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BRIEF AND EXTENDED ANALYSIS OF SPELLING DEFICITS

by

KIMBERLY REYES-GIORDANO

A dissertation submitted to the Graduate Faculty in Psychology, Learning Processes and
Behavior Analysis in partial fulfillment of the requirements for the degree of Doctor of
Philosophy, The City University of New York

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Brief and Extended Analysis of Spelling Deficits:
A Case Study by Kimberly Reyes-Giordano

This manuscript has been read and accepted for the Graduate Faculty in Psychology, Learning Processes and Behavior Analysis in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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ABSTRACT

Brief and Extended Analysis of Spelling Deficits: A Case Study

by

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Brief Experimental Analyses (BEA) have been primarily used to evaluate the effects of instructional variables on reading deficits with regular education students. The broader utility of BEA's has been limited in academic scope and population. The current study aimed to expand upon previous research by determining the efficacy of a BEA in identifying effective spelling interventions for students with established spelling deficits. Four different spelling strategies, drawn from the BEA and broader spelling intervention literatures were integrated into the BEA assessment technology and were compared and experimentally analyzed. For all students, effective interventions were identified with clear distinctions between the best and worst performing spelling interventions. The best interventions were then applied in an extended treatment analysis (EXT) and compared to a Treatment-as-Usual (TAU) condition. During the extended analysis, effective interventions identified during the BEA continued to produce positive spelling outcomes over time, which were above and distinguishable from TAU. The current study provides implications for the use of BEA's in identifying effective spelling interventions that continue to be effective over time for students who demonstrate established spelling deficits.

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Brief and Extended Experimental Analysis of Spelling Deficits

Spelling is a valuable skill that is a routine part of instruction and assessment in the classroom (Calhoun, Greenberg, & Hunter, 2010) but is often conceptualized and treated as an isolated skill, which marginalizes its importance (Calhoun, Al Otaiba, & Greenberg, 2010). Spelling is not an isolated skill, but rather a skill that affects several areas of academic performance. Most directly, spelling has been found to be moderately to strongly correlated with reading performance (Moats, Foorman, & Taylor, 2006). Additionally, research has shown that deficits in spelling are associated with lower academic performance in multiple other areas such as: clarity of writing, ability to derive meaning or decode information during reading, writing fluency, early reading development, and written expression (Calhoun, Greenberg, & Hunter, 2010; Cates, Dunne, Erkfritz, Kivisto, Lee, & Wiezbicki, 2007; Berninger et al., 1998; Nies & Belfiore, 2006). Apart from academics, a deficiency in spelling may affect an individual's task persistence and lead students to exhibit an increase in frustration towards academic activities. As a result, students may avoid or escape tasks that involve spelling and/or writing that is too difficult (Alber & Walshe, 2004).

Unfortunately, students with spelling difficulties may face these challenges rather often due to the routine way in which classroom spelling instruction is administered. Typically, students are assigned a list of 10 to 20 words on a weekly basis. They are provided the list of words to be learned at the beginning of the week and tested on the acquisition of those words at the end of the week. In between assigning and testing the list, there may or may not be formal instruction (Cuvo, Ashley, Marso, Zhang & Fry, 1995). While these traditional approaches may be effective spelling strategies for many students, they have not been found to be successful for helping poor spellers become more accurate spellers (Alber & Walshe, 2004).

Students struggling with spelling may be exposed to many of the traditional spelling

interventions, which apply instruction using phonological and morphological aspects of written language. Specifically, these interventions concentrate on sound-symbol relationships, word patterns, rhyming patterns, vowel-change patterns, syllabication, dictionary skills, synonyms, and word usage (Alber & Walshe, 2004). While these interventions may help some poor spellers, not all spelling interventions are equally effective for all students (Cates et al., 2007). This is not surprising because for any academic deficit, regardless of subject matter, there are multiple functions or reasons why students exhibit academic failure in the respective area. As a result, it can be very difficult to properly address and remedy spelling deficits without understanding the reason why students are failing.

Daly et al. (1997) have provided a framework for understanding academic deficits and proposed five reasons that may explain why students fail to achieve success academically. These five reasons can be conceptualized as functions of academic skill deficits using the three-term contingency (setting events, antecedents, behavior, and consequences). The first of the five reasons addresses setting events and students who struggle academically because they lack the prerequisites for the work level required. The second reason deals with antecedent issues in which a student's academic failure is a result of insufficient instruction and/or prompts. The third reason is also a result of antecedent problems in which the students demonstrate a lack of stimulus generalization to the current evaluation format. The fourth reason relates to students who do not succeed academically because they lack a sufficient number of opportunities to engage in the required academic behavior. The fifth reason deals with students whose poor academic performance is a result of lack of reinforcement for engaging in correct academic behavior, signifying a problem with the consequence portion of the three-term contingency (Daly et al., 2006; Daly et al., 1998).

The aforementioned reasons underlying academic failure can be tested using a Brief Experimental Analysis (BEA). Brief Experimental Analyses involve using single subject research designs (e.g., alternating treatments or withdrawal designs) to determine the function of an academic deficit as well as experimentally analyze the effectiveness of interventions. A BEA is like a functional analysis, and is used to determine what variables control academic deficits in order to develop effective, individualized academic interventions. The design of the analysis involves a rapid transition between two or more interventions that evaluate different reasons for academic deficits (Daly et al., 1997). As a result, a BEA should allow an interventionist to identify the reason for an academic deficit and an intervention that would be most effective in remedying the deficit (Daly et al., 1997).

One of the major benefits of a BEA is that in each case where a particular reason is associated with academic failure, interventions can be directly linked to address and remedy that failure (Daly et al., 1997). For example, when the academic deficit is related to an inappropriate skill level, individuals will not emit the academic behavior correctly because the behavior itself is too difficult. To remedy this reason for failure as it pertains to spelling, interventions should focus on establishing and mastering skills that are prerequisites for the target spelling behavior. In other cases individuals do not emit the correct academic behavior because the presentation of the skill is unfamiliar, thereby demonstrating an issue with stimulus generalization. For those with spelling deficits related to stimulus generalization, these individuals may need further instruction on the correct usage of the new format. If the academic skill deficit is a result of inadequate instruction, intervention recommendations would include effective teaching practices, which could include appropriate modeling and prompting of the correct academic behavior followed by error correction procedures and feedback. In the event that an individual is not

demonstrating a skill with mastery as a result of lacking practice, we can use interventions that increase the number of learning opportunities. Specific to spelling, students may be provided with an intervention that involves repeatedly copying the correct spelling of a word list. When failure to demonstrate a spelling skill is a result of inadequate reinforcement contingencies, we can use interventions that involve contingency management. A common intervention would be to provide immediate reinforcement for correct spelling or provide tangible reinforcers contingent on increases in spelling accuracy (in the absence of learning opportunities or instruction and prompts).

Developing a BEA for any academic area requires the identification of empirically supported interventions for that particular academic skill. When designing a BEA for spelling, there are a multitude of empirically supported spelling interventions that can be used to address Daly et al's (1997) reasons for academic failure as it pertains to spelling deficits. According to Daly et al's (1997) first reason for academic failure, the academic deficit is tied to a student's inability to meet the expected work level. This in fact can be tested outside of a BEA. This reason for spelling failure can be tested using standardized spelling assessments, which would help to determine a student's appropriate level of instruction.

The second reason for academic failure assumes that a student has had inadequate or inappropriate instruction and/or prompts. A spelling deficit related to this reason can be assessed in the context of a BEA using empirically supported treatments such as Constant Time Delay (CTD) and Cover, Copy, Compare (CCC). CTD is an intervention that allows for a constant delay (i.e., 5-10 s) to occur between the presentation of some dictated target word and the initiation and/or completion of a spelling response by the student. If no response is made or completed during that delay, the student is presented with the target word using a visual prompt.

A visual prompt is also provided when the student produces an incorrect response. Correct responses are met with a reinforcer (i.e., social praise) and the oral presentation of the next word in the list (Cates et al., 2007; Coleman-Martin & Heller, 2004; Hughes, Frederick, & Keel, 2002). CCC is an intervention that can be implemented by the student independently or with the assistance of an adult. First, the instructor presents the student with a list of spelling words and the student works through the list with one word in view at-a-time and the remaining words out of view. After some period of time (i.e., 5-10 s) the target word is covered and the student attempts to correctly spell the word. Following the student's response, the target word is uncovered and the student evaluates the accuracy of his or her spelling response by comparing it to the visual model. If the student's response is accurate, he or she moves onto the next target word and repeats the same procedure. If the student determines that their spelling response was incorrect, an error correction procedure (i.e., copying the correct spelling from the model) follows before moving on to the next target word. This procedure continues until all words in the list have been attempted by the student (Cates et al., 2007; Carter, McLaughlin, Derby, Schuler, & Everman, 2011; Skinner, McLaughlin, & Logan, 1997). While both of the above mentioned interventions include reinforcement as part of the instructional package, they are two of the most common spelling interventions that map onto the instructional deficit best and were therefore selected to address this reason for deficit.

The third reason for spelling deficits assumes that a student's spelling deficit is due to stimulus generalization, in which they demonstrate difficulty utilizing a spelling format that is novel or difficult to understand. Students with spelling deficits related to stimulus generalization could receive direct instructions on the spelling format to address this deficit. However, to-date

there is no direct study that has evaluated the effects of formatting interventions on spelling accuracy.

The fourth reason for spelling deficits assumes that a student's spelling deficit is due to a lack of practice. This reason for failure can be evaluated and treated by having a student engage in Repeated Practice (RP) of spelling words. This intervention requires students to engage in the repeated practice of the correct spelling of a word in the presence of the correct spelling model (Grskovic & Belfiore, 1996; Viel-Ruma, Houchins, & Frederick, 2007). The fifth reason assumes that a student's poor spelling performance is a result of a lack of reinforcement, which can be assessed and remedied using reinforcement procedures, such as providing incentives contingent upon correct spelling responses. Material and/or social incentives have been used to evaluate their effects on improving spelling accuracy in addition to or in the absence of direct instruction (Benowitz & Busse, 1970; Benowitz & Busse, 1976; Thomson & Galloway, 1970).

There are multiple spelling interventions that can be mapped onto the BEA paradigm to assist in discovering the reason for spelling failure. However, the literature to date does not have research that supports the utility of BEA's for spelling. The current study will extend both the spelling and the BEA literature in three distinct ways. First, most spelling interventions have been compared to baseline spelling performance and not other potentially effective spelling interventions. When studies have compared different spelling interventions, the researchers have primarily focused on parametric manipulations or compared studies within a particular reason for academic failure (Cates et al., 2007; Erion, Davenport, Rodax, Scholl, & Hardy, 2009; Fulk & Stormont-Sturgin, 1995; Grskovic & Belfiore, 1996). The current study evaluated the comparative effectiveness of spelling interventions across three different reasons for spelling deficits: practice, motivation, and instruction. These reasons related to spelling deficits were

assessed in the context of four empirically supported spelling interventions. Through the BEA, we were able to identify the two interventions (of the four compared) that produced the best spelling performance for each individual participant.

Second, while BEA's have been effective in identifying reasons for academic failure and effective interventions to treat such failure, the majority of studies focus on reading fluency with students who function in regular educational settings and do not have established reading deficits as per standardized assessments (Burns & Wagner, 2008; Daly, Bonfiglio, Mattson, Persampierie & Forman-Yates, 2006; Daly et al., 1999). There have been a few studies that have focused on other areas of academic functioning, such as math (Coddington et al., 2009), reading comprehension (McComas et al., 1996), and letter formation (Burns, Gaunza, & London, 2009). Our current study extended the BEA literature by examining spelling deficits with students who demonstrate sub-par spelling skills as determined by standardized spelling assessments. The researcher included students with spelling deficits of 6 months or more when compared to their current grade level and/or age appropriate peers.

Third, while the use of a BEA has been supported in some academic areas (i.e. oral reading fluency), its utility beyond the assessment phase has been limited. There have been few studies that have evaluated the findings from a BEA in an extended analysis. Furthermore, many of those studies have only evaluated or compared the best intervention(s) from the BEA to a baseline or control condition (Baranek, Fienup, & Pace, 2011; Everett, Swift, McKenney, & Jewell, 2016). The majority of findings from the extended analyses support that the best intervention from the BEA was better than either the control or baseline condition or that the best intervention from the BEA continued to be better than the worst intervention from the BEA (Baranek, Fienup, & Pace, 2011; VanAuken, Chafouleas, Bradley, & Martens, 2002). In this

study, we evaluated the continued effectiveness of interventions over TAU during an extended analysis. The two best interventions identified in the BEA condition were compared to a TAU condition, which served as a control. The length of the extended analysis (EXT), in comparison to other BEA extended analyses, spanned well over baseline and for all cases was between 9 to 16 additional sessions. When combined, all three extensions to the literature provide new information to the field regarding the utility of a BEA on a different population, for a different academic skill deficit, and over time.

