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Phonological Awareness Skills of Children With Articulation Disorders in Kindergarten to Third Grade

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The nature of the relationship between phonological awareness and articulation performance has not as yet been defined clearly. In the present study 14 children in grades K to 3 with articulation disorders were compared to 14 age matched subjects with normal articulation on three tests of phonological awareness (rhyming, phoneme blending and phoneme counting). Additionally, the performance of subjects with articulation disorders on phonological awareness tasks involving their error sounds and the same tasks not involving error sounds was compared. Articulation impaired subjects performed more poorly than subjects with normal articulation. The articulation impaired group did not make more errors on tasks involving their error sounds. Results of the present study revealed that subjects with articulation disorders made significantly more errors on three phonological awareness tasks than did subjects without articulation disorders.

Phonological awareness refers to the explicit understanding of the sound structure of language, including the awareness that words are composed of syllables and phonemes (Catts, 1991a). Phonological awareness includes not only understanding but also the ability to manipulate speech segments at the level of phonemes (Cunningham, 1990). Several types of tasks have been employed in order to assess phonological awareness in children. These assessment tasks generally fall into one of the following categories: rhyming, phoneme segmentation, phoneme manipulation, categorization, or phoneme blending.

Much of the reported research on phonological awareness has compared children's skills with reading ability. Several studies have reported that phonological awareness in early elementary school children is a reliable predictor of later reading ability (Bradley & Bryant, 1983; Catts, 1991b; Lundberg, Olofsson & Wall, 1980; Mann & Liberman, 1984; Share, Jorm, Maclean & Matthews, 1984; Stanovich, Cunningham & Cramer, 1984; Swank & Catts, 1994). Whether phonological awareness is a prerequisite or a result of reading ability has not been answered with certainty. However, recent investigations of the causal relationship between reading and phonological awareness have indicated that a reciprocal relationship exists (Perfetti, 1991; Stackhouse, 1997; Torgesen, Wagner, & Rashotte, 1994).

Bird, Bishop and Freeman (1995) indicated that one group of children who have literacy and phonological awareness problems are children with persisting speech sound production difficulties. The relationship between speech sound production skills and phonological awareness is an area that is receiving increasing attention in the literature. Webster and Plante (1992) reported that a group of phonologically normal children consistently performed better on a phoneme segmentation task than did a matched group of children with moderate to severe phonological impairments. Lewis and Freebairn (1992) demonstrated that children with phonological disorders may continue to have reduced phonological awareness skills into adolescence and adulthood.

The relationship between phonological awareness and expressive skill, however, is not a simple one. For example, Magnusson and Naucler (1990) reported that although children with phonological disorders as a group performed more poorly on phonological awareness tasks than a matched group of children with normal phonological skills. However, the difference was not always observed when individual subjects were compared. That is, some children with phonological disorders performed better on some or all of the phonological awareness tasks than some of the subjects with normal phonology. It is not clear as yet whether reduced phonological awareness reported in children with phonological disorders is related to their specific sound errors or reflects a more general reduction in this metalinguistic skill. Hodson, Nonomura and Zappia (1989) reported that when children with unintelligible speech were asked to complete sound identification tasks, their errors often reflected their own impaired phonological system and these errors usually carried over to oral and written tasks. The findings reported by Hodson et al. (1989) suggest that phonological awareness skills may be related to specific types of sound errors. Catts (1991b) suggested

that children with language disorders have poorly developed phonological awareness skills, but that children with articulation disorders without significant language disorders generally do not have difficulties with phonological awareness. This finding suggests that phonological awareness problems might reflect a general delay in the cognitive-linguistic aspects of speech sound production. Bird et al. (1995) reported that phonological awareness in children with expressive phonological impairments was not related to their level of language skill. Their research suggests that severity of the phonological impairment may be more important than the degree of accompanying language disorder in predicting a deficit in phonological awareness.

