Embedding a Speech Sound Intervention in Shared Storybook Reading

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According to the American Speech-Language-Hearing Association (ASHA) 2012 schools survey, 92.6% of school-based speech-language pathologists (SLPs) provide intervention services for students with speech sound disorders. Of those SLPs who provide speech sound intervention, the average number of students on their caseload who receive intervention for speech sound disorders is 19.3. With large caseloads becoming a growing concern, it is important to continue to investigate interventions that provide efficient and effective means for remediating speech sound disorders.

ABSTRACT: Purpose: Studies conducted to date on storybook reading have focused on the development of vocabulary and narrative skills as well as on decoding and concepts of print. Few researchers, however, have conducted studies to evaluate the effectiveness of remediating speech sound disorders in the context of shared storybook reading. Storybook reading provides a natural context in which to remediate speech sound disorders. It is an activity that potentially can be conducted during speech and language intervention, in the classroom, and at home.

Method: A single-subject, multiple-baseline, across-subjects design was conducted with 6 preschool participants who were 42 to 66 months of age. Participants were placed in groups according to their speech sound errors. In addition, 1 typically developing peer was included in each group as a model. Three groups were formed, each focusing on a different target sound. Target sounds included initial /s/ blends, initial velars, and final consonants.

Results: Five of the 6 participants showed improvement in the total percentage correct for their target speech sound in words at the imitation level once the embedded speech sound intervention was applied. One participant did not respond to the procedures in the 1st intervention. For this participant, a 2nd phase of intervention, which incorporated stimulability training for his target sound, resulted in improvements.

Conclusion: For children who demonstrate some initial stimulability for a target sound, embedding a speech sound intervention in storybook reading can produce positive treatment outcomes for a variety of speech sound production errors.

KEY WORDS: speech sound intervention, shared storybook reading, embedded intervention

Intervention Approaches

Interventions that are designed to remediate speech sound disorders generally follow one of two theoretical approaches: an articulation approach or a phonological approach (Bernthal, Bankson, & Flipsen, 2009). The articulation approach, also known as the motor approach, focuses on providing the client with direct cues for positioning the articulators so that specific sounds can be produced. Articulation intervention often progresses from remediating one error sound to the next and moves from most stimulable to
least stimulable treatment targets. The foundation of the articulation approach emphasizes client knowledge of misarticulated sounds and understanding of how a sound is typically produced (Bankson et al., 2009). Although this approach is beneficial in the remediation of motoric impairments (i.e., physical inabilities that inhibit phonemes production), it is limited in the ability to remediate language-based disorders such as deviated phonological processes (Bauman-Waengler, 2011).

The phonological approach to remediating speech sound disorders, on the other hand, is a language-based approach that focuses on the organization and classification of speech sounds and how they are used contrastively in a given language (e.g., Hodson & Paden, 1991). Whereas the articulation approach focuses on individual sound mastery, the phonological approach focuses on the remediation of phonological processes. Phonological processes generally affect sound classes. Thus, the focus of a phonological intervention is on groups of phonemes at one time. In general, phonological interventions target phonologically contrastive sound patterns and often focus on the most stimulable and least stimulable patterns simultaneously. The foundation of the phonological approach emphasizes the ability to distinguish and produce the sound patterns of adult language (Bauman-Waengler, 2011).

Service Delivery

Although the two approaches to remediating speech sound disorders differ across most theoretical constructs, both approaches can be conducted within similar communicative contexts using similar service delivery methods. Whereas interventions for language disorders have evolved from dyadic contexts using discrete trial training methods to more conversational, language-based contexts (Fey, Windsor, & Warren, 1995), interventions for speech sound disorders have been slow to evolve to more natural intervention contexts. Interventions for speech sound production disorders often use drill-based activities that emphasize numerous production trials of specific sounds (in articulation intervention) or specific patterns (in phonological intervention) (Gierut, 1990; Williams, 2000). Articulation and phonological intervention are often conducted in settings outside natural communicative contexts using a pull-out service delivery model and decontextualized situations and materials (e.g., drill-based games using picture cards).

In the 1990s, several researchers who were interested in speech sound production disorders emphasized moving away from drill-based procedures within decontextualized settings to more naturalistic communication contexts. Naturalistic approaches. Hoffman, Norris, and Monjure (1990) were the first researchers to explore more naturalistic contexts by examining the effects of a whole-language intervention approach versus a traditional speech sound production intervention approach to remediate cluster reduction in two 4-year-old children with a phonological delay. The whole-language approach focused on narrative production without specific attention to consonant clusters. The approach was based on research linking articulatory proficiency to the pragmatic need to communicate (Gallagher, 1977). The basic underlying philosophy was that a child who is receiving whole-language treatment would make greater phonological improvements, compared to traditional intervention, in order to produce intelligible narratives. One child received a whole-language approach and the other received the traditional speech sound production intervention (e.g., focus on drill out of a communicative context).

