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Phonological Awareness Acquisition in Children With Coexisting Mental Retardation and Behavioral Disorders

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ABSTRACT: Phonological awareness is the ability to manipulate the individual speech sounds that make up connected speech. Little information is reported on the acquisition of phonological awareness in special populations. This study used a quasi-experimental, within-subjects, time-series design to determine whether 60 min of instruction per week provided for 14 weeks would enhance phonological awareness in 16 children ages 7 through 13 who had been dually diagnosed with borderline to moderate mental retardation (IQs 48–83) and behavioral disorders. The purpose of treatment was to encourage explicit knowledge of phonology. A statistically significant increase in performance was achieved on five phonological awareness tasks across repeated measures. Phonological awareness intervention was both accessible and beneficial to children with mental retardation and behavioral disorders.

KEY WORDS: phonological awareness, mental retardation, behavioral disorders, emergent literacy

Phonological awareness refers to the ability to perceive and manipulate the individual speech sounds, known as phonemes, that make up connected speech (Yopp & Yopp, 2000). Skill in phonological awareness entails the analysis of speech sounds as they appear in isolation and/or in the context of words, phrases, and sentences (Neuman, Copple, & Bredekamp, 2000). Speakers generally do not attend to individual phonemes as they listen to or produce speech; rather, they process phonemes automatically while giving direct attention to the meaning of the message conveyed (Adams, Foorman, Lundberg, & Beeler, 1998a). Phonological awareness involves the acquisition of a variety of metalinguistic insights that relate to understanding the sound structure of language, including (a) identifying phonemes in the context of syllables and words; (b) blending phonemes to form syllables, words, and sentences; (c) segmenting wholes into parts (i.e., sentences into words and words into constituent syllables or phonemes); (d) analyzing word parts (e.g., if /b/ is deleted from *bat,* the resulting word is *at*); and (e) analyzing sound correspondences within groups of rhyming words (DiSanto, Kraft, Lentini, & Sivitz, 2000; International Reading Association [IRA], 2000; Stone, Merritt, & Cherkes-Julkowski, 1998; Yopp & Yopp, 2000).

The relationship between phonological awareness and beginning reading has been ascertained since the 1970s (Stahl & Murray, 1994). Phonological awareness provides the insight into the sound structure of language that underlies the understanding of letter–sound correspondences (Adams, 1994; Griffith & Olson, 1992). Longitudinal studies of reading development have demonstrated that the acquisition of phonological awareness is highly predictive of success in learning to decode (Adams, Foorman,

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Lundberg, & Beeler, 1998b; Catts & Kahmi, 1999; Ehri et al., 2001; IRA, 2000; Snow, Burns, & Griffin, 1998; Stone et al., 1998). In fact, training in phonological awareness has been found to result in improved reading achievement for typically developing children (Adams et al., 1998a; van Kleeck, Gillam, & McFadden, 1998).

Children and adults who struggle with reading are likely to have less well-developed phonological awareness than those who do not struggle (Snow et al., 1998). Children with mental retardation are often struggling readers (Cawley & Parmar, 1995; Hoogeveen, Birkhoff, Smeets, Lancioni, & Boelens, 1989; Katims, 1996). Mental retardation is defined as an intellectual functioning level at or below 70–75 as measured by standardized IQ tests, such as the Wechsler Intelligence Scale for Children—Third Edition (WISC, Wechsler, 1991) or the Stanford Binet Intelligence Scale, Fourth Edition (Thorndike, Hagan, & Sattler, 1986), plus significant limitations in communication, self-care, home living, social, leisure, and health and safety skills; self-direction; functional academics; community involvement; and/or work (Cegelka & Prehm, 1982). Children with mental retardation typically manifest some degree of phonological deficit (Reed, 1994) that may interfere with their realization of the meaning of print (Swank & Catts, 1994). Identifying and analyzing phonemes are abstract metalinguistic processes that may be difficult for children with mental retardation for several reasons: (a) producing and listening to individual speech sounds may be unfamiliar, (b) phonemes produced in isolation may not sound similar to phonemes coarticulated to form words, (c) some children with mental retardation may not understand instructional terms such as "sounds" or "word parts" (Hoogeveen et al., 1989), (d) they may have difficulty encoding phonological information into memory, and/or (e) they may have difficulty retrieving phonological codes from memory (Catts, 1986). Notwithstanding, several authors recounted successful phonological awareness interventions for children with mental retardation. These include Conners (1992), who discussed sound discrimination and blending sounds; Hoogeveen et al. (1989), who reported on the isolation of final sounds in words and segmenting sounds in words; Hoogeveen and Smeets (1988), who explored blending sounds to form words; and Kabrich and McCutchen (1996), who inquired into the skills needed for detecting phonemically similar words.

Children with behavioral disorders may display significant reading difficulties. Predominantly, it appears that reading difficulties arise in this population when attention is compromised. Reading requires great attentional resources. Lonigan et al. (1999) and Coleman and Vaughn (2000) reported a significant degree of co-morbidity of reading disorders and attentional disorders in school-age children. Coleman and Vaughn conducted a review of the research on reading interventions for children with behavioral disorders related to attentional skills and found that, other than the positive impact of peer tutoring programs, there is very little information that describes successful interventions for this population.

Children who have more than one disorder typically experience insufficient access to literacy materials and engage in fewer reading-type activities than do children with a single disability (Katims, 1996). There appears to be no published research that has explored phonological awareness intervention for children with coexisting mental retardation and behavioral disorders.

The purpose of the present study was to determine whether instruction via a specific progression of phonological awareness tasks would enhance the phonological awareness skills of children who had been dually diagnosed with mental retardation and behavioral disorders. It was hypothesized that a progression of tasks designed to facilitate the acquisition of phonological awareness in typically developing children (Adams et al., 1998b; Robertson & Salter, 1995) would also facilitate the acquisition of phonological awareness in this sample of children. The present research documented how participants progressed through the completion of a series of increasingly complex speech sound recognition and manipulation tasks.

METHOD

Design Considerations

Because ethical considerations precluded establishing a control group of children with mental retardation and behavioral disorders from whom phonological awareness intervention would be withheld or delayed for several weeks of a school year, a quasi-experimental, within-subjects, time-series design was employed. The objective was to determine via multiple observations whether intervention resulted in improved performance within this single group of participants (Cook & Campbell, 1979; Schiavetti & Metz, 1997).

Participants and Setting

Participants were 16 children—1 girl and 15 boys. Table 1 reports data taken from participants' case files. For purposes of comparing participants to one another, participants were assigned to three subgroups based on their level of mental retardation—borderline, mild, or moderate. Classification of level of mental retardation was based on the scale proposed by the President's Committee on Mental Retardation (Vinson, 1999): The mild range of mental retardation represents an IQ of 55–69; moderate mental retardation encompasses IQs of 40–54. Borderline mental retardation was a designation used by the participants' school for students whose IQ is 70–83. Participants' IQ scores were obtained by the school's administration of either the WISC (Wechsler, 1991), the Stanford Binet Intelligence Scale, Fourth Edition (Thorndike et al., 1986), or the Kaufman Assessment Battery for Children (Kaufman & Kaufman, 1983). Six participants presented with borderline mental retardation, seven with mild mental retardation, and three with moderate mental retardation.

