow-up. Manny learned and maintained approximately the same percentage of words in both experimental conditions across the immediate posttest, 2-week follow-up, and 4-week follow-up. The total words learned and maintained across the two interventions were similar.

Immediately following the intervention, Mike spelled more words correctly in the CCC and CCC+SD conditions than the control condition. However, after 2 weeks his spelling performance on the two experimental conditions decreased to 48%. The control list rose to 24% words spelled correctly. At the 4-week follow-up, the experimental conditions remained relatively level and the control list continued to improve to 33% words spelled correctly. Although Mike spelled a higher percentage of words from the CCC+SD list than the CCC list immediately following the study (81% compared to 68%), his actual number of words spelled correctly was the same (17 words). This occurred because Mike practiced more words in the CCC condition than the CCC+SD condition. His results from the two interventions also were similar at both the 2-week and 4-week follow-up probe. After 2 weeks, Mike spelled correctly 12 words from the CCC list and 10 words from the CCC+SD list. At 4 weeks, he correctly spelled 11 words from each of the two experimental lists.

Overall, each participant showed increased levels of spelling immediately after the intervention and at the subsequent maintenance probes. Each participant also improved spelling on the control lists, though at much lower percentages. In one case, Manny correctly spelled a relatively low percentage of the words learned immediately following the intervention (40% of CCC and 50% of CCC+SD words) but maintained that level over the 2-week and 4-week posttests. Conversely, Mike demonstrated a high level of spelling recall immediately following the intervention (68% in the CCC condition and 81% in the CCC+SD condition) but regressed by the 4-week posttest (44% in CCC and 53% in CCC+SD). Immediately after the intervention, Kirk was better able to spell words in the CCC condition (62% of words) than the CCC+SD condition (43% of words), but this difference was not observed on the 4-week posttest.

Letter sequences correct. Letter sequences correct were calculated as a finer measure of changes in spelling performance. Table 2 illustrates the percentage of letter sequences correct for each participant. Kirk's percentage of letter sequences correct in the CCC and CCC+SD conditions increased considerably immediately following the intervention in comparison to the control condition, although the three conditions were very similar at the 2-week and 4-week follow-ups. Kirk spelled correctly 29%, 14%, and 13% more letter sequences in the 4-week follow-up than the pretest in the CCC, CCC+SD, and control condition, respectively. Thus, Kirk's gains in the CCC+SD condition mirrored that of the control list. His gains in the CCC condition were greater than the other two conditions.

Manny's performance on the control list remained relatively steady across the pretest, immediate posttest, 2-week follow-up, and 4-week follow-up. Manny

demonstrated considerable gains in the CCC and CCC+SD conditions immediately following the intervention, and these gains were maintained at both the 2-week and 4-week maintenance checks. In total, Manny correctly spelled 21% more letter sequences in the CCC condition, 29% more in the CCC+SD condition, and 7% more in the control condition at the 4-week follow-up than at the pretest. These results mirrored Manny's results for percentage and number of words spelled correctly outlined in the previous section.

In the control condition, Mike made only modest gains in percentages of correct letter sequences from pretest to 4-week follow-up, whereas Mike's percentages of correct letter sequences in the CCC and CCC+SD conditions increased at the immediate posttest. Although his 2-week and 4-week results for the CCC and CCC+SD conditions were lower than his immediate posttest results, they still remained higher than the control condition. A comparison of Mike's pretest score with his 4-week follow-up score in each of the three conditions revealed that Mike correctly spelled 24% more letter sequences in the CCC condition, 33% more letter sequences in the CCC+SD condition, and 13% more letter sequences in the control condition.

In summary, all 3 participants demonstrated gains in correct letter sequences in all three conditions. However, Kirk's gains in the CCC+SD condition were initially greater than in the control condition at the immediate posttest but were similar to those in the control condition by the 4-week posttest. Kirk showed more improvement in the CCC condition than in the other two conditions by the 4-week follow-up. The gains for both Mike and Manny mirrored those found in the percentage of words learned described in the previous section. Mike and Manny demonstrated greater growth in percentage of

letter sequences learned in the CCC (24% for Mike and 21% for Manny) and CCC+SD (33% for Mike and 29% for Manny) conditions than in the control condition (13% for Mike and 7% for Manny).

Word reading. See Table 2 for percentages of words read correctly and Table 3 for total number of words read correctly for each participant across the pretest, immediate posttest, 2-week follow-up, and 4-week follow-up probe. Immediately after the intervention, Kirk's percentage of words read correctly from the CCC and CCC+SD word lists increased. Meanwhile, Kirk's percentage of words read correctly from his control list decreased. By the 4-week follow-up, Kirk demonstrated the greatest gains in the CCC+SD condition. His percentage of words read correctly in the CCC and control conditions were both 48%. Although Kirk's final percentages were the same in the CCC and control conditions, Kirk could read a higher percentage of the control list during the pretest and thus made fewer gains under that condition. From pretest to the 4-week follow-up, Kirk demonstrated an increase of 24% in the CCC condition, 38% in the CCC+SD condition, and 13% in the control condition. Because Kirk practiced 21 words in both the CCC condition and the CCC+SD condition, his total number of words read correctly mirrored the percentages of words read correctly described earlier in this paragraph.

Manny's percentage of words read correctly for the control list remained steady from pretest to 4-week follow-up (64% at pretest and 68% at the 4-week follow-up), which indicated that he made no gains in reading of words he had not practiced. Manny's reading of words practiced in the CCC and CCC+SD interventions increased in subsequent assessments. From the pretest to the 4-week follow-up, Manny correctly read

25% more words in the CCC condition, 33% more words in the CCC+SD condition, and only 4% more words in the control condition. Regarding the total number of words read correctly, Manny read 16 of 20 possible words in the CCC condition**,** and 17 of 18 words in the CCC+SD condition. Although Manny correctly read a higher percentage of words in the CCC+SD condition than the CCC condition, this actually represents only one additional word read correctly.

