ABSTRACT: **Purpose:** This study examined how 2 children with language and phonological impairments exhibiting different levels of phonological consistency responded to a storybook reading approach. In particular, within-treatment response to contrastive word pairs was examined. **Method:** The following questions were asked: (a) Does a child with phonological inconsistency respond differently than a child with phonological consistency to use of a CCVC/CVCC contrastive word pair strategy during treatment? (b) Does a child with phonological inconsistency exhibit a similar phonological response to treatment as a child with phonological consistency? **Results:** Treatment effects supported a storybook reading approach with children possessing different levels of phonological consistency. However, differential responses were identified. The child with phonological inconsistency responded to contrastive word pairs with revised productions, whereas the child with phonological consistency responded to contrastive word pairs with both revised and accurate productions. A similar treatment effect was noted on the percentage of consonant correct—revised measures. However, effects on the proportion of errors, consistency measures, and occurrence of cluster errors were different. Implications for treatment are discussed. **KEY WORDS:** phonology, language, intervention
Single-subject and small-group studies have pointed to gains in phonology following various storybook reading approaches (Hoffman, 1997). For example, children with mild language and phonological impairments experienced gains in phonology following an indirect storybook approach (Hoffman, Norris, & Monjure, 1990). On the other hand, children with moderate-to-severe impairments benefited from direct phonological approaches in addition to storybook reading approaches (Friberg & Lund, 2010; Hart & Gonzalez, 2009; Tyler & Sandoval, 1994). Bellon-Harn, Hoffman, and Harn (2004) suggested that the use of direct phonological strategies during storybook reading may be beneficial to children with mild, moderate, or severe impairments.

Although studies have supported the use of storybook reading approaches in children with co-occurring impairments at differing levels of severity, previous studies have not considered phonological consistency as a factor in treatment outcomes. Our study contributes to existing studies by examining how two children with language and phonological impairments exhibiting different levels of phonological consistency responded to a storybook reading approach. In particular, we examined within-treatment response to a direct phonological strategy (i.e., contrastive word pairs).

**Treatment Approach**

Treatment in this study included the repetition of storybooks and clinical presentation of cloze procedures, expansions, models, and contrastive word pairs, which we refer to as RSR-CWP (i.e., repeated storybook reading—contrastive word pair). A cloze procedure provides a linguistic context in which a child fills in specific information signaled by an adult pause (Bradshaw, Hoffman, & Norris, 1998). Expansion refers to adult repetition of a child’s utterance using more mature language. One or more morphosyntactic elements is added, and the central meaning is expanded (Proctor-Williams, 2009). Modeling refers to an adult production of appropriate semantic, syntactic, and phonologic aspects of language (Camara, 1993; Fey et al., 1994). A contrastive word pair provides a contrast between the child’s error production and his or her correct production (Gierut, 1989; Weiner, 1981; Williams, 2000).

In our treatment approach, the strategies were presented in a scaffolded structure and the targets were not preselected. Rather, we presented the strategies based on the child’s initiation or response. Applying strategies in this structure is considered scaffolding because the clinician supports the child’s use of complex phonology and language with each subsequent production (Bornstein & Bruner, 1989; Bruner, 1978; Kirchner & Skarakis-Doyle, 1983). As the child’s language and phonology increases in complexity, the linguistic complexity of the clinician gradually increases (Ukrainetz, 2006). Multiple repetitions of a storybook provide context for strategy presentation with redundant linguistic and phonological elements.

The following is an example of a scaffolded structure during RSR-CWP using the book *Mrs. Wishy Washy* (Cowley, 1990).