Table 1 also reports the language age-equivalent scores obtained on a standardized measure, Assessing Semantic Skills through Everyday Themes (ASSET; Barrett, Bowers,

Table 1. Participant description.

Participant-classroom	*Age*	*Language age (ASSET)*	*Gender*	*Ethnicity*	*IQ-scale subgroup*	*Diagnoses*	*Medications*
1-A	8;1	5;5	M	Anglo European	55 WISC Mild	Dysthymia, Oppositional Defiant Disorder, Attention Deficit Hyperactivity Disorder, Asthma	Ritalin
2-B	9;8	8;0	F	African American	61 WISC Mild	Attention Deficit Hyperactivity Disorder, Oppositional Defiant Disorder, Bipolar Disorder	Risperidone Adderall
3-A-B	8;8	5;1	M	Anglo European	82 Kaufman	Pervasive Developmental Disorder	None
4-B	12;0	5;2	M	African American	50 WISC Moderate	Oppositional Defiant Disorder, Asthma	Depakote Dexedrine Clonadine
5-A	8;4	4;4	M	African American	65 Kaufman Mild	Oppositional Defiant Disorder, Asthma	None
6-A	7;9	4;10	M	Anglo European	76 WISC Borderline	Oppositional Defiant Disorder, Repaired Cleft Palate, Parent–Child Interaction Problem	Risperdal Lithin Wellbutrin
7-B	9;11	4;5	M	Anglo European	48 WISC Moderate	Oppositional Defiant Disorder, Attention Deficit Hyperactivity Disorder, Bipolar Disorder	Risperdal Dexedrine
8-A	7;4	4;4	M	Hispanic	77 Kaufman Borderline	Oppositional Defiant Disorder, Attention Deficit Hyperactivity Disorder, Asthma, Seizures, Post-Traumatic Stress Disorder	Adderall Clonadine
9-B	9;2	6;4	M	Anglo European	83 Kaufman Borderline	Oppositional Defiant Disorder, Attention Deficit Hyperactivity Disorder, Congenital Nystagmus	Ritalin Clonadine
10-B	13;0	6;1	M	African American	67 WISC Mild	Attention Deficit Hyperactivity Disorder, Depressive Disorder, Post-Traumatic Stress Disorder	Risperdal Cogentil Adderall Depakote
11-B	9;6	5;7	M	African American	71 Kaufman Borderline	Attention Deficit Hyperactivity Disorder, Asthma	None
12-A	9;9	4;5	M	African American	56 WISC Mild	Oppositional Defiant Disorder, Attention Deficit Hyperactivity Disorder, Seizures	None
13-A	8;4	4;7	M	Anglo European	74 Kaufman Borderline	Oppositional Defiant Disorder, Attention Deficit Hyperactivity Disorder, Parent–Child Interaction Problem	Asthma inhaler
14-B	11;1	5;6	M	African American	70 WISC Mild	Psychosis, Pervasive Developmental Disorder, Oppositional Defiant Disorder, Attention Deficit Hyperactivity Disorder	None
15-B	10;3	5;1	M	African American	61 Kaufman Mild	Post-Traumatic Stress Disorder, Tourettes Syndrome, Schizophrenia	Risperdal Clonadine
16-B	11;4	5;0	M	African American	52 Binet Moderate	Dysthymia, Oppositional Defiant Disorder, Attention Deficit Hyperactivity Disorder	Adderall Wellbutrin

Note. ASSET = Assessing Semantic Skills through Everyday Themes; WISC = Wechsler Intelligence Scale for Children—Third Edition; Kaufman = Kaufman Assessment Battery for Children; Binet = Stanford Binet Intelligence Scale, Fourth Edition. Age is in years;months.

& Huisingh, 1988). Developmental receptive and expressive language disorders were documented for all participants. Some participants were of a chronological age that exceeded the age range on which the ASSET was normed; however, the test was chosen for the type of information that it yielded regarding children's cognitive–linguistic abilities.

The ASSET required examinees to label items, categorize items by recognizing similarities among objects, identify attributes by comprehending characteristics of objects, attach purpose to an object by giving its function, and define essential features of objects. The semantic skills assessed by the ASSET were considered somewhat comparable to the phonological awareness skills that the current investigation meant to assess and facilitate, albeit in a different domain of language. Phonological awareness entails recognizing similar and different attributes of sounds and categorizing sounds. These are cognitive–linguistic operations that are perhaps related to the types of cognitive–linguistic skills measured by the ASSET. Even so, despite potential similarities in task demands, it was not possible to infer whether the cognitive–linguistic capabilities demonstrated by performance on the ASSET related to the potential for acquisition of phonological awareness skills. Although language age-equivalent scores provided useful descriptive information concerning participants, these scores did not yield any concurrent or predictive information concerning phonological awareness skills.

None of the participants was currently diagnosed as having an articulation disorder, impairment in expressive speech phonology, apraxia, or dysarthria.

The participants attended a school for students with mental retardation, defined by the school as an IQ of 83 or below, whose behavioral concerns prevented placement in a regular education setting. The school's curriculum and instruction addressed behavioral and educational needs with a focus on preparation for supportive or independent living, further education, and vocational readiness. A primary goal was to return students to their home schools upon resolution of behavioral issues.

Students were grouped into classrooms according to developmental abilities rather than by grade level. Participants were drawn from two classrooms, 7 from Classroom A, where students were less developmentally advanced, and 9 from Classroom B, where students were more developmentally advanced. At the time of the study, all students took part in a multisensory early literacy curriculum that included letter recognition; book handling; comprehension of stories read aloud; and producing journals by drawing, copying words, and using invented writing. More advanced learners, approximately half of the participants, engaged in rhyming words, counting syllables in words, identifying their names in print, and reading sight word flash cards. Students attended 60 min of speech-language therapy per week where development of the semantic, syntactic, pragmatic, and phonological aspects of language was facilitated. It must be acknowledged that some classroom and therapy activities explicitly and implicitly exposed all of the children to the phonological properties of language (e.g., rhyming, isolating sounds in words, and syllabication). These practices were not suspended while the study was being conducted.

Procedures

Testing and treatment were conducted by two speech-language pathologists (SLPs), one of whom was on staff as the school SLP. Her credentials included more than 10 years of experience working with this population, a Certificate of Clinical Competence awarded by the American Speech-Language-Hearing Association, a master's degree in reading instruction, and years of experience designing and teaching professional development courses for teachers on language and literacy instruction. She was well-versed in the use of the instruments and intervention techniques selected for the study. She directly supervised the second SLP, who was a master's candidate nearing completion of her degree program. Although the master's candidate designed the study, selected the instrumentation, and planned the progression of intervention tasks, the supervisor trained the master's candidate in the use of instrumentation and evaluated the quality and appropriateness of all instructional materials and strategies. The two SLPs met regularly to discuss detailed written treatment plans that were prepared in order to ensure consistent implementation of treatment across the two practitioners. Also, regular debriefings took place after each session was completed. In addition, the university program's field supervisor and the student's master's thesis advisor, both SLPs, provided the candidate with occasional supervision and consultation throughout the study.