The purpose of the present study was to compare the phonological awareness skills of early elementary school children with articulation impairments to those of a matched group of children with normal articulation. Additionally, the present study also compared the phonological awareness skills of the subjects with articulation disorders on tasks which contained their error phonemes to their performance on the same type of tasks which did not contain their error phonemes.

METHOD

Subjects

Subjects for the present study were 28 kindergarten, first and second-grade students who attended public school in east central Alabama. The subjects were divided into two groups. The first group (subjects with articulation disorders) consisted of 14 subjects enrolled in the Speech-Language Impaired program provided by the school district. These subjects ranged in age from 5:8 (years:months) to 8:11, with a mean age of 6:10. The group consisted of seven males and seven females. The subjects qualified for the articulation disorders category if their phoneme errors on the Goldman-Fristoe Test of Articulation (Goldman & Fristoe, 1986) were not acceptable for their age according to norms provided by Sander (1972). These subjects were not receiving other special education services (e.g., emotionally conflicted, mentally retarded, multiple disabilities, or specific learning disabilities). The subjects with articulation disorders had received either a language screening and/or a formal measure (e.g., Preschool Language Scale - 3, Zimmerman, Steiner, & Pond, 1979) of their language abilities. Seven of the 14 subjects were currently receiving therapy for language skills in addition to articulation. The language problems exhibited by this group were syntactic problems related to sentence structure and tense and did not have any effect upon their articultaion skills. Unlike subjects in some previous research on this topic (e.g. Hodson, et al., 1989), the subjects in the present study did not exhibit severe articulation disorders. All subjects demonstrated two to five phonemes in error on the Goldman-Fristoe Test of Articulation (Goldman & Fristoe, 1986) and all exhibited good intelligibility.

A second group of 14 subjects (subjects with normal articulation) was matched to the experimental group for age, race and gender. This group also ranged in age from 5:8 to 8:11, with a mean age of 6:10. This group also consisted of seven males and seven females. All members of the normal articulation group passed a speech and language screening consisting of the Goldman-Fristoe Test of Articulation (Goldman & Fristoe, 1986), a spontaneous speech sample, and the Clinical Evaluation of Language Fundamentals - Revised, Screening Test (Semel, Wiig & Secord, 1989). Passing criterion for the articulation test was "no errors." In order to pass this screening, subjects could not demonstrate any errors on the articulation assessment and had to achieve scores above the age norms provided by the language instrument. The spontaneous speech sample also had to be free of articulation errors and language problems inappropriate for this age level. All subjects passed a pure-tone audiometric screening test at 25 dB HL ISO for 500, 1000, 2000, and 4000 Hz bilaterally (ANSI, 1989).

Procedure

All subjects were administered three tests designed to assess various aspects of phonological awareness. The specific tests used were modifications of the Yopp rhyming test (Yopp, 1988); the Roswell-Chall Test of Auditory Blending (Roswell & Chall, 1959); and the Liberman phoneme counting test (Liberman, Shankweiler, Fischer, & Carter, 1974). These tests were chosen because they each assess a different phonological awareness skill. The rhyming test assesses rhyming abilities, the phoneme counting test assesses segmentation abilities and the phoneme blending test assesses synthesis abilities.

Due to the nature of the subjects involved (i.e., children with articulation disorders), tests requiring minimal verbal responses were desirable. Finally, Yopp (1988) reported reasonable test-retest reliability for the three tests chosen (rhyming .76, phoneme counting .83, and phoneme blending .96).

Each subject was tested individually in the speech-language impaired classroom at his/her school by the first author. All phonological awareness tests were administered in one session. The order in which the tests were presented to each subject was varied to prevent an order effect.

The subjects were seated at a table with the examiner seated behind and to the right. This was done in order to eliminate any visual cues which might inadvertently be provided, as the examiner presented the stimulus words. The subjects were recorded using a Radio Shack model CTR-69 audio recorder placed in front of the subject. The average time required to complete testing was 30 minutes.

