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ABSTRACT

A study examined which phonological skills, as primary skills, can more effectively be developed and lead to decoding skills in low-skilled kindergartners: (1) segmentation/blending, or (2) rhyming/first sound identification? Low-skilled kindergartners (n=61), who scored less than 4 items correctly in 3 out of 5 measures, were randomly assigned to one of the strategy groups, receiving instruction in small groups of 3-4, for 20-30 minutes each time, twice a week, over 10 weeks. Results indicated that both groups were effective in improving target skills, as well as reading and writing readiness skills. Findings suggest that there was no significant difference between the groups and neither group demonstrated successful transfer of trained skills to the untrained skills, or sufficient generalization to reading or spelling novel words. The study supports other research using both training strategies and reminds researchers of the challenge in promoting generalization ability. (Includes 6 tables of data; contains 29 references.) (Author/CR)

Running Head:

WHICH PHONIC SKILLS MORE EFFECTIVELY LEAD TO DECODING?

Which Phonological Skills, as Primary Skills, Can be More Effectively Trained and Lead to Decoding Skills in Low-Skilled Kindergartners?

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Abstract

Which phonological skills, as primary skills, can more effectively be developed and lead to decoding skills in low-skilled kindergartners: (a) segmentation/blending, or (b) rhyming/first sound identification? Sixty-one low-skilled kindergartners, who scored less than 4 items correctly in 3 out of 5 measures, were randomly assigned to one of the strategy groups, receiving instruction in small groups of 3 to 4, 20 to 30 minutes for each time, twice a week, over 10 weeks. Results showed that both groups were effective in improving target skills, as well as reading and writing readiness skills. No significant difference between the groups was found. Neither group demonstrated successful transfer of trained skills to the untrained skills, or sufficient generalization to reading or spelling novel words. The study supports other research using both training strategies, and reminds us of the challenge in promoting generalization ability.

Which Phonological Skills, as Primary Skills, Can be More Effectively Trained and Lead to Decoding Skills in Low-Skilled Kindergartners?

There are 20-25% of children who have problems in reading (Liberman & Liberman, 1992). A majority of children with learning disabilities, from 75% to 95%, suffer from reading disabilities (Bateman, 1991). Broader evidence indicates that phonological awareness may be the main determinant related to reading disabilities (e.g. Fletcher, Shaywitz, Shankwieler, Liberman, Sturebing, Francis, Fowler, & Shaywitz, 1994; Liberman & Shankweiler, 1985; Stanovich & Siegel, 1994; Vellutino, Scanlon, & Spearing, 1995; Waterman & Lewandowski, 1993), although there may be a subgroup of children's reading disabilities that are caused by dysfunction of the visual system, brain injuries, or genetics.

How may we prevent young children from developing reading disabilities or intervene with children at risk of reading disabilities as early as possible? Encouraged by finding the important role of phonological awareness in reading, many phonological and /or phonemic awareness training projects have been conducted. The results show that children's phonological awareness can be developed through explicit training in preschool or kindergarten (e.g. Ball & Blachman, 1988 & 1991; Bradley & Bryant, 1985; O'Connor, Jenkins, & Slocum, 1995; Lundberg, Frost, & Petersen, 1988), even for very low-skilled children (O'Connor et al., 1995; O'Connor, Notari-syverson, & Vadasy, 1996).

Training strategies, however, are various. One of the issues that puzzled researchers is which phonological and /or phonemic skills influence decoding skills and ultimately reading ability. Some researchers used phonemic segmentation (e.g. cat -- c-a-t) or blending (e.g. c-a-t -- cat) as the target training skills. With trained phonemic skills, students were taught to assign

letter sounds to the letters in a word and sound the word out (e.g. Ball & Blachman, 1988). This is called the letter-sound decoding procedure (3-ph) (see Rack, Hulme, Snowling, & Wightman, 1994).

Other researchers used sound categorization as the target training skills (i.e., categorizing word sounds by initial sounds or rhyming parts such as fat / fight or hat / sat) (e.g. Bradley & Bryant, 1985). This skill was thought to be directly related to reading by making analogues (e.g. leak -- beak peak) (e.g. Goswami & Bryant, 1990; Goswami & Mead, 1992). This is called the procedure of using analogues (SC) (see Rack et al., 1994).

