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

Dissertation

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By

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Abstract

This study examined the effectiveness of a sound box intervention that incorporated scaffolding procedures on preschoolers’ phoneme segmentation skills. The participants consisted of four African-American preschool students attending a Head Start center and who had difficulty acquiring phonemic awareness skills as measured by the DIBELS and Get it Got Go! assessments. An intervention was employed which utilized a sound box and scaffolding procedures to improve preschool participants’ performance on a phoneme segmentation task. Briefly, a sound box is a drawn rectangle with divided sections according to the number of phonemes in a word. Participants were required to slide tokens in respective divided sections as they articulated/segmented each sound in a word. Verbal as well as visual supports associated with the sound box technique were gradually faded in a systematic way (i.e., scaffolding) to assist children in segmenting phonemes without the use of those supports. A multiple probe design across four participants was used to measure the effects of the intervention. All participants improved in trend and level during intervention phases in contrast to their performance in the baseline phase. Participants were able to segment phonemes when verbal and visual supports were gradually removed, and generalized segmenting phonemes in words that were directly taught during intervention phases to words that were not directly taught during intervention phases. Implications for practitioners and future directions are discussed.
Dedication

This work is dedicated to preschool students - current and future - in hopes of many years of rich, challenging, and rewarding education before you.
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In my newfound free time, I hope to be able to repay much of the kindness, patience, and encouragement I have received throughout this journey.
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Fields of Study

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Chapter 1: Introduction

Strategies to improve the early literacy skills of preschoolers from low socioeconomic status (SES) backgrounds need to be identified. This study examines the effectiveness of an intervention designed to increase Head Start preschoolers’ phonemic awareness, specifically their performance on a phoneme segmentation task. Young children living in poverty are often under-exposed to language and literacy in the home (Brooks-Gunn, & Duncan, 1997). This deprivation can result in low school readiness at kindergarten, particularly in terms of early literacy skills, when compared to their more advantaged peers (Foster, Lambert, Abbott-Shim, McCarty, & Franze, 2005). Early struggles with reading often lead to continuing difficulties throughout a child’s schooling (Justice, Meier, & Walpole, 2005; Scarborough, 1998). Many preschool programs that work with this low-SES population, such as Head Start, are not inspiring significant literacy gains in their students. These preschools’ curricula often fail to provide an explicit and intentional method for promoting early literacy. Particularly because these children are lagging behind their higher-SES peers by preschool-age, they require explicit instruction in literacy skills to narrow the gap (Yeh, 2003). Although a fair amount of research has explored storybook reading, and rhyme detection, there is limited literature on preschool interventions to promote phonemic awareness, which is the early literacy
skill most crucial for later reading development. Demonstrated effectiveness of the studied intervention suggests it could be employed in preschool classrooms in hopes of increasing the literacy-readiness of a large number of at-risk children.

Early literacy development should be at the heart of all high-quality preschool curricula. It is clear that struggles with literacy occur early on, and that difficulties with early literacy in preschool and kindergarten are associated with reading difficulties in later elementary years (Beauchat, Blamey, & Walpole, 2009; Scarborough, 1998). Very often the students who continue on this trajectory of reading failure are those from low-SES backgrounds who enter early schooling experiences with limited literacy knowledge (Justice et al., 2005). Further, research shows that these skills are much easier to develop and build upon in the early years, but become more stable and resistant to remediation as the students get older (Lonigan, Burgess, Anthony, & Barker, 1998). Therefore, the preschool experience is an invaluable chance to impose early literacy instruction on these children to ensure early success and increase the likelihood for positive outcomes in the future.

Unfortunately, a review of 135 publicly-funded preschool programs revealed that, in general, the quality of literacy instruction is low (Justice, Mashburn, Hamre, & Pianta, 2008). Model, and well-funded, preschool programs implemented in the 1970s, such as the High/Score Perry Preschool, and the Abecedarian Program, have effected sizeable and sustained improvements in their students’ reading skills (Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001), whereas the current Head Start program has failed to provide such benefits (U.S. Department of Health and Human Services, 2010).
As stated by Bradley and Bryant (1983) in their landmark paper, phonological awareness is the only reading ability for which a causal relationship between it and future reading achievement has been established. Of all the phonological awareness component skills, including detection of syllables and rhyme, phonemic awareness has repeatedly been shown to be the strongest predictor of later reading ability (Hulme et al., 2002). Whereas language development is largely child-directed, high-quality literacy instruction is characterized by teacher-directed, explicit, and systematic instruction. Both the phonological and print-based qualities of literacy must be directly addressed (Justice et al., 2008). Similar to other studies that demonstrated that simple exposure to storybooks is not sufficient to promote many literacy skills, informal exposure is not adequate to affect phonemic awareness (Senechal, LaFevre, Thomas, & Daley, 1998).

A consistent body of research has demonstrated that living in poverty serves as a risk factor for children, particularly in early development, and can contribute to negative social, behavioral, cognitive, and academic outcomes (Brooks-Gunn, & Duncan, 1997). Primarily, acquisition of emergent literacy skills is crucial for school readiness and future reading achievement (Foster et al., 2005). Foster et al. (2005) concluded that home learning environment mediated the relationship between SES and emergent literacy. As defined by this research, the home learning environment is characterized by reading to the child, enrichment experiences (e.g. trips to the library and zoo, and other community activities), home learning activities (e.g. playing games and completing art and craft projects), and books and reading materials in the house. These findings implicate the central importance of a cognitively-stimulating and linguistically-rich home learning
environment and prompt a recognition of the ways in which poverty can affect this. Poverty influences the resources available to a family, including their time and energy, can induce stressors, and may affect their attitudes toward education. Preschool is especially vital for children from low-income homes as it serves as an equalizer and buffer against present risk factors (Barnett & Belfield, 2006). Similarly, preschool can function as a tool to promote social mobility if its practices place children on a path toward greater success compared to their parents.

Sound boxes, also called say-it move-it activities, have been found to be an evidence-based tool for improving phonemic awareness, among other literacy skills, in elementary school children (Joseph, 2000a, 2000b, 2002a, 2002b; Keesey, 2012), and can easily be incorporated into an explicit instruction method. By using tangible, plastic counters or tokens, this tool helps children attend to the distinct sounds within a single word. Little is currently known about the effectiveness of use of sound boxes with preschool children; however, because it is a simple, clear, and quick tool, it is appropriate for use with this population, and its effectiveness is expected to be similar to that with older children. Additionally, because the children in this study possess low present levels of phonemic awareness, and because their age and performance on a class-wide screening measure indicate they are developmentally ready to acquire phonemic awareness, scaffolding the intervention is appropriate to target the zone of proximal development, as named by Vygotsky (Bodrova & Leong, 2006). Scaffolding similar interventions has been shown to increase the number of preschool children entering kindergarten with basic phonemic awareness skill (McGee & Ukrainetz, 2009).
A scaffolded, and thus developmentally appropriate, intervention, combined with an explicit instruction method, is important both for speed and efficiency of improvement. Because these students who are struggling may have greater difficulty picking up the skills from implicit exposure, as evidenced by the fact they have not adopted the abilities from their everyday exposures to language and text, it is vital to boost these skills for lagging preschoolers quickly (Justice, Chow, Capellini, Flanigan, & Colton, 2003). Use of these instructional methods along with lesson scripts, can prove beneficial for guaranteeing a student is provided with sufficient instruction prior to being asked to complete a task, and lessens the possibility for frustration or boredom, particularly in young children.

**Purpose of the Study**

The purpose of this study was to examine the effectiveness of a sound box intervention, which incorporated scaffolding and scripted lessons, on preschoolers’ phoneme segmentation skills. Although a moderate amount of research has examined sound boxes with school-age populations, there is limited research that evaluates their use with the preschool population. The current study aimed to extend prior studies by examining the effects of this method with preschoolers from low SES backgrounds. The current study also extends prior studies by incorporating the use of scaffolding in a systematic fashion. Specifically, verbal as well as visual supports were gradually faded in a systematic way to assist children in segmenting phonemes independently.

**Significance of the Study**
This study makes an important contribution to the literature by evaluating the effectiveness of a sound box intervention on improving phonemic awareness in preschool-aged children. Limited research on this intervention with this population exists. Further, this study examines ways of scaffolding student’s development of phonemic awareness skills so that they are able to eventually perform them with minimal support. This intervention could easily be adapted for use in multi-tiered classroom setting as it has the potential to be used one-on-one, in small group, or as a class-wide intervention.

**Research Questions**

The following questions guided this study:

**Research question 1:** *Does this sound box intervention effectively improve preschoolers’ performance on a phoneme segmentation task?* It was predicted that following implementation of the intervention, preschoolers’ performance on a phoneme segmentation task would improve. Previous research has demonstrated that phonemic awareness skill can be taught, and significant gains can be made in preschoolers’ phoneme segmentation skill in a relatively short time frame (Brady, Fowler, Stone, & Winbury, 1994; Justice et al., 2003). Yeh (2003) demonstrated that children instructed on phoneme segmentation using a direct approach made significantly greater gains in phonemic awareness than children whose teachers focused on rhyme, alliteration, and story activities. In this study, an improvement in performance on the phoneme segmentation task was expected following introduction of the intervention.

**Research question 2:** *Will phoneme segmentation task improvement be maintained after the support structures of the intervention are faded?* It was predicted
that improved performance on the phoneme segmentation task would remain after all support structures were faded due to the gradual removal of these supports only after a participant had demonstrated readiness. Despite the fact that phonemic awareness is the most advanced component ability within phonological awareness, and that phoneme segmentation is one of the most challenging phonemic tasks, the use of scaffolding was expected to affect both an initial and sustained improvement, even in the absence of typically preceding skills such as rhyme and alliteration detection. Previous research has demonstrated that the use of scaffolding can improve the speed and efficiency of phonemic awareness instruction (McGee & Ukranetz, 2009). Also, incorporation of the sound box was expected to help participants to attend to the individual phonemes and promote the acquisition of phonemic awareness (Joseph, 1998/1999).

**Research question 3:** Does improvement of ability to segment words taught during intervention generalize to other words not taught during intervention sessions? It was predicted that improvement on the phoneme segmentation task would generalize to words not taught during intervention due to an overall increase in phonemic awareness. Because all intervention support structures would be faded by the end of the intervention, participants would be required to demonstrate phonemic awareness skill independently, thus having transferred stimulus control from the prompts to the spoken word (McDowell, 1982).

**Definition of Terms**

**Phonological awareness.** Phonological awareness is the understanding that spoken words can be broken down into smaller and smaller units, or alternately, that a
spoken word is a blend of individual sounds, such as syllables, onset-rime patterns, and phonemes (Goswami, 2002; Paris, 2011; Stahl, 2002). Further, it is the conscious awareness of and reflection on these sounds, and the ability to manipulate them (Anthony & Lonigan, 2004).

**Phoneme.** A phoneme is the smallest unit of sound in spoken language. For example, the word cat is comprised of three phonemes, /k/ /a/ and /t/. There exist approximately forty-one phonemes in the English language (Ehri et al., 2001).

**Phonemic awareness.** Phonemic awareness is the most advanced state of phonological awareness (Yeh, 2003) and is the ability to detect and manipulate the smallest units of sound in spoken speech, phonemes (Evans & Shaw, 2008).

**Phoneme segmentation.** Phoneme segmentation is a task that requires a word to be segmented into its individual phonemes. For example, the three phonemes /k/ /a/ /t/ are articulated when the word “cat” is presented.

**Explicit instruction.** Explicit instruction is a teaching strategy characterized by clear and fully defined intentional methods (Fielding-Barnsley, 1997; Nullman, 2009).

**Scaffolding.** Scaffolding is a deliberately-planned support structure that allows a child to complete a task he or she could not accomplish independently. The instructor determines the minimal amount of support necessary to make the child successful at a given task. This support is then gradually faded with the anticipation that the skill will be internalized and the child will be able to accomplish the task independently (McGee & Ukrainetz, 2009).
**Head Start.** Head Start is a publicly funded preschool program initiated in the mid-1960s as part of President Lyndon Johnson’s *War on Poverty* (Magnuson & Waldfogel, 2005). Since its conception, the program has strived to increase the school readiness of low-income children. To address the whole child and the context in which he or she lives, Head Start provides comprehensive services including preschool education; medical, dental, and mental health care; nutrition services; and efforts to help parents foster their child’s development. Their services are designed to be aware of and responsive to each child’s and his or her family’s ethnic, cultural, and linguistic background (U.S. Department of Health and Human Services, 2010).
Chapter 2: Literature Review

This chapter presents a review of the literature that is most closely related to the current study. It begins with a discussion of preschool and its importance, particularly for disadvantaged children from low SES, literacy-weak home environments. Next, a discussion about the importance of developing phonological awareness is discussed. Following, a discussion of an effective instructional component such as scaffolding for teaching phonological awareness are discussed. This is followed by a description of a sound box method for teaching phonemic awareness and a discussion of the research on the effectiveness of sound boxes.

**Early Literacy Development and Poverty**

A consistent body of research has demonstrated that living in poverty serves as a risk factor for children, particularly in early development, and can contribute to negative social, behavioral, cognitive, and academic outcomes (Brooks-Gunn, & Duncan, 1997). Poverty influences the resources available to a family, including their time and energy, can induce stressors, and may affect their attitudes toward education. Children living in poverty have poorer school achievement, are less likely to attend college, are more likely to be a teen parent, are more likely to smoke and use illegal drugs, and are more likely to be unemployed than their more advantaged counterparts (FPG Child Development Institute, 2007).
Many suggest that preschool is especially vital for children from low-income homes as it serves as an equalizer and buffer against present risk factors. Similarly, preschool can function as a tool to promote social mobility if its practices place children on a path toward greater success compared to their parents (Barnett & Belfield, 2006). This also requires that the preschool experience affects different children of different SES backgrounds differently, such that the effects are stronger for low-income children thereby lessening the income-driven school readiness gap. Further, the effects of preschool are dependent on the quality of the program in relation to the quality of the home. High-quality preschool will enhance development for children from lower-quality homes, whereas low-quality preschool can function as a detriment for children from better homes (Barnett, 1995; Burchinal, Peisner-Feinberg, Bryant, & Clifford, 2000; Loeb, Fuller, Kagan, & Carrol, 2004). In other words, preschool serves as a benefit if its quality is higher than that of the individual child’s home life, which is more often the case for children from poverty. Therefore, high-quality programs will lead to better outcomes for the widest range of children; elements of preschool quality are universal to all children of all racial and ethnic groups (Burchinal & Cryer, 2003).

**Early Literacy Development and the Preschool Experience**

Preschool programs have demonstrated influence on participants’ cognitive ability, academic achievement, school readiness, future school attendance, grades, and graduation rates (Barnett, 1995; Barnett & Belfield, 2006; Blair & Razza, 2007; Burchinal, Campbell, Bryant, Waski, & Ramey, 1997; Diamond, Barnett, Thomas, Munro, 2007; Magnuson & Waldfogel, 2005). Certainly, the central mission of most
preschool efforts is to set the child on a trajectory toward initial, and continuing academic
success. Preschool strives for school readiness such that the child will be prepared to
absorb all that kindergarten offers. If the child enters formal schooling without the
necessary skills, he will likely start off already behind his peers, and it is often difficult
for him to fully to catch up. Further, the theory behind preschool, and early intervention
in general, is that the early years are a particularly crucial time period for instilling a child
with certain knowledge and experiences that, if missed, can never be fully recovered.
Additionally, early failures can set the tone for a child’s academic career and mold his
expectations for future performance.

Model preschool programs, such as the High/Score Perry Preschool Project and
the Carolina Abecedarian Program, which conducted true experimental design with
random assignment, demonstrated the greatest effects on children’s subsequent school
success (Barnett, 1995; Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002;
Epstein, 2007; Hohmann, Weikart, & Epstein, 2008). Some studies found that the gains
from the preschool experience persisted through second grade, fourth grade, or even
through middle school (Barnett, 1995; 1998). Large-scale programs, such as Head Start,
found fewer or more variable long-term effects on achievement. This is to say,
enrollment in preschool is only a benefit if the program is of sufficient quality.
Identifying the characteristics which make a program strong can be difficult as the effect
of each is seemingly influenced by its dynamic relationship with the others. However,
most fundamentally, a program’s intensity, and its use of evidence-based instruction
methods and interventions, particularly in terms of its literacy curriculum, are factors
necessary for producing positive outcomes. The noted variability in preschool program quality lends itself to the conclusion that we must strive to identify these qualities and communicate their importance to programs and teachers.

The word *intense* is frequently used as a key descriptor of the high-quality programs which have resulted in the most impressive positive effects (Barnett, 1995). However, the sub-components of intensity are more elusive. In most cases intensity coexisted with a detailed, broad curriculum, and constant purposefulness demonstrated by staff. Intense programs ran longer hours, and more months per year. Also, these programs were very involved with families, offering additional supports and ensuring that parents were aware of the child’s progress and manners in which development could be promoted at home. Years in a program, or stability, was positively associated with better outcomes. Positive outcomes were often largest for those who had been in the programs longer, and had entered at an earlier age (Loeb et al., 2007).

Language and early literacy development should be at the heart of all high-quality preschool curricula. It is clear that struggles with literacy occur early on, and that difficulties with early literacy in preschool and kindergarten are associated with reading difficulties in later elementary years (Scarborough, 1998; Beauchat et al., 2009). As is the focus in much educational philosophy currently, this is a situation that calls for a preventative approach. Very often the students who begin, and then continue on this trajectory of reading failure are those from low-SES backgrounds who enter early schooling experiences with limited literacy knowledge (Justice et al., 2005). Further, research shows that these skills are much easier to develop and build upon in the early
years, but become more stable and resistant to remediation as the students get older (Lonigan et al., 1998). Therefore, the preschool experience is an invaluable chance to impose emergent literacy skills on these children to ensure early success and increase the likelihood for positive outcomes in the future.

A review of 135 publicly-funded preschool programs revealed that, on the whole, the quality of literacy instruction is low (Justice et al., 2008). Although the instructional fidelity of language and literacy curricula was found to be very high, even after minimal training, this did not equate to high levels of quality, which is an important distinction. On the whole, teachers adhered almost flawlessly to the lesson plans and structured curriculum, but the instruction often lacked the necessary elements of quality. As measured by the researchers, high-quality instruction was characterized by frequent teacher-child conversation, clear intent to promote children’s use of language, open-ended questions, repetition or expansion of children’s responses, mapping of teacher’s actions and children’s actions with language, use of advanced or abstract language, intent to connect the concepts of written and oral language, and well-planned, sequenced activities with obvious goals (Justice et al., 2008).