Rhyming

The rhyming test was administered to measure each subject's ability to determine if word pairs produced by the examiner rhymed. The test consisted of 25 word pairs (see Appendix A). The test was based on Yopp's rhyming test (1988). Each subject was asked if he or she knew what a rhyme was. The investigator then defined the concept as

"words that sound the same at the end." Several examples were provided, including *cat/hat, man/fan,* and the child's name with an appropriate rhyme. Counter examples were also given, such as *bag/bat* and *run/green.* The investigator then read each pair of words, and the subject responded with either "yes" indicating that the word pair rhymed or "no" indicating that the pair did not rhyme. The percentage of correct responses was recorded for each subject. The test took approximately five minutes to administer.

Phoneme Blending

The phoneme blending test was administered to measure each subject's ability to blend isolated sounds into words. The test consisted of three sections, each containing 10 words (see Appendix A). The sections were progressively more difficult. The first section consisted of two-phoneme words segmented into two parts (e.g., /l/-/f/). The second section consisted of three- to four-phoneme words segmented into two parts (e.g., /fl/-/ot/). The third section consisted of three- to four-phoneme words segmented into three parts (e.g., /s/-/l/-/t/).

Each subject was administered three sample items before starting the actual test. The subject was asked to tell "what word we would have if these sounds were put together." After each segmented word was read by the investigator, the subject was asked to tell the word he or she heard when the sounds were put together. The percentage of correct responses was recorded for each subject. In order to accommodate the articulation errors of the experimental group, the following criterion was applied: Responses were considered correct if the word produced contained the same number of phonemes as the target response, and if the substituted phoneme had been used previously by that subject (e.g., in testing, therapy or in conversation) as a substitution for the target phoneme. The test took approximately 10 minutes to administer.

Phoneme Counting

The phoneme counting test was administered to measure each subject's ability to count the number of phonemes in an utterance. The test consisted of 50 one-, two-, and three-phoneme utterances (see Appendix A). Each subject was given the following directions, based on the directions for the Liberman test (Liberman, et al.,1974) prior to starting the test:

> "We are going to play a listening and tapping game now. I'm going to say some words and sounds and tap them after I say them. Listen, so you'll see how to play the game."

As training stimuli, the following examples were given: */u/* (one tap); *boo* (two taps); *boot* (three taps). After the example, each subject was asked to repeat the demonstration task. When the subject responded correctly to the demonstration task, three additional groups of utterances were given as training. After the training was completed, the subjects were administered the following directions, taken from Yopp (1988):

> "Now we are ready to play the real game. I'll say a word or sound, but I won't tap it because you know how to play the game yourself. So, you say the word after me and then tap it. After each word, be sure to put your pencil down so I'll know you've finished tapping" (p.164).

The percentage of correct responses was recorded for each subject. The test took approximately 10 minutes to administer.

In addition to the tasks described above, the experimental group was also administered additional items from each test in order to further analyze words containing phonemes they could not correctly produce. Each subject with articulation disorders was administered five additional items per error phoneme (for purposes of the present study an error phoneme was any phoneme produced incorrectly in all positions tested on the Goldman-Fristoe Test of Articulation (Goldman & Fristoe, 1986). This was repeated for all three tests. These items were administered after the completion of each test (i.e., the additional rhyming items were administered after the original rhyming test was finished). Due to the additional test items, the experimental groups required more time than the control group to finish each testing session. This additional time varied with each subject but was always in the range of 15 to 30 minutes.

Reliability

Examiner variables such as rate of presentation, variations in stress, and insertion of a *schwa* vowel during the phoneme blending task, if not monitored, could have affected the performance of individual subjects. The examiner practiced presentation of the items without introducing such factors and made every effort to control such variations during the testing. In order to ensure that such factors were not introduced inadvertently, the tape recorded test sessions were reviewed independently by each author and by a graduate student in speech-language pathology. No items were considered to have been presented in a way that would have affected the subjects' performance.