Results of the Hoffman et al. (1990) study indicated slightly higher improvements in phoneme production for the child who received the traditional approach. However, in defense of whole language, the researchers suggested that the whole-language approach produced improvements in phonology and expressive language simultaneously, making it a more dynamic intervention overall. Critics of the whole-language approach suggest that the lack of focus on phonology may have resulted in the failure to make phonological improvements above and beyond the phonological approach (Fey et al., 1994).

Using a slightly more focused approach to phonological remediation, Camarata (1993) investigated the effects of naturalistic conversation training on two children with speech sound production disorders. Basic elements of naturalistic conversation training include (a) providing the child with a correct model of the target phoneme immediately following an incorrect production, and (b) reinforcement in the form of semantic affirmations following correct production of a target phoneme. Naturalistic conversation training was conducted during child-guided play activities that used toys that would likely elicit the target phonemes. Results of the naturalistic conversation training suggested improved phonology and, equally importantly, improved spontaneous speech intelligibility for both participants (Camarata, 1993).

In an attempt to expand the naturalistic approach to different populations, Koegel, Camarata, Koegel, Ben-Tall, and Smith (1998) examined the naturalistic approach (Camarata, 1993) versus an analog approach (more traditionally structured) with five children who had been diagnosed with autism. Intervention procedures for the analog approach included imitation-based drill activities followed by tangible
reinforcement for correct phoneme productions. Results of the study indicated that both methods effectively increased the children’s correct production of target phonemes; however, the naturalistic method resulted in greater functional use of the target phonemes in conversations (Koegel et al., 1998).

In addition to speech sound production intervention, the naturalistic approach has also been studied in the remediation of language impairments (Camarata, Nelson, & Camarata, 1994; Gillum, Camarata, Nelson, & Camarata, 2003) with similar results in favor of naturalistic procedures in comparison to analog or traditional procedures. Although the line of research supporting use of the naturalistic approach suggests that the method is promising, it is not without limitations. All of the studies mentioned thus far, with the exception of Camarata et al. (1994), had sample sizes of five or fewer, making it difficult to generalize the results to the general population.

Fey et al. (1994) expanded the naturalistic approach to a larger population in an investigation of the effects of grammar facilitation on phonological performance, using naturalistic procedures, with 26 children with speech and language impairments. Participants were randomly assigned to one of three interventions: a clinician-administered intervention, a parent-administered intervention, and a delayed intervention control group. Intervention procedures were similar for all three groups: Modeling and sentence recasts were used to facilitate improvement of grammatical goals and phonological impairments simultaneously within child-guided play routines. Results indicated that all three interventions had significant impact on the participants’ grammatical output, but no indirect effects on phonology were observed. These results led the investigators to conclude that in order to remediate phonological impairments and gain maximum benefits, clinicians should use intervention strategies that focus directly on phonology (Fey et al., 1994).

Although the results from Fey et al. (1994) were conflicting in regard to the effectiveness of the naturalistic approach, the authors’ conclusions make for an interesting investigation. Specifically, it remains unclear whether an intervention that incorporates structured articulation/phonological intervention techniques into a naturalistic language-based activity will lead to speech sound production improvements. A few researchers have suggested a hybrid approach that addresses this issue.

**Hybrid approach.** A hybrid approach to phonological remediation, operationally defined, is one that integrates structured phonological intervention strategies into natural communicative contexts (cf. Fey, 1987). Hoffman (1997) described a hybrid approach to phonological remediation when he suggested placing a phonological intervention in the context of storybooks. Hoffman emphasized “scaffolding techniques” used within genuine communication contexts to promote correct phoneme production. Examples of Hoffman’s scaffolding techniques specific to phoneme correction include visual, auditory, and descriptive cues that are embedded within a story narrative. Hoffman argued that interventionists need to move speech sound intervention from discrete speech production skills that are taught outside the context of meaningful language to a more functional communicative approach in order to promote spoken and written language abilities.

Ezell and Justice (2005) also promoted embedding articulation/phonology intervention in the context of shared storybook reading. Shared storybook reading is characterized by active involvement and engagement of both adult and child while reading a storybook. Ezell and Justice encouraged the use of visual and auditory cues, word imitations, and multiple attempts to practice target phonemes during a storybook reading session as a means of improving children’s phoneme productions. However, in order to maintain the integrity of the story line, the authors suggested refraining from extended interruptions. Embedding a least-to-most hierarchy of scaffolding would address this concern by providing graduated cues beginning with the minimal amount of support necessary to encourage correct phoneme production (e.g., a request to imitate) to the maximum support (e.g., physical or descriptive cues) (Cook, Klein, & Tessier, 2004).