The prospect of early education is an unmatched opportunity to affect life-long positive outcomes in a population of children at-risk for future failures, namely those children living in poverty. Such an improvement in outcomes could lessen the school readiness gaps between racial, ethnic, and economically-diverse groups, and serve as a tool for social mobility. Exemplary preschool programs depict the potential that high-quality intervention holds. Positive early experiences can improve cognitive and
academic performance, reduce years in special education, increase the likelihood of high school graduation, enhance social skills, reduce crime, teen parenthood, and dependence on welfare and other governmental programs, and increase future earnings (Barnett, 1995; Barnett & Belfield, 2006; Blair & Razza, 2007; Burchinal et al., 1997; Diamond et al., 2007; Magnuson & Waldfogel, 2005). However, many of the programs currently available to low-income families are of lower quality and result in fewer, less significant, and impermanent positive outcomes. Further, current public programs serve only a small percentage of the eligible low-income population. The serious discrepancy between the great potential of early intervention and its mediocre condition within the United States calls for immediate reform.

**Head Start.** Despite the fact that preschool programs, in general, have been shown to contribute to an increase in positive outcomes, particularly for low-income students, the reputation of Head Start, the country’s largest and best-funded, aside from public special needs preschool programs, preschool effort has recently been deteriorating due to multiple reports indicating its wide-scale failure to produce large and sustained effects. Still, some research, most of it older, has found substantial benefits for children participating in Head Start during their years of attendance and immediately following. Head Start was shown to improve future attendance for its children, and reduce the probability the child would be placed in special education or other remediation programs (McKey et al., 1985). When tested at age six, children who had previously attended Head Start scored better on measures of vocabulary and reading than their siblings who did not attend preschool (Currie & Thomas, 1995).
A recent report from the U.S. Department of Health and Human Services (2010) examined the current impact of Head Start attendance, also considering the age of entry. Factors such as cognitive skill, social-emotional development, health status and parenting practices were examined. For children entering the program at age four, gains were observed in the areas of language and literacy. Higher scores were noted in vocabulary, letter-word identification, spelling, letter naming, parent-reported emergent literacy, as well as color identification. Improvement in dental care was also noted. For the cohort entering Head Start education at age three, more wide-ranging gains were found. In addition to the language and literacy gains attributed to the four-year-old cohort, this group showed improvements in perceptual motor skills, pre-writing, applied mathematical problems, and decreases in hyperactive behavior, and withdrawn behavior. Broader health benefits and improved parenting practices were also observed. It seems an appropriate inference that earlier entrance into Head Start is necessary in order to reap substantial benefit.

Another study found that Head Start attendance was associated with improved cognitive development, social competence, and reduced attention problems (Zhai, Brooks-Gunn, & Waldfogel, 2011). But, however significant improvements are at the end of the Head Start experience, these gains do not withstand time. One study found that most gains disappeared by the end of the child’s first grade school year. Compared to the control group, the four-year-old cohort maintained an advantage in vocabulary and the three-year-old cohort still outperformed in the area of oral comprehension. Some health and parenting improvements remained as well (U.S. Department of Health and Human Services, 2010).
Services, 2010). Certain subgroups, specifically dual-language learners and children with lower skills at entry, demonstrated broad gains that persisted through the end of first grade. However, any substantial advantage in the cognitive or social-emotional domains was lost for the vast majority of Head Start students.

Head Start was initiated in the mid-1960s as part of President Lyndon Johnson’s “War on Poverty” (Magnuson & Waldfogel, 2005). For the past forty years, additional monies have continually been added to the mission as awareness of the importance of early education and of social inequalities grows. Funding increased from $735 million in 1980 to $6.2 billion in 2001 (Schweinhart et al., 2005). Currently it is just over $7 billion. Due to the findings from recent and large study by the U.S. Department of Health and Human Services, many have begun to question whether the minimal return in benefits is worth the extensive costs.

Perhaps there is a need to improve the quality and efficiency of the general Head Start intervention. Studies have revealed only modest initial benefits and nearly nonexistent long-lasting effects. Compared to other programs, if often appears that Head Start functions inadequately. Reviews of other programs, namely the High Scope Perry Program and the Carolina Abecedarian Program, conclude that intensive preschool programs targeted at low-income students can produce significant, wide-reaching, and lasting effects (Barnett, 1995; Barnett et al., 2004; Campbell et al., 2002; Epstein, 2007; Hohmann et al., 2008).
Phonological Awareness

Reading skill and subsequent reading motivation are established early in a child’s life, often before they even begin school (Morgan, Fuchs, Compton, Cordray, & Fuchs, 2008). Only 5 to 10% of readers who demonstrate success with early literacy skills ever experience trouble later on, whereas between 65 and 75% of those who struggle early on continue to have problems with reading throughout their entire school career (Scarborough, 2002). If early reading struggles destine a child for a career of reading struggles, the obvious response would seem to be one of prevention and early intervention. As efforts to revitalize our education system mature, with preschool and early intervention at the forefront, a strong emphasis on emergent literacy skills needs to be made. The broad topic of emergent literacy involves many prereading skills and extends to a wide range of other skills. However, exclusively, the relationship between phonological awareness and emerging reading skill has been shown to be causal in nature (Bradley & Bryant, 1983) and therefore warrants significant attention and efforts to develop this awareness in young children. Phonemic awareness, due to its status as the most advanced of the component phonological awareness abilities, should be particularly coveted.

Phonological awareness is the understanding that spoken words can be broken down into smaller and smaller units, or conversely, that a spoken word is a blend of individual sounds, such as syllables, onset-rime patterns, and phonemes (Goswami, 2002; Paris, 2011; Stahl, 2002). Further, it is the conscious awareness of and reflection on these sounds, and the ability to manipulate them (Anthony & Lonigan, 2004). Children are
observed to grasp phonological awareness when they successfully perform tasks such as blending, segmentation, and deletion/elision detection (Stahl, 2002).

Recently, some have proposed that *phonological awareness* is an inaccurate title, and *phonological sensitivity* is more appropriate because conscious awareness is not always required when decoding text (Paris, 2011). Stanovich (1992) first proposed the idea of the distinction, but did not use the new term to replace phonological awareness. Rather, Stanovich suggested that phonological sensitivity be used to describe a broader set of capacities dealing with sensitivity to speech sounds, whereas phonological awareness be reserved for the ability to manipulate phonemes in words.

Additionally, the debate regarding this ability stretches beyond labeling and asks whether this is a unitary ability, or a combination of many abilities (Burgess, 2006). Because phonological awareness is demonstrated by a variety of tasks such as rhyme recognition and phoneme deletion, and because these skills develop at different rates and have different relationships to later reading ability, it is questionable whether the ability to perform each comes from a centralized mechanism, or from separate ones.

**Development of phonological awareness.** As phonological awareness ability progresses, a child moves from being able to detect larger units such as syllables and full words, to being able to detect smaller ones such as phonemes (Stanovich, 1992). Between the ages of three and five, phonological awareness development is largely variable. Prior to age three it is extremely limited, and after age five or six it becomes far more stable (Paris, 2011). Gillon (2004) asserts that this development, within the English language, follows a common trend. Typically-developing children learn to detect these larger units
before the smaller ones, can identify consonants before vowels, initial consonants prior to
medial or final consonants, and grasp rhyme before segmentation or blending. Other
research confirmed that children are competent in word-level skills before syllable-level
ones, followed by onset/rime skills, and finally master phoneme-level skills last (Anthony
et al., 2003). This study did find a few exceptions to this trend including that children
were able to blend syllables before they were able to blend words, and able to elide
phonemes before they were able to elide onsets. Of additional importance, this study
contradicted the idea that the stages of phonological development are temporally distinct,
and that one must be achieved prior to the next. Rather, Anthony et al. (2003) reported
that moderate levels of the next stage may be achieved prior to mastery of the current
stage. In other words, although the nature of the development follows a typical trend,
some concurrent skill acquisition also occurs.

One theory as to the agent that motivates the development of phonological
awareness is the lexical restructuring hypothesis (Metsala, 2011; Metsala & Walley,
1998). As it posits, a growing vocabulary functions as the catalyst for phonological
awareness development. When a child possesses only a small number of words in his
vocabulary, it is simple for him to discriminate between them because they are very
different from each other. He may recognize them by the sound of the entire word, or its
syllables. But an expanding vocabulary is bound to contain similar-sounding words, and
the child must then learn to discriminate between them in terms of smaller and smaller
units. In other words, there becomes pressure to represent the “segmental phonology” in
his head. As vocabulary and phonological awareness grow, it demands that the mental
lexicons be restructured (Burgess & Lonigan, 1998). Goswami (2002) also discusses the concept of “neighborhood density.” Dense phonological neighborhoods are those that contain many similar-sounding words, whereas sparse phonological neighborhoods do not. Children are better at determining rimes within the dense neighborhoods because these words are most common and children are most familiar with these rimes.

In contrast to the lexical restructuring hypothesis, the psycholinguistic grain size theory (Ziegler & Goswami, 2005) posits that not all learning of phonological awareness can stem from oral language and growing vocabulary, but rather requires direct literacy instruction as well. Additionally, this suggests that an orthographic component is necessary for an understanding of phonological segments. Some research has supported this theory. Knowledge of letter-phoneme correspondence was shown to be a significant predictor of the rate of acquisition of word-blending skills, whereas a growth in semantic knowledge (i.e., vocabulary) did not influence this growth (Wise, Sevcik, Morris, Lovett, & Wolf, 2007).

Preliminary knowledge of letters and other print concepts has been demonstrated to have a bidirectional relationship with phonological awareness development (Burgess, 2006; Wagner, Torgeson, & Rashotte, 1994). An experimental study working with preschool children in Brazil investigated the manner in which phonological awareness aids in the development of letter-sound relationship knowledge (Cardosa-Martins, Mesquita, & Ehri, 2011). In this study twenty children were taught letter names. The experimental group was also tutored in how to organize words by rhyme and alliteration, whereas the control group sorted the words according to semantics. Results indicated that
training in phonological awareness skills, in combination with teaching letter names, added a unique contribution and enabled struggling preschoolers to learn letter sounds more quickly. Children are usually better able to make these connections when a letter’s name and sound are phonologically related (Treiman, Tincoff, Rodriguez, Mouzaki, & Francis, 1998). In other words, these connections are clearer in cases where the letter name sounds like its sound.

Early experiences with language and literacy affect the development of phonological awareness as well. Burgess (2006) identifies these exposures as related to SES, home language, and home literacy environments. Research has demonstrated closer associations between early phonological awareness skills and more direct, proximal factors such as shared reading experiences, and exposure to an oral language-rich home environment, more so than with the more distal variables such as SES, magazine subscriptions in the home, parental reading behavior, and others (Burgess, 2002; Senechal et al., 1998). The evidence relating shared reading experiences to phonological awareness development is mixed, but much research attributes at least a minimal association between the two, particularly when shared reading experiences include dialogue and active participation from the child (Senechal et al., 1998). Additional research has pointed to the conclusion that alphabet books are more instrumental in promoting phonological awareness than are other books (Burgess, 2006).

Phonological awareness contributes to reading development, but reading development also facilitates phonological skills. Similarly, as mentioned, the relationship between phonological awareness and letter name-learning is also reciprocal. The power
and importance of phonological awareness as a tool to promote reading and spelling development and ward off reading and written language disabilities has repeatedly been delineated in the research. However, this ability does not work alone in facilitating linguistic maturity as children must not only be able to detect phonemes heard in speech, but must be able to connect them to print, and graphemes, as well. In conjunction with phonological awareness, competency in terms of the orthographic demands of reading, specifically knowledge of letter-sound correspondence is required for proficient reading. Similar to the dense/sparse phonological neighborhoods discussed previously, dense and sparse orthographic neighborhoods also exist (Goswami, 2002). Dense orthographic neighborhoods are those that contain words with common rimes, which are spelled the same as each other. Thus, strong phonological awareness skills, and knowledge of these common rimes, will help a child both read and spell.

Confirming the typical phonological awareness developmental trajectory, and the processes that facilitate the progression, is important for informing assessment and identification of disabilities, and in designing appropriate instruction and intervention. In order to select lessons that account for a young child’s current skill and challenge him or her just above that, we must know what comes next. Based on the research of Anthony et al. (2003) the development of individual phonological skills overlaps, and interventionists must not require mastery of one skill before progressing on to the next. Understanding the intricacy of this development, along with identifying valid and reliable measures to assess it, will provide a solid base from which effective interventions can develop.
**Phonological awareness as a predictor of reading and spelling abilities.**

Although between 65 to 75% of those who struggle early on continue to have problems with reading throughout their entire school career, only 5 to 10% of readers who demonstrate success with early literacy skills ever experience trouble later on (Scarborough, 2002). According to Bradley and Bryant (1983), phonological awareness is the only reading ability for which a causal relationship between it and future reading achievement has been established. Bradley and Bryant’s study, conducted more than twenty-five years ago, assessed a large group of children’s phonological awareness skills before they were able to read, and then compared these scores with their reading and spelling progress over the following four years. Intensive training in sound categorization was also given and its effects were monitored. The researchers concluded that early struggles with rhyme and alliteration are predictors of later reading and spelling difficulties. Due to the experimental nature of their study, a causal relationship between these early abilities and future achievement was deduced. Offering support to their work, other research has shown that even after controlling for IQ, vocabulary, memory abilities, and socio-economic status, children who are able to detect phonemes and rhymes learn to read faster than those who cannot (Bryant, MacLean, Bradley, & Crossland, 1990).

Phonological awareness has been shown to have an important role in emerging reading skill, but which component skill is truly the strongest predictor of future reading and spelling ability can be questioned. Specifically, does awareness of the larger units of spoken words (i.e., onsets and rimes) demonstrated through recognition of rhyme and alliteration, or awareness of the smallest units (i.e., phonemes) have greater effects? As
mentioned, Bradley and Bryant (1983) concluded that awareness of onsets and rimes, as evidenced by performance on alliteration and rhyme tasks, was the most valuable predictor of later reading and spelling, more so than phonemic awareness. Others who support this claim suggest that onset-rime awareness is most critical, and awareness of phonemes only comes about after reading development is well underway, more as a byproduct than an instigator (Goswami, 1993).

Bryant et al. (1990) investigated three theories of the relationships between rhyme recognition, alliteration recognition, and phonemic awareness. The first hypothesis, as articulated by Goswami (1993), suggests no connection between ability to detect rhyme and alliteration, and subsequent ability to detect phonemes. Here, later reading development should be much more strongly related to phonemic skills than rhyme and alliteration detection, given that reading skill would function as a precursor to phonemic awareness; phonemic awareness, according to this theory, will only develop after formal instruction. The second hypothesis considered by Bryant et al. suggests a linear quality to the developmental progression of phonological awareness skills. Understanding of rhyme eventually develops into an understanding of the smaller phonemic units, which ultimately facilitates reading ability. Therefore, rhyme affects reading development indirectly, via phonemic awareness. The third model of this relationship suggests a more direct connection between rhyme and reading development. It states that both rhyme detection and phonemic awareness contribute to reading skill, albeit separately. Phonemic awareness, again, aids in a comprehension of the alphabetic principle and application of letter-sound correspondence knowledge. Within this hypothesis, rhyming skill contributes
uniquely to reading development by helping children identify the common rimes in words, and thus apply their knowledge of rime spellings in certain words to new words containing those same rimes.

Bryant et al. (1990) found confirmation for both the second and third hypotheses offered above. Their results indicate that early rhyme detection contributes to later phonemic awareness, which then has a direct, and strong, influence on reading ability. This supports the second hypothesis and the idea that phonemic awareness is the strongest, and most proximal contributor. However, researchers also found a relationship between alliteration and rhyme sensitivity that was independent of phoneme awareness. They infer that this confirms the third hypothesis and that, distinct from their ability to detect and manipulate phonemes, children’s proficiency with rimes helps them read unfamiliar words. This research offered no support for the idea that a connection between alliteration/rhyme detection and phoneme detection is nonexistent. Further, it admonishes the notion that formal reading instruction is in fact a necessary precursor to phoneme detection abilities.

Additionally, Hulme et al. (2002) conducted a study to compare the abilities of onset-rime awareness and phoneme awareness to function as predictors of later reading skill. Phonological awareness skills were measured by a Detection task, an Oddity task, and a Deletion task. The Detection task required the child to identify, from the words provided, a nonword that sounded like the stimulus word. For Oddity, the task was similar to that used by Bradley and Bryant (1983) and asked the children to identify the one word out of three that did not begin/end with the same sound as the other two. And
finally, for the Deletion task children were required to remove either a phoneme, onset, or rime from a presented word and then say what was left. Researchers concluded that phoneme awareness, but not onset-rime awareness, serves as a strong predictor of both simultaneous and longitudinal reading skills. Onset-rime awareness was a weak predictor, and once its shared variance with phoneme awareness was factored in, its effect was negligible (Hulme et al., 2002).

The importance of phonemic awareness should be made clear when selecting reading interventions due to the greater gains that can be reaped from an emphasis on phonemes, rather than onsets and rimes. A study conducted by Muter, Hulme, Snowling, and Taylor (1997) argues that phonological awareness consists of component skills, and that phoneme segmentation is the component skill with the strongest predictive ability. Using factor analysis, Muter et al. (1997) determined two separate and independent components of phonological awareness, namely rhyming and segmentation. Tasks that involved rhyme identification and rhyme production fell under rhyming, and segmentation included tasks requiring phoneme identification and phoneme deletion. This analysis further confirms the idea that phonological awareness is not a unitary construct, but rather one made up of component skills. The researchers were also interested in the predictive power of these components and their results indicated segmentation, measured when children were prereaders, to be the strongest predictor of reading and spelling ability at the end of first grade. It continued to predict spelling ability in second grade, but not reading ability. At the end of second grade, Rhyming gained some predictive power over spelling only, but still less than segmentation. Also,
factoring in the additional impact of children’s letter knowledge with segmentation skill greatly increased its predictive power for spelling achievement, and moderately so for reading.

Scarborough (1998) summarized the correlational analyses of several studies, and determined that phonological awareness remains the only variable for which a causal relationship with future reading ability has been demonstrated. It makes theoretical sense that phonological awareness is necessary for children to begin to learn the alphabetic principle. That is, children must have an understanding that words are made up of phonemic segments before they begin to understand that printed letters represent these segments. Theoretically, children, as well as adults, who struggle intensely with reading fail to make this connection. Phonological awareness’s causal property is also exhibited by the outcomes of training in the recognition of and ability to manipulate the segments of spoken words. Such training has shown to increase achievement for struggling readers (Torgesen, Wagner, & Rashotte, 1997). Scarborough (1998) also concluded that phonological awareness was found to be a better predictor of future success in reading than of future failure. This is because it is unlikely that those who have very strong literacy skills early on will later falter, but it is fairly common for early strugglers to catch up and be fine in the future. Testing preschool age children, or children at the start of kindergarten largely evaluates the children’s previous exposure to literacy, language, and phonological tasks, not necessarily an underlying mechanism.