The study tested this experimental question: Which phonological skills, as primary skills, can more effectively be trained and lead to decoding skills in low-skilled kindergarten students: (a) letter-sound decoding with 3-phoneme segmentation and blending as the target skills, or (b) reading by analogues with sound categorization (rhyming & first sound identification) as the target skills? Specifically, this study examined the following questions: Would 10 weeks of instruction with one of the instructional strategies be more effective than the other in raising the trained phonological skills in the low-skilled kindergarten students? Would 10 weeks of instruction with one of the instructional strategies be more effective than the other in transfer trained phonological skills to the untrained phonological skills? And would 10 weeks of instruction with one of the instructional strategies be more effective than the other strategy in promoting generalization of developed phonological skills to reading and spelling tasks?

Methods

Participants

One hundred and seventy-five children from 7 kindergarten classes were assessed in late February, 1997. The basic criteria for the participants were that they scored less than 40% in 3 out of the following 5 phonological measures: a) segmentation, b) blending, c) rhyming, d) syllable deletion, and e) first sound identification. Segmentation, as the primary screening measure, must be one of the 3 measures. In addition, they could not recognize more than one word in the Woodcock-Johnson Letter-Word Identification Subtest. These criteria meant that the students selected would be both nonreaders and very poor in phonological skills. Sixty-four low-skilled kindergarten students were finally selected for the training. Since 3 of the selected students moved out, 61 participants remained.

A randomized blocking procedure was applied. The selected samples were blocked by the five teachers who participated, so that the different teachers' instructional effects could be controlled. Students selected from each teacher were randomly assigned to one of the two treatment conditions: 31 to the letter-sound decoding procedure with segmentation and blending as the target skill, and 30 to the analogue procedure with sound categorization (rhyming & first sound identification) as the target skill.

Assessment Measures

Peabody Picture Vocabulary Test-Revised

The Peabody Picture Vocabulary Test-Revised (PPVT-R) (Dunn & Dunn, 1981) was used in the pretests to assess students' receptive vocabulary. The PPVT-R is a norm-referenced, individually administrated achievement test on subject's receptive vocabulary, conducted through

asking the subject to hear a word and match the word to a picture from four choices. The mean score is 100 with a standard deviation of 15. The split-half reliability coefficients range from .67 to .88 on Form L.

The Woodcock-Johnson Tests of Achievement Battery--Revised

The Woodcock-Johnson Tests of Achievement Battery--Revised (WJ-R): Letter-Word Identification and Dictation Subtests (Woodcock & Johnson, 1989) were used in both pretests and posttests to assess students' early reading skill. The raw scores were used in the data analysis. The reliability of the Letter-Word Identification Subtest with the children at age between 4 to 6 ranged between .92 to .96, and the Dictation subtest between .86 to .92.

Phonological Skill Measures

Phonological processing skills were assessed in pretests and posttests with O'Connor et al.'s (1995) phonological measures, including: 1) blending words at the onset-rime level or phoneme level, 2) segmenting words into onset-rimes or 3 phonemes, 3) identifying initial sounds, 4) producing rhymes, 5) deleting syllables, and 6) sound repetition. Each task was introduced with 3 practice items, and corrective feedback was provided after each trial.

Rapid Letter Naming

The Rapid Letter Naming (RLN) taken from O'Connor et al's study (1995) was included in the assessment battery to test students' alphabetic knowledge through a continuous naming task (i.e. the children naming letters presented randomly as rapidly as possible). With a total of 52 letters, the number of letters that students named correctly in one minute were recorded.

Lindamood Auditory Conceptualization Test

The Lindamood Auditory Conceptualization Test (LAC) (Lindamood & Lindamood, 1979) was used in posttests to test whether trained students could transfer learned phonological skills to the broader context. The LAC examines whether students can repeat and discriminate speech sounds, represent these sounds with color blocks, and make sound patterns through adding, deleting or substituting color blocks, which are tasks very different from those taught in the treatments. The predictive validity of the correlation between total scores of LAC and the scores of spelling and reading subtests in the Wide Range Achievement Test is .75 at kindergarten level. The scaled converted scores were used for the data analysis in this study.