Pretesting. Pretesting was referred to as Test 1. Five of the eight subtests of The Phonological Awareness Test (Robertson & Salter, 1997) were administered to each child. The Phonological Awareness Test was used to assess a hierarchy of phonological awareness skills. It provided scores relative to the students' developmental ages. Subtests were (a) identifying rhyming word pairs and producing rhymes for one- and two-syllable words; (b) segmenting sentences into individual words, words into syllables, and words into phonemes; (c) isolating initial, medial, and final sounds in words; (d) deleting word parts, such as compound word parts, syllables, and phonemes, to result in different words; and (e) blending given syllables or phonemes to form words. Letter recognition, word decoding, and developmental spelling can be assessed by the remaining subtests of The Phonological Awareness Test, but these competencies were beyond the scope of the current research.

The Phonological Awareness Test was selected for use in the present study because of its many strengths. The test authors reported that their reviews of the literature on phonological awareness and of available tests informed their design of The Phonological Awareness Test so that it would adequately depict the requisite phonological awareness skills that are developmentally present at ages within the test domain (Robertson & Salter, 1997).

The Phonological Awareness Test was normed using 1,235 children (ages 5;0 [years;months] through 9;11), with 10% of the sample present in each half-year age range (e.g., 5;0 to 5;6, 5;7 to 5;12, etc.). Important to the population under study, the authors indicated that testing older learners is an appropriate use of the test and may

provide useful diagnostic information for planning intervention. The test was appropriate for the present study in that it was developed using a comparison group of students who had been identified as being at risk for atypical reading development. The test authors noted that contrasted groups validity, on the basis of comparing the test performance of randomly selected children from the normative population with a matched sample of students who had been identified as being at risk, revealed that the test significantly discriminated between these two groups for each subtest and for total test performance. Therefore, this test should be a valid indicator of any less than adequate performance by study participants; their scores should differ from scores that would be obtained by students whose acquisition of phonological awareness was progressing typically.

Another strength of The Phonological Awareness Test is its reliability. The test authors reported that point biserial correlations revealed acceptable levels of item consistency. Satisfactory reliability correlations of no less than $r = .7$ were found, at all ages, between individual item scores and total test scores, between item scores and subtest task scores, and between subtest scores and total test scores. Homogeneity of statistically significant results supported the inclusion of all test items.

Further, the standardization sample roughly approximated the demographic characteristics of the United States. Pertinent to the current study, 16% of the children who made up the standardization sample were African American and 11% were Hispanic American. All items were analyzed for racial bias.

Each subtest has 10 items. Pretesting required 45–60 min per child.

Treatment and repeated measures. Testing and treatment required approximately an additional 1,000 min of contact time per child. Therapeutic instruction was directed at improving the phonological awareness competencies that were tested by The Phonological Awareness Test (Robertson & Salter, 1997). The test assessed rhyming, segmenting, isolating, deleting, and blending as linguistic manipulations that the examinee should be able to execute at the sound, syllable, word, and sentence level. However, for purposes of instruction, in accordance with Kavanagh's (1991) suggestion that instruction proceed from whole to part, these phonological awareness skills were regrouped into the following teaching units: (a) rhyming (i.e., rhyme discrimination and rhyme production), (b) awareness of words (i.e., segmentation of sentences, deletion of compound words, and blending of compound words), (c) awareness of syllables (i.e., segmentation of syllables, deletion of syllables, and blending of syllables), and (d) awareness of phonemes (i.e., isolation of initial, final, and medial phonemes, deletion of phonemes, and blending of phonemes).

Treatment procedures were devised after a review of several published phonological awareness programs. Resources included *The Phonological Awareness Book* (Robertson & Salter, 1995), designed for use with The Phonological Awareness Test, as well as materials by Adams et al. (1998b), Kavanagh (1991), Stone et al., (1998), and Yopp and Yopp (2000). Authors of these resources addressed the challenge of finding successful approaches for teaching children to notice the individual phonemes that are used when words are spoken and to discover how these sounds can be manipulated. All advocated an approach that is intentional and systematic. Kavanagh (1991) proposed a whole-to-part approach, beginning with listening games followed by rhyming games, segmentation of sentences into words, segmentation of words into syllables through clapping and rhythmic activities, identification of phonemes, and segmentation of individual phonemes in words. Yopp and Yopp (2000) suggested using enjoyable multisensory songs, word games, chants, and riddles that develop sensitivity to sounds and the structure of words. The Appendix lists the skills that were taught in the context of a variety of multisensory activities.

Researchers have also explored the amount of time needed for phonological awareness instruction to be effective. Yopp and Yopp (2000) established that typically developing children can benefit from periods of instruction that range from as little as 30 min to as much as dozens of hours. Stone et al. (1998) suggested 15–20 min of formal training three times a week as a minimum for typical kindergartners and first graders. In keeping with these suggestions, 60 min of instruction per week, delivered in 20- or 30-min sessions, was provided for 14 weeks (840 min total per child). One SLP working alone led groups of 3–6 children. Some children had occasion to complete all treatment sessions with only one SLP and some worked with both of the SLPs. Occasionally, a child met alone with an SLP if absence from a group session necessitated a makeup session.

Repeated measures of phonological awareness were interspersed amid the teaching sessions, as indicated in the progression of tasks described in the Appendix. The second measure of skill, in each of the areas of rhyming, awareness of words, awareness of syllables, and awareness of phonemes, was referred to as Test 2. After participants completed instruction related to each skill area, at the time of their next session, the corresponding subtest items of The Phonological Awareness Test (Robertson & Salter, 1997) were administered, before any subsequent teaching of new skills began. Test 2(A) was given after rhyming was taught, Test 2(B) assessed awareness of words (deletion and segmentation), Test 2(C) measured awareness of syllables (segmentation, deletion, and blending), Test 2(D) evaluated awareness of phonemes (isolation), and Test 2(E) assessed awareness of phonemes (deletion, segmenting, and blending). Test 2 necessitated five 15-min testing sessions per participant.

Test 3 entailed a reassessment of 20% of the items on which each participant achieved a correct score at the most recent testing. Therefore, Test 3 was individualized for each child and consisted of only two questions selected from every subtest of 10 items. If the child had not answered two questions correctly at Test 2, then items #1 and #10 from the most recently administered subtests were presented. Test 3(A) was conducted 2 weeks after Test 2(B) and reassessed rhyming, awareness of words, and awareness of syllables. Test 3(B) took place 2 weeks after Test 2(E) and provided a repeated measure of awareness of syllables and awareness of phonemes. Test 3 required two testing

sessions of less than 10 min per participant. Test 3 was intended to measure retention following intervening instruction of alternate content.

Test 4, posttesting, was conducted 2 weeks after completion of Test 3(B). The five subtests given at Test 1 were readministered to determine whether participants retained skill over the duration of the intervention. Test 4 required 45–60 min per participant.