The role of phonemic awareness in learning to read. Phonemic awareness is a strong predictor of children’s future reading ability. When phonemic awareness was
assessed at the start of kindergarten, and then reading ability measured at the end of kindergarten, a correlation of $r = 0.66$ was found. Phonemic awareness at the start of kindergarten correlated $r = 0.62$ with reading ability in first grade (Jorm, Share, Maclean, & Matthews, 1984). These relationships were stronger than that of later reading ability and any of the following at the start of kindergarten: memory for sentences, vocabulary, father’s occupational status, parental reports of reading to children, and TV watching.

Phonemic awareness has an integral role in reading development for several reasons. The English language is alphabetic and therefore to read English, one must be able to match up phonemes and graphemes (i.e., the alphabetic principle). This is difficult, however, because individual phonemes are not segmented clearly in spoken language, but rather are co-articulated. Learning to identify the individual phonemes within words is best accomplished through explicit instruction of the system (Ehri et al., 2001). An understanding of the system aids the child’s comprehension of the alphabetic principle as he or she begins to understand that printed letters represent phonemic segments.

The greatest contribution of phonemic awareness to reading skill is through decoding. Word decoding, a fundamental skill of reading, is essentially the act of phoneme blending. To decode, the reader must look at each grapheme, associate it with its phoneme, and after this is done for each letter, all phonemes must be blended together to read the word as a whole. In addition to decoding skill, sight word reading demands phonemic awareness as well. To read a word from sight, a reader must match up the
phonemes and graphemes and have those relationships stored in memory to be retrieved and applied when that word is encountered (Ehri et al., 2001).

**Early phonological awareness instruction and intervention.** A review of the research reveals that early phonological awareness is an integral precursor to the development of early literacy. Phonological awareness enables component skills such as the detection and manipulation of rhyme, alliteration, and individual phonemes. Although many other skills are necessary as a young child learns to read, this ability is the only one that has a demonstrated causal relationship with subsequent reading performance. But despite its importance, many children are entering formal schooling with minimal early literacy knowledge and skill. Early struggles in reading often place a child on a trajectory, bound for reading failure throughout their schooling career. For this reason, early reading instruction and intervention, targeting phonological awareness, and more specifically phonemic awareness, is vital. Many studies have demonstrated that phonological awareness is not an immutable ability, and instead training programs can lead to significant improvements. It is necessary that these effective training programs be identified, promoted, and utilized in early intervention situations, particularly with at-risk children.

The National Reading Panel (NRP) conducted a meta-analysis to evaluate the effects of phonemic awareness instruction on children’s reading and spelling skills. The most effective instruction included letters, only involved instruction in one or two phonemic awareness skills rather than multiple, was taught in small group rather than individually or whole class, and when total instruction time last between five and
eighteen hours, not longer (Ehri et al., 2001). However, results of individual studies debate the usefulness of inclusion of letters, often advocate the benefits of individual instruction in phonemic awareness, as opposed to small group, and suggest training in one or more phonemic awareness skills as part of a larger, or multi-tiered program.

Brady et al. (1994) conducted a phonological awareness training intervention with urban kindergarten classrooms and achieved favorable results. Four classes participated; two in the experimental condition and two as controls. The intervention spanned eighteen weeks and consisted of phases that addressed phonological awareness above the level of the phoneme (e.g., rhyming, segmentation, etc.), isolating the phoneme (e.g., articulation activities), and representing the internal structure of the syllable (e.g., blending). Intervention sessions were conducted for twenty minutes at a time, three times each week. Assessment was taken at the beginning of kindergarten and again at the end. A third data point was also collected as follow-up in first grade. Results indicated improved phonological awareness and increased likelihood for promotion to first grade for the students in the experimental group. Compared with the control group, the children in the experimental group performed significantly better on rhyming and segmentation tasks at the end of the kindergarten year. In the fall of the kindergarten year, the vast majority of children could not supply a rhyme. By spring, all but one in the experimental group could provide a rhyme, whereas only 43% of those in the control group could. Positive outcomes were found for all children in the experimental group, regardless of previous ability. This suggests that children with lower IQs, or who have multiple risk factors, can benefit from phonological awareness training as well. Additionally, 86% of
kindergarteners in the experimental group were promoted to first grade, whereas only 52% of those who did not receive the training were. Emergent literacy skills are at the heart of early schooling and play an incredibly significant role in children’s initial school experiences and success. This research suggests that early educators must place particular emphasis on phonological training.

A study conducted by Hurford et al. (1994) resulted in improvement of the phonological processing skills of struggling readers after intervention. This study looked at the effects on both those first graders who were classified as reading disabled solely due to poor reading skill (RD) and also those considered “garden variety” poor readers who were struggling in reading and also had lower intelligence scores (GV). The intervention employed consisted of training in syllabic discrimination and phonemic blending and phonemic segmentation. Students received the intervention two times per week for approximately twenty minutes per session over the course of twenty weeks. Results indicated that the intervention was equally beneficial for both groups of struggling readers, and both groups demonstrated significant improvement. The trained RD group even performed as well as, or better than, the nondisabled group on all aspects of the phonemic segmentation task. These findings offer support for early reading interventions that target phonological awareness skills. It is also important to note that the training was effective for all struggling students, regardless of intelligence level.

Often literacy is promoted in the classroom not through explicit instruction in phonemic awareness but rather through storybook reading, or shared storybook reading. Because reading books to children is a common and familiar early literacy experience
(Beauchat et al., 2009), it is usually a well-received style of intervention and is already occurring in the classroom, and the home. Children, by nature, enjoy stories and therefore storybook reading will likely be the first enjoyable, high-interest experience with literacy (Bus, 2002). However, simply reading a story to a child is not sufficient for promoting rapid growth of emergent literacy skills, including phonological awareness. Shared storybook reading occurs when an adult reads to a child and engages the child with the text through methods such as questioning, elaborating, and pointing out concepts of print. Storybook reading can be used as a tool for teaching many emergent literacy skills including phonological awareness. Experiences with shared storybook reading are associated with emergent literacy development and continuing reading achievement (Beauchat et al., 2009). This is true via both home literacy and classroom-based experiences.

However, storybook reading, even with intentional mediation by an adult, may still not be an adequate tool to enhance phonological awareness skill adequately, particularly for those vulnerable students at higher risk for reading difficulties. One study reported that phonological awareness skill was a stronger predictor of word decoding than storybook reading experiences (Bus & van IJzendoorn, 1999). Frijters, Barron, and Brunello (2000) determined a connection between home literacy experiences, and specifically shared reading with parents, and written language. However, they found that this relationship was mediated by phonological awareness. In other words, it is the manner in which those home literacy experiences foster phonological awareness growth that leads to written language outcomes. Children require a more advanced grasp of
phonological awareness to be able to gain sound-print knowledge from the passive nature of home literacy experiences, and to develop improved written language outcomes.

Additionally, this development must also be promoted with more direct, explicit techniques and instruction. Whereas language development is largely child-directed, high-quality literacy instruction is characterized by teacher-directed, explicit, and systematic instruction (Justice et al., 2008). Teachers must systematically structure their lessons and should name and make clear the properties of the alphabetic system. Their instruction should be purposeful, and they should effectively connect the decontextualized aspects of literacy to meaning and comprehension activities. This is important both for speed and efficiency – it is vital to boost these skills for lagging students quickly – and because these students who are struggling may have greater difficulty picking up the skills from implicit exposure, as evidenced by the fact they have not adopted the abilities from their everyday exposures to language and text (Justice et al., 2003).

Justice et al. (2003) compared the use of an adult-child storybook reading intervention to a second intervention that employed more explicit methods for teaching emergent literacy concepts to determine which had larger outcomes for the at-risk preschool population. Children in this study were considered at-risk due to oral language delays and low SES backgrounds. Results revealed that the experimental intervention was successful at creating significant growth in both written language awareness and phonological awareness over the 12-week treatment period. The largest growth was observed in the areas of phonological segmentation, rhyme production, as well as
alphabet knowledge. Some gains were noted for the storybook intervention/comparison group, although they were more modest, and only significant for phonological segmentation. Additionally, researchers found that individual characteristics of the preschoolers affected the impact of the intervention. Higher oral language ability and a stronger orientation toward literacy (e.g., more interest and motivation) were associated with larger gains. This study highlights the potential benefit of preschool literacy interventions, while stressing the need for these interventions to include explicit components.

To summarize, early literacy development should be the central focus of all preschool curricula, and other early intervention efforts. It is clear that struggles with literacy occur early on, and that difficulties with early literacy in preschool and kindergarten are associated with reading difficulties in later elementary years (Beauchat et al., 2009; Scarborough, 1998). The importance of early phonological awareness skills is undeniable as both an indispensible causal factor and moderate predictor of later reading ability. Research shows that these skills are much easier to develop and build upon in the early years, but become more stable and resistant to remediation as the students get older (Lonigan et al., 1998). Very often the students who continue on a trajectory of reading failure are those from low-SES backgrounds who enter early schooling experiences with limited literacy knowledge (Justice et al., 2005; Wilkie, 1994). Therefore, the preschool experience is an invaluable chance to impose emergent literacy training on these children to ensure early success and increase the likelihood for positive outcomes in the future. Strategies and interventions must be developed to fill in
the gaps for these children in preschool and kindergarten. It is important that we identify these interventions and convey them to teachers working with young children so that they can be employed in their classrooms.

**Sound Boxes**

Sound boxes (also referred to as say-it move-it activities) have been used as a teaching tool used to promote phonemic awareness in children. First conceived by Elkonin (1963) in his work with preschool children, a sound box is a drawn rectangle, divided into a number of segments, which represent the number of phonemes in a particular word. Elkonin’s version, and many that followed, also supply an image of the word on the page above the sound box, such as a photo of a cat when segmenting the word “cat.” Use of the sound box involves stating the word, then asking the child to move a counter, such as a plastic token, into each segment as he or she articulates each of the word’s phonemes in the correct sequential order. This method helps the child attend to the individual phonemes by providing a concrete representation of each. Visually, the sound box symbolizes the individual phonemes and their relationship to each other to form the whole word.

Word boxes are an adaptation of sound boxes, which function much the same, but include the graphemes within the box. Lessons utilizing sound boxes and word boxes have been incorporated into the phonemic awareness development component of the Reading Recovery curriculum (Clay, 1993). These lessons consist of three phases. In the first phase, students are exposed to the sound box as described above, sliding counters to represent each phoneme, without acknowledging the corresponding grapheme.
Following, letter tiles are introduced and replace the counters. During this second phase, the appropriate letter tile is slid into its box as each phoneme is uttered. In the third phase, the child is asked to write each grapheme in its box as its sound is spoken.

Sound boxes and word boxes employ many empirically supported principles of effective teaching including concrete manipulatives, repeated exposures, modeling, opportunities to respond, corrective feedback, and reinforcement (Joseph, 2002a). In addition to their success as a component feature of larger reading programs (e.g., Reading Recovery), word boxes used in isolation have resulted in gains in reading and spelling skills for children with deficits in those areas (Joseph, 1998/1999). Additionally, children who received word box instruction outperformed children who were instructed with a more traditional phonics approach, or through the use of word sorts (Joseph 2000b; Joseph 2002a; Maslanka & Joseph, 2002).

The effectiveness of sound and word boxes has been demonstrated with preschool children (Elkonin, 1973; Maslanka & Joseph, 2002) and children in elementary school (Ball & Blachman, 1991; Joseph, 1998/1999, 2000a, 2002a; Keesey, 2012), as well as with students in high school (Devault & Joseph, 2004). After implementation of an intervention, which combined use of word boxes with repeated readings, Maslanka and Joseph (2002) concluded that this technique showed promise for increasing reading fluency levels of high school students with severe reading delays. Additionally, Keesey (2012) demonstrated a functional relationship between word box instruction and improvement on making letter-sound correspondence and spelling words, and improved performance on phonemic segmentation task for kindergarten and fifth grade students.
In the majority of studies, the use of sound and word boxes has been examined when implemented in a one-on-one or small group environment. However, Joseph (2000a) provided evidence that these techniques are also effective when applied within a whole-class context. In Joseph’s study, a first grade class instructed using word boxes significantly outperformed a class taught using a traditional phonics approach on outcome measures of word identification and spelling.

Although often discussed as minor variations of a single technique, the differences between sound boxes and word boxes are worthy of consideration. The incorporation of graphemes into phoneme segmentation training (e.g. word boxes) has been argued to confuse children who have not yet acquired phoneme segmentation (Lewkowicz, 1980; Roberts, 1975). Contrary to this, Hohn and Ehri (1983) concluded that during a phonemic segmentation task, kindergartens who used letter tokens outperformed kindergarteners who completed the task with blank tokens. It was hypothesized that the letters aided in distinguishing between, and conceptualizing the different sounds. Through their research, Ball and Blachman (1991) determined that the greatest improvement in early reading and spelling skills was achieved when a sound box-like activity (i.e., say-it-and-move-it activity) was coupled with letter-sound correspondence training, compared to letter-sound correspondence training alone. Graphemes were added to the tokens gradually as the say-it-and-move-it activity intervention progressed, and as the children began to master letter-sound relationships. That is, word boxes should be reserved for use with children who have knowledge of letter sounds, whereas sound boxes are appropriate for children without a strong grasp of
letter-sound correspondence. Both serve as an integral component of training programs intended to make children aware that words can be broken into individual phonemes, and that each phoneme corresponds to an orthographic symbol. This knowledge is integral as young children begin to read.

Researchers have demonstrated the effectiveness of sound boxes and word boxes at improving the phonological awareness and subsequent reading and spelling skills of students of all ages (Ball & Blachman, 1991; Joseph 1998/1999; Keesey, 2012; Maslanka & Joseph, 2004), and many ability levels including students with mild mental retardation (Joseph, 2002a). Their use creates success when implemented as part of a larger reading program (Clay, 1993), through one-on-one or small group intervention, and through whole class instruction (Joseph, 2000a).

**Scaffolding and Prompt Fading**

Scaffolding is a well-planned, with intention, support structure that allows a child to complete a task he or she could not accomplish independently. The instructor determines the minimal amount of support necessary to make the child successful at a given task. This support is then gradually faded (i.e., prompt fading) with the anticipation that the skill will be internalized and the child will be able to accomplish the task independently (McGee & Ukrainetz, 2009). This method is often used with individuals who are low functioning, or to increase the frequency of a behavior that occurs rarely or is not present at all. Highly supportive prompts are used to elicit these behaviors initially, and then gradually faded as the improvement in the frequency or accuracy of the behavior is observed. Prompt fading continues until the behavior is performed independently. It is
effective in these cases because intense support can be offered at the outset, often in the form of modeling. The individual then merely mimics the behavior, or is required to exert little effort to complete it. As progress is made, prompts and supports can be faded, such that increasingly more is being required of the individual until ultimately he or she completes the behavior independently. To effectively employ scaffolding in instruction, the teacher must first determine what skills are missing and what skills are necessary for performing the ultimate task (McGee & Ukrainetz, 2009). He or she then must outline the steps required for the student to internalize the skills necessary to reach the final goal of independent performance (Ukrainetz, 2006).

Using a direct instruction method developed by Marchand-Martella, Slocum, and Martella (2004), researchers were able to increase the number of letters that were legibly written by participants with cognitive and physical delays (Park, Weber, & McLaughlin, 2007). A model, lead, and test approach was utilized and allowed verbal prompts and traceable lines to be faded as participants gradually acquired letter-writing skill. This method was also successful at teaching children with mental retardation to feed themselves using a spoon (Berkowitz, Sherry, & Davis, 1971). These children were in their preteen and early teenage years and had never successfully fed themselves. A series of seven phases were identified, with the first involving the aide physically guiding the child’s hand through the entire feeding process. On the second day, the aide guided the child’s hand until it was just inches below the mouth, requiring the child to complete the motion. After this was performed successfully for an entire meal the following phase was entered, with increasingly less guidance. The guidance was gradually faded and
ultimately the child was feeding himself independently. Results indicated that this behavior was maintained and still present at a follow-up several months later.

Just as prompt fading can be used to increase desired behaviors, it can aid in academic skill acquisition as well. Mayfield, Glenn, and Vollmer (2008) used prompt fading to effectively improve students’ ability to spell sets of words. A computer program was designed which stated a word to the student, presented that word on the screen, and required the student to type the word below, using the model. Subsequent prompts removed more and more letters from the model such that by the final trial, the student was required to spell the word from memory. This use of modeling, leading, and fading prompts resulted in quick acquisition of spelling skill for these students. On average, a student met the criterion for the twenty-word spelling list after ninety minutes of program use. Maintenance probes indicated that students did not decrease in spelling skill over time, after use of this program.

A comprehensive review of over 120 studies on the teaching of reading to individuals with cognitive disabilities concluded that the only reading interventions for which a strong base of evidence existed were those that employed systematic prompting and fading (Browder, Wakeman, Spooner, Ahlgrim-Delzell, & Algozzine, 2006). These interventions, in general, used prompting at the outset, supplying adequate instruction or modeling so that errorless learning could occur. Gradually, these prompts were delayed such that the student was given an opportunity to anticipate the correct answer. This time delay continued to increase until the student was consistently responding correctly. Browder et al. (2006) found that these types of studies were most commonly used to
teach sight word recognition, but could, and should, be utilized within instruction for a wider range of reading component skill.

Furthermore, scaffolding with the use of fading prompts has been shown to increase student engagement with complex reading tasks (Lutz, Guthrie, & Davis, 2006). Here, a scaffolding model was used which initially supplied a high level of support, and then faded rapidly as students grasped the task. This use of scaffolding was demonstrated to boost student engagement with a difficult task. That is, a task that could have resulted in frustration and failure instead was engaging and rewarding through use of a scaffolding approach. Alternatively, researchers found that a moderate and consistent level of scaffolding (e.g., supplying some support, permitting some autonomy/eliciting responses, providing feedback) was required to maintain student engagement with simple tasks. In this instance scaffolding was effective in fostering engagement with something mundane. Although students possessed the skills to complete the task, scaffolding of instruction was necessary to promote engagement. Researchers conclude that the design of scaffolding should be carefully planned and based on task complexity. Appropriate use of scaffolding can not only increase skill acquisition, but can result in heightened engagement as well.

McDowell (1982) argued against the overuse of prompting. When three groups of kindergarteners were given various levels of prompts (i.e., picture cues that corresponded to a target sight word presented on flashcards) – prompts that faded, prompts that did not fade, and no prompts – the group that received no prompts performed best, followed by the group whose prompts faded, on a test of word recognition. The group that received
continuous prompting performed poorest. Researchers concluded that because the picture prompts were never removed for this lowest performing group, there was never an opportunity for stimulus control to shift from the prompt to the printed word. Moreover, because the no prompting group and the fading prompts groups performed similarly, with no prompting slightly ahead, it was concluded that errorless practice at the outset is not necessary for skill acquisition. Rather, trial and error, with errors corrected by the instructor, appeared sufficient for skill improvement. In this study, however, the task was not of great difficulty and perhaps the support provided by the picture prompts was unnecessary. Intensive support provided as part of scaffolding instruction has been demonstrated to improve performance of difficult and complex tasks, that the student struggles to perform without support (Berkowitz et al., 1971; Browder et al., 2006; Lutz et al., 2006; Mayfield et al., 2008; McGee & Ukrainetz, 2009; Park, 2007). It is required though, in all uses of prompting, that prompts are gradually faded as performance improves so that stimulus control can transfer away from the prompt (McDowell, 1982).