Method

Participants

The researcher recruited participants through the use of flyers (see Appendix A) that were a) posted on the Queens College campus or b) sent electronically to academically relevant Queens College departments (i.e. psychology, education). The researcher received thirteen emails and/or calls from parents regarding interest in the study. The parents directly received and/or saw the flyers or were contacted by an individual in the Queens College community who received and/or saw the flyer.

Upon initial contact, the researcher conducted a phone screening to determine eligibility and gather information regarding parental spelling concerns and the student's current academic and behavioral functioning (see Appendix B). Students who met the initial eligibility requirements had to have been between the ages of 6 and 12 and be a native English speaker. All thirteen students met the initial criteria. After the screener was completed, all thirteen students and their parents agreed to meet with the researcher at either their home or the Queens College campus to further discuss the study, sign consents and assents, as well as complete standardized spelling subtests to further determine inclusion into the research study. Only students who had

below average or lower spelling achievement as measured by the Spelling and Spelling of Sounds subtests from the Woodcock Johnson III, Achievement Test (2001) were included in the study.

All thirteen parents attended the initial visit with their student. Each session lasted between 30 and 60 min. During the visit, parents were provided with consents and the researcher further explained the structure of the study. All thirteen parents signed off on consents and the researcher then discussed the study with the student using the age appropriate assent. Each student agreed to participate in the study, providing verbal assent. Following assent, each student first completed the Spelling subtest followed by the Spelling of Sounds subtest (Woodcock-Johnson, 2001). The former subtest asked that students correctly write orally presented words. On the Spelling of Sounds subtest, students were asked to demonstrate their ability to decode words orthographically and phonologically by spelling letter combinations that were regular patterns in English spelling but were not real words or were low frequency words (Woodcock-Johnson, 2001). Once each student completed the two spelling subtests, the initial visit terminated and the researcher informed the parents that the scores for each subtest would be calculated and that they would be notified about the results within 1 week.

Of the 13 students assessed, nine did not meet criteria for inclusion into the study. Seven of those nine students were not included in the study because they demonstrated spelling proficiency either above or on par with their grade level and/or peers. For two of the nine students not included in the study, the spelling assessment was invalid due to significant cognitive delays. The researcher included four of the thirteen students who met the age, language, and spelling skills inclusion criteria, as participants into the study.

Bryan was a 6-year-old (who turned 7 during the study) Caucasian male, enrolled in grade 2.0. His mother reported that the participant was receiving grades of 20% on classroom spelling tests as of last year and that traditional methods did not seem to be effective in improving his spelling accuracy. Bryan was in a regular education classroom and was provided no supplemental educational services. Bryan's performance on the Spelling and Spelling of Sounds subtest was assessed at grade levels 1.5 and K.3, respectively. Bryan's scores on the Spelling and Spelling of Sounds subtest were below his current grade level in school by approximately 6 months and 2 years, respectively. During the study, the researcher taught Bryan first grade spelling words. Bryan presented as a generally compliant participant, with occasional periods of resistance and/or off task behavior.

Jeff was a 6-year-old (who turned 7 during the study) Caucasian male, enrolled in grade 2.0. His mother reported that she believed his spelling skills had regressed over the summer break. He was in a regular education classroom and was provided no supplemental educational services. Jeff's performance on the Spelling and Spelling of Sounds subtest was assessed at grade levels 1.1 and K.5, respectively. Jeff's scores on the Spelling and Spelling of Sounds subtest were below his current grade level in school by approximately 1 and 1.5 years, respectively. During the study, the researcher taught Jeff first grade spelling words. Jeff presented as a generally compliant participant, with occasional periods of refusals to work and/or off task behavior.

Aiden was a 9-year-old Caucasian male enrolled in grade 4.7. His mother reported that the participant demonstrated spelling and reading difficulties. The parents currently paid for tutoring to address reading comprehension issues. Aiden was in a regular education classroom at a Yeshiva school and was provided no supplemental educational services. Aiden's performance

on the Spelling and Spelling of Sounds subtest was assessed at grade levels 2.9 and K.7, respectively. Aiden's scores on the Spelling and Spelling of Sounds subtest were below his current grade level in school by approximately 2 and 4 years, respectively. During the study, the researcher taught Aiden third grade spelling words. Aiden presented as an extremely compliant participant, with no periods of resistance and/or off task behavior.

Giuliana was a 7-year-old Hispanic female enrolled in grade 1.1. It should be noted that Giuliana should have been enrolled in grade 2.2, but was not due to grade retention. Her mother reported that Giuliana was inattentive at times, which had led to academic struggles. Giuliana was in a regular education classroom and was provided with in-school speech services. Giuliana's performance on the Spelling and Spelling of Sounds subtest was assessed at grade levels 1.0 and K.0, respectively. Her score on the Spelling subtest was on par with her current placement in school, but below the grade level (2.2) she should be enrolled in by approximately 1 year. Giuliana's score on the Spelling of Sounds subtest was below her current grade level in school by approximately 1 year and below the grade level (2.2) she should be enrolled in by approximately 2 years. During the study, the researcher taught Giuliana first grade spelling words. Giuliana presented as a participant with sporadic compliance and throughout much of the BEA and extended analyses demonstrated work aversion and resistance.

Setting

All sessions were conducted in a small and quiet room, devoid of distractions when possible, in the participant's home or on the Queens College campus. All sessions were videotaped. In either setting, the room consisted of one desk with two or three chairs. The participant was seated at a desk next to or across from the researcher and when possible, a second researcher was present and seated proximally. Occasionally, the researcher allowed the

participants to stand or work on the floor if it increased their compliance with task demand. It was the responsibility of the second researcher to monitor the progress of the session, time practice sessions and breaks, operate the video camera, manage paperwork, and evaluate portions of the dependent variable and treatment integrity.

Bryan and Jeff completed all three BEA sessions on the Queens College campus. Of the nine EXT sessions, three were completed on the Queens College campus and six were completed in the home. Aiden completed all six BEA and nine EXT sessions in their home. Giuliana completed all five BEA sessions on the Queens College campus. Of the 16 EXT sessions, 11 were completed on the Queens College campus and 5 were completed in the home.

Materials

The researcher compiled spelling words, to be used throughout the study (pre-testing, practice, and testing), from two sources, <http://www.aaaspell.com/index.htm> (Erion, Davenport, Rodax, Scholl, & Hardy, 2009) and Complete Graded Spelling Lists for Years One to Six (Kit's Educational Publishing, 2014). The researcher aggregated all grade appropriate words from the two sources and organized them into graded master lists (i.e., first grade master list, see Appendix C), which were then randomized for order of presentation using randomizing software (www.randomizer.org). Participants were assigned to a particular graded list based on their grade and/or age equivalence outcome from the Woodcock Johnson-III Spelling and Spelling of Sounds subtests (see reported Participants section). For example, a participant with a grade equivalent of first grade on their Spelling and Spelling of Sounds subtests was administered words from the first grade master list.

The graded words were applied to each intervention during pre-testing, practice, and testing using direction and intervention templates unique to each condition. The pretesting

directions (see Appendix D) and probe sheets (see Appendix E) across all phases were identical. Spelling intervention directions (see Appendices F, G, H and I) and templates (see Appendices J, K, and L) varied across conditions. Spelling intervention probes (see Appendix M) and data collection templates (see Appendix N) across all conditions and phases were identical. All templates were printed on standardized 8x11 printer paper, with the exception of the practice sheets for the CCC condition, which were printed on cardstock. Pencils were used for all participants' responses.

The researcher organized all spelling and data collection materials into participant-specific binders. At the front, each binder contained a copy of the master list of graded spelling words (appropriate to the participant), followed by two main sections, BEA and Extended Analysis. The BEA section contained three to six spelling partitions for which each represented one of the sessions, each with its own separate pretesting, practice, testing, and data collection. During all interventions, the researcher utilized one practice sheet and one probe sheet with the exception of the incentive intervention, which only employed the use of a probe sheet (see Appendix O). The researcher required additional materials for three of the four interventions. Standard index cards and Post-It Flags, were used in addition to the templates for the CTD and CCC conditions, respectively. During the incentive intervention, the researcher presented participants with the opportunity to earn tangible objects, which consisted of inexpensive (\$1-2) items (e.g. bracelets, crayons, erasers, key chains, hand sanitizer) in a medium sized box.

The Extended Analysis section contained an additional three to five spelling subsections, which accounted for the three to five weeks of spelling words tested during the extended analysis. Each spelling subsection had its own separate pretesting, practice, testing, and data collection. The researcher utilized multiple practice sheets (related to the unique intervention)

for all extended interventions. The researcher used a probe sheet during the first and last day of the extended analysis for each spelling week. Two of the four possible extended interventions required additional materials. Standard index cards and Post-It Flags, were used in addition to the templates for the CTD and CCC conditions, respectively.

To improve compliance with completion of tasks (and not task accuracy) across all extended analysis conditions, participants received multiple opportunities to earn tangible objects, which consisted of inexpensive (\$1-2) items (e.g. bracelets, crayons, erasers, key chains, hand sanitizer) in a medium sized box.

Dependent Variable

Words Spelled Correctly. During the BEA and the extended analyses, the primary dependent variable was the number of words spelled correctly (WSC) out of 10. WSC was calculated for each observation of each intervention and graphed as an alternating treatments design. The researcher collected BEA probes after the presentation of each intervention on each session day. A word was spelled correctly if a participant's written response contained all letters in the word in the correct order. There were multiple forms of incorrectly spelled words, such as: additional letters, incorrect sequencing of letters, letter omissions, word omissions, scribbling illegible text, and pictures/numbers. In cases where a participant made a response that was illegible, but could have potentially been correct, the researcher requested clarification from the participant before scoring the word as correct or incorrect.

During the extended treatment analysis, the primary dependent variable, number of words spelled correctly out of 10, was collected twice during a spelling week. The spelling probes were presented on the first and last day of a given spelling week. Participants were probed after practicing each unique intervention on each of those days. During the EXT, the dependent

variable WSC was calculated on the last day of all spelling weeks, for each of the three interventions.

Learning Opportunities. The researcher assessed compliance across interventions in the EXT phase indirectly by evaluating the difference in percentage of learning opportunities between the best and worst interventions during the 15 min intervention procedures. The researcher collected information on how many learning opportunities each participant contacted during each intervention on each session. The individual session opportunities were then aggregated and averaged.

Procedure

Pre-testing. Prior to BEA intervention, the researcher pre-tested participants on spelling words using graded master lists (see Appendix C), compiled by the researcher (see Materials section). At the start of each BEA session, the researcher presented the participant with words sequentially from the appropriate graded master list until 40 words had been identified as unknown. For all participants, this pretesting process was completed on three to 6 occasions (one time per each BEA session) using a standardized set of directions (see Appendix D). The researcher orally presented the words (in sequential order) to each participant. After reading a word, the researcher provided a sentence with that word in it and then presented the word orally again. The researcher asked participants to emit their best spelling effort on the pretesting probe in the absence of instruction or feedback. Once compiled, the researcher reviewed the participant responses, and determined if a response was correct or incorrect. Correct responses included the full spelling of each word in its correct order. Incorrect responses varied in topography and could include, but were not limited to: incorrect sequencing, omission or addition of letters, omission of any response, drawings, and scribbles. The researcher terminated

pretesting once they had collected 40 incorrect responses and classified the words as unknown. She applied each word to one of the four interventions in the randomly assigned intervention word list (see Appendix N). Each BEA session had a different intervention word list that contained all four interventions in a randomized order, each with a unique set of words.

Pre-testing during the extended analyses was very similar to that done during the BEA phase, with some minor differences. Pretesting was done using the same graded master lists and procedural elements. However, during the extended analyses the researcher completed pretesting only on the first session of each spelling week. For all participants, the researcher completed pretesting on a total of three to five occasions during the extended analyses (one time per each spelling week). The researcher pretested each participant until 30 words had been identified as unknown. She utilized the same procedure when collecting unknown words. The researcher collected 30 incorrect responses and classified them as unknown words. She then applied each word to one of the three interventions in the randomly assigned intervention word list. The list contained the order of intervention presentation for the first session of the spelling week. The words that the researcher assigned to each intervention on the first session of the extended analyses remained constant throughout all other sessions in the spelling week.

