Dialog, *19*(3), 27-41
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ISSN: 1930-9325

RESEARCH ARTICLE

Scaffolding Preschoolers' Acquisition, Maintenance, and Generalization of Phoneme Segmentation Skills Using Sound Boxes

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The purpose of this article is to describe a study that examined the effects of a supplemental instructional method called sound boxes on the phoneme segmentation performance of a sample of preschoolers enrolled in a Head Start program. The sound box intervention was implemented using most to least prompting procedures as a way to scaffold children's acquisition, maintenance, and generalization of phonemes. Findings revealed that all children improved their performance on phoneme segmentation tasks during the implementation of the sound box intervention. Results also showed that all children were able to maintain their high phoneme segmentation performance levels after prompts were removed. Additionally, children were able to generalize segmenting a fair percentage of phonemes when they were presented within words that were not directly taught during intervention sessions. Limitations of the study and directions for future research as well as implications for Head Start educators who may be interested in implementing this intervention are provided.

Keywords: phoneme awareness; early literacy intervention

All too often, young children who reside in low income households experience limited opportunities to engage in early literacy activities resulting in low levels of school readiness upon entering kindergarten when compared to their peers who reside in average to high income households (Foster, Lambert, Abbott-Shim, McCarty, & Franze, 2005). It has been estimated that, without proper early literacy instruction, about 75% of young children who struggle acquiring early literacy skills will continue to have problems with reading throughout their entire school career (Scarborough, 2002), and some are likely to be identified with learning disabilities (Snow, Burns & Grifith, 1998). These young children require high quality early intensive literacy instruction to narrow the achievement gap between them and their peers who are functioning at average or above average reading achievement levels (Hatcher, Hulme and Snowling, 2004; Yeh, 2003). High-quality early literacy skill instruction for young children involves instruction that focuses on explicitly and systematically teaching fundamental early literacy skills (Justice et al., 2008).

One such critical early literacy skill that should be explicitly and systematically taught to young children is phonemic awareness. Indeed, phonemic awareness is one of the domain elements included in the Head Start learning standards that can be found in the Head Start Child Outcomes Framework released in 2000 (US Department of Health and Human Services, 2003). Although, supporting young children's phonemic awareness is a part of Head Start learning standards, several Head Start educators were surveyed, and they reported infrequent use of phonological strategies in their classrooms (Hawkin, Johnston, & McDonnell, 2005).

Phonemic awareness is the alertness to and manipulation of sounds in spoken words. Teaching phonemic awareness involves isolating, blending, and segmenting sounds in spoken words. It is important that early childhood educators teach children phoneme awareness as it has been well established that the acquirement of phonemic awareness is highly predictive of early reading achievement (e.g., Bentin & Leshman, 1993; Byrne & Fielding-Barnsley, 1991; Hatcher, Hulme, & Ellis, 1994; Smith, Scott, Roberts, & Locke, 2008; Vellutino, Scanlon, & Lyon, 2000). Among the range of phonemic awareness skills that early child educators teach children to perform, segmenting phonemes is the most advanced skill and most related to reading decoding skills (Nation & Hulme, 1997) and spelling (Al Otaiba, et al., 2010). Phoneme segmentation involves the teacher saying the word /cat/ and asking the children to say each individual sound in the word such as saying /c/ /a/, and /t/.

Researchers recommend that instructional lessons on phonemic awareness skills such as phoneme segmentation be direct, fast paced, include a small group of children, and consist of tasks that involve having the children identify and manipulate sounds in spoken words (Leafstedt, Richards, & Gerber, 2004). One such supplemental method designed to teach phoneme segmentation is called sound boxes (also referred to as "say it move it activities"), which was created by D. B. Elkonin in Russia to teach preschool children to attend to sound sequences in spoken words (Elkonin, 1973). It is included as part of several comprehensive reading programs such as Reading Recovery (Clay, 1993) and Kindergarten Peer Assisted Learning (K-PALS; Fuchs et al., 2001). Sound boxes, subsequently described in detail in the methods section, consist of visual prompts that are designed to assist children in completing the task of segmenting sounds in words successfully. Although studies have examined the effects of comprehensive phonological instruction that encompassed the sound boxes technique (Ball & Blachman, 1991; Bentin & Lesham, 1993; Hohn & Ehri 1983; Rafdal et al., 2011), these studies did not show how sound boxes alone influenced young children's early literacy performance.