Articulation/phonological intervention within shared storybook reading seems to be a logical and resource-efficient strategy for remediating speech sound disorders as children would be participating in a developmentally appropriate and commonly occurring instructional practice. Indeed, results of investigations on the effect of shared storybook reading on children’s developing language skills suggest that this approach increases children’s emergent literacy skills such as vocabulary development (Justice, 2002; Penno & Wilkinson, 2002; Van Kleek, Bauer, & Stahl, 2003; Whitehurst, Falco, Lonigan, & Fischel, 1988) and narrative abilities (Zevenbergen, Whitehurst, & Zevenbergen, 2003). Although research has not focused on remediating disordered speech sounds through shared storybook interventions, using the natural occurrence of phonemes and words in books and the likelihood of repeated exposure to those phonemes and words makes storybook reading a possible beneficial activity in which to embed a phonological or speech sound intervention.
The procedures and techniques suggested by Hoffman (1997) and by Ezell and Justice (2005) for embedding a phonological intervention within naturally occurring language activities, such as shared storybook reading, have not been examined empirically. Without the support of research findings, these suggested interventions are considered to be the lowest level of evidence when making evidence-based decisions (ASHA, 2004) and should be cautiously advocated as effective strategies for phoneme remediation.

We designed the following two-phase study to evaluate the effect of embedding a speech sound intervention in shared storybook reading with children ages 42 to 66 months of age. We used an embedded speech sound intervention within a storybook context as a means to measure change across three different impaired speech sound systems in six children. A second phase was added when one of the participants was not responding to the intervention. The second phase used a combination of the embedded speech sound intervention and one-on-one stimulability training with one child who showed little to no response to the embedded intervention after 32 intervention sessions. Specifically, the research question asked was “Does speech sound production improve with an intervention technique embedded into shared storybook readings?”

**PHASE 1**

**METHOD**

**Participants**

Five boys and one girl who were attending two preschool classes in Florida served as the study participants. Selection was based on teacher identification, parental consent, and the participants’ pretest articulation score. First, members of the preschool staff were asked to identify students in their classes who were “unintelligible” or “difficult to understand.” Then, informed-consent letters were sent to the parents/guardians of the children whom the preschool staff had identified as unintelligible. Informed consent was obtained from the parents, and the researcher obtained verbal assent from each child before testing using a verbal-assent script.

Following the informed-consent process, potential participants were administered a standardized assessment in order to obtain data on their speech sound production abilities. The standardized assessment instrument used was the Goldman-Fristoe Test of Articulation—Second Edition (GFTA–2; Goldman & Fristoe, 2000). Speech samples also were collected for each child through a storytelling activity in which the investigator asked the child to narrate a story using a wordless book as the stimulus. A total of six participants met the following entry requirements: (a) exclusion of at least three phonemes from their articulation repertoire as determined by articulation and phonological analyses, (b) normal functioning of the oral motor mechanism as determined by performance on an oral mechanism examination, (c) age between 42 and 66 months, and (d) informed consent from parent/guardian. Results from the participants’ GFTA–2s are provided in Table 1.

**Design**

To examine the effects of embedding a speech sound intervention in shared storybook reading, the researcher implemented a single-subject, multiple-baseline, across-subjects design (Richards, Taylor, Ramasamy, & Richards, 1999). This design allows for continuous observation of changes in behavior during the treatment period. Changes in each participant’s behavior before, during, and after treatment can be determined by visually inspecting the multiple-baseline graphs. Visual inspection of the graphs also allows for the detection of clinically significant change; trends in behavioral change across subjects indicate that treatment is responsible for the behavioral change and not intervening or extraneous factors (Richards et al., 1999). The multiple-baseline, across-subjects design requires that subjects engage in different numbers of baseline sessions that are staggered across time. Staggering baseline sessions allows the researcher to monitor any extraneous variables that may affect participant performance, such as maturation. The number of baseline sessions that was used for each subject is discussed in the following paragraphs.

<table>
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<tr>
<th>Participant</th>
<th>Age (years;months)</th>
<th>Raw score</th>
<th>Standard score</th>
<th>Percentile</th>
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<td>8</td>
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<td>4;11</td>
<td>60</td>
<td>&lt;40</td>
<td>&lt;1</td>
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Table 1. Participants’ ages, raw scores, standard scores, and percentile rankings on the Goldman-Fristoe Test of Articulation—Second Edition (Goldman & Fristoe, 2000) Sounds-in-Words subtest.
Clinical Setting

All baseline, intervention, and maintenance sessions were conducted at the public school that the participants attended. Each participant was seen in a room that was designated for speech and language services. Sessions were conducted at a U-shaped table, where the interventionist sat in view of all of the participants of a group.

Three interventionists, the primary investigator and two graduate students in communication disorders, conducted the baseline, intervention, and maintenance sessions. Training was provided on the specifics of the intervention procedures for both graduate student clinicians prior to study initiation.

Procedure

Each participant was assigned to one of three “book groups” according to his or her speech sound production errors, with two children with phonological impairments assigned to each book group. Group A consisted of one boy and one girl who exhibited initial /s/ clusters reduction. Group B consisted of two boys exhibiting stopping of velars, producing /t/ for /k/ and /d/ for /g/ in all word positions. Group C consisted of two boys who exhibited final consonant deletion of all phonemes in words. In addition, a typical peer was placed into each group to act as a peer model for correct phoneme production. The procedures and results of this study, however, are based on the children with speech sound impairments.