Brief Experimental Analysis. The researcher administered four interventions to each participant: Repeated Practice (RP), Incentive (INC), Constant Time Delay (CTD) and Cover-Copy-Compare (CCC). These interventions are in line with Daly et al.'s (1997) reasons for why a student demonstrates an academic deficit. The researcher administered the RP intervention to test the hypothesis that a lack of practice caused the spelling deficit. The researcher administered the INC intervention to test the hypothesis that a lack of reinforcement caused the spelling deficit. The researcher administered the interventions CTD and CCC to test the hypothesis that a

lack of effective instruction and/or prompts caused the spelling deficit. While the first two hypotheses were tested using only one intervention, the researcher decided to test the instructional hypothesis using two different interventions due to the broader nature of instruction as a function deficit. Ideally, all interventions would map only onto one of Daly et al.'s (1997) reasons for academic deficits. However, the two instructional interventions, CCC and CTD, contained feedback regarding accuracy spelling, which could have functioned to reinforce accurate spelling. While there are limitations regarding the inferences made when using these interventions, the researcher opted to continue with the interventions as traditionally administered.

The researcher administered each of the four interventions once during a session, for a total of three to six sessions. The researcher randomized the sequence of the intervention presentation within and across all sessions using randomizing software (www.randomizer.org) prior to the start of the first session. During each intervention the researcher utilized a unique set of spelling words determined through pre-testing. Following each intervention, the researcher administered a spelling probe. The probes measured the dependent variable, number of words spelled correctly out of 10 presented. The length of time to administer each intervention and probe varied across all participants, but typically ranged from 3 to 10 min. After each intervention was presented once in a session, the researcher presented the participant with a 5-min break before the presentation of the next intervention. Including pretesting and the administration of each intervention, BEA sessions lasted approximately 60 – 75 min. In the end, the researcher exposed each participant to each intervention for a minimum of three sessions and the researcher terminated the BEA phase once stable and discriminable responding had been established.

For all interventions and spelling probes, the participants were seated across from or next to the researcher. Occasionally, the researcher allowed the participants to work on the floor or standing to improve compliance with work-related tasks. The researcher provided participants with small material rewards for each work-related task in which they did not refuse or comply. During each intervention, the researcher presented participants with a unique spelling list and asked them to spell all ten words, imploring their best efforts. For example, participants were instructed by the researcher to “Be sure to do your best spelling.” During the probes for all conditions, the researcher orally presented each word, used it in a sentence (the same sentence from pretesting), and orally presented the word again in the absence of feedback and instruction. Once the participant completed both the intervention and probe, the researcher verbally praised the participant for their efforts. The researcher provided the participants with feedback specific to their effort and not spelling accuracy, such as “Great job trying your best” or “Thanks for working so hard.” The researcher then provided the participant with a five-minute break. Aside from this general process, each intervention had unique procedural differences related to the underlying hypothesis of the intervention. The step-by-step procedures for each intervention are available in Appendices F, G, H, and I.

Repeated practice. In the RP condition (see Appendix F), the researcher asked the participants to write the correct spelling of each word three times, using written models for all words which remained present throughout intervention. Following intervention, the researcher again asked participants to spell those same 10 words without the presence of the model, which then acted as the probe.

Cover, copy, compare. In the CCC condition (see Appendix G), the researcher exposed participants to a written model of each word in a list of 10 words. The researcher displayed each

modeled word sequentially, one-at-a time, while the other 9 modeled responses were covered with Post-It Flags. Following each visual presentation, the participant or researcher then covered the modeled word. The participant then attempted to produce the correct written word (in the absence of the written model), and lastly the participant uncovered the target word and evaluated their response for accuracy. If the word was spelled incorrectly, the participant then wrote the correct spelling of the word using the model. If the word was spelled correctly, the researcher provided the participant with verbal praise regarding their accuracy and the next word was presented visually (Nies & Belfiore, 2006).

Incentive. In the INC procedure (see Appendix H), the researcher informed the participants that they would be given an opportunity to earn prizes for correctly spelling target words. She told the participants that they had the opportunity to earn more prizes if they were able to spell more words correctly. For example, two correctly spelled words earned one prize, but 10 words spelled correctly earned five prizes. The researcher provided no direct instruction during this procedure. A probe was administered to the participant following the researcher's description of the incentive contingency.

Constant time delay. In the CTD intervention (see Appendix I), the researcher dictated each word to the participant, used the word in a sentence, and then dictated the word again. The researcher allowed the participant 5 s to begin spelling the word or 10 s to complete the spelling of the word. The researcher monitored the time using a silent count. If the participant did not initiate a response within 5 s or took longer than 10 s to complete the spelling of the word, they were visually prompted by the researcher with the correct spelling of the word on an index card and were instructed to copy from the model. If the participant spelled the word correctly, praise was provided by the researcher, followed by the presentation of the next word in the list.

Extended Treatment Analysis. At the conclusion of the BEA, the researcher identified two interventions that produced the greatest number of words spelled correctly. Those identified interventions continued to be presented during the EXT sessions and were identical in procedural elements to those used in the BEA with the exception of how often the words were practiced and if a probe was or was not presented following practice.

Treatment-As-Usual Interventions. The researcher then compared the two best interventions in an extended treatment analysis to a TAU condition. The researcher used information from each parent regarding typical classroom and/or homework spelling practices to construct each participant's TAU condition. All four parents endorsed repeated practice and/or sentence creation as standardized classroom and/or homework practices. Using parental feedback, Bryan and Jeff both had RP + Sentences (SE) as their TAU condition (see Appendix P). In the RP + SE condition, the RP portion of the procedure was identical to that used in the BEA. Following RP, participants were asked by the researcher to provide one sentence for each of the target words in the presence of the written models. A correct practice response was one in which a phrase (i.e., more than one word) was provided using the correctly spelled target word. The researcher did not address grammar and syntax. Using parental feedback, Aiden's TAU condition consisted only of the SE procedure (see Appendix Q). Using parental feedback, Giuliana's TAU condition consisted only of RP. For all participants except Aiden, there was overlap between the experimental conditions in the BEA and the TAU. Ideally, the TAU conditions should have been disparate from the BEA, but the researcher opted to utilize what was naturally used for spelling instruction in the participant's school environment as opposed to constructing a TAU condition that was novel.

Participants began EXT sessions after the termination of the BEA sessions and as soon as scheduling permitted. The participants engaged in the EXT sessions in the same settings as during the BEA. Similar to BEA, when possible, two researchers were present to conduct each session. The primary researcher implemented the intervention and a second researcher ensured that the treatment was applied with integrity, monitoring the session for timeliness, videotaping, and assisting with paperwork.

EXT sessions consisted of one set of words per intervention (for a total of 30 words) to be practiced for one “spelling week”, which consisted of a minimum of three and a maximum of five sessions. A spelling week was usually completed within a one to two week period (dependent upon participant availability and scheduling constraints) with each session lasting approximately 70 to 95 minutes.

Prior to the start of the EXT sessions, the researcher randomized the sequence of the intervention presentation within and across all sessions using randomizing software (www.randomizer.org). Similar to the BEA, the researcher applied unique sets of spelling words, determined through pre-testing, to those interventions. Those spelling words assigned to each intervention were practiced for 1 spelling week each (as opposed to 1 session in the BEA). In a given spelling week, each of the three lists of target words were intervened upon at least three times and probed twice. On the first day of the spelling week the researcher conducted pretesting, intervention for 15 min, and probes. On the second day of the spelling week the researcher administered intervention for 15 min alone, in the absence of probes. On the last day of the spelling week the researcher administered 15 min of intervention, followed by probes. Intervention administration on any given spelling day, required that the participants practice the words assigned to each intervention (within the context of the intervention) for a standard 15

min. During each intervention, the researcher gave each participant directions unique to the specific intervention (see Appendices F, G, I, P, and Q). The participant was then given one copy of the intervention template (see Appendices J, K, L, and R) for completion along with any feedback and/or instruction particular to the intervention. Once the first intervention template was completed, the participant was provided with another template sheet and the instructions were re-read. This procedure continued until the 15 min of practice had elapsed. The researcher terminated the EXT phase once stable and discriminable responding had been established.

For Giuliana, a fourth spelling day was included in one spelling week due to a large scheduling gap. In her case, days two and three of the spelling week were conducted in the absence of probes or pretesting.

Compliance Procedures. Once participants transitioned from the BEA to the EXT phase, the majority (3 of 4) of the participants engaged in behaviors that interfered with and minimized the number of learning opportunities they contacted during the 15 min intervention period (see Procedures). Some of the non-compliant behaviors included: refusal to engage in spelling tasks, off-topic conversation initiations, destruction of work materials, and leaving the work area. Due to the presence of such behaviors, a Differential Reinforcement of Other Behavior (DRO) procedure was introduced during the EXT to increase compliant work-related behaviors (not spelling accuracy). Participants were able to earn one tangible item for each intervention of the three (or four if pre-testing was conducted) administered in which they were able to exhibit behaviors other than those that were non-compliant. Specifically, participants were able to earn items for engaging in work-related tasks, staying on-topic, and/or remaining in the work area. During each intervention, participants were allowed to engage in non-compliant work behavior up to 3 times. If participants disengaged from the intervention more than the maximum 3 times,

he or she lost the opportunity to earn a tangible item for that work period of 15 min. Participants collected any tangibles earned at the conclusion of the session. Though only three of the four participants (Aiden did not demonstrate non-compliance) demonstrated non-compliant behavior, all four participants were exposed to the DRO procedure for consistency.

For Giuliana, the above-mentioned procedure was also in place during the last three of the five BEA sessions. Data analyses of the BEA for Giuliana would not have been possible without the application of the compliance-contingencies during the BEA. Giuliana engaged in non-compliant work behavior throughout all of the BEA sessions and the majority of the EXT sessions. Giuliana engaged in task refusal and avoidance, destruction of materials, and engaging in the task inappropriately (i.e., writing “Anna” as a response to each request even when request did not approximate that word).

Research Design

During the BEA and extended analysis, an alternating treatments design (ATD) was utilized to compare the effectiveness of four and three spelling interventions, respectively. ATDs allow two or more treatment conditions to be conducted in rapid succession and have been used in multiple BEA studies (Baranek, Fienup, & Pace, 2011; Mong & Mong, 2012). After each intervention was implemented in the BEA and EXT, the most effective interventions were identified as the interventions producing the highest WSC based on visual inspection. Visual inspection was selected as the method for assessing best intervention(s) as opposed to percentage over baseline since there is no current precedent for a percentage increase over baseline criterion using a BEA for spelling.

During the BEA, the participants were exposed to each intervention once during a session, for three to six sessions. The order of the intervention presentation was randomized

within and across sessions using randomizing software (www.randomizer.org). The participants were given unique lists of 10 unknown words during each intervention. Effectiveness of each intervention was measured using the primary dependent variable, number of words spelled correctly (WSC) out of 10 words presented. Participants were provided with a 5 min break between each intervention in order to decrease the likelihood of fatigue or carryover effects.

Interobserver Agreement

One or more independent observers (i.e. undergraduate and masters-level research assistants) scored 86% of the spelling probes for the BEA and EXT sessions. IOA data were collected for 100% of Giuliana and Aiden's BEA and EXT sessions and 33% of Bryan and Jeff's BEA and EXT sessions. The observers scored all spelling probes by comparing the participant's spelling response to the correct spelling response. First, the observers collected each participant's probe sheets across all interventions. Second, the observers collected the intervention word list for each spelling session (BEA) or week (EXT). Third, the observers compiled a set of blank data collection sheets, identical to the ones the primary researcher used to score the participant's spelling responses. Once all materials were gathered, the observers compared the participant's written response with the correct spelling listed in the intervention word list. All IOA was conducted in the absence of the data collection sheet scored by the primary researcher. On their own data collection sheet, the observers recorded whether a word was spelled correctly or incorrectly, using a 1 to denote a correct response and a 0 to denote an incorrect response. The observer then compared their recordings with that of the researcher, using an item-by-item interobserver agreement procedure, with each word scored as either an agreement (both observers had the same correct or incorrect recording) or a disagreement. Permanent product IOA was calculated using the following formula: $\text{agreements}/(\text{agreements} +$

disagreements) *100. Agreements were scored if both observers indicated a word was spelled correctly or incorrectly. A disagreement was scored when one observer indicates that a word was spelled incorrectly and the second observer indicated that the word was spelled correctly (or vice-versa). Interobserver agreement for all sessions evaluated was 100%.

