Phonological Awareness and Phonemic Perception in 4-Year-Old Children With Delayed Expressive Phonology Skills

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The purpose of this study was to compare the phonological awareness abilities of 2 groups of 4-year-old children: one with normally developing speech and language skills and the other with moderately or severely delayed expressive phonological skills but age-appropriate receptive vocabulary skills. Each group received tests of articulation, receptive vocabulary, phonemic perception, early literacy, and phonological awareness skills. The groups were matched for receptive language skills, age, socioeconomic status, and emergent literacy knowledge. The children with expressive phonological delays demonstrated significantly poorer phonemic perception and phonological awareness skills than their normally developing peers. The results suggest that preschool children with delayed expressive phonological abilities should be screened for their phonological awareness skills even when their language skills are otherwise normally developing.

Key Words: phonological awareness, articulation, phonemic perception, phonological delay

Phonological awareness refers to the explicit awareness of the abstract units that compose spoken words, including syllables, onset and rime units, and individual phonemes. Phonological awareness is a critical precursor to the acquisition of reading (Stanovich, 2000) and the promotion of literacy has recently been placed within the scopes of practice for speech-language pathologists (American Speech-Language-Hearing Association, 2001). Consequently, speech-language pathologists have the responsibility to identify and treat children with deficits in phonological awareness. It would be helpful for speech-language pathologists to have a clear understanding of which children are at risk for delayed acquisition of phonological awareness skills and the subsequent acquisition of reading. Converging evidence indicates that children with language impairments are at significant risk for delayed phonological awareness skills, but the relationship between the development of phonological awareness and expressive phonological skills is not yet clear. Some researchers have concluded that children who produce many more speech sound errors than would be expected for their age are not at risk for delayed acquisition of phonological awareness unless they have a concomitant deficit in other aspects of language functioning (see Justice, Invernizzi, & Meier, 2002, for a review). However, variations in sample selection procedures across the small number of relevant studies make it difficult to draw a clear conclusion. The purpose of the study reported herein was to compare the phonological awareness skills of children with moderate to severe delays in expressive phonological development, but age-appropriate language skills, to the phonological awareness skills of children with normally developing speech and language abilities.

Phonological Awareness and Expressive Phonology

In contrast to the large number of studies showing that children with specific language impairment are at-risk for delayed acquisition of phonological awareness and reading skills (e.g., Aram, Ekelman, & Nation, 1984; Bishop & Adams, 1990; Boudreau & Hedberg, 1999; Catts, 1993; Catts, Fey, Zhang, & Tomblin, 2001; Magnusson & Naucler, 1990), relatively few studies have focused specifically on children whose primary communication deficit is in the area of expressive phonology. Furthermore, the results of these studies have been mixed, with two concluding that phonological deficits are not a risk factor...
for reading delay, and three others concluding that expressive phonological delay is associated with delays in the acquisition of phonological awareness and/or reading skills.

Bishop and Adams (1990) described language and literacy outcomes for 83 third grade children who had previously been shown to have delayed speech or language skills at age 4 years. They reported that the children with the best outcomes were children who had difficulties in the areas of expressive phonology and syntax. Children who had more widespread delays in multiple areas of language function were more likely to show reading and spelling disorders at later ages. They also concluded that children who entered school with age-appropriate speech and language skills were at relatively low risk for later academic problems.

Catts (1993) examined reading achievement in three groups of second grade children: normally developing children, language-impaired children, and children with normal language skills but relatively impaired phonological skills (although we note that the average articulation test percentile for these children was below average but within the normal range). The reading skills of the language-impaired group were significantly below average, whereas the children with weak articulation skills scored within the average range on all reading tests.

Webster and Plante (1992) assessed the phonological awareness abilities of 22 children, aged 6;5 to 8;6 [years; months], with persistently delayed phonological development. As with the Catts (1993) study discussed above, the children in this study had a history of prior therapy for remediation of articulation errors, but some of the children presented with age-appropriate expressive phonological skills at the time of testing. A comparison group matched for age and nonverbal mental age was also assessed. The children with delayed phonological development achieved significantly lower scores on tests of receptive language, sentence–word segmentation, word–syllable segmentation, and word–phoneme segmentation, in comparison with the normally developing children.