Scaffolding is often employed as part of a scripted lesson (Coyne, Kame’enui, & Carnine, 2007). Although often conceptualized as mechanical and inappropriate for use with diverse learners by educators, scripted lessons can be advantageous (Gunter & Reed, 1997). Use of well-designed scripts guarantees that the student is being exposed to content that is complete and clearly explained (Cooke, Galloway, Kretlow, & Helf, 2011). Cooke et al. cites the manual from the Council for Exceptional Children (1987) and its emphasis on “model,” “prompt,” and “check” steps being incorporated into effective scripted lessons. The first of these steps, model, involves the teacher
demonstrating the task. Following, the teacher and student complete the task simultaneously (i.e., prompt), and lastly, the student completes the task independently (i.e., check). These three steps are hallmarks of effective instruction, and their use within a lesson script guarantees that the student receives the complete content, training in that content, and the instructions for demonstration in a clear, sequenced, scaffolded manner.

Scaffolding, with prompt fading, as an integral component of a scripted intervention lesson is particularly beneficial for children with emotional and behavioral disorders because it assures the child is being provided with an amount of information and preparedness required for them to complete the task (Gunter & Reed, 1997). This lessens the likelihood of the child becoming frustrated or avoiding the task due to its difficulty. Similarly, this method is appropriate for use with young children who may be less tolerant of frustration and who respond best to frequent successes. Adapting the intensity of support throughout all sessions of interventions to a level appropriate for the individual ensures minimal frustration, adequate preparedness, and an amount of challenge that prevents boredom.

**Current Study**

The current study intends to contribute to this literature by examining the use of sound boxes with preschool children from low-income backgrounds attending a Head Start program. Successful outcomes will further expand the range of potential uses for sound boxes, as part of a scripted, scaffolded intervention, and promote their use with a younger population. Positive outcomes would also combat the conception that phonemic awareness is too advanced a skill for preschool students. Teachers and other practitioners
need to be made aware of empirically supported strategies, such as sound boxes and word boxes, used as part of a scripted, scaffolded intervention, for promoting phonemic awareness.
Chapter 3: Method

This chapter describes the procedures employed during the execution of this study. Description of the process of obtaining research approval and the research design, and detailed information regarding the participants, study variables, and intervention is provided.

Institutional Review Board

Due to the nature of this study, approval from the Institutional Review Board (IRB) for Research with Human Subjects at The Ohio State University was required prior to the start of data collection. Following submission of necessary information, IRB approval was received for the procedures and forms described below.

Participants

The participants of this study consisted of four preschool children who attended a Head Start program in a large metropolitan city in the Midwest. Their families met the program’s income requirement for eligibility, generally at least 25% below poverty criteria, and are thereby considered at-risk for reading disability due to low SES. All children spoke English as their only language.

Participant demographic information, including age, gender, and ethnicity, is presented in Table 1. The participant’s age at the start of the study was recorded. All
participants, with the exception of James, intended to enter kindergarten at the end of the summer.

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Gender</th>
<th>Ethnicity</th>
<th>Bracken Letter Naming</th>
<th>Bracken Letter Sounds</th>
<th>GGG Picture Naming</th>
<th>GGG Rhyming</th>
<th>GGG Alliteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winston</td>
<td>4 years, 10 months</td>
<td>Male</td>
<td>African American</td>
<td>8.4</td>
<td>10</td>
<td>16</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>Mia</td>
<td>5 years, 2 months</td>
<td>Female</td>
<td>African American</td>
<td>6.7</td>
<td>25</td>
<td>14</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>James</td>
<td>4 years, 7 months</td>
<td>Male</td>
<td>African American</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Nolan</td>
<td>4 years, 7 months</td>
<td>Male</td>
<td>African American</td>
<td>4</td>
<td>22</td>
<td>16</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 1. Participant Demographic Information with Bracken and Get It, Got It, Go! Pre-Assessment Scores.  
Note. GGG = Get It, Got It, Go!

**Sampling procedure.** Parental permission was requested for all students in the classroom via a letter sent home, and also presented to parents by the researcher at school drop-off and pick up times (see Appendix A for parent consent form). Once permission was received, each child was considered for participation in the study based on prerequisite criteria including: a) age over four years, six months, b) performance on Bracken and Get It, Got It, Go! pre-assessment measures that indicated the presence of minimal yet emerging early literacy skills, and c) teacher recommendation of those children who possessed adequate attention skills such that they were likely to cooperate with the investigator, and who had strong attendance.

Two additional participants were recruited, but withdrew from the preschool program during pre-assessment data collection. In order to obtain a desirable number of participants, prerequisite criteria had to be loosened slightly. James was admitted to the
study without the presence of minimal early literacy skills (see Table 1).

**Setting**

Assessment, intervention, and data collection took place in a designated room, separate from the classroom and mostly free from noise and other distractions, at the preschool center, which also serves as a community center. This room was large and divided, by bookshelves, into several sections. The center coordinator’s desk was also housed in this space, but her occasional presence was unobtrusive. The researcher and participant sat at the same seats at a table, at adjacent sides of a corner, during each session. Data were collected over the course of three months, from June 4 until August 14.

**Experimenter**

The experimenter was a fourth-year doctoral candidate enrolled in the School Psychology program at The Ohio State University, and held a Master’s Degree in the field as well. She had previously served as the Special Services Coordinator at a charter school and, at the time of the study and for one-and-a-half years prior, served as a Mental Health Consultant at several Head Start centers in the Columbus, Ohio area. The researcher was the only interventionist and completed this study as partial fulfillment of the requirements for the Doctor of Philosophy in School Psychology degree.

**Pre-Assessments**

**Dynamic Indicators of Basic Early Literacy Skills – 6th edition.** The Dynamic Indicators of Basic Early Literacy Skills – 6th edition (DIBELS) is a set of measures used to assess and monitor early literacy skills, specifically phonological awareness and
alphabet knowledge (Good & Kaminski, 2002). The three subtests of the DIBELS include Letter Naming Fluency (LNF), Initial Sound Fluency (ISF), and Phonemic Segmentation Fluency (PSF). All three subtests were used as a pretest and posttest in this study. LNF requires a participant to identify as many letters as possible in one minute. ISF asks the participant to select the picture, out of four, that begins with a target sound. The PSF subtest requires the participant to segment words with three or four phonemes, presented orally, into their individual phonemes. Administering the alternate form probes of the LNF, ISF, and PSF subtests has resulted in reliability coefficients of .93, .72, and .88 respectively (Hintze, Ryan, & Stoner, 2003).

Get It, Got It, Go!: This screening assesses three key indicators of early literacy – vocabulary, rhyming, and alliteration – through three different tasks. During the first task, Picture Naming, cards from a set are presented for one minute to assess a child’s ability to quickly label items presented to him or her on the picture cards (i.e., vocabulary). A second set of cards requires the child to identify rhyming words (i.e., Rhyming). Each Rhyming card contains an image at the top, and three images at the bottom. The child’s task is to identify the image at the bottom that’s name rhymes with that of the top image. Similar to Rhyming, Alliteration cards contain an image at the top, and three images at the bottom. The child’s task is to identify the image at the bottom that’s name has the same initial sound as the word at the top. Scores for Picture Naming, Rhyming, and Alliteration are stable over time and test-retest reliability coefficients have been demonstrated to be .67, range from .83 to .89, and range from .46 to .80
respectively. Concurrent validity between the three measures and DIBELS LNF has been demonstrated as well (Missall & McConnell, 2004).

**Study Variables**

**Dependent variable.** The primary dependent variable was defined as performance on phoneme segmentation probes. Phoneme segmentation probes were administered during baseline and after each intervention session. Phoneme segmentation probes consisted of five items (see Appendix B for a copy of the probe). Each item consisted of a word that contained a consonant-vowel-consonant (CVC) sound pattern and all were identical to the words practiced during intervention. These probes were administered without any of the support structures present during intervention including modeling, leading, the sound box card, or corrective feedback. Following the intervention session, the experimenter stated, “Let’s say the words again.” Each word was read and the participant was asked to repeat the word back. Then he or she was instructed to “say the sounds” in the particular word. Data were recorded on accuracy of identification of initial, medial, and final phonemes. Five words were probed, each with three phonemes, so a maximum of 15 points could be achieved on each data collection probe for 100% correctly segmented phonemes.

Data on number of phonemes correct based on position within the word – initial, medial, final – was also collected. That is, a participant could receive five points for initial phonemes, five points for medial phonemes, and five points for final phonemes, given that each of the five words contained an initial, a medial, and a final phoneme. For
example, within the word “fan,” /f/ is the initial, /a/ is the medial, and /n/ is the final phoneme, with one possible point for each.

Lastly, data were collected on the number of words, out of five, for which the participant accurately segmented all three of its phonemes. For example, a participant may have correctly stated the /f/ as the first phoneme in “fan,” but may have incorrectly segmented the others, earning one point for an articulated initial phoneme. Or, the participant have correctly segmented the whole word - /f/ /a/ /n/, earning three points for phonemes, and one point for whole words (see Appendix B for the data collection probe).

The secondary dependent variable was defined as generalizing phoneme segmentation skill to words that were not directly taught in the intervention phases of the study. Specifically, children were asked to segment sounds of nonsense words, not taught during intervention. Each generalization probe consisted of five nonsense words randomly selected from a pool of 20 CVC nonsense words that contained both phonemes taught during intervention and novel phonemes. A generalization probe was administered after the final session of Phase 2-Intensive Support, after the final session of Phase 3-Moderate Support and after the final session of Phase 4-Minimal Support (see Appendices F – H for Generalization probes). Without teaching, modeling, feedback, or a support tool such as the sound box, each word was read and the participant was asked to say the sounds in that word. This method was identical to that used during administration of the data collection probes which followed each intervention session. Generalization data were collected on each participant’s ability to correctly segment phonemes.

**Independent variable.** The independent variable in this study is the sound box
intervention, which was used to teach, and ultimately improve, phoneme segmentation skill. This intervention included the sound box tool, a scripted procedure, and scaffolding with fading prompts. The support structures presented at the outset of the intervention, including modeling, leading, and corrective feedback, were gradually faded over time (i.e., scaffolding). These support structures were all present during the first phase of intervention. To begin, the experimenter stated the word, asked the participant to repeat it, then modeled use of the sound box as she segmented the target word into its three phonemes (i.e., modeling). As each phoneme was spoken, a plastic token was slid into the corresponding section of the sound box. Following, the participant was instructed to slide the tokens as he or she orally segmented the phonemes in unison with the experimenter (i.e., leading). Then, the participant was instructed to slide the tokens and segment the word independently. If successful, the participant was prompted to perform the independent task once more before moving on to the next word. If an error was made during the independent attempt, the experimenter again modeled the task, including use of the sound box while segmenting the word. The participant was then prompted to attempt the independent task again. This corrective feedback procedure was implemented until the participant completed the independent task successfully or a maximum of four times. These intervention procedures were employed for all five words during all interventions sessions. After each of the five words had been practiced according to these procedures, the participant and experimenter went through the procedures a second time. During this second run-through, the participant was only required to practice the independent segmentation task once, rather than twice. However, if an error was made,
the corrective feedback procedure was implemented until the participant completed the independent task successfully or a maximum of four times.

As a participant progressed through the phases of the intervention (i.e., *Phase 2-Intensive Support, Phase 3-Moderate Support, and Phase 4-Minimal Support*), the support structures faded gradually. Modeling and leading were first removed, and the sound box card and chips were eliminated last. Corrective feedback was always supplied, throughout all phases of intervention, when errors were made during independent segmentation attempts. The decision to move a participant onto the next phase, thereby reducing support structures, was based on his or her reaching a level of performance that indicated developmental readiness. That is, once a participant earned a number of high scores in a row, it was assumed that a reduced amount of support was appropriate.

**Materials**

**Sound box cards.** A laminated sound box card was used in *Phase 2-Intensive Support* and *Phase 3-Moderate Support*. A sound box is a drawn rectangle divided into a number of sections equal to the word’s number of phonemes (see Appendix D). All words used in this study contain three phonemes and followed a CVC pattern. A plastic counter was placed under each section of the sound box. As a participant articulated each sound in the word, he or she slid the counter into its corresponding box. That is, for the word “fan,” the participant slid a chip into the first box as /f/ was articulated, slid a chip into the middle box as /a/ was articulated, and slid a chip into the last box as /n/ was articulated.
**Intervention script.** A script was created to ensure standardized administration of the sound box intervention, including all phases, generalization probes, and data collection (see Appendix E).

**Research Design**

A single-subject, multiple probe design (Horner & Baer, 1978), replicated across participants, was used to measure the effects of a sound box intervention on children’s phoneme segmentation performance. A multiple probe design was selected instead of a multiple baseline design to minimize the potential of participant fatigue and frustration if probes were administered over several sessions during baseline. Contrary to a multiple baseline design in which data points are collected continuously throughout baseline for all participants, in a multiple probe design baseline data is only collected for each participant periodically throughout baseline. This limits frustration, fatigue, and practice effects.

The multiple probe design is used to establish the reliability of the intervention’s effect across participants (Horner & Baer, 1978). In this study, experimental control was demonstrated when abrupt improvement in phoneme segmentation occurred after introduction of the intervention for each participant whereas performance of participants remaining in the baseline condition remained relatively stable. Verification was evident when predictions made according to changes observed in one participant were supported by the performance of the subsequent participant.

In a multiple probe baseline design across subjects, one behavior serves as the dependent variable and is evaluated for two or more participants in the same setting.
(Nullman, 2009). Once baseline data collected on this variable is stable, the intervention (i.e., independent variable) is administered, and data is collected to evaluate change in the outcome (i.e., dependent variable). In this study, effectiveness of the intervention is demonstrated by improvement in performance on the phoneme segmentation task for a participant receiving the intervention, whereas performance on this task remains low and stable for other participants remaining in baseline.

For this study, the multiple probe design is fitting and advantageous. After it is developed, phonemic awareness cannot be removed from a participant, and therefore a reversal design would not be possible. That is, it could not be expected that once implementation of the intervention ceases, learned phoneme segmentation skill would be lost. Additionally, sequential implementation of the intervention, as allowed by a multiple probe design, is desired and appropriate. Lastly, the multiple probe design is easily conceptualized, and visual depiction of its results is interpretable by even those unfamiliar with single subject research (Horner & Baer, 1978).

**Threats to Validity**

By using a multiple probe design in which each participant served as his or her own control, threats to internal validity such as confounding variables, history, and maturation are of no concern. Pretest was administered to assess any potential for selection bias. Assessing each participant in baseline immediately prior to beginning the intervention ensures that diffusion has not taken place between participants in the intervention phases and their peers still in baseline.
External validity is threatened by the design’s small sample size. It can only be concluded that the findings are representative of the four participants, and cannot be generalized to a larger population or to other children of different ages, SES backgrounds, or with other abilities or disabilities.

**Experimental Phases**

**Phase 1-Baseline.** In *Phase 1-Baseline*, baseline data were collected on the phoneme segmentation probes for all four participants during the first three sessions. A word was read and the participant was asked to segment it into its individual phonemes. Data were recorded on accuracy of identification of initial, medial, and final phonemes. Five words were probed, each with three phonemes, so a total of 15 points could be achieved at each data collection. Data on percentage phonemes correct based on position within the word – initial, medial, final – was also collected.

**Phase 2-Intensive Support.** In *Phase 2-Intensive Support* the sound box was implemented using modeling, leading, and corrective feedback. For each of the five words, the instructor first modeled use of the sound box by saying each phoneme while sliding a chip into its corresponding box. Following, the participant was prompted to slide a chip for each phoneme as the participant and the instructor said each phoneme together. Finally, the participant was prompted to complete the task independently. If an error was made during the independent attempt, corrective feedback was supplied. In these instances, the experimenter again modeled the task, including use of the sound box while segmenting the word. Following, the participant was prompted to attempt the independent task again. This corrective feedback procedure was implemented until the
participant completed the independent task successfully or a maximum of four times. These intervention procedures were employed twice for all five words during all sessions. After each of the five words had been practiced, the participant and experimenter went through the procedures a second time. After each of the five words had been taught twice, each was probed in the same manner as baseline data collection.

**Phase 3-Moderate Support.** In this phase, modeling and leading were removed. Corrective feedback and the sound box tool and chips remained. For each of the five words, the participant was prompted to slide a chip for each phoneme independently. Corrective feedback was provided, when necessary. After each of the five words had been taught twice, each was probed in the same manner as baseline and the other phases’ data collection.

**Phase 4-Minimal Support.** In this final intervention phase, the sound box tool was removed. The participant was prompted to say the sounds in each of the five words without the divided box or chips. Corrective feedback was still given, when necessary. After all five words had been taught twice, each was probed in the same manner as during baseline and the other phases’ data collection.

**Procedures**

To obtain parental permission, a letter formally requesting permission was mailed home to be signed and returned by the parent, child, or by U.S. mail (see Appendix A). During the week in which the permission packet was sent home, the researcher was present at the preschool center during drop-off and pick-up times so that parents’ questions could be answered. The researcher spoke with many parents to explain the
study’s goals and procedures, and to request permission for the child’s participation. After receiving permission, the researcher met with each selected participant individually to explain the requirement and gain assent (see Appendix E). The DIBELS was administered using standardized procedures as a pre-assessment measure to determine participants’ levels of phonemic awareness performance. Get It, Got It, Go! was also administered as a pre-assessment. This screening examines a child’s ability to identify rhyming words (i.e., Rhyming) and to match consonant sounds in the initial position of words (i.e., Alliteration). Get It Got It Go also assesses a child’s ability to quickly label items presented to them on picture cards (i.e., Picture Naming).

**Phase 1-Baseline.** In this phase, baseline data were collected on performance on phoneme segmentation probes for all four participants during the first three sessions. After the first three sessions, participants were then randomly assigned to numbers 1 through 4 to minimize the potential to bias intervention effects. After the first three sessions, baseline data continued to be collected for the first participant until it stabilized. Once baseline data had stabilized for the first participant, the intervention was implemented for this participant.

**Phase 2-Intensive Support.** In this phase, the sound box intervention was implemented. Each of the five words was practiced a minimum of three times each session. The first time the word was presented, it was practiced on two consecutive trials before proceeding to the next word. If the participant was unable to successfully segment the sounds of the word on the second trial, the word could be practiced up to four total trials before moving on to the next word. After all five words had been practiced a
minimum of two trials each, a second run-through allowed each to be practiced at least one more time. If the participant was unable to complete the independent task for a word after it was practiced once during the second run-through, the word could again be practiced up to four total times before moving on to the next word. After all five words had been practiced a sufficient number of times according to the above criteria, phoneme segmentation probes that mirrored those administered during baseline phase were administered. This procedure was consistent for all participants.