Treatment Integrity

Treatment Integrity data were collected for 33% of each participant's BEA and EXT sessions. When possible, a second researcher was present during all sessions and was responsible for recording the steps in the intervention that were and were not followed with integrity. If a second observer was not available, an independent second observer collected TI from the video taped sessions. The independent observer assessed whether the researcher implemented all portions of the pre-testing, intervention, and/or probe with integrity. Generally, the observer evaluated whether or not the researcher was seated next to the participant, read scripted instructions, implemented intervention strategies, praised the child for effort, and conducted a spelling probe accurately. Specifically, the observer calculated TI using the directions for each specific intervention as a method for accountability (see Appendices F, G, H, I, P, and Q). Each intervention had between 8 and 14 steps. Overall TI was 100% for all sessions evaluated.

Results

Words Spelled Correctly (WSC)

The individual performances of the four participants during the BEA are displayed in the top panels of Figures 1, 2, 3, and 4. Each data point represents the number of words spelled correctly out of 10 for each of the four interventions. Data points were connected between observations of the same intervention. Additionally, for each intervention the following data was

collected and is represented in Table 1: average rank ordering of the interventions from highest WSC (rank 1) to lowest WSC (rank 4) and prediction from session one of the most effective intervention. Rank orderings from 1 to 4 were calculated for each intervention on each session day. For example, the interventions that produced the highest WSC were ranked 1 and the interventions that produced the second highest WSC were ranked 2. The rank orderings for each intervention were then averaged across all sessions. Predictions were made for each participant as to which intervention(s) would continue to work best throughout the rest of the BEA and the EXT. The researcher derived this prediction by identifying which intervention(s) produced the greatest number of WSC on day one of the BEA.

The individual performances of the four participants during the EXT are displayed in the bottom panels of Figures 1, 2, 3, and 4. The data across the spelling weeks were aggregated to display the cumulative number of WSC across the last sessions of each spelling week. The abscissa represents the number of spelling weeks during the EXT. The ordinate represents the cumulative number of WSC across the spelling weeks. Each marker represents one of the three interventions tested during EXT. Above each marker is a line indicating the maximum number of potential words spelled correctly given the spelling week (i.e., maximum value for week 2 is 20). Additionally, for each intervention the following data was collected and is represented in Table 2: average rank ordering of the interventions from highest WSC (rank 1) to lowest WSC (rank 3), average WSC after the first EXT session, and mean words practiced across all EXT sessions.

Bryan. The top panel of Figure 1 displays the results for Bryan, who spelled first grade spelling words. Across all three BEA sessions, Bryan spelled the greatest number of words correctly with the CCC and CTD procedures with an average of 4.0 WSC and 3.3 WSC per

session, respectively. Under the RP and INC conditions, Bryan spelled the least number of words correctly with an average of 1.7 and 0.3 WSC, respectively. The difference between the best (CCC) and worst (INC) performing intervention was 3.7 WSC. Overall, instructional interventions (CCC and CTD) produced greater spelling accuracy than motivational or practice interventions (INC or RP). Based on the data collected, CCC and CTD were selected as the first and second best interventions, respectively, and the researcher continued to administer these interventions during the extended analyses.

The bottom of Figure 1 displays the EXT results for Bryan across all three experimental conditions, CTD, CCC, and TAU for three spelling weeks. An average spelling week consisted of 4.7 days. Across all three weeks CTD was the best intervention. At the conclusion of each spelling week, for all three spelling weeks, Bryan was able to correctly spell all 30 (M=10.0) of the words exposed to the CTD condition. Under the CCC condition, Bryan's performance pattern was similar to that of CTD with steep rates of spelling accuracy, however, with fewer words spelled correctly (M=8.7). The performance pattern under the TAU was the most dissimilar with a less steep slope, slower acquisition, and fewer words spelled correctly (M=5.0). Overall, instructional interventions (CTD and CCC) produced greater spelling accuracy than TAU.

Jeff. The top panel of Figure 2 displays the results for Jeff, who spelled first grade spelling words. Across all three BEA sessions, Jeff spelled the greatest number of words correctly with the CCC and/or RP procedures with an average of 5.0 WSC and 3.7 WSC, respectively. Under the CTD and INC conditions, Jeff spelled the least number of words correctly with an average of 2.0 and 1.3 WSC, respectively. The difference between the best (CCC) and worst (INC) performing interventions was 3.7 WSC. Overall, instructional and

practice interventions (CCC and RP) produced greater spelling accuracy than motivational or an alternative instructional interventions (INC or CTD). Both CCC and RP utilize practice as an active component as opposed to CTD, which may account for why CCC was better as an instructional procedure than CTD. Based on the data collected, CCC and RP were selected as the first and second best interventions, respectively, and the researcher continued to administer these interventions during the extended analyses.

The bottom of Figure 2 displays the EXT results for Jeff across all three experimental conditions, CCC, RP, and TAU for three spelling weeks. An average spelling week consisted of 4.7 days. Across all three weeks CCC was the best intervention. At the conclusion of all three spelling weeks, Jeff was able to correctly spell 28 of the 30 ($M=9.3$) words exposed to the CCC condition. Jeff demonstrated a steeper trend under the CCC condition when compared to RP and TAU. Jeff's spelling accuracy under the RP ($M=6.3$) and TAU ($M=7.0$) conditions produced similar trends relative to one another with a less steep slope, slower acquisition, and fewer words spelled correctly. Overall, the instructional intervention, CCC produced greater spelling accuracy than RP or TAU.

Aiden. The top panel of Figure 3 displays the results for Aiden, who spelled third grade spelling words. For the majority of all six BEA sessions (5 of the 6), Aiden spelled the greatest number of words correctly with the CTD and/or CCC procedures with an average of 6.8 WSC and 5.8 WSC, respectively. Under the RP and INC conditions, Aiden spelled the least number of words correctly with an average of 5.5 and 2.8 WSC, respectively. The difference between the best (CTD) and worst (INC) performing interventions was 4.0 WSC. Overall, instructional interventions (CTD and CCC) produced greater spelling accuracy than motivational or practice interventions (INC or RP). Based on the data collected, CTD and CCC were selected as the first

and second best interventions, respectively, and the researcher continued to administer these interventions during the extended analyses.

The bottom of Figure 3 displays the EXT results for Aiden across all three experimental conditions, CTD, CCC, and TAU for three spelling weeks. An average spelling week consisted of 9.3 days. Across all three weeks CTD and CCC were the best interventions. At the conclusion of all three spelling weeks, Aiden was able to correctly spell all 30 ($M=10$) words exposed to the CTD and CCC conditions. Under the CTD and CCC conditions, Aiden's performance pattern was identical with steep rates of spelling accuracy. The TAU condition had a similar performance pattern to the CTD and CCC conditions, however, with fewer words spelled correctly ($M=8.7$)

Giuliana. The top panel of Figure 4 displays the results for Giuliana, who spelled first grade spelling words. Across all five BEA sessions, Giuliana spelled the greatest number of words correctly with the CTD procedures with an average of 1.8 WSC. Following CTD, Giuliana performed equally well with the CCC and RP interventions with an average of 0.8 WSC. Under the INC condition, Giuliana spelled the least number of words correctly with an average of 0.6 WSC. The difference between the best (CTD) and worst (INC) performing interventions was 1.2 WSC. Overall, the instructional intervention CTD produced the greatest spelling accuracy and was determined to be the best intervention. The researcher selected CCC as the second best intervention to run during the extended analyses. CCC was selected as the second best intervention for two reasons, a) the function deficit is in line with the best intervention CTD and b) the parent endorsed RP as the TAU condition and so all three conditions would continue to be run during the EXT.

The bottom of Figure 4 displays the EXT results for Giuliana across all three experimental conditions, CCC, CTD, and TAU for five spelling weeks. An average spelling week consisted of 14.2 days. For the majority of the five weeks (3 out of 5) CTD was the best intervention. At the conclusion of all five spelling weeks, Giuliana was able to correctly spell 38 of the 50 words taught ($M=7.6$) using the CTD intervention. Giuliana's spelling accuracy under the CCC ($M=6.4$) and TAU ($M=6.8$) conditions produced similar trends relative to one another with a less steep slope, slower acquisition, and fewer words spelled correctly. Overall, the instructional intervention, CTD produced greater spelling accuracy than CCC or TAU.

Relationship Between Learning Opportunities and Compliance

The individual learning opportunities per session were aggregated and averaged (see Table 2). Bryan engaged in the most learning opportunities during his best intervention, CTD ($M=39.3$) and the fewest during his worst intervention, TAU ($M=27.3$). Under the TAU condition, Bryan engaged in 30.5% fewer learning opportunities when compared to CTD. Jeff engaged in the most learning opportunities during his best intervention, CCC ($M=31.2$) and the fewest during his worst intervention, TAU ($M=13.3$). Under the TAU condition, Jeff engaged in 45.5% fewer learning opportunities when compared to CCC. Giuliana engaged in the most learning opportunities during her best intervention, CTD ($M=37.3$) and the fewest during one of her two worst interventions, TAU ($M=23.4$). Under the TAU condition, Giuliana engaged in 37.3% fewer learning opportunities when compared to CTD. Aiden engaged in the most learning opportunities during one of his best interventions, CCC ($M=86.1$) and the fewest during his worst intervention, TAU ($M=46.1$). Under the TAU condition, Aiden engaged in 36.9% fewer learning opportunities when compared to CCC. It should be noted again that Aiden did not exhibit non-compliant behavior, but did report frustration and lack of success under the TAU

condition. Overall, participants engaged in fewer learning opportunities during the EXT under conditions that were least effective.

Summary. Each participant produced more WSC in the EXT when utilizing one or both of the best interventions identified in the BEA and when compared to TAU. When provided instruction under TAU, participants spelled fewer words correctly when compared to one or both of their BEA interventions. CTD was the best intervention for Bryan and Giuliana, while Jeff did best under CCC, and Aiden did equally well under CTD and CCC. For all four participants, an instructional procedure produced greater spelling accuracy when compared to practice or motivational procedures. All four participants engaged in the most learning opportunities during their best intervention as opposed to one of their least effective interventions, which indirectly mapped onto which interventions resulted in more compliant behavior.

Does the BEA Predict EXT Outcomes?

The researcher assessed whether data obtained from the first BEA session was predictive of a) the intervention(s) determined to be the most effective at the end of three to six sessions of BEA, and b) which intervention would produce the largest number of words learned during the EXT. Using data from the first BEA session, the intervention that produced the highest WSC for Jeff and Aiden (CCC and CTD), continued to produce the highest WSC throughout the BEA. Across the EXT sessions, Jeff and Aiden continued to perform best on spelling probes using the interventions identified on the first day of the BEA in comparison to the other intervention and TAU. For Bryan and Giuliana, there were two identical data points with the highest WSC on the first BEA session. Using this first day of data as predictive, either CTD or CCC could have been most effective for Bryan, while Giuliana could have benefited best from either CTD or RP in the BEA and EXT. For both Bryan and Giuliana, throughout the BEA, at least one of these

interventions continued to be the most effective in producing the largest average WSC (Bryan-CCC; Giuliana-CTD) and the other produced the second largest number of WSC in the BEA. Across the EXT sessions, both participants continued to perform best under one of these interventions (CTD for both Bryan and Giuliana) identified on day one of the BEA when compared to the other intervention and TAU.

Discussion

Standardized spelling instruction is routinely integrated into classroom teaching and assessment (Calhoun, Greenberg, & Hunter, 2010) and is helpful to many students, but not all (Alber & Walshe, 2004). For those students, who do not benefit from routine spelling instruction, interventionists and teachers may continue to use traditional interventions in a trial-and-error manner to remedy the spelling deficit. The instructors may apply treatments consecutively, spending copious amounts of time assessing treatment success, without necessarily improving spelling proficiency (Wanzek et al., 2006). For many students, the typical spelling instruction and interventions applied may not be successful because these strategies do not address the function of their spelling deficit.

A BEA is a potential alternative to traditional spelling methods, using data to guide intervention-based decisions for students with spelling deficiencies. A BEA can provide a better fit between the function of the spelling failure and intervention recommendations (Baranek, Fienup, & Pace, 2011; Burns, Ganuza, & London, 2009). Despite the benefits to using a BEA, there is a dearth of research using BEA's to assist students with spelling deficits.