Mike demonstrated improvement in word reading in all three conditions, including the control condition; however, he made greater gains in the CCC and CCC+SD condition than in the control condition. From the initial evaluation to the 4-week follow-up, Mike demonstrated an increase of 64% on the CCC list, 52% on the CCC+SD list, and 33% on the control list. After 4 weeks, Mike read 24 of the 25 CCC words and 19 of 21 CCC+SD words. Thus, although the 4-week posttest reveals a relatively similar percentage of words read correctly, he actually read 5 more words correctly in the CCC condition than the CCC+SD condition because he covered more words in the CCC condition.

In summary, all 3 participants showed gains in the percentage of words read correctly in the CCC (24% for Kirk, 25% for Manny, and 64% for Mike) and CCC+SD condition (38% for Kirk, 33% for Manny, and 52% for Mike). Also, all three demonstrated increases in words read correctly from the control list (13% for Kirk, 4% for Manny, and 33% for Mike), although these rates were less than those found in the CCC and CCC+SD lists.

Definitions. Participants' results for percentage and total number of words defined correctly are in Tables 2 and 3. From pretest to the 4-week follow-up, Kirk correctly

defined only 9% more words in the CCC and control lists, whereas he correctly defined 38% more words from the CCC+SD. After 4 weeks, he correctly defined 12 words from the CCC+SD list and only 6 words from the CCC list. Thus, Kirk demonstrated that he could define words from the CCC+SD condition much more effectively than the CCC or control conditions.

Immediately following the intervention, Manny defined 35% of the words from the CCC list, 67% from the CCC+SD list, and 50% from the control list. Although there is a difference between Manny's scores on CCC and CCC+SD, this is due to a drop in percentage of words defined correctly on the CCC list rather than an increase in words defined correctly in the CCC+SD condition. From the pretest to the 4-week follow-up, Manny correctly defined 20% less in the CCC condition, 6% less in the CCC+SD condition, and 8% more in the control condition. Manny's total words defined in the CCC and CCC+SD condition actually declined across the course of the intervention. Similarly, Mike showed no improvement from pretest to posttest in the CCC and CCC+SD conditions and a 4% improvement in the control condition.

Neither Mike nor Manny showed any improvement in their ability to define words in any of the three conditions. Conversely, Kirk showed marked improvement in the CCC+SD condition.

Summary of principal findings. The primary dependent variable was the acquisition of spelling words. CCC and CCC+SD appeared to be equally effective in teaching spelling words to the 3 participants, whereas the control condition remained at near baseline level. Other data collected during the intervention include (a) the total number of trials in each session, (b) the number of spelling errors in each session, and (c)

the number of words spelled correctly in each session (trials correct on the first attempt). For these variables, Kirk engaged in more trials per session and had more trials correct the first attempt in the CCC condition than the CCC+SD condition. Manny committed more errors in the CCC+SD condition than the CCC condition.

Pretest and posttest data yielded the total number of words spelled correctly, the percentage of words spelled correctly, and the percentage of letter sequences spelled correctly. All participants demonstrated greater growth in spelling accuracy in the CCC and CCC+SD conditions than the control condition. For letter sequences correct, Manny and Mike showed the greater improvements in the CCC and CCC+SD conditions than the control condition. Kirk showed initial improvement in the CCC and CCC+SD conditions, but only the CCC gains were maintained at the 4-week follow-up. Additional pretest and posttest data included the percentage and the total number of words read correctly, and the percentage and the total number of words defined correctly. All 3 participants demonstrated greater growth in reading of words from the CCC and CCC+SD lists than the control list. One of the 3 participants (Kirk) was better able to define words from the CCC+SD condition, although the other 2 participants demonstrated no growth in ability to define words in any of the three conditions.

In summary, the CCC and CCC+SD conditions were equally effective in increasing participants' spelling and word reading accuracy. One participant demonstrated greater gains in his ability to define words in the CCC+SD condition when compared to the other two conditions. One participant engaged in more trials in the CCC condition than the CCC+SD condition, and the other 2 participants showed no differences in trials per session across conditions.

Treatment Acceptability

After the last day of data collection, the experimenter asked each participant which intervention (a) he liked better, (b) was harder, and (c) helped him learn words better. Each participant answered that he liked the CCC+SD intervention better than the CCC intervention, the CCC intervention was harder than the CCC+SD intervention, and the CCC+SD intervention helped him learn words better than the CCC intervention. Thus, treatment acceptability data favored the CCC+SD intervention as the more preferred method.

CHAPTER IV

DISCUSSION

In the current study, two different spelling interventions that used the Cover Copy Compare (CCC) method were evaluated and compared. One intervention included only CCC, and during the other intervention (CCC+SD), Cover Copy Compare was supplemented by the experimenter's stating the definition of the word and using it in a sentence before each CCC trial. This study evaluated if adding these statements (definition and using the word in a sentence) to CCC enhanced students' spelling accuracy. Because adding these components was likely to increase the time each trial required, the interventions were compared using learning rates (see Cates et al., 2003; Skinner et al., 1995). To obtain a clear measure of learning rates (efficiency), instructional time was held constant across the two interventions (i.e., 6 min for CCC and CCC+SD). Additionally, learning trials per session and generalization to word reading and vocabulary were measured.

Evaluation of CCC

The current results supported the efficacy of CCC for enhancing spelling accuracy, as all students showed steady improvement in spelling words assigned to both interventions relative to the words not targeted. The small increase in spelling accuracy on untargeted words indicated that the interventions, as opposed to some other variable (e.g., learning in class) likely caused the increases in spelling. This study provided clear support for previous findings that showed CCC was effective for increasing spelling accuracy (McLaughlin et al., 1991; Murphy et al., 1990; Nies & Belfiore, 2006). The

current results extended previous research on CCC by evaluating generalization to word reading and vocabulary. Post-tests and maintenance data showed that words targeted under both CCC interventions resulted in greater gains in word reading across all 3 participants relative to the control condition. The data indicated that CCC may prove effective in enhancing both word reading and spelling.

Comparison of CCC and CCC+SD

Comparisons of time-series data showed no differences in spelling acquisition rates between the two interventions. These findings indicated that supplementing CCC with sentences and definitions did not enhance spelling acquisition rates. Thus, hearing the definition of a word or hearing it used in a sentence did not enhance spelling accuracy.

