

Improving the Spelling Performance of Students with Disabilities

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The present study examined the effects of an error correction strategy on the spelling accuracy of students with emotional and/or learning disabilities. The strategy, which asked students to spell a word, view a correct model, and then correct their errors, was compared to a traditional strategy that asked students to write words three times each while viewing a correct model. Results showed that students learned more words in the error correction condition than in the traditional condition. The error correction treatment was shown to be an effective strategy that reduced the number of repetitive spelling practice trials, and was preferred by students.

KEY WORDS : error correction; learning disabilities; spelling.

The repetitive practice required for the acquisition of new spelling words has caused it to be characterized as the most “boring” task in school (James, 1986). While Delquadri, Greenwood, Stretton, and Hall (1983) found that increasing the “opportunities to respond” to spelling practice words resulted in improved performance, repetitive practice has increased the level of escape behavior engaged in by students with disabilities (Winterling, Dunlap, & O’Neill, 1987), who require many more spelling practice trials to reach criterion than their normally achieving peers (Nulman & Gerber, 1984). Because of this additional practice, spelling is not intrinsically motivating to many students with disabilities and Graham and Voth (1990) suggested teachers find ways to make spelling more interesting.

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Numerous instructional strategies have been developed to remediate the spelling difficulties of students with disabilities. Stewart and Singh (1986) used a five step procedure where students mimicked the teacher by saying a word and its letters before writing it. Graham and Freeman (1986) added the components of tracing the word and checking the spelling. Each of these studies required students to practice words five times each. In addition to using a write-say strategy, Kearney and Drabman (1993) used negative reinforcement, asking students to practice missed words 5 times the first day, 10 times the second day, and then the following day, 15 times each. Although each of these methods showed improved performance, they included the aversive element of five or more repetitive practices.

Ollendick, Matson, Esveldt-Dawson, and Shapiro (1980) attempted to reduce the aversive effects of spelling practice by increasing reinforcement. Unfortunately, only one of the **two** students preferred the reinforcement condition. Additionally, the performance of students who received **a** star and praise for correctly spelling words did not differ from those who did not receive reinforcement. In a second study, Ollendick et al. (1980) found the addition of positive reinforcement contributed to the acquisition of correct spelling, but positive practice procedures were perceived by students as aversive. In another assessment of the effects of reinforcement on spelling performance, Singh, Farquhar, and Hewett (1991) added **task** variation (i.e., the intermittent presentation of known words) which may have increased student motivation but did not increase acquisition of unknown words. It seems the most effective spelling strategy for students with disabilities would be one that allows students to reach mastery in the least number of repetitive practice trials and is not viewed by students as aversive.

In addition to having the potential of reducing the number of training trials, having students correct their own spelling errors has been suggested as the single most important factor in learning to spell (Nulman & Gerber, 1984). One method **of** error correction utilizes imitation of misspelled words. To focus students' attention **on** errors, Nulman and Gerber (1984) asked a teacher to imitate each misspelling and write the correct spelling next to it, while the student was required to read the misspelled word, copy the correct spelling, and say the correct word. Gettinger (1993) asked students to make a red circle around the parts that differed in imitated and correct words. Although error correction allowed students to master new words in as few as one training trial, the imitation component was perceived by students **as** punishing (Nulman & Gerber, 1984).

The purpose **of** this study was to identify an effective error correction spelling procedure that directed students' attention to incorrect letters without imitating their errors and allowed them to reach mastery in the least number of training trials. Additionally, we sought a **strategy** that **was** not

aversive, but was preferred by students with disabilities. Therefore, we assessed the efficacy of a spelling strategy that (a) allowed comparison of spelling words to a correct model, (b) required three daily practice trials per **word**, and (c) required spelling errors to be corrected. Additionally, student acceptance of the procedure was examined.

METHOD

Participants and Setting

Three boys and **two** girls, attending a primary, self-contained class for students with emotional handicaps, participated in this study. Four of the students were enrolled in the **fifth** grade and one was a fourth grader. For all participants, full-scale IQ scores, as reported by the special education teacher, were within the average range. While all participants met the Indiana State eligibility requirements for emotional handicaps, Ian and Bob also received services for learning disabilities (LD), and Jess was in the process of being evaluated for suspected LD. Additionally, Bob, Marty, and Jess were diagnosed with Attention Deficit Hyperactivity Disorder and were prescribed stimulant medications by their physicians.