Baseline procedure. Once the book groups were formed, baseline sessions were initiated with all three groups. During the baseline sessions, the interventionists read books to each group. These books had high concentrations of words that contained phonemes representing that group’s target pattern. When the interventionist came to a target word in the book, she asked each child in the group, one at a time, to produce the word and documented whether the child produced the word correctly or incorrectly. Each child was given 10 opportunities to produce the target word in isolation. Baseline sessions were conducted for approximately 30 min three times per week. Group A completed 33 intervention sessions, Group B completed 27 intervention sessions, and Group C completed 18 intervention sessions.

Intervention procedure. Upon completion of the baseline sessions, the three groups entered the intervention phase, in which the interventionists embedded speech cues in the storybook reading activity in order to promote correct pattern production. When the interventionist came to a word in the book containing a target pattern, she asked each child individually to produce the word and provided speech cues to the children who produced the word incorrectly. The speech cues were presented in hierarchical order from least to most intrusive until the child could produce the target. When a child correctly produced the target, at any level, the cuing was stopped and the storybook reading proceeded. If a child did not produce the target upon completion of the entire hierarchy of cues, cuing ceased and storybook reading proceeded.

The cuing hierarchy progressed from word imitations (e.g., “Watch me say cat”), to word models with auditory cues (e.g., “I heard you say tat. Say cat”) and then to word models with physical cues (e.g., “Leave the tip of your tongue down, arch the back of your tongue up and give me a throaty sound when you say cat”). After the interventionist provided a speech cue, the participant was requested to produce the target. If a child was not successful at the word level, the interventionist proceeded with a cuing hierarchy to phonemes in isolation, beginning with phoneme models with visual cues (e.g., “Watch me say /k/”), phoneme models with auditory cues (e.g., “I heard you say /t/. Say /k/”), and phoneme models with physical cues (e.g., “Leave the tip of your tongue down, arch the back of your tongue up and give me a throaty sound when you say /k/”). After the interventionist provided a speech cue at the isolation level, the participant was requested to produce the target phoneme in isolation.

During the intervention sessions, the participants were given 15 opportunities to produce their target pattern in words (or phonemes representing the target process in isolation). Similar to baseline, intervention sessions were conducted for approximately 30 min three times per week. Group A completed 33 intervention sessions, Group B completed 27 intervention sessions, and Group C completed 18 intervention sessions.

Generalization procedure. Six generalization probes were administered toward the end of the study (sessions 33–38). Generalization probes were conducted to measure each participant’s speech sound production, for his or her specific target pattern, in an activity that was unrelated to the storybook reading activity. During the generalization sessions, the interventionist engaged the participants in one of two card games using articulation cards with pictures of objects that contained their target pattern in words. The card game played during the generalization sessions was Memory or Go Fish. The interventionist did not provide any speech cues during the generalization sessions, but she did document whether the
child produced the word correctly during his or her turn in the card game. The generalization sessions were conducted with each group outside of the storybook reading session in the participants’ classrooms.

**Maintenance procedure.** Three maintenance sessions were held 2 weeks after intervention was terminated for all of the participants except Child 4, who did not participate in the maintenance sessions. The maintenance procedure was the same as the baseline procedure. During the maintenance sessions, the interventionist read books with high concentrations of words that contained that group’s target pattern to each group. When the interventionist came to a target word in the book, she asked each child in the group to produce the word and documented whether the child produced the word correctly. The interventionist did not provide any speech cues during the maintenance sessions. Each child was given 10 opportunities to produce the target processes in words during each maintenance session.

**Reinforcement**

A token reinforcement system was used throughout the study. Reinforcement was based on a participant’s on-task behavior during the baseline, intervention, and maintenance sessions. Reinforcement was not contingent on correct production of the target phoneme. At the beginning of each session, the participants were given three tokens and were reminded of the on-task behaviors that were expected of them throughout the session. On-task behaviors included sitting properly, listening to the story, and following general rules of respectable conduct. Participants who ended the session with at least two tokens were allowed to exchange the tokens for a “reward item.” Reward items included stickers, animal crackers, and small toys.

**Data Collection**

The interventionist recorded all of the baseline, intervention, generalization, and maintenance data on forms during each session. The data recording forms were designed to reflect the various levels of the cuing hierarchy, and the interventionist circled the level of correct production immediately after each participant’s response. For example, during the intervention phase, if the participant produced the target pattern correctly after being given a model of the word with visual cues, the interventionist circled M1 on the data recording form. This procedure was repeated each time the participant was asked to produce a word or isolated phoneme. If the participant did not correctly produce the word or phoneme after completing the cuing hierarchy, the interventionist documented the response as NP (no production). At the end of each session, the total percentage correct for words produced at the imitation level was calculated and was entered into the multiple-baseline graphs. An example data recording form is provided in Appendix A.