There have been some studies that explored the effects of using sound boxes as the sole intervention. Most of these studies included primary grade school age children with and without disabilities (Alber-Morgan et al., 2016; Keesey, Konrad, & Joseph, 2015; Joseph, 1998/1999; Joseph, 2000; Joseph, 2002). For instance, Joseph (1998/1999) examined the effects of this procedure on teaching word identification and spelling to second graders with learning disabilities. In this study, the sound boxes increased the children's word recognition and spelling performance. These findings were also supported by Joseph (2000) who compared the effects of using sound boxes, word sorts (grouping words with similar patterns), and no supplemental instruction on teaching first graders' phoneme segmentation, word recognition, and spelling performance. Findings indicated that there were no significant differences between sound boxes and word sort groups on phoneme segmentation, word recognition, and spelling performance. However, these groups significantly outperformed the no supplemental instruction group. Sound boxes were also used to teach word identification and spelling to 9 to 10 year olds with intellectual disabilities (Joseph, 2002) and first graders who were receiving supplemental Title 1 reading instruction (Alber-Morgan et al., 2016). Findings revealed that the children performed above baseline (no intervention) conditions on word identification and spelling when sound boxes were implemented. When sound boxes were used to teach segmenting sounds and making letter-sound correspondences to kindergartners who were at risk of not developing early literacy skills, the children improved greatly on segmenting sounds, making letter-sound correspondences, and spelling words (Keesey et al., 2015).

Maslanka and Joseph (2002) was the only study that examined the effects of using sound boxes with preschool children. In their study, the children were Caucasian and attended a private preschool. They were randomly assigned to participate in either a sound box or a sound sort intervention group. Findings revealed that children in the sound box group outperformed children in the sound sort group on isolating initial sounds and segmenting phonemes.

With the exception of Maslanka and Joseph's (2002) study, most of the studies that were described here explored the effects of sound boxes with primary grade children. In Maslanka and Joseph's (2002) study, preschool participants were Caucasian, resided in middle to high socio-economic conditions, and attended a private preschool. More studies are needed to explore the effects of sound boxes with samples of preschool children who are of ethnic and racial origins other than Caucasian, preschool children who reside in low socio-economic conditions, preschool children who attend a Head Start program, preschool children with disabilities, and preschool children who are at risk of not developing critical emergent literacy skills such as phonemic awareness. Not only are there few studies that have explored the effects of sound boxes on the phonemic awareness performance of preschool children at risk of reading difficulties, there are no studies that assessed maintenance and generalization performance with this sample of young children. Moreover, there are no studies that examined the systematic fading of the sound box prompting procedures to determine if children can eventually perform phonemic awareness skills independently without the visual and verbal prompts. The process of gradually removing supportive prompts as students demonstrate success with academic tasks is often referred to as scaffolding (McGee & Ukrainetz, 2009) and has been shown to be effective in several studies (e.g., Lutz, Guthrie, & Davis, 2006; Mayfield, Glenn, and Vollmer; 2008; Park, Weber, & McLaughlin, 2007). Moreover, from a comprehensive review of the effects of reading interventions on individuals with special needs, researchers concluded that the interventions that appeared to have the strongest effects were those that incorporated systematic prompts and gradual removal of prompts (Browder, Wakeman, Spooner, Ahlgrim-Delzell & Algozzine, 2006).

The purpose of the current study was to extend the research on the effects of sound boxes by exploring their usefulness for helping preschool children who were at risk of reading difficulties and who were enrolled in a Head Start program. The aim of the current study was to examine whether this sample of young children can segment sounds in spoken words that were directly taught to them using the sound boxes as well as generalize those skills to untaught words. Additionally, the purpose of this study was to explore the effects of systematically removing the verbal and visual prompts incorporated within the task as the young children became successful at performing the skill. This helped determine if children can maintain their performance levels when the supportive structures were removed. The following research questions guided this study: (1) Do sound boxes improve phoneme segmentation performance for children who are enrolled in a Head Start program? (2) Will the children maintain and generalize their phoneme segmentation performance after supportive prompts are systematically removed?