While **all** students received some instruction each day in the mainstream with their nonhandicapped peers, spelling **was** taught in the special education room. When the study began, Bob, Jess, and Annie were working in the fifth grade spelling series. Ian had been placed in a third grade **book** while Marty, **who** was new to the school and **the** fourth grader, **was** receiving fourth grade words. Prior to the **study**, students were learning spelling words by engaging in the activities provided in their spelling series workbooks including word search puzzles, fill in the blanks, and rhyming activities. The teacher reported that while Ian and Bob rarely scored higher than 20–30% on Friday spelling tests, the girls did fairly well (when they **com-**plied with assignments) and these activities might be considered enrichment.

Spelling Words

For the three boys, **Ian**, Bob, and Marty, **fifth** grade spelling words **from** the D.C. Heath and Company (1990) spelling series were used to create the training sets. To reduce the possibility of patterns and similarities in words, but to maintain the **difficulty** level, 16-word sets were constructed **from** 3 consecutive spelling lessons. Words were randomly assigned to

either the error correction or traditional condition. Words in the traditional condition were laser printed onto 21.5 cm (8.5 in) by 14 cm (5.5 in) pieces of white paper.

Because the girls scored 80% or above on pre-tests with fifth grade words, their training sets were created with words from the seventh grade Merrill (1990) spelling series. These words appeared to be more independent so intact 20-word lists were used beginning with the first lesson in the series. **Words** were randomly assigned to either condition and words in the traditional condition were printed onto white paper, identically to the boys' words in the traditional condition.

Procedures

Small group instruction was provided to the boys and girls separately due to differences in their **mainstreaming** schedules. Instruction and testing sessions were conducted five days per week at a table behind a partition in the special education classroom. Instruction of other students and other normal classroom activities continued throughout the rest of the room. The first author served as the experimenter.

Assessment

A new word set was introduced weekly. Each 30 min session began with a test followed by instruction, with the exception **of** Friday, when only the test was given. First-day tests (Monday) and next-day tests began when the experimenter verbally presented each word, used the word in a sentence or phrase, and repeated the word while the students **wrote** the words on pre-numbered test papers (e.g., "bridge. He felt the bridge shaking. bridge"). On next-day tests, students were also given cues to, "Remember how you wrote the words yesterday in practice." Cues were presented after every **fifth** or **sixth** word. No feedback was provided for correct **or** incorrect responses on the tests.

Intervention

Instruction was provided **four** times per week and began immediately after the first-day- or next-day tests. In the **traditional condition**, the experimenter began each training session **by** placing a printed word list on the table in front of each student. Students were given numbered, lined spelling practice sheets and instructed to write words three times each in a row across the page. Feedback (e.g., "You've got them all right") was provided at the end **of** each row and upon completion **of** the page. In the **error**

correction condition, words were verbally presented, one at a time, in random order. As each word was presented, students wrote the word with a colored dry-erase pen on a 22.9 cm (9 in) by 30.5 cm (12 in), white, mylar, dry-erase, Iap board. While students wrote, the instructor also wrote the word on a mylar board. When finished writing, students and instructor compared the spellings. While viewing the instructor's model, students were instructed to erase and correct only the incorrect letters. Then, students were instructed to erase the word, and the instructor presented the next word. The word list was repeated twice more until **each** word had been written correctly or corrected three times. Accuracy feedback (e.g., "That's correct") was provided by the instructor after **every** third response, on the average, to equate feedback distribution across conditions.

Dependent Measures and Reliability

The number of words written correctly on the first-day test and next-day tests served as dependent measures. Additionally, the percentage of correct letters was calculated **by** counting correct letter sequences **or** N-grams (Shapiro, 1989; Deno, Mirkin, Lowry, Kuehnle, 1980) and dividing by the total letters per word set. This method was chosen as a more sensitive measure of spelling improvement. To score letter sequences, a phantom character was placed before and after each word. For example, the word -table- has six possible letter sequences. Data were also collected on the duration **of** training sessions by condition.

To assess **students'** satisfaction with the error correction procedure, a questionnaire was administered on the last day of the study asking students how much they agreed with five statements (see Table I).