Bird, Bishop, and Freeman (1995) also examined the relationship between expressive phonology, phonological awareness, and reading skills in a longitudinal study of children who were aged 5;0 to 7;4 at the onset of the study. In comparison with a control group matched for age and nonverbal ability, these children demonstrated significantly poorer phonological awareness and reading skills throughout the 2 year period of the study, regardless of whether they had an accompanying deficit in oral language skills. They concluded that children who have severe phonological impairments at school entry are at particular risk for reading and spelling difficulties.

Recently, Larrivee and Catts (1999) confirmed that first grade children with a history of expressive phonological disorder are at risk for delayed acquisition of reading skills. They compared the performance of 27 kindergarten-age children with normal phonological development to that of 30 kindergarten-age children who were receiving treatment for expressive phonological delay. A standardized measure of articulation skills revealed that the clinical sample scored at the 9th percentile on average but the range was from 1 to 51 for the total group. The clinical sample scored significantly lower than their peers with normal speech and language development on tests of expressive phonology, phonological awareness, and receptive and expressive language skills. All children received tests of reading ability at the end of their Grade 1 year. Although the children with expressive phonological delay achieved lower scores than their normally developing peers on average, there was considerable within-group variation in reading ability. Children with expressive phonological delay and relatively good reading ability in Grade 1 demonstrated better expressive phonology, phonological awareness, and language test scores in kindergarten than did the children with poor reading outcomes in Grade 1. Imutation of multisyllabic nonwords and phonological awareness skills in kindergarten were both predictive of reading ability at the end of Grade 1. Larrivee and Catts concluded that both of these measures reflect the accuracy and segmental organization of the children’s underlying representations.

Taken together, these studies suggest that children with more severe difficulties with expressive phonology will be at risk for problems with both phonological awareness and reading. However, in those studies in which this relationship was revealed, the groups of children with expressive phonology deficits demonstrated poorer language skills than the normal control group, even in those cases where their language skills were generally within normal limits. It seems possible that the phonological awareness difficulties demonstrated by these children may be associated with current or previously resolved difficulties with language development, rather than with their expressive phonological delay per se.

Purpose of the Present Study

The purpose of the present study was to compare the phonological awareness skills of children with delayed expressive phonology to the phonological awareness skills of children with normally developing phonological skills. The clinical sample was selected to ensure a moderate to severe delay in expressive phonological abilities. Only children with receptive vocabulary skills within the normal range were included in the sample. Furthermore, the receptive vocabulary skills of the clinical group and the normally developing comparison group were carefully matched to ensure that there would be no significant differences in the distribution of receptive vocabulary skills between the two groups.

A further difference between the present study and previously published research concerns the age of the participants. In this study the children were assessed during their prekindergarten year when they were 4 years old. If it proves possible to identify deficits in phonological awareness during the preschool period it may be feasible to provide earlier intervention with the potential for preventing delayed acquisition of reading skills after school entry.

The operational definition of phonological awareness that was used in this study was chosen to reflect Swan and
Goswami’s (1997) perspective in which phonological awareness is grounded in the precision with which children encode underlying representations for words and in the segmental organization of those underlying representations. In this study, the children’s ability to encode precise underlying representations was assessed using a phonemic perception task in which they were required to identify well-produced versions of certain words and reject mispronunciations of those same words. Previous research has shown that a large proportion of children with delayed expressive phonology have difficulty with the phonemic perception of phonemes that they misarticulate (e.g., Rvachew & Jamieson, 1989), whereas children with normally developing phonology have more precise underlying representations for consonants produced in the onset of words. For example, a typical 5-year-old knows that /f/u/ is a word referring to footwear, /s/u/ is a female name, and /t/u/ is not a real English word. Children with speech delay are more likely to accept all three productions as being equivalent versions of the word shoe.