**Materials**

The storybooks used in the baseline, intervention, and maintenance sessions were selected from the classroom curriculum and the children’s section of a local public library. Each group was exposed to 13 books in all—12 books throughout baseline and intervention and one book during maintenance. Groups B and C used the same set of books throughout the intervention. Group A used a separate set of books in order to capitalize on the amount of target words containing /s/ clusters. From the total number of books, a set of two books was used every 2 weeks. These books were read on a rotating schedule. For example, Group A was read two books for the first 2 weeks of the study, Books 1 and 2. During the first week, Book 1 was read on Tuesday, Book 2 on Wednesday, and Book 1 on Thursday; during the second week, Book 2 was read on Tuesday, Book 1 on Wednesday, and Book 2 on Thursday.

**Reliability**

Before initiation of the study, the investigator trained an independent evaluator in the baseline, intervention, and maintenance procedures that were used in the study. Descriptions and examples of each variable, as well as all scoring decisions, were documented in a training manual that was provided by the primary investigator to be used as a reference. Twenty-five percent of the baseline, intervention, and maintenance sessions were selected for reliability analysis and were scored by the independent evaluator. The independent evaluator conducted all reliability evaluations live during the selected session. The reliability score was calculated by dividing the number of agreements by the number of disagreements plus agreements and multiplying this score by 100. The overall percentage of agreement between the interventionist and the independent evaluator for all participants was 99%.

**Fidelity of Treatment**

To ensure that the procedures were administered in a standardized manner, a fidelity checklist was used to guide each storybook session. The fidelity checklist consisted of 10 items that focused on three core...
areas. Four items focused on effective articulation intervention, four on effective shared storybook reading, and two on behavior management. The fidelity checklist was used in two different ways: (a) as a general guide for the interventionist to ensure that specific procedures for each session were followed; and (b) by the independent evaluator, during direct observations, to ensure treatment fidelity by all interventionists across randomly selected intervention sessions (i.e., the checklist was scored by the independent evaluator during the same randomly selected sessions described in the Reliability section). A copy of the fidelity checklist is provided in Appendix B.

In addition to the fidelity checklist, a training manual was provided to all of the interventionists. The checklist included general daily procedures, written procedures for implementing the cuing hierarchy, a copy of the book schedule for each group, data recording forms, and behavior management procedures.

RESULTS

Treatment Results by Group

Once intervention was initiated, the participants in Group A showed immediate and substantial increases in the total percentage correct for words containing initial /s/ clusters produced at the imitation level. Both participants demonstrated stable baseline scores before the beginning of treatment: Baseline scores for Participant 1 ranged from 10% to 20%; Participant 2 scored 10% in all baseline sessions. Over the intervention phase, Participant 1 averaged a score of 71% (range 27%–100%), and Participant 2 averaged a score of 67% (range 33%–93%). The range of scores during intervention sessions did not overlap with the scores that were obtained during the baseline sessions for either participant.

The participants in Group B differed in their response to intervention focusing on the production of velars. Both participants demonstrated stable baseline scores before the beginning of treatment: Baseline scores for Participant 3 ranged from 0% to 20%; Participant 4 scored 0% in all baseline sessions. Throughout the intervention phase, Participant 4’s performance was significantly lower than Participant 3’s performance. During the intervention phase, Participant 3 averaged 75% (range 0%–100%); only one point overlapped with the baseline data. Participant 4 averaged a score of 3% (range 0%–33%); 17 points overlapped with the baseline data.

Once intervention was introduced, the participants in Group C, the final-consonant-deletion group, showed immediate and substantial increases in total percentage correct for words produced at the imitation level. Before beginning treatment, both participants presented with stable baseline scores ranging from 0% to 30% for Participant 5 and from 0% to 10% for Participant 6. During the intervention phase, Participant 5 averaged 53% (range 33%–66%), and Participant 2 averaged 76% (range 33%–100%). The range of scores during the intervention sessions did not overlap with the scores that were obtained during the baseline sessions for either participant.

Each of the participant’s total percentage correct production for imitations in the baseline and intervention sessions for all six participants are provided in Figure 1.

Generalization Results

Results from the generalization probes suggest that carryover was achieved by five of the six participants. Participant 4 did not participate in the generalization sessions. The remaining five participants exhibited no more than a 30% decrease in percentage correct for nonimitated production of their target phonemes in words during the generalization probes. Each of the participant’s total percentage correct production for imitations in the generalization sessions is provided in Figure 1.

Maintenance Results

No substantial changes were observed in any of the participants’ percentage correct production for word imitations 2 weeks after the intervention, with the exception of Participant 4. Because Participant 4 did not respond to intervention (i.e., little to no production of velars), maintenance sessions were not conducted for him. Instead, Participant 4 was entered into a second phase of intervention, to be discussed later. The remaining five participants exhibited no more than a 20% decrease in percentage correct production for word imitations during any given maintenance session from the conclusion of the intervention to the maintenance phase. Each of the participants’ total percentage correct production for imitations in the maintenance sessions is shown in Figure 1.