When the first participant’s performance on probes in Phase 2-Intensive Support had demonstrated the intervention’s effect (i.e., three consecutive data points of an upward trend), the second participant was again probed in Phase 1-Baseline for two consecutive sessions, or more if the two points were unstable. When stable, the second participant entered Phase 2-Intensive Support. At this time, all participants remaining in baseline were probed again. When the second participant’s performance on probes in Phase 2-Intensive Support had demonstrated the intervention’s effect (i.e., three consecutive data points of an upward trend), the third participant was again probed in Phase 1-Baseline for three consecutive sessions, or more if the three points were unstable. When stable, the third participant entered Phase 2-Intensive Support. This procedure repeated for the fourth participant.

A participant exited an intervention phase, Phase 2-Intensive Support, Phase 3-Moderate Support, and Phase 4-Minimal Support, when he or she had met the set criterion level for mastery for probes during that phase (i.e., three sessions in a row, each with 80% or greater of total phonemes correctly segmented). This progression
continued for all participants through the three phases of gradually fading support structures.

A generalization probe was administered at the end of the third consecutive session in which the participant achieved the mastery criteria of 80% or greater phonemes identified, within each phase. That is, a generalization probe was administered after the final session of Phase 2-Intensive Support, after the final session of Phase 3-Moderate Support and after the final session of Phase 4-Minimal Support. Each generalization probe consisted of five nonsense words randomly selected from a pool of 20 CVC nonsense words that contained both phonemes taught during intervention and novel phonemes. Without teaching, modeling, feedback, or a tool such as the sound box, each word was read and the participant were asked to say the sounds in that word (see Appendix D for generalization probe scripts). Data were collected on the accuracy of the participant’s identification of initial, medial, and final phonemes (see Appendices F-H for generalization probe data collection).

**Procedural Integrity**

Procedural integrity data were collected to ensure the intervention was implemented with a satisfactory level of fidelity. These data were collected for 17% of intervention sessions and data collection probes. During intervention, a graduate student trained in intervention and data collection indicated a checkmark for each line of the intervention script correctly implemented. The number of lines correctly implemented was divided by the total number of lines to calculate a mean adherence to the script.
During data collection, a graduate student trained in intervention and data collection indicated a checkmark for each line of the intervention script correctly implemented. The number of lines correctly implemented was divided by the total number of lines to calculate a mean adherence to the script.

**Inter-observer Reliability**

Inter-observer agreement (IOA) was calculated for the words probed during data collection, and generalization probes to ensure accurate scoring of data. A graduate student trained in intervention and data collection scored 17% of the words probed during data collection, and 25% of the generalization probes, indicating participants’ responses on a separate, identical data collection sheet. Scores from the experimenter’s and second rater’s data collection sheets were correlated to ensure Inter-observer reliability above .90. Items from data collection probes were analyzed for IOA using the following point-by-point formula: number of agreements divided by the sum of agreements plus disagreements, multiplied by 100. Generalization probe items were analyzed for IOA using the following point-by-point formula: number of agreements divided by the sum of agreements plus disagreements, multiplied by 100.
Chapter 4: Results

This chapter presents results of the study, which examined the effect of a sound box intervention on four preschoolers’ phoneme segmentation skill. To begin, inter-observer agreement and procedural integrity data are reported. Following, results illustrating the effect of the sound box intervention are described for each participant, including change in level and trend after introduction of the intervention. Additional results outlining participants’ performance on sound positions, individual phonemes, and whole words are provided. This chapter concludes with generalization data and a comparison of pre- and post-test performances on DIBELS and Get It, Got It, Go! measures.

Procedural Integrity

Procedural integrity data were collected to ensure the intervention was implemented with a satisfactory level of fidelity. These data were collected for 17% of intervention sessions and data collection probes.

Intervention procedural integrity. During intervention, a graduate student trained in intervention and data collection indicated a checkmark for each line of the intervention script correctly implemented. Mean adherence to the script was 98% (range: 95–100%).

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**Probe procedural integrity.** During data collection, a graduate student trained in intervention and data collection indicated a checkmark for each line of the intervention script correctly implemented. Mean adherence to the script during data collection was 99% (range: 98–100%).

**Inter-observer Agreement**

Inter-observer agreement (IOA) was calculated for the words probed during data collection, and generalization probes. A graduate student trained in intervention and data collection scored 17% of the words probed during data collection, and 25% of the generalization probes.

**Data collection.** Items were analyzed for IOA using the following point-by-point formula: number of agreements divided by the sum of agreements plus disagreements, multiplied by 100. The mean IOA for the data collection probes was 97% (range: 80–100%).

**Generalization.** Items were analyzed for IOA using the following point-by-point formula: number of agreements divided by the sum of agreements plus disagreements, multiplied by 100. The mean IOA for the generalization collection probes was 98% (range: 93–100%).

**Participants**

Four preschool children participated in this study. Participant ages, at the start of the study, ranged from four years and seven months to five years and two months. As evidenced by pre-assessment data, including performance on the Bracken Letter/Sound Naming subtest and three subtests of the Get It, Got It, Go! assessment, all participants...
possessed similar early literacy skill at the start of the study, with the exception of Winston’s relative strength in Rhyming. His score on this measure was 16, whereas other participants scored between four and five. Also, James could name no letters and no letter sounds (see Table 2).

Baseline data collected during Phase 1-Baseline was also similar across participants, and was stable, near zero, for all. Mia and James identified no phonemes on any Phase 1-Baseline probe. Winston and Nolan identified between zero and three phonemes on these probes, and averaged 1.4 and 0.8 phonemes respectively. All four participants demonstrated an increase in phonemic segmentation ability after introduction of the sound box intervention. For three of the four participants, all except James, improvement continued until each met the criterion for progression to the following phase, Phase 3-Moderate Support, in which the supports of the intervention began to fade. The number of intervention sessions required for the three participants to demonstrate the criterion performance during Phase 2-Intensive Support ranged from 10 to 14, with an average of 11.67 sessions.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Bracken Letter Naming</th>
<th>Bracken Letter Sounds</th>
<th>GGG Picture Naming</th>
<th>GGG Rhyming</th>
<th>GGG Alliteration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winston</td>
<td>8.4</td>
<td>10</td>
<td>16</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>Mia</td>
<td>6.7</td>
<td>25</td>
<td>14</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>James</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Nolan</td>
<td>4</td>
<td>22</td>
<td>16</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 2. Bracken and Get It, Got It, Go! Pre-Assessment Scores. 
*Note.* GGG: Get It, Got It, Go! Assessment.
**Intervention Effectiveness**

The effectiveness of the sound box intervention was evaluated using probes administered to each participant during Phase 1-Baseline and at the end of each intervention session (phases 2 through 4). Probes consisted of the same five words practiced during intervention. Participants were required to segment each word into its three phonemes. A total of 15 points could be earned on each probe for correctly identifying all 15 phonemes.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Phase 1-Baseline</th>
<th>Phase 2-Intensive Support</th>
<th>Phase 3-Moderate Support</th>
<th>Phase 4-Minimal Support</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( M )</td>
<td>( SD )</td>
<td>( m )</td>
<td>( M )</td>
</tr>
<tr>
<td>Winston</td>
<td>1.4 0.55 0.30</td>
<td>11.3 3.65 1.02</td>
<td>14.5 1.00 0.60</td>
<td>15 0 0</td>
</tr>
<tr>
<td>Mia</td>
<td>0 0 0</td>
<td>8.2 6.03 1.37</td>
<td>15 0 0</td>
<td>15 0 0</td>
</tr>
<tr>
<td>James</td>
<td>0 0 0</td>
<td>6.3 3.71 0.46</td>
<td>n/a n/a n/a</td>
<td>n/a n/a n/a</td>
</tr>
<tr>
<td>Nolan</td>
<td>0.8 1.03 0.02</td>
<td>8.64 3.83 1.05</td>
<td>13.4 0.55 0</td>
<td>14.7 0.58 0.50</td>
</tr>
</tbody>
</table>

Table 3. *Mean, Standard Deviation, and Slope Across Participants Within Each Phase Note.* \( M = \) mean, \( SD = \) standard deviation, \( m = \) slope.

**Visual analysis.** Graphs were created for visual analysis, and report the raw data.

Mean (\( M \)), standard deviation (\( SD \)), and slope (\( m \)) are reported in Table 3 for each participant, for each phase. The number of sessions each participant engaged in each phase, as well as score ranges for each participant in each phase, are reported in Table 4.

Examination of Figure 1 reveals that all participants demonstrated very low and stable phoneme segmentation skill during Phase 1-Baseline. Mia and James scored zero on all Phase 1-Baseline probes. Winston and Nolan scored between zero and three across Phase 1-
Baseline probes. All participants experienced improvement in segmenting phonemes in the five words probed after introduction of the intervention (Phase 2-Intensive Support). Improvement was immediate and abrupt for Winston and Nolan. Mia and James both required four Phase 2-Intensive Support sessions before improvement was visible. This growth continued as the intervention supports were faded (Phase 3-Moderate Support and Phase 4-Minimal Support). As illustrated by Figure 1, intervention effectiveness was demonstrated. Improvement on the phoneme segmentation task was observed by each as performance remained low and stable for participants who remained in Phase 1-Baseline while a participant was receiving Phase 2-Intensive Support.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Phase 1-Baseline</th>
<th>Phase 2-Intensive Support</th>
<th>Phase 3-Moderate Support</th>
<th>Phase 4-Minimal Support</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># of sessions</td>
<td>Range</td>
<td># of sessions</td>
<td># of sessions</td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td></td>
<td></td>
<td>Range</td>
</tr>
<tr>
<td>Winston</td>
<td>5</td>
<td>1 – 2</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Mia</td>
<td>7</td>
<td>0 (all)</td>
<td>14</td>
<td>0 – 15</td>
</tr>
<tr>
<td>James</td>
<td>11</td>
<td>0 (all)</td>
<td>22</td>
<td>0 – 12</td>
</tr>
<tr>
<td>Nolan</td>
<td>10</td>
<td>0 – 3</td>
<td>11</td>
<td>3 – 15</td>
</tr>
</tbody>
</table>

Table 4. Participants’ Number of Sessions and Range of Scores Within Each Phase
Figure 1. *Number Phonemes Correct Across Phases for All Participants*
**Winston.** For Phase 1-Baseline, Winston earned a mean score of 1.4, out of a potential 15 correctly identified phonemes. Five points of baseline data were collected during Phase 1-Baseline and indicated weak and stable performance. Baseline scores ranged from one to two. Winston’s mean score for Phase 2-Intensive Support, the phase in which the intervention was introduced, was 11.3. This was an increase of 9.9 points. An abrupt and rapid change in the data trend was observed, as depicted by Figure 2.

Slope of the line for Phase 1-Baseline was 0.30, but increased to 1.02 in Phase 2-Intensive Support. Winston’s mean score for Phase 3-Moderate Support was 14.5 (3.2 increase from Phase 2-Intensive Support). Fifteen was his mean score for Phase 4-Minimal Support (0.5 increase from Phase 3-Moderate Support).

![Figure 2. Winston’s Level for Each Phase and Comparison of Trend Between Phases 1 and 2](image)

**Mia.** For Phase 1-Baseline, Mia earned a mean score of zero, out of a potential 15 correctly identified phonemes. Seven points of baseline data were collected. All scores
were zero, demonstrating stable and very poor performance during baseline. Her mean score for Phase 2-Intensive Support, the phase in which the intervention was introduced, was 8.2. This was a sizeable gain of 8.2 phonemes identified correctly, indicating a significant change in level as depicted by Figure 3. The data trend increased greatly after the fourth session of intervention. The slope in Phase 1-Baseline was 0 and increased to 1.37 in Phase 2-Intensive Support. Mia’s mean score for Phase 3-Moderate Support was 15 (6.8 increase from Phase 2-Intensive Support) and 15 for Phase 4-Minimal Support. She mastered the task by the time she entered Phase 3-Moderate Support, obtaining perfect scores, and maintained that level of performance during Phase 4-Minimal Support.

Figure 3. Mia’s Level for Each Phase and Comparison of Trend Between Phases 1 and 2

James. For Phase 1-Baseline, James earned a mean score of zero, out of a potential 15 correctly identified phonemes. Eleven points of baseline data were collected. All scores were zero. His mean score for Phase 2-Intensive Support, the phase in which
the intervention was introduced, was 6.3. This was a gain of 6.3 phonemes identified correctly. The slope of the line in Phase 1-Baseline was zero and increased to 0.46 in Phase 2-Intensive Support. As visible in Figure 4, improvement in performance was observed by the fifth session of Phase 2-Intensive Support and continued through the fourteenth session, but then leveled off until intervention was discontinued at the 22nd session of Phase 2-Intensive Support. The slope of James’ Phase 2-Intensive Support line from sessions #1 through #12 was 0.86. From session #13 through session #22, the slope was -0.17, indicating a very slight worsening of performance. Due to unstable performance during Phase 2-Intensive Support, and failure to achieve the criterion required to move on to the next phase, James did not participate in Phase 3-Moderate Support or Phase 4-Minimal Support.

![Figure 4. James’ Level for Each Phase and Comparison of Trend Between Phases 1 and 2](image)

**Nolan.** For Phase 1-Baseline, Nolan earned a mean score of 0.8, out of a potential 15 correctly identified phonemes. Ten points of baseline data were collected. Scores
ranged from zero to three, indicating low and stable performance during baseline.

Nolan’s mean score for Phase 2-Intensive Support, the phase in which the intervention was introduced, was 8.8. This was an increase of 8.0 phonemes, indicating an abrupt and significant change in level, as visible in Figure 5. The slope of the line increased from -0.2 during Phase 1-Baseline to 1.05 during Phase 2-Intensive Support. Nolan’s mean score for Phase 3-Moderate Support was 13.4 (4.6 increase) and 14.7 (1.3 increase) for Phase 4-Minimal Support.

![Figure 5. Nolan’s Level for Each Phase and Comparison of Trend Between Phases 1 and 2](image)

**Percentage of Non-Overlapping Data.** Percentage of non-overlapping data (PND) was calculated between the baseline phase and each intervention phase, for each participant. PND is achieved by identifying the highest data point during baseline, counting all intervention data points higher than that highest baseline point (i.e., non-overlapping data), and calculating the proportion of non-overlapping data to total number of intervention points. An intervention demonstrates a strong effect if PND is greater than 70%.
As shown in Table 5, PND exceeded 70% for all participants in all phases. Across participants, PND ranged from 86% to 100% when comparing Phase 1-Baseline performance to Phase 2-Intensive Support performance. This suggests that the sound box intervention introduced in Phase 2-Intensive Support had a strong effect. PND for all participants for phases 3 and 4 was 100%. Examining the PND within Phase 3-Moderate Support and Phase 4-Minimal Support indicates that the effect of the intervention was maintained, even as its support structures faded.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Phase 2-Intensive Support</th>
<th>Phase 3-Moderate Support</th>
<th>Phase 4-Minimal Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winston</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Mia</td>
<td>86%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>James</td>
<td>91%</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Nolan</td>
<td>90%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 5. Percentage of Non-Overlapping Data

**Sound position.** Data were also collected on the sound position of correctly identified phonemes – initial, medial, and final. Five points could be earned for each position on each probe. Table 6 displays the average number of phonemes correctly segmented, per sound position, out of a possible five, achieved by each participant during each phase. The total percentage of correctly identified initial, medial, and final phonemes were also reported for all participants. During Phase 1-Baseline, performance...
was strongest on initial phonemes (6%). Participants experienced the most difficulty with final phonemes during Phase 1-Baseline identifying none during this first phase. Again, initial phoneme performance was strongest during Phase 2-Intensive Support (58%); however, differences within this phase between initial, medial, and final sounds were minimal. During Phase 2-Intensive Support, performances on medial and final phonemes were similar, hovering around 50%. By Phase 3-Moderate Support, performance on initial and medial phonemes was similar (98%, 97%), whereas phonemes in final position lagged slightly behind (88%), only because of Nolan’s persisting weakness with phonemes in this position. In the final phase, Phase 4-Minimal Support, little difference existed between performances on the three phoneme positions. Participants in Phase 4-Minimal Support demonstrated mastery of phonemes in all positions.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Phase 1-Baseline</th>
<th>Phase 2-Intensive Support</th>
<th>Phase 3-Moderate Support</th>
<th>Phase 4-Minimal Support</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>M</td>
<td>F</td>
<td>I</td>
</tr>
<tr>
<td>Winston</td>
<td>1.00</td>
<td>0.40</td>
<td>0</td>
<td>4.30</td>
</tr>
<tr>
<td>Mia</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.90</td>
</tr>
<tr>
<td>James</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.00</td>
</tr>
<tr>
<td>Nolan</td>
<td>0.50</td>
<td>0.30</td>
<td>0</td>
<td>3.40</td>
</tr>
<tr>
<td>Total %</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>58</td>
</tr>
</tbody>
</table>

Table 6. Average Number of Phonemes Correctly Segmented Based on Sound Position

Note. I = Initial, M = Medial, F = Final.

**Individual phonemes.** Performance across participants on individual phonemes was also examined. Figure 6 displays the percentage of each individual phoneme correctly identified during Phase 2-Intensive Support and across all phases of
intervention (phases 2-4). During *Phase 2-Intensive Support*, participants demonstrated the most success on /s/ (75% correctly identified), and the least success on /t/ (25% correctly identified). More rapid improvement occurred for several of the more difficult phonemes during the following phases of intervention, than for many of those learned quickly at the start. Growth was most rapid on phonemes /i/, /n/, and /e/ during *Phase 3-Moderate Support* and *Phase 4-Minimal Support*. Growth was less rapid for the most difficult phoneme, /t/. The least rapid growth during the final two phases of intervention occurred for the phonemes most successfully identified during *Phase 2-Intensive Support*, specifically /s/, /ʃ/, /æ/, and /b/. However, these remained the most successfully identified phonemes across all phases of intervention, even though their growth during *Phase 3-Moderate Support* and *Phase 4-Minimal Support* was less.