The segmental organization of the children’s underlying representations was assessed using a task developed by Bird et al. (1995). This task requires the children to match words that share the same rime (e.g., Paul and ball) or the same onset (e.g., Tom and tea). This test does not require the child to manipulate segments in the manner required by more difficult tasks such as sound deletion. However, an implicit ability to segment words at the onset-rime level is necessary in order for the child to match words that share the same onset or the same rime. This type of task and the units of analysis probed by this test have been shown to be appropriate for normally developing preschool-age children, both in terms of difficulty and sensitivity (Schatschneider, Francis, Foorman, Fletcher, & Mehta, 1999; Stanovich, Cunningham, & Cramer, 1984).

A test of emergent literacy skills was also administered to assess the children’s knowledge of letter names, basic literacy concepts, and sight word reading of frequently occurring words. We had no particular hypothesis relating to the outcome of this test. Emergent literacy has been shown to predict later reading skills (Scarborough, 1998) and at least some children with delayed phonology are at risk for delayed acquisition of reading (Larrivee & Catts, 1999), in which case it might be expected that our sample with phonological delay would demonstrate poorer performance on this test than the comparison sample. On the other hand, this test does not reflect the proposed core deficit in the area of phonological processing. Therefore, it seems equally likely that the children with delayed phonology might not differ from the normally developing comparison group with respect to emergent literacy knowledge, especially in this case where family socioeconomic status (SES) and receptive vocabulary skills were matched across the two groups.

To summarize the hypotheses, it was expected that the children with delayed expressive phonology would have more difficulty with phonemic perception and phonological awareness in comparison with the normally developing comparison group.

### Method

#### Participants

The participants were selected and grouped on the basis of their performance on the Goldman-Fristoe Test of Articulation—Second Edition (GFTA-2; Goldman & Fristoe, 2000). The participants were 13 children who presented with a moderate or severe expressive phonology disorder (GFTA-2 percentile less than 12) and 13 children with normal expressive phonology (GFTA-2 percentile greater than 20). All children were between the ages of 4;0 and 4;11. The group of children with expressive phonology delay (PD group) comprised 4 girls and 9 boys, and the group of children with normally developing speech and language skills (PN group) comprised 7 girls and 6 boys. The PD group was recruited from the caseloads of speech-language pathologists working at a large children’s hospital while the PN group was recruited from suburban preschool programs. All of the children were monolingual speakers of English and had normal hearing and normal oral structure. Family SES was within the middle-class range for all participants, as measured by the Blishen score, a numerical index that reflects the education level and occupation of the child’s parents (Blishen, Carroll, & Moore, 1987).

The two groups were matched for vocabulary development using the Peabody Picture Vocabulary Test—Third Edition (PPVT-III; Dunn & Dunn, 1997). The groups were also matched in terms of SES and age. The groups were not matched for expressive language abilities, and as described below, 4 of the participants in the PD group had mean length of utterance (MLU) values that were below normal limits for their age.

The characteristics of the PN group are shown in Table 1. These children presented with normal expressive phonological skills, as revealed by their GFTA-2 scores and their percentage of consonants correct (PCC) for connected speech. GFTA-2 percentiles ranged from the 21st to the 85th percentile and PCC scores ranged from 83.65% to 97.28%, which is within the normal range (Shriberg & Kwiatkowski, 1982). Receptive and expressive language skills (PN group) comprised 7 girls and 6 boys.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>PD Group</th>
<th>PN Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>SES (Blishen score)</td>
<td>56.15</td>
<td>55.85</td>
</tr>
<tr>
<td>Age (months)</td>
<td>56.23</td>
<td>56.46</td>
</tr>
<tr>
<td>PPVT-III</td>
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<td>108.00</td>
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<tr>
<td>MLU</td>
<td>5.32</td>
<td>3.94</td>
</tr>
<tr>
<td>GFTA-2</td>
<td>49.77</td>
<td>5.73</td>
</tr>
<tr>
<td>PCC</td>
<td>92.17</td>
<td>63.84</td>
</tr>
</tbody>
</table>

Note. SES = socioeconomic status (Blishen score); PPVT-III = Peabody Picture Vocabulary Test—Third Edition, standard score; MLU = mean length of utterance; GFTA-2 = Goldman-Fristoe Test of Articulation—Second Edition, percentile rank; PCC = percentage of consonants correct.
skills were within the normal range, as measured by the PPVT-III and MLU.