Reading Analogue

A reading analogue task revised from O'Connor et al.' study (1995) was provided in the posttests as a transfer task, in which 5 new words -- MAS, AT, MOM, TAG, TOD made of the learned letter sounds, were presented 5 times, with a total of 25 altogether. Practice and corrective feedback were not provided, but trained strategies were prompted. The prompt of blending sounds was provided for the students in the 3-ph Group. For example, if the students did not know how to pronounce the word MAS, the instructor would tell each sound of these 3 letters, then ask "Remember the word SAD? We blended S-A-D into SAD. Would you put these 3 sounds together?" The prompt of using rhyming or first sound identification was provided for the SC Group. For example, if the students did not know how to say AT, the instructor would say, "Remember the word HAT? Take the first sound H away, what's the rhyming part?" The percent of the correctness was recorded to assess whether students could transfer learned phonological skills and phonemes (letter sounds) into new word recognition.

Spelling

An informal spelling test designed by this author was provided in the posttest. The spelling words were FAT, HAT, CAT, MAD, SAD, DOG, DOT, HAM, HAD, FOG, HOT, SAM, MOM, DAD. The first eight words were the training words. The other words were not training words but composed of learned letter sounds. The performance was scaled as in the Developmental Spelling Test (DST) of Tangel and Blachman, 1992. There were 6 points for each word and 84 points in total. The following is an example from the stimulus: SAM

Response	*Comment*	*Points*
FHD	Random string	0
C	Phonetically related letter	1
S	Correct first letter	2
SAH	More than one phoneme but not all, with phonetically related or conventional letters	3
SZAM	All phonemes with mix of phonetically related and conventional letters	4
SAAM	All phonemes with conventional letters;	5
SAM	Correct spelling	6

Probes

On-going probes were provided throughout the training. There were two kinds of probes: One to assess whether children learned the content of the session, one to assess generalization to new items with the same trained strategies.

Kindergarten Curriculum

The kindergarten classes involved in this project were using the MacMillan McGraw Hill curriculum, which uses a whole-language approach with various kinds of child-centered activities. For example, during the circle time, activities include big book story reading, telling a story, or trading books. Word meanings are discussed, and children write journals (drawing mostly).

Teacher Training and Fidelity of Treatment

All the instruction was provided by first author, and four graduate or undergraduate students of education, child development, or psychology. A doctoral student in special education program assisted pretesting and posttesting. Two hours of training was provided, and on-going inservice training was provided before each new lesson was introduced. The trainers met weekly for discussing issues and preparing the new lessons. I observed the other trainers once a week at first, then every two weeks. Feedback was provided after each observation.

Treatment

Students received instruction in small groups of 3 to 4, for 20-30 minutes, twice a week, over 10 weeks, from March through May, 1997. The treatment was provided in a quiet room at the schools. Ten letters were introduced -- A, O, S, C, T, D, M, F, G, H at the rate of 2 per week in the words used to practice phonological skills included HAM, FAT, HAT, DOG, CAT, SAD, MAD, and DOT, taught with different orders for the two treatments. The target phonological skills were practiced first with pictures. In the latter 5 weeks, 1 to 2 printed words were introduced weekly. The same phonological skills that were practiced with pictures in the first 5 weeks, were practiced with words in the latter 5 weeks.

Training for the 3-ph Group

In the 3-ph group, there were two main skills -- blending and segmentation. Showing a set of pictures, the experimenters asked students, "Which picture is /d/-/o/-/g/?" The students were supposed to identify the picture and say "dog." Then the picture was removed and the experimenters asked students "What is d-o-g?" The students were supposed to say "*dog*". In the last weeks, the students were asked to read words with 3- phonemes hyphened and underlined,

and then to recognize them through blending sounds, for example, "Look at this word, D-O-G, what word is that?" The students were supposed to say "DOG."

Segmentation was taught with a move-it-and-say-it game. A three square sheet was used with each student. Presented with 1 to 2 pictures, the students were first asked to put one dot to represent one phoneme of a pictured word into one of the three squares while saying the letter sounds c-a-t. For example, "Let's put each sound in cat into one of the squares and say the sound." In practicing with words, the students were shown a word and asked to put one plastic letter to represent each phoneme of the word into one of the squares while saying the letter sound. Finally, the students were asked to segment words without the 3 square sheet. For example, showing an underlined word c a t, the instructor asked students, "Would you tell me three sounds in the word cat?" (c-a-t).