Data collected during treatment sessions. Additional data were collected to explore whether participants performed similarly on phonological awareness tasks presented at Test 4 and on tasks presented during treatment. Progress during treatment was carefully documented using individual performance charts and audio recordings of sessions. For each participant, a percentage correct score was tallied for each session by calculating the number of correct responses divided by the number of attempted responses. At the conclusion of treatment, each participant attained a cumulative average score. Cumulative averages were figured into a group mean score, which was correlated with Test 4 mean scores.

Data were also collected on participants' behavior during treatment sessions. Given that each participant had been dually diagnosed with mental retardation and behavioral disorders (Table 1), participants' potential for gains in phonological awareness skills conceivably could have been adversely affected by nonproductive behavior during treatment. The therapist providing intervention gave each participant a weekly score of up to three points for session behavior based on cooperation, participation, and avoidance of behaviors that warranted negative consequences. A cumulative individual behavior score of 42 points (3 points × 14 sessions) was the best possible score. Individuals' behavior scores were plotted against their test score gains, that is, an increase in score points from Test 1 to Test 4, to determine whether any relationship between positive behavior and achievement of a test score increase could be noted.

RESULTS

Significance of Score Gains

Raw scores were converted to percentage correct scores because of the need to compare an unequal number of test items per administration. Table 2 reports group and subgroup mean scores for each of the five subtests at each administration.

On the rhyming subtest, gains were attained for the whole group and for each subgroup from Test 1 to Test 2, Test 1 to Test 3, Test 1 to Test 4, and Test 2 to Test 4. For segmentation, the whole group and each subgroup showed gains from Test 1 to Test 2, Test 1 to Test 3, and Test 1 to Test 4. For deletion, the whole group and each subgroup improved its scores from Test 1 to Test 2, Test 1 to Test 3, and Test 1 to Test 4. On the isolation subtest, gains were made by the whole group and each subgroup from Test 1 to Test 2, Test 1 to Test 3 (except for the whole group for isolation of phonemes/medial sounds), and Test 1 to Test 4 (except for the moderate group for isolation of phonemes/final sounds). For blending, score increases were attained for the whole group and each subgroup from Test 1 to Test 2, Test 1 to Test 3, and Test 1 to Test 4. Performance increased for all five phonological awareness tasks across repeated measures. On some subtests, scores were highest at Test 2 then fell at Test 4, although remaining higher at Test 4 than at Test 1.

To determine the significance of these gains, a one-way repeated measures analysis of variance (ANOVA) was performed using each of the 16 participants' percentage correct score for each of the four tests. The results were significant, $F(3, 60) = 16.78$, $p \leq .001$. Following the significant F finding, Tukey's HSD test was conducted. Results indicated a significant difference ($p \leq .0001$) in performance between Test 1 and Test 2, Test 1 and Test 3, and Test 1 and Test 4.

Given that the participants were children whose IQs ranged from 48 to 83, it was important to determine whether the children with the higher IQ scores were responsible for the increased scores attained by the whole group. This was not the case. Each subgroup contributed substantially to the whole group's subtest mean scores by having the highest mean score on various subtests. Although the borderline subgroup had the highest mean scores most frequently, this subgroup did not always outperform the other subgroups or have full responsibility for the subtest mean scores that were achieved by the whole group. Figure 1 illustrates the average percentage correct scores at each test administration for each of the subtest areas. Performance by the borderline, mild, and moderate subgroups is shown separately.

Correlations Between Subtest Scores

Pearson product moment correlations were conducted to determine whether participants evidenced related gains across various subtests. Correlated gains might provide evidence that the ability to perform one phonological awareness task can be seen as related to the ability to perform another phonological awareness task. The intent of obtaining these correlations was to suggest that if participants showed corresponding gains across a variety of phonological awareness tasks, they may be said to be demonstrating a general set of phonological awareness skills. Perhaps some element of the interdependence and hierarchical complexity of phonological awareness tasks could be illustrated by the participants' performance.

Correlations were run using mean scores at Test 4. Seventy-seven significant correlations between whole group mean scores were obtained. Eight of the ten strongest correlations included isolation as a variable: the isolation total score correlated with segmentation of phonemes ($r = .867$, $p = .0001$), segmentation of sentences ($r = .767$, $p = .001$), the segmentation total score ($r = .917$, $p = .0001$), and the deletion total score ($r = .797$, $p = .0001$), and isolation of final sounds correlated with isolation of medial sounds ($r = .782$, $p = .0001$), segmentation of phonemes ($r = .828$, $p = .0001$), segmentation of sentences ($r = .729$, $p = .001$), and the segmentation total score ($r =$

Table 2. (Page 1 of 2). Group and subgroup mean scores at four test administrations.

	Whole group		*Borderline subgroup*		*Mild subgroup*		*Moderate subgroup*	
	M	SD	M	SD	M	SD	M	SD
Rhyme Discrimination								
Test 1	51.30%	34.0	43.30%	39.3	55.70%	36.0	56.70%	25.2
Test 2	80.00%	17.9	93.30%	8.2	71.40%	20.4	73.30%	11.6
Test 3	78.10%	36.4	100.00%	0	64.30%	47.6	66.70%	28.9
Test 4	92.50%	9.3	98.30%	4.1	91.40%	7.0	83.30%	15.3
Rhyme Production								
Test 1	15.00%	28.9	18.30%	27.9	12.90%	34.0	13.30%	23.1
Test 2	69.40%	35.5	86.70%	28.1	61.40%	33.9	53.30%	50.3
Test 3	71.90%	40.7	83.30%	40.9	71.40%	39.3	50.00%	50.0
Test 4	82.50%	22.4	95.00%	5.5	72.90%	29.3	80.00%	17.3
Rhyme Total								
Test 1	33.10%	27.0	30.80%	32.0	34.30%	30.7	35.00%	5.0
Test 2	74.70%	22.9	90.00%	15.5	66.40%	24.3	63.30%	20.8
Test 3	75.00%	28.9	91.70%	20.4	67.90%	31.3	58.30%	28.9
Test 4	87.50%	12.5	96.70%	4.1	82.10%	13.8	81.70%	12.9
Segmentation of Sentences								
Test 1	52.50%	25.2	61.70%	26.4	48.60%	23.4	43.30%	30.6
Test 2	78.80%	28.0	80.00%	14.1	84.30%	25.1	63.30%	55.1
Test 3	84.40%	30.1	91.70%	20.4	71.40%	39.4	100.00%	0
Test 4	72.50%	23.5	80.00%	11.0	74.30%	26.4	53.30%	32.2
Segmentation of Syllables								
Test 1	43.10%	24.7	60.00%	26.8	34.30%	15.1	30.00%	26.5
Test 2	90.00%	15.1	98.30%	4.1	92.90%	11.1	66.70%	15.3
Test 3	90.60%	20.2	91.70%	20.4	85.70%	24.4	100.00%	0
Test 4	74.40%	13.7	81.70%	11.7	71.40%	15.8	66.70%	5.8
Segmentation of Phonemes								
Test 1	6.30%	12.6	6.70%	16.3	2.90%	7.6	13.30%	15.3
Test 2	31.20%	24.0	45.00%	20.7	27.10%	22.2	16.70%	28.9
Test 3	3.90%	3.2	58.30%	20.4	50.00%	50.0	16.70%	28.9
Test 4	26.30%	17.8	33.30%	17.5	25.70%	15.1	13.30%	23.1
Segmentation Total								
Test 1	33.90%	17.9	42.70%	20.3	28.40%	12.4	29.00%	23.1
Test 2	66.90%	18.6	74.30%	10.0	68.10%	17.3	49.00%	28.2
Test 3	73.90%	21.1	80.50%	12.4	68.90%	29.6	72.30%	9.2
Test 4	57.60%	15.6	64.90%	10.7	57.00%	16.8	44.30%	16.3
Deletion of Compounds								
Test 1	36.30%	26.8	36.70%	30.1	32.90%	28.1	43.30%	25.2
Test 2	70.60%	19.1	80.00%	6.3	61.40%	24.8	73.30%	15.3
Test 3	78.10%	31.5	91.70%	20.4	64.30%	37.8	83.30%	28.9
Test 4	62.50%	14.4	63.30%	10.3	60.00%	18.3	66.70%	15.3
Deletion of Phonemes								
Test 1	16.30%	26.3	31.70%	34.9	4.30%	11.3	13.30%	23.1
Test 2	41.30%	15.4	50.00%	15.5	34.30%	16.2	40.00%	0
Test 3	78.10%	25.6	66.70%	25.8	85.70%	24.4	83.30%	28.9
Test 4	42.50%	13.4	50.00%	8.9	35.70%	16.2	43.30%	5.8
Deletion Total								
Test 1	26.30%	24.4	34.20%	32.3	18.60%	17.3	28.30%	23.6
Test 2	55.90%	14.5	65.00%	8.4	47.90%	17.0	56.70%	7.6
Test 3	76.60%	23.2	79.20%	10.2	71.40%	33.6	83.30%	14.4
Test 4	51.80%	11.6	56.70%	6.8	46.10%	14.3	55.00%	8.7
Isolation of Initial Sounds								
Test 1	49.40%	44.6	48.30%	53.1	51.40%	44.1	46.70%	45.1
Test 2	84.40%	19.7	91.70%	9.9	80.00%	25.8	80.00%	20.0
Test 3	62.50%	46.6	75.00%	41.8	57.10%	53.5	50.00%	50.0
Test 4	78.10%	29.9	78.30%	24.0	75.70%	40.0	83.30%	10.8

Table 2. (Page 2 of 2). Group and subgroup mean scores at four test administrations.

	Whole group		*Borderline subgroup*		*Mild subgroup*		*Moderate subgroup*	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Isolation of Final Sounds								
Test 1	22.50%	27.5	28.30%	34.9	15.70%	23.7	26.70%	25.2
Test 2	63.80%	24.7	78.30%	18.3	60.00%	24.5	43.30%	25.2
Test 3	59.40%	41.7	66.70%	51.7	57.10%	34.5	50.00%	50.0
Test 4	48.80%	34.4	68.30%	24.0	44.30%	37.8	20.00%	26.5
Isolation of Medial Sounds								
Test 1	14.40%	24.5	20.00%	31.6	11.40%	22.7	10.00%	17.3
Test 2	45.00%	25.6	55.00%	27.4	44.30%	26.4	26.70%	11.6
Test 3	4.20%	3.4	75.00%	41.8	28.60%	39.3	50.00%	0
Test 4	39.40%	30.4	58.30%	24.8	28.60%	27.3	26.70%	37.9
Isolation Total								
Test 1	28.80%	29.8	32.20%	37.9	26.10%	27.1	28.00%	28.5
Test 2	64.30%	19.9	74.80%	13.5	61.40%	22.7	50.00%	17.3
Test 3	57.30%	32.8	72.20%	37.5	47.60%	32.5	50.10%	16.9
Test 4	78.10%	29.9	68.70%	21.4	49.40%	31.5	43.30%	23.3
Blending Syllables								
Test 1	60.60%	36.1	63.30%	35.0	60.00%	36.5	56.70%	51.3
Test 2	91.30%	7.2	91.70%	4.1	88.60%	9.0	96.70%	5.8
Test 3	93.80%	17.1	100.00%	0	100.00%	0	66.70%	28.9
Test 4	85.60%	14.6	91.70%	11.7	84.30%	12.7	76.70%	23.1
Blending Phonemes								
Test 1	25.00%	23.1	20.00%	23.7	28.60%	23.4	26.70%	28.9
Test 2	71.30%	24.7	80.00%	21.9	70.00%	20.0	56.70%	40.4
Test 3	81.30%	31.0	75.00%	41.8	85.70%	24.4	83.30%	28.9
Test 4	56.30%	24.2	66.70%	16.3	52.90%	21.4	43.30%	41.6
Blending Total								
Test 1	42.80%	26.6	41.70%	26.4	44.30%	26.9	41.70%	37.5
Test 2	82.20%	14.0	85.80%	12.0	81.40%	13.1	76.70%	22.6
Test 3	87.50%	18.3	87.50%	20.9	92.90%	12.2	75.00%	25.0
Test 4	70.90%	17.9	79.20%	12.0	68.60%	15.7	60.00%	30.0

.877, $p = .0001$). Two of the ten strongest correlations included blending as a variable. The blending total score correlated with segmentation of phonemes ($r = .784$, $p = .0001$) and with the segmentation total score ($r = .771$, $p = .0001$). Reviewing these ten correlations, segmentation was a variable in eight of the correlations, blending was a variable in two correlations, and deletion was a variable in one correlation. When correlations were run using mean scores for the borderline, mild, and moderate subgroups, segmentation and isolation were again the most frequently occurring variables among the correlations of the greatest magnitude.

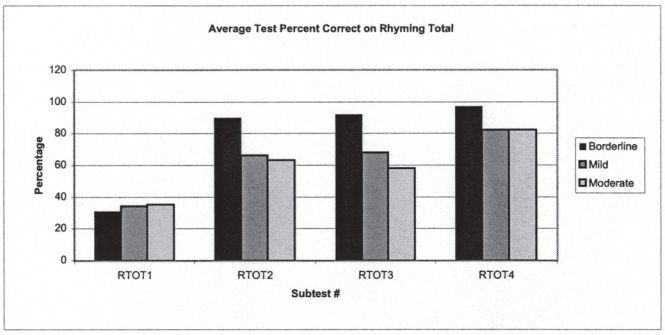
These results might imply that the ability to isolate sounds in words and to segment language wholes into their constituent parts bore relationship as interdependent or interrelated abilities. Blending and deletion did not appear frequently among the strongest correlations. Rhyming appeared in one correlation for the moderate subgroup.

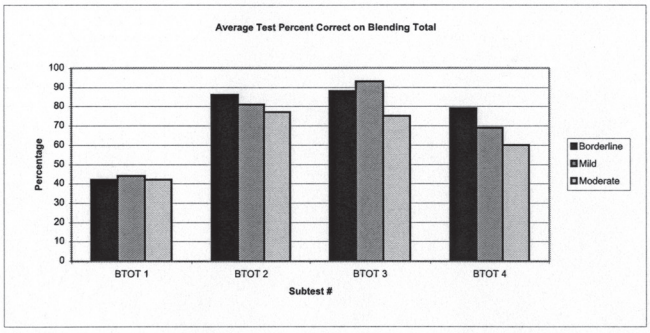
Correlations Between Test Scores and Performance and Behavior During Treatment

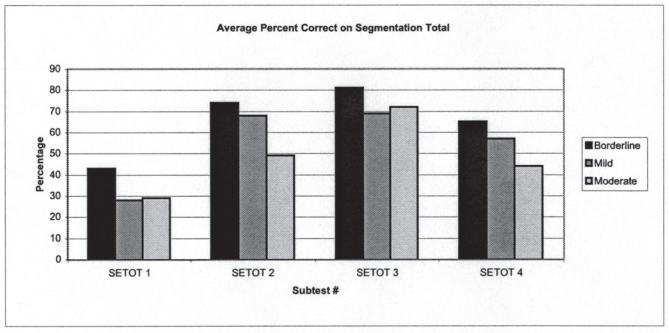
Additional correlations explored whether participants performed similarly on phonological awareness tasks presented at Test 4 and on tasks presented during treatment. Group mean scores for percentage of correct responses during treatment correlated significantly with subtest mean scores at Test 4. Significant results were obtained for rhyme discrimination ($r = .500$, $p = .048$), segmentation of sentences ($r = .710$, $p = .002$), isolation of initial sounds ($r = .723$, $p = .002$), isolation of final sounds ($r = .648$, $p = .007$), isolation of medial sounds ($r = .742$, $p = .001$), blending syllables ($r = .777$, $p = .0001$), and blending phonemes ($r = .777$, $p = .0001$). These data revealed that participants' performance at posttesting was at times related to their performance during treatment.

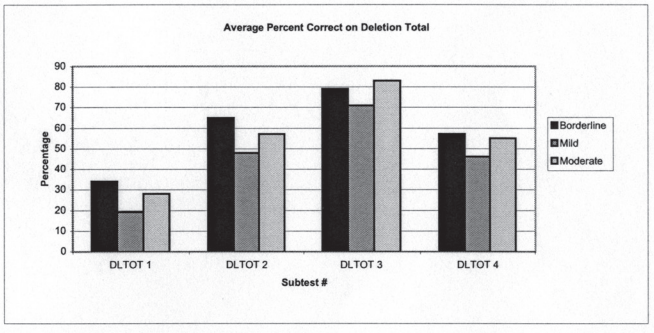
To determine whether gains in phonological awareness skills were adversely affected by nonproductive behavior during treatment, Figure 2 plots participants' test score gains (*y* axis) against behavior scores earned during treatment sessions (x axis). Test score gains were reported as the number of raw score points gained on The Phonological Awareness Test (Robertson & Salter, 1997) from Test 1 to Test 4. A Pearson product moment correlation of behavior scores and test score gains was not significant ($r = –.102$, $p = .706$). An insignificant inverse relationship between participants' behavior and achievement of an

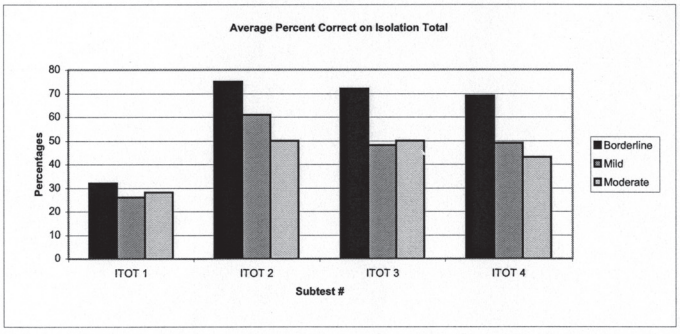
Figure 1. Average percentage correct scores per subtest by subgroup.











increase in test scores was revealed. It was not shown that test gains were negatively affected by nonproductive behavior. The majority of participants made gains in performance when tested and maintained appropriate behavior during treatment. The participants who achieved the greater score gains also earned some of the better scores for behavior. However, children whose scores improved the least also displayed appropriate behavior. The three participants whose behavior was the poorest attained moderate score gains. There was no direct relationship between treatment behavior and testable gains in phonological awareness skills.

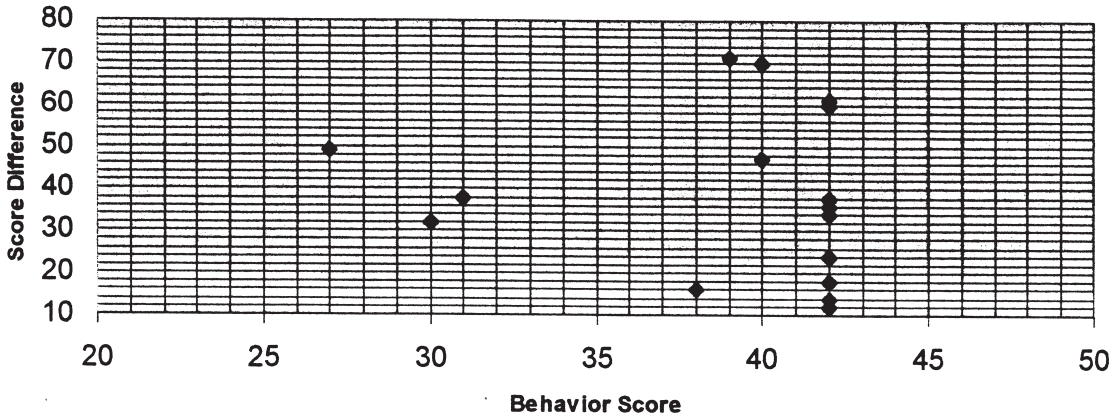
DISCUSSION

Limitations

The present study was limited by the relatively brief length of treatment, the small sample of children involved, and the lack of control group. Internal validity may have been threatened by practice effects; however, no real evidence pointed to this threat. From Test 1 to Test 2, there was an increase in test scores; from Test 2 to Test 3, there was a slight decline in scores; and from Test 3 to Test 4, there was an increase in scores. If there had been a consistent increase in scores across the four test administrations, there would have been more of a question as to whether practice effects played a role in results obtained.

The study was further limited by three possible threats to external validity. First, a pretest interaction effect may have been operative. Pretest cues and therapeutic practice may have alerted the participants to the type of questions that they would be asked to answer on repeated measures. Second, interaction of selection bias and therapy may have occurred; therefore, results of the study may not generalize to other children with the same diagnoses. Third, changes in participants' performance may have occurred because they knew they were being monitored during testing and treatment sessions, a condition known as the Hawthorne effect (Ventry & Schiavetti, 1980).

Figure 2. Plot of participant test score gains and behavior.



Implications for Intervention

Findings suggested that it is important that educators and clinicians who work with children who have been dually diagnosed with mental retardation and behavioral disorders provide developmentally appropriate instruction in phonological awareness as a component of a literacy-rich environment. The whole-to-part progression (Kavanagh, 1991) that was successful during the present study was designed to help learners discover that words are composed of sounds and syllables and thereby develop sensitivity to individual speech sounds (Adams et al., 1998a). Children with mental retardation and behavioral disorders may benefit from instruction that teaches the structure of sentences, words, and syllables and that describes the properties of individual sounds and sounds in words.

Successful instruction may include songs, games, language play, imaginative activities, and multisensory, hands-on experiences (Adams et al., 1998b; Yopp & Yopp, 2000). The high level of involvement that these activities required, coupled with a focus on one or two skills per session, predictability, and frequent opportunities for success, may have been key factors in keeping children with behavioral disorders motivated and engaged (Reitz, 1994; Shores, Jack, Gunter, Ellis, DeBriere, & Wehby, 1993).

CONCLUSIONS

The purpose of treatment was to encourage children to move from implicit use of speech sounds to explicit knowledge of phonology. Successful intervention was conducted using approaches that were originally designed for use with children who are typically developing or who have reading delays but who possess more average cognitive skills than the children who participated in the current study. Treatment induced a group of children who had been dually diagnosed with borderline, mild, or moderate mental retardation and behavioral disorders to achieve statistically significant pretest–posttest improvement in performance on The Phonological Awareness Test (Robertson & Salter, 1997). The children with higher IQs were not responsible for the whole group's enhanced performance.

The greatest number of significant correlations between subtest mean scores for the whole group and for each of the three subgroups included the skills of isolation and segmentation as variables. Although it cannot be demonstrated that skill in one area enhanced skill in another area, it can be said that these two skill areas were complementary. Moreover, as a theoretical consideration, it is by using isolation and segmentation that children learn to deconstruct words and sentences and to identify the individual sounds that form syllables and words.

Participants demonstrated that they were achieving the insight required to analyze speech sounds in isolation and in the context of words, phrases, and sentences (Adams et al., 1998a; Neuman et al., 2000; Yopp & Yopp, 2000). The children exhibited metalanguage skills, which involved using language to analyze language (Chryshochoos, 1991). Phonological awareness intervention was both accessible and beneficial to children with mental retardation and behavioral disorders and may have provided them with a beginning insight into the sound structure of language that will stimulate their understanding of letter–sound correspondences.

Future research may explore how children with mental retardation and behavioral disorders can move from phonological awareness to an understanding of sound to print correspondences. Approaches to enhancing abilities in word decoding, writing, and spelling in this population may be investigated.

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APPENDIX. THERAPEUTIC INSTRUCTION AND REPEATED MEASURES

Pretest (Test 1)
Week #1
Administer rhyming, segmentation, blending, deletion, and isolation subtests of The Phonological Awareness Test (Robertson & Salter, 1997).

Rhyming
Week #2 – Yes/No Tasks
Read rhyming poems.
Reread poems; emphasize rhyming pairs from poems.
Children identify rhyming pairs when questioned.
Rhyme worksheets: Determine if two pictures are of rhyming words or not (Zaun, 2001, pp. 4–5).
7UP game: Children cover eyes and listen to aurally presented word pairs; respond with "thumbs up" if words rhyme, "thumbs down" if not.
Monster game: Children determine if two pictures are of words that rhyme; reward for correct response is to feed a bingo chip to a monster puppet (Robertson & Salter, 1997, p. 13; Zaun, 2001, p. 25).

Week #3 – Generate Own Rhyme
Silly name game (Stone, Merritt, & Cherkes-Julkowski, 1998, p. 380) rhyme using names (Doug/Mug).
Read *The Hungry Thing* (Slepian, Martin, & Seidler, 1967): Children determine what the "hungry thing" wants by correctly rhyming (pancakes/sancakes).
Generate a rhyming word: A field of three pictures is shown, then a nonpictured word is given aurally; children state which word from the field of three rhymes with the word given aurally.
Generate own rhyme.
Children create rhyme pairs in song (traditional song, "Down by the Bay").
Children create a rhyme for a word spoken by the adult (Adams, Foorman, Lundberg, & Beeler, 1998b, p. 34).
Test 2(A)
Administer rhyming subtest from The Phonological Awareness Test (Robertson & Salter, 1997) (10 items of rhyme discrimination, 10 items of rhyme production).

Awareness of Words
Week #4 – Monosyllabic Words in Sentences
Explain how a sentence is like a "little story" with a subject and verb (Adams et al., 1998b, p. 40).
Sentence repetition: Children repeat two- to six-word sentences out loud.
Picture sentences: Use pictures to depict a sentence (picture of "boy" + picture of "run" + picture of "park" = the boy runs in the park).
Block game: Each word in a picture sentence is represented by a small snap-together block; words are the building blocks of sentences.
Each word in a sentence presented aurally is represented by a snap-together block.
Children stand in a line to represent the number of words in sentences.
Clapping: Children clap once for each individual word in a sentence spoken by an adult.
Clapping while generating sentences: Children generate their own sentences and clap once for each word.

Week #5 – Compound Words
Short word/long words (Adams et al., 1998b, pp. 45–46).
Blending compound words using pictures: Children place two picture cards together to form a compound word.
Blending compound words using blocks: Each part of a compound word is represented by a snap-together block.
Blending compound words orally: Given two words spoken by an adult, children say the words together as a compound word.

Week #6 – Compound Words
Deleting compound word parts: Given two picture cards placed together to form a compound word, children take one picture away and name the picture that remains.
Deleting compound words using blocks: Each part of a compound word is represented by a snap-together block; children remove one block and state the word that remains.
Deleting compound words orally: Adult speaks a compound word and tells the child to delete one constituent word (e.g., say "cowboy" without "boy").
Test 2(B)
Administer the deletion subtest (items #1–5 for compounds) and the segmentation subtest (items for segmenting sentences into words) of The Phonological Awareness Test (Robertson & Salter, 1997).

Awareness of Syllables
Week #7 – Syllables in Words
Jaw drop: Children speak words and feel how the action of the jaw dropping demarcates syllables in words (Adams et al., 1998b, p. 49).
Giant steps game: Children walk, taking giant steps to demarcate syllables in words (Robertson & Salter, 1997, p. 35).
Syllable breakup game: Each syllable of a word is represented by a snap-together block; children separate blocks and say each syllable distinctly (Robertson & Salter, 1997, p. 32).
Clapping game: Children pull familiar items out of a box, name the item, and clap once for each syllable in this word (Adams et al. 1998b, pp. 51–52).

Week #8 – Syllable Blending
Listen first, look after game: Adult says a word in an exaggerated, syllabicated fashion (e.g., "bay-bee" for baby); child responds by selecting a picture of the item from an array of three pictures

(Adams et al., 1998b, p. 55).
Listen, look game: Adult says a word in an exaggerated, syllabicated fashion (e.g., "bay-bee" for baby); child responds by saying the word without exaggeration.
Troll talk: Adult tells a story about a troll that grants wishes for toys and games; adult says the name of the item in an exaggerated, syllabicated fashion; child responds by naming the item without exaggeration (Adams et al., 1998b, p. 56).
Test 3(A) (retest of 20% of the information tested at Test 2(A) and **Test 2(B)** of The Phonological Awareness Test*;* Robertson & Salter, 1997)

Week #9 – Syllable Deletion
Two, three, and four syllable words: Children stand together to represent the syllables in words (e.g., one child represents "trac" and another represents "tor" — together they are "tractor" – if "trac" steps away, "tor" remains).
Children use blocks to represent the syllables in words; if one syllable is deleted, the other syllable remains.
Syllables aurally: Adult speaks a two-, three-, or four-syllable word; child responds by saying the word syllable by syllable.
Test 2(C)
Administer the segmentation subtest (items for syllables), the blending subtest (items for syllables), and the deletion subtest (items for syllables #6–10) of The Phonological Awareness Test (Robertson & Salter, 1997).

Awareness of Phonemes
Week #10 – Initial Sounds
Guess Who game: Adult produces a sound that is the initial phoneme of the name of one child in the group; children respond by identifying whose name begins with that sound (Adams et al., 1998b, p. 58).
Singing game: Adult sings, for example, "Whose name starts with the /d/ sound?"; children respond by identifying whose name begins with that sound (Jordano & Callella-Jones, 1998, p. 22).
Yes/No discrimination: Given two pictures, child identifies whether the pictures both start with the same sound.
Picture game: Adult states the name of a functional household item (e.g., bed, comb); child produces the initial sound of the word (Adams et al., 1998b, p. 66).
Group sound match game: Each child is given a picture card; adult produces a phoneme in isolation; each child must identify whether his/her pictured word begins with the given sound (Adams et al., 1998b, p. 67).
Sound soup: Adult starts a "soup pot" of words beginning with a given sound; children respond by stating the name of an item to add to the "soup" that begins with the given sound (Jordano & Callella-Jones, 1998, p. 49).
Odd one out: Given a field of three pictures, two of which feature items that begin with the same sound, the child determines which two pictured items begin with the same sound and which one pictured item begins with a different sound.
"What big ears you have": Adult sings a sound and then asks children to identify this sound in the initial position of words represented by pictures (Fitzpatrick, 1997, p. 37).

Week #11 – Final Sounds
Adult sings a song that isolates the last sound in children's names (Jordano & Callella-Jones, 1998, p. 22).
Adults uses blocks to show where the last sound in a word can be found (Fitzpatrick, 1997, p. 43).
Yes/No discrimination: Given two picture cards, the adult asks the child to determine whether both pictured items end with the same sound.
Picture game: Given a set of three or four pictures of items that end with the same phoneme, the child must determine the final sound that the words have in common (Adams et al., 1998b, p. 66).
Group sound match game: Each child is given a picture card; adult produces a phoneme in isolation; each child must identify whether his/her pictured item ends with the given sound (Adams et al., 1998b, p. 67).
Song: Adult sings a song that isolates the last sound in words ("What is the last sound you hear," Robertson & Salter, 1997, p. 38).
Odd one out: Given a field of three pictures, two of which feature items that end with the same sound, the child determines which two pictured items end with the same sound and which one pictured item ends with a different sound.
Song: Adult sings a song that isolates the last sound in words ("What do you hear?") (Fitzpatrick, 1997, p. 38).

Week #12 – Medial Sounds
Adults uses blocks to show where the middle sound in a word can be found (Fitzpatrick, 1997, p. 44).
Yes/No discrimination: Given two picture cards, the adult asks the child to determine whether both pictured items have the same middle sound.
Picture game: Given a set of three or four pictures of items that have the same middle phoneme, the child must determine the middle sound that the words have in common (Adams et al., 1998b, p. 66).
Group sound match game: Each child is given a picture card; adult produces a phoneme in isolation; each child must identify whether his/her pictured item has the given sound as its medial sound (Adams et al., 1998b, p. 67).
Child to child sound match game: Each child is given a picture card; one child tells the middle sound in the item pictured on his/her card; other children state whether the middle sound of the item pictured on their card is the same (Fitzpatrick, 1997, p. 67).
"What big ears you have": Adult sings a sound that asks children to identify sounds in the medial position of words (Fitzpatrick, 1997, p. 37).
Odd one out: Given a field of three pictures, two of which feature items that have the same medial sound, the child determines which two pictured items have the same medial sound and which one pictured item has a different medial sound.
Test 2(D)
Administer the isolation subtests of The Phonological Awareness Test (Robertson & Salter, 1997).

Awareness of Phonemes
Week #13 – Segmentation of Phonemes
Adult demonstrates how to segment words into sounds: "Turtle Talk" — adult and children slowly speak words sound by sound (Fitzpatrick, 1997, p. 30).
Two-, three-, and four-phoneme words: Adult shows pictures of items whose names have two, three, or four phonemes; adult pronounces words in a slow, exaggerated fashion, phoneme by phoneme (Adams et al., 1998b, pp. 45–47).
Children use blocks to represent the number of phonemes in words (Adams et al., 1998b, p. 77; Fitzpatrick, 1997, p. 49).
Song: "Penny Push" (Jordano & Callella-Jones, 1998, p. 75).
Duck-duck-goose game: Each child is given a picture card; child who is tagged as the "goose" doesn't run, but rather must pronounce the name of the item pictured on their card phoneme by phoneme.

Week #14 – Blending of Phonemes
"Talking Like a Ghost": adult and children intone as they speak words, stretching out the sounds in words and blending the sounds together using a "ghostly" lilt ("hhhheeellllllooooo") (Fitzpatrick, 1997, p. 33).
Two-, three-, and four-phoneme words: Adult shows cards with individual letters; demonstrates how sounds are blended to say words by placing the letters together to form words; adult speaks the words by blending the phonemes in a slow, exaggerated way. Each child is given a picture card; adult says the name of each picture by blending the phonemes in a slow, exaggerated way; children determine which picture card was named.
Children use blocks to represent the number of phonemes in words and speak the words by blending the phonemes in a slow, exaggerated way (Adams et al., 1998b, p. 77; Fitzpatrick, 1997, p. 49).
Adult leads a game of Simon Says, speaking the directions by

blending the phonemes in a slow, exaggerated way.
Song: Blending sounds (Fitzpatrick, 1997, p. 32).

Week #15 – Deletion of Phonemes
Adult shows cards with individual letters; demonstrates how sounds are blended to say words by placing the letters together to form words; adult then deletes a letter (sound) from the word and speaks the word minus the deleted sound ("draw" becomes "raw").
Two-, three-, and four-phoneme words: Adult helps children manipulate word cards with separable individual letters; together they identify the number of phonemes, then delete a phoneme, say the word that remains, and determine the number of phonemes in the shorter word.
Children use blocks to represent the number of phonemes in words, then delete a phoneme and speak the word that remains.
Song: "Who stole the cookie from the cookie jar?": Adult sings children's names minus one of the sounds in the name; children must determine whose name was called ("Aul" for "Paul" or "Meliss" for "Melissa").
Adult presents a word; child must say the word phoneme by phoneme. Then, adult tells the child which phoneme to delete: "Say home without the /h/."

Week #16
Test 2(E)
Administer the segmentation subtest (items for phonemes), the deletion subtest (items for phonemes), and the blending subtest (items for phonemes) of The Phonological Awareness Test (Robertson & Salter, 1997).

Week #18
Test 3(B)
Retest 20% of the information answered correctly at Test 2(C), Test 2(D), and Test 2(E).

Week #20
Posttesting (Test 4)
Administer rhyming, isolation, segmentation, deletion, and blending subtests of The Phonological Awareness Test (Robertson & Salter, 1997).