However, adding these two components to CCC did not hinder students' spelling acquisition rates, either. This result can be explained by examining the number of learning trials during each intervention, because increasing CCC learning trials has been shown to enhance learning (Skinner, et al., 1997). Participants were expected to complete many more learning trials in 6-min sessions under the CCC condition than under the CCC+SD condition. However, learning trials per session did not differ consistently between the two conditions for the 3 participants. Thus, equivalent learning rates for the two interventions was consistent with the finding that participants engaged in a similar number of learning trials across the interventions.

Writing fluency development may have influenced relative learning trial rates. Because participants were very young students who have not mastered basic writing

skills, the majority of time during sessions was spent on the CCC procedure (i.e., studying and writing words). During this study Kirk showed an increasing trend in the number of trials completed per session. This suggested that Kirk was in the fluency building stage of writing skill development and these trials were actually enhancing his fluency. This indicated an external validity limitation, which should be addressed by future researchers. It is possible that with children who write more fluently, a greater percentage of their time would be spent listening to sentences and definitions, relative to time spent performing CCC. If this were the case, then we would expect students to complete many more trials in the CCC condition than the CCC+SD condition, which may result in greater increases in spelling accuracy for the CCC condition. Additionally, this increasing trend in trials completed suggested that researchers may want to evaluate the impact of CCC on generalized writing fluency.

Another purpose of the current study was to evaluate whether CCC and CCC+SD would enhance word reading and vocabulary (i.e., generalization). Because no experimental design was used to evaluate changes across word reading and vocabulary, these comparisons must be interpreted with caution. However, the current results do provide some direction for future researchers.

All 3 participants showed greater gains on all three word-reading posttests (immediate, 2-week follow-up, and 4-week follow-up) on words targeted by CCC and CCC+SD compared to control words. These results support previous researchers who found that increases in spelling word accuracy can generalize to word reading accuracy (Noell et al., 2006). Comparisons between the two interventions revealed little difference

on word-reading posttest accuracy, which suggested that hearing words defined and used in a sentence did not enhance generalization and maintenance of word reading.

With respect to word reading, during both interventions the students were exposed to the written word and heard the word read the same number of times each trial. Under the CCC condition the words were always read in isolation three times. However, during CCC+SD they were read in isolation one time, read in a sentence one time and read followed by a definition one time. Researchers have suggested that the match between instructional conditions and assessment conditions may influence results (Greenwood, Delquadri, & Hall, 1984). During the word-reading assessment in this study, participants read words in isolation, which was similar to all three CCC opportunities to hear the word read, but only similar to one CCC+SD opportunity to hear the word. Therefore, researchers should conduct similar studies but include a measure of word-reading accuracy when words are imbedded in sentences, as opposed to isolation (Nist & Joseph, in press).

Perhaps the clearest difference between the two interventions was expected to be found in participants' ability to define words learned in the CCC+SD condition. This was anticipated because in the CCC+SD condition, the definition and a sentence were provided for each word; however, this expected difference was not found. In fact, only 1 of the 3 participants, Kirk, was better able to define words in the CCC+SD condition than the CCC or control conditions. The other 2 participants showed no gains in their ability to define words from their CCC+SD list relative to the CCC or control lists. A number of behavioral observations of Kirk's performance during the interventions and assessments may explain this difference between Kirk and the other 2 participants. On multiple

occasions, Kirk stated the definition aloud with the experimenter. In addition, Kirk repeated definitions from his CCC+SD list verbatim on the posttests, even the 4-week follow-up. He also occasionally repeated the sentences and definitions during the daily assessment (at which time the experimenter did not provide the sentence and definition, nor was it requested). Finally, Kirk engaged in fewer trials per session in the CCC+SD condition than the CCC condition. This indicated that trials in the CCC+SD condition took slightly longer, which may have been caused by Kirk repeating the definitions. These unsolicited active responses may have enhanced Kirk's learning (Skinner et al., 1997), and suggest a procedure for enhancing the effectiveness of CCC+SD trials. Researchers should investigate whether requiring students to repeat the definition after the experimenter improves students' ability to recall definitions.

Conversely, neither Manny nor Mike ever repeated a definition during the intervention or provided a definition during assessments that closely approximated a definition provided by the experimenter. Although the participants were not allowed to begin spelling the words until after the experimenter used the word in a sentence and provided a definition, it is possible that Manny and Mike used that time to study the spelling of the words. In fact, Mike engaged in slightly *more* trials in the CCC+SD condition than the CCC condition. These mixed results suggested differences between the participants in their level of attention given to the word's sentence and definition.

In the current study, participants were tested daily on their spelling performance, which may have motivated the participants to attend to this aspect of the intervention rather than the sentences and definitions presented by the experimenter. This treatment-assessment interaction could be balanced by providing motivation (i.e., feedback,

reinforcement) to attend to the words' definitions. This could be done by testing vocabulary accuracy more regularly (i.e., daily).

Other Limitations and Directions for Research

Internal validity. This study contained a number of threats to internal validity. To begin, word reading and vocabulary were measured by assessing participants' performance prior to the study and at points after the study. Because only 3 participants were used and no repeated measures were collected (i.e., time-series data), it is not possible to determine the true cause of any changes in word reading and vocabulary. Future single-subject design researchers should assess changes in word reading and vocabulary over time. This would result in data indicating the learning rates for these variables, as was carried out with spelling in the current study. An alternative method to a repeated-measures design would be a true experimental design with a larger number of participants and statistical procedures to test for significant differences. This would allow more conclusions to be drawn from the pretest/posttest results than was possible in this study.

Another factor that may influence the findings of this study was the method used to determine participants' vocabulary. In the current study, each participant was asked to provide an oral definition for each word from his word list, and these definitions were recorded and scored as either correct or incorrect. It is probable that the participants had knowledge of some words' definitions but could not adequately state a definition. In this case, participants may have been limited by their own language and cognitive processes. Oftentimes, the participants provided a correct sentence that included the word when

trying to define the word, but this sentence was not a sufficient definition. Participants' difficulty providing oral, expressive definitions of vocabulary words may have led to an underestimation of generalization. It is possible that participants increased their vocabulary over the course of this study but their increase was not reflected by the vocabulary measure used in this study. A different test of vocabulary knowledge may be a more appropriate measure of vocabulary. One alternative method for measuring vocabulary would be to state a word and have the student point to a picture that corresponds to the word. Another possibility would involve stating the word, then having the student choose a synonym in a multiple-choice format.