METHODS

Participants and Setting

The participants of this study consisted of three English speaking preschool children, Winston (male; age 4-10), Mia, (female; age 5-2) and Nolan (male; age 4-7) who are African-American and who attended a Head Start program in a large metropolitan city in the Midwest. The participants met eligibility requirements to enroll in the Heat Start program due to residing in households with income levels that are below the state poverty level. Criteria for participating in the study included referral from the Head Start teacher (i.e., children were nominated to participate in the study if they were observed to perform below their peers on early literacy skills in the classroom), obtained parental permission, and below benchmark performance on Individual Growth and Development Indicators (IGDIs) measures (i.e., *Rhyming*, *Alliteration*, and *Picture Naming*). Specifically IGID scores on *Rhyming* were 16, 5, and 4 for Winston, Mia, and Nolan, respectively. IGID scores on *Alliteration* were 4, 5, and 4 for Winston, Mia, and Nolan, respectively. IGID scores on *Picture Naming* were 16, 14, and 16 for Winston, Mia, and Nolan, respectively. Initially five participants were recruited, however, two of the participants moved and withdrew from the Head Start center just prior to the start of the study. Before this study was implemented, a proposal was submitted to the university human subjects review board detailing the protection of the participants and the implementation of ethical practices. The study was approved and was in compliance with the institution's internal review board requirements of human subjects' participation in research studies.

The setting for the study took place in a Head Start center in a Midwestern urban area. A classroom that was separate from the children's regular Head Start preschool classroom was used for the study as it contained minimal noise level and mainly free from distractions. The instructor was a doctoral student who was working as a consultant for Head Start at the time of the study.

Pre-assessment and Selection of Words to be Taught

A pre-assessment was administered to identify a set of words that children did not know how to segment. Several words containing consonant-vowel-consonant (CVC) patterns obtained from a list of words found in McCormick's (2003) textbook were administered to the children until five words that the children were unable to segment were identified. The instructor presented each word orally to the student, and the student was asked to repeat the word followed by saying each sound in the word. For example, the instructor said the word, "fan", asked the student to say the word and then asked, "Now, say each sound in the word "fan" by first saying the beginning, the middle, and then the ending sound. The words that were chosen for inclusion in the study were the first five words in which the children were not able to segment any of the sounds in those words. The words were, "fan", "jet", "kid", "mop", and "bus." Words with different beginning, middle, and ending sounds were chosen to control for potential transfer effects across words. They were included on all baseline and intervention assessment probes and were used to teach phoneme segmentation across all intervention phases.

Dependent Variables

The primary outcome variable was defined as the number of sounds said correctly in the correct order on phoneme segmentation probes. Five-item phoneme segmentation probes containing the aforementioned selected words were administered during baseline and during intervention phases of the study.

Generalization was defined as the number of sounds in nonsense words said correctly. These words were not directly taught during the intervention sessions, however, they contained some of the same sounds that were taught during intervention sessions. Nonsense words were used instead of real words to minimize chances of being exposed to words during the time that the study took place. Each child was administered a total of three generalization probes. Specifically, a list of 15 different nonsense words containing consonant-vowel-consonant patterns was generated, and the words were randomly selected and placed on one of a total of three probes. Thus, each generalization probe consisted of a different set of five nonsense words. For instance, nonsense words, "maf", "nov", "vem", dop, and vis" were included on probe 1; "lam, "kud, pag, fon, and zim" were included on probe 2; and "ked", "tun", "ret", "jad", and "tep" were included on probe 3.

Experimental Design and Procedures

A single subject multiple probe across participants design, a variation of the multiple baseline design (Cooper, Heron & Heward, 2007), was used to examine the effects of sound boxes and the gradual removal of the visual and verbal prompts included in the procedure. This design was used instead of the standard multiple baseline design to prevent children from experiencing frustration and fatigue due to multiple administrations of phoneme segmentation probes during the baseline phases of the study. In the multiple probe design, probes are administered periodically across baseline sessions rather than on every session as in the case with multiple baseline designs. Sound boxes intervention was implemented in a staggered (stair case) like fashion across participants. The first participant received the intervention when a stable baseline was achieved for that participant. The second participant remained in baseline until the first participant demonstrated an upward trend in performance toward achieving mastery, which was approximately 90 percent correct on phoneme segmentation probes. The third participant remained in baseline until the second participant demonstrated an upward trend toward achieving mastery performance, which was achieving approximately 90 percent correct on phoneme segmentation probes. Implementing the intervention in this staggered like fashion across participants controlled for extraneous variables.