The PD group presented with delayed articulation skills, as shown in Table 1. GFTA-2 percentiles ranged from below the 1st to the 11th percentile and PCC scores ranged from 40.50% to 79.00%. To better characterize the phonological skills of the PD group, their responses to the GFTA-2 items were submitted to a nonlinear analysis using the procedures described by Bernhardt and Stoel-Gammon (1994). Specifically, match ratios were calculated for both features and syllable structures. For example, Participant 204’s production of the word stars as [sɔz] was coded as a mismatch for complex onsets but a match for the feature [+continuant] in the syllable onset position. However, his production of the word clown as [tliun] was coded as a mismatch for the place node Dorsal in the syllable onset position but as a match for the complex onset structure. Appendix A contains match ratios for selected features and structures that would be expected to be mastered by children of this age. Distortion errors and unusual substitution errors were also noted when they occurred more than twice in a given syllable position. All of the children had difficulty with liquids, resulting in less than perfect matches for the [+consonantal] feature. No child had mastered [-anterior] or [+distributed], reflecting difficulties with the palatal and interdental fricatives. Eight children had mastered [+continuant] with less than 80% accuracy, indicating stopping of fricatives. Participants 218 and 220 substituted glides for at least some fricatives on a consistent basis. Five children failed to match dorsal place consistently. Match ratios for simple onsets and codas were generally good, although 3 children omitted coda consonants.

Procedure

The children were tested during the late winter or early spring of their prekindergarten year (i.e., all of the children were expected to begin kindergarten during the fall term of the year in which they were tested). The timing of the assessment meant that the children in the PD group had completed one or more 8-week blocks of speech therapy prior to their participation in this study. Each child was tested individually in a quiet environment. In most cases the assessments were completed in a single session lasting approximately 75 min. In some cases the assessments were completed in two 45-min sessions.

Expressive Phonology. The GFTA-2 was administered in order to assess the children’s articulation skills. The children’s responses to the test items were also submitted to a phonological analysis using the nonlinear analysis procedures described by Bernhardt and Stoel-Gammon (1994).

Receptive Vocabulary. The PPVT-III was used to evaluate receptive single-word vocabulary.

Phonological Awareness. A modified version of the Bird et al. (1995) phonological awareness test was administered to all participants. The phonological awareness test consisted of three sections: rime matching, onset matching, and onset segmentation and matching. The first section administered to each child was rime matching. The child listened to the name of a puppet and then selected from an array of four pictures the one whose name rhymed with the name of the puppet. For example, the child was shown a puppet named “Dan.” They were then told, “Dan likes things that sound like his name” and were asked which he would like from “house”, “boat”, “car”, and “van”. The pictures were named for the child and the child was only required to point to the picture. For the onset matching section, the child was shown a puppet and told that everything it owned began with the same sound (e.g., /p/).

The four response alternatives were named by the experimenter and the child was instructed to select the picture of the word that starts with the target sound that was produced in isolation by the experimenter. Finally, for onset segmentation and matching, the child was again told the puppet’s name and was then asked to point to the picture whose name “began with the same sound as the puppet’s name”. In this case the target sound was not pronounced by the experimenter. Before each of the three sections, the children were given five practice items with feedback. Across the three subtests were 34 test items in total. The test items and administration procedures and instructions were exactly as described in Bird et al., except that we produced the picture stimuli using the Board Maker software and we replaced the item see with soap. Bird et al. did not report reliability information for this measure, but we have determined split-half reliability to be .9772 (using an odd–even split) on the basis of 87 administrations of this test in which total scores ranged from 0% to 100% correct.