Training for the SC Group

In the SC group, there were two main skills -- identification of initial sounds and rhyming. Identification of initial sounds was practiced by categorizing initial sounds of pictured words first, then of printed words. In categorizing initial sounds with pictures, the instructor first showed the students three pictures and asked them questions, such as "Which two pictures start with the same sound?", or "Find a picture that does not have the same first sound as the other two." Similar questions were repeated for the practice with words. Showing a set of underlined words (e.g. HAT, HOT, and FAT), the instructor asked students questions such as "Which two words have the same first sound?", "Find two words starting with the same letter sound," or "Which word does not have the same first sound?"

When identifying rhymes, the students of the SC groups first practiced with pictures, and answered questions such as "Which two pictures sound like (or rhyme with) each other?", or "Find the picture that does not sound like (or rhyme with) the other two." Similar questions were repeated for practice with words. Showing a set of underlined words (e.g. SAT, HAT, DOG), the experimenter asked questions, such as "Which two words sound like (rhyme with) each other?", or "Find a word that does not sound like (rhyme with) the other two."

Data Analysis

The data analyses are presented in the following five sections. The first section is related to the treatment groups' performance level before training. The middle three sections answer each of the research questions. The last section provides information about overall treatment effectiveness. All of the data analyses were conducted on small training group means, with 3 to 4 students in each group and 10 groups for each treatment.

Pretest

To examine whether the two treatments were at the same level before the training started, a series of t-tests was conducted on the pretest scores by treatment. The tests showed that there was no significant difference between the treatments before the training (Table 1).

Table 1 inserted here

Question 1 -- Would 10 Weeks of Instruction with One of the Strategies be More Effective than the Other in Raising the Trained Phonological Skills in the Low-Skilled Kindergarten Students'?

A series of 2 (time: pretest vs posttest) x 2 (treatment strategies: 3-ph vs SC) ANOVAs was conducted to assess: 1) the degree of improvement in phonological awareness (main effect

for time), and 2) the difference between the two treatment strategies in improvement (interaction between strategies and time). The results (Table 2) showed that both strategy groups made significant improvement in phonological measures such as segmentation, blending, rhyming, first sound, and syllable deletion, but there was no significant treatment difference in the improvement.

Table 2 inserted here

Question 2 -- Would 10 Weeks of Instruction With One of the Strategies be More Effective Than the Other in Encouraging Transfer of Trained Phonological Skills to Other Untrained Phonological Skills?

A t-test was applied to analyze the scores from the Lindamood Auditory Conceptualization Test (LAC), which was the test to evaluate whether the trained children could transfer the trained phonological skills to other untrained tasks (Table 3). No significant difference between the two treatments was found, which indicated that there was no significant difference between the two strategy groups in encouraging transfer of trained to untrained skills. It is important to note, however, that the mean scores from both treatments on the LAC were below 20, which was far below the recommended minimal score (40) for normally developed kindergarten students during the second half year.

Table 3 inserted here

Question 3 -- Would 10 Weeks of Instruction With One of the Instructional Strategies be More Effective Than the Other in Promoting Generalization of Developed Phonological Skills to Reading and Spelling Tasks?

To assess whether there was a difference between the two strategy groups in generalizing trained skills to prereading or prewriting tasks, 2 x 2 analyses of variance were conducted for the scores on the Woodcock-Johnson Letter-Word Identification and Dictation subtests (Table 4). The results demonstrated that both treatments made significant improvement in reading and writing readiness skills (identifying letters and some sight words, or dictating letters and some sight words) based on their performance on the two measures. No significant group difference in the improvement, however, was found.

Table 4 inserted here

Scores from the trained students and from the test norming sample for the WJ Letter-Word Identification and Dictation subtests are provided in Table 5 to compare the students' growth with the expected growth due to maturation.

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T-tests for the scores on the reading analogue (an informal measure on reading a set of words) and spelling (an informal measure on spelling a set of words) were performed, in order to examine whether there was a treatment group difference in improving word reading and spelling skills (Table 6). No significant difference was found in either test, again confirming that there was no treatment group difference in improving prereading and prewriting skills.

Table 6 inserted here

It should be pointed, however, that the average numbers of words read correctly for either treatment group in the reading analogue was as low as 6 to 7 out of 25 opportunities (5 times for each word). In other words, only about 25 % of words for the 3-ph Group and 31% of words for the SC Group were read correctly. The same pattern happened with scores on the spelling test. These results indicated that the participants in neither of the treatment groups were fully ready to generalize the trained phonological skills to reading novel words or spelling novel words successfully.