Phase 1: Baseline. During the baseline phase, phoneme segmentation probes were administered periodically across sessions. No intervention was implemented during this phase. The following procedures were used during the administration of the phoneme segmentation probes. The instructor presented each word orally to the student, and the student was asked to repeat the word followed by saying each sound in the word. For example, the instructor said the word, "mop", and then asked the student to repeat the word. Next, the instructor asked the student to say each sound in the word "mop" by first saying the beginning, the middle, and then the ending sound. The student could earn one point for each sound said correctly as long as it was stated in the correct order. For the word “mop”, the student received a total of three points if they said /m, /o/, and then /p/ in that order. On each probe, the student could earn up to a total of 15 points. No corrective feedback for incorrect responding or verbal praise for correct responding was provided.

Phase 2 Intensive support. In this phase, the instructor followed a script detailing the sound boxes procedure using modeling, guided practice, and independent practice with corrective feedback. The five CVC words were taught individually to each child during each instructional session. Specifically, the sound boxes consisted of a drawn rectangle divided into three sections according to the number of phonemes in the CVC words. Figure 1 depicts an illustration of this technique. For each word, the instructor said the word, demonstrated placing tokens in the divided sections of the rectangle as she slowly articulated each sound in the word (i.e., modeling). Next, the instructor prompted the child to place the tokens in their respective sections as the child and the instructor together said each sound in the word (i.e., guided practice). Afterwards, the child was asked to complete the task independently with instructor corrective feedback. Corrective feedback consisted of providing the child with the correct response if the child made an incorrect response. Verbal praise such as saying, “ correct” was given for correct responses. After all five words were taught during each daily session, a phoneme segmentation probe was administered at the end of each daily session following the same procedures as used during baseline sessions. These procedures were repeated on every session during this phase until the child demonstrated at least 90 percent accuracy on probes on two consecutive sessions. Generalization probe 1 was administered at the end of this phase just before the implementation of intervention phase 3 using the same procedures as the baseline and intervention probes.

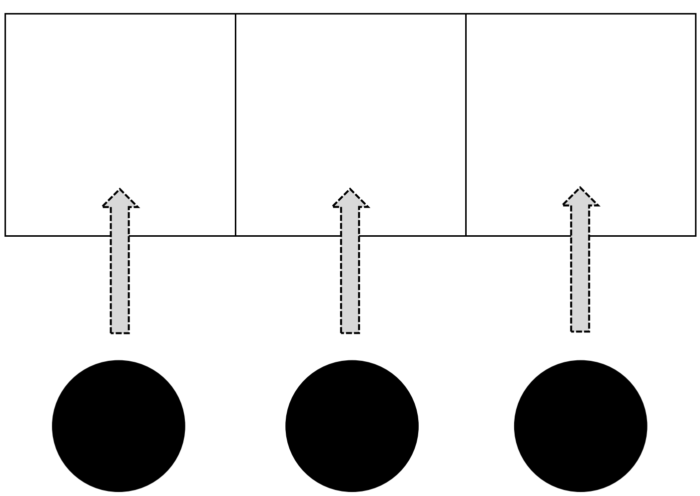

Figure 1. Illustration of Sound Boxes

Phase 3. Moderate support. Once the child met performance criteria in phase 2, phase 3 was implemented. In this phase, the instructor followed a script detailing the implementation of sound boxes procedures without the modeling and guided practice components. The children were asked to segment the sounds of the words using the sound boxes on their own with corrective feedback. Corrective feedback consisted of providing the child with the correct response if the child made an incorrect response. Verbal praise such as, saying "correct," was given if the child made a correct response. After each word was taught using the sound boxes with corrective feedback during each daily session, the phoneme segmentation probe was administered at the end of each daily session using the same procedures as in all prior phases. Once students were able to maintain 90 percent accuracy on probes on at least two consecutive sessions, they moved onto phase 4 of the study. Generalization probe 2 was administered at the end of this phase just before the implementation of intervention phase 4 using the same procedures for administering baseline and intervention probes.

Phase 4 Minimal support. In this phase, the instructor asked the children to segment the sounds when the words were presented without the visual supportive structures of the sound boxes. The instructor only provided the children with corrective feedback and verbal praise (i.e., same form of feedback and praise as was used in phases 2 and 3), which occurred after each response made by the children. The phoneme segmentation probe was administered at the end of each daily session following the same procedures as in all prior phases. Generalization probe 3 was administered at the end of this phase using the same procedures for administering baseline and intervention probes.

It should be noted that, throughout the study, the segmentation and generalization probes in all phases of the study were administered without any of the support structures including modeling, guided practice, sound box materials, or corrective feedback.