Performance on individual phonemes was also analyzed according to phonemes’ voiced or unvoiced quality. Ten of the phonemes were voiced (e.g., /a/, /b/, /d/, /e/, /i/, /ʃ/, /m/, /n/, /o/, /u/) and five of the phonemes were unvoiced (e.g., /ʃ/, /k/, /p/, /s/, /t/). Voiced phonemes are those that cause the vocal cords to vibrate (e.g., /ʃ/), whereas unvoiced phonemes do not (e.g., /s/). Performance on voiced phonemes across all phases of intervention was calculated to be equal to performance on unvoiced phonemes. Figure 7 displays that 65% of voiced phonemes, and 65% of unvoiced phonemes were correctly identified across all phases of intervention. This indicates no difference in the ease of learning a voiced phoneme compared to an unvoiced phoneme.
Figure 6. Percentage of Correctly Segmented Individual Phonemes During Phase 2-Intensive Support and Within All Phases of Intervention

Figure 7. Percentage of Correctly Segmented Unvoiced Versus Voiced Phonemes Within All Phases of Intervention
**Whole words.** Participants’ performance on whole words was examined and is displayed on Figure 8. A whole word was considered correct when each of its three phonemes was correctly identified on a single probe. The hierarchy of word difficulty remained the same during all phases of intervention and was in the following order, from least to most difficult: “mop,” “bus,” “fan,” “kid,” and “jet.” As outlined by McCarthy (2008), “mop,” “bus,” “fan,” and “kid” all have a Level 1 difficulty in terms of phoneme segmentation, whereas “jet” has a Level 2 difficulty. Level 1 words are able to be stretched out into their sounds using one continuous breath. Level 2 words, however, begin with a stop-consonant sound, which in this case is /j/. A stop-consonant sound is one in which a puff of air is required to articulate it, and therefore it cannot be maintained, which prevents a smooth transition into the next phoneme. Rather, in “jet,” a break must occur between /j/ and /e/. Weak performance on “jet,” in addition, was the result of participants’ general difficulty correctly identifying /t/.

![Figure 8](image.png)

*Figure 8. Percentage of Each Word Correctly Segmented in Whole During Phase 2-Intensive Support and Across All Phases of Intervention*
Generalization

Participants’ performances on generalization probes, containing novel words not taught during intervention sessions, is presented in Table 7. A generalization probe was administered after the final session of Phase 2-Intensive Support, after the final session of Phase 3-Moderate Support and after the final session of Phase 4-Minimal Support, for a total of three generalization probes. Each generalization probe consisted of five nonsense words randomly selected from a pool of 20 CVC nonsense words that contained both phonemes taught during intervention and novel phonemes. Without teaching, modeling, feedback, or a tool such as the sound box, each word was read and the participant was asked to say the sounds in that word, in a manner identical to intervention data collection probes. Data were collected on the accuracy of the participant’s segmentation of initial, medial, and final phonemes. Like intervention data collection probes, generalization probes contained a total of fifteen phonemes to segment.

With the exception of James’s performance on Generalization probe 2, each participant performed better on each generalization probe than his or her best performance during Phase 1-Baseline. That is, 100% of Generalization data points exceeded baseline data points for each participant, with one exception mentioned above. Although James’ performance was better than that during baseline on two out of three generalization probes, his performance substantially lagged behind the other three participants. Whereas James only segmented 9% of phonemes presented on generalization probes, Winston, Mia, and Nolan segmented 51%, 44%, and 53%, respectively. Still, all participants’ abilities to perform phonemic segmentation on novel
words was not as strong as their ability to do so on words taught during intervention; however it indicates the skill was being generalized, even if not yet fully developed, particularly for Winston, Mia, and Nolan.

It should also be noted that performance on generalization probes was compared to *Phase 1-Baseline* performance which assessed participants’ ability to segment real words, the words that would later be taught during intervention. That is, a generalization probe, using nonsense words, was not administered at baseline and therefore there is no data on participants’ phoneme segmentation performance on nonsense words prior to implementation of the intervention. However, due to the very low levels of phoneme segmentation skill demonstrated by participants during baseline, and participants’ performance on the phoneme segmentation DIBELS task (i.e., PSF) which indicated no phoneme segmentation skill when applied to nonsense words, it can be assumed with some confidence that performance on a generalization probe at baseline would have revealed low or nonexistent phoneme segmentation ability.

To further evaluate phonemic segmentation skill generalization, correctly segmented phonemes were considered for whether each was a novel phoneme or one taught during intervention. Those phonemes taught during intervention were also considered for whether they sat in the same sound position – initial, medial, final – as in the taught word. That is, phonemes appearing on generalization probes were placed in one of three categories: *taught – same position*, *taught – different position*, or *novel*. Thirty phonemes were in the *taught – same position* category, nine were in the *taught – different position*, and six were in the *novel* category. Performance across all participants
was best for *taught – same position*, followed by *taught – different position*, and lastly *

*novel*, although performances between the phoneme types varied only slightly.

Participants segmented 42% of *taught – same position* phonemes, 39% of *by taught –

*different position* phonemes, and 29% of *novel* phonemes on generalization probes.

Because James did not demonstrate skill generalization, these numbers were also
calculated excluding his generalization data. Factoring in only Winston, Mia and Nolan,
51% of *taught – same position* phonemes were correctly segmented, 52% of *by taught –
*different position* phonemes, and 39% of *novel* phonemes. These percentages indicate
that participants were able to perform phonemic segmentation not only in cases very
similar to those taught during intervention, but also when taught-phonemes altered sound
position and in cases of novel phonemes as well.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Generalization probe 1</th>
<th>Generalization probe 2</th>
<th>Generalization probe 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winston</td>
<td>6</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Mia</td>
<td>3</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>James</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Nolan</td>
<td>7</td>
<td>6</td>
<td>11</td>
</tr>
</tbody>
</table>

*Table 7. Performance on Generalization Probes Across Participants*

**Pre- and Post-testing**

*Dynamic Indicators of Basic Early Literacy Skill – 6th Edition.* The DIBELS
measure was used as a pre- and post-test, administered to each participant before the first
intervention session and after the last. Four measures of the DIBELS were administered – Initial Sound Fluency (ISF), Letter Naming Fluency (LNF), Phoneme Segmentation Fluency (PSF), and Nonsense Word Fluency (NWF). These measures are traditionally intended for benchmarking and progress-monitoring with kindergarten children.

**Initial Sound Fluency.** The ISF measure required the participant to listen to a list of four words and then identify which word began with a particular given sound. The participant was presented with four pictures, read the names of each picture, then provided a sound and asked which picture began with that sound. These sounds were a mixture of single phonemes and blends. The number of sounds correctly identified within one minute was recorded. Results presented in Table 8 indicate very little growth on this measure between pre- and post-test. Across participants, growth ranged from 0 to 4.3 points. The target score on the ISF measure for students at the beginning of kindergarten is eight sounds identified.

**Letter Naming Fluency.** The LNF measure required the participant to name as many letters as possible within one minute from a presented list of upper and lower case letters. If the participant hesitated on a letter for three seconds, the researcher provided the correct letter name and the participant was told to move to the next letter. Results are presented in Table 8. At pre-test, Mia and Nolan were able to name more than 20 letters within one minute. Winston was able to name 10, and James was not able to name any letters. Improvement in letter naming skill was very slight for Mia and Nolan as demonstrated at post-test. Winston improved significantly, growing from 10 letters
named to 25. At post-test, James was still unable to name any letters. The target score on the LNF measure for students at the beginning of kindergarten is eight letters named.

**Phoneme Segmentation Fluency.** The PSF measure required participants to segment words read aloud into their individual phonemes. The PSF task was similar to that of the sound box intervention. However, many PSF target words contained more than three phonemes as all words in the intervention did, and many contained blends and a mixture of short and long vowels. That is, the PSF task was more difficult than the intervention task. The number of phonemes segmented in one minute was recorded. Results presented in Table 7 indicate that participants could not segment any of the phonemes on the pre-test. An improvement in performance on this task by Winston and Mia was observed at post-test. Nolan was able to segment only one phoneme at post-test, but it is important to note that he was uncooperative during this testing session and it could be presumed that with increased cooperation, his performance would have been similar to that of Winston and Mia. At post-test, James was unable to segment any phonemes. The PSF target score for middle-of-kindergarten is 18 phonemes identified. This test is not normed for beginning-of-kindergarten and so no target score is available for that period.

**Nonsense Word Fluency.** The NWF measure assessed participants’ knowledge of letter-sound correspondence and their ability to apply it, fluently, to nonsense words. Each participant was presented with a paper containing a list of VC and CVC nonsense words and asked to produce the sound of each phoneme, or read the whole word. The total number of correct letter sounds produced (CLS) and the total number of whole
words recoded completely and correctly (WRC) within one minute were recorded. Participants’ results are presented in Table 8. No participant was able to produce any correct letter sounds at pre-test, and thereby no whole, correctly recoded words either. At post-test, Winston, Mia, and Nolan demonstrated growth and were able to produce 7, 5, and 3 letter sounds respectively, whereas James was not able to produce any. No participant was able to correctly recode a whole word at post-test. The NWF-CLS target score for middle-of-kindergarten is 13 letter-sounds produced. This test, like PSF, is not normed for beginning-of-kindergarten and so no target score is available for that period.

<table>
<thead>
<tr>
<th>Participant</th>
<th>ISF Pre</th>
<th>ISF Post</th>
<th>LNF Pre</th>
<th>LNF Post</th>
<th>PSF Pre</th>
<th>PSF Post</th>
<th>NWF CLS Pre</th>
<th>NWF CLS Post</th>
<th>WRC Pre</th>
<th>WRC Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winston</td>
<td>8.4</td>
<td>11</td>
<td>10</td>
<td>25</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mia</td>
<td>6.7</td>
<td>11</td>
<td>25</td>
<td>30</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>James</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nolan</td>
<td>4</td>
<td>4</td>
<td>22</td>
<td>23</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 8. DIBELS Pre- and Post-test Results
Note. ISF=Initial Sound Fluency, LNF=Letter Naming Fluency, PSF=Phoneme Segmentation Fluency, NWF=Nonsense Word Fluency, CLS=correct letter sounds, WRC=whole words recoded correctly.

Get It, Got It, Go!. Get It, Got It, Go! is a quick assessment of children’s early literacy skills and includes three measures: Picture Naming, Rhyming, and Alliteration.
These assess crucial literacy skills – vocabulary, rhyming, and alliteration - with vital importance to reading development.

**Picture Naming.** During administration of the *Picture Naming* measure, flashcards with various photographs and images are presented to the child for one minute. The total number of correctly identified images within this timeframe is recorded. This measure assesses a child’s vocabulary; the faster he or she is able to identify images, the stronger his or her vocabulary. As displayed on Table 9, performance on this measure across participants at pre-test was similar and ranged from 14 to 17 identified images. At post-test, performance was similar for all participants except Mia, and ranged from 16 to 19 for the other three. Mia demonstrated substantial improvement, identifying 24 images as post-test.

**Rhyming.** Flashcards presenting one target image and three other images were shown to participants during administration of the *Rhyming* subtest. Image names were read to the participant and he or she was asked to pick which of the three images rhymed with the target image. Cards were presented for two minutes and the number of correctly rhymed words was recorded. As displayed in Table 9, Winston demonstrated the strongest rhyming skill at pre-test, with a score of 16. Scores for the other participants ranged from five to seven. At post-test, a slight improvement was noted for Winston and Mia, whereas scores for James and Nolan were lower than at pretest.

**Alliteration.** During administration of the *Alliteration* subtest, flashcards presenting one target image and three other images were shown to participants. Image names were read to the participant, and he or she was asked to choose which of the three
images began with the same sound as the target image. Cards were presented for two minutes and the number of correct responses was recorded. As displayed in Table 9, performance on the *Alliteration* measure was worse than *Rhyming* for all participants and minimal or negative growth was observed. Specifically, Winston and Mia both earned scores at post-test identical to his or her score at pre-test. Nolan’s score improved by two cards, and James earned a lower score by two cards. Overall, change in *Alliteration* performance across all participants was negligible.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Picture Naming</th>
<th>Rhyming</th>
<th>Alliteration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
</tr>
<tr>
<td>Winston</td>
<td>16</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>Mia</td>
<td>14</td>
<td>24</td>
<td>7</td>
</tr>
<tr>
<td>James</td>
<td>17</td>
<td>19</td>
<td>5</td>
</tr>
<tr>
<td>Nolan</td>
<td>16</td>
<td>16</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 9. *Get It, Got It, Go! Pre- and Post-test Results*
Chapter 5: Discussion

This chapter presents a discussion of the results of the study. First, results are discussed according to each of the following research questions: (1) *Does this sound box intervention effectively improve preschoolers’ performance on a phoneme segmentation task?*, (2) *Will phoneme segmentation task improvement be maintained after the support structures of the intervention are faded?*, and (3) *Does improvement of ability to segment words taught during intervention generalize to other words not taught during intervention sessions?* Limitations, implications for practitioners, and future directions for research are also described.

**Dependent Variables**

**Research question 1. Does this sound box intervention effectively improve preschoolers’ performance on a phoneme segmentation task?** The study was structured such that improvement would be observed if a participant’s performance on phoneme segmentation tasks was higher in level after introduction of the intervention than it was during baseline. It was predicted that following implementation of the intervention, a participant’s performance on a phoneme segmentation task would improve.

Results of this study indicated that the sound box intervention effectively improved preschoolers’ performance on a phoneme segmentation task. Each of the four...
participants’ PND exceeded 70%, which suggests strong effect. PND ranged from 86 to 100% for participants in Phase 2-Intensive Support. Further, a functional relationship between the sound box intervention and phoneme segmentation performance was established for each participant as a change in level was observed after implementation of the intervention.

This functional relationship is additionally supported by the structure of the multiple probe design replicated across participants. That is, while the intervention was introduced for one participant, the subsequent participant remained in baseline. In each instance, the participant remaining in baseline continued to perform at a low and steady rate, as the performance of the participant receiving intervention improved rapidly. These results support previous research which has demonstrated that phonemic awareness skill can be taught, and significant gains can be made in preschoolers’ phoneme segmentation skill in a relatively short time frame (Brady et al., 1994; Justice et al., 2003). Yeh (2003) demonstrated that children instructed on phoneme segmentation using a direct approach made significantly greater gains in phonemic awareness than children whose teachers focused on embedded type of methods using rhyme, alliteration, and story activities.

Participants demonstrated increases in phonemic awareness despite continuing weak competencies, overall, on other phonological awareness skills such as rhyming, alliteration, and initial sound detection, which are considered less difficult and typically developed prior to phonemic awareness. Gillon (2004) outlined a common trend in phonological awareness development which begins with detection of larger units (e.g., syllables and rimes) and finishes with phonemes. Results support the idea that although
the development of phonological awareness typically follows a general trajectory, overlap may occur, with moderate levels of later stages may be acquired before earlier stages (Anthony et al., 2003; Ukrainetz, Nuspl, Wilkerson, & Beddes, 2011). Because phonemic awareness is the most advanced of the phonological awareness skills, it is encouraging that rapid progress could be made and suggests that practitioners should not be hesitant to instruct in this skill prior to children’s development of lesser phonological awareness skills.

It must also be noted that participants’ ability to perform the phoneme segmentation task during Phase 1-Baseline, was not simply low, but very low, negligible, and in the cases of Mia and James, nonexistent. Rather than providing segmented phonemes in response to baseline prompts, participants often described the word, used it in a sentence or phrase, and sometimes provided a rhyming, or otherwise similar-sounding word. This occurred despite being shown how to segment phonemes in a word (i.e., using the word “jam,” at the start of Phase 1-Baseline data collection sessions. Thus, the change from weak or nonexistent phoneme segmentation skill to strong is noteworthy.

Moreover, weak or nonexistent phoneme segmentation skill demonstrated during baseline point to the fact that these children were not developing the skill as a natural progression or through exposure to language and literacy in the home or school, or through any previous interventions. This offers support for the psycholinguistic grain size theory (Ziegler & Goswami, 2005) or others that stress the importance of explicit instruction for the development of phonological awareness (Justice et al., 2008).
Conversely, it contradicts the basis of the *lexical restructuring hypothesis* (Metsala, 2011; Metsala & Walley, 1998) which posits that phonological awareness is a byproduct of a growing vocabulary. As a child’s vocabulary expands, he or she must learn to distinguish words by smaller and smaller units. This forces the progression through the increasingly more difficult phases of phonological awareness, initially distinguishing whole words and ultimately distinguishing by individual phonemes. The current study suggests the need for explicit, intentional instruction to incite phonemic awareness for these preschool students, suggesting that exposure to language, which leads to vocabulary growth, is not sufficient. This is of particular importance for at-risk preschool students, who may not be exposed to literacy- and language-rich environments in the home. These children, in particular, demand explicit instruction in early literacy skills.

Each participant improved significantly in his or her ability to perform a phoneme segmentation task. Three out of four participants met mastery criteria on segmenting phonemes in words. However, one participant’s progression was unlike that of the others. James did not meet mastery criteria during *Phase 2-Intensive Support*, despite 22 sessions, whereas the other participants met criteria within 10 to 14 sessions. James had the most difficulty correctly segmenting “jet,” followed by “kid.” Over the course of the 22 sessions, James only identified /j/ in 5% of opportunities, and /t/ in 5% of opportunities. This is consistent with the previous discussion of word difficulty, which reported “jet” as the most difficult of the intervention words, due to its initial stop consonant. Moreover, /t/ was the most difficult phoneme to identify for all participants. Figure 9 displays James’ performance on individual phonemes and whole words during
Phase 2-Intensive Support, in comparison to the averaged performance of the other three participants during Phase 2-Intensive Support. James performed as well as, or better than, the other participants on “mop” and “bus,” but poorer on the other three words, with particularly weak performance on /j/, /t/, /k/, and /i/.

Several possible explanations for James’ performance exist. His scores at pre-test indicated fewer early literacy skills than the other participants. James knew no letter names, no letter sounds, and was not able to match any initial sounds in spoken words. Perhaps, phoneme segmentation was too high of a skill to target for James when considering the progression of phonological awareness skills. James may have needed direct instruction on lower level skills before receiving instruction on this skill. Letter
knowledge and development of phoneme awareness have been linked in previous research (Bowey, 1994; Carroll, 2004; Hohn & Ehri, 1983). Bowey found evidence that, controlling for language abilities, children who had higher levels of letter knowledge also had higher levels of phoneme awareness. Other research has concluded that training in letter knowledge can simultaneously improve phonemic awareness skills (Carroll, 2004; Hohn & Ehri, 1983). Following training in letters, both letter names and sounds, Carroll (2004) documented improvement on a phoneme segmentation task, whereas no improvement was found for those pre-literate children who did not receive the training. No child who did not know at least three letters was able to successfully complete the phoneme segmentation task; however, some children who knew some letters were not able to perform the task either. A potential explanation for the link between letter knowledge and phonemic awareness is that letters, their names and appearances, serve as mental symbols for the auditory phonemes presented during phoneme segmentation tasks. Additionally, particularly because segmented phonemes are abstract, knowledge of letter sounds may function as guidance as a child searches within a spoken word for its individual phonemes.

Secondly, James’ behavior must be considered. Of the four participants, he was observed to have difficulty with sustaining his attention during tasks. He required frequent prompts to sustain focus and attend to instruction. He was constantly moving and struggled to stay in his seat. These problems with hyperactivity and inattention may have limited James’ engagement with the intervention and thus he benefited less. An additional explanation is that a reading disability or speech/language disorder was
preventing James from mastering the phoneme segmentation task as easily as the other participants. James’ general speech articulation was the weakest of the participants and this weakness may have contributed negatively to his ability to segment phonemes accurately (Roberts, 2005). It is possible that James required additional support and instruction to acquire the skill. This last explanation highlights the importance of early intervention for identifying students who do not respond as expected to interventions and may require more intense instruction, and additional supports, modifications, and accommodations.