**Adult:** And that cow is ________ (cloze procedure)

**Child:** Looking at the mud
**Pho:** /wʊkɪn æt də mæd/

**Adult:** /wʊkɪn/ or /lʊkɪn/? (contrastive word pair)

**Child:** Looking
**Pho:** /lʊkɪn/

**Adult:** He’s looking at that mud. Because he wants ________ (expansion and cloze procedure)

**Child:** To jump in the mud
**Pho:** /tju dʒæmp in də mæd/

Bellon-Harn et al. (2004) reported that the elicitation of specific phonological forms through a contrastive word pair followed by cloze procedure and expansion during repeated storybook reading increased the phonological accuracy of children with speech and language impairments. Bellon-Harn, Credeur-Pampolina, and LeBoeuf (2013) corroborated these results and further clarified the role of contrastive word pairs. Greater speech production accuracy was related to redundant, massed presentation of contrastive word pairs, which included bisyllabic, CVCC, CCVC, and CVC structures. Additionally, contrastive word pairs with greater phonological complexity positively impacted the speech-sound production of children with speech and language impairments. Our study extends this research by examining how two children with language and phonological impairments exhibiting different levels of phonological consistency responded to RSR-CWP.

**Phonological Consistency**

Inconsistent speech productions in typically developing children are well documented. Inconsistency can occur when a child has different productions of a particular speech sound for different lexical items (e.g., /s/ produced as /s/ in *sea* but not *sun*) or different word positions (e.g., /s/ produced as /s/ in initial but not final positions). This may be related to incomplete underlying representations of words,
misperception, or immature articulatory abilities (Holm, Crosbie, & Dodd, 2007). Variable production of speech sounds is indicative of ongoing phonological reorganization, and inconsistency decreases as a child masters the sounds of language (Forrest & Elbert, 2001).

The speech of children with impaired phonological systems may be characterized by inconsistency as well (Broomfield & Dodd, 2004). These children often have variable productions of the same words or phonemes within and across word positions (Crosbie, Holm, & Dodd, 2005; Tyler, Lewis, & Welch, 2003). The underlying cause of inconsistency in children with phonological disorders has not been determined (Betz & Stoel-Gammon, 2005). Dodd (1995) suggested that these children may have a degraded phonological plan. In other words, they may have difficulty selecting and sequencing phonemes for the production of a word or utterance. Through treatment, children with phonological disorders may begin to stabilize their phonological plan for word production, thereby decreasing their variable production.

According to Forrest, Elbert, and Dinnsen (2000), treating children with inconsistent speech patterns may be difficult because the clinician may not know the appropriate sound to contrast with the error production. McIntosh and Dodd (2008) documented positive outcomes using an approach to assist children in assembling a phonological plan online via modeling and stabilizing the child’s best error production (i.e., core vocabulary approach). They suggested that intervention should target sequences of phonemes in whole words. Tyler et al. (2003) found that children with language and phonological impairments who were characterized with a highly inconsistent system made greater phonological changes following a morphosyntax treatment than those with a highly consistent system. The authors suggested that the more diversified stimuli and varied opportunities for production in the language approach may have contributed to more widespread change than an approach focused on particular phonemes.

We suggest that RSR-CWP may be a viable option for the treatment of children with phonological inconsistency. To examine this possibility, we asked the following research questions:

- Does a child with phonological inconsistency respond differently than a child with phonological consistency to use of a CCVC/CVCC contrastive word pair strategy during treatment?
- Does a child with phonological inconsistency exhibit a similar phonological response to treatment as a child with phonological consistency?

We hypothesized that the child with phonological inconsistency would be likely to produce revised responses, albeit not fully accurate responses, following CCVC/CVCC contrastive word pairs because the child is working toward a gestural match with the adult target and is developing a more efficient phonological plan. On the other hand, we hypothesized that the child with phonological consistency would be likely to produce accurate responses following CCVC/CVCC contrastive word pairs because the child has a stable phonological system and is able to select and sequence the correct phoneme for the production of a word.

We also hypothesized that both children would improve their phonological performance because of the clinical strategies used within the storybook reading interaction. Storybook repetition allows the child to focus on complex lexical and phonological relationships. Clinical strategies presented in a scaffolded structure provide multiple opportunities to hear and produce lexical items in varied linguistic units. In RSR-CWP, clinicians do not predetermine stimuli; rather, the strategies are applied as a consequence of the child’s initiation or response. As a result, there are many words used in contrastive word pairs, with various lexical and phonological characteristics. Lexical items are not tightly controlled, ensuring diversified stimuli.

