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A Phonemic-Based Remediation Approach for /r/

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The phoneme /r/ is one of the most frequently misarticulated sounds that a speech-language pathologist (SLP) hears. Despite advances in research, its misarticulation is still considered one of the most difficult sounds to correct and one of the most persistent speech errors in school-aged children (Clark, Schwarz, & Blakeley, 1993; Elbert & McReynolds, 1975). According to a recent survey of approximately 200 SLPs (plus anecdotal evidence), many SLPs are not making adequate progress with students who have /r/ disorders, and they feel inadequately prepared in diagnostic and evaluation procedures (Ristuccia, 2004). These factors, coupled with a critical shortage of speech-language pathologists, mandate the investigation of new, research-based approaches relevant to school settings. Thus, the discussion presented here seeks to demonstrate that using an approach based on phonetically consistent word lists, which use 21 variations of vocalic /r/, will improve students' speech production.

The Traditional Approach to Articulation Therapy & How Many /r/'s Are There?

As previously stated, misarticulation of /r/ presents a significant challenge to the speech student and clinician. Several reasons have been presented in the literature to account for the persistence of /r/ speech errors. A primary reason is the variability in the manner of /r/ production (Zawadzki & Kuehn, 1980). The phoneme /r/ has allophones that may be considered consonantal forms, and others that are considered vocalic in nature. Given the variable nature of the /r/ phoneme, it is possible that its complexity is not adequately addressed in traditional approaches of articulation remediation, also known as the "stimulus approach" (Van Riper, 1978). In the traditional approach, the focus is on the single misarticulated sound, in this case, consonantal /r/. Traditional articulation remediation is characterized as a continuum ranging from ear/perceptual training to hierarchically arranged steps of production training. Depending upon the level of stimulability of the sound in error, production training could begin by establishing correct production of the sound in isolation, syllables, words, phrases, sentences, and ultimately ending with correct production in conversation. Although the approach is generally considered to be effective at speech remediation, most would agree that it is often not effective with remediation of /r/ errors.

In the traditional approach, the phoneme /r/ is simply classified in terms of word position: prevocalic (before a vowel, as in *red*); intervocalic (between vowels, as in *arrow*); and postvocalic (after a vowel, as in *father*). However, actual pronunciation of /r/ is far more complex. It comprises six vocalic combinations as well as pre-vocalic /r/, initial /r/ blends, and medial and final /r/. The prevocalic classification of the traditional approach works for words such as *red*, because /r/ in the initial position functions as a consonant. However, the other initial vocalic /r/s (as in *Ernie, earphone, airplane, Archie, ornament*, and *Ireland*) cannot be classified as prevocalic/consonantal because a vowel precedes the /r/. It would be difficult to remediate [er] initial words (e.g., *Ernie*) using prevocalic/consonantal /r/ words such as *red* and *run*. Establishment/training on /r/ in the traditional approach often does not distinguish among the different allophones of /r/, especially the vocalic allophones. Therefore, traditional practice on "medial /r/" might involve the mixing of disparate words in practice lists such as *carpet, butterfly, parachute, hamburger*, or *bird*. Taking the complexity and variability of articulation of /r/ into account, it is apparent why the traditional approach might not be very effective in correcting the production of misarticulated /r/ (Clark et al., 1993). One possible reason given for the lack of success is the variability of the /r/ phoneme that is not taken into account, particularly with /r/ allophones that function as vowels, such as [er].

The Rationale for Targeting Different /r/ Allophones

The difficult and intricate nature of /r/ is well-documented in the literature. The phoneme /r/ is generally considered to be a consonant, especially when used in the pre-vocalic position, such as *ring, race*, and *run*. However, as noted above, the phoneme /r/ has vowel-like properties and therefore is labeled as a *glide*, a *semi-vowel*, or a *liquid*. The position of /r/ changes the quality of the vowel that immediately precedes it in such words as *bear, pear, pour*, and *arrow* (Carmona, 1987), clearly affecting the position of the tongue and mandible. Clinically, this suggests that /r/ articulation is variable depending on the preceding vowel. Researchers suggest that postvocalic /r/ could be considered the second element of a diphthong, and that it varies as a function of the preceding vowel, in contrast to the steady state and lower formant frequency of the prevocalic /r/ (Zawadzki & Kuehn, 1980).