In order to provide a reliability check on the responses for each of the three phonological awareness tasks, 25% of the tape recorded sessions were reviewed by the second author and findings were compared to those reported after the live testing by the first author. An item-by-item comparison was made using the following formula:

$$\frac{\text{Agreements}}{\text{Agreements + Disagreements}} \times 100$$

A high level of agreement would be expected because the tasks were relatively simple to monitor. The subjects' responses were either a "yes" or "no", the production of a word, or the tapping out of the number of phonemes all in close proximity to the tape recorder. All responses were clearly audible on the tape. For the phoneme counting task, the examiner also indicated verbally the number of taps she counted after each item. The item by item comparison of the 25% of individual responses for each task scored by the first and second authors revealed agreement levels as follows: 100% for the phoneme counting task (420

responses compared); 97.5% for the rhyming task (210 responses compared); and 97% for the phoneme blending task (280 responses compared).

RESULTS

Subjects With Articulation Disorders and Subjects With Normal Articulation

Because the various tasks contained different numbers of items, the percentage of correct responses was recorded. The mean percent of correct responses for the subjects with normal articulation and subjects with articulation disorders on the rhyming, phoneme blending and phoneme counting tasks are presented in Table 1. As seen in Table 1., subjects with articulation disorders demonstrated a lower percentage of correct responses than the normal articulation group on all three tasks. Because data expressed in percentages tends to cluster at the upper end of the scale, it is fairly common to transform the data before subjecting it to certain statistical procedures. One of the more common transformations is known as an arcsine transformation. The arcsine transformation shifts all scores downward thus centering the new distribution around the middle percentages (Shearer, 1982). The percentage of correct responses for each subject on each of the phonological awareness tasks was subjected to an arcsine transformation. The transformed data for the subjects with articulation disorders were compared to that for the subjects with normal articulation by means of a two-factor (group by test) Analysis of Variance (ANOVA). Results of the ANOVA are summarized in Table 2.

The ANOVA revealed that the subjects with articulation disorders made significantly more errors on the three tasks of phonological awareness than subjects with normal artic-

Table 1

Mean, Range and Standard Deviation of Percent of Correct Responses Made by Two Groups on Three Tests of Phonological Awareness

	Normal Articulation			Articulation Disorders		
Task	Mean	Range	S.D.	Mean	Range	S.D.
Rhyming	83.21	65-95	11.70	71.07	35-100	17.89
Blending	82.50	60-97	11.41	59.43	23-100	26.03
Counting	77.00	54-100	14.16	64.07	38-86	16.17

Note. For each group the total number of items presented to each subject was rhyming, 20; blending, 30; counting, 50.

Table 2

ANOVA Summary for Subjects With Normal Articulation and Subjects With Articulation Disorders

Source	Sum of Squares	df	Mean Square	F-Ratio	Prob.
Between Groups	10.45164	27			
Group	2.88682	1	2.88682	9.9219	.0041
Subjects W/in Group	7.56482	26	.29095		
Within Group	7.19287	56			
Task	.73443	2	.36722	3.0554	0556
Grp. X Task	.20879	2	.1044	.8686	.4255
Grp.X Subj W/in Group	6.24965	52	.12019		
Total	17.64451	83			

ulation. (F=9.9219; df=27,1; p=.0041). There was no significant difference among the three tasks. There was also no significant interaction between factors.

Words With and Without Error Phonemes

The mean percentage of correct responses for the subjects with articulation disorders on the rhyming, phoneme blending and phoneme counting tasks using words containing error phonemes and words without error phonemes are presented in Table 3. These percentages were also arcsine transformed and subjected to a two factor (word type by test) within-subjects ANOVA. Results of the ANOVA are summarized in Table 4.

Table 3.