We used a case study design (Yin, 2003) whereby we examined clinician–child treatment interactions to answer the first question, and we evaluated the children’s baseline, treatment, and posttreatment performance to answer the second question.

**METHOD**

**Participants**

We recruited two children via the speech-language pathologist (SLP) at a local public school. Beth was a female, age 5;7 (years;months), and Diane, also a female, was age 5;4. Their language and phonological abilities are shown in Table 1. Both children exhibited impaired language based on scores at least 1 SD below the mean on the Structured Photographic Expressive Language Test—Third Edition (Dawson & Stout, 2003) and/or the Preschool Language Assessment Instrument—Second Edition (Blank, Rose, & Berlin, 2004). The children’s cognitive abilities were within normal limits based on scores within 1 SD from the mean on the Columbia Mental Maturity Scale—Revised (Burgemeister, Blum, & Lorge, 1972). Neither child presented with gross oral-motor,
Phonological impairment was based on the children's scores of at least 1 SD below the mean on the word, consonant, and phonological process inventories of the Bankson-Bernthal Test of Phonology (1990). The scores indicated that Beth demonstrated a more severe phonological impairment than Diane. The phonetic inventories demonstrated that both children produced most sounds expected for children between 5 and 6 years of age (Grunwell, 1987). However, the children's production of clusters was limited. The consistency index is defined as a raw number that reflects the total number of different errors occurring across the 23 phonemes of the language (Tyler et al., 2003). A low consistency index score reflects fewer errors per phoneme; a high score reflects a lack of consistency in the child's production. Beth presented with phonological inconsistency; Diane did not.

### Treatment Procedure

A second-year graduate student clinician conducted the baseline, treatment, and posttreatment sessions. Baseline measures were obtained 1 week before the treatment; the posttreatment measures were obtained 1 week following the treatment. The baseline and posttreatment sessions lasted as long as needed to obtain a representative sample, which was approximately 15 min. The clinician presented a storybook, asked broad wh-questions (e.g., “What's happening?”), and used general prompts (e.g., “Tell me the story”). No strategies were presented at the baseline or posttreatment session.

Each child completed 12 treatment sessions, three times per week for 4 weeks. Treatment was conducted in 20-min sessions. The books selected for repeated reading contained narrative structures that were characterized as reactive or abbreviated sequences and were approximately 15 pages in length, including the cover and title page (Applebee, 1978). At the first session, the initial five pages of a book were introduced. Each subsequent session reviewed the previous set of five pages and introduced the next set of five pages. Each book was completed in three sessions. Cloze procedures, expansions, models, and contrastive word pairs were applied. Following treatment, five posttreatment measures were obtained following procedures used in the baseline phase.

To ensure uniform treatment, the first author recorded and reviewed each session. Clinician utterances across eight treatment sessions were coded as either cloze procedure, expansion, model, or contrastive word pair. Clinician productions that included nonstorybook-related utterances and utterances for behavior regulation (e.g., “Sit in your seat”) were removed from the sample. Next, the number of total strategies and number of contrastive word pairs were calculated (see Figure 1). The frequency of each was determined using the FREQ program from the Child Language Analysis (CLAN) computer program (MacWhinney, 2010). Strategies occurred at a rate of 139–180 per session (i.e., 7–9 per min) for Beth and at a rate of 123–180 (i.e., 6–9 per min) per session for Diane. Contrastive word pairs occurred at a rate of 53–75 per session (i.e., 3–4 per minute) for Beth and at a rate of 37–61 per session (i.e., 2–3 per min) for Diane.

### Treatment Outcome Measures

To answer the question of whether or not a child with phonological inconsistency responds differently than a child with phonological consistency to CCVC/CVCC contrastive word pairs, we examined eight treatment sessions. We decided to examine CCVC/CVCC contrastive word pairs because both children had limited production of clusters in the pretreatment assessment, and the production of clusters is considered a complex phonological task (McLeod, Van Doorn, & Reed, 2001). Within each session, clinician–child exchanges that included CCVC/CVCC contrastive word pairs were selected for analysis. The following is an example of a clinician–child exchange.