DISCUSSION

Phase 1 examined the effects of embedding a speech sound intervention in shared storybook reading. The results of the multiple-baseline design indicated that the embedded articulation intervention was effective in teaching initial /s/ clusters, initial velars, and final consonants in words to five of the six participants.
Figure 1. Average percentage correct for imitated words during the baseline, intervention, and generalization phases of an articulation intervention that was embedded in storybook readings. All of the participants, with the exception of Participant 4, improved markedly in correct articulation and maintained that improvement during the generalization phase, which followed a 1-week break.
All of the participants showed growth in their total percentage correct productions once intervention was initiated, with the exception of Participant 4.

It should be noted that, upon visual inspection of the multiple-baseline graphs, it appears that all of the participants except Participant 4 exhibited emerging abilities to produce their target pattern in the baseline sessions. This emerging ability suggests that five of the six participants were stimulable for the target patterns. Thus, stimulability may be a contributing factor in the overall effectiveness of the embedded intervention.

Participant 4 was the only participant who did not respond to intervention, never progressing past 30% correct productions for word imitations. Toward the end of the intervention phase, he was beginning to respond to physical cuing at the isolation level. Participant 4’s failure to respond at the word level may be attributable to his low attendance; he was absent for six of 31 intervention sessions. Additionally, Participant 4 was the only participant who scored 0% for all baseline sessions, suggesting a lack of stimulability for his target pattern production. All of the other participants ranged from 10% to 30% correct production for target sounds in words at the imitation level during their baseline sessions. It may be, then, that a storybook approach is not beneficial when children show no emerging abilities to produce target processes spontaneously prior to intervention.

To determine whether a lack of stimulability may have contributed to the poor response of Participant 4 to this intervention, a follow-up treatment phase, Phase 2, was conducted. The goal of this treatment phase was to provide supplemental stimulability training in addition to the procedures outlined in Phase 1 to measure whether the participant’s percentage correct production for imitations would increase once stimulability for the target process was established.

**PHASE 2**

Phase 2 was a modified extension of Phase 1 that was designed to address Participant 4’s poor performance in the first phase. Specifically, the purpose of Phase 2 was to provide supplemental stimulability training in addition to the procedures outlined in Phase 1 to measure whether the participant’s percentage correct production for imitations would increase once stimulability for the target process was established.

**METHOD**

**Participant**

Participant 4 from Phase 1 was the only participant of Phase 2. The selection criteria, entry requirements, clinical setting, and reinforcement methods for Phase 2 remained the same as those for Phase 1. Participant 4’s parents were notified of the additional services, and parent consent was obtained before Phase 2 was initiated.

**Procedure**

During Phase 2, the primary investigator provided one-on-one intervention to Participant 4. Intervention remained on the same schedule as Phase 1; however, the structure of each session changed. Throughout Phase 2, the first 15 min of each session focused on stimulability training, and the second 15 min consisted of the embedded storybook intervention procedures described in Phase 1. During the stimulability segment, the interventionist first focused on increasing Participant 4’s correct production of the /k/ phoneme in isolation. During this time, the interventionist provided speech correction prompts that ranged from full physical cues (e.g., using a tongue depressor to move the tongue toward the back of the mouth), to visual cues (having the child watch and mimic sound production), to imitation cues (providing a sound, syllable, or word for the child to produce). The level of prompt provided generally followed a least-to-most cuing hierarchy depending on the level of prompt necessary to establish correct production.

Once correct production of /k/ in isolation was established, the interventionist advanced to /k/ in C-V syllables, and then /k/ in the initial position of C-V-C words. The interventionist engaged the participant in a variety of turn-taking articulation games aimed at facilitating numerous phoneme productions.

After 15 min of stimulability training, the interventionist engaged the participant in 15 min of the embedded storybook intervention described in Phase 1. Data were collected on the participant’s performance using the same data collection methods as per Phase 1. The participant’s total percentage correct production for imitations was calculated at the end of each session and was entered into a single-subject graph.

By the 44th session (or the 13th session of Phase 2), Participant 4 demonstrated stimulability for velar production. As a result, starting at session 45, the design was shifted back to the original design of Phase 1. Thus, sessions 45 through 47 focused on 30 min of the embedded storybook intervention, which included all of the original participants of Group B.

**RESULTS**

Participant 4’s total percentage correct production for imitation increased dramatically after seven sessions
of one-on-one stimulability training. Once consistent sound production was established, Participant 4’s average percentage correct productions for imitations in the embedded storybook intervention increased to 80% or greater across six consecutive sessions.

Participant 4 then was reintroduced to the procedures described in Phase 1, without receiving additional speech services, and maintained an average percentage correct for imitations of 80% or greater across three sessions. Participant 4’s total percentage correct for imitations in baseline, Phase 1, and Phase 2 are provided in Figure 2.