Mean, Range, and Standard Deviation of Percentage of Correct Responses of Subjects With Articulation Disorders on Three Tasks of Phonological Awareness

	Error Words			Non-Error Words		
Task	Mean	Range	S.D.	Mean	Range	S.D.
Rhyming	68.29	40-100	20.58	75.93	40-100	17.69
Blending	48.93	20-100	35.31	54.92	13-100	31.98
Counting	59.07	20-100	26.21	62.57	20-100	26.49

Table 4

ANOVA Summary for Subjects with Articulation Disorders on Two Word Types

Source	Sum of Squares	df	Mean Square	F-Ratio	Prob.
Block	14.02608	13	1.07893		
Word Type(WT)	.1419	1	.1419	.541	.4751
WT by Block	3.41006	13	.26231		
Task(T)	3.37243	2	1.68622	2.471	.1041
T by Block	17.74263	26	.68241		
WT by T	.08081	2	.04041	.278	.7595
Total	42.55252	83			

The ANOVA revealed that the performance of the subjects with articulation disorders on tasks involving words containing error phonemes was not significantly different from their performance on tasks using words without error phonemes. Also, the differences in percentages correct on the three different tasks for these subjects were not statistically significant.

The subjects with articulation disorders in the present study included seven subjects who had passed a language screening, and seven subjects who were currently receiving intervention for language skills along with their articulation disorders. Upon inspection of the means for these two subgroups revealed that the subjects with accompanying language disorders achieved a higher mean percentage of correct responses than the subjects who passed a language screening on two of the three tasks, with the exception being the rhyming task. Because the number in each of these subgroups was small (seven in each group), it was felt that a traditional ANOVA could not be used to compare these two subgroups. Therefore, a Friedman Two-Way Analysis of Variance by Ranks (Siegel, 1956) was used to compare the performance of the subjects with articulation and language disorders to that of subjects with articulation disorders only. This test revealed that the differences noted among the groups were not significant (p=.833).

DISCUSSION

Subjects With Articulation Disorders vs. Subjects Without Articulation Disorders

The first stated purpose of the present study was to compare the phonological awareness skills of children with articulation disorders with those of a matched group of children with normal articulation. Results of the present study revealed that subjects with articulation disorders made significantly more errors on three phonological awareness tasks than did subjects without articulation disorders. This finding is consistent with the reports of Magnusson and Naucler (1990), and Lewis and Freebairn (1992). Webster and Plante (1992) also reported that children with speech sound production errors performed more poorly on tasks of phonological awareness than did children without speech sound errors.

Although a relationship between articulation ability and

phonological awareness apparently does exist, the nature of that relationship is not clear in at least two respects. First, not all children with articulation errors appear to have problems in phonological awareness. In the present study, as was the case in the study reported by Magnusson and Naucler (1990), some subjects with articulation disorders performed better on phonological awareness tasks than some of the subjects with normal articulation. One factor that may have an effect upon the relationship between phonological awareness and articulation skill is the severity of the articulation disorder. Both Webster and Plante (1992) and Bird et al. (1995) suggested that severity of the expressive phonological disorder may be associated with performance on phonological awareness tasks. The articulation impaired subjects in the present study all had relatively mild problems and all were highly intelligible. It is possible that relatively mild speech sound production problems may have a weak relationship to phonological awareness skill and additional child specific factors may affect these children's ability to deal with phonological awareness tasks.

A second area in which the relationship between articulation ability and phonological awareness is not clear is in the causal aspect of the relationship. It is not known if the reduced phonological awareness demonstrated by many children with articulation disorders is due to poor articulation skills or if the articulation errors are due to a lack of phonological awareness. The causal relationship that has been examined between phonological awareness and reading skills has come up with with mixed results. Some researchers (Ball, 1993; Mann & Liberman, 1984; Yopp, 1992) believe that the two are reciprocal (i.e., some phonological awareness is needed in order to learn to read). The process of learning to read then, in turn, increases phonological awareness. The same type of relationship may exist between speech sound production skill and phonological awareness. A discussion of such a relationship, however, is beyond the scope of the present investigation.