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**Table 1. Results of the two children’s language, cognitive, and speech assessments.**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Beth</th>
<th>Diane</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPELT–3</td>
<td>74</td>
<td>74</td>
</tr>
<tr>
<td>PLAI–2</td>
<td>82</td>
<td>94</td>
</tr>
<tr>
<td>CMMS–R</td>
<td>95</td>
<td>102</td>
</tr>
<tr>
<td>W.I.</td>
<td>65</td>
<td>76</td>
</tr>
<tr>
<td>C.I.</td>
<td>65</td>
<td>72</td>
</tr>
<tr>
<td>P.I.</td>
<td>65</td>
<td>80</td>
</tr>
<tr>
<td>Consistency index</td>
<td>25</td>
<td>5</td>
</tr>
</tbody>
</table>

So he’s flying in the __________. (cloze procedure)
Child: Sky
Pho: /kaɪ /

The following is an example of a cluster production that did not change.
Adult: It made a __________. (cloze procedure)
Child: splash
Pho: /fwaɪʃ /

To answer the question of whether or not a child with phonological inconsistency has a similar phonological response to treatment as a child with phonological consistency, we examined the speech samples at baseline, treatment, and posttreatment. The speech samples consisted of 60–70 child utterances based on complete, intelligible child utterances taken from the start of each session. Utterances consisted of child initiations and responses to strategies. Spontaneous speech not related to the storybook interaction was not included. To provide a global measure of speech-sound change that accounts for uncommon and common clinical distortions, we calculated the percentage of consonants correct–revised (PCC–R; Shriberg, Austin, Lewis, McSweeny, & Wilson, 1997). PCC–R is calculated using the following formula: \( \frac{\text{# consonants correct}}{\text{# consonants targets}} \times 100 \).

The proportion of errors (POE) provides a measure of articulatory accuracy in whole word production using the following formula: \( \frac{\text{# errors}}{\text{# total productions}} \times 100 \) (Betz & Stoel-Gammon, 2005). A POE score of 0% means that there were no errors made on any of the words in the sample; a POE score of 100% means that all attempts at the words comprising the sample were incorrectly produced. This measure is a percentage, allowing the results to be compared between children (Betz & Stoel-Gammon, 2005).

Because both children presented a limited production of clusters, we also calculated the percentage of occurrence of errors on consonant clusters. All clusters in syllable-initial and syllable-final position, excluding those that marked morphological relationships, were counted. A cluster was considered to be in error if one or more elements was omitted, if one or more elements included a phoneme substitution, or if one or more elements was added.

A consistency index score was calculated to examine changes in phonological consistency (Tyler, 2002). Within each sample, the total number of different sound substitutions/omissions for each of
the 23 phonemes made across word positions was summed.

**Data: Transcription, Coding, Reliability**

All baseline, treatment, and posttreatment data were recorded using digital flash audio recorders. Sessions occurred in speech therapy rooms in the children’s public school. Sessions were individual and occurred at the same time in the same room each week. Two graduate students in a program of speech-language pathology completed the transcription. First, they phonetically transcribed the samples individually. Then, they compared the samples. If agreement could not be reached on all utterances, the second author listened and transcribed the utterances in question to make the final decision. To establish transcript reliability, 20% of the baseline, treatment, and posttreatment speech samples were phonetically transcribed by the second author. Transcriptions were compared using verbatim agreement in that every phoneme had to be the same. Agreement was calculated using the following formula: \( \frac{\text{agreements}}{\text{agreements} + \text{disagreements}} \times 100 \). Transcript reliability of the child utterances during the baseline, treatment, and posttreatment speech samples ranged from 90% to 94%. The same process was completed for transcript reliability of the clinician’s utterances during the treatment phase. However, these utterances were not phonetically transcribed. Agreement ranged between 92% and 95%.