External validity. There were also a number of methodological limitations caused by issues with external validity. Because only 3 participants were used, it was not possible to compare 1 participant's results to another to make generalized statements. In this study, there were a number of idiosyncratic differences between participants' results that cannot be explained. One participant clearly listened to and learned the definitions to words practiced while the others did not. A different participant made greater gains in word reading than the other 2 participants. The third participant maintained his gains in spelling from the immediate posttest to the 4-week follow-up, while the other 2 participants demonstrated lower levels of spelling maintenance.

A larger number of participants would allow greater analysis of data; however, this arrangement would cause its own set of difficulties in that it is challenging to implement a daily intervention lasting many weeks with a large number of participants. One solution would be to run a similar intervention using a class-wide design.

The nature of this study does not allow these results to be generalized to children who do not match the characteristics of the participants in this study. For example, because first-grade students were used, the results cannot be generalized to older students. In particular, the difference in writing fluency between first-grade students and older students may lead to different results if the same study were to be replicated with older students.

Procedures used in this study differed from a typical classroom environment. All 3 participants solicited feedback (i.e., “Did I get it right?”) during the daily assessments, interventions, pretests, and posttests. However, the experimenter did not provide feedback on correct or incorrect responses at any time except during the intervention (CCC or CCC+SD), at which time the participants were told to compare their response to the stimulus. Instead of reinforcement contingent upon accuracy, participants were provided with non-contingent reinforcement in the form of praise and tangibles. Non-contingent reinforcement was provided in order to establish rapport and create a pleasant working environment for the participants without contaminating the study.

Extensions. An important practical issue when choosing an intervention is whether to target an entire class or a specific individual. Moreover, if it is a class-wide intervention, are all students studying the same words? For an individual (one-on-one) intervention or a class-wide intervention in which all children are studying the same words, students can be given a sentence and definition in a relatively short amount of time, which may benefit some students. On the other hand, it is also possible to give a group of children their own set of words on their Cover Copy Compare sheets if there are

varying skill levels among the children. In this case, it would be more practical to abstain from providing definitions to each child.

In this CCC+SD condition, the experimenter provided the participant with a sentence containing the target word followed by a definition of the word. Presenting the definition before the sentence may be more beneficial than the method used in this study. Hearing the definition of an unfamiliar word could provide context and word knowledge, whereas hearing an unfamiliar word in a sentence (before knowing the word's meaning) may not enhance learning beyond what would occur by hearing the definition without a sentence.

This study examined the addition of components (sentences and definitions) to an empirically validated intervention (CCC) to determine if the added components led to greater improvements in spelling, word reading, and vocabulary development. The clearest advantage to giving students the definitions of their spelling words is that 1 of the 3 participants demonstrated growth in his ability to define words in that condition. Although the other 2 participants did not improve in their ability to define words in that condition, they also did not demonstrate any negative effects regarding number of trials per session, spelling words mastered, spelling words maintained, or words read correctly. In addition, all 3 participants indicated that they preferred the condition in which they were provided with a sentence and definition. It is possible that the participants found the CCC+SD condition less monotonous and more interactive. It also may be the case that the participants preferred the CCC+SD condition due to the context provided by hearing a sentence and definition. It may be worthwhile to consider student preference in

recommending treatment conditions if no differences are found in performance between the two interventions.

Researchers should conduct further component analysis studies in order to find the most useful allocation of time in spelling instruction and practice. For example, other spelling activities oftentimes included in the classroom could be added to a CCC intervention in order to determine the impact of these components on learning rate. More specifically, many classroom teachers have students engage in word searches and crossword puzzles with their spelling words as a method to practice their spelling words. Research should be performed to determine if such practice results in any added benefit to spelling accuracy or other literacy variables, particularly when learning rates are considered.

Summary

Although there were no consistent differences found between the two interventions on the primary dependent variable (spelling words learned), a number of valuable inferences may be concluded from this study. If two interventions require the same amount of time to cover the same number of learning trials, we would expect to see similar gains in the primary dependent variable from the two interventions (i.e., an equivalent learning rate). Researchers should continue to assess the relative *rates* of learning, and not just level of learning, when making critical decisions about which intervention to implement**.** However, one must also consider how the targeted variables affect other related variables. In this case, targeting spelling and definitions led to improvements in spelling and reading of target words for all participants and an

improvement in 1 participant's ability to define words. Research on any literacy variable should include measurement of how the variable in question affects other aspects of literacy before researchers judge the effectiveness of the intervention or method used. A principal issue is which intervention should be chosen if one intervention takes slightly longer than the other but results in a greater level of generalization to other variables. The cost of implementing an intervention that requires more time must be weighed against the added benefit of providing greater depth of understanding, maintenance, and generalization. Other researchers should continue to study how changes in one literacy variable lead to changes in other variables.

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APPENDICES

APPENDIX 1: Procedures for Making Word Lists

1. Words were broken up first by grade level, then by definition and word reading scores, and finally by number of letters.
2. Words in the same category were split between the three lists. For example, one 2nd-grade, 4-letter word that the child did not properly read or define would be matched with two other words in the same category.
3. When it was no longer possible to make exact matches, words that were similar in all aspects except number of letters were grouped. For example, if *cup*, *far*, and *with* were all 2nd-grade words that the child defined but could not read, they would be matched even though *with* has 4 letters (but only because all other 3 letter words besides *cup* and *far* in that category had already been used).
4. When words could no longer be grouped by rule 3, words with different reading and/or definition scores were grouped.
5. It was attempted to have an equal number of letters, words that the child could and could not define, words that the child could and could not read, and first-grade versus second-grade words in each list of words.
6. A random number generator was used to assign each word list to a condition (CCC, CCC+SD, and Test-only/control).
7. A random number generator was used to create a word order. Words stayed in their correct rows in order to always be given in the same order as their matched pairs. Thus, if "cow," "man," and "car" are matched, they might be moved lower down the list (each becoming the 6th word in their respective lists), but they would

never be at different levels in their lists (e.g., “cow” could never be 5th on its list while “man” and “car” were 2nd on their lists).