The accuracy of scoring daily spelling tests was assessed **by** an independent rater for **25%** of the tests. Interrater agreement was computed using a word by word analysis **of** accuracy and number **of** correct letter sequences. Treatment integrity **was** assessed for both conditions **by** independent observers **using** a procedural checklist. Reliability on both the dependent (spelling test scores) and independent (procedural integrity) measures was 100%.

Experimental Design

An alternating treatments design was used to **assess** the effects of error correction on the spelling accuracy **of** students with disabilities. Each week, half **of** the students' **spelling** words were taught with error correction **and** half with the traditional method **of** writing them three times each while

Table I. Social Validity Questions

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1. Learning spelling by correcting my mistakes on the mylar boards is more fun than writing them 3 times each.
 2. I think I learn more using the mylar boards for spelling.
 3. It takes too long to learn spelling with the mylar boards.
 4. I am a better speller when I use the mylar boards.
 5. I would like to learn other school subjects using the mylar boards to fix my mistakes.
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Note. Answers choices were 5 = very much, 4 = a little, 3 = not sure, 2 = not much, and 1 = not at all.

looking at a correct model. The presentation order of the conditions was counterbalanced across sessions.

RESULTS

Figure 1 presents the number of words spelled correctly by each of the five students. The first and last data points of each weekly series represent the first-day test scores (i.e., baseline) and Friday test scores for each series, respectively. All students learned spelling words in the error correction condition.

Ian, Bob, and Jess learned more total words each in the error correction condition ($M = 15.3$) than in the traditional condition ($M = 7.6$). Additionally, they learned the words more quickly. After only one training day each week, these three students learned a total of **28** new words over the **3** weeks, an average of **3.1** new words per student on a second-day test, compared to only 1 word in the control condition. Ian, the lowest speller in the group, had the most dramatic first-day gain each week, learning, on the average, **4** new words after one day of error correction compared to 1.3 words in the traditional condition.

Marty and Annie reached mastery more often on word sets in the error correction condition than in the traditional condition (5 sets in error correction compared to only 1 set in traditional). Overall, they acquired slightly more new words in the traditional condition ($M = 16$, compared to 14.5 for error correction), but their gain in new words in the error correction condition was limited by the ceilings. It is not known how many words beyond the original eight they might have learned if they had been given additional words in the error correction condition once all words in that condition had been mastered (e.g., Jess, word set **3**; **Marty**, word set **2**; Annie, word sets **2** & **3**).

Another measure of the impact of the treatment was the number of correct letter sequences in spelled words. The average number of correct sequences improved over baseline/first-day tests were calculated for each