Procedural Integrity

Instructional integrity was assessed to ensure that the procedures were implemented with fidelity. A trained independent observer who was a graduate student in a school psychology program observed 17% of the experimental sessions. The independent observer was given two scripts, one for implementation procedures during experimental conditions and one for phoneme segmentation probe administration procedures. The independent observer was asked to place a checkmark next to each line on the scripts if the scripts were followed as written. To calculate a mean adherence to each script, the number of checkmarks was divided by the total number of possible checkmarks. Mean adherence to following the instructional script was 98% (range = 95–100%), and mean adherence to correctly administering phoneme segmentation probes was 99% (range = 98-100%).

Interobserver Agreement (IOA)

To ensure that phoneme segmentation probes were scored reliably, a graduate student trained in the administration of the probes independently scored 17% of children's responses on the probes administered during baseline and intervention phases and 25% of the generalization probes. An item-by-item comparison was made between the instructor's and independent observer's scores on children's responses on each item to ensure that inter-observer reliability scores were above 90%. Mean percent of agreement between independent observers and instructor's scores on item responses on probes were calculated by dividing the number of scoring agreements by the total number of scoring agreements plus scoring disagreements and multiplying that sum by 100. Mean percent of IOA for probes administered during experimental sessions was 97% (range = 80–100%). Percent of IOA for the generalization probes was 98% (range = 93–100%).

RESULTS

Figure 2 presents a graph depicting children's phoneme segmentation performance across baseline and intervention phases. Findings revealed that all children demonstrated low and stable performance during baseline phases of the study. When sound boxes with modeling, guided practice, and corrective feedback were implemented, all children improved on their performance on phoneme segmentation probes. After modeling and guided practice followed by the sound boxes were gradually removed, all children were able to maintain a high level of phoneme segmentation performance.

Each child's performance as seen in Figure 2 revealed that it took Winston fewer learning trials (n = 6) to segment a total of 15 phonemes at about 90% accuracy than it took Mia and Nolan (n =8) when sound boxes with modeling, guided practice, and independent practice with feedback were implemented (i.e., phase 2). It appears that Winston and Mia steadily showed an upward trend in performance during intervention sessions under phase 2 with Mia showing the most dramatic upward trend in performance from session to session. Nolan's performance remained stable at mainly segmenting a total of about 6 to 7 phonemes correctly in about the first seven intervention sessions then improved to segmenting 10 to 15 phonemes correctly in subsequent sessions. Importantly, all children demonstrated consistently high levels of performance ranging from segmenting 13 to 15 phonemes correctly during phases 3 and 4 when most of the support structures were systematically removed.