Phonemic Perception. Phonemic perception was assessed using Speech Assessment and Interactive Learning System (SAILS) software (Avaaz Innovations Inc., 1997), a computer game that assesses a child’s ability to hear sounds pronounced correctly and sounds pronounced incorrectly within the context of words, each beginning with a commonly misarticulated consonant. The test words were organized into modules consisting of 10 to 30 tokens recorded from children and adults, half articulated correctly
(e.g., lake → [lek]), half articulated incorrectly (e.g., lake → [wek]), and all presented in random order. The recorded words were presented one at a time over headphones. The children were also presented with two response alternatives on the computer monitor, a picture of the target word, and a picture of a large X. Using the lake module as an example, the children were instructed to point to the picture of the lake if they heard the word lake and to point to the X if they heard a word that was not lake. Test trials were preceded by a 10-trial practice block that contrasted the words lake and make. Corrective feedback was provided if necessary and the children were required to achieve a level of at least 80% correct before proceeding to the test trials. All children in this study were presented with the test modules targeting the words lake, cat, rat, and Sue in order as written. Across the four modules, 70 items were presented in total.

Early Literacy Skills. The children’s literacy skills were assessed using the Early Literacy Assessment, adapted from Johns (1997). The test included three sections: alphabet knowledge, literacy knowledge, and basic word knowledge. The test items are shown in Appendix B.

Speech Sample. Speech samples were recorded from all 26 participants using a picture book (Carl Goes Shopping; Day, 1989). The children were asked to “talk about the pictures” and, if necessary, the examiner prompted with open-ended questions, primarily “What is happening here?” and “What do you think is going to happen next?” Systematic Analysis of Language Transcripts (SALT; Miller & Chapman, 1996) was used obtain the MLU in morphemes for each participant. Samples were also phonetically transcribed and coded to obtain the PCC (Shriberg & Kwiatkowski, 1982). Ten percent of the samples were randomly selected for recoding by a second observer. Morpheme by morpheme reliability for the SALT transcriptions was 93.61%. Point by point reliability for the PCCs was 89.31%.

Results
Table 2 displays the mean scores of each group on the tests of phonological awareness, phonemic perception, and early literacy knowledge and the results of the t tests used to assess between-group differences on each of the three variables.

### Phonological Awareness
An examination of phonological awareness test performance revealed significant differences between the two groups. Children with normal expressive phonological skills scored higher than children with delayed expressive phonological skills on the phonological awareness test on average. The PN group scores ranged from 10 to 32, whereas the PD group scores ranged from 7 to 28 correct responses. Seven of the PD group children obtained scores that were more than 1 SD below the mean of the PN group. The effect size was determined to be large (d = 1.50, indicating that the mean of the PN group was at the 93rd percentile of the PD group scores; Cohen, 1988).

### Phonemic Perception
Results for the SAILS test of phonemic perception revealed that the children in the PN group obtained significantly higher scores on this test in comparison with the children in the PD group. The children with normally developing expressive phonological skills were better able to perceive phonemic contrasts within the context of a word, correctly identifying correct pronunciations and mispronunciations more often. The effect size was determined to be large (d = 0.95, indicating that the mean of the PN group was at the 82nd percentile of the PD group scores (Cohen, 1988).

### Early Literacy
No significant differences were observed between the two groups with respect to early literacy skills. The only child who did not know the names of any letters was in the PD group. However, the only child who was able to read some words was also in the PD group. With the exception of these 2 children, the ranges of scores on the three subtests of the early literacy test were completely overlapping.