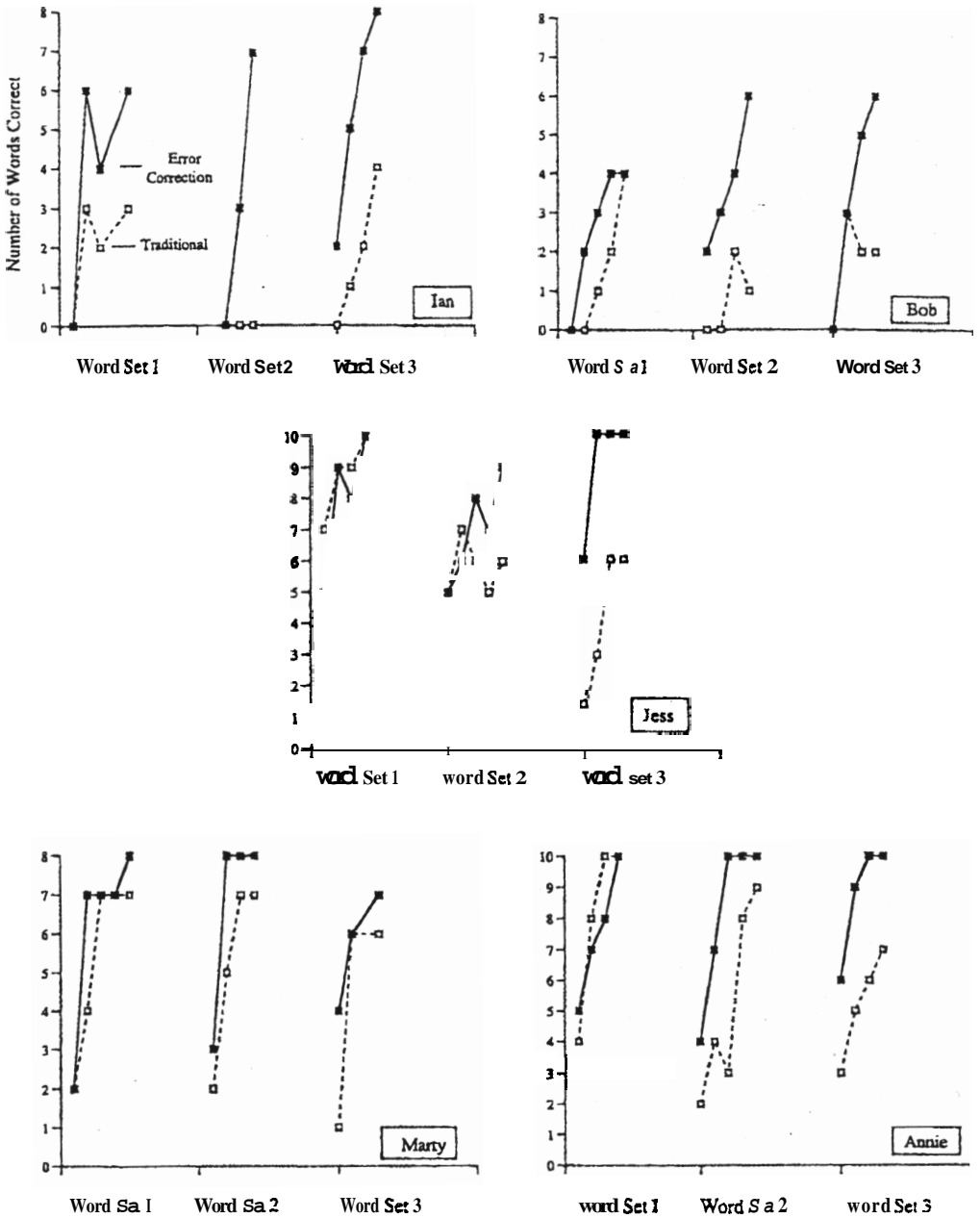


Fig. 1. Number of words spelled correctly in error correction and traditional conditions.

student and appear in Table 2. Ian, Bob, and Jess improved more in their correct sequencing of letters in the error correction condition. Marty and Annie appeared to learn slightly more letter sequences in the traditional condition than in the error correction condition, which was restricted by the ceilings.

The duration of the training conditions was recorded daily and averaged over the study. The treatment duration declined over time as students

Table II. Percentage of Correct Letter Sequences for Baseline/First Day (B) and Friday Tests (F) and Mean Percentage of Improved Correct Letter Sequences (CLS) for Error Correction (EC) and Traditional Conditions

Student Condition	Word Set 1		Word Set 2		Word Set 3		MCLS
	B	F	B	F	B	F	
Ian							
EC	59	93	52	97	77	100	38.6
Traditional	62	76	49	45	45	74	14.3
Bob							
EC	41	67	49	92	54	91	35.3
Traditional	34	78	38	54	50	66	25.3
Jess							
EC	97	100	76	99	84	100	14
Traditional	91	100	81	84	58	83	12
Marty							
EC	74	100	70	100	86	96	22
Traditional	69	95	68	98	67	88	25.6
Annie							
EC	78	100	74	100	80	100	22.6
Traditional	77	100	50	99	60	88	33

improved their speed at learning trials with an average treatment taking 3 min 39 sec (range: 1 min 55 sec—7 min 3 sec) in the traditional condition and 9 min 54 sec (range: 4 min 1 sec—19 min 30 sec) in error correction.

The social validity of the error correction procedure was assessed by administering a questionnaire with a five point scale. Students strongly agreed that they were better spellers with the Mylar boards ($M = 4.6$), that spelling with the Mylar boards did not take too long ($M = 4.8$), and that they would like to learn other school subjects using the Mylar boards to fix their mistakes ($M = 4.8$). Four out of five students felt “Very Much” that learning spelling by correcting their mistakes on the Mylar boards was more fun ($M = 4.2$). Three of the students agreed with the rating of “Very Much” that they learn more using the Mylar boards. The other two marked A Little and Not Sure ($M = 4.4$).

DISCUSSION

While increased opportunities to respond to educational materials have been associated with increases in achievement (Delquadri, Greenwood, Stretton, & Hall, 1983), too many remedial practice trials may be “boring” and aversive to students. One way to increase mastery of spelling words for students with disabilities is to find interesting and novel

ways for students to engage in repetitive practice. Another method is to find more effective ways to practice, thereby reducing the number of training trials to mastery. In this study, we compared a spelling strategy with three trials that required students to spell a word, view a correct model, and then correct their errors to a traditional strategy that asked students to write words three times each while viewing a correct model. Students had equal opportunities to view stimulus words and respond actively in both conditions.

The results of this study suggest the efficacy of our error correction strategy on improving the spelling accuracy of **five** students with **emotional and/or** learning disabilities. These findings replicate and extend the findings of previous studies that have shown error correction to be effective in the academic improvement of students with and without disabilities (e.g., Barbetta, Heward, & Bradley, **1993**; Rosenberg, 1986; Jenkins, & Larson, 1979; Rose, McEntire, & Dowdy, **1982**; Gettinget, **1993**; Skinner, Shapiro, Turco, Cole, & Brown, **1992**; Drevno, **Kimball**, Possi, Heward, Gardner, & Barbetta, **1994**).

Rogers and Iwata (1991) suggested that the mechanism present in error correction is negative reinforcement, in that correct responses usually allow subjects to avoid additional error correction trials. Remedial trials contain an aversive element that is avoided through correct performance. Since both intervention conditions in this study incorporated three repetitive practice trials, regardless of the number of errors, it is probable that correct responding was not the result of negative reinforcement. In the error correction condition students' attention **was** focused on the stimulus **feature(s)** of words that still needed to be learned, allowing for self-reinforcement of approximations each time an additional correct letter was produced. While, to equate reinforcement in the two conditions, we refrained **from** offering extra praise, students were observed engaging in reinforcing self-statements with improvements which may have contributed **to** more correct responding in the error correction condition.

Although the error correction procedure used in this study was **more** costly in instructional time than the traditional strategy (due primarily to the manipulation and erasing of the Mylar boards), the total time spent daily in spelling instruction **was still** within the limits of best practice put forth by Brown (1990) and less than the time allotted for spelling prior to the study. Additionally, although the error correction strategy required that students engage in spelling practice for a longer time, the students preferred it over the quicker method of writing the words three times each. Error correction seems especially **cost** efficient when you consider the spelling performance of students with LD was normalized by the **pro-**

cedure, equaling, and some times exceeding, that of the other students with emotional handicaps but without specific learning disabilities in spelling. The efficacy of error correction is also apparent for the other students. Marty reached mastery in the error correction condition for two of three word sets but did not reach mastery on any of the three traditional word sets (see Marty in Figure 1). Annie mastered all the words presented in the error correction condition while mastering only one of three word sets presented in the traditional condition (see Annie in Figure 1).

One possible limitation of this study is the ceiling effect created by the sometimes high baseline/first-day test scores. Although all words were randomly assigned to either the error correction or traditional condition from a common pool of words, baselines may have been unequal. Because of the applied nature of the study, higher baselines often resulted under the error correction procedure, limiting the possible number of new words learned for those sets (see Jess, Marty, Annie). If new words were added to those lists, additional acquisition may have been observed under the error correction condition. Secondly, the role of individual components of the spelling package needs further assessment. For example the effects of the Mylar boards as a novel instructional device needs to be examined. Additionally, the practice of words in the error correction condition included verbal, as opposed to written, presentations and comparisons with the instructor's performance, components which should be separated from error correction in further research. Students with disabilities are often characterized by difficulties with fine motor skills (Goldstein, 1994). Because students' handwriting was larger on the boards with dry erase markers, the demand for fine motor skills was reduced, possibly reducing the effort (e.g., tension or anxiety) associated with handwriting. Lastly, while the practice of words in the error correction condition occurred three times in a randomly dispersed order, practice words in the traditional condition were sequentially repetitive (i.e., students wrote the same word three times in a row), which may have functioned for students as a single trial with multiple response opportunities embedded in the trial.

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