Note: Once the experiment began, words were transferred from the control list to the experimental lists if there was the potential for the child to have less than six eligible words. Also, words from the experimental lists that were not tested or practiced were transferred to the control list upon the completion of the study.

APPENDIX 2: Rules for Receiving Credit for Definitions

1. No credit was given for using the word in a sentence, unless the sentence contained a sufficient descriptor of the word or had a definition embedded in the sentence.
2. Credit was given for an example of the word.
3. Credit was given for providing a synonym.
4. Credit was given for using an antonym as long as the child designates that the word mean *not* the antonym. For example, for the word *stop*, a child would receive credit for *not go.* Similarly, *not on* would be an appropriate definition for *off*.
5. For animals (e.g., dog, cow), the child received credit for the responses *animal* or *mammal*. For food (e.g., apple), the child received credit for *it's something you eat* or *fruit*.
6. No credit is given if the child made an obviously incorrect statement, even if part of the rest of the answer is correct (e.g., "cars fly in the sky, and you drive them and they have 4 wheels" would be scored as incorrect, even though the second part is correct).

APPENDIX 3: Word Lists

List 1: Kirk

	CCC	CCC+SD	Control
1	mother	before	coming
2	outside	clean	brother
3	all	pet	came
4	cold	best	lost
5	want	bring	why
6	candy	cake	boat
7	cry	how	try
8	your	coat	make
9	ride	ball	home
10	box	old	big
11	far	cup	wet
12	get	hen	fun
13	woke	baby	door
14	warm	wind	wash
15	with	wish	when
16	said	house	bird
17	come	look	good
18	bike	apple	after
19	child	dress	train
20	who	ago	bus
21	bus	wet	cow
22			us
23			school

List 2: Manny

	CCC	CCC +SD	Control
1	down	said	make
2	why	try	cry
3	who	ask	drop
4	deep	could	other
5	after	apple	train
6	when	baby	door
7	bird	woke	boat
8	mother	outside	brother
9	coat	seat	tree
10	daddy	truck	men
11	good	cow	play
12	today	clean	sleep
13	before	drive	coming
14	ago	eat	far
15	came	home	ride
16	warm	many	duck
17	child	horse	city
18	wind	bike	cake
19	dress		house
20	want		hope
21			candy
22			wash
23			all
24			come
25			dry

List 3: Mike

	CCC	CCC +SD	Control
1	pet	cow	mad
2	wish	when	with
3	try	why	cry
4	bird	baby	said
5	other	could	after
6	your	love	door
7	dog	fun	car
8	child	candy	clean
9	come	stop	get
10	coat	boat	seat
11	best	lost	want
12	today	mother	sleep
13	man	hen	ball
14	outside	school	brother
15	hope	cold	who
16	warm	woke	horse
17	train	bring	old
18	coming	before	daddy
19	far	ice	ago
20	home	came	apple
21	cup	off	
22	wash	deep	
23	dress		
24	ride		

APPENDIX 4: Order of Tasks

Day 1:

WJ-III Achievement Spelling Subtest

WJ-III Achievement Reading Subtest

Spelling Pretest

Day 2:

Spelling Pretest, continued

(Determine unknown spelling words)

Day 3:

Word Reading Pretest (covering unknown spelling words)

Definitions Pretest (covering unknown spelling words)

(Determine three word lists)

Day 4-19:

Word list tests (six words for each of the three lists)

First intervention

Second intervention

Day 20:

Spelling Posttest

Day 21:

Word Reading Posttest

Definitions Posttest

Day 33:

2-week Maintenance Spelling Posttest

Day 34:

2-week Maintenance Word Reading Test

2-week Maintenance Definitions Posttest

Day 47:

4-week Maintenance Spelling Posttest

Day 48:

4-week Maintenance Word Reading Posttest

4-week Maintenance Definitions Posttest

APPENDIX 5: Integrity Checklist

Integrity Checklist - Date:

Child's Pseudonym:

____get child

____start watch once child is seated and ready to begin

____start stopwatch

____give child 18-item pretest over the previous day's words

____stop stopwatch, record time

____score pretest and edit lists while child has short break

____complete first intervention*

____short break

____complete second intervention*

____stop watch and record total session time

*For CCC intervention:

____start stopwatch

____read each word 3 times

____prompt covering, copying, comparing, if necessary

____prompt correction, if necessary

____after 6 minutes, stop the stopwatch, say "Stop", and take worksheet

*For CCC+SD intervention:

____start stopwatch

____read each word, say sentence, say definition BEFORE child begins copying

____prompt covering, copying, comparing, if necessary

____prompt correction, if necessary

____ after 6 minutes, stop the stopwatch, say "Stop", and take worksheet

APPENDIX 6: Tables

Table 1. Trials, Errors, and Trials Correct First Attempt per Session

		Kirk			Manny			Mike		
		CCC	CCC+SD	ES	CCC	CCC+SD	ES	CCC	CCC+SD	ES
	Total	217	175		151	140		229	246	
Trials	Mean	16.69	13.46	0.57	11.62	10.77	0.22	17.62	18.92	0.31
	SD	5.72	5.61		3.88	3.81		4.79	3.55	
	Total	17	16		10	16		16	11	
Errors	Mean	1.31	1.23	0.09	0.77	1.23	0.50	1.23	0.85	0.37
	SD	1.11	0.73		1.01	0.93		1.24	0.80	
Trials Correct	Total	200	159		141	124		213	235	
First Attempt	Mean	15.38	12.23	0.49	10.85	9.54	0.29	16.38	18.08	0.35
	SD	6.61	6.17		4.71	4.43		5.65	4.05	

Note. Effect Size (ES) formula: $M_1 - M_2 / SD_{pooled}$
An ES of .2 is small, .5 is moderate, and .8 is large (Cohen, 1988)
CCC = Cover Copy Compare, CCC+SD = Cover Copy Compare with Sentences and Definitions

Table 2. Percentage Correct for Spelling, Letter Sequences, Word Reading, and Definitions