Discussion

Effectiveness of the treatments was assessed in three ways: effectiveness on five phonological skills (segmentation, blending, rhyming, first sound identification, and syllable deletion); effectiveness on transfer from learned skills to the broader structure of phonological skills required by the LAC (making sound patterns by mimicking sounds, adding and deleting sounds, or sound substitution); and effectiveness on pre-reading and pre-writing skills based on

the WJ Letter-Word Identification and Dictation subtests, a reading analogue task, and a developmental spelling measure.

Effectiveness Comparison

The main effect for time (pretest to posttest) on the phonological measures and WJ Letter-Word Identification and Dictation subtests (see Table 2 & 4), as well as the descriptive comparison between the performance of the trained students and the national norming sample on the two WJ subtests (see Table 5), demonstrated that both treatment groups significantly improved their phonological skills and their pre-reading and pre-writing skills. These findings confirm that phonological awareness can be developed in kindergarten children with explicit instruction combined with letter sound instruction as many other studies have done (e.g. Ball & Blachman, 1991; Bradley & Bryant, 1985; O'Connor et al., 1995). The findings also supported the suggestion that phonological skills are closely related to children's letter knowledge, letter writing, and spelling (e.g. Juel, 1988; Liberman, Shankweiler ,& Liberman, 1989; Stanovich, 1986; Torgesen, Wagner, & Rashotte, 1994).

However, no significant difference between these two instructional procedures in the training effectiveness was found. This lack of a significant difference was not only demonstrated in the phonological skill improvement and the transfer of phonological skills (see Table 2 & 3), but also in the impact on pre-reading or pre-writing skills (see Table 4). These results indicate that either type of instruction can be effective in training the phonological skills of low-skilled kindergarten children.

Transfer of Learned Phonological Skills

The t-test for the scores on the Lindamood Auditory Conceptualization Test (LAC) (see Table 3) did not show any significant difference between the two strategy groups. The mean scores of both groups were similarly low, lower than 40 which was the recommended minimal score for students at this age. The result suggests that students in neither group were ready to transfer what they had learned (segmentation and blending in the 3-ph Group, rhyming and first sound identification in the SC Group) into other phonological skills that the LAC required such as sound discrimination, sound substitution, sound deletion, and sound addition. This result was not consistent with the evidence provided by some other studies in which students transferred the trained segmentation and blending into other types of phonological manipulations provided in the same assessment measure (e.g. Cunningham, 1990; O'Connor et al., 1995).

Three possible reasons may explain the inconsistency in transfer of phonological skills between this study and others. One is the collection of skills that made up as the training content. In Cunningham's study (1990), meta cognitive activities (discussing purposes of learning phonemic awareness) were linked to the phonological training in one of the treatment groups. This group transferred significantly better than both the group without the metalevel activities and the control group. Apparently the metalevel activity made the difference here. Of course, it also appears that the participants in Cunningham's study were higher skilled students, while those in this study were lower skilled students.

Another possible reason is that there may be mutual influence among segmentation/blending and rhyming/first sound identification, so that these two kinds of skills should be integrated or synthesized together as Walton (1995) or Bruck and Treiman (1992)

suggested. O'Connor et al.'s study (1995) demonstrated that training segmentation and blending could raise the low-skilled kindergarten students' phonological awareness as well as the students trained with global training skills (sound deletion, alliterating, syllable segmenting and blending, phoneme segmenting and blending, and rhyming), and also help them transfer the trained skills to the phonological skills required by the LAC. However, their segmentation and blending training was delivered at the onset-rime level first, then at the phoneme level. Practicing first sound identification and rhyming may be, in fact, an indirect segmentation activity, and segmentation and blending at the onset-rime level may be, actually, an indirect rhyming and first sound identification activity. Hence, synthesizing these two models may be more effective.

Reading Analogue

The number of words read correctly on the reading analogue for both treatment groups was low (see Table 6), which implied that neither strategy group was ready to read novel words with the trained skills. Torgesen et al.'s study (1992) and O'Connor et al.s' study (1995) provided modeling, corrective feedback, and many more trials on the analogue task. In Torgesen et al.'s study (1992), the reading analogue was administrated over two to three 20-min sessions. First, the children were taught the new letter sounds for 6 novel words. Then they were presented 6 CVC words. The criterion was that the child was able to complete two consecutive errorless trials (a complete exposure of all six words was counted as one trial). At every 10 trials, the children received 2 refresher trials on the sound-symbol correspondences they had learned earlier. The task was stopped if the child could not meet the criterion after 40 trials. In O'Connor et al.'s study (1995), there were five novel words. The examiner and the child took turns alternately, in order that the child was provided modeling and corrective feedback. The errors that the student

made were recorded. There were 25 trials possible, and the test stopped when the child read all five words correctly within one trial. In comparison, this study provided only 5 trials on the set of 5 words, nor was there modeling or corrective feedback. It may be that corrective feedback, modeling, and more trials of practice are necessary for stimulating reading following training in phonological skills.