Research supports the relevance of the /r/ division in assessment and treatment of /r/ disorders. Pollock (1991) suggests that clinicians consider six vocalic /r/s: (1) the unstressed / ɚ/ as in *father*, (2) the stressed /ɝ/ as in *bird*, (3) /ɪɚ/ as in *fear*, (4) / ɛɚ/ as in *fair*, (5) /ɑɚ/ as in *car*, and (6) / ɔ ɚ/as in *oar*. Shine, Downes, & Denning (1982) postulated 10 phones of /r/: (1) consonantal (or prevocalic) /r/ as in *red*; (2) voiceless fricative di- and tri- clusters as in *price* and *spring*; (3) voiced fricative di-clusters as in *broke*; (4) /ɪɚ / as in *fierce*; (5) /ɛɚ/ as in *shared*; (6) / ɔ ɚ/ as in *fork*; (8) /ʊr/ as in *toured*; (9) stressed / ɝ / as in *hurt*; and (10) unstressed / ɚ / as in *sister*. Curtis and Hardy (1959) identified four classes of phonetic events in which their subjects showed differential behavior: (1) the consonantal /r/; (2) the stressed vocalic / ɝ /; (3) the unstressed vocalic / ɚ / as in *butterfly*; and (4) the intervocalic / ɛɚ / as in *share*. Interestingly, Curtis and Hardy documented their subjects' ability to produce 43 different /r/ combinations divided into seven distinct classifications depending upon context. They concluded:

> Subjects behave differently with respect to the different types of /r/i. It seems evident that this differential response should be given consideration when analyzing the problem of a child who exhibits misarticulations of /r/ sounds...the evidence supports the division of /r/ sounds into a number of types to which responses seem to suggest that there may very well be important underlying differences of articulatory movement. (p. 252)

Thus, it is evident that although various researchers have not agreed on exactly how many /r/ allophones exist, or how they are to be divided, it is obvious from the literature that the /r/ phoneme contains allophones that are distinctive enough to warrant more attention in /r/ intervention. That is, that the traditional three-way division of /r/ (initial/prevocalic, medial/intervocalic, final/postvocalic) does not adequately address the variable nature of /r/ articulation.

How Many /r/s to Teach?
The Question of Generalization and Transfer

Since it is agreed upon that there are many allophones of /r/, the next question pertains to the nature of /r/ generalization: Is teaching one, two, or three /r/s enough to transfer to all other variants? This is not at all straightforward, hence the shortcomings of the traditional approach and its division of /r/ into simply three basic variants: initial, medial, and final word positions. Furthermore, is one allophone of /r/ more likely to generalize to other nontargeted forms? This has been studied with some, but not nearly all, of the allophones of /r/. The most well-studied are consonantal /r/, /r/ in blends, stressed / ɝ /, and unstressed /ɚ /. For example, Elbert and McReynolds (1975) investigated the transfer of these four different variants of /r/. They concluded that overall generalization of correct production occurred to other, nontrained allophones. Elbert and McReynolds thus concluded that all four /r/s studied belonged to the same "group" and need not be divided. However, their data show that there were differences in generalization patterns between the /r/ groups. Namely, those that were trained on consonantal /r/ generalized skill across other allophones better than subjects trained on the vocalic /r/ categories. This in itself appears to point

out that differences exist with regard to the learning of the /r/ allophones. Although no one has stated that it is indeed necessary to train each and every allophone of /r/, it appears that differences do exist in the pattern of transfer. Hoffman (1983) found that, although generalization of training to untrained allophones did occur to some extent, there were some conditions in which generalization was less likely. Specifically, Hoffman found that training on stressed / ɝ/ was less likely to transfer to other allophones, such as unstressed /ə˞/, consonantal /r/, or blends containing /r/. The results of these studies seem to suggest that there are issues with generalization of /r/ production to other allophones in the /r/ phoneme group. Thus, training on several /r/ allophones, especially vocalic forms (e.g., /ə˞/) seems warranted. This runs contrary to the approach that is most often used in articulation therapy, an approach that focuses almost exclusively on consonantal forms of /r/, and at most, three variants based on word position.