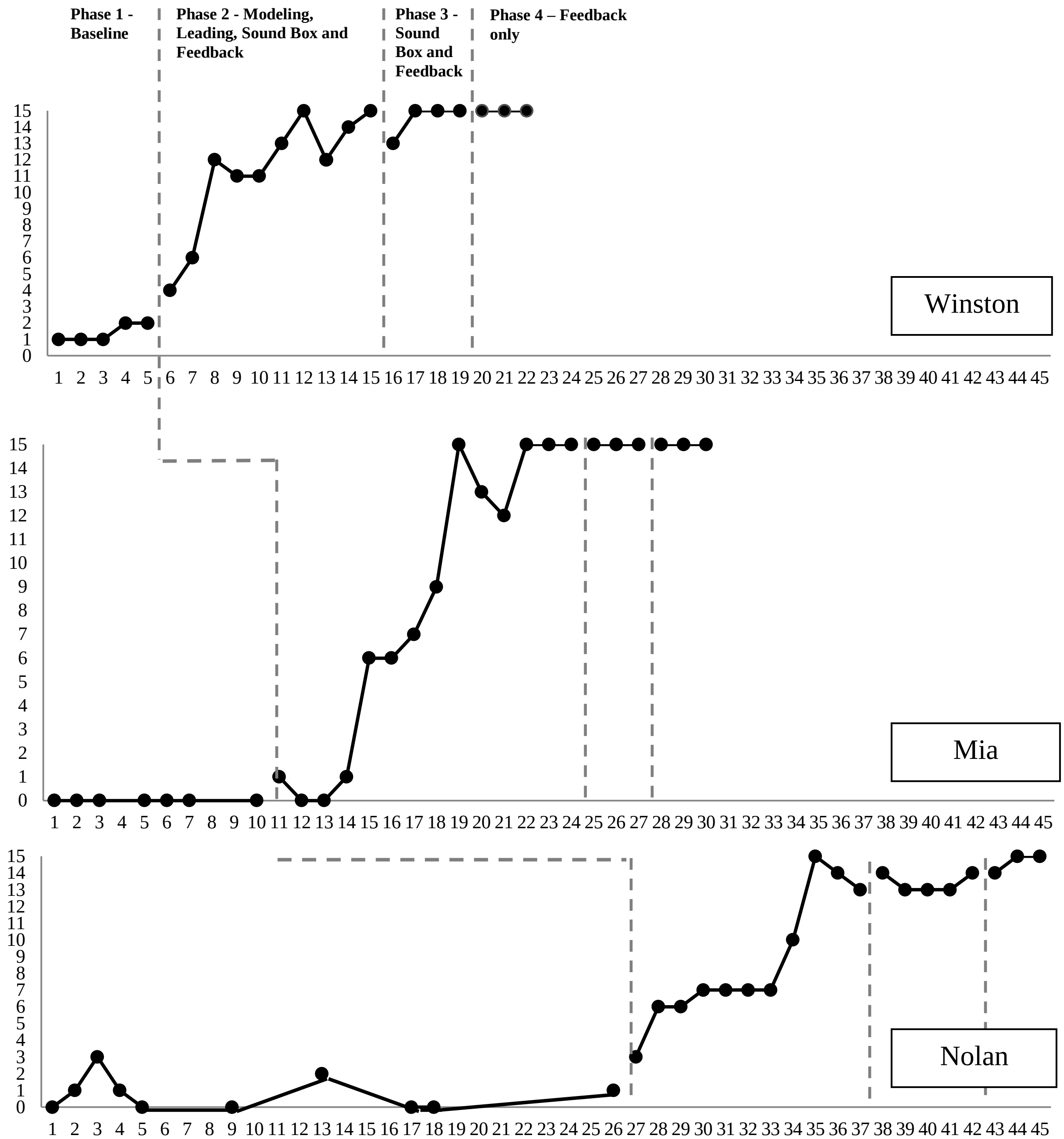

Figure 2. Sessions

Table 1 presents the means and standard deviations of children's phoneme segmentation performance across baseline and intervention phases. Winston, Mia, and Nolan demonstrated a mean change score of 9.9, 8.2, and 7.84 respectively from baseline to intervention phase 1; a mean change score of 13.1, 15.0, and 12.6 respectively from baseline and intervention phase 2; and a mean change score of 13.6, 15.0, and 13.9 respectively from baseline to intervention phase 3. Findings revealed that all children correctly segmented a comparable number of beginning, middle, and ending sounds across intervention phases. Specifically, children as a group correctly segmented 58% of the beginning sounds, 51% of the middle sounds, and 52% of the ending sounds on probes administered during the first intervention phase. During the second intervention phase, children as a group correctly segmented 98% of the beginning sounds, 97% of the middle sounds, and 88% of the ending sounds. During the final intervention phase, children as a group correctly segmented 100% of the beginning and middle sounds and 98% of the ending sounds.

TABLE 1
Participants' Means (M) and Standard Deviations (SD) on Phoneme Segmentation Probes across Experimental Phases

	Phase 1-Baseline		Phase 2 Intensive Support		Phase 3-Moderate Support		Phase 4-Minimal Support	
Participant	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Winston	1.4	0.5	11.3	3.6	14.5	1.00	15.0	0.0
Mia	0.0	0.0	8.2	6.0	15.0	0.0	15.0	0.0
Nolan	0.8	1.0	8.6	3.8	13.4	0.5	14.7	0.6

To assess the overall magnitude of the intervention effects, percent of non-overlapping data (PNDs; Scruggs, Mastropieri, & Casto, 1987) and improvement rate differences (IRDs; Parker, Vannest, & Brown, 2009) were calculated for all children. PNDs were calculated for each participant by identifying the highest performance data point during baseline and counting all intervention performance data points higher than the highest baseline point (i.e., non-overlapping data) and dividing that number by the total number of intervention data points and multiplying that sum by 100. PNDs were calculated separately between baseline and each of the intervention phases. Winston obtained PNDs of 100% between baseline and all intervention phases. Mia obtained PNDs of 86% during the first intervention phase and 100% in subsequent intervention phases. Nolan obtained PNDs of 90% during the first intervention phase and 100% in subsequent intervention phases. All children's PNDs showed strong intervention effects as all exceeded PNDs of 70% (Scruggs, Mastropieri, & Casto, 1987).