Other Issues Related to Generalization Difficulties

There were some other possible reasons may have contributed to this problem. First, we experienced four unexpected changes for the treatment training. The training logs suggested that the instructor turnover rate may have influenced students' learning. Maintaining consistency in instructional space was also problematic, as often occurred when research is housed in schools.

Another possibility may be a lack of specific training for generalization, such as Cuningham's meta-level activity (1990), or self-instructional strategies recommended by Harris and Pressley (1991). The basic teaching procedure in this study was to teach with the assistance of pictures first, then without pictures. Repeated practice was provided in each session, followed by a review in subsequent sessions. In Cunningham's study (1990), the children were trained with phonological skills, but they also discussed why they should use phonological skills. Harris and Pressley (1991) suggested a self-instructional strategy, which included: a) strategy introduction; b) knowledge about the use and importance of those strategies; and c) explicit self-regulation of strategy performance. Prompts, interaction, modeling and guidance were faded over practice sessions until independent performance was achieved. In this study, however, the children were not taught about the importance of target strategies, or taught self-regulation, nor were they

provided guidance and assistance from teachers (except the limited prompts of the strategy use) during the generalization tests. Incorporating strategies that include a meta-cognitive component may increase the likelihood of generalization.

Finally, the cognitive age difference may have impeded the low-skilled kindergartners' ability in this study to generalize successfully. Strategy use is usually developed with age and experience (Harris & Pressley, 1991), and requires a higher level of cognitive activity. Based on Piaget's cognitive development theory (Piaget,1954; 1970; Piaget & Inhelder, 1958), generalization ability should develop around age of 7, because children's language skills are sufficiently developed, and they can understand relationships. Goswami and Bryant (1990), however, questioned this theory with evidence that young children who were younger than 7 could make analogues. Other intervention studies using a letter-sound decoding mechanism also demonstrated that younger children (including low-skilled) can transfer trained skills or generalize the trained skills to reading novel words (e.g. O'Connor et al., 1995). It should be noticed, nevertheless, that all of these studies applied explicit training approaches with modeling, corrective feedback, and many practice times or trials. It may be that young children who are low-skilled may not be able to spontaneously develop generalization skills without explicit instruction.

Summary & Implications

In this study, both strategy groups were effective in raising trained phonological skills. However, no significant difference in the effectiveness does not mean that the two instructional strategies are equally efficient (i.e., taking the same amount of sessions to master the target skills), which still needs to be investigated in future research.

This study emphasizes the challenge of helping low-skilled kindergarten to transfer the learned phonological skills to the untrained phonological skills, and to generalize the developed phonological skills to reading and spelling words. It would be useful in future studies to provide more pratice, modeling, and corrective feedback for promoting generalization ability in low-skilled populations.

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Table 1

T-Tests for the Pretest Scores of the Two Strategy Groups (N = 10 Groups/per Treatment):

Strategy	Tests	Mean	SD	t-value	p (df=18)
	Rapid Letter Naming				
3-ph		18.58	8.53		
				-0.17	0.87
SC		19.23	8.93		
	Segmentation				
3-ph		.98	.99		
				0.17	0.87
SC		0.90	1.24		

(tables continues)

Strategy	Tests	Mean	SD	t-value	p (df=18)
	Blending				
3-ph		1.12	.75		
				0.51	0.61
SC		0.93	.84		
	Rhming				
3-ph		1.95	2.17		
				-.05	0.96
SC		2.00	1.96		
	Syllable Deletion				
3-ph		1.95	1.89		
				.97	0.35
SC		1.27	1.23		

(table continues)

Strategy	Tests	Mean	SD	t-value	p (df=18)
	First Sound Identification				
3-ph		1.62	1.47		
				-1.46	0.16
SC		2.93	2.45		
	Sound Repetition				
3-ph		6.76	1.99		
				-1.14	0.27
SC		7.87	2.36		
	WJ (Letter-word)				
3-ph		9.13	2.77		
				-0.31	0.76
SC		9.50	2.65		

(table continues)

Strategy	Tests	Mean	SD	t-value	p (df=18)
	WJ (Dictation)				
3-ph		8.08	1.86		
				-.80	0.44
SC		8.70	1.65		
	PPVT				
3-ph		80.51	6.00		
				-1.05	0.31
SC		84.20	9.41		

PPVT = Peabody Picture Vocabulary Test.