While this literature suggests that targeting more than one form of /r/ seems necessary, in truth, the issue is ripe with complicating factors. Namely, the roles that coarticulation can play in /r/ articulation, linguistic contexts in which /r/ occurs, and finally, individual differences. Hoffman, Schuckers, & Ratusnik (1997) found that not only do children demonstrate inconsistencies in the production of various allophones of /r/ (namely, /ɝ/, /ə˞/, and /r/) but that anticipatory (R-L) and carryover (L-R) coarticulation exert influence on the production of /r/ (see also Diedrich, 1984 for discussion of how linguistic context influences /r/ production). Furthermore, they found that lexical and grammatical factors operate in production of /r/. The Hoffman et al. (1997) study examined the production of /r / in lexically constrained and nonlexically constrained conditions, such as:

> lexically constrained [r]: He has **pr**ide.
> nonlexically constrained [r]: The jee**p r**ide was fun.
> nonlexically constrained [er]: The kic**ker k**icked the ball.

Hoffman et al. found that, in lexically constrained conditions, more accuracy was demonstrated for /r/ than for its vocalic variants. When compared to nonlexically constrained exemplars (the [er] variants), /r/ was also more accurately produced. In nonlexically constrained conditions, unstressed /ə˞/ was produced with more accuracy than /r/.

Effectiveness of a Phonemic-Based Approach to /r/ Intervention

Although it is apparent from earlier literature that there are different /r/ allophones that are articulatorily distinctive, there has been no comprehensive assessment and treatment program that systematically addresses this, except for a recent study by Ristuccia (in press) using the *Entire World of R* ™ (EWR), which includes treatment for six vocalic /r/s ([ar], [air], [ear], [er], [ire], [or]), prevocalic /r/, and medial and final /r/. The core of this approach is its use of phonetically-consistent word lists for production training as well as stabilization techniques and visual diagrams for sound acquisition (for production training lists and details of techniques, see Ristuccia, 2002; Ristuccia, Gilbert, & Ristuccia, 2005).

In addition, while the *EWR* ™ incorporates many aspects of the traditional approaches, the 10 phones of /r/ (Shine et al., 1982) and the other vocalic /r/ studies, it also evaluates the initial vocalic /r/s that were not acknowledged in the other studies' evaluation and treatment procedures. The initial vocalic /r/s are just as important as the vocalic /r/ in other word positions, because a student may be able to produce a vocalic /r/ in one word position and not in another. The production training word lists (Ristuccia, 2002; Ristuccia et al., 2005) specific for each of 21 variations of /r/ are phonetically-consistent; this makes production training and sound establishment more efficient due to the specific breakdown of the /r/ variations and by allowing consistent practice on not only one word position at a time, but also on one allophone of /r/ at a time.

A soon to be published study by Ristuccia and Aldridge (2007) confirmed the complexity of the /r/ phoneme. The analyses clearly demonstrated that all /r/s are not the same. Word position and vocalic variation were significant factors for correct

production for children with /r/ articulation disorders. These findings demonstrated that the evaluation and treatment of /r/ should involve the consideration of all allophonic variations along with word position. Separating out /r/ into more specific vocalic allophones and word positions provides a much clearer picture of a student's actual production capability and allows for easy selection of treatment targets. The method is effective and has been proven to work in a naturalistic school setting. Most notably, the approach was effective for the SLPs. In a post-study survey, all participating SLPs rated the method either 5 or 4 (5 = very effective, 4 = effective on a 5-point scale, (M = 4.75) and all indicated that they would continue to use the approach with their students.

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