		Kirk			Manny			Mike		
		CCC	CCC+SD	Control	CCC	CCC+SD	Control	CCC	CCC+SD	Control
Spelling	Pretest	0	0	0	0	0	0	0	0	0
	Immediate	62	43	22	40	50	20	68	81	12
	2-week	24	38	26	40	50	8	48	48	24
	4-week	38	33	22	45	44	20	44	53	33
Letter Sequences	Pretest	30	39	34	52	47	48	43	48	37
	Immediate	74	71	41	70	78	58	82	94	46
	2-week	47	51	46	73	76	53	74	81	51
	4-week	57	53	47	73	76	55	67	81	50
Word Reading	Pretest	19	19	30	55	61	64	32	38	48
	Immediate	48	43	22	80	78	60	88	95	76
	2-week	57	48	39	85	83	64	92	95	71
	4-week	43	57	43	80	94	68	96	90	81

Table 2. Continued

		Kirk			Manny			Mike		
		CCC	CCC+SD	Control	CCC	CCC+SD	Control	CCC	CCC+SD	Control
Definition	Pretest	19	19	30	55	56	52	36	33	29
	Immediate	28	62	22	35	67	50	40	38	43
	2-week	33	67	26	40	56	56	32	38	43
	4-week	28	57	22	35	50	60	36	33	33

Note. CCC = Cover Copy Compare, CCC+SD = Cover Copy Compare with Sentences and Definitions, Control = Control list.

Table 3. Total Number Correct for Spelling, Word Reading, and Definitions

		Kirk		Manny		Mike	
		CCC	CCC+SD	CCC	CCC+SD	CCC	CCC+SD
Spelling	Pretest	0	0	0	0	0	0
	Immediate	13	9	8	9	17	17
	2-week	5	8	8	9	12	10
	4-week	8	7	9	8	11	11
Word Reading	Pretest	4	4	11	11	8	8
	Immediate	10	9	16	14	22	20
	2-week	12	10	17	15	23	20
	4-week	9	12	16	17	24	19
Definition	Pretest	4	4	11	10	9	7
	Immediate	6	13	7	12	10	8
	2-week	7	14	8	10	8	8
	4-week	6	12	7	9	9	7

Note. CCC = Cover Copy Compare, CCC+SD = Cover Copy Compare with Sentences and Definitions.

APPENDIX 7: Figures

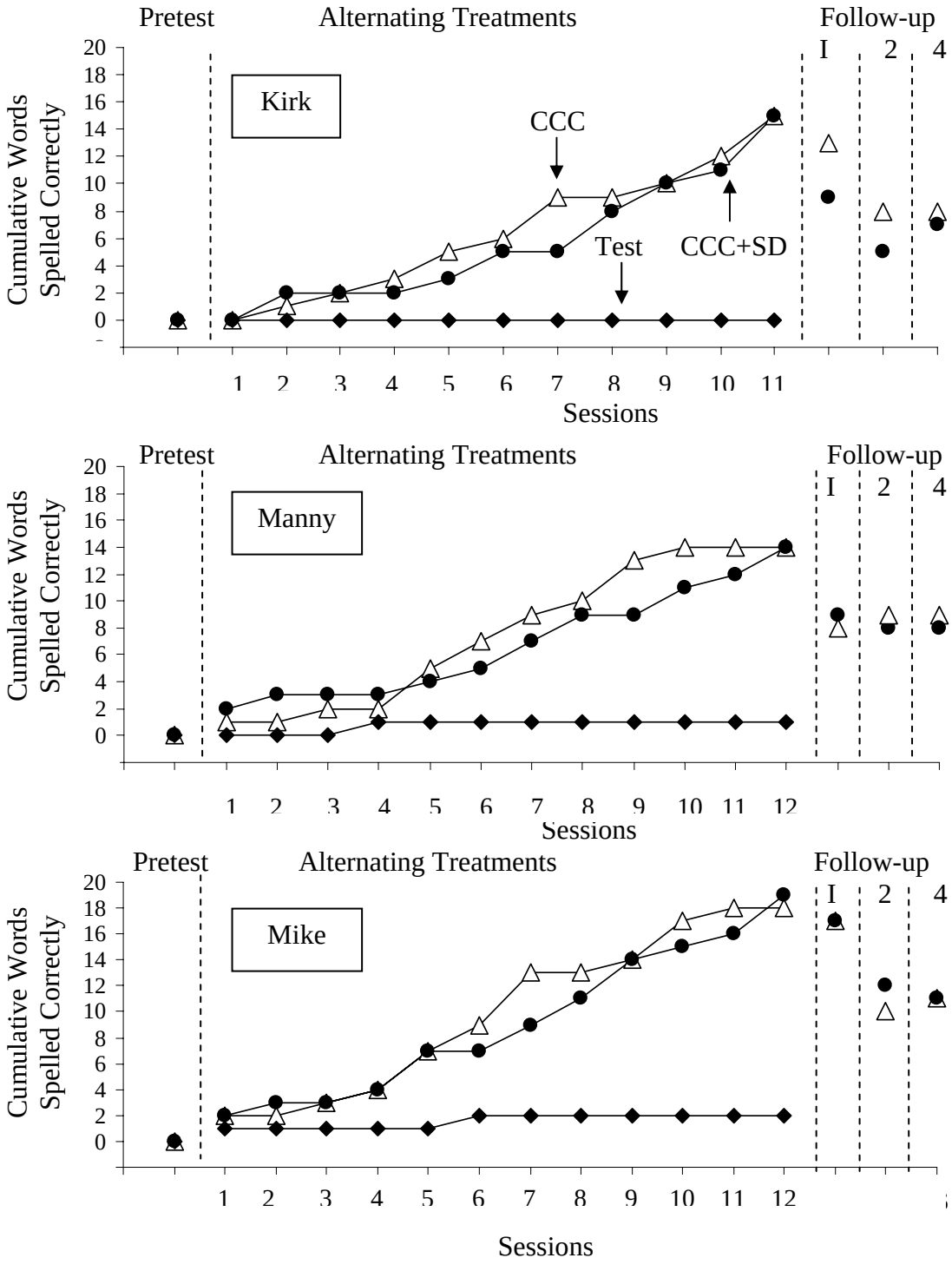

Figure 1. Cumulative words spelled correctly during intervention and follow-up

I = immediate posttest, 2 = 2-week follow-up, 4 = 4-week follow-up. CCC = Cover Copy Compare, CCC+SD = Cover Copy Compare with Sentences and Definitions, Test = test-only control condition.