The second author completed PCC–R, POE, occurrence of consonant cluster error, and consistency index scores on all of the speech samples. A graduate student completed these measures on 20% of the baseline, treatment, and posttreatment speech samples. Point-by-point comparison of child utterances was completed. For PCC–R, phonemes correct and incorrect per utterance were counted; for POE, whole word accuracy per utterance was counted; and for occurrence of consonant cluster error, accuracy on clusters per utterance was counted. For consistency index, phonemes produced differently in different word positions were counted. Agreement was calculated using the following formula: \( \frac{\text{agreements}}{\text{agreements} + \text{disagreements}} \times 100 \). Agreement for PCC–R was 96%, POE was 95%, occurrence of consonant cluster error was 91%, and consistency index was 90%.

The first author identified clinical strategies and coded child productions as revised, accurate, or no change. A graduate student in the program of speech-language pathology completed these measures on 20% of the treatment samples. Agreement was calculated using point-by-point comparison and the following formula: \( \frac{\text{agreements}}{\text{agreements} + \text{disagreements}} \times 100 \). Agreement for clinical strategy identification was 97% and for child production coding (i.e., revised, accurate, no change) was 99%.

**Data: Analysis**

In order to identify the presence of trends, we plotted the frequency of child responses to CCVC/CVCC contrastive word pairs (i.e., revised, accurate, no change) across sessions and examined them. We also plotted the treatment outcome measures across sessions and examined them to identify trends of changes during the baseline, treatment, and posttreatment sessions. To compare baseline and posttreatment performance, we used Busk and Serlin’s (1992) \( d_i \) statistic (Beeson & Robey, 2006). This statistic is a reliable estimator of the effect size when the pretreatment variance is a nonzero value. Although effect size measurements in single-subject studies do not test the null hypothesis, they do yield a measure of the magnitude of change (Meline, 2010). Law, Garrett, and Nye (2004) analyzed five clinician-administered treatments for expressive phonology and reported an effect size range from 0.96 to 2.86 when the outcome measure was PCC–R in conversation.

**RESULTS**

**Within-Treatment Response to Contrastive Word Pairs**

Responses to CCVC/CVCC contrastive word pairs primarily consisted of revised productions for Beth (see Figure 2). Transcripts 3 and 4 contained the greatest level of accurate responses (i.e., 28% and 41%, respectively). Each transcript included responses in which Beth’s production did not change. Diane’s revised productions and responses in which production did not change decreased, whereas her accurate responses increased (see Figure 2).

**Treatment Outcomes**

A divergence of data points was apparent toward the end of the treatment phase for Beth (see Figure 3). Her PCC–R increased, and her POE decreased. A slight upward slope in PCC–R occurred across Diane’s treatment phase. Her POE increased slightly during her initial treatment sessions, followed by a slight downward slope. The pre–post PCC–R comparison indicated differences with moderate effect sizes for both children when compared to the range reported in Law et al. (2004; see Table 2). Pre–post POE comparison indicated differences with a large effect size for Beth and a minimal effect size for Diane.
Visual inspection of the consonant cluster errors suggested that both children improved in their production (see Figure 4). The treatment had a greater effect on Diane than on Beth. Visual inspection of the changes in consistency index scores suggested a treatment effect for Beth. The pre–post consistency index comparison indicated a large effect size.

DISCUSSION

We examined how two children with language and phonological impairments exhibiting different levels of phonological consistency responded to a storybook reading approach. One child presented with a mild–moderate, consistent phonological impairment and the other with a moderate–severe, inconsistent phonological impairment. The treatment protocol included the use of cloze procedures, expansions, models, and contrastive word pairs. Collectively, clinical strategies were massed so that they occurred at a high frequency per minute. The use of contrastive word pairs occurred at comparable rates for both children. As with Bellon-Harn et al. (2004), the child with a mild–moderate phonological impairment required contrastive word pairs with slightly less frequency than did the child with a moderate–severe phonological impairment.