A more conservative estimate of the magnitude of intervention effects is improvement rate differences (IRDs) with IRDs of .70-1.0 reflecting strong effects, .50-.70 reflecting moderate effects, and below .50 reflecting small or questionable effects (Parker, Vannest, & Brown, 2009). IRDs were calculated for each participant by subtracting the improvement rate in the intervention phase from the improvement rate in the baseline phase (i.e., $IR_T - IR_B = IRD$; Parker, Vannest, & Brown, 2009). In the case of this study, IRD was calculated between baseline and the first intervention phase. IRD reflected strong intervention effects for all three children (Winston IRD = 1.0; Mia IRD = .85, and Nolan IRD = .90). Thus, all three children showed significant improvements from baseline to intervention phases.

Table 2 presents the number of phonemes segmented correctly across all participants on each generalization probe. Winston and Mia obtained higher performance on generalization probes after phase 3 of the intervention was completed than after phase 2 of the intervention was completed. There was a very slight change in Nolan's scores on generalization probes between intervention phases 2 and 3. All participants obtained higher performance on generalization probes after phase 4 of the intervention was completed than after phase 2 of the intervention was completed. When performance on all three generalization probes were combined, Winston, Mia, and Nolan correctly segmented 51%, 44%, and 53%, respectively, of the phonemes in untaught nonsense words.

TABLE 2
Participants' Performance on Generalization Probes

Participant	Generalization probe 1	Generalization probe 2	Generalization probe 3
Winston	6	7	10
Mia	3	9	7
Nolan	7	6	11

DISCUSSION

The purpose of this study was to determine the effectiveness of sound boxes plus modeling, guided practice, and independent practice with corrective feedback on the phoneme segmentation performance of preschool children enrolled in a Head Start program. Additionally, this study sought to examine the effects of systematically removing instructional prompts such as modeling and guided practice followed by removing the use of the sound boxes materials on all of the outcome variables.

Findings revealed that the sound boxes plus modeling and opportunities for guided and independent practice helped the children improve their phoneme segmentation performance. This was an important finding as phoneme segmentation is considered a precursor skill to learning how to make letter-sound correspondences and decode and spell words (Nation & Hulme, 1997; Al Otaiba, et al., 2010). The preschool children in this study were close to entering kindergarten, and the acquirement of this skill may likely ease their understanding of the alphabetic principle. These findings extend the current literature on the effects of sound boxes as the current study consists of children attending a Head Start program in an urban setting. Prior studies reporting on the positive effects of sound boxes on phoneme segmentation performance consisted of preschool children attending a private school in middle to high socioeconomic setting (Maslanka & Joseph, 2002) and with primary grade school age students (e.g., Keesey, Konrad & Joseph, 2015; Joseph, 2002).

Not only did this study extend the research by including young children who were enrolled in a Head Start program and who were at risk of not developing literacy skills, it also extended the research by examining the systematic removal of the visual and verbal prompts as children approximate proficient performance. Prior studies examining the effects of sound boxes did not include the systematic fading of prompts such as modeling, guided practice, and the sound box materials, which is important to examine if the goal is to help students make the transition from completing tasks correctly with guidance to successfully completing tasks independently. In this study, children were able to consistently maintain high levels of phoneme segmentation when the prompts were systematically removed. The finding of this current study supports other studies that systematically faded supports to facilitate children's successful independent performance on tasks (e.g., Lutz, Guthrie, & Davis, 2006; Mayfield, Glenn, and Vollmer; 2008).

Another way that the current study extended prior studies was that this study included generalization measures. In the current study, children were also able to generalize segmenting about a total of 50% of the sounds in words that were directly taught to untaught nonsense words. All children improved their performance on generalization probes from probe 1 to probe 3. These results indicated that, overall, the children demonstrated better performance on the generalization measures as they became proficient at segmenting phonemes.. This finding was expected given that children are likely to generalize skills in untrained contexts as they achieve mastery and perform skills with greater independence (Skinner & Daly, 2010). Moreover, teachers can instruct in an efficient manner if they are able to use methods that not only help children acquire skills in one context but that also help children transfer those skills to another context (Konrad, Helf, & Joseph, 2011).