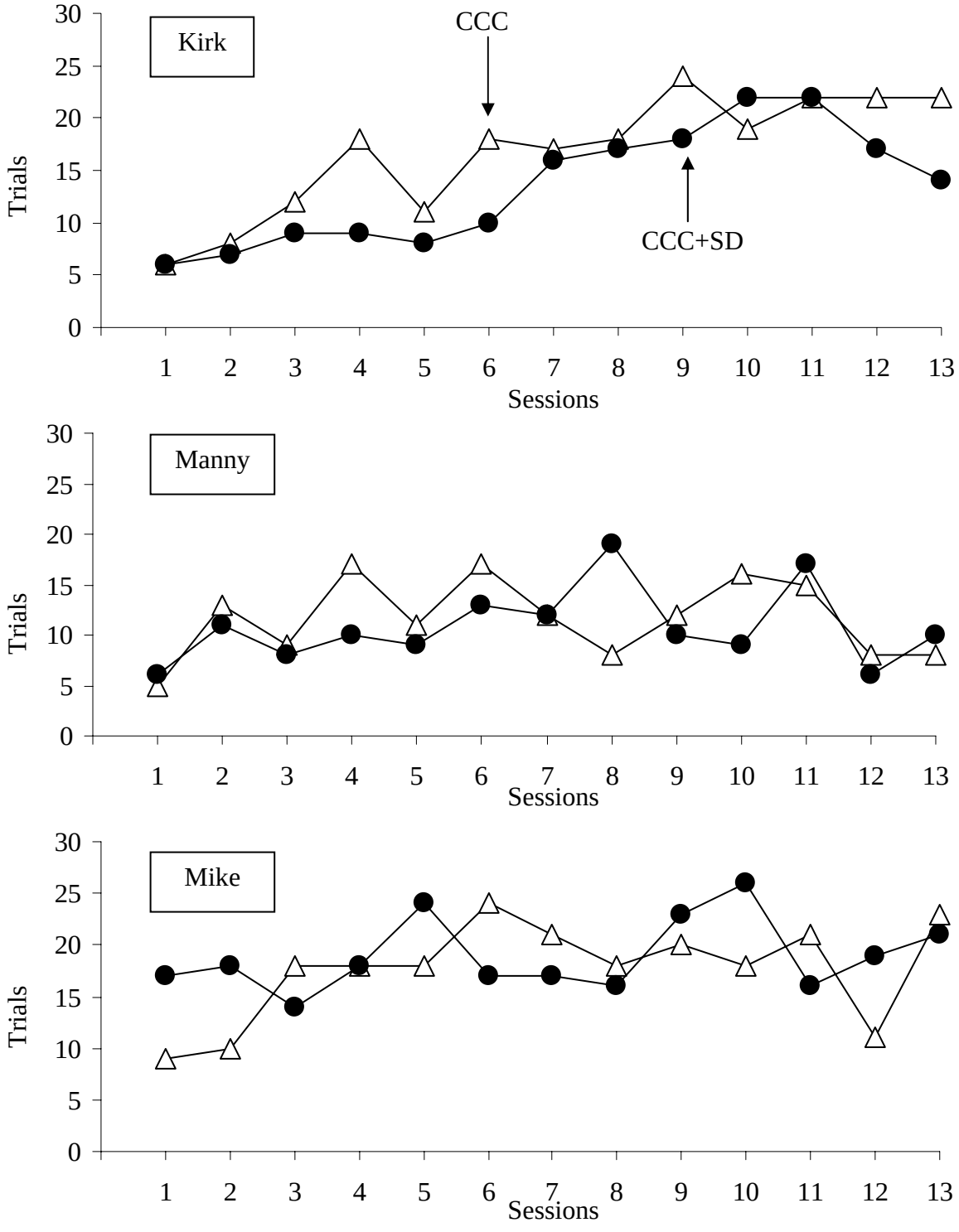

Figure 2. Trials per session

CCC = Cover Copy Compare, CCC+SD = Cover Copy Compare with Sentences and Definitions.