| TABLE 2. Mean (and standard deviation) of scores on the tests of phonological awareness, phonemic perception, and early literacy knowledge, by group. |
|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
|                  | PN Group         | PD Group         |                  |                  |                  |                  |
|                  | M SD             | M SD             | t(12)            | p                |                  |                  |
| Phonological awareness | 21.38 5.30 | 15.19 5.74 | 2.86 0.001 |                  |                  |
| Rime Match       | 9.62 3.73        | 6.69 2.78        | 2.78             |                  |                  |
| Onset Match      | 7.23 2.42        | 4.46 2.70        | 2.70             |                  |                  |
| Onset Segmentation | 4.38 2.69 | 3.85 2.73        | 2.73             |                  |                  |
| Phonemic perception | 74.08 9.57 | 63.08 13.28 | 2.42 0.01 |                  |                  |
| Early literacy knowledge | 14.54 3.60 | 12.46 5.47 | 1.14 0.27 |                  |                  |
| Letter names     | 9.00 3.14        | 7.23 3.61        | 3.61             |                  |                  |
| Literacy knowledge | 5.54 1.98 | 4.85 2.73        | 2.73             |                  |                  |
| Word knowledge   | 0.00 0.00        | 0.23 0.83        | 0.83             |                  |                  |
Discussion

The purpose of this study was to compare the phonological awareness abilities of two groups of 4-year-old children, one with normally developing expressive language skills and one with moderately or severely delayed expressive phonological skills. The two groups were well matched for receptive vocabulary skills, age, SES, and preliteracy knowledge. The children with expressive phonological delays demonstrated significantly poorer phonological awareness skills than their normally developing peers.

These results support previous findings of a relationship between expressive phonological skills and phonological awareness abilities (Bird et al., 1995; Larivee & Catts, 1999; Webster & Plante, 1992). Our findings further support Bird et al.’s conclusion that this relationship is independent of the children’s language skills. Although we admit that our measure of language functioning was restricted to a single measure of receptive vocabulary skills, our two samples appear to be more closely matched on receptive language skills than clinical and control samples examined in previous studies. It is unlikely, however, that samples of children with delayed and typical phonology could be exactly similar with respect to all aspects of language functioning. The majority of children with expressive phonological delay have difficulties with other areas of language functioning, especially morphology (Paul & Shriberg, 1982; Ryachew, Gines, Cloutier, & Blanchet, 2003). Difficulties with morphology have been correlated with phonological awareness and reading skills in other studies (Bishop & Adams, 1990) but it has been shown that these difficulties stem from the core deficit in phonological processing (Gottardo, Stanovich, & Siegel, 1996; Shankweiler et al., 1995).

The profile of phonological awareness abilities observed in both groups of children also supports the proposal that phonological awareness develops gradually and sequentially, reflecting the hierarchical phonological structure of language (Burt, Holm, & Dodd, 1999; Wood & Terrel, 1998). Children in both groups demonstrated the best accuracy for the rime-matching subtest and least accuracy for the onset-segmentation-and-matching subtest. In fact, both groups of children found the latter subtest to be equally difficult.

The children with delayed expressive phonological skills had more difficulty with a test of phonemic perception than did their peers with normally developing phonology. It is important to note that the SAILS test of phonemic perception and the test of phonological awareness skills used in this study are not equivalent tests. Accurate performance on the phonological awareness test required the children to have some ability to segment words into intrasyllabic units (i.e., onset and rime). Segmental representation of lexical items is not required in order to identify [su] as belonging to one lexical category and [tu] to another. Nonetheless, it is clear that a child who identifies both [su] and [tsu] as exemplars of the word Sue has a less detailed and precise underlying representation for this word than a child who responds that [tsu] is not-Sue. The finding that children with expressive phonological deficits had particular difficulty with this task is consistent with a number of other studies that have shown that at least some children who have difficulty with speech production also have difficulty with speech perception (Broen, Strange, Doyle, & Heller, 1983; Hoffman, Daniloff, Benua, & Schukers, 1985; Ryachew & Jamieson, 1989).

At least one other study has shown that delayed phonemic perception skills are associated with difficulties with phonological awareness. Nitttouer (1996) assessed children’s ability to identify /su/ and /ju/ using segmental cues (i.e., spectral information about the fricative and vowel portions of the syllable) rather than syllable based cues (i.e., spectral information about the transitional portion of the syllable). Children with a more mature weighting strategy (i.e., focused on the segmental cues) also showed superior phonological awareness skills. Children with a history of otitis media or low SES demonstrated difficulties with both the phonological awareness and speech perception tasks.