**Research question 2.** Will phoneme segmentation task improvement remain after the support structures of the intervention are faded? PND, level, and trend in Phase 3-Moderate Support and Phase 4-Minimal Support was compared to that in Phase 1-Baseline and Phase 2-Intensive Support. If PND between Phase 3-Moderate Support and Phase 1-Baseline, and between Phase 4-Minimal Support and Phase 1-Baseline, is equal to, or exceeds PND between Phase 2-Intensive Support and Phase 1-Baseline then phoneme segmentation performance remained the same or improved throughout the final two phases. That is, if data points remain at the same, or a higher level, and trend is steady or continuing to increase throughout Phase 3-Moderate Support and Phase 4-Minimal Support, then it can be concluded that improved skill on remained after the support structures of the intervention were faded. Results demonstrate this to be the case. PND between the phase and Phase 1-Baseline for each participant in Phase 3-Moderate Support and Phase 4-Minimal Support was 100%. In addition, level continued to increase throughout the final two phases, and trend remained steady. Even as the support
structures of the intervention were faded, participants continued to demonstrate strong, and increasingly stronger, performance on the phoneme segmentation task.

Despite the fact that phonemic awareness is the most advanced component ability within phonological awareness, and that phoneme segmentation is one of the most challenging phonemic tasks, the use of scaffolding is likely responsible for both the initial and sustained task improvement, even in the absence of typically preceding skills such as rhyme and alliteration detection. Previous research has demonstrated that the use of scaffolding can improve the speed and efficiency of phonemic awareness instruction (McGee & Ukrainetz, 2009). In the current study, the use of scaffolding provided participants with intensive support as they were acquiring the ability to perform the phoneme segmentation task, and then gradually fading the supports, as participants demonstrated developmental readiness and internalization of skill in their ability to complete the task with increasing independence. The success of this method as evidenced by the success of the intervention maintained throughout phases. This finding supports previous research conclusions regarding the positive effect of scaffolding (Berkowitz, Sherry, & Davis, 1971; Cooke, Galloway, Kretlow, & Helf, 2011; Coyne et al., 2007; Gunter & Reed, 1997; Mayfield, Glenn, & Vollmer 2008; McGee & Ukrainetz, 2009; Ukrainetz, 2006).

**Research question 3.** *Does improvement of ability to segment words taught during intervention generalize to other words not taught during intervention sessions?* It was predicted that improvement on the phoneme segmentation task would generalize to words not taught during the intervention due to a general, pervasive improvement of
phonemic awareness. To answer this question, generalization probes were administered at various points throughout the intervention sequence. For a total of three generalization probes, one probe was administered following the final session of each intervention phase. Results demonstrate that 92% of performances on generalization probes exceeded performance during baseline. Skill generalization as indicated by probe performance increased from Generalization Probe 1 to Generalization Probe 3 for all participants except James, indicating a gradual increase in skill generalization over the course of the intervention for the other three participants. This suggests that stimulus control transferred from the prompts to the spoken word, which is the ultimate goal of scaffolding procedures with fading prompts (McDowell, 1982).

To further assess phoneme segmentation skill generalization, performance on generalization probes was also considered in terms of whether each correctly segmentation was a novel phoneme or one taught during intervention. Those phonemes taught during intervention were also considered for whether they held the same sound position – initial, medial, final – as in the taught word. Results indicated that participants experienced near-equal success segmenting a taught phoneme when it was in the same position as in intervention, as when it was in a different position. Ability to segment novel phonemes lagged only slightly behind the other two. In other words, participants were able to perform phonemic segmentation not only with words very similar to those taught during intervention, but also when taught-phonemes sound position was altered and in cases when novel phonemes were presented as well.
Generalization of phoneme segmentation skill can also be considered through a review of performance on post-test measures. The PSF measure required participants to segment words read aloud into their individual phonemes, a task similar to that of the sound box intervention. This task differed, however, in that many PSF target words contained more than three phonemes and many contained blends and a mixture of short and long vowels. That is, the PSF task was more difficult than the intervention task. Further, instructions differed for the PSF, and participants may not have recognized it as the same task. Still, performance on the PSF task improved for Winston, Mia, and Nolan at post-test, although only slightly for Nolan. Although a less striking display of phoneme segmentation skill generalization than that demonstrated on the Generalization probes, participants’ performance on PSF indicates post-intervention growth.

**Obstacles and Limitations**

Due to the small number of participants, the results cannot be generalized to the larger population from which these participants were selected. Although there are threats to external validity due to the small number of participants, threats to internal validity were minimal as a functional relationship was demonstrated across children. Though results cannot be generalized to a larger population, they offer significant support for the value of the intervention, and provide direction for future studies to employ the intervention with a larger sample.

A second limitation of the study is the absence of a generalization probe administered at baseline. A generalization probe, using nonsense words, was not administered at baseline and therefore there is no data on participants’ phoneme
segmentation performance on nonsense words prior to implementation of the intervention. Instead, performance on generalization probes administered after Phase 2-Intensive Support, Phase 3-Moderate Support, and Phase 4-Minimal Support, was compared to participants’ performance on real words during baseline. However, due to the very low levels of phoneme segmentation skill demonstrated by participants during baseline, and participants’ performance on the PSF DIBELS task which indicated no skill when participants were asked to segment nonsense words into individual phonemes, it can be assumed with some confidence that performance on a generalization probe at baseline would have revealed low or nonexistent phoneme segmentation ability, similar to performance on probed real words during baseline.

A central obstacle to smooth implementation of the intervention was participants’ occasional unfocused or oppositional behaviors. Particularly when tasks were difficult, and thus more so at the beginning of Phase 2-Intensive Support, participants’ focus frequently needed redirected. This limited participants’ engagement with the intervention and their ability to benefit from it. James demonstrated more off-task behaviors than the other three participants. Whereas the others often indicated feelings of success as they progressively mastered the task, James did not express those feelings after he experienced success. The other three participants, Winston in particular, were observed to appear motivated to engage in the task when they experienced success. However, participants appeared resistant and frustrated at times when new tasks were introduced or they experienced challenge. For example, Winston experienced success on the pre-assessment task of rhyming, and when the intervention began, he expressed frustration and
repeatedly asked to return to rhyming tasks. Similarly, Winston was more oppositional during generalization probes than the data collection probes. Therefore, when designing interventions for use with preschool students, building in a structure that provides for frequent positive reinforcement is necessary. This additionally highlights the importance of scaffolding and the use of supports, which minimizes feelings of frustration and maximizes success and engagement (Lutz et al., 2006).

Poor attendance was a significant obstacle to intervention implementation and may have been intensified by the fact that the study was conducted during the summer months. Each participant missed several days of school both for unknown reasons, and known ones including illness, vacation, and transportation issues. Because of the multiple probe design and the dependence of one participant on the previous participant to dictate when intervention begins, inconsistent attendance was often problematic and halted the study at times. Further, individual’s missed sessions potentially resulted in regression of skill, though no data were collected to evaluate this. Follow-up from center staff regarding student absences was slow and often several consecutive unexcused absences would result before a call was made to the home. Additionally over the course of the summer, the center was closed for a day, or in some cases multiple days, for the following reasons: professional development, a water main break, an insect infestation, and a rooftop fire. Therefore, instructional time, not merely as part of this study’s intervention, but more importantly within the classroom, was unstable.
Future Research

This study used sound boxes and focused on having the children segment sounds of words that were orally presented to them. Letters were not incorporated at any point in this study. Future research should evaluate the contribution of inclusion of letters in an intervention similar to that used in this study. Research could examine whether the presence of letters resulted in more rapid, or slower, acquisition of phoneme segmentation skill, and whether this effect has an interaction with an individual’s knowledge of letter names and letter sounds at pre-test. The presence of letters may help facilitate the development of phoneme segmentation skills as some researchers have suggested (Ehri et al., 2001; Hohn & Ehri, 1983).

Additionally, the use of letters could be incorporated into a broader training program to help students make letter-sound associations. Previous research has argued for the benefit of incorporating letters in phoneme segmentation interventions due to letters’ iconicity – many letter names contain information about that letter’s sound. Letter names are not just verbal labels or visual cues, they also provide crucial information about the letter’s corresponding sound (Treiman & Kessler, 2003). For example, the letter name “p,” begins with the /p/ phoneme. Therefore, knowing a letter’s name, and seeing it on a word box card, may help a child name that phoneme. However, this may serve as a crutch for children who have mastered letter names and letter sounds. In this case, the task would be one of reciting letter sounds, rather than an auditory task of phoneme segmentation. Similarly, the overuse of prompts can prevent the transfer of stimulus control from the prompt (i.e. the grapheme) to the spoken phonemes (McDowell, 1982).
Further, some level of phonological awareness may be necessary before a child can take advantage of the phonetic information the letter names provide (Kim, Petscher, Foorman, & Zhou, 2010). These researchers found that increased phonological awareness was associated with increased letter-sound knowledge when students also had strong letter-name knowledge. However, Share (2004) found only a moderate correlation between phonological awareness and letter-sound knowledge after children received training in letter names only. So, although phonological awareness facilitates extraction of letter sound information from letter names, it is not required for learning letter sounds. This may suggest that simultaneous instruction in letter sounds may be beneficial for children acquiring phonological awareness. Still, future research could examine these interactions and effects on phoneme segmentation tasks, still requiring participants to segment words without any supports, including the presence of letters, at data collection.

Replication of this study, with more participants and minor alterations, would be advantageous. Future studies should reduce the mastery criteria required to exit *Phase 2-Intensive Support*. The criteria to move on to *Phase 3-Moderate Support* was high, three sessions in a row with 80% or greater phonemes segmented during data collection. Though it took each participant many sessions to meet that criterion (i.e., about 12 sessions, on average, for those participants who met the criterion), each demonstrated developmental readiness to have support structures faded earlier. Specifically, participants began to resist the interventionist’s modeling of the task after the first few sessions. Once a participant felt competent in the procedure, he or she preferred to make his or her own attempt at segmenting the word, without first observing the interventionist
do so, and was often frustrated when the interventionist insisted on first modeling. In many cases, the participant voiced the phonemes in unison with the interventionist as the interventionist modeled the task. Therefore, in practice, fading the modeling support, prior to 80% accuracy, may be fitting. It may also provide each participant with an earlier opportunity to recall the phonemes from his or her long-term memory, rather than from short-term memory, as is the case when the task has just been modeled. Further, errors, which will be more common once modeling is removed, may result in increased associations and elaboration as the memory is stored, which may help with retrieval during data collection probes. Adjusting the amount of support to an appropriate level within scaffolding procedures is crucial to ensure student engagement (Lutz et al., 2006).

Additional alterations to this study may be considered for future research. These could include shortening the intervention such that its length is more aligned with preschoolers’ attention spans. The intervention, particularly in Phase 2-Intensive Support, and particularly in the early sessions when the task was most difficult, could be quite lengthy (e.g. 20 minutes) and participants struggled to maintain focus for the duration. In these instances, once it was time for the data collection probes, the participant was sometimes distracted and oppositional. Data collection probes were more difficult and required more focus because there were no supports. Participants’ performance during data collection often seemed poorer than what was demonstrated during intervention. Students’ phoneme segmentation performance level that was demonstrated during intervention was not always apparent during data collection. This issue may offer additional reasons to fade the modeling support more quickly, thus shortening the early
sessions, when they require the most mental effort. This observation is also consistent with Vygotsky’s theory of the zone of proximal development (Berk, 2009). Though participants demonstrated emerging skill during intervention, inconsistent performance during data collection indicates that participants still required support and adult facilitation to perform the phoneme segmentation skill in the early sessions.

Future replications of this study could also collect additional pre-assessment data regarding participants’ early literacy skills at the outset, cognitive ability, or language skills. This would allow stronger conclusions to be drawn about the contribution of individual differences to intervention performance. Other environmental factors including measures of the home literacy environment, frequency of caregiver reading to their child, and others could be addressed in future studies.

**Implications for Practice**

The results of this study provide many implications for practitioners in their work with early childhood populations. First, it supports previous research which concluded that the skill of phonemic awareness could be taught to preschool children through explicit methods, resulting in quick and substantial improvements in skill (Brady et al., 1994; Justice et al., 2003; Yeh, 2003). Practitioners should not wait until kindergarten to implement phonemic awareness instruction, assuming that younger children are not developmentally ready to acquire this skill. This study demonstrates that young children can experience significant gains in performing a phoneme segmentation task in a relatively short amount of time when an explicit, systematic intervention using scaffolding is implemented. Phonemic awareness is crucial to the development of reading
skills (Bradley & Bryant, 1983), and therefore targeting this skill as early as possible, particularly in the case of children at-risk for reading failure, is vital.

Simple alterations could be made to this intervention, which would make it suitable for use with larger groups or a whole class. Joseph (2000a) demonstrated that the use of word boxes within the context of a whole class can result in improved word identification skills and spelling in first grade students. Providing each student in a preschool classroom with a sound box card and three tokens, an instructor could follow the same method as used in this intervention, beginning with modeling, then asking students to slide the tokens as the class segments the phonemes in unison, and finally prompting them to attempt the task independently. Within a whole class setting, corrective feedback could not be provided as simply as when one-on-one; however, weekly one-on-one progress monitoring could assess those students who need additional support and practice.

When possible, implementation is also applicable to small group. Small group implementation would allow students to be homogenously grouped so that progression through the phases of intervention could be more tailored to individual ability level whereas this would not be possible in a whole class setting. A small group setting may even be advantageous as a meta-analysis reviewed by Ehri et al. (2001) concluded that this format was more effective for phonemic awareness instruction than one-on-one or large group. Although researchers did not elaborate on this finding, it could be the result of peer influence, and additional opportunities for modeling by peers. Further, this intervention is appropriate for classroom implementation because it is inexpensive,
requires few materials, can be performed quickly, and allows for simple progress monitoring. Because of the scaffolding, which accounts for an individual’s current level of phoneme segmentation skill, the use of manipulatives, and the inclusion of active participation, this intervention can be enjoyable and engaging for young children. It should also be noted that despite demonstration of its effectiveness at rapidly increasing participants’ phoneme segmentation skills, this intervention alone is not sufficient for creating strong readers. Effective reading programs will incorporate many evidence-based practices.

The implementation of this intervention, and other similar evidence-based interventions with young children, is necessary for the purpose of early identification of those children at greater risk for reading disability. As was the case with James, those students who do not respond as expected, by making adequate progress, after the implementation of an intervention, require more intensive intervention. This is important to identify early on, in order to provide additional support and address deficits before skill gaps widen. When more intensive, individualized interventions do not yield positive results, a treatment resister may be evaluated for a reading disability such that most appropriate instruction can be designed.

Conclusions

Juxtaposed against the vital importance of identifying methods to improve preschoolers’ early literacy skills, particularly disadvantaged preschoolers, is the void of research examining such methods. This study was designed to evaluate the effectiveness of a phonemic awareness intervention, which used a scaffolding method with a sound
Preschoolers’ responsiveness to the intervention not only demonstrates their ability to develop phonemic awareness when instructed explicitly, but also implicates our responsibility to implement such interventions in preschool classrooms where children’s early literacy skills are weak. Explicit, intentional instruction in early literacy skills is particularly important for young children from literacy- and language-poor home environments who are at-risk for reading problems.
References


Keesey, S. (2012). *Effects of word box instruction on the phonemic awareness skills of older, struggling readers and young children at risk for reading failure* (Unpublished doctoral dissertation). The Ohio State University, Columbus, OH.


Appendix A: Parent Consent Form
The Ohio State University Parental Permission and Consent
For Child’s Participation in Research

Study Title: Effects of Sound Boxes on Preschoolers’ Phonemic Segmentation Skills
Researcher: Laurice Joseph, Ph.D.
Co-investigator: Elizabeth Durst, M.A.

This is a parental permission form for research participation. It contains important information about this study and what to expect if you permit your child to participate.

Your child’s participation is voluntary.

Please consider the information carefully. Feel free to discuss the study with your friends and family and to ask questions before making your decision whether or not to permit your child to participate. If you permit your child to participate, you will be asked to sign this form and will receive a copy of the form.

Purpose: Elizabeth is conducting an intervention to learn more about how early literacy skill develops in preschool students. Specifically, the intervention will focus on the development of phonemic awareness. Phonemic awareness is the ability to recognize the individual sounds that make up a single word. For example, phonemic awareness is required to identify that the word “cat” is made up of the sounds /k/, /a/, and /t/. This skill is very important as children learn to read. Strong phonemic awareness in preschool helps reduce the risk for later reading disability.

Procedures/Tasks and Duration: By granting permission for your child’s study participation, you are granting permission for Elizabeth to access your child’s educational records. Specifically, information regarding your child’s age, performance on class-wide screening measures such as the Denver II and Get It, Got It, Go!, and his or her attendance records. Your phone number will also be accessed so that contact can be made if there are questions or concerns about your child’s participation in the study. If your child meets eligibility requirements, which include age over four years, six months, the presence of emerging literacy skills, and strong attendance, he or she may be selected to participate in the study.

If selected, a few brief assessments will be administered prior to the intervention to gauge your child’s present level of phonemic awareness. During the intervention
sessions, your child will practice phonemic awareness segmentation tasks. Elizabeth will say a word and your child will be asked to say its sounds. For example, if Elizabeth said “cat,” your child would say “/k/ /a/ /t/.” Throughout the intervention sessions, Elizabeth will model the task, and support your child as he or she practices. At the end of each session, your child will be asked to break words into their separate sounds independently. Data will be collected on his or her ability to complete this independent task successfully. Your child will meet with Elizabeth for five to fifteen minutes most school days for 8 to 12 weeks.

**Risks and Benefits:** It is unlikely that participating in this intervention will cause your child any stress or major problems. Some tasks may be difficult for your child, particularly at first. However, praise and encouragement will be offered. A session will be discontinued if your child seems overly frustrated. Any risks are outweighed by the opportunity for your child to improve his or her phonemic awareness, and become better prepared for kindergarten and learning to read.

**Confidentiality:** Efforts will be made to keep your child’s study-related information confidential. The results of this study may be published, but your child WILL NOT be identified in any reports or publications. All information collected will be identified with codes and your child’s name WILL NOT be attached to any data collection forms. However, there may be circumstances where this information must be released. For example, personal information regarding participation in this study may be disclosed if required by state law. Also, your records may be reviewed by the following groups (as applicable to the research):

- Office for Human Research Protections or other federal, state, or international regulatory agencies;
- The Ohio State University Institutional Review Board or Office of Responsible Research Practices

**Participant Rights:** Participation in this study is voluntary. You or your child may refuse to participate in this study, or stop at any time, without penalty or loss of benefits to which you or your child are otherwise entitled. By signing this form, you do not give up any personal legal rights your child may have as a participant in this study.