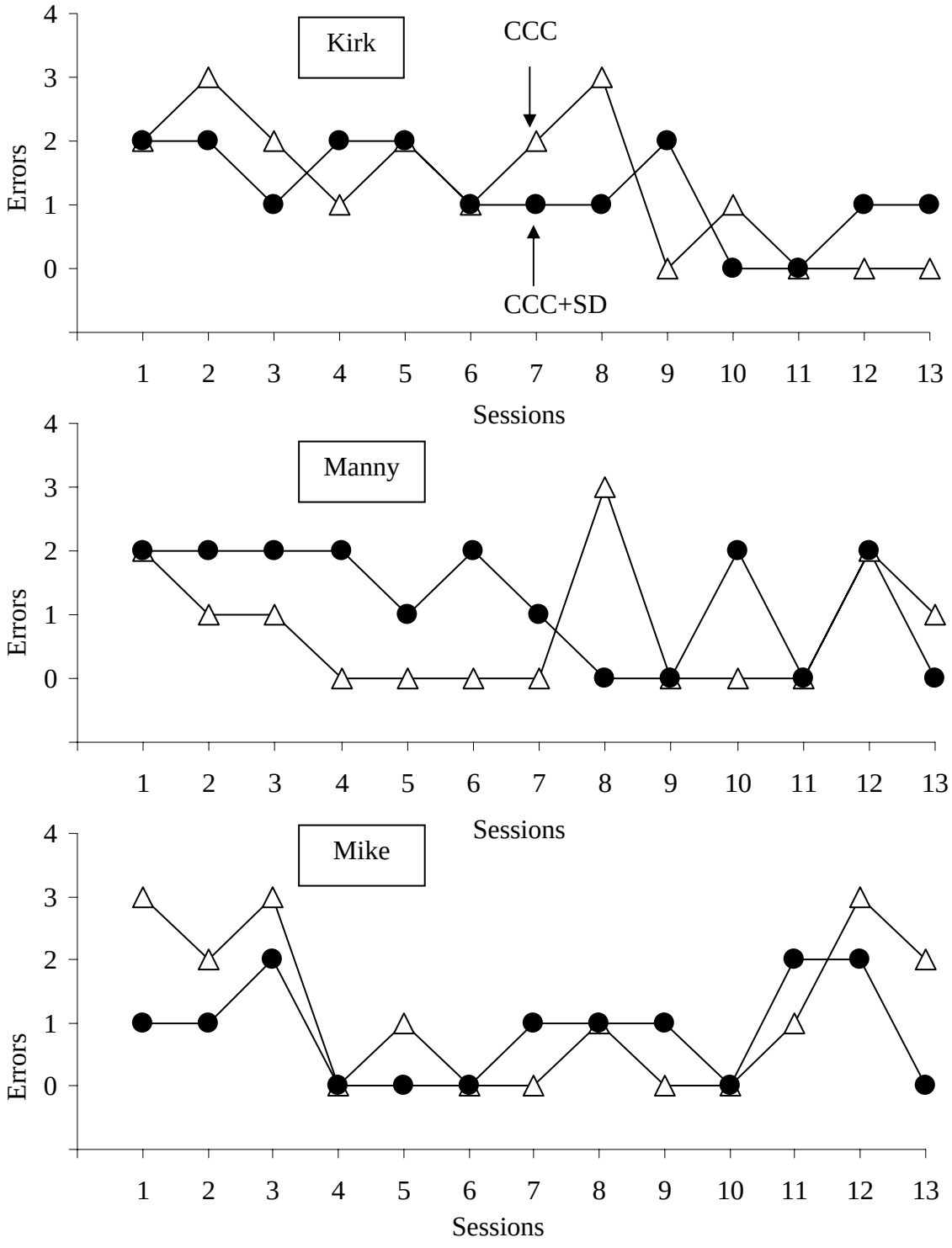

Figure 3. Errors per session

CCC = Cover Copy Compare, CCC+SD = Cover Copy Compare with Sentences and Definitions.

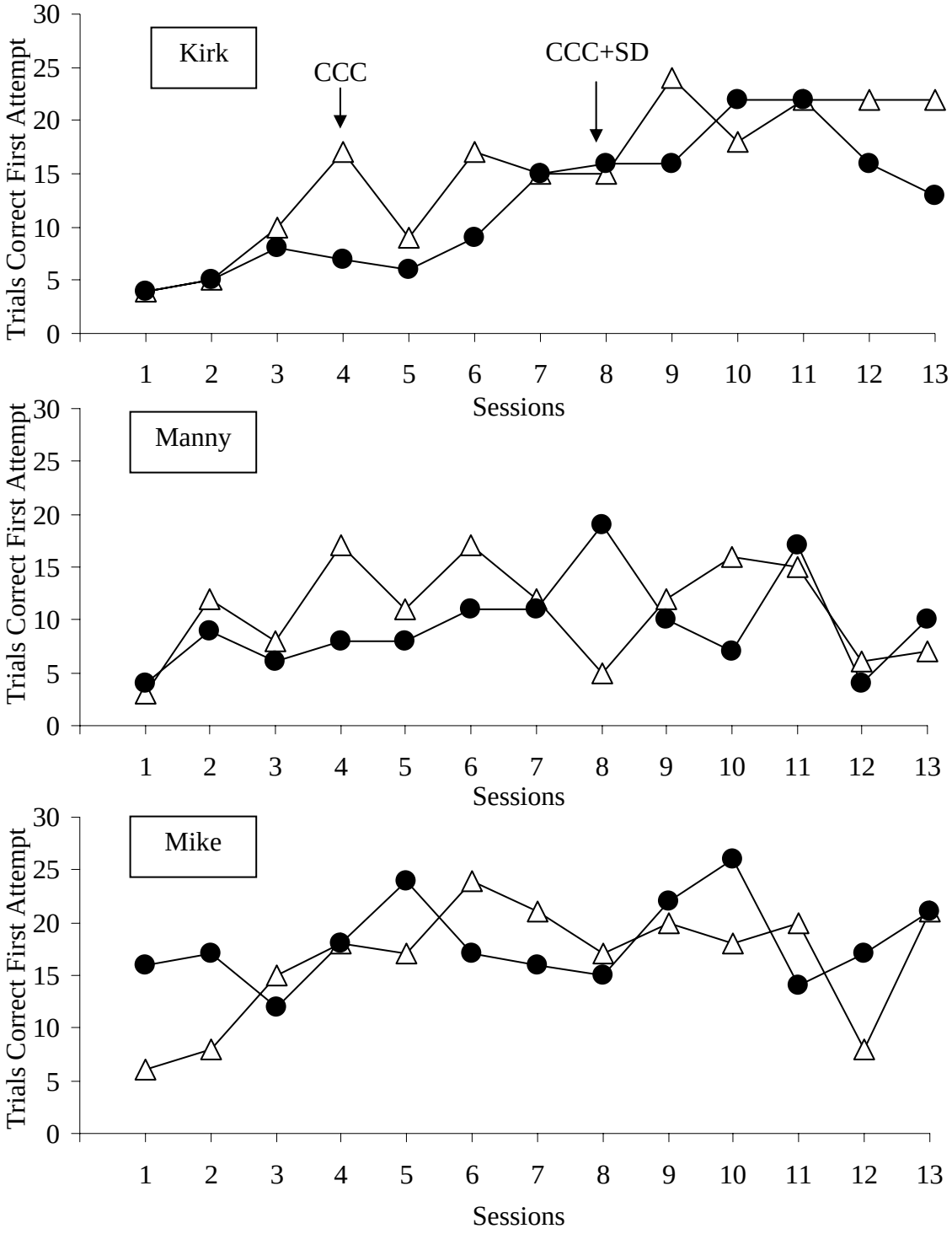

Figure 4. Trials correct the first attempt per session

CCC = Cover Copy Compare, CCC+SD = Cover Copy Compare with Sentences and Definitions.

VITA

Kathryn Jaspers was born in Durango, Colorado. She was raised in Prescott, Arizona, by her parents, Kendall and Amy Jaspers. She graduated from Mississippi State University in 2004, where she double-majored in Psychology and Spanish. She received her Masters degree in Applied Educational Psychology from the University of Tennessee in 2008. She graduated with her Ph.D. in School Psychology from the University of Tennessee in 2009.