The correspondence of deficits in the areas of expressive phonology, phonemic perception, and phonological awareness support Swan and Goswami’s (1997) proposal that poor phonological awareness skills arise from deficiencies in both “(1) the precision of the phonological specification of the underlying representations and (2) the segmental organization of those representations” (p. 19). This proposal has been supported by studies in which the precision of the children’s phonological representations has been estimated from the children’s ability to produce multisyllabic nonwords (e.g., Larrivee & Catts, 1999) and real words (e.g., Swan & Goswami, 1997). This may be a problematic procedure, however, for determining preschool-age children’s ability to form precisely specified underlying representations. Firstly, even normally developing young children have difficulty with accurately producing multisyllabic words. Secondly, young children with moderate and severe expressive phonological impairments produce many phonemic substitution errors. For this reason it is difficult to distinguish between problems at the level of the underlying representations and output constraints when testing younger children using this procedure. The phonemic perception assessment used in this study appears to be a good alternative for understanding the precision with which children’s underlying representations are specified.

The findings reported here have a number of clinical implications. First, it is clear that children with moderate and severe expressive phonological delay are at risk for deficits in phonological awareness, even when their receptive language skills are well within normal limits. A number of tools for assessing phonological awareness in young children are now available, in addition to the Bird et al. (1995) procedure that was used in this study (see Justice et al., 2002). At the very least, children should be monitored during the preschool period so that school speech-language pathologists can be alerted to the presence of children who enter kindergarten with phonological awareness deficits.

Ideally, phonological interventions delivered during the preschool period would include measures to ensure
normalized development of phonological awareness skills prior to school entry and prevent delays in the acquisition of reading during the elementary school years. However, researchers have only recently turned their attention to the development of phonological awareness skills in very young children. Gillon (2000, 2002) has shown that kindergarten-age children with delayed expressive phonology obtain long-term benefits from an intensive phonological awareness treatment program. However, similar studies of younger children have not been conducted. More descriptive studies are required to better understand the way in which explicit phonological awareness abilities emerge from the development of children’s implicit oral language skills. Further treatment efficacy studies are required in order to determine the best means of enhancing the development of phonological awareness abilities in very young children.

Acknowledgments

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Appendix A (p. 1 of 2)

Details of Phonological Analysis for Each Participant: Match Ratios for Selected Features and Syllable Structures, Distortion Errors, and Atypical Error Patterns, by Syllable Position (Onset or Coda)

<table>
<thead>
<tr>
<th>Position</th>
<th>Continuant</th>
<th>Dorsal</th>
<th>C</th>
<th>CC</th>
<th>wSyl</th>
<th>Distortions</th>
<th>Atypical Errors</th>
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Appendix A (p. 2 of 2)
Details of Phonological Analysis for Each Participant: Match Ratios for Selected Features and Syllable Structures, Distortion Errors, and Atypical Error Patterns, by Syllable Position (Onset or Coda)

<table>
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<th>Dorsal</th>
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<th>wSyl</th>
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*Match ratios are shown for the following syllable structures: simple onsets and codas (C), complex onsets and codas (CC), and weak syllables (wSyl). A match indicates that the child included all required elements of the structure regardless of whether the segments were articulated accurately.

Appendix B
Early Literacy Assessment

Part One: Alphabet Knowledge

Instructions to child: Here are some letters. I want you to tell me their names.

Items: O, S, V, B, W, A, x, e, t, l, n, z.

Part Two: Literacy Knowledge

Instructions to child: I'd like you to show me some of the things you know about reading. You won't have to read.

Items using a picture book: Show me the front of this book. Show me the title. Point to where I should start reading. Which way should I go? Where should I go after that?

Items using index cards with one item per card, presented all at once in random order on the table: Show me one letter. Now show me two letters. Show me only one word. Now show me two words. Show me a sentence.

Part Three: Word Knowledge

Instructions: I want to see if you know any of these words. Let's begin with this one.

Items: the, of, and, to, a, in, is, that, it, was.