In the current study, the researcher explored the utility of a BEA in assisting students with spelling deficits, an academic intervention area that has yet to be explored in the context of a BEA. In this study, the researcher incorporated four spelling interventions with empirical

support into a BEA. The four spelling interventions assessed and applied were: incentive, repeated practice, constant time delay, and cover copy compare. These four interventions addressed three of Daly's (1997) hypotheses for academic deficits: motivation, practice, and instruction. All four students demonstrated differential responding to the four interventions during the BEA. The researcher used these data to determine which interventions worked best for each student. For two of the four students, Jeff and Giuliana, CCC and CTD, respectively, were the best overall interventions in both the BEA and EXT. For the other two students, Aiden and Bryan, CCC and/or CTD were the best overall interventions in both the BEA and EXT. For all four students, an instructional intervention was the best intervention, producing the highest number of WSC. This data implies that for all students, the spelling skill deficit was related to a lack of effective instruction. For all four students, incentives alone produced the fewest WSC, implying that motivation was not the underlying issue related to his or her spelling skill deficits. However, it should be noted that the instructional strategies did include feedback and reinforcement (i.e. social praise) for correct spelling, so while incentives alone were not sufficient to positively affect spelling behavior, they were part of the instructional packages that did produce the highest WSC.

While the outcomes of the BEA helped to identify the best interventions after three to six sessions the researcher attempted to expand upon their analysis of the BEA results to determine if the data from the first BEA session could be used to make an accurate prediction about the interventions that would work best across the BEA and the EXT. Throughout the literature, there lacks consistent evidence in support of conducting a BEA for a specified number of occasions. The studies conducted thus far typically include one to three data points in order to determine which interventions are most effective (Baranek, Fienup, & Pace, 2011; Burns,

Ganuza, & London, 2009). However, it may not be necessary to continually administer the BEA if the data on one single occasion is predictive of what works best for students with specific skill deficits. Across all four students the spelling intervention that worked best on the first day continued to be most effective for each student in producing a greater number of WSC throughout the BEA as well as the EXT. In the future, researchers could continue to assess the necessity to continue testing past the first BEA sessions. Researchers may be able to determine if only one session, known as an abridged BEA (Daly, Witt, Martens, & Dool, 1997), is sufficient to appropriately predict which of the interventions tested is most likely to be effective for the student.

An important contribution of this study was that the researcher incorporated an extended analysis into the research design following the BEA. The researcher assessed whether interventions identified in the BEA produced better acquisition of new spelling words when those interventions were implemented continuously for 15 min increments (as opposed to 1x in the BEA) and compared the outcomes to traditional spelling interventions that the participants experienced in their respective school environments (TAU). The two best interventions from the BEA were compared to a TAU condition, which was an intervention that mimicked what the students experienced at school. Across three to four sessions, with 15 min exposures to a respective intervention strategy, the researcher evaluated the cumulative number of words a student learned with that intervention. For all four participants a differentiation was found amongst the three interventions tested during the extended analyses.

For all four students, the results from the EXT verified that the outcomes of the BEA are a good indicator of which intervention(s) work best for each student and that the BEA consistently identified interventions that were better than TAU. Each student continued to

demonstrate superior responding to WSC using the best interventions identified during the BEA when compared to the TAU. For Bryan, his performance under the intervention identified as best (CCC) during the BEA continued to be better than TAU in the EXT but slightly less effective than the intervention identified as second best (CTD) under the BEA. Under both CCC and CTD, Bryan produced WSC values above and discriminable from TAU during EXT. For the other three of the students, Jeff, Aiden, and Giuliana, their performances under the intervention identified as best (CCC for Jeff and CTD for Aiden and Giuliana) during the BEA produced the highest WSC during the EXT. Jeff's performance under the second best intervention (RP) and TAU were less discriminable from one another, but both RP and TAU produced fewer WSC when compared to the best intervention (CCC). Aiden performed equally well during the EXT using the first (CTD) and second best (CCC) interventions from the BEA. Giuliana's data pattern during the EXT was variable, with CTD only slightly better than TAU and the second best intervention (CCC) across all five sessions. The variability may be a result of the continued issues with compliance for work-related tasks. Overall, in the EXT all students were able to spell more words correctly after engaging in the intervention that worked best for them during the BEA when compared to TAU. While the sustained effects found during the EXT are promising, future research could focus on providing more information about the long-term effects of an EXT by administering maintenance probes on words taught during EXT. Words taught during the EXT could be re-assessed through the use of probes two or more weeks after the last day in the spelling week to evaluate if students are able to retain the information learned.

During the EXT, students were required to repetitiously engage in three interventions for 15 consecutive minutes while the BEA required practicing each intervention only once. This

transition was not received well by the majority of the students (3 of 4) and they began to refuse to work during the longer periods of time required during the EXT. This outcome was not surprising given that the participants presented with a history of struggling to spell and the research study involved spelling interventions, all of which were not equally effective. To improve compliance with spelling-related tasks the researcher implemented a DRO procedure to reinforce the emission of behaviors that were not off-task. A difference in learning opportunities was found across all participants with participants engaging in more learning opportunities when administered the most effective interventions and fewer learning opportunities when administered the least effective interventions.

Non-compliance or escape-maintained behavior during spelling related tasks is not unique to the research environment. Parents and teachers of deficient spellers can also encounter problems when administering spelling interventions. The BEA technology can help them identify spelling interventions that are effective and probably less aversive to their learners. With that in mind, based on the outcomes of the BEA and EXT, parents of struggling spellers were provided with guidelines and instructions on how to implement the strategies that worked best for their student across the BEA and EXT. Bryan and Giuliana's parents were informed that for each of them CTD was the best intervention. Jeff's parent was informed that for him CCC was the best intervention. Aiden's parent was informed that for him CTD and CCC worked equally well for him. Parents can now opt to continue to adopt these strategies to further improve the below average spelling of their children, assisting them in making gains towards grade level spelling. While parents were not directly instructed on how to conduct a BEA, future studies could look to ensure fidelity by parents and teachers through the use of direct training. Such skills can be taught by employing behavior skills training and treatment integrity checks.

While the results of this study are supportive of the utility of a BEA for spelling, the findings should be interpreted within the context of the specific interventions we tested and it should be noted that the inclusion of different interventions or different variations of the interventions used might have produced different outcomes. For example, the CCC and CTD instructional had overlapping features, such as error correction for incorrect responses, written models, and orally presented feedback. Additionally, repeated practice overlapped with the instructional interventions since written practice is a key component in the error correction procedure. Perhaps larger discriminability amongst some of the instructional interventions, for students such as Aiden, could have been found if we had used instructional interventions that were more dissimilar. Future research should focus on identifying and utilizing interventions that do not share overlapping features.

Additionally, we selected instructional spelling interventions (CCC and CTD) that have empirical support across multiple studies (Calhoun, Otaiba, & Greenberg, 2010; Carter, McLaughlin, Derby, Schuler, & Everman, 2011; Erion, Davenport, Rodax, Scholl & Hardy, 2009; Fulk & Stormont-Spurgin, 1995; Ross & Stevens, 2003) as opposed to constructing interventions that only map onto one function of deficit. In doing so, we selected the interventions CCC and CTD that have reinforcement as part of the instructional package in the form of social praise. We realize that the inclusion of such treatments with components that are not solely instructional may limit our ability to state that instruction alone is the active component in these procedures. In the future, when testing instruction as a function of the academic deficit it may be best to use interventions without reinforcement as part of the procedure. Alternatively, we could have modified the CCC and CTD interventions so that feedback, and not praise was provided for correct responding. For example, the researcher could

have provided accuracy feedback by simply stating “Correct” following a correct response. This is an important avenue for future research as instructional interventions like CCC and CTD may or may not work as well without reinforcement, but it is important to gain a better understanding of how reinforcement plays a role in remedying spelling deficits.

When looking to the future, researchers could consider adjusting other elements of the research design to improve responding and discriminability amongst interventions. For instance, the practice component and the number of days in a spelling week could be amended to improve outcomes. Students could be provided with a set number of intervention exposures that need to be completed prior to the termination of the intervention and/or presentation of the probe. In the current design, the researcher applied time as a measurement of practice, with students being given an equal amount of time to access each of the interventions. However, when provided with interventions that were less effective (i.e., TAU), three of the four students (Bryan, Jeff, and Giuliana) engaged in task avoidance and refusals and did not contact the interventions for the entire time specified. In line with this finding, for all participants, the best interventions were those interventions with the greatest number of words practiced within the 15 min practice period (see Table 2). Based on this information, it can be implied that if a set number of trials were administered for all interventions, those interventions that were more effective would produce greater gains in WSC when compared to less effective interventions if practiced for the same number of trials.

Another limitation of the study was that the researcher did not use a standardized TAU across all conditions. TAU varied across the four students tested, in which two students (Bryan and Jeff) were exposed to RP + SE, and the other two participants to only either RP (Giuliana) or SE (Aiden). Differences across TAU patterns could be attributed to the lack of consistency

across the students. For instance, during the SE condition students were provided with minimal guidance, feedback, and instruction. Students were asked to provide sentences with the target word, and grammar and syntax were not addressed, and a response was only noted as correct if the target word was spelled correctly within the sentence. Future studies could establish a TAU based on local teacher surveys, in which teachers in surrounding neighborhoods are polled regarding their standard spelling practices. Teachers could provide details regarding the elements of spelling they find most important (i.e. spelled correctly and used grammatically correct) and these practices can be employed as the TAU across all students.

In summary, the instructional procedures CCC and/or CTD were successful across all students in increasing number of WSC across both the BEA and EXT conditions. Two students continued to improve under the CTD and CCC condition (Bryan and Aiden), while the other two students thrived best under CCC or CTD (Jeff and Giuliana). Based on the results from the study, it seems that BEA's can be used by interventionists to determine which strategies work best for a student struggling with spelling. Furthermore, the findings from the current study suggest that a BEA can effectively be used to predict which interventions will be most effective for improving spelling accuracy across the BEA and the EXT and when compared to TAU.

Appendix A

Spelling Flyer



Free Spelling Assessment Research Program for Children Aged 6–12.

DOES YOUR CHILD HAVE PROBLEMS SPELLING?

- Spells words incorrectly...
- Has a hard time completing spelling related assignments...
- Gives up when completing spelling related work...
- Has a hard time reading because they lack spelling skills...

FREE EVALUATION AND ASSESSMENT OF SPELLING SKILLS DESIGNED TO:

DETERMINE WHY YOUR CHILD IS HAVING DIFFICULTIES SPELLING

DETERMINE EFFECTIVE STRATEGIES TO HELP YOUR CHILD SPELL MORE
ACCURATELY

RECEIVE A FREE REPORT ABOUT YOUR

CHILD'S SPELLING SKILLS

Child must be fluent in English.

For more information call us at 718-997-2944 or e-mail QCSpelling@gmail.com

Appendix B

Spelling Study Screening

Date:
Parent Name:
Child's Name:

“I just want to begin by getting some information from you about your child. The questions are to see whether your child would be appropriate for this study.”

1. How old is your child? _____ (EXCLUSION CRITERIA)
2. What is your child's first language? _____ (EXCLUSION CRITERIA)

DID PARENT ENDORSE EXCLUSION CRITERIA?
(YES to any or both of the below disqualifies participant for study)

CHILD IS UNDER 6 OR OVER 12	YES	NO
LANGUAGE OTHER THAN ENGLISH IS ENDORSED	YES	NO

“Thank you for your interest in our study, but at this time your child does not meet eligibility requirements to be enrolled in our study.”

CONTINUE WITH SECTION BELOW IF PARENTS DID NOT ENDORSE EXCLUSION CRITERIA

2. Birth date? _____
3. What grade is your child in? _____
4. Is your child on any medications? _____
5. Does your child have spelling difficulties?
 - a. Does your child have an IEP at school? (frequency, intensity, duration)
6. Could you tell me how your child is socially and behaviorally? (frequency, intensity, duration)
7. Is your child compliant at home? At school? (Oppositional? Frequency, intensity, duration)

8. How does he/she respond to authority? (frequency, intensity, duration)

9. How did you find out about the study? (Flyer, Social Skills group, Personal Recommendation)

“Your child may be eligible for enrollment in our study. We need to conduct an initial meeting with a parent and your child. We can conduct the meeting in your home, at the social skills group (if child was referred by social skills group), or on the Queens College Campus.”

In term of scheduling...