Limitations and Directions for Future Research

While internal validity is strengthened through the use of single subject designs such as the multiple probe design, external validity is compromised. In the case of this study, findings cannot be generalized to every preschool child who is enrolled in a Head Start program and who is at risk of not developing early literacy skills. However, the great advantage of these designs is that they permit the ongoing observation of a dynamic interaction between the intervention and students' performance across time. In the current study, the trend in each student's data set revealed that each student responded favorably to the sound boxes intervention. Replication of the current study will strengthen its positive findings.

Another limitation was that the amount of words that children learned to segment was relatively small in number. This was due to it being the end of the school year, and there was not enough time to examine the prompt fading effects using more sets of words. If this study were replicated, the researchers may want to allocate more intervention sessions so children have an opportunity to learn to segment more words than the amount that was taught in this study.

In this study, modeling and guided practice instructional components were removed at the same time in one phase followed by the removal of the entire sound box structure in the subsequent phase. The way in which these prompts were systematically removed in this particular study was appropriate given that participants' continued to maintain high levels of performance during prompt fading phases. This confirms the notion that the use of scaffolding can improve the efficiency of phonemic awareness instruction (McGee & Ukrainetz, 2009). However, some children with even more challenging learning needs may need a more extensive prompt fading procedure. For instance, there may be four prompt fading phases rather than just two for those children. The first prompt fading phase may consist of removing the modeling component only followed by removing the guided practice component in the second phase. The sound boxes structure could be removed in phases three, four, and five by first removing the divided sections of the box leaving a rectangle in phase 3 and then removing the rectangle in phase 4 followed by removing the tokens in phase 5. Thus, future researchers may need to examine the effects of a more extensive prompt fading procedure for participants who are functioning at lower levels than the participants in this study. It also may be interesting to determine if more extensive prompt fading procedures have a stronger impact on students' performance on generalization measures.

The current study was conducted in a one to one instructional format. From an instructional efficiency perspective, it may be useful for future researchers to examine the effects of the intervention with small groups of children to determine if the magnitude of the intervention effects is similar when implemented in a small group context.

Social validity with regards to teacher acceptability of the sound boxes intervention was not formally assessed in this study. Future researchers should assess teachers' perceptions of the feasibility of implementing the intervention in their classrooms. In addition to measuring teachers' perceptions, future researchers may wish to conduct post study observations in the classroom to determine if the teacher is using the intervention.

Implications for Practice

It is important for early childhood educators such as Head Start instructors to have proper training and instructional tools and materials to teach phonemic awareness well to young children (Cheesman, McGuire, Shankweiler, & Coyne, 2009). It should be noted that it was not the purpose of this study to address all the possible ways that phoneme segmentation can be taught. The sound boxes technique that was examined in this study is just one tool that early childhood educators can use to teach phoneme segmentation. The advantages of using sound boxes are that sound boxes are a low cost and an easy method for teachers to implement. The visual structure and the opportunity to manipulate materials may make learning phoneme segmentation more appealing for young children who are having difficulty acquiring these skills. Specifically, the children become aware of the positions of the phonemes through the visual structure. The visual structure of the sound boxes may also be especially helpful for children who may find it challenging to attend to each individual sound in a word.

Modeling, guided practice, and independent practice with feedback procedures that are used in conjunction with the sound box materials are instructional procedures that are universal and can be implemented in many classrooms across many countries around the world. These procedures are also low cost and easy for teachers to use when teaching new skills to children (Bursuck & Damer, 2011). When teachers scaffold instruction in this way, they may permit skills to be learned that are otherwise perceived to be challenging for young children who are academically at risk of not developing early literacy skills proficiently.

Early childhood educators such as Head Start teachers can incorporate sound boxes within a more comprehensive early literacy program that they are already using in their classroom (e.g., Rafdal, et al., 2011; Ball & Blachman, 1991). Early childhood educators can also use sound boxes to supplement general early literacy instruction in the classroom for children who are not meeting early literacy standards.

When young children transition from an early childhood program such as Head Start to kindergarten, the kindergarten instructor can move from teaching phonemic awareness to teaching letter-sound correspondences to the children using the sound box procedure. This can be accomplished by replacing the tokens (used to teach segmenting phonemes) with plastic letters to teach children to make letter-sound associations. For instance, children can slide the letters into the boxes as they articulate each sound in a word. By the middle of first grade, teachers can use the sound boxes to help children spell words by having them write the letters in the boxes as they sound out the word.

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