**DISCUSSION**

Phase 2 examined the effects of a two-pronged intervention on Participant 4’s total percentage correct production of the /k/ phoneme in imitated words. Intervention procedures from the embedded storybook reading activity described in Phase 1 were combined with a one-on-one stimulability intervention. The results of Phase 2 indicate that the combination of intervention procedures was beneficial in facilitating the use of the velar /k/ in initial word positions at the imitation level. Participant 4 showed growth in the total percentage correct productions within the first seven sessions of Phase 2. It appeared that the change in performance was due to Participant 4’s stimulability for the /k/ phoneme. Once stimulability was achieved and consistent correct production for the /k/ phoneme was established, Participant 4’s performance improved remarkably in the embedded storybook reading activity.

It should be noted that attendance may have been a factor in the improvement of Participant 4’s speech sound performance during Phase 2. As mentioned in the Discussion section of Phase 1, Participant 4 was absent for six out of 31 sessions in Phase 1. In Phase 2, Participant 4 missed 0 out of 13 sessions. Upon analysis of consecutive sessions attended, however, Participant 4 showed no response to intervention after 10 consecutive sessions in Phase 1 but showed dramatic improvement after eight consecutive sessions in Phase 2. This suggests that attendance alone was not the main factor that influenced his sudden increase in performance; rather, it appears that stimulability played a large role.

**GENERAL DISCUSSION**

For decades, drill-based articulation/phonological intervention strategies have been used to remedy speech sound production disorders. However, in recent years, drill-based approaches have been scrutinized by proponents of more naturalistic approaches (Camarata, 1993; Hoffman, 1990). Naturalistic approach proponents argue that current phonological interventions are too contrived and require children to participate in activities that are conducted within limited interactive contexts outside of a natural language learning environment. Proponents of the naturalistic approach also argue that moving phonological interventions away from current contrived, drill-based strategies to more naturalistic approaches will encourage greater generalization of spontaneous speech intelligibility (Camarata, 1993; Gillum et al., 2003; Koegel et al., 1998).

**Figure 2.** Participant 4’s average percentage correct for imitated words during baseline, intervention Phase 1, and intervention Phase 2 of an articulation intervention that was embedded in storybook readings. Participant 4’s performance in the embedded storybook intervention improved remarkably once supplemental speech services were provided in intervention Phase 2 and target sound production was established.
When examined empirically, the naturalistic approach produced conflicting results in regard to its overall effectiveness in remediating children’s speech sound production impairments (Fey et al., 1994). This led researchers to suggest an integrated approach, one that incorporates characteristics of more structured phonological approaches within naturalistic contexts (Ezell & Justice 2005; Hoffman 1997).

The results from this study support that a hybrid approach that embeds a speech sound intervention within shared storybook readings can improve children’s use of target patterns in words. The factors of this intervention that appeared to lead to success included the following: (a) Treatment procedures were administered in a structured and consistent manner, (b) the children were stimulable for target patterns prior to intervention, and (c) the intervention was administered on a frequent basis.

In comparison to previous studies that focused solely on naturalistic approaches, the hybrid approach reported here appeared to produce greater results in regard to phonological remediation. Specifically, in comparison to Hoffman et al. (1990) and Camarata (1993), the hybrid approach produced speech sound improvements across five children with three different phonological impairments. As suggested by Fey et. al. (1994), this difference in results may be due to the fact that the hybrid approach places a structured speech sound intervention within a natural communicative context, thereby allowing for direct focus on speech sound remediation. Results of the hybrid approach also indicated that generalization to nonimitated speech was achieved by five of the six participants. These results are similar to previous findings by Camarata (1993), suggesting that the generalization results reported in the hybrid approach may be attributed to embedding the speech sound intervention into a natural context.

**Further Study**

Several issues remain that warrant further study. This study measured the performance of six participants. Future studies should include a larger participant pool before the results can be generalized to a larger population. In addition, this study only looked at the remediation of three phonological processes. Future studies should include participants with a broad range of speech sound impairments aside from those examined in this study. All of the participants in this study were preschool students who had been diagnosed with speech sound production disorders only. Future research should broaden the participant pool to include children of various ages with co-occurring speech and language disorders.

The current study was administered using a pull-out service delivery model. Given that this intervention uses the natural occurring routine of storybook reading, future research should examine the use of more progressive service delivery models that use inclusive settings (i.e., the classroom or home setting). Moving articulation/phonology intervention toward an inclusive setting would match current guidelines set forth by ASHA (1993). In addition, with the use of highly structured fidelity checklists in combination with in-depth training, future research also may explore the possibilities of using alternative interventionists such as teachers, paraprofessionals, or parents.

Finally, future studies should expand on the cuing hierarchy that was used in this study to incorporate responses beyond imitations. Expanding the cuing hierarchy to include nonimitative or spontaneous productions would have a greater impact on children’s overall speech intelligibility at the conversation level, which is the ultimate goal of all speech sound interventions.