An Institutional Review Board responsible for human subjects research at The Ohio State University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

**Contacts and Questions:** For questions, concerns, or complaints about the study, or if you feel you have been harmed by participating in this study, you may contact Elizabeth Durst at 614-653-7580. For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the
research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

**Signing the Parental Permission Form:** I have read (or someone has read to me) this form and I am aware that I am being asked to provide permission for my child to participate in a research study. I voluntarily agree to permit my child to participate in this study.

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<th>Printed name of person authorized to provide permission for subject (e.g., parent)</th>
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**Investigator/Research Staff**

I have explained the research to the participant or his/her representative before requesting the signature(s) above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

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Appendix B: Data Collection Probe

Participant ID: _______________    Phase:_________________    Date: ________________

fan     ____  ____  ____          0 / 1
jet     ____  ____  ____           0 / 1
kid     ____  ____  __________    0 / 1
mop     ____  ____  ____           0 / 1
bus     ____  ____  ____           0 / 1

____ /5   ____ /5   ____ /5

____ /15 = ____%   ____ /5 = ____%
Appendix C: Sound Box Card
Appendix D: Intervention, Generalization Probe, and Data Collection Scripts
**INTRODUCTION**

T: Words are made up of different sounds. [For example, the word jam has 3 sounds. Listen as I say the sounds in jam. /j//a//m/. Jam.] I am going to say a word, after I say it, you repeat the word and then tell me all the sounds in that word. [For example, if I said the word jam, you would say /j//a//m/.] Now it is your turn.

**WORD 1**

T: The first word is fan. What is the word?
S: fan
T: Say the sounds in fan.
S: /f/ /a/ /n/
T: (Marks correct/incorrect)

**WORD 2**

T: The next word is jet. What is the word?
S: jet
T: Say the sounds in jet.
S: /j/ /e/ /t/
T: (Marks correct/incorrect)

**WORD 3**

T: The next word is kid. What is the word?
S: kid
T: Say the sounds in kid.
S: /k/ /i/ /d/
T: (Marks correct/incorrect)

**WORD 4**

T: The next word is mop. What is the word?
S: mop
T: Say the sounds in mop.
S: /m/ /o/ /p/
T: (Marks correct/incorrect)

**WORD 5**

T: The next word is bus. What is the word?
S: bus
T: Say the sounds in bus.
S: /b/ /u/ /s/
T: (Marks correct/incorrect)
INTRODUCTION
T: Today, we are going to learn about the sounds that make up words. We will use these boxes to help us say each sound in the word. Ready...

WORD 1
T: The first word is fan. What is the word?
S: fan
T: Watch as I slide a chip into a box for each sound in fan. /f/ /a/ /n/ (Teacher says each phoneme and slides chip for each phoneme.)
T: Now it’s your turn. Slide the chips as we say the sounds together. /f/ /a/ /n/
S: /f/ /a/ /n/ (Student slides chip for each phoneme.)
T: Good. Now do it by yourself. Go ahead.
S: /f/ /a/ /n/ (Student slides chip for each phoneme.)

Corrective feedback, if appropriate:
T: Remember, /f/ /a/ /n/. (Teacher slides chip for each phoneme.) Now you do it.
S: /f/ /a/ /n/ (Student slides chip for each phoneme.)
[Repeat until student is successful, up to 4x]

Time I: 1 2 3 4
Time II: 1 2 3 4

T: Good job. (Let’s do it again!)

WORD 2
T: The word is jet. What is the word?
S: jet
T: Watch as I slide a chip into a box for each sound in jet. /j/ /e/ /t/ (Teacher slides chip for each phoneme.)
T: Now it’s your turn. Slide the chips as we say the sounds together. /j/ /e/ /t/
S: /j/ /e/ /t/ (Student slides chip for each phoneme.)
T: Good. Now do it by yourself. Go ahead.
S: /j/ /e/ /t/ (Student slides chip for each phoneme.)

Corrective feedback, if appropriate:
T: Remember, /j/ /e/ /t/. (Teacher slides chip for each phoneme.) Now you do it.
S: /j/ /e/ /t/ (Student slides chip for each phoneme.)
[Repeat until student is successful, up to 4x]

| Time I: | 1 | 2 | 3 | 4 |
| Time II: | 1 | 2 | 3 | 4 |

T: Good job. (Let’s do it again!)

**WORD 3**

T: The word is kid. What is the word?
S: kid
T: Watch as I slide a chip into a box for each sound in kid. /k/ /i/ /d/ (Teacher slides chip for each phoneme.)
T: Now it’s your turn. Slide the chips as we say the sounds together. /k/ /i/ /d/
S: /k/ /i/ /d/ (Student slides chip for each phoneme.)
T: Good. Now do it by yourself. Go ahead.
S: /k/ /i/ /d/ (Student slides chip for each phoneme.)

**Corrective feedback, if appropriate:**

T: Remember, /k/ /i/ /d/. (Teacher slides chip for each phoneme.) Now you do it.
S: /k/ /i/ /d/ (Student slides chip for each phoneme.)

[Repeat until student is successful, up to 4x]

| Time I: | 1 | 2 | 3 | 4 |
| Time II: | 1 | 2 | 3 | 4 |

T: Good job. (Let’s do it again!)

**WORD 4**

T: The word is mop. What is the word?
S: mop
T: Watch as I slide a chip into a box for each sound in mop. /m/ /o/ /p/ (Teacher slides chip for each phoneme.)
T: Now it’s your turn. Slide the chips as we say the sounds together. /m/ /o/ /p/
S: /m/ /o/ /p/ (Student slides chip for each phoneme.)
T: Good. Now do it by yourself. Go ahead.
S: /m/ /o/ /p/ (Student slides chip for each phoneme.)

**Corrective feedback, if appropriate:**

T: Remember, /m/ /o/ /p/. (Teacher slides chip for each phoneme.) Now you do it.
S: /m/ /o/ /p/ (Student slides chip for each phoneme.)
T: Good job. (Let’s do it again!)

**WORD 5**

T: The word is bus. What is the word?
S: bus

T: Watch as I slide a chip into a box for each sound in bus. /b/ /u/ /s/ (Teacher slides chip for each phoneme.)

T: Now it’s your turn. Slide the chips as we say the sounds together. /b/ /u/ /s/  

S: /b/ /u/ /s/ (Student slides chip for each phoneme.)

T: Good. Now do it by yourself. Go ahead.

S: /b/ /u/ /s/ (Student slides chip for each phoneme.)

**Corrective feedback, if appropriate:**

T: Remember, /b/ /u/ /s/. (Teacher slides chip for each phoneme.) Now you do it.

S: /b/ /u/ /s/ (Student slides chip for each phoneme.)

[Repeat until student is successful, up to 4x]

**Time I:**  
1 2 3 4  

**Time II:**  
1 2 3 4  

T: Good job. (Let’s do it again!)
Phase 3 – Moderate support

INTRODUCTION
T: Today we will do the same thing we were doing before, but this time I won’t show you first, and we won’t practice together [initial]. Today we will do just as we did before [subsequent].

WORD 1
T: The first word is fan. What is the word?
S: fan
T: It’s your turn. Slide a chip into a box for each sound in fan. Remember to say the sound as you move the chip. Go ahead.
S: /f//a//n/ (Student slides chip for each phoneme.)

Corrective feedback, if appropriate:
T: Remember, /f/ /a/ /n/. (Teacher slides chip for each phoneme.) Now you do it.
S: /f/ /a/ /n/ (Student slides chip for each phoneme.) [Repeat until student is successful, up to 4x]

Time I: 1 2 3 4
Time II: 1 2 3 4

T: Good job. (Let’s do it again!)

WORD 2
T: The next word is jet. What is the word?
S: jet
T: Slide a chip into a box for each sound in jet. Remember to say the sound as you move the chip. Go ahead.
S: /j/ /e/ /t/ (Student slides chip for each phoneme.)

Corrective feedback, if appropriate:
T: Remember, /j/ /e/ /t/. (Teacher slides chip for each phoneme.) Now you do it.
S: /j/ /e/ /t/ (Student slides chip for each phoneme.) [Repeat until student is successful, up to 4x]

Time I: 1 2 3 4
Time II: 1 2 3 4

T: Good job. (Let’s do it again!)

WORD 3
T: The next word is kid. What is the word?
S: kid
T: Slide a chip into a box for each sound in kid. Remember to say the sound as you move the chip. Go ahead.
S: /k/ /i/ /d/ (Student slides chip for each phoneme.)
Corrective feedback, if appropriate:
T: Remember, /k/ /i/ /d/. (Teacher slides chip for each phoneme.) Now you do it.
S: /k/ /i/ /d/ (Student slides chip for each phoneme.)
[Repeat until student is successful, up to 4x]
Time I: 1 2 3 4
Time II: 1 2 3 4
T: Good job. (Let’s do it again!)

WORD 4
T: The next word is mop. What is the word?
S: mop
T: Slide a chip into a box for each sound in mop. Remember to say the sound as you move the chip. Go ahead.
S: /m/ /o/ /p/ (Student slides chip for each phoneme.)
Corrective feedback, if appropriate:
T: Remember, /m/ /o/ /p/. (Teacher slides chip for each phoneme.) Now you do it.
S: /m/ /o/ /p/ (Student slides chip for each phoneme.)
[Repeat until student is successful, up to 4x]
Time I: 1 2 3 4
Time II: 1 2 3 4
T: Good job. (Let’s do it again!)

WORD 5
T: The next word is bus. What is the word?
S: bus
T: Slide a chip into a box for each sound in bus. Remember to say the sound as you move the chip. Go ahead.
S: /b/ /u/ /s/ (Student slides chip for each phoneme.)
Corrective feedback, if appropriate:
T: Remember, /b/ /u/ /s/. (Teacher slides chip for each phoneme.) Now you do it.
S: /b/ /u/ /s/ (Student slides chip for each phoneme.)
[Repeat until student is successful, up to 4x]

<table>
<thead>
<tr>
<th>Time I:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tr>
<td>Time II:</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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</table>

T: Good job. (Let’s do it again!)
Phase 4 – Minimal support

INTRODUCTION
T: Today we will say the sounds in the words without using the box or the chips [initial]. Today we will do just as we did before [subsequent].

WORD 1
T: The first word is fan. What is the word?
S: fan
T: Say the sounds in fan.
S: /f//a//n/

Corrective feedback, if appropriate:
T: Remember, /f/ /a/ /n/. Now you do it.
S: /f/ /a/ /n/
[Repeat until student is successful, up to 4x]

Time I: 1 2 3 4
Time II: 1 2 3 4

T: Good job. (Let’s do it again!)

WORD 2
T: The next word is jet. What is the word?
S: jet
T: Say the sounds in jet.
S: /j/ /e/ /t/

Corrective feedback, if appropriate:
T: Remember, /j/ /e/ /t/. Now you do it.
S: /j/ /e/ /t/
[Repeat until student is successful, up to 4x]

Time I: 1 2 3 4
Time II: 1 2 3 4

T: Good job. (Let’s do it again!)

WORD 3
T: The next word is kid. What is the word?
S: kid
T: Say the sounds in kid.
S: /k/ /i/ /d/

Corrective feedback, if appropriate:
T: Remember, /k/ /i/ /d/. Now you do it.
S: /k/ /i/ /d/  
[Repeat until student is successful, up to 4x]  
Time I:  1  2  3  4  
Time II:  1  2  3  4  
T: Good job. (Let’s do it again!)

**WORD 4**  
T: The next word is mop. What is the word?  
S: mop  
T: Say the sounds in mop.  
S: /m/ /o/ /p/  
Corrective feedback, if appropriate:  
T: Remember, /m/ /o/ /p/. Now you do it.  
S: /m/ /o/ /p/  
[Repeat until student is successful, up to 4x]  
Time I:  1  2  3  4  
Time II:  1  2  3  4  
T: Good job. (Let’s do it again!)

**WORD 5**  
T: The next word is bus. What is the word?  
S: bus  
T: Say the sounds in bus.  
S: /b/ /u/ /s/  
Corrective feedback, if appropriate:  
T: Remember, /b/ /u/ /s/. Now you do it.  
S: /b/ /u/ /s/  
[Repeat until student is successful, up to 4x]  
Time I:  1  2  3  4  
Time II:  1  2  3  4  
T: Good job (Let’s do it again!)
INTRODUCTION
T: Today we are going to say the sounds in new words we haven’t practiced yet. These words aren’t real words, but they sound like real words. Say the sounds in these words just like you did before. Ok? Ready…

NONSENSE WORD 1
T: The first word is maf. What is the word?
S: maf
T: Say the sounds in maf.
S: /m//a//f/
T: (Marks correct/incorrect)

NONSENSE WORD 2
T: The next word is nov. What is the word?
S: nov
T: Say the sounds in nov.
S: /n//o//v/
T: (Marks correct/incorrect)

NONSENSE WORD 3
T: The next word is vem. What is the word?
S: vem
T: Say the sounds in vem.
S: /v//e//m/
T: (Marks correct/incorrect)

NONSENSE WORD 4
T: The next word is dop. What is the word?
S: dop
T: Say the sounds in dop.
S: /d//o//p/
T: (Marks correct/incorrect)

NONSENSE WORD 5
T: The next word is bis. What is the word?
S: bis
T: Say the sounds in bis.
S: /b//i//s/
T: (Marks correct/incorrect)
**Generalization probe #2**

**INTRODUCTION**
T: Today we are going to say the sounds in new words we haven’t practiced yet. These words aren’t real words, but they sound like real words. Say the sounds in these words just like you did before. Ok? Ready...

**NONSENSE WORD 1**
T: The first word is lam. What is the word?
S: lam
T: Say the sounds in lam.
S: /l//a//m/
T: (Marks correct/incorrect)

**NONSENSE WORD 2**
T: The next word is kud. What is the word?
S: kud
T: Say the sounds in kud.
S: /k//u//d/
T: (Marks correct/incorrect)

**NONSENSE WORD 3**
T: The next word is pag. What is the word?
S: pag
T: Say the sounds in pag.
S: /p//a//g/
T: (Marks correct/incorrect)

**NONSENSE WORD 4**
T: The next word is fon. What is the word?
S: fon
T: Say the sounds in fon.
S: /f//o//n/
T: (Marks correct/incorrect)

**NONSENSE WORD 5**
T: The next word is zim. What is the word?
S: zim
T: Say the sounds in zim.
S: /z//i//m/
T: (Marks correct/incorrect)
Generalization probe #3

INTRODUCTION
T: Today we are going to say the sounds in new words we haven’t practiced yet. These words aren’t real words, but they sound like real words. Say the sounds in these words just like you did before. Ok? Ready...

NONSENSE WORD 1
T: The first word is ked. What is the word?
S: ked
T: Say the sounds in ked.
S: /k//e//d/
T: (Marks correct/incorrect)

NONSENSE WORD 2
T: The next word is tun. What is the word?
S: tun
T: Say the sounds in tun.
S: /t//u//n/
T: (Marks correct/incorrect)

NONSENSE WORD 3
T: The next word is ret. What is the word?
S: ret
T: Say the sounds in ret.
S: /r//e//t/
T: (Marks correct/incorrect)

NONSENSE WORD 4
T: The next word is jad. What is the word?
S: jad
T: Say the sounds in jad.
S: /j//a//d/
T: (Marks correct/incorrect)

NONSENSE WORD 5
T: The next word is tep. What is the word?
S: tep
T: Say the sounds in tep.
S: /t//e//p/
T: (Marks correct/incorrect)
Data collection

- Administer at the end of all post-baseline sessions
- No feedback

INTRODUCTION

T: Great! Let’s say the sounds again.

WORD 1
T: The word is fan. What is the word?
S: fan
T: Say the sounds in fan.
S: /f/ /a/ /n/
T: (Marks correct/incorrect)

WORD 2
T: The word is jet. What is the word?
S: jet
T: Say the sounds in jet.
S: /j/ /e/ /t/
T: (Marks correct/incorrect)

WORD 3
T: The word is kid. What is the word?
S: kid
T: Say the sounds in kid.
S: /k/ /i/ /d/
T: (Marks correct/incorrect)

WORD 4
T: The word is mop. What is the word?
S: mop
T: Say the sounds in mop.
S: /m/ /o/ /p/
T: (Marks correct/incorrect)

WORD 5
T: The word is bus. What is the word?
S: bus
T: Say the sounds in bus.
S: /b/ /u/ /s/
T: (Marks correct/incorrect)
Appendix E: Child Assent Script
CHILD ASSENT SCRIPT

Hi [name]. My name is Miss Elizabeth. I’m a student at Ohio State, and some days I work here at your school. Right now, I’m trying to learn about how children learn to read. I would like to ask you to help me by being in a study, but before I do, I want to explain what will happen if you decide to help me.

If you agree to be in my study, we will meet almost every day you are at school, for only about 10 minutes at a time. I will ask you to listen to some words and tell me the sounds in those words. It may be hard at first, but it is ok if you don’t know all the answers. When we are done meeting each day, I will give you a sticker. By being in the study, you will help me understand how children learn to read.

When I tell other people about my study, I will not use your name, and no one will be able to tell whom I’m talking about.

Your [guardian] says it’s okay for you to be in my study. But if you don’t want to be in the study, you don’t have to be. I won’t be upset, and no one else will be upset, if you don’t want to be in the study. If you want to be in the study now but change your mind later, that’s okay. You can stop at any time.

You can ask me questions about the study. If you have a question later that you don’t think of now, you can call me or ask your parents/teacher to call me or send me an e-mail.

Do you have any questions for me now?

Would you like to be in my study and talk about the different sounds in words?

NOTES TO RESEARCHER: The child should answer “Yes” or “No.” Only a definite “Yes” may be taken as assent to participate.

Name of Child: __________________________  Parental Permission on File: □ Yes □ No
(If “No,” do not proceed with assent or research procedures.)
Child’s Voluntary Response to Participation: □ Yes □ No
Signature of Researcher: __________________________  Date: ________________

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Appendix F: Generalization Probe 1

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___ /5 ___ /5 ___ /5

___ /15 = ____%  ___ /5 = ____%
Appendix G: Generalization Probe 2

Participant ID: _______________  Phase: _______________  Date: _______________

lam  ___ ___ ___  □  0 / 1
kud  ___ ___ ___  □  0 / 1
pag  ___ ___ ___  □  0 / 1
fon  ___ ___ ___  □  0 / 1
zim  ___ ___ ___  □  0 / 1

□  □  □

___ /5  ___ /5  ___ /5

___ /15 = _____%  ___ /5 = _____%
Appendix H: Generalization Probe 3

Participant ID: _______________    Phase:___________    Date: __________

ked     ___  ____  ____  ____ 0 / 1

tun     ___  ____  ____  ____ 0 / 1

ret     ___  ____  ____  ____ 0 / 1

jad     ___  ____  ____  ____ 0 / 1

tep     ___  ____  ____  ____ 0 / 1

___ /5   ___ /5   ___ /5

___ /15 = ____%       ___ /5 = ____%