Error Words vs. Non-Error Words

The second purpose of the present study was to compare the performance of children with articulation disorders on tasks of phonological awareness involving words containing error phonemes and words without error phonemes. In the present study, performance of the subjects with articulation disorders on tasks involving words containing error phonemes was not significantly different from their performance on tasks involving words without error phonemes. This finding suggests that the poorer performance of the subjects with articulation disorders compared to the normal articulation group on tasks of phonological awareness was not directly related to the subjects inability to correctly produce specific target phonemes but rather reflected a more general reduction in phonological awreness. Such an observation would be consistent with the observation of Bird et al. (1995) that expressive phonological disorders reflect deeper difficulties in classifying and analyzing sounds. These results relate to the observation stated above that not all children with articulation disorders performed poorer than normal speakers. Perhaps some of the children in the present study had articulation disorders attributed to motor based problems, while the others had a disorder, although mild, resulting from difficulties with the underlying organization or categorization of the sound system.

An additional factor in the present study which may have affected the results is the subjects' prior participation in speech therapy. Some of the words used as "words containing error phonemes" were words to which the subjects had been exposed during treatment. The prior exposure to these words may have affected the subjects' performance on tasks containing these words. Since some of the students had received auditory perception training for their misarticulated phonemes they had, by the nature of this training, received some phonological awareness practice.

Clinical Implications

The present study demonstrates that even children with relatively mild articulation disoders may have problems in phonological awareness. Because tests of phonological awareness are relatively quick and easy to administer, clinicians may wish to consider including such tests as part of all articulation/phonological assessments, even when speech sound production problems appear to be mild. Research has demonstrated that phonological awareness skills can be taught (Ball & Blachman, 1991; Blachman, 1991; Byrne & Fielding-Barnsley, 1991). Therefore, students with articulation disorders might benefit from direct instruction in phonological awareness. This would seem especially appropriate for children with articulation disorders who also experience difficulties with reading. This is an area to be considered by speech-language pathologists, reading specialists and classroom teachers when planning intervention for children with articulation disorders.

Some traditional approaches to articulation therapy include the use of perceptual or ear training. The goal of this training is "for the client to develop an auditory model that will serve as an internal standard against which comparisons of his/her own productions can be made" (Bernthal and Bankson, 1988, p. 321). The process of ear training involves some of the same skills required in phonological awareness. According to Van Riper and Emerick (1984), perceptual training includes identification, isolation, stimulation and discrimination of target phonemes. Since the nature of this training is similar to that of phonological awareness training, possibilities may exist to combine the two areas in therapy.

Tasks designed to teach phonological awareness can be easily incorporated into speech therapy. Yopp (1992) suggests that tasks designed to teach phonological awareness should be fun, informal and conducted in group settings. One activity that could be utilized is having the children name words that rhyme with the words being targeted for articulation practice. Another suggestion is for the children to practice blending phonemes into words, and segmenting

and counting the phonemes in words. Phonemes being targeted in therapy should be used in these activities. Having the children isolate and manipulate sounds in their targeted articulation words would also help to promote phonological awareness. These activities can be conducted in a play or game setting that many speech/language pathologists already utilize in therapy.

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APPENDIX A

Words used in the phonological awareness tasks

Rhyming	Blending		Counting	
	Part1	Part3		
pig-big	a-t	c-a-t	is	/au/
gum-sum	th-e	d-e-sk	/ɛ/	/u/
sun-stove	z-oo	v-a-n	my	toys
sandal-candle	i-f	h-ou-se	toy	cake
thing-rug	o-n	w-a-sh	/ae/	cool
buzz-fuzz	u-p	r-e-d	/i/	/e/
mat-hat	b-ee	y-e-ll	soap	Ed
cub-come	g-o	m-a-n	/l/	cup
yellow-fellow	t-o	b-ir-d	his	at
top-cop	s-ew	c-u-t	pout	book
watch-wish	Part2		mine	lay
lathe-fade	st-ep		out	/o/
train-mean	f-at		red	/ɔI/
chair-bear	fl-ag		/a/	give
bike-kite	l-ong		cough	chew
the-she	j-ump		pot	wing
cage-maid	gr-een		/U/	Joe
bath-half	ch-ip		heat	yam
yell-mess	th-in		he	shirt
snake-lake	m-ilk		/ɔ/	this
	sl-ide		pa	blue
			mat	snow
			/ŋ/	bath
			so	grow
			up	eye