In summary, this study demonstrated the benefits of a hybrid approach to the remediation of speech sound disorders. Further, results suggest that using a hybrid approach may be a unique alternative to the remediation of speech sound impairments as it integrates structured intervention techniques within natural communicative contexts, in turn making it an approach that may be conducive to inclusive settings.

**REFERENCES**


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# APPENDIX A. SAMPLE DATA RECORDING FORM

<table>
<thead>
<tr>
<th>Date</th>
<th>Book</th>
<th>Vocab.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child Name/Number</td>
<td></td>
<td>Child Name/Number</td>
</tr>
</tbody>
</table>

| 1.          | _________________ I M(1 2 3) Isol.(1 2 3) N/P | 1. _________________ I M(1 2 3) Isol.(1 2 3) N/P |
| 2.          | _________________ I M(1 2 3) Isol.(1 2 3) N/P | 2. _________________ I M(1 2 3) Isol.(1 2 3) N/P |
| 3.          | _________________ I M(1 2 3) Isol.(1 2 3) N/P | 3. _________________ I M(1 2 3) Isol.(1 2 3) N/P |
| 4.          | _________________ I M(1 2 3) Isol.(1 2 3) N/P | 4. _________________ I M(1 2 3) Isol.(1 2 3) N/P |
| 5.          | _________________ I M(1 2 3) Isol.(1 2 3) N/P | 5. _________________ I M(1 2 3) Isol.(1 2 3) N/P |
| 6.          | _________________ I M(1 2 3) Isol.(1 2 3) N/P | 6. _________________ I M(1 2 3) Isol.(1 2 3) N/P |
| 7.          | _________________ I M(1 2 3) Isol.(1 2 3) N/P | 7. _________________ I M(1 2 3) Isol.(1 2 3) N/P |
| 8.          | _________________ I M(1 2 3) Isol.(1 2 3) N/P | 8. _________________ I M(1 2 3) Isol.(1 2 3) N/P |
| 9.          | _________________ I M(1 2 3) Isol.(1 2 3) N/P | 9. _________________ I M(1 2 3) Isol.(1 2 3) N/P |
| 10.         | _________________ I M(1 2 3) Isol.(1 2 3) N/P | 10. ________________ I M(1 2 3) Isol.(1 2 3) N/P |
| 11.         | _________________ I M(1 2 3) Isol.(1 2 3) N/P | 11. ________________ I M(1 2 3) Isol.(1 2 3) N/P |
| 12.         | _________________ I M(1 2 3) Isol.(1 2 3) N/P | 12. ________________ I M(1 2 3) Isol.(1 2 3) N/P |
| 13.         | _________________ I M(1 2 3) Isol.(1 2 3) N/P | 13. ________________ I M(1 2 3) Isol.(1 2 3) N/P |
| 14.         | _________________ I M(1 2 3) Isol.(1 2 3) N/P | 14. ________________ I M(1 2 3) Isol.(1 2 3) N/P |
| 15.         | _________________ I M(1 2 3) Isol.(1 2 3) N/P | 15. ________________ I M(1 2 3) Isol.(1 2 3) N/P |

*Note.* I = Imitation, M = With a model (M1 = visual cue, M2 = auditory/discrimination, M3 = physical cue), Isol. = Sound(s) in isolation (I1 = visual cue, I2 = auditory/discrimination, I3 = physical cue), N/P = No production.
**Appendix B. Sample Fidelity Checklist**

**Fidelity Checklist for Book Reading Sessions**

<table>
<thead>
<tr>
<th>Date</th>
<th>Book</th>
<th>Book Group</th>
<th>Interventionist</th>
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<tbody>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Does the clinician position him/herself, and maintain a position, so that students in the group can see the book and hear the story?</td>
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<tr>
<td>2. Does the clinician start the session with an overview of the letter/sound that will be worked on in the book?</td>
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<tr>
<td>3. Does the clinician effectively engage and maintain the interest of all students in the group? (Maintain attention, accomplish responses, provides turn ratio of 1–3)</td>
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<tr>
<td>4. Does the clinician follow the questioning hierarchy throughout the book reading activity?</td>
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<tr>
<td>5. Is the clinician able to manage student behaviors that impede the group’s ability to accomplish activity goals? (Is distracting talk and interruptive behavior limited?)</td>
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<tr>
<td>6. Does the clinician provide opportunities on one of the predetermined sounds at least 30 times per story?</td>
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<td>7. Does the clinician attempt to elicit target sounds from each student in the group at least 15 times?</td>
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<tr>
<td>8. Does the clinician present with effective elocution throughout the storybook activity? (good vocal volume, prosody, and intonation)</td>
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<tr>
<td>9. Are the book reading sessions and interactive activities between 15 and 20 minutes long?</td>
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<tr>
<td>10. Does the clinician provide a summary of the session to review the purpose/goal of the activity?</td>
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