1. What days would be good to schedule the initial meeting (Circle all that apply)?

Monday Tuesday Wednesday Thursday Friday Saturday Sunday

2. What times would be good to schedule the initial meeting?

3. Where would you like to conduct the initial meeting?

Address (for sending materials and reports):

License plate (for parking pass):

E-mail address: _____

Appendix C

Sample Graded Master List – Grade 1

1	an	She is an astronaut.
2	let	Please let me stay.
3	fate	It was her fate to be president.
4	lime	I like to put a lime in my water.
5	prod	The farmer will prod the cow.
6	vent	The vent let out the hot air.
7	hose	The garden hose was long.
8	quack	The duck did not quack.
9	lost	Bridget was lost in Italy.
10	pipe	The water pipe began to burst.
11	dive	I want to dive in the pool.
12	hub	The train station was a big hub.
13	mash	I need to mash the baby's food.
14	down	Eden went down to the lake.
15	neck	Holly's neck is warm with a scarf.
16	hank	A hank of yarn is very long.
17	pew	File into the pew.
18	food	Owen's food had spoiled.
19	hate	I hate to see spiders.
20	dame	The dame was very fancy.
21	deer	The deer were asleep.
22	kill	Please don't kill the spider.

Appendix D

Directions for Pretesting of Word Lists

- ❑ Student should be seated across from or next to the interventionist. Once the student is settled the interventionist should place the pretesting probe sheet in front of the student.
- ❑ The interventionist should state, “I have a list of words that I would like you to spell. Be sure to do your best spelling. Any questions?”
- ❑ The interventionist should read each word from the master grade list in order of presentation. The interventionist should then use the word in a sentence and state the word again.
 - Students are given 5 s to initiate a response. If the student does not begin writing the response within that timeframe, the interventionist will prompt them to begin (with verbal directions, like “Please begin writing the word I just said” and pointing).
 - If the student does not respond to the prompt within 5 s, move onto the next word item in the master list.
- ❑ Words will be marked with a K if Known, and U if Unknown in the column adjacent to each word.
 - No feedback regarding performance accuracy is provided to the student.
- ❑ Words will continue to be administered to the student until 20 unknown words have been identified or the student appears to be fatigued.
 - A break will then follow and be 3-5 minutes in duration.
 - Following the first break, words will continue to be administered in the same manner until 20 additional unknown words have been identified or until the student appears to be fatigued.
 - This procedure will terminate once 40 (BEA) or 30 (EXT) unknown words have been identified.
- ❑ During the breaks the interventionists will assign each unknown word to 1 of the 4 interventions in the randomized order of administration (determined prior to session). One word at a time will be assigned to each list until all lists have 10 spelling words.

Appendix F

Repeated Practice Directions

- ❑ Student should be seated across from or next to the interventionist. Once the student is settled the interventionist should place the intervention practice sheet in front of the student.

- ❑ The interventionist should state, “I have a list of 10 words. I would like you to spell each word three times. Copy each word three times, one time in each column. Be sure to do your best spelling. Let me know when you have finished copying the words three times each. Any questions?”
 - Students are given 5 s to initiate the practice response. If the student does not begin practicing within that timeframe, the interventionist will prompt them to begin with verbal directions, like “Please begin practicing the target word” and pointing.
 - If the student skips a column or misplaces a word, prompt the student to correctly fill in the appropriate space with the appropriate word.

- ❑ Once all 10 words have been exposed to the RP condition, take away the intervention practice sheet and replace with a probe sheet.

This spelling list is scored:

- ❑ The interventionist should state, “I have a list of 10 words that I would like you to spell. Be sure to do your best spelling. Any questions?”
 - The interventionist states the word, uses the word in a sentence, and then re-states the word.
 - The interventionist prompts the student to spell the word when: the student waits longer than 5 s to begin writing the word, or takes longer than 10 s to complete the spelling of the word.
 - If the student does not respond to the prompt by beginning or completing the spelling item, move onto the next spelling word in the list.

- ❑ The interventionist does not verbally praise or provide feedback on any spelling response.
 - At the end of the 10-word list the interventionist should verbally praise the student for completing the list.

- ❑ Take a 5 min break.

Appendix G

Cover, Copy, Compare Directions

- ❑ Student should be seated across from or next to the interventionist. Once the student is settled the interventionist should place the intervention practice sheet in front of the student.
- ❑ The interventionist should state, “I have a list of 10 words that I would like you to spell. When I say begin I want you to look at the first word in the word list.”
 - Interventionist uncovers flap for word 1. Interventionist states, “Look at word 1.” (Give student 5-10 s to look at the first word).
 - Interventionist states, “Okay, now close the flap over Word 1.”
 - Interventionist states, “Please spell word 1 in Column 1. Do your best spelling.”
 - Students are given 5 s to initiate their response. If the student does not begin writing within that timeframe, the interventionist will prompt them to begin writing with verbal directions, like “Please begin writing the word that you just looked at”.
 - If the student does not begin writing the response after the prompt, uncover the word in the word list. Have them repeat steps 1-3.
 - If student skips a column or misplaces a word, prompt the student to correctly fill in the appropriate space with the appropriate word.
 - Interventionist uncovers target word. Interventionist states, “Did you spell the word correctly?”
 - If yes, state “Good job, spelling ‘target word.’”
 - If no, state “You made a mistake spelling ‘target word’. Look at the word and spell it again in column 2.”
 - Repeat steps 1-4 for all 10 words.
 - Once all 10 words have been exposed to the CCC condition, take away the intervention practice sheet and replace with a probe sheet.

This spelling list is scored:

- ❑ The interventionist should state, “I have a list of 10 words that I would like you to spell. Be sure to do your best spelling. Any questions?”
 - The interventionist states the word, uses the word in a sentence, and then re-states the word.
 - The interventionist prompts the student to spell the word when: the student waits longer than 5 s to begin writing the word, or takes longer than 10 s to complete the spelling of the word.
 - If the student does not respond to the prompt by beginning or completing the spelling item, move onto the next spelling word in the list.
- ❑ The interventionist does not verbally praise or provide feedback on any spelling response.
 - At the end of the 10-word list the interventionist should verbally praise the student for completing the list.
- ❑ Take a 5 min break.

Appendix H

Incentive Directions

- ❑ Prior to the start of the intervention, the interventionist should present the student with the Reward Box. Allow the student 2-3 minutes to engage with the items and choose five items to earn. Once the student has selected their items, place the items to the side. The student should then be informed that they will be able to earn some or all of the prizes depending on their spelling accuracy.
 - The interventionist could state, “The more words you spell right, the more prizes you can earn. If you spell 1-2 words correctly, you get 1 prize. If you spell 3-4 words correctly, you can earn 2 prizes. If you spell 5-6 words correctly, you could earn 3 prizes. If you spell 7-8 words correctly, you could earn 4 prizes. If you spell 9-10 words correctly, you can earn all 5 prizes.”
- ❑ Student should be seated across from or next to the interventionist. Once the student is settled, the interventionist should place a probe sheet in front of the student.

This spelling list is scored:

- ❑ The interventionist should state, “I have a list of 10 words that I would like you to spell. Be sure to do your best spelling. Any questions?”
 - The interventionist states the word, uses the word in a sentence, and then re-states the word.
 - The interventionist prompts the student to spell the word when: the student waits longer than 5 s to begin writing the word, or takes longer than 10 s to complete the spelling of the word.
 - If the student does not respond to the prompt by beginning or completing the spelling item, move onto the next spelling word in the list.
- ❑ The interventionist does not verbally praise or provide feedback on any spelling response.
 - At the end of the 10-word list the interventionist should verbally praise the student for completing the list.
- ❑ Take a 1-2 min break.
 - During the break calculate the number of words spelled correctly.
- ❑ The interventionist should state, “You spelled (number of words) correctly. You can pick (number of items) prizes.” Provide the student with the number of item(s) they chose according to the following breakdown:
 - 1-2 correctly spelled words: 1 prize
 - 3-4 correctly spelled words: 2 prizes
 - 5-6 correctly spelled words: 3 prizes
 - 7-8 correctly spelled words: 4 prizes
 - 9-10 correctly spelled words: All 5 prizes
- ❑ If a student does not earn all or any of the chosen items, indicate that there is an opportunity to earn rewards again during their next visit.
- ❑ Take a 5 min break.

Appendix I

Constant Time Delay Directions

- ❑ Student should be seated across from or next to the interventionist. Once the student is settled the interventionist should place the intervention practice sheet in front of the student.

- ❑ The interventionist should then state, “I have a list of 10 words that I would like you to spell in column 1. If you come to a word you don’t know, wait for me and I will show you how to spell it. Be sure to do your best spelling. Any questions?”
 - Interventionist states the word, uses the word in a sentence, re-states the word.

- ❑ Interventionist provides correct spelling of the word on a flashcard when: student writes the word incorrectly or waits longer than 5 s to begin writing the word.
 - If the correct spelling does need to be provided, state “ This is how to spell ‘target word.’ Please copy this word into column 2.” No verbal praise follows the prompted spelling response.
 - If the correct spelling does not need to be provided, verbally praise (i.e. “Great Job Spelling, ‘target word!’”) each correct spelling response made independently.

- ❑ Once all 10 words have been exposed to the CTD condition, take away the intervention practice sheet and replace with a probe sheet.

This spelling list is scored:

- ❑ The interventionist should state, “I have a list of 10 words that I would like you to spell. Be sure to do your best spelling. Any questions?”
 - The interventionist states the word, uses the word in a sentence, and then re-states the word.
 - The interventionist prompts the student to spell the word when: the student waits longer than 5 s to begin writing the word, or takes longer than 10 s to complete the spelling of the word.
 - If the student does not respond to the prompt by beginning or completing the spelling item, move onto the next spelling word in the list.

- ❑ The interventionist does not verbally praise or provide feedback on any spelling response.
 - At the end of the 10-word list the interventionist should verbally praise the student for completing the list.

- ❑ Take a 5 min break.

Appendix J
Repeated Practice Template

Word List	Column 1	Column 2	Column 3
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Appendix K
CCC Template

Word List	Column 1	Column 2
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.
5.	5.	5.
6.	6.	6.
7.	7.	7.
8.	8.	8.
9.	9.	9.
10.	10.	10.

Appendix L
CTD Template

Column 1	Column 2
1.	1.
2.	2.
3	3
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

Appendix M
Intervention Probe Sheet

1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Appendix N

Researcher Data Collection Sheet

Data Collection

Mark 1 for Correct Response

Mark 0 for Incorrect Response

Intervention:

Interventionist Initials:

Date:

Phase, Session:

Total Score:

1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Appendix O

Intervention Word List

Intervention #1	Intervention #2	Intervention #3	Intervention #4
1.	1.	1.	1.
2.	2.	2.	2.
3.	3.	3.	3.
4.	4.	4.	4.
5.	5.	5.	5.
6.	6.	6.	6.
7.	7.	7.	7.
8.	8.	8.	8.
9.	9.	9.	9.
10.	10.	10.	10.

Appendix P

Repeated Practice + Sentences Directions

- ❑ Student should be seated across from or next to the interventionist. Once the student is settled the interventionist should place the intervention practice sheet in front of the student.
- ❑ The interventionist should state, “I have a list of 10 words. I would like you to spell each word three times. Copy each word three times, one time in each column. Be sure to do your best spelling. Let me know when you have finished copying the words three times each. Any questions?”
 - Students are given 5 s to initiate the practice response. If the student does not begin practicing within that timeframe, the interventionist will prompt them to begin with verbal directions, like “Please begin practicing the target word” and pointing.
 - If the student skips a column or misplaces a word, prompt the student to correctly fill in the appropriate space with the appropriate word.
 - If the student incorrectly copies a word, prompt them to correct the spelling.
- ❑ Once all 10 words have been exposed to the RP condition, take away the intervention practice sheet and replace with a Sentence practice sheet.
- ❑ The interventionist should state, “I have a list of 10 words. I would like you to write 1 sentence for each word listed in the word list. Any questions?”
 - Students are given 5 - 10 s to initiate the writing response. If the student does not begin writing a sentence within that timeframe, the interventionist will prompt them to begin with verbal directions, like “Please begin writing a sentence for ‘target word’” and pointing.
- ❑ Once all 10 words have been exposed to the sentence condition, take away the intervention practice sheet. The RP condition will then be re-presented followed by the re-presentation of the Sentence condition. Interventions will continue being presented until 15 min have elapsed.
- ❑ At the conclusion of 15 min, remove the current practice sheet and replace with a probe sheet.

This spelling list is scored:

- ❑ The interventionist should state, “I have a list of 10 words that I would like you to spell. Be sure to do your best spelling. Any questions?”
 - The interventionist states the word, uses the word in a sentence, re-states the word.
 - The interventionist prompts the student to spell the word when: the student waits longer than 5 s to begin writing the word, or takes longer than 10 s to complete the spelling of the word.
 - If the student does not respond to the prompt by beginning or completing the spelling item, move onto the next spelling word in the list.
- ❑ The interventionist does not verbally praise or provide feedback on any spelling response.
 - At the end of the 10-word list the interventionist should verbally praise the student for completing the list.
- ❑ Take a 5 min break.