The first research question asked whether or not a child with phonological inconsistency responds differently than a child with phonological consistency to CCVC/CVCC contrastive word pairs. We hypothesized that the child with phonological inconsistency would be likely to produce revised, albeit not fully accurate, responses following contrastive word pairs as she worked toward a gestural match with the adult form and developed a more efficient phonological plan. This hypothesis was supported. Beth revised her productions following contrastive word pair strategies and approximated the adult form more often than accurately matching the adult form.

We expected that the child with phonological consistency would be more likely to produce accurate responses than revised responses following contrastive word pairs because she had a stable phonological system and was able to select and sequence a correct phoneme for the production of a word. This hypothesis was not fully supported. During the initial treatment sessions, Diane’s responses were revised.
Analysis of subsequent transcripts suggested that this behavior decreased and Diane’s accurate productions increased. Initially, the CCVC/CVCC contrastive word pairs may have included more difficult or novel words than Diane produced during her pretreatment speech samples. As such, during treatment, Diane made multiple revised productions in order to more closely resemble the clinician’s production. She produced the same word in several different ways as she worked toward a gestural match with the adult target.

To answer the second question of whether or not a child with phonological inconsistency has a similar phonological response to treatment as a child with phonological consistency, we obtained measures of PCC–R, POE, percentage of occurrence of consonant cluster errors, and consistency index scores. We hypothesized that the phonological performance of both children would improve because of the clinical strategies used and the nature of the storybook repetition. However, the results do not fully support this hypothesis. For both children, similar effects were noted on PCC–R in that both children increased their correct production of phonemes. On the other hand, treatment effects on Beth’s POE and consistency index were large, whereas Diane’s were minimal.

During baseline, the children had control of the book and the interaction. For Beth, once treatment began, the clinician’s use of repeated lexical items within a controlled interaction resulted in increased consistency. Massed application of the strategies may have contributed to consistency because Beth had multiple attempts to hear her error production contrasted with the adult target. Although speculative, it may be that Beth had less entrenched errors than Diane, which resulted in greater flexibility during treatment. Conversely, Diane’s stable system was thrown into flux following the introduction of complex and/or unfamiliar contrastive word pairs, resulting in more revised than accurate responses and greater POE at initial treatment sessions. Overall, both children worked toward a more efficient phonological plan.

The occurrence of cluster errors in Diane’s speech decreased at a greater rate than in Beth’s speech. When a contrastive word pair strategy was triggered, Beth’s responses typically remained incorrect, albeit revised and stabilized. It may be that Beth’s accurate production of clusters required phonemic placement and/or other cues as described in Friberg and Lund (2010), Hart and Gonzalez (2009), and Tyler and Sandoval (1994). Further, when using RSR-CWP, more sessions may be required to reach accurate production for a child with moderate–severe, inconsistent speech impairment. Thus, an extension of the total treatment time may be needed.

**Conclusion**

Overall, treatment effects on phonological consistency and speech-sound accuracy provide data to
support using RSR-CWP with children with either phonological consistency or inconsistency and corroborate outcomes from previous studies (Bellon-Harn et al., 2004, 2013). Results lend support to Tyler et al. (2003), who suggested that a language-based approach to treatment may be appropriate for a child with phonological inconsistency.

**Limitations and Future Research**

We speculate that this treatment could be appropriate for children with language and phonological impairments exhibiting different levels of phonological consistency. To fully consider the viability of this treatment, group comparison studies with various subgroups of children are needed. Additionally, treatment time with greater duration may have revealed patterns that were not noted in this examination.

Previous examinations of RSR-CWP with children with co-occurring impairments have suggested that the children's level of language impairment plays a role in the outcomes. Although both children in this study exhibited language impairment, Diane performed better on semantic language assessment than did Beth. This study did not parse out cognitive-linguistic abilities as contributing factors to treatment responses. Further, this study did not examine morphophonemic relationships. Future research on RSR-CWP should consider language factors before treatment initiation.

Full word type analysis within storybooks and storybook interactions was not conducted at all treatment phases, which limits interpretation of the results. Further, we are not certain that the differences observed between the children were linked to phonological consistency because the children differed in severity at the outset of the study. The child with a more severe disorder received more strategies than the child with a milder disorder.

**REFERENCES**


