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Phonological and Language Improvements in Preschool Children: A Comparison of Phonological Process Targeting and Whole Language Training.

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PHONOLOGICAL AND LANGUAGE IMPROVEMENTS IN PRESCHOOL CHILDREN: A COMPARISON OF PHONOLOGICAL PROCESS TARGETING AND WHOLE LANGUAGE TRAINING

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by
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J.M.

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ABSTRACT

This study compared phonological and language changes that occurred in preschool phonologically-impaired children following treatment via a discrete phonological process targeting approach or a whole language approach. It was hypothesized that a treatment program utilizing a communication-based, whole language approach would result in improvements in various language domains (e.g., phonology, morphology, syntax, semantics, and pragmatics), while treatment targeting a specific aspect of language, that is, phonology, would result in improvements limited to that specific domain.

Subjects were eight preschool children, 3-4 years of age, exhibiting multiple articulation errors, and randomly assigned to one of two intervention programs for a six-week period. The phonological process approach targeted the most salient error pattern exhibited by subjects in this group (i.e., Consonant Cluster Reduction or Fronting) through practice in production and perception of affected minimal pair contrasts. The whole language approach focused on improving the child's ability to formulate and express useful language in a communicative setting through production of narratives, while expanding and increasing complexity of narrative structure.

Pretreatment and posttreatment measures of phonological

and language performance were used to compare the efficacy of the two treatment approaches. The assessment battery included assessment of single word performance on tests administered, connected speech performance on various tasks (e.g., storytelling; relating familiar experiences) and higher level language performance, including syntactic, semantic, and pragmatic measures.

Data analysis revealed that while all subjects demonstrated improved phonological performance, subjects in the whole language group demonstrated a greater degree of improvement than those in the phonological process group. In addition, the whole language group showed larger gains in syntactic, morphological, semantic, and pragmatic expression. These results suggest the need for further studies that evaluate treatment efficacy by utilizing a whole language approach as compared to a discrete phonological approach with young phonologically-impaired children.

CHAPTER I

INTRODUCTION

The process of generalization has been widely observed and investigated in the study of children with articulation disorders. Generalization refers to transfer of accepted production of a target sound learned during treatment, to subsequent production of that target sound in untrained contexts. Such transfer is an important and necessary component in treatment of articulation disorders. Since it is virtually impossible to rehearse/learn acceptable production of target sounds in all words and contexts, articulation generalization serves to facilitate remediation and provide a measure of treatment effectiveness.

Children with phonological disorders have been observed to generalize accurate sound production across untreated items (Elbert & McReynolds, 1975, 1978; Mowrer, 1971; McLean, 1970; Hoffman, 1983; Powell & Elbert, 1984), word positions (McReynolds, 1972; Rockman & Elbert, 1984; Powell & McReynolds, 1969), linguistic units of increasing complexity (Gierut, 1985; McReynolds, 1972; McLean, 1970; Wright, Shelton, & Arndt, 1969), within sound classes (Costello & Onstine, 1976; McReynolds & Bennett, 1972; Elbert & McReynolds, 1975; Hoffman, 1983), across sound classes (Gierut, 1985; Weiner, 1981; Dinnsen & Elbert, 1984), and across various settings (Olswang & Bain, 1985; Costello

& Bosler, 1976; Griffiths & Craighead, 1972).

Several investigators (Elbert & Gierut, 1986; Stokes & Baer, 1977; Mowrer, 1971; Rockman & Elbert, 1984; Engel et al., 1966) have suggested various ways of facilitating generalization during remediation. For example, Elbert and Gierut (1986) suggest that generalization may be enhanced by selecting treatment items that are meaningful to the child, thus serving as a communicative function, and by presenting different and varied treatment items.

As Gierut, Elbert, and Dinnsen (1987) suggest, the process of generalization is variable across children with phonological disorders. The rate, amount, and degree of generalization differ for individual children. Thus far, no single factor has been clearly shown to account for the observed variability and individual differences in the generalization process. Thus, generalization continues to be a persistent, unpredictable variable in articulation treatment and remediation.

Children's misarticulations have traditionally been described as errors of speech sound production at a motoric level (McDonald, 1964; Vaughn & Clark, 1979). It has been implied by this viewpoint that misarticulation results from an inability to produce specific speech sounds at a motoric level, or perceive the salient features of articulate speech. Winitz (1969) suggested that most misarticulating children demonstrate a mislearning of the phonology of English rather

than specific motoric or sensory deficits. Following the Chomskyan era in linguistics, Compton (1970) described misarticulation in terms of distinctive features as descriptive devices. More recently, Ingram (1976) sought to describe misarticulations using "phonological processes" which refer to changes, affecting classes of sounds, that children make in simplifying adult speech. As a result, there has been a contemporary emphasis from studying children's misarticulations in terms of sensory and motoric abilities to studying children's abstract understanding of English phonology. The primary evidence in favor of most abstract descriptions of children's misarticulations involve the existence of certain patterns in their phonological system, usually patterns which are judged relative to an adult norm.

Phonology has traditionally been viewed as a separate component of language, in addition to morphology, syntax, semantics, and pragmatics. Similarly, treatment techniques have historically been "speech sound" oriented, focusing on remediation of misarticulated or "deviant" sounds. Young (1983, p.47) reported that traditional approaches to articulation assessment and treatment "have been based on the premise that there is a linear relationship between speech intelligibility and the number of phonemes acquired."

Increasing evidence has shown that phonology is hierarchically associated within a synergistic language

system and, therefore, should be cautiously viewed when considered a separate entity. Studies have shown that children make phonological shifts based on word differences (Campbell & Shriberg, 1982), and children modify their productions based on contextual meaning within a conversation (Scollon, 1979). It has also been suggested that it is more difficult to control articulation as linguistic complexity increases from word to sentence to conversation (Shriner, Holloway, and Daniloff, 1969; Panagos, 1974). Therefore, in order to adequately assess and treat children with articulation disorders, procedures should be "comprehensive enough to include other aspects of the developing phonological system" (Young, 1983, p.47).

Particularly, young, phonologically-impaired children (3-4 years of age) who are in stages of formulating and refining processes of phonology, may not need to receive direct treatment approaches including isolated rehearsal of particular speech sounds. Frequently, young children don't conform successfully to the rigors of rehearsal programs appropriate for older children --- and perhaps such programs are unnecessary. Younger children may be more expeditiously treated using a language approach which has as its focus establishment, refinement, and extension of purposeful, interpersonal communication.

The present study examined whether refinement in the phonological systems of young, phonologically-impaired

children could occur by working at the level of purposeful, interpersonal communication rather than focusing on isolated phonological/phonetic components. This investigation compared the amount and extent of generalization or phonological change that occurred in young, 3-4 year old, phonologically-impaired children when two different treatment approaches were employed: a phonological process targeting approach and a whole language approach.

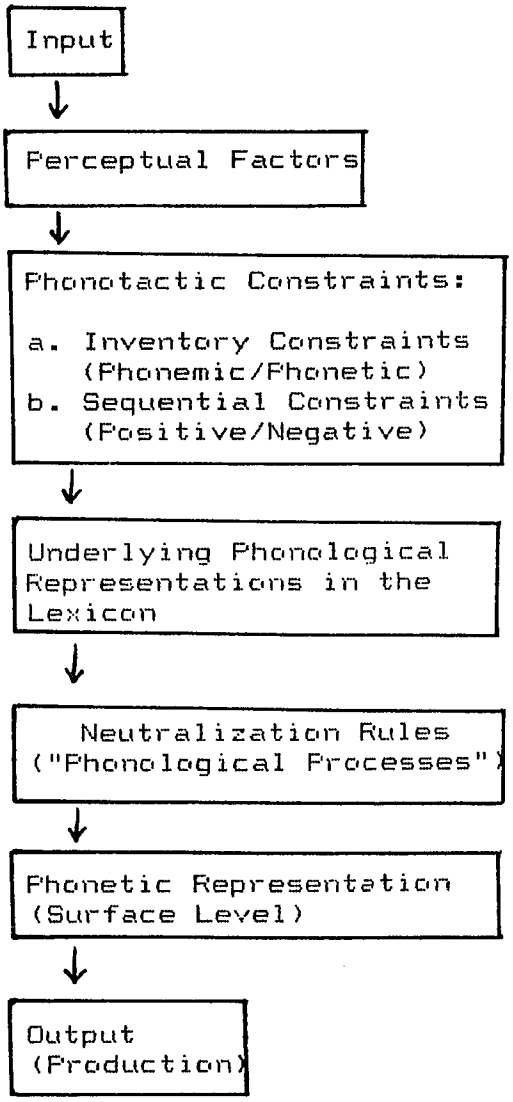
CHAPTER II

REVIEW OF LITERATURE AND PURPOSE OF STUDY

The following chapter is divided into three major sections: Dinnsen's generative model of children's misarticulation, an alternative model: parallel distributed processing, and purpose of the study. The first section includes (1) description of a discrete component model of children's misarticulation, (2) generalization research addressing separate components of this model including phonemic inventory constraints, phonetic inventory constraints, and sequential constraints, and (3) relationship between phonological knowledge and generalization learning. The second section includes (1) review of generalization across settings, (2) generalization research supporting the relationship of phonology to the overall language process, and (3) an alternative model: parallel distributed processing (PDP) including major aspects of the PDP model and application of this model to children's misarticulations. In the final section, purpose of the study, specific questions are enumerated that relate to the present investigation.

A Discrete Component Model of Children's Misarticulation

A schematic of a model based on Dinnsen's research (1984) is followed by description of the various components.



There are two major viewpoints proposed regarding the functionally misarticulating child's underlying representations. Some investigators (Compton, 1970; Donegan & Stampe, 1979; Ingram,1976; Shriberg & Kwiatkowski, 1980; Weiner, 1979) have assumed that the child's underlying representations are identical to adult surface forms. In this viewpoint, however, evidence is not offered to support claims about the child's underlying representations. A second viewpoint suggests that the child's underlying representations are not directly comparable to adult surface forms and may be unique to the child's own system (Braine, 1976; Dinnsen, 1984; Macken, 1980; Maxwell & Weismer, 1982; Weismer, Dinnsen, & Elbert, 1981).

According to Dinnsen (1984,p.5), an underlying representation "may be viewed as a lexical representation comprising meaning and all idiosyncratic, learned phonological properties of a morpheme." It is an abstraction, a theoretical construct, and not directly observable. While a morpheme may have different phonetic representations, there would be only one underlying representation for that morpheme stored in the speaker's lexicon or "mental dictionary." Phonological rules, when applicable, would then change the underlying representation into its phonetic realizations as determined by the phonetic context.

Phonological processes refer to kinds of changes that

apply to classes of sounds, not just individual sounds, that children make in simplifying adult speech. For example, if the child replaces an adult [s] with a [t] (e.g., tea/see; kit/kiss), it is also possible that other fricative sounds may be changed into corresponding stop consonants. These changes can be grouped together as a general process of STOPPING. Phonological processes or rules described by Compton (1970) and Ingram (1976), resemble what Dinnsen refers to as "neutralization" rules, i.e., an adult contrast is being neutralized in the child's speech.

Dinnsen suggests that we should never refer to phonological rules if there is no evidence of the phoneme's contrast in some contexts so that it can be neutralized in other contexts. In other words, to say that a child deletes [g], for example, at the end of "dog", i.e., the phonological process of FINAL CONSONANT DELETION, we must be able to show evidence that he uses the [g] in some other context (e.g., word-initial, "go" or word-medial position, "doggie"). Dinnsen maintains that we should look for evidence suggesting final consonants at the child's underlying representational level before inferring a phonological rule of FINAL CONSONANT DELETION. However, if the child <u>never</u> uses final consonants at the end of words and there is no evidence to show that they exist in the underlying representations (i.e., if there are no alternations), Dinnsen (1984) asserts that this child may have a negative sequential constraint against

allowing final consonants to enter underlying representations, not a rule of FINAL CONSONANT DELETION. Based on this assumption, a phonological rule of FINAL CONSONANT DELETION would be unnecessary because there are no consonants in word-final positions at the child's underlying representational level.

Proponents of the opposing viewpoint assume that there are word-final consonants in the child's underlying representations and therefore, attribute the child's production of [dɔ] for [dɔg] as a function of the phonological rule of FINAL CONSONANT DELETION. They assume that there is a [g] in the underlying representation of "dog", namely /dɔg/.

Dinnsen maintains there are two main types of phonotactic constraints: inventory constraints (phonemic or phonetic) and sequential constraints (positive or negative). Inventory constraints specify restrictions on sounds that can occur in a language, independent of context, e.g., all obstruents are voiceless; fricatives are not allowed. Sequential constraints specify possible sequences of phonemes, e.g., a plosive followed by a fricative in word-initial position cannot occur in English; [ŋ] cannot occur at the beginning of a word in English. Phonotactic constraints specify restrictions on underlying and phonetic representations. An empirical characteristic of the presence of phonotactic constraints is an absence of alternation in a given morpheme.

For example, if a child who apparently omits word-final obstruents produces non-alternating pairs, it is possible that this child would have a phonemic inventory constraint against using word-final obstruents. Examples of non-alternating pairs are the following:

[dʌ]	"duck"	[dʌi]	"ducky"
[pI]	"pig"	[pIi]	"piggy"
[dae]	"dad"	[daei]	"daddy"
[mʌ]	"mud"	[mʌi]	"muddy" ,

According to Dinnsen, the phonotactic constraint acts as a filter that does not allow any representation in the lexicon that does not conform to phonotactics of the particular language.

Neutralization rules (or phonological process rules) serve to eliminate or merge a phonemic contrast in certain phonological contexts - e.g., a rule that devoices obstruents in word-final position. Neutralization rules specify restrictions on phonetic representations, but say nothing about the possible form of underlying representations. Dinnsen contends that in order to identify a neutralization rule as such, one must look for evidence of the contrast in some contexts so that it can be neutralized in other contexts. For example, with the devoicing rule that applies only in word-final position, there should be a voice contrast in some other context, e.g., word-initial or word-medial position. For example, if both voiced and voiceless obstruents occur in word-initial position with concomitant

difference in meaning (e.g., [pʰaI] "pie" / [baI] "bye"), then there is evidence that this contrast could possibly be neutralized in other contexts. Another criterion that must be met in order to identify a neutralization rule is that the particular contrast must not be present in a well-defined context. For example, if the devoicing rule is restricted to apply to obstruents in word-final position only, then word-final position should fail to evidence the voice contrast. A third empirical condition that must be present in the identification of a neutralization rule is alternation. Alternation is the phonetic variation present in a morpheme, referred to as a "morphophonemic alternation." The English plural morpheme is an example of alternation. At the underlying representational level, the English plural morpheme is represented as /z/; however, at the phonetic representational (surface) level, the English plural morpheme may be realized as the allomorphs [s] (e.g., [dʌks] "ducks"), [z] (e.g., [pIgz] "pigs"), or [əz] (e.g., [dIʃəz] "dishes"). Changes like these in a morpheme indicate that a phonological rule is in effect.

In summary, according to Dinnsen, a child's underlying representations are not always the same as adult surface forms and may be unique to the child's personal phonological system. Proponents of this viewpoint maintain that it is unnecessary to assume that all children with functional misarticulations have adult-like underlying representations.

Some children may be described as having adult-like underlying representations, while other children may have non-adult underlying representations unique to the child's own phonological system. This claim can be applicable to both normal and misarticulated speech.

Generalization Research Addressing Separate Components of Dinnsen's Model

Phonemic Inventory Constraints

Costello and Onstine (1976) and McReynolds and Bennett (1972) applied distinctive feature theory to articulation training. The main goal of this approach is to target a feature rather than a phoneme. It is thought that if a child learns a feature rule (e.g., (+) stridency, (+) voicing), then he should generalize use of that feature to other phonemes in error. Costello and Onstine (1976) trained the (+) continuant feature to preschool phonologically-impaired children who substituted stops for most fricatives (e.g., tick/sick). Both children substituted /t/ for /s/ and /θ/; therefore, they were taught to produce contrasts among /t/, /s/, and /θ/. That is, these phonemes were trained and contrasted in isolation, syllables, words, sentences, connected speech, etc. Percentage of correct responses for both children on sound production tasks administered prior to treatment was less than 7%. Correct articulations of the treated phonemes /θ/ and /s/, as well as the untreated

phonemes /ð/, /z/, and [ʃ] improved for both subjects by the end of therapy. The first child demonstrated 93% generalization to /s/, 80% to /θ/, 95% to /z/, 90% to [ʃ], and less generalization (i.e., 47%) to /ð/. The second child demonstrated 97% generalization to the alveolar fricative /s/ but only 57% to the dental fricative /θ/. For the untreated phonemes, he demonstrated 85% generalization to the alveolar /z/, 70% to the palatal fricative /ʃ/, and only 50% to the dental voiced cognate /ð/. The treatment program consisted of training phonemes through a progression of isolation, nonsense syllables, single words, phrases and sentences, and finally story and conversation. Results of this study replicate and expand those of McReynolds and Bennett (1972) who explored feature generalization in three children trained on three different features. One child was trained on the (+) continuant feature in the context of /ʃ/ which was later constrasted with the (−) continuant /tʃ/. Baseline testing indicated that all fricatives were being produced as (−) continuant (i.e., STOPPING). Subsequent to therapy, mean error on the (+) continuant feature was reduced by 69% during /ʃ/ training. Changes in the (+) continuant feature were observed in all phonemes used in the probe. The /ʃ/ and /s/ exhibited the greatest change, being produced as fricatives in 92% of their occurrences. However, the /f/ and voiced /z/ and /v/ showed the least amount of change, being produced incorrectly in 36%, 64%, and 40%, respectively, of the

possible occurrences. It must be noted that generalization of correct articulation may have been limited because phonemes were trained only in nonsense syllables.

Weiner (1981) employed a minimal-contrast treatment method as a means of reducing frequency of phonological processes in two preschool children with unintelligible speech. For the process of STOPPING, subjects were taught to contrast stops with fricatives in four minimal pairs of words, i.e., fin-pin, vase-base, zip-dip, and see-tea. Correct production of initial fricatives in untrained probe words improved 62% and 42% for the two children. It is important to note Weiner's definition of "correct responses." Correct responses were based on elimination of phonological processes and not on correct production of target sounds. For example, for STOPPING, any initial fricative was reinforced. Weiner contends that this definition is based on the premise that normal-speaking children progress through several stages of development in acquiring speech sounds of their language; therefore, we should not expect phonologically-impaired children to simultaneously acquire speech sounds.

To reduce the process of FRONTING of velar stops, Weiner taught subjects to contrast the minimal pairs can-tan, key-tea, gum-dumb, and gate-date. Generalization of correct production of initial [kʰ] and [g] in untrained probe words was only 33% and 21% for the two subjects.

In a study by Elbert, Shelton, and Arndt (1967), seven children who consistently misarticulated [s], [z], and [r] were trained on correct production of [s]. A sixty-item sound production task containing twenty items each for [s], [z], and [r] was administered throughout the course of training. Results indicated that subjects made articulatory improvement on the sound taught, [s], and its voiced cognate [z], but not on the unrelated sound, [r]. It appeared that training one fricative enhanced the acquisition of another related fricative but not a liquid. Results indicate that teaching one member of a cognate pair allows for transfer to the other member of that pair.

Phonetic Inventory Constraints

Teaching one target phoneme has resulted in generalization to associated allophones. Elbert and McReynolds (1975) investigated the nature of generalization across /r/ allophones. Twelve elementary-age children who misarticulated [r] received training on correct [r] production in a single syllabic context, either [re], [tre], [ɝt], or [ʌtɝ]. Generalization of [r] training to untrained syllabic production was measured. Results indicated that generalization was slightly higher for the two consonantal groups than for the vocalic groups. In general, it was found that transfer of learning occurred regardless of the specific allophone trained.

Hoffman (1983) expanded upon the Elbert and McReynolds'

(1975) study to investigate interallophonic generalization of /r/ training. Each child received training in correct production of a single allophone: [rV], [CrV], [C˞C], or [V́C˞]. Training for each allophone progressed through four phases: syllable rehearsal, noun rehearsal, noun phrase rehearsal, and sentence rehearsal. Results indicated that generalization to untrained allophones occurred for all children. It was found that improvement in [Vr] production was most noticeable following [ɚ] and [Cr] training. The two vocalic forms [ɚ] and [ɝ] showed less transfer of training than the two consonantal forms [rV] and [CrV]. In agreement with the previous study, the overall rate of generalization across /r/ allophones did not seem to be contingent upon the allophone trained.

Several investigators have examined generalization of accurate sound production across word positions and across contexts or linguistic units of increasing complexity (e.g., words, sentences, conversation). Rockman and Elbert (1984) studied a phonologically disordered five-year-old child over a period of several months and examined untrained acquisition of [s] in imitated words and spontaneous conversation. Results indicated that this child's pattern for acquiring [s] was similar to that described in the literature for children normally acquiring fricatives. That is, production of [s] in word-final position was produced correctly earlier and more frequently than in word-initial or word-medial contexts.

Over the 14 probes, 140 final [s] words were presented and 55% were produced correctly by the subject. In contrast, however, initial [s] words demonstrated almost no change from zero correct responses over the first ten probes. The subject correctly produced only 16% of the total 140 initial [s] probe words presented. It was also found that in spontaneous connected speech, as with imitated single words, correct production of the fricative [s] occurred earliest in word-final position.

In a training study by Wright, Shelton, and Arndt (1969), nineteen subjects who consistently misarticulated at least one phoneme were given articulation training on one particular phoneme. Comparisons were made of the subjects' articulation performance on thirty-item sound production tasks with articulation performance on talking and reading tasks chosen to sample more spontaneous speech. These comparisons involved articulation change as demonstrated by subjects' performances on the three tasks. Findings indicated that while subjects demonstrated articulation improvement on the imitative task, less improvement was shown on the reading task, and much less improvement on the talking task. Wright et al. concluded that due to the relatively poor performance on both talking and reading tasks, none of these subjects established automatic, correct usage of the newly learned phoneme in spontaneous speech.

Powell and McReynolds (1969) examined generalization from

nonsense syllable training to words among four children who misarticulated the /s/ phoneme in all positions in words. For generalization testing, twelve test probes (words) were used consisting of familiar /s/ pictures -- four pictures each for initial, medial, and final positions. Results indicated that two of the subjects generalized correct [s] production to all twelve test probe words at the end of nonsense syllable training and two of the children generalized to only some of the test probes during the training program. While all four children generalized to some degree during the training program, they exhibited a great deal of variability as to the degree of generalization, and when generalization did occur, the position of [s] in the training item was irrelevant.

Elbert and McReynolds (1978) trained five children who primarily substituted [θ] for [s] to produce [s] correctly in three nonsense syllables paired with nonsense pictures. Untrained probe items consisting of both spontaneous and imitated words and syllables were tested throughout training to examine contextual effects. While a strong contextual effect was not observed, Elbert and McReynolds maintained that other factors seemed to contribute to generalization patterns exhibited by children, such as stimulability, amount of training required for generalization to begin, and specific error patterns of the children prior to treatment. They concluded that children with different error patterns

displayed different generalization patterns. This supports findings of a previous study by McReynolds (1972) who concluded that patterns of generalization learning seldom occur in an orderly fashion but are often variable and inconsistent with individual children. While three of the four children in her study correctly articulated all test probes by the end of nonsense syllable training, all of the children showed a decrease in the number of correctly articulated probe words at some time during the training program.

Sequential Constraints

In analyzing and comparing the phonological systems of 60 unintelligible children between three and eight years of age, Hodson and Paden (1981) found FINAL CONSONANT DELETION (e.g.,bed --> [b]) and CLUSTER REDUCTION (e.g., tree --> [ti]) to be among the phonological processes most commonly demonstrated in their speech.

Weiner (1981) reported results of a study in which two four-year-old misarticulating children who deleted final consonants were taught to contrast final consonants in four minimal word pairs: bee-bead, pie-pipe, no-nose, and tea-teeth. Production of any final consonant was considered a correct production and thus appropriately reinforced. Generalization to non-treatment words was demonstrated. The percentage of usage of the process FINAL CONSONANT DELETION decreased for both subjects in the generalization probes.

For Subject A, frequency of occurrence of this process dropped from 90% (during baseline) to 15% by the final session. Similarly for Subject B, frequency of occurrence of FINAL CONSONANT DELETION reduced from 100% (during baseline) to 20% by the last session. Although children were acknowledging presence of final consonants in their productions, it must be noted that final consonants produced may not have been accurate, i.e., any final consonant was counted as a "correct production." Elimination of the phonological process was the main consideration in this study, not whole word accuracy. However, both subjects did show increases in percentage of correct sound production of final consonants in probe words during baseline and final treatment sessions: Subject A - 0% to 58%; Subject B - 0% to 42%.

Elbert and McReynolds (1985) provide additional data on on generalization of training for FINAL CONSONANT DELETION. Four children who consistently deleted final consonants were taught to produce either final stops or fricatives in syllables using minimal pair contrasts. For example, [a] was paired with either [ab], [at], [ag], [ak], [as], [az], or [af]. These syllables were paired with nonsense drawings. Two subjects were taught stops first followed by fricatives, and the other two subjects were taught fricatives first, followed by stops. Generalization was tested by imitation and spontaneous naming of pictures. Only two subjects

demonstrated noticeable generalization; however, generalization was confined to sounds within the class being taught. For example, when stops were taught first in syllable-final position, generalization occurred only to untrained words containing final stops. The same held true for the training of fricatives, that is, when fricatives were taught first in syllable-final position, generalization only occurred to untrained words containing final fricatives.

Dinnsen and Elbert (1984) found that when children who deleted final stops and fricatives were trained on accurate production of final fricatives, accurate production of untreated final stops was enhanced. However, the reverse was not true - that is, children who were trained on accurate production of final stops did not generalize to untreated final fricatives. Results of this study suggest that training the more difficult sound class, fricatives, may facilitate learning of the easier sound class, stops.

CLUSTER REDUCTION has been described as a general phonological process used by young misarticulating children to simplify production of the two or three consonants in the cluster. For example, string may be produced as [tIŋ] or [twIŋ]. McReynolds and Elbert (1981) explored generalization of this process in six misarticulating children. All children produced no more than 10% correct responses on [s], [r] or [l] clusters in baseline. Three children were trained on [s] clusters in syllables first, and [r] or [l] clusters

in syllables second, and three children received [r] cluster training followed by [s] cluster training. In other words, training on one of the cluster classes, either [s] or [r], occurred first, while the other cluster remained in baseline. The second cluster (i.e., [s] or [r]) was trained next, following completion of training on the first cluster. Generalization within-cluster-class and across-cluster class was tested. Results indicated that four of the six children demonstrated generalization to within-class clusters only, e.g., training on [s] clusters resulted in generalization to untrained [s] clusters only, not to untrained [r] clusters. Only one child generalized to both within-class and across-class items (i.e., [s] and [r] clusters). During baseline testing, this child produced 0% correct responses on both [s] and [r] cluster items. However, after training on [s] cluster syllables, she achieved 75% correct responses on probe [s] cluster items and 90% correct performance on the untrained [r] cluster items. One subject failed to reach generalization criterion (i.e., 70& correct production) on either cluster category - that is, after [r] cluster training, he only attained 16% correct on probe [r] cluster items and only 10% correct performance on untrained [s] cluster items. Since only one child demonstrated across-class generalization, McReynolds and Elbert suggest that results indicate that a phonological process of CLUSTER REDUCTION may not be general enough to apply across-classes,

but may instead be confined to the cluster class receiving training. This may imply that rather than using a general phonological process, errors produced by misarticulating children may be production errors on specific sounds.

Developmental studies of normal phonological acquisition suggest that children usually master stop + liquid consonant clusters (e.g., [bl]) before achieving mastery of fricative + liquid clusters (e.g., [fl]) (Ingram,1976). Powell and Elbert (1984) examined generalization following remediation of early-developing (stop + liquid) clusters and later-developing (fricative + liquid) clusters in six children who misarticulated word-initial consonant clusters. Subjects received treatment on one cluster category and were probed for all clusters to assess across-cluster generalization. Five of the six subjects generalized almost equally to both treated and untreated cluster categories during the final probe administration, regardless of which category was taught. These results differ somewhat from those of previous investigations (e.g., McReynolds & Elbert, 1981). One major difference is that subjects in this study (Powell & Elbert, 1984) were required (for subject selection) to be able to correctly produce all phonemes contained in clusters as singletons in words, during baseline, whereas subjects in previous studies usually had zero baseline performance. Powell and Elbert found that subjects in this study appeared to generalize primarily to those clusters for which they had

productive knowledge prior to treatment.

Relationship Between Phonological Knowledge and Generalization Learning

"Those sounds that the child does or does not produce, and the appropriate or inappropriate use of those sounds, constitute a description of the child's tacit 'knowledge' of his or her phonologic system and its possible relationship to the ambient system" (Elbert et al., 1984, p. 309). According to Dinnsen and Elbert (1984), underlying representations constitute tacit knowledge.

It has been suggested that there is a relationship between productive phonological knowledge (as assessed via the child's productions prior to treatment) and variation in generalization learning among misarticulating children (Dinnsen & Elbert, 1984; Elbert, Dinnsen, & Powell, 1984).

Dinnsen and Elbert (1984) examined generalization learning patterns in children who omitted final consonants. It was found that generalization to final consonants that were phonologically "known" (i.e., produced by the child in a manner like the adult target system) was greater than generalization to final consonants that were phonologically "unknown" (i.e., produced by the child in a manner unlike that of the adult target system). In a second study, Elbert et al. (1984) investigated the relationship between

phonological knowledge and generalization learning in children with cluster reduction errors. As in the previous study, results indicated that generalization to clusters that were phonologically "known" was better than on clusters that were phonologically "unknown."

In a series of three related studies involving six misarticulating children, Gierut, Elbert, and Dinnsen (1987) sought to investigate the assumption that productive phonological knowledge influences generalization learning. A knowledge continuum was developed for each child based on the productive phonological knowledge of his or her own sound system compared with that of the adult sound system. Target sounds were ranked on a continuum ranging from "most" to "least" knowledge relative to the adult system. For example, at one end of the continuum labelled "most" knowledge or Type 1 knowledge, a child would produce those sounds accurately in all positions as compared to the adult, whereas target sounds at the opposite end of the continuum labelled as Type 6 knowledge or "least" phonological knowledge were described as being nonadult-like productions, i.e., would never be produced correctly. Results of this study were consistent with those described in previous research (Dinnsen and Elbert, 1984; Elbert et al., 1984). As predicted, generalization to error sounds for which a child had "most" knowledge was greater than generalization to those for which a child had "least" knowledge. A second finding from this

study was that it appeared that extent of generalization was influenced by the starting point of treatment on the knowledge continuum. That is, when treatment began with error sounds for which the child had "most" knowledge (i.e., easier to learn), generalization extended to limited aspects of production. However, when treatment began with error sounds for which the child had "least" knowledge (i.e., harder to learn), generalization was more widespread and extended across the overall sound system. Gierut et al. suggest that productive phonological knowledge may be one factor that explains variation (i.e., individual differences) observed in generalization learning across misarticulating children.

Weismer, Dinnsen, and Elbert (1981) examined vowel durations in three misarticulating children who deleted word-final stop consonants. Results indicated that two of the children produced longer vowels when the omitted stop consonant was voiced as opposed to voiceless. Thus, these children showed evidence that they had productive knowledge of word-final stop consonants. It would be appropriate to say that these children used a phonological rule of word-final consonant deletion. However, the third child failed to make this distinction. Since he did not show productive knowledge of word-final stop consonants, he could not be using a process to delete final consonants. Perhaps this child had a phonotactic (sequential) constraint in his

phonological system against using word-final stop consonants.

Generalization Across Settings

Generalization of correct articulation production across various settings (e.g., outside of the clinic) and with other listeners (e.g., parents, teachers, peers) is crucial to the remediation process of the phonologically disordered. In a study by Costello and Bosler (1976), three young misarticulating children received articulation training on one error phoneme, [v], by their mothers in their own homes. The articulation program designed by Carrier (1970) which included progression of the target phoneme from single words through spontaneous speech was used in the home setting. Throughout the treatment program, each child was periodically brought into the clinic in order for generalization of [v] to be measured in four different probe settings in which the examiner, physical location, or formality differed. Only 20 stimulus words were used throughout the treatment program, and the generalization probe consisted of the 20 training words plus <u>five</u> additional nontraining words. Results indicated that while all three children demonstrated generalization of correct articulation from the teaching setting to the probe settings, additional stimulus words not included in training were nearly always produced less accurately than the training words. Costello and Bosler suggest that this may have been due to the limited number of

exemplars (20) used throughout the training program.

Olswang and Bain (1985) explored the natural occurrence of generalization across various speaking situations and word positions without direct training, in three preschool children with multiple articulation errors. Subjects received individual treatment for particular error phonemes in specific word positions. Generalization of correct production to untreated word positions was examined. In this study, parents were aware of their child's target sounds, but were not directly involved in the treatment program. Also monitored were children's productions of target phonemes in connected spontaneous speech, with different adults both in the clinic and at home. Weekly spontaneous speech samples lasting about 15 minutes were audio recorded both in the clinic setting by a clinician (who only interacted with the child during this weekly activity), and by the child's parents during conversational activities at home. Data from all three subjects indicated that generalization of correct phoneme production in connected spontaneous speech both in the clinic and at home occurred without direct training. Results also revealed that generalization of correct production with another adult in the clinic setting and with parents at home, occurred to a similar degree and at a similar rate. However, the degree of generalization across word positions varied and appeared to be related to specific phonemes. In discussing clinical

implications of their findings, Olswang and Bain pointed out that direct treatment for generalization may not always be a necessary step in articulation training, but the need for monitoring a child's connected speech is necessary.

Generalization Research Supporting Relationship of Phonology to Overall Language Process

Campbell and Shriberg (1982) studied the relationship among pragmatic function, linguistic stress, and natural phonological processes in five speech-delayed children ranging in age from 4 years, 9 months to 6 years, 7 months. Four 15-minute connected speech samples, obtained over an 18-month period, were analyzed for each child. Nine singleton target phonemes were selected for analysis and four natural phonological processes pertaining to these phonemes were targeted: Final Consonant Deletion, Stopping, Palatal Fronting, and Velar Fronting. The pragmatic functions of interest in this study were discourse topics and comments. A "topic" was defined as the presupposed or old (i.e., given) information; that is, information that has already been presented to the listener and which usually takes the form of the subject in an utterance. A "comment" was defined as the newest information and often associated with the predicate in an utterance. Articulation errors made by these children were divided according to whether they were talking about old information (topics) or new information (comments).

Results indicated that children made fewer errors, i.e., the phonological processes occurred less often, during production of comments (10%) than topics (42%). Subjects made more errors restating uninformative topics than they did when adding new information. Perhaps they know that new information has to be well articulated in order to be understood. It was also found that phonological processes occurred less frequently in words produced with primary stress (7%) than words with nonprimary stress (34%). Findings of this study revealed a significant relationship among pragmatic and stress variables with phonological performance.

Several studies (e.g., Shriner, Holloway, and Daniloff,1969; Menyuk and Looney, 1972; Panagos, 1974; Panagos, Quine, and Klich, 1979) have shown evidence of the interrelationship between syntax and phonology in misarticulating children. That is, as linguistic strings increase in complexity and length, articulation errors increase. More recently, Paul and Shriberg (1982) investigated the interaction of phonology and syntax among 30 speech-delayed children. Results revealed that two-thirds of the subjects demonstrated overall syntactic delays that were independent of phonological deficits, that is, syntactic errors which could not be explained by reference to specific misarticulations. Of the remaining children, 20% demonstrated restricted use of morphological markers which

appeared to be directly related to the use of the phonological processes of Final Consonant Deletion and Cluster Reduction. In discussing clinical management, Paul and Shriberg suggested including morphological markers at or below the child's general syntactic level, so that as articulation improves, morphological production should also improve.

Panagos and Prelock (1982) investigated the influence of phonological structure on syntactic processing in ten language-disordered children (mean age of 6 years, 2 months). A sentence repetition task was employed consisting of 36 declarative sentences (eight words per sentence) of varying syllabic structure and syntactic complexity, containing nouns and verbs familiar to the children. Results revealed that syