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Phonological Awareness Skills in Children with Highly Unintelligible Speech

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THESIS APPROVAL

The abstract and thesis of Sheryl Mohwinkel for the Master of Science in Speech Communication: Speech and Hearing Science were presented May 15, 1996, and accepted by the thesis committee and the department.

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ABSTRACT

An abstract of the thesis of Sheryl Mohwinkel for the Master of Science in Speech Communication: Speech and Hearing Science presented May 15, 1996.

Title: Phonological Awareness Skills in Children with Highly Unintelligible Speech

The phonological awareness skills of children with language disorders has been well addressed throughout the literature. Research into the phonological awareness skills of children with highly unintelligible speech, however, is still in its infancy. One published study has looked at the relationship between phonological awareness skills in children with persistent phonological impairments and in children with normal phonology (Webster & Plante, 1992). Significantly higher scores were recorded on three of the four phonological awareness measures for the children with normal phonology As phonology improved, so did the children's phonological awareness skills.

The purposes of the present study were to determine if there is an improvement in phonological awareness skills of children with highly unintelligible speech who receive speech sound intervention services, and to determine if there is a difference in phonological awareness skills between children who receive a phoneme-oriented treatment approach and those who receive a phonological cycling treatment approach. Children who took part in

a larger study (Buckendorf, 1996) in which the effectiveness of the two treatment approaches was examined, were given the Assessment of Metaphonological Skills-Prekindergarten (Hodson, 1995) early in the course of treatment and again 2 to 3 months later.

The following specific questions were addressed:

1. Is there an increase in phonological awareness skills for children who receive articulation/phonological intervention?

2. Is there a difference in the amount of improvement of phonological awareness skills for children who receive a phoneme-oriented treatment approach as compared with children who receive a phonological cycling treatment approach?

To test if the subject's phonological awareness skills improved from pretest to posttest, a one tailed t-test for paired differences, and the Wilcoxon Matched-Pairs Signed-Ranks test were performed. Results on both of these analyses indicated a statistically significant improvement between pretest and posttest scores. To test if there is a difference in the improvement of phonological awareness skills between the two groups, a t-test for independent samples of group and the Mann-Whitney U-Wilcoxon Rank Sum W-Test were performed on pretest, posttest, and pretest-to-posttest. Results on both analyses indicated no statistically significant differences between the two groups on any of these variables.

PHONOLOGICAL AWARENESS SKILLS IN CHILDREN WITH HIGHLY UNINTELLIGIBLE SPEECH

by
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TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

A majority of the research that has been done on phonological awareness skills of young children has been performed on children with language disorders rather than children with phonological deficiencies. More research is needed in the latter area, hence the development of this study. In this study, children with phonological deviations and their phonological awareness skills will be examined in the beginning stages of speech sound intervention and at the end of speech sound intervention.

Phonological awareness skills have been shown to be an important element in the development of literacy, especially reading, and possibly other areas such as productive phonology. Phonological awareness skills that develop early play a vital part in learning to read (Chaney, 1992; Fox & Routh, 1975; Lundberg, Frost, & Peterson,1988; Maclean, Bryant, & Bradley, 1987). In addition, phonological awareness abilities can affect spelling performance (Clarke-Klein & Hodson, 1995). Being aware that words are made up of smaller units, segmental awareness, has been found to be an important component in both learning to read and spell (Harbers, 1994). To be able to decode words, a child must be able to produce the sounds that match with each letter and must be aware that speech can be broken down into phonemic units represented in the alphabet (Blachman, 1989).

In addition to the correlation of learning to read and spell with phonological awareness, Webster and Plante (1992) showed a correlation

between productive phonology and phonological awareness skills. Webster and Plante hypothesized a possible reason for this correlation between persistent productive phonological impairments in children and poor phonological skills. Since productive phonological skills depend partly on the ability to code phonological information into working memory effectively, children who have persistent phonological impairments may have difficulties with phonological awareness tasks. Webster and Plante also stated that speech intelligibility in preschoolers and school-aged children has been found to be a predictor of phonological awareness and that, as productive phonological ability increases, there is an increase in phonological awareness skills such as word, syllable, and phoneme segmentation.

If there is a relationship between productive phonological ability and phonological awareness skills, it would be beneficial to screen young children with phonological impairments for phonological awareness deficits. Knowing then that the child has difficulties in phonological awareness skills, professionals and others involved could be better prepared for possible difficulties the child may encounter when learning to read and spell, and with speech sound production. In addition, if there is a relationship noted between increased phonological awareness skills and a specific approach to speech sound intervention, the speech-language clinician may want to

choose the intervention approach that has a potential effect of improving phonological awareness skills.

Statement of Purpose

The purpose of this study is twofold: (a) to determine if there is an improvement in phonological awareness skills of children with highly unintelligible speech who are receiving speech sound intervention services and (b) to determine if there is a difference in phonological awareness skills developed between children with highly unintelligible speech who receive a phoneme-oriented approach and those who receive a phonological cycling approach.

The following research questions this study posed were:

1. Will there be an increase in phonological awareness skills for children who receive articulation/phonological intervention?

2. Will there be a difference in the amount of improvement of phonological awareness skills for children who receive a phoneme-oriented treatment approach as compared with children who receive a phonological cycling treatment approach?

These questions led to the following null hypotheses:

1. There is not an increase in phonological awareness skills for children who receive articulation/phonological intervention.

2. There is not a difference in the amount of improvement of phonological awareness skills for children who receive a phoneme-oriented treatment approach as compared with children who receive a phonological cycling treatment approach.

Definition of Terms

The following are terms used for the purpose of this study:

Alliteration- repetition of initial consonant sounds in two or more neighboring words or syllables (Ball, 1993).

Feature awareness- organizing sounds by features such as place of sound production, manner of how sound is produced, and voicing (Harbers, 1994)

Metalinguistic awareness- ability to comprehend and produce language in a communicative way and the ability to separate language structure from communication intentions. This term is used to describe a wide range of linguistic skills such as phonological awareness (Chaney, 1992).

Phoneme awareness- identifying individual sounds in a word or syllable in order to segment and blend the smaller units (Harbers, 1994).

Phoneme blending- putting individual phonemes together to produce a word (Ball, 1993).

Phoneme segmentation- breaking a word into its constituent phonemes (Ball, 1993).

Phonological awareness- ability of the language user to reflect on and to manipulate the phonological segments in words. Can include rhyming, blending, segmenting of words and syllables, phoneme manipulation, and alliteration (Ball, 1993).

Phoneme manipulation- manipulating the phonemes of a word by either combining, separating, deleting, or substituting.

Productive phonology- speech that is verbally produced.

Speech-sound intervention- speech intervention referring specifically to articulation/phonology versus intervention for voice and stuttering.

Syllable segmentation- segmenting a word into the syllables of which it is comprised (Fox & Routh, 1975).

Word segmentation- segmenting a sentence/short phrase into all its separate words (Fox & Routh, 1975).

CHAPTER II

REVIEW OF LITERATURE

Phonological Awareness Defined

Phonological awareness refers to the ability to consciously reflect on and manipulate the phonological segments in words (Blachman, 1989; Tunmer, Herriman, & Nesdale, 1988). Phonological awareness is often considered to be a smaller part of a larger area of research and instruction termed metalinguistic awareness (Ball, 1993). According to Ball, metalinguistic awareness refers to "the ability of the language user to reflect on and to manipulate the structural features of spoken language" (p. 130). As Tunmer et al. (1988) pointed out, language users do not usually think of how words are comprised of individual phonemes, how utterances are comprised of words, and if an utterance is structurally different or the same as another utterance unless they purposely think about it. Incorporating phonological awareness with metalinguistic awareness then, Ball (1993) stated that phonological awareness is the metalinguistic ability that requires the explicit understanding that words are comprised of discrete units. For example, a person with good phonological awareness skills realizes that a word such as *sip* has three units and that the word *slip* has four (Ball, 1993). This awareness does not mean that the language user must know *how* to spell the word, but only know that it *can* be spelled (Liberman & Liberman,

1990). Phonological awareness encompasses the following skills according to Morais (as cited in Harbers, 1994): (a) awareness of phonological strings; (b) awareness of syllables; (c) awareness of phonemes, also called segmental awareness; and (d) awareness of phonetic features.

Phonological Awareness Development

The question as to when and how phonological awareness and metalinguistic awareness develop has been a topic addressed throughout the literature. Theories have been proposed, which will be discussed, and studies have been conducted to investigate these theories. Two theories that address the proposed question of when metalinguistic awareness develops are the **autonomy hypothesis** and the **interaction hypothesis**, both described by Smith and Tager-Flusberg (1982).

According to the autonomy hypothesis, children's initial acquisition of basic comprehension and production processes comes before and is distinct from their development of metalinguistic awareness. Metalinguistic awareness, which Smith and Tager-Flusberg (1982) considered to be a distinctive type of linguistic functioning, facilitates later linguistic skills, such as the acquisition of writing and reading. Two assumptions that underlie this theory are: (a) the development of basic comprehension and production processes do not require metalinguistic awareness, but acquiring certain skills, like learning an alphabetic reading system does require the

awareness; and (b) skills used for spoken language develop during the preschool years, while skills needed in making judgments about language, particularly about the form of utterances, develop in the middle childhood years.

Empirical evidence supporting this hypothesis relates to the timing of metalinguistic awareness development. It has been shown in numerous studies that typically developing children between the ages of 6 and 8 years use a variety of metalinguistic awareness skills that are related to each other, but preschool children demonstrate difficulties with tasks that require making explicit judgments about linguistic forms (Chaney, 1992). A potential problem related to the autonomy hypothesis concerns the age at which the ability to make explicit judgments occurs. Smith and Tager-Flusberg (1982), for example, believe the age at which a child is able to make explicit judgments about linguistic forms is still in question. Many researchers have shown that the majority of 5-year-old children and many 6-and 7-year old children do not demonstrate the ability to segment spoken words into phonemes (Calfee, Lindamood, & Lindamood, 1973; Liberman, Shankweiler, Fischer, & Carter, 1974), but are able to distinguish among similar phonemes. Concerning the task of judging the acceptability of sentences, Hakes (1980) found that older children rely on the syntactic and semantic characteristics of the sentence, but younger children appear unable to make this distinction between the meaning of the sentence and its form. These studies have shown various

difficulties that young children can have with metalinguistic tasks, such as separating form from meaning, segmenting spoken words into phonemes, and making explicit judgments about linguistic forms.

In review of the research on the autonomy hypothesis, the general poor performance on metalinguistic awareness tasks by young children has resulted in many researchers believing preschool children lack the ability to separate form from meaning, and that learning these distinctive types of language skills does not emerge until after age 6 (Chaney, 1992). Even with this empirical evidence though, it should be noted that several researchers have succeeded in simplifying the required tasks to adapt to the preschoolers' metalinguistic abilities more readily (e.g., de Villiers & de Villiers, 1972; Fox & Routh, 1975).

The interaction hypothesis was also developed by Smith and Tager-Flusberg (1982) who presented a different view concerning the relationship between linguistic and metalinguistic development. According to this theory, children's acquisition of basic comprehension and production processes are influenced by, and is not separate from, the development of metalinguistic awareness. In turn, metalinguistic awareness development is influenced by linguistic development. The two assumptions that underlie this hypothesis are: (a) metalinguistic awareness plays an important part in the acquisition of preschool language and in later developments of language, like the emergence of literacy; and (b) preschoolers, as well as older children,

possess some metalinguistic awareness abilities and these abilities change as they acquire new skills.

Observational studies that support this theory come from Chaney (1992), van Kleeck and Schuele (1987), and Smith and Tager-Flusberg (1982). These researchers reported that even 2- and 3-year-old children perform metalinguistic awareness tasks such as the following: spontaneously repairing their own mistakes (e.g., "She want-she wants to go to sleep"), commenting on rhymes they make (e.g., "boodle and noodle...that matches"), segmenting beginning sounds (e.g., "Mamma starts with /m/"), and playing with words and alliteration (e.g., "canpakes, cancakes, pancakes," deanut dutter dandwich"). These samples vary in their linguistic complexity, and some may only be considered a basic awareness (Chaney, 1992). Even though some awareness may only be considered basic, the results of Smith & Tager-Flusberg (1982) and Chaney (1992) are quite compelling in that children as young as 3 and 4 years are making some explicit metalinguistic awareness judgments out of context and on demand, and they are monitoring their own speech. This demonstrates that these young children are already developing a mental framework for analyzing language structure and making the distinction between semantic and syntactic characteristics.

It is of interest to know what accounts for this lack of agreement regarding the development of metalinguistic awareness in children. Chaney (1992) supplied two possible reasons. The first reason is related to where

the support for the hypotheses comes from. For the autonomy hypothesis, much of the research is gathered from experimental tasks, that show mastery of skills across numbers of children. For the interaction hypothesis, much of the support is gathered from spontaneous data, that reveals the emergence of a skill in one or several children (van Kleeck & Schuele, 1987). Second, the experimental tasks used may be too difficult when attempting to probe early emergence of those metalinguistic awareness skills, (Chaney, 1992; van Kleeck & Schuele, 1987). Due to the lack of agreement regarding the timing and nature of the development of metalinguistic awareness, one would question if the development of metalinguistic awareness fits neatly into either of the two theories presented. It would seem that metalinguistic awareness develops on a continuum, possibly starting very early as some research suggests, but with some skills not developing until middle childhood, as other research suggests.

As cited in Chaney (1992), Adams (1990) and Tunmer and Herriman (1984) have given their attention to this continuum issue. Rather than focusing on the mastery of certain skills, they devised stages for the development of phonological, word, and structural awareness. From least to most difficult, the following is their predicted ordering of metalinguistic awareness tasks: (a) monitoring and correcting speech errors, (b) knowing nursery rhymes/sound play, (c) comparing the sounds of words for rhyme or

alliteration, (d) sound blending/syllable splitting, (e) phoneme segmentation, and (f) phoneme manipulation.

Ball (1993) also hypothesized a developmental continuum for phonological awareness and categorized the behaviors into emerging, simple, and complex. Many of the behaviors she categorized come from van Kleeck and Schuele (1987). These behaviors increase in complexity with age and are similar to the behaviors described by Adams (1990) and Tunmer and Herriman (1984) as cited in Chaney (1992). Emerging behaviors include correcting and regulating speech productions, sound play (e.g., nonsense rhyme and alliteration), and comments on or attracting attention to pronunciations. Simple behaviors include providing rhymes, categorizing by rhymes, providing categorization by initial sounds, and phoneme blending. Complex behaviors include phoneme manipulation, deletion, substitution, and reversal. The tasks at the lower end of the continuum do not require much phonemic processing abilities, whereas the tasks at the higher end of the continuum require a deeper level of phonemic processing that entails explicit, conscious, and analytic skills (Ball, 1993). As one progresses across the continuum, the tasks require more metalinguistic skills to perform.

The development of metalinguistic skills that Liberman et al. (1974) discussed are phoneme and syllable segmentation. They concluded that even though both skills improved with grade level, explicit analysis of spoken words into phonemes is a more complex task for young children than is

syllable segmentation. Preschool children in their study were unable to segment by phonemes, but 46% could segment by syllables. Phoneme segmentation increased to 17% in kindergarten and 70% in first grade, whereas syllable segmentation was performed by 70% of kindergartners and 90% of first graders.

Maclean et al. (1987) studied another phonological awareness task, rhyming. Their results showed that many 3-year-olds have a reasonable knowledge of nursery rhymes, and this knowledge of nursery rhymes predicted their success over one year later in a rhyme detection task. The researchers stated that this study may have been the first systematic group study that has shown that children as young as 3 years exhibit the ability to analyze sounds into words.

Assessment of Phonological Awareness

A variety of different tasks have been used to asses phonological awareness skills in young and older children, such as blending, phoneme segmentation, rhyming, phoneme counting, matching, and phoneme substitution. This large number of different tasks makes it difficult to know exactly what information is provided by the studies (Stanovich, Cunningham, & Cramer, 1984). The tasks may involve not only phonological awareness, but also cognitive processes such as stimulus comparison, short-term memory, and processing of task instructions. In addition, there is even within-task types of variability such as Yopp (1988) mentioned. These

variabilities could include the types of words that researchers use. Some researchers use nonsense words versus real words. Another within-task variability is that some researchers target initial sounds of words versus some who may target medial or final sounds. Nesdale, Herriman, and Tunmer (as cited in Yopp, 1988) said to exercise caution when comparing results of specific phonological awareness studies, due to the variance of what phonological awareness skills are being tested from task to task. Reliability and validity for many of the phonological awareness tasks, according to Yopp (1988), have yet to be determined, as well as a rationale for why certain test items were included. In Yopp's study (1988), three phonemic awareness tests did show higher reliability coefficients than others (.90 or greater): (a) the Roswell-Chall (1959) phoneme blending test (b) the Bruce (1964) phoneme deletion test, and (c) the Yopp-Singer phoneme segmentation test which was designed for the Yopp (1988) study. The purpose of the Roswell-Chall phoneme blending test is to determine a child's ability to combine sounds into words. The purpose of the phoneme deletion test is to determine a child's ability to delete phonemes. The purpose of the Yopp-Singer Phoneme Segmentation test is to determine a child's ability to identify the sounds of a word separately, yet in order.

One can conclude that tasks placed on a phonological awareness screening test must be carefully selected. Consideration should be given to the various task requirements such as the following: (a) is there extraneous

cognitive requirements for the tasks?; (b) is there task convergence, that is, is task a correlated with task b?; and (c) is there predictability of the tasks to later acquired skills, that is, do rhyming tasks predict later reading ability?

As mentioned previously, a variety of tasks have been used to assess phonological awareness. A list, adapted from Yopp (1988), is provided in Table 1.

Regarding rhyming tasks, Yopp's study (1988) resulted in the same conclusion as did Stanovich's et al.'s (1984) study. Both studies showed the rhyme tasks are the easiest of the phonemic tasks for kindergarten children to perform.

These are various areas that Ball (1993) suggested considering when assessing phoneme awareness. These are invented spellings, categorizing words by rhyme, producing rhymes on demand, alliteration, and phoneme blending. Blachman (1991) suggested simple measures of phonological awareness, such as categorizing words by placement of sounds, counting or segmenting words, or sound deletion tasks when assessing a beginning reader or older nonreader. The assessment of these tasks could provide general information about the child's phonological awareness skills.

Table 1

Phonological Awareness Tasks (adapted from Yopp, 1988)

Task	Example
sound to word matching	Is there a /f/ in calf?
word to sound matching	Do pen and pipe begin the same?
recognition or production of rhyme	Does sun rhyme with run?
isolation of a sound	What is the first sound in rose?
phoneme segmentation	What sounds do your hear in hat?
phoneme counting	How many sounds do you hear in cake?
phoneme blending	Combine these sounds /c/-/a/-/t/.
phoneme deletion	What word is left when you take /t/ away from the middle of stand?
specifying deleted phonemes	What sound do you hear in meat that is missing in eat?
phoneme reversal	Say os with the first sound last and the last sound first.
invented spellings	write the word monster.

Phonological Awareness Skills of Children with Phonological/Articulation Disorders

To a large extent, research investigation of metalinguistic awareness skills of children with communication disorders has mostly been performed on children with language impairments (Webster & Plante, 1992). Research performed on children with phonological impairments and their metalinguistic awareness has not been nearly as extensive. Webster and Plante reported that the investigation they did into the phonological awareness skills of children with persistent phonological impairments as compared to children with normal phonology showed significantly higher scores for the children with normal phonology on three of the four phonological awareness measures. They speculated the reason to be that phonological impairment precludes efficient phonological coding in memory, and this can cause difficulties with phonological awareness tasks. An example that Webster and Plante (1992) provided is the task of segmenting a word into its constituent phonemes, which requires holding a word in working memory for analysis. If the child has difficulties in phonological coding, these difficulties could affect the child's phonological awareness skills. Webster and Plante (1992) concluded: (a) phonological awareness is closely associated with productive phonological ability, independent of mental age and education experience; and (b) as speech intelligibility increases, so does the ability to segment words and syllables. Webster and Plante (1992) suggested that these

conclusions indicate that "phonological awareness bootstraps on the primary or overt phonological system" (p. 181), and that phonological awareness may be a strong predictor of performance on phonological tasks that require explicit phonological awareness, such as word-to-phoneme segmentation, and pseudoword-to-sound segmentation, and sentence-to-word segmentation. Generalization of these results though should be limited, because of the small sample size (n = 22), and because it is only a preliminary study.

Clarke-Klein and Hodson (1995) studied the misspellings by third graders with histories of disordered phonology as compared to children with normal phonology. They found that on the phonological awareness tasks, the children with a history of disordered phonology scored poorer in all three phonological awareness areas: phoneme segmentation, rhyming, and alliteration. In regard to the spelling tasks, the children with disordered phonology exhibited more phonologically based errors (e.g., consonant sequence/cluster reduction) in their written misspellings than their phonologically normal counterparts. There was a negative correlation found between phonological awareness and misspellings noted in both groups of children. As phonological awareness increased, phonological deviations in misspellings decreased.

Approaches to Speech Sound Intervention

Two approaches to speech sound intervention, the phoneme-oriented approach and the phonological cycling approach, will be discussed here as they are the types of interventionadministered to the children in this study. Other approaches will be mentioned in order to gain a broader understanding of what articulation/phonological remediation can entail.

There are two broad areas into which most speech intervention treatments are categorized: (a) motor approaches, and (b) cognitive-linguistic approaches. Motor approaches are based on the view of teaching and automizing new motor behaviors, since articulation errors are believed to be the individual's inability to perform the motor skills required to articulate the sound (Bernthal & Bankson, 1988). In this approach, once the person learns to produce the correct sound and practice the sound at increasingly complex linguistic levels, the target sound will become automatic (Bernthal & Bankson, 1988). Typical motor approaches involve phonetic placement to teach the location of the articulators, practice of the correct sound at increasingly complex linguistic levels (e.g., isolation, syllables, words, sentences, conversation), production training, successive approximation, and imitation.

Cognitive-linguistic approaches are based on the view that some people have not learned the rules for appropriate use of sound or have not established the phonemic contrasts of the language. Typical cognitive-

linguistic approaches involve phonological process analysis, minimal word pair contrasts, phonological cycling, and activities that require appropriate rule use for the listener to comprehend certain words said by the speaker (Bernthal & Bankson, 1988).

Phoneme-Oriented Approach

The phoneme-oriented approach, more commonly referred to as the traditional approach, has been the speech sound treatment that has been in existence the longest and is best known (Bernthal & Bankson, 1988). Even though the beginnings of this approach had its roots in the early decades of the 1900s, Charles Van Riper, in the late 1930s, was the person who began using these treatment techniques (Bernthal & Bankson, 1988). The traditional approach is based on the belief that articulation errors have become fixed, reinforced, and automatized. After this occurs, persons with articulation errors do not recognize their errors and do not know how to produce them correctly (Van Riper & Erickson, 1996). The traditional approach focuses on sequencing of activities for (a) sensory-perception training, (b) varying and correcting various productions of the sound until it is produced accurately, (c) strengthening and stabilizing the correct production, and (d) transferring the new speech skill to everyday communication settings (Van Riper & Erickson, 1996). This approach usually focuses on teaching one phoneme at a time to a specified criterion (e.g., 90%), and the selection of the phonemes to be taught are based on

developmental phoneme acquisition norms. After a phoneme is selected, it is taught in hierarchical steps, which are the following: (a) isolation; (b) nonsense syllables; (c) initial, final, and medial position of words; (d) phrases; (e) sentences; and (f) conversation. The client achieves criterion at each step before moving on to the next one. After criterion is met at the conversation level, the next phoneme is selected and taught in the same manner. Since the articulation errors are considered so fixed, reinforced, and automized, isolation production is chosen as the first stage. Thus, the long history of usage that has reinforced the error is avoided. Production of the phoneme would then need strengthening and the person would keep progressing through the increasingly complex steps. This strengthens the newly acquired sound so it can be incorporated into the person's communication.

Phonological Cycling

Developed by Hodson and Paden (1991), the phonological cycling approach to speech intervention incorporates linguistic principles and evaluation of sound systems versus isolated phonemes (Hodson, 1989). Target patterns (e.g., /s/ clusters, velars, liquids) are selected for treatment rather than targeting one sound at a time. Two concepts underlying this approach that led to its development are mentioned by Hodson and Paden (1991): (a) "phonological acquisition is gradual", and (b) "children are

actively involved in their phonological acquisition" (p. 76). In discussing the first concept, Hodson (1989) stated that normally developing children do not master one sound or pattern completely before they learn another one. Rather, they acquire sounds in a gradual process. This is why the approach does not focus on the mastery of one target at a time, but rather attempts to facilitate or stimulate all of the target patterns in succession. In response to the concept that children should be active participants in the learning process, the phonological cycling approach incorporates experiential-play activities (e.g., bowling) to provide motivation.

Following phonological assessment, potential targets are selected for intervention. Selection of targets is important for several reasons. One reason is so that immediate success can be experienced by the child. Early targets are selected for which the child is stimulable in order for the child to experience success. A second reason is that the child should experience not only success, but also be challenged. As the cycles progress, the targets are selected to be more difficult. A third reason why appropriate target selection is important is because of the need to reduce opportunities for assimilation effects. For example, words containing labial consonants and/or vowels should not be used as target words, especially during early cycles, for children who substitute the labial glide /w/ for liquids (Hodson, 1989). In addition to target selection being important for success in this approach, so is

auditory and kinesthetic awareness of phonological patterns according to Hodson (1989). The reason is that "unintelligible children seem to rely solely on their own inaccurate kinesthetic images, which feel right at the time" (p. 158). Since children with phonological impairments seem to rely on their own inaccurate kinesthetic images, new kinesthetic images are developed. These new images are developed by providing many opportunities for the child to produce the carefully selected words. Auditory awareness is also incorporated into the session, because children with unintelligible speech do not always hear their own speech (Hodson, 1989). Auditory awareness is accomplished through the use of an auditory trainer at the beginning and end of each session.

In summary of the two approaches, Hodson (1989) described several of the main differences between the phoneme-oriented approach and the phonological cycling approach. The goal for phonological remediation is to help the child develop intelligible speech patterns as quickly as possible, and the goal for phoneme-oriented remediation is to perfect phonemes one by one. In the phonological based approach, "phonemes serve as a means to an end" (p. 160), and in the phoneme-oriented approach, "the phonemes act as an end in themselves" (p.160). Early targets for the cycles approach typically include /s/ clusters and liquids (/l/ and /r/), whereas in the phoneme-oriented approach, these are not likely targeted early, but rather phonemes such as /f/ are selected as early targets. Hodson (1989) reported that for

children with mild to moderate speech disorders, the phoneme-oriented approach is quite adequate, but for highly unintelligible children, it is usually not as efficient nor effective, and a phonologically based approach would more likely best serve the child.

Summary

There are different opinions regarding when and how phonological awareness and metalinguistic awareness develop. According to the autonomy hypothesis, metalinguistic awareness develops at the same time, but independently of certain literacy skills, such as reading, around the age of 6 or 7, and comes after the development of basic language comprehension and production processes. In contrast, according to the interaction hypothesis, acquisition of basic comprehension and production influences metalinguistic awareness, and metalinguistic development is influenced by linguistic development. In addition, preschool children as well as older children posses some metalinguistic awareness abilities and these abilities change as they acquire new skills. The interaction hypothesis supports the notion that children in the preschool years do demonstrate some phonological awareness. If this is the case, this knowledge should be testable. The specific phonological awareness skills that should be tested, however, has not been agreed upon in the literature. Some phonological awareness tasks though, have been shown to be more reliable than others as cited earlier by Yopp (1988).

In addition to testing phonological awareness skills of preschool children with normal phonology, it would be beneficial to test phonological awareness skills of preschool children with disordered phonology. Testing the latter group would help to understand better the phonological awareness skills that children with disordered phonology have and why these skills may be lacking.

Children who are highly unintelligible as well as exhibiting phonological awareness deficits are of concern when they enter kindergarten (Hodson, 1994). Many researchers have indicated that children with phonological awareness deficits will later have more difficulties when learning to read. If these children also have an expressive phonological impairment, it may even further impinge on their development of literacy skills.

When choosing a speech sound intervention approach for children with disordered expressive phonology and phonological awareness deficits, it would be wise to choose the most efficient and effective treatment. The sooner the children's deficits can be remediated, the less chance there is of the deficits having a negative effect on literacy development. Hodson (1989) stated that the most effective and efficient speech sound intervention for highly unintelligible children is the phonological cycles approach, because it targets the underlying organization of the child's sound system. This approach may not only be more effective and efficient, but also may facilitate

phonological awareness skills faster. A possible reason for this is the assumption given by Webster and Plante (1992) that "phonological awareness bootstraps on the primary or overt phonological system" (p.181). Making the phonological system as the target of speech intervention and using the cycling approach to do this would then seem to make more sense than targeting single sounds.

CHAPTER III

METHOD

Subjects

The subjects used in this research are part of a study conducted at Portland State University by Buckendorf (1996) who investigated the effectiveness of two speech intervention approaches, that is, phoneme-oriented and phonological cycling. Ten children between the ages of 3 years 8 months and 5 years 5 months, pretest age, served as the subjects for this study. Five children received the phoneme-oriented treatment approach, and 5 children received the phonological cycling treatment approach. Another subject who was in the phoneme-oriented group discontinued participation in the study due to parent scheduling conflicts, and a 12th subject who was receiving phonological cycling intervention was dismissed because he achieved normal phonology after 15, 50-minute sessions.

Subjects were recruited for the Buckendorf (1996) study by sending letters to three groups of people/programs: (a) physicians, (b) private practice speech-language pathologists, and (c) early intervention programs. Potential referees were asked to refer children between the ages of 3 1/2 years and 5 years who were difficult to understand. To be included in the study, subjects were required to pass screening tests for: (a) hearing and (b) receptive language which included the Peabody Picture Vocabulary Test-Revised (PPVT-R) (Dunn & Dunn, 1981) and the Test of Auditory

Comprehension Language-Revised (TACL-R) (Carrow-Woolfolk,1985). Passing for the hearing screening was at 20 dB at the frequencies of 500, 1000, and 2000 Hz. To pass the PPVT-R and the TACL-R, children had to score no lower than a standard score of 85. Permission for the subjects to participate in this study was granted through a written consent form signed by the parents of the subjects (Appendix A).

The children were then screened with the Assessment of Phonological Processes-Revised (APP-R) screening test (Hodson, 1986). This screening test consists of 15 single words. The child is shown a picture or object representing the word, and the child is asked to name it. If the child substitutes or omits the targeted phoneme(s) for that word, it is considered an error. Targeted phonemes include velars, liquids, and /s/ clusters. If the child receives three or more errors on the screening test, it is considered failing. All subjects failed the screening test. The APP-R was then administered in its entirety. In this test, children name 50 items. Phonological patterns used in the child's productions are analyzed and the average percentage of occurrence of phonological deviations is calculated. The average is converted to a severity rating by factoring in chronological age. Children scored from 40-60 on the severity scale on this instrument, which corresponds to a rating of severe. Such a severity rating is indicative of inadequate intelligibility. The range of intelligibility, which was a measure of the percentage of words understood in a 100 word speech sample ranged

from 27% to 65% pretest, and from 50% to 100% posttest. Children who passed the other screenings and scored between 40-60 on the severity scale, were used in this study.

Testing instrument

The unpublished testing instrument used in this study, The Assessment of Metaphonological Skills-Prekindergarten, was developed by Hodson (1995). This assessment is recent in its development; hence, normative data are not available. Since the test is a recent development and because there are no current norms for it, the author (B. Hodson, personal communication, October 17, 1995) asked that the test form not be included in the appendix so inappropriate use would be discouraged.

The instrument consists of three sections, including blending syllables, rhyming, and segmentation. These tasks were designed to test the children's metaphonological skills. The first section is blending syllables (using manipulatives) which consists of 6 items. In this task, the child is required to combine two small words to make a larger word (e.g., hot and dog make hot dog). Blocks are used to represent the small words, and the child pushes the blocks together to make the larger word.

The second section of the test is rhyming (matching), which consists of 7 items. First, the children are instructed to point to the pictures that are named to ensure they know each picture. Second, the children are required to choose which word rhymes with the key word from a set of pictures that

are read by the examiner The third section of the test is segmentation (counting syllables), which consists of six items. In this task, the children are required to count the number of syllables in a word by tapping out the syllables through use of finger tapping. The three sections of this assessment were chosen by the Hodson because research and experience indicate that children learn these skills earliest and that pre-kindergarten children who are developing normally can do these tasks fairly successfully (B. Hodson, personal communication, February 15, 1996).

Procedures

The subjects were administered the test two separate times, pretest and posttest. Each testing session took approximately 15 minutes. Testing of most of the subjects was performed by the researcher, who was trained in administration procedures by the author of the test. One subject who was not compliant on the first meeting was tested over two sessions for the pretest. Testing for this child was completed by the child's clinician, who was trained by the researcher. Hodson also administered the test to two children during the pretest to instruct the researcher on procedures. The subjects had received from 10 to 12, 50-minute speech intervention sessions prior to the pretest. Time between the pretest and posttest was from 2 months 2 weeks to 3 months 1 week. Differences were due to different days the subjects attended clinic, cancellations, and time conflicts when testing.

Before the Assessment of Metaphonological skills-Prekindergarten was administered, a precheck was performed. This ensured that each child was able to push objects together, differentiate between same and different, and count to three, either rote counting or counting objects, all skills needed during the testing. When testing for the ability to push blocks together, which prechecked for the blending syllables task, the subject was given three blocks and was instructed to push the blocks together. When testing for the ability to differentiate between same and different, which prechecked for the rhyming task, the subject was given three blocks, two of which were the same color and height and one which was a different color and height. The subject was then asked to identify which blocks looked the same and which ones looked different. In order to test for the ability to count to three, which prechecked for the segmentation task, the subjects were given three blocks and were asked to count them. All subjects passed the three prechecks.

Following the precheck, the Assessment of Metaphonological Skills was administered. Two demonstration items were given for the first section, blending syllables. The examiner said the word, had the child repeat the word, and placed a block on the table that represented the word that was said. This was repeated for the second (and sometimes third) word. After the words were said, the child was asked to slide the blocks together and say the new word.

The second task was rhyming (matching). The examiner asked the children if they have ever heard the nursery rhyme "Humpty Dumpty" or "Mary had a Little Lamb" (examiner can say the nursery rhyme). Examples of words that sound alike and that do not sound alike were provided. The child was asked to point to each picture as its name was said. They were then asked to identify, from 2 to 3 pictures, which words rhymed with the key word. The choices were read aloud as was the key word.

The third task was segmentation (counting syllables). Two demonstration items were given, and instructions provided. A word was provided by the examiner, and the child was to count the parts of the word by tapping fingers. The examiner asked the child how many parts were in the word.

Scoring and Data Analysis

Scoring analysis

The subject received 1 point for each correct response, 0 points for each incorrect response, and 1/2 point for each partially correct response. All points were added together, with 20 being the highest possible points, and multiplied by 5, with 100% being the highest possible score.

Data analysis

Data used in this study were taken from the pretest and posttest scores. Overall pretest-posttest change was calculated for each subject All analyses were performed at the .05 significance level. Means and standard

deviations were obtained for pretest and posttest. A t-test for paired differences and the Wilcoxon Matched-Pairs Signed-Ranks were used to determine if there was a significant improvement in phonological awareness scores from pretest to posttest. In order to investigate whether there was a difference between the two treatment groups in their improvement in phonological awareness skills, a t-test for independent samples of group as well as a Mann-Whitney U- Wilcoxon Rank Sum W test were performed for pretest scores, posttest scores, and pretest-posttest differences.

CHAPTER IV

RESULTS AND DISCUSSION

Results

The purposes of this study were to determine if there was an improvement in phonological awareness skills of children with highly unintelligible speech who received speech sound intervention services, and to determine if there was a difference in phonological awareness skills between children who received a phoneme-oriented treatment approach and those who received a phonological cycling treatment approach. Phonological awareness skills of preschool children with severe phonological disorders were tested early in their speech treatment and again after 10-13 weeks of intervention. Five of the subjects received a phoneme-oriented treatment approach and 5 received a phonological cycling approach. The pre- and posttest scores were compared, as well as the posttest performance between the two groups.

Two research questions were addressed in this study. The first question asked was: Is there an increase in phonological awareness skills for children who receive articulation/phonological intervention? A one-tailed t-test for paired differences was applied to investigate if the phonological awareness scores improved for the preschool subjects after receiving articulation/phonological treatment. The mean score for the pretest for all 10

subjects was 38.0 (SD = 26.3) and 51.8 (SD = 31.3) for the posttest (Table 2).

Table 2

Comparison of Pre and Posttest Phonological Awareness Skills for Preschoolers with Articulation/Phonological Disorders (n = 10)

VARIABLE	MEAN	STD DEV.	t-value	df	p
Pretest	38.0	26.3			
			2.04	9	*.035
Posttest	51.8	31.32			

*p < .05

The alpha level was set at .05. The resulting p-value [t (9) = -2.04, p = .03] indicated that phonological awareness skills did improve significantly from pretest to posttest (Table 2).

Due to the small sample size (n = 10), the Wilcoxon Matched-Pairs Signed-Ranks Test, a nonparametric measures, was performed to provide more support for the above findings. These results (p = .02) also indicated that phonological awareness skills improved between pretest and posttest.

The second question asked was: Will there be a difference in the amount of improvement of phonological awareness skills for children who

receive a phoneme-oriented treatment approach as compared with children who receive a phonological cycling treatment approach? To determine if there was a difference between the two groups, a t-test for independent samples of group was performed on three variables: pretest, posttest, and pretest-posttest difference (Table 3).

Table 3

t-Tests for Independent Samples of Group for Testing the Difference Between Group One and Group Two for the Variables Pretest, Posttest, and Pretest-Postest Difference

	Group 1		GROUP 2		t-VALUE	df	p
	Mean	SD	Mean	SD			
Pretest	40.5	35.90	35.5	15.85	.28	8	.093
Posttest	64.5	34.20	39.0	25.10	1.34	8	.216
Pretest-Posttest Difference	24.0	24.50	3.5	12.50	1.67	8	.134

Note: Group 1= Phoneme-Oriented; Group 2= Phonological Cycling

Preliminary to conducting the t-test, Levene's Test for Equality of Variances was applied to examine if the variances of each variable were

equal. This test is done when $n < 30$ in order for the t-test to be valid (P. Lees, personal communication, March 16, 1996). The p-values were beyond the .05 level of confidence for all three variables, hence, the variances were determined to be equal. For the pretest, results indicated that there was no significant difference in means [$t(8) = .28$, $p = .093$]. This result demonstrates that the subjects performed at approximately the same level in phonological awareness skills when first tested and therefore were fairly evenly matched. From visual inspection for the posttest data, there appears to be a large difference in means between the two groups; however, the difference is not statistically significant [$t(8) = 1.34$, $p = .216$]. For the pretest/posttest differences, there appears to be a large difference in the mean differences; however, the difference between the two groups are not statistically significant [$t(8) = 1.67$, $p = .134$].

Due to the small sample size, the Mann-Whitney U-Wilcoxon Rank Sum W Test, a non-parametric measure, was performed to examine the differences between the two groups (Table 4). The results of this analysis were that there were no statistically significant differences between the two groups in mean ranks for the three variables: pretest, posttest, and differences. This supports the results of the t-test for independent samples.

Table 4

Mann-Whitney U-Wilcoxon Rank Sum W Test for Testing the Difference Between Mean Ranks for Group One and Group Two for the Variables Pretest, Posttest, and Pretest-Posttest Difference

	GROUP 1 Mean Rank	GROUP 2 Mean Rank	2-TAILED p Corrected for ties
Pretest	5.60	5.40	.9168
Posttest	6.80	4.20	.1693
Difference	6.90	4.10	.1376

Note: Group 1= Phoneme-Oriented; Group 2= Phonological Cycling

Discussion

The results of the first question posed by this investigation revealed that the phonological awareness skills of the subjects did improve at a significant level from pretest to posttest. Even in the short time span between pretest and posttest, these findings are in agreement with other research findings that phonological awareness skills improve over time. The question should be addressed if the children's scores would have improved, or improved as much, without the speech intervention they received. Since

the amount of improvement of the scores varied considerably from subject to subject, this question is difficult to answer. Scores that increased by just 5 points may have been due to maturation alone. Scores that improved more than 5 points, such as for subjects 2, 4, 5, 9, and 10 (see Appendix B), may have been influenced by the speech intervention. It is quite likely that the intervention did exhibit some influence over the scores. Children who receive speech intervention may learn to become aware of how words are comprised of different parts. One way this could happen is when the clinician is stressing the first phoneme of a word. For example, for a child who glides /r/ and replaces it with a /w/, the clinician may model the word red as r----ed and use a small pause following the /r/. In this way, the child may become more aware that the sounds in words can be separated. In addition, the phonological cycling approach is designed to target the child's underlying phonological system (Hodson & Paden, 1991) which may increase the child's awareness of the sound system.

Children's scores could have also improved due to being presented with the pretest. When the posttest was administered, the children may have been more familiar with the tasks and therefore know what was expected. In fact, several parents reported that following the pretest, their children appeared frustrated because they were unable to perform some of the tasks, and when arriving at home, the children wanted to practice rhymes as well as blend syllables with blocks. Parents also questioned the researcher if the

tasks on the test were something they should be working on with their child. Parents may especially have a motivation to practice these tasks with their child if they noticed the child performed poorly. This practice as well as maturation and speech intervention may have contributed in the increase in scores. Regarding subject 10 whose score decreased (see Appendix B), it is believed by the researcher that the child was inattentive during the posttest and understood the task better than his performance indicated.

Although a task comparison was not performed statistically, there appeared to be an equal improvement in the three sections of the test, blending syllables, rhyming, and segmentation. In each area the scores of 6 children increased, although different subjects had increases of scores in different areas. For blending syllables, six scores increased from one point to three points. For rhyming, six scores increased from one point to eight points; and for blending syllables, six scores increased from one point to three points. Even though the same number of children exhibited an increase in scores in each section, the rhyming section had the largest mean point increase. This is in agreement with the literature that rhyming abilities are considered one of the easiest phonological awareness skills for preschool children to perform. Since each preschool subject in this study demonstrated phonological awareness skills in at least one of the three sections, the interaction hypothesis that states that preschool children can perform certain metalinguistic tasks, is supported.

The results of the second question addressed by this investigation revealed that even though the mean scores of the posttest were quite different between the two groups, this difference was not statistically significant. Hence, it can not be concluded that one group improved significantly more than the other. It should be noted that because there were only 5 children in each group, each subject carried 20% of the mean score. Group 1, phoneme-oriented approach, had a large standard deviation that is influenced by subject 2 who increased from 10.0 to 75.0, subject 3 who improved from a .00 to 7.50, and subject 4 whose posttest score was 100.0. The results for group 2, phonological cycling approach, were also skewed. Subject 10 had a decrease in score from 27.5 to 10.0.

Possible methodological reasons for the lack of significant findings regarding this question are as follows: (a) not enough time between pretest and posttest, (b) number of subjects was too small, and (c) standard deviations were large. There is also the possibility that the type of speech sound intervention children receive does not influence phonological awareness skills. Future research might clarify this.

CHAPTER V

SUMMARY AND IMPLICATIONS

Summary

The phonological awareness skills of children with language disorders has been well addressed throughout the literature. Research into the phonological awareness skills of children with highly unintelligible speech, however, is still in its infancy. One published study has looked at the relationship between phonological awareness skills in children with persistent phonological impairments and in children with normal phonology (Webster & Plante, 1992). Significantly higher scores were recorded on three of the four phonological awareness measures for the children with normal phonology in the Webster and Plante study. Results indicated a positive relationship between phonological awareness skills and productive phonology. As phonology improved, so did the children's phonological awareness skills.

The purposes of the present study were to determine if there is an improvement in phonological awareness skills of children with highly unintelligible speech who receive speech sound intervention services, and to determine if there is a difference in phonological awareness skills between children who receive a phoneme-oriented treatment approach and those who receive a phonological cycling treatment approach. Children who took part in a larger study (Buckendorf, 1995) in which the effectiveness of the two treatment approaches was examined, were given the Assessment of

Metaphonological Skills-Prekindergarten (Hodson, 1995) early in the course of treatment and again 2 to 3 months later.

The following specific questions were addressed:

1. Is there an increase in phonological awareness skills for children who receive articulation/phonological intervention?

2. Is there a difference in the amount of improvement of phonological awareness skills for children who receive a phoneme-oriented treatment approach as compared with children who receive a phonological cycling treatment approach?

To test if the subject's phonological awareness skills improved from pretest to posttest, a one tailed t-test for paired differences, and the Wilcoxon Matched-Pairs Signed-Ranks test were performed. Results on both of these analysis indicated a statistically significant improvement between pretest and posttest scores. To test if there is a difference in the improvement of phonological awareness skills between the two groups, a t-test for independent samples of group and the Mann-Whitney U-Wilcoxon Rank Sum W-Test were performed on pretest, posttest, and pretest-to-posttest change measures. Results on both analyses indicated no statistically significant differences between the two groups on any of these variables.

Implications

Research

Future research of interest would include a similar study with larger group sizes and more time between pretest and posttest to better determine if significant differences exist between the two groups. In such a study, the pretest should be administered at the beginning of speech intervention rather than several weeks into treatment. A control group of children with normal phonology could also be incorporated into the study. A study such as the above mentioned would be interesting to perform on prekindergarten children, as well as doing a follow up study of the same children in 2nd grade when they are learning to read. Their reading skills could also be examined and then compared with their phonological awareness skills to determine what relationship exists between reading phonological awareness skills.

Clinical

Data from this study suggest that phonological awareness skills do improve over time; however, it can not be suggested that children who receive the phoneme-oriented treatment improved significantly more than the children who received the phonological cycling treatment and vice versa. If results of future studies were to show that one group receiving a certain type of speech treatment improved significantly more than a group receiving a different type of speech treatment, speech-language pathologists may choose the treatment approach that is most effective, not only in improving

intelligibility, but also in improving phonological awareness skills. Since it has been shown in the research that, as intelligibility increases, so does the ability to segment words and syllables (Webster & Plante, 1992), targeting both intelligibility and phonological awareness would have a positive impact. In addition to the benefits of increased intelligibility, increased phonological awareness skills would help the child when learning to read when considering the strong correlation between phonological awareness skills and reading.

Specific phonological awareness activities that could be included in treatment for preschool children are skills that have been shown to be learned early, such as sound play (e.g., nonsense rhyme & alliteration), providing rhymes, categorization by initial sounds, phoneme blending, and monitoring and correcting speech errors. These phonological awareness activities could be incorporated into the speech intervention session. For example, if the clinician is targeting final /t/ as the speech sound and wants the child to provide rhymes, the child could be asked what words rhyme with *mat* and be given pictures such as *rat*, *cat*, and *sat* to choose from. In this case, the child is stimulated with productions for final /t/ when saying the words as well as working on rhyming words.

Phonological awareness activities that could be incorporated into speech intervention sessions of older children would be the later developing skills, such as sound blending, syllable splitting, phoneme segmentation,

phoneme manipulation, phoneme deletion, phoneme reversal, and phoneme substitution. These could also be incorporated into the speech intervention session. If trying to incorporate phoneme substitution into speech intervention, the clinician could have children substitute their targeted speech sound into different words. This would assist the children in learning how to manipulate phonological segments in words as well as practicing the target speech sound.

Phonological awareness skills have been shown to be valuable in the development of literacy as well as being incorporated into productive phonology and language skills. It is important that phonological awareness skills be incorporated into children's learning.

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Appendix A

Informed Consent form for subject participation

I, _____, (child's name) agree to take part in this research project on phonological awareness skills in children with speech sound errors.

I understand that in this study, my child will be assessed on his/her ability to combine syllables to make larger words, rhyme words, and count syllables in words. This short test will take approximately 12 minutes and will be give twice, with about 8 weeks in between the two tests. It will be given right before or right after the child's normal session.

I understand that my child may feel frustrated, because of the unfamiliarity of the task.

Sheryl Mohwinkel has told me the purpose of this study is to learn about the phonological awareness skills in children who have speech sound errors, and to use the results as a learning tool for future study into similar areas.

My child may not receive any direct benefit from taking part in this study, however, the study may help to increase other speech-language pathologist's knowledge in this area in the future.

Sheryl Mohwinkel has offered to answer any questions I have about the study and what my child is supposed to do.

She has promised that all information will be kept confidential to the extent permitted by law, and that the names of all people in the study will remain anonymous and be kept confidential.

I understand that participation in this study is voluntary, and that if I choose not to participate or withdraw from this study, it will not affect my relationship with Portland State University and the professionals involved in this study.

I have read and understand the above information and agree to take part in this study.

Date: _____ Signature _____

If you have concerns or questions about this study, please contact the chair of Human Subjects Research Committee, Research and Sponsored Projects, 105 Neuberger Hall, Portland State University, 503-725-3417, P.O. Box 751, Portland, OR 97297

APPENDIX B

Raw Scores of Pretest, Posttest, Group, and Difference

Subject	Pretest	Posttest	Group	Difference
1	65.0	70.0	1	5.0
2	10.0	75.0	1	65.0
3	.0	7.5	1	7.5
4	85.0	100.0	1	15.0
5	42.5	70.0	1	27.5
6	20.0	25.0	2	5.0
7	50.0	60.0	2	10.0
8	25.0	30.0	2	5.0
9	55.0	70.0	2	15.0
10	27.5	10.0	2	-17.50

Note: Group 1 = phoneme-oriented group

Group 2 = phonological cycling group