Appendix Q

Sentences Directions

- ❑ Student should be seated across from or next to the interventionist. Once the student is settled the interventionist should place the intervention practice sheet in front of the student.
- ❑ The interventionist should state, “I have a list of 10 words. I would like you to write 1 sentence for each word listed in the word list. Any questions?”
 - Students are given 5 - 10 s to initiate the writing response. If the student does not begin writing a sentence within that timeframe, the interventionist will prompt them to begin with verbal directions, like “Please begin writing a sentence for ‘target word’” and pointing.
- ❑ Once all 10 words have been exposed to the Sentence condition, take away the intervention practice sheet and replace with a new practice sheet. Repeat the Sentence condition until 15 min have elapsed.
- ❑ At the conclusion of 15 min, remove the current practice sheet and replace with a probe sheet.

This spelling list is scored:

- ❑ The interventionist should state, “I have a list of 10 words that I would like you to spell. Be sure to do your best spelling. Any questions?”
 - The interventionist states the word, uses the word in a sentence, re-states the word.
 - The interventionist prompts the student to spell the word when: the student waits longer than 5 s to begin writing the word, or takes longer than 10 s to complete the spelling of the word.
 - If the student does not respond to the prompt by beginning or completing the spelling item, move onto the next spelling word in the list.
- ❑ The interventionist does not verbally praise or provide feedback on any spelling response.
 - At the end of the 10-word list the interventionist should verbally praise the student for completing the list.
- ❑ Take a 5 min break.

Appendix R
Sentences Template

Word List	Sentences
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Table 1

BEA Data

BEA					
Participant		RP	INC	CTD	CCC
Bryan	Average Rank	3.0	3.7	1.3	1.0
	1 st Session Prediction	CTD or CCC			
Jeff	Average Rank	1.7	3.3	3.3	1.3
	1 st Session Prediction	CCC			
Aiden	Average Rank	2.2	3.7	1.5	1.8
	1 st Session Prediction	CTD			
Giuliana	Average Rank	1.8	2.0	1.0	1.8
	1 st Session Prediction	CTD			

Table 2

EXT Data

		EXT			
Participant		RP	CTD	CCC	TAU
Bryan	Average Rank		1.2	1.7	3.0
	1 st probe average		7.7	7.0	4.7
	Mean Words Practiced		39.3	38.3	27.3
Jeff	Average Rank	2.5		1.0	2.2
	1 st probe average	3.7		8.3	4.7
	Mean Words Practiced	24.4		31.2	13.3
Aiden	Average Rank		1.0	1.2	3.0
	1 st probe average		10.0	9.7	8.3
	Mean Words Practiced		73.1	86.1	46.1
Giuliana	Average Rank		1.4	2.0	2.3
	1 st probe average		7.6	5.2	3.4
	Mean Words Practiced		37.3	28.3	23.4

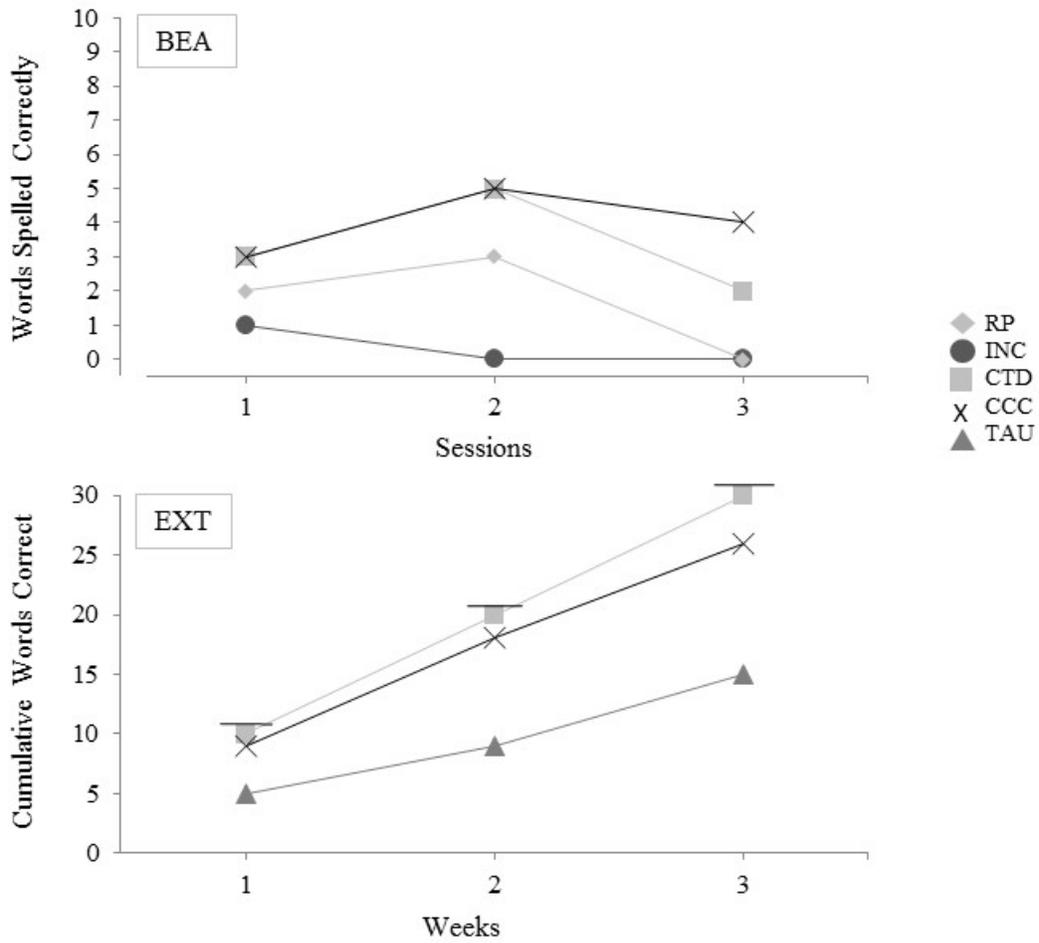


Figure 1. (Top Panel) Number of WSC across all three BEA sessions for each of the four interventions for Bryan. (Bottom Panel) Number of Cumulative WSC across the last day of each spelling week for all three EXT weeks.

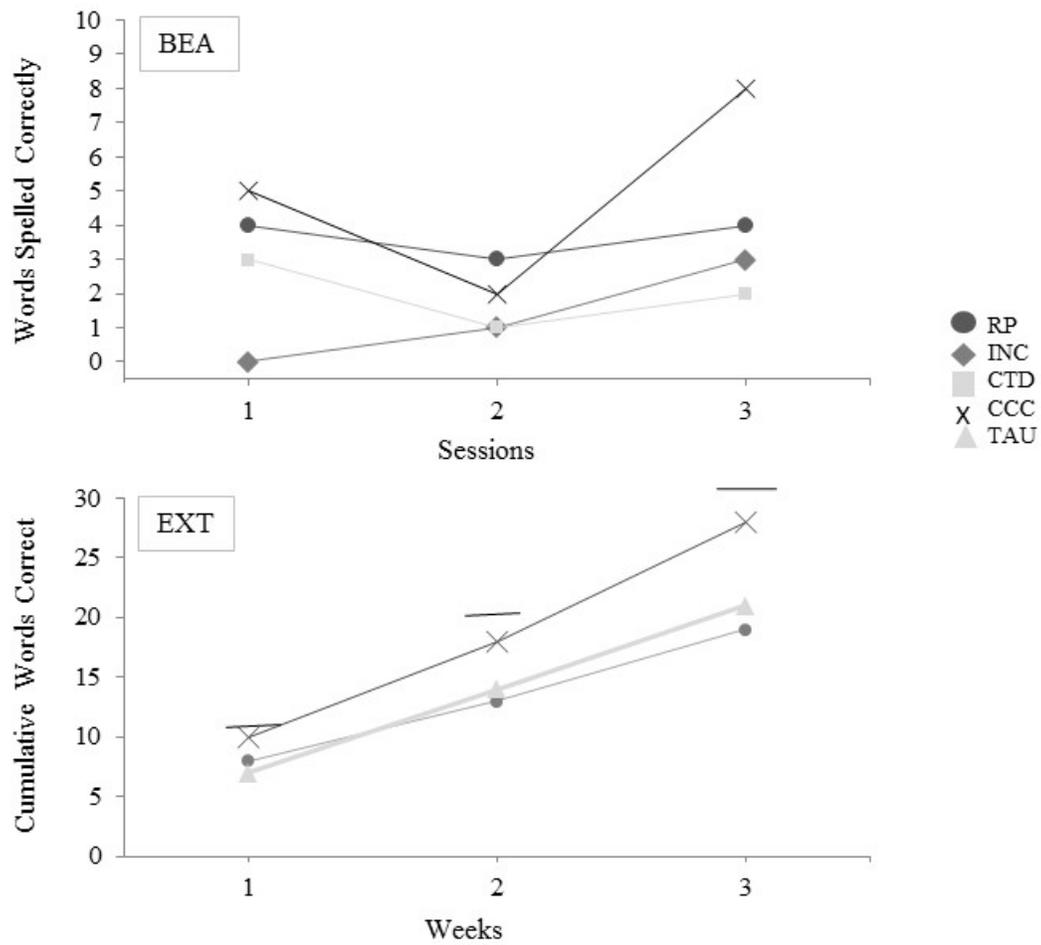


Figure 2. (Top Panel) Number of WSC across all three BEA sessions for each of the four interventions for Jeff. (Bottom Panel) Number of Cumulative WSC across the last day of each spelling week for all three EXT weeks.

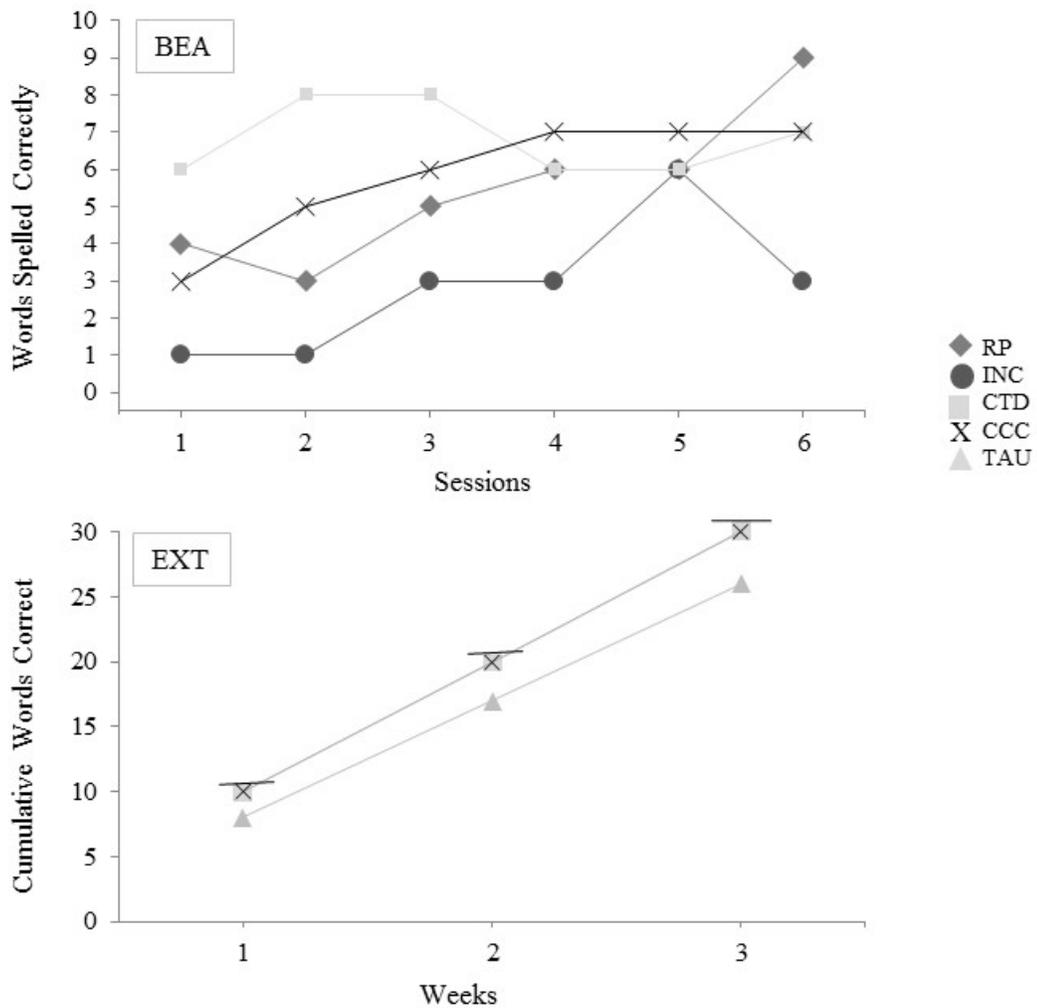


Figure 3. (Top Panel) Number of WSC across all six BEA sessions for each of the four interventions for Aiden. (Bottom Panel) Number of Cumulative WSC across the last day of each spelling week for all three EXT weeks.

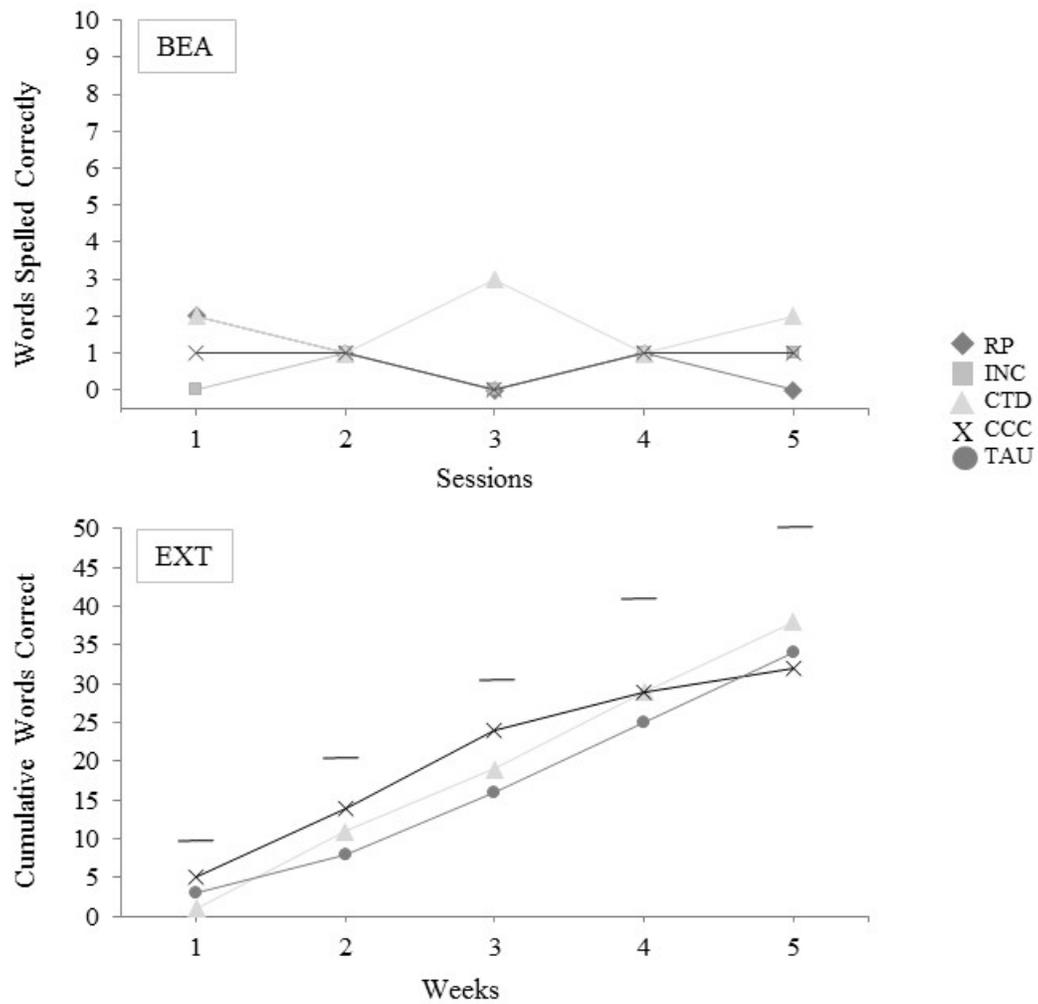


Figure 4. (Top Panel) Number of WSC across all five BEA sessions for each of the four interventions for Giuliana. (Bottom Panel) Number of Cumulative WSC across the last day of each spelling week for all five EXT weeks.

References

- AAASpell. (2011). Retrieved from: <https://AAASpell.com>
- Baranek, A., Fienup, D. M., & Pace, G. (2011). Brief experimental analysis of sight word interventions: A comparison of acquisition and maintenance of detected interventions. *Behavior Modification, 35*, 78-95.
- Berninger, V. W., Vaughan, K., Abbott, R. D., Brooks, A., Abbott, S. P., Rogan, L., ... Graham, S. (1998). Early intervention for spelling problems: Teaching functional spelling units of varying size with a multiple-connections framework. *Journal of Educational Psychology, 4*, 587-605.
- Birnie-Selwyn, B., & Green, B. (1997). Teaching children to spell: Decreasing consonant cluster errors by eliminating selective stimulus control. *Journal of Applied Behavior Analysis, 30*, 69-71.
- Burns, M. K., Ganuza, Z. M., & London, R. M. (2009). Brief experimental analysis of written letter formation: Single-case demonstration. *Journal of Behavioral Education, 18*, 20-34.
- Calhoun, M. B., Al Otaiba, S., & Greenberg, D. (2010). Spelling Knowledge: Implications for instruction and intervention. *Learning Disability Quarterly, 33*, 145-147.
- Calhoun, M. B., Greenberg, D., & Hunter, C. V. (2010). A comparison of standardized spelling assessments: Do they measure similar orthographic qualities? *Learning Disability Quarterly, 33*, 159-170.
- Carter, M. A., McLaughlin, T. F., Derby, K. M., Schuler, H., & Everman, J. (2011). Differential effects of cover, copy, compare in spelling with four high school students with severe behavior disorders. *Academic Research International, 1*, 43-51.

- Cates, G. L., Dunne, M., Erkfritz, K. N., Kivisto, A., Lee, N., & Wierzbicki, J. (2007). Differential effects of two spelling procedures on acquisition, maintenance and adaptation to Reading. *Journal of Behavioral Education*, 16, 71-82.
- Codding, R. S., Baglici, S., Gottesman, D., Johnson, M., Kert, A. S., & Lebeouf, P. (2009). Selecting intervention strategies: Using brief experimental analysis for mathematics problems. *Journal of Applied School Psychology*, 25, 146-168.
- Coleman-Martin, M. B., & Heller, K. W. (2004). Using a modified constant prompt-delay procedure to teach spelling to students with physical disabilities. *Journal of Applied Behavior Analysis*, 37, 469-480.
- Daly III, E. J., Bonfiglio, C. M., Mattson, T., Persampieri, M., & Foreman-Yates, K. (2005). Refining the experimental analysis of academic skills deficits: Part I. An investigation of variables that affect generalized oral reading performance. *Journal of Applied Behavior Analysis*, 38, 485-497.
- Daly III, E. J., Bonfiglio, C. M., Mattson, T., Persampieri, M., & Foreman-Yates, K. (2006). Refining the experimental analysis of academic skills deficits: Part II. Use of brief experimental analysis to evaluate reading fluency treatments. *Journal of Applied Behavior Analysis*, 39, 323-331.
- Daly, E. J., III, Martens, B. K., Hamler, K. R., Dool, E. J., & Eckert, T. L. (1999). A brief experimental analysis for identifying instructional components needed to improve oral reading fluency. *Journal of Applied Behavior Analysis*, 32, 83-94.
- Daly III, E. J., Martens, B. K., Dool, E. J., & Hintze, J. M. (1998). Using brief functional analysis to select interventions for oral reading. *Journal of Behavioral Education*, 8, 203-218.

- Daly III, E. J., Witt, J. C., Martens, B. K., & Dool, E. J. (1997). A model for conducting a functional analysis of academic performance problems. *School Psychology Review*, 26, 554-574.
- Dube, W. V., McDonald, S. J., McIlvane, W. J., & Mackay, H. A. (1991). Constructed-response matching to sample and spelling instruction. *Journal of Applied Behavior Analysis*, 24, 305-317.
- Erion, J., Davenport, C., Rodax, N., Scholl, B. & Hardy, J. (2009). Cover-Copy-Compare and Spelling: One Versus Three Repetitions. *Journal of Behavioral Education*, 18, 319-330.
- Everett, G. E., Swift, H. S., McKenney, E. L. W., & Jewell, J. D. (2016). Analyzing math-to-mastery through brief experimental analysis. *Psychology in the Schools*, 53, 971-983.
- Gettinger, M. (1993). Effects of invented spelling and direct instruction on spelling performance of second-grade boys. *Journal of Applied Behavior Analysis*, 26, 281-291.
- Gettinger, M. (1985). Effects of teacher-directed versus student-directed instruction and cues versus no cues for improving spelling. *Journal of Applied Behavior Analysis* 18, 167-171.
- Grskovic, M. S., & Belfiore, P. J. (1996). Improving the spelling performance of students with disabilities. *Journal of Behavioral Education*, 6, 343-354.
- Fulk, B. M., & Stormont-Spurgin, M. (1995). Spelling interventions for participants with disabilities: A review. *Journal of Special Education*, 28, 488-513.
- Hanna, E. S., De Souza, D. G., De Rose, J. C., & Fonseca, M. (2004). Effects of delayed constructed-response identity matching on spelling of dictated words. *Journal of Applied Behavior Analysis*, 37, 223-227.
- Hughes, T. A., Fredrick, L. D., & Keel, M. C. (2002). Learning to effectively implement

- constant time delay procedures to teach spelling. *Learning Disability Quarterly*, 25, 209-220.
- Kemper, M. J., Verhoeven, L., & Bosman, A. M. T. (2012). Implicit and explicit instruction of spelling rules, *Learning and Individual Differences*. Advance online publication. doi:10.1016/j.lindif.2012.06.008
- Kit's Educational Publishing. (2014). Complete Graded Spelling Lists for Years One to Six. American English. San Bernadino, CA: Kit's Educational Publishing.
- Lee-Viera, A., Mayer, M. D., Cameron, M. J. (2006). Constructed-response spelling and literacy development: An application in an urban classroom. *Behavioral Interventions*, 21, 111-122.
- Mayfield, K. H., Glenn, I. M., & Vollmer, T. R. (2008). Teaching spelling through prompting and review procedures using computer-based instruction. *Journal of Behavioral Education*, 17, 303-312.
- McComas, J. J., Wacker, D. P., Cooper, L. J., Asmus, J. M., Richman, D., & Stoner, B. (1996). Brief experimental analysis of stimulus prompts for academic tasks in an outpatient clinic. *Journal of Applied Behavior Analysis*, 29, 397-401.
- Nies, K. A., & Belfiore, P. J. (2006). Enhancing spelling performance in participants with learning disabilities. *Journal of Behavioral Education*, 15, 163-170.
- Research Randomizer. (2016). Retrieved from: <https://randomizer.org>
- Ross, A. H., & Stevens, K. B. (2003). Teaching spelling of social studies content vocabulary prior to using the vocabulary in inclusive learning environments: An examination of constant time delay, observational learning, and instructive feedback. *Journal of Behavioral Education*, 12, 287-309.
- Skinner, C. H., McLaughlin, T. F., & Logan, P. (1997). Cover, copy, and compare: A self-

- managed academic intervention effective across skills, students, and settings. *Journal of Behavioral Education*, 7, 295–306.
- Stevens, K. B., Blackhurst, A. E., & Slaton, D. B. (1991). Teaching memorized spelling with a microcomputer: Time delay and computer-assisted instruction. *Journal of Applied Behavior Analysis*, 24, 153-160.
- Stromer, R. & Mackay, H. A. (1992). Spelling and emergent picture-printed word relations established with delayed identity matching to complex samples. *Journal of Applied Behavior Analysis*, 25, 893-904.
- VanAuken, T. L., Chafouleas, S. M., Bradley, T. A., & Martens, B. K. (2002). Using brief experimental analysis to selectoral reading interventions: An investigation of treatment utility. *Journal of Behavioral Education*, 11, 163-179.
- Viel-Rum, K. Houchins, D., & Frederick, L. (2007). Error self-correction and spelling: improving the spelling accuracy of secondary students with disabilities in written Expression. *Journal of Behavioral Education*, 16, 291-301.
- Woodcock-Johnson Test of Achievement. Reading Mastery Test-Revised (2001). Riverside Publishing.