Table 2

2 x 2 ANOVAs to Assess: 1) the Degree of Improvement in Phonological Awareness, and 2) the Difference of the Two Treatment Groups in the Improvement, With Group Means (n=10 for per treatment) and F (1, 18)

	3-ph		SC				
	M	SD	M	SD	MS	F	p
Segmentation							
pretest	.98	.99	.90	1.24			
posttest	10.13	4.74	11.67	1.24			
time (pre & post)					991.12	99.25	.00*
interaction (str vs time)					6.60	.66	.43
Blending							
pretest	1.12	0.75	.93	.84			
posttest	6.29	2.55	6.80	2.48			

(table continues)

	3-ph		SC				
	M	SD	M	SD	MS	F	p
time					304.70	117.40	.00*
interaction					1.19	.46	.51
Rhyming							
pretest	1.95	2.17	2.00	1.96			
posttest	3.73	2.65	5.26	2.51			
time					63.78	39.61	.00*
interaction					5.50	3.41	.08
First Sound Identification							
pretest	1.62	1.47	2.93	2.45			
posttest	5.07	2.36	7.23	2.24			

(table continues)

	3-ph		SC				
	M	SD	M	SD	MS	F	p
time				150.16	39.88	.00*	
interaction				1.81	.48	.50	
Syllable Deletion							
prestest	1.96	1.89	1.27	1.23			
posttest	5.33	1.60	5.43	2.25			
time				142.17	98.97	.00*	
interaction				1.56	1.09	.31	

* significant when p= or < .001

Table 3

A T-Test for Scores on LAC to Assess the Group Difference in the Ability of Transferring Phonological Skills Into the Broader Structure of Phonological Awareness Provided by This Measure

Strategy	N	Mean	SD	t-value	df	p
3-ph	10	15.03	4.76			
				-1.57	18	.13
SC	10	18.90	6.17			

Table 4

2 x 2 ANOVAs to Assess: 1) the Degree of Improvement in Woodcock-Johnson Letter-Word Identification & Dictation subtests, and 2) the Difference of the Two Treatment Groups in the Improvement, with Group Mean (n=10 for treatment group) and F (1, 18)

	3-ph		SC				
	M	SD	M	SD	MS	F	p
WJ Letter-word							
pretest	9.13	2.77	9.50	2.65			
posttest	11.34	1.56	11.47	2.12			
time (pre & post)					43.79	26.44	.00*
interaction (str vs time)					.16	09	.76
WJ Dictation							
pretest	8.08	1.86	8.70	1.65			
posttest	9.79	1.29	10.37	1.26			

(table continues)

	3-ph		SC				
	M	SD	M	SD	MS	F	p
time (pre & post)					28.61	43.87	.00*
interaction (str vs time)					.00	.01	.92

Note: * = significant when p = or < .001;

Table 5

Descriptive Comparisons Between the Actual Scores and the Expected on the Woodcock-Johnson Letter-Word Identification & Dictation Subtest

Test	Age	Expected Scores		3-ph	SC
Letter-Word Identification	5-0	9.00			
	5-3	10.00			
	5-6	11.00	pretest	9.13	9.50
	5-8	12.00	posttest	11.47	11.35
Dictation	5-1	8.00			
	5-6	9.00	pretest	8.03	8.70
	5-9	10.00	posttest	9.80	11.37

Table 6

T-Tests With Scores on the Reading Analogue and Spelling

Strategy	N	M	SD	t-value	df	p
Reading Analog						
3-ph	10	6.33	0.16			
				-0.99	18	0.34
SC	10	7.97	0.14			
Spelling						
3-ph	10	27.91	23.39			
				-0.40	18	0.69
SC	10	31.80	20.01			

Notes: M = 1) the average number of words read correctly out of the total 25 times of practice in the reading analogue; 2) the average developmental spelling score out of 84 total (6 points per word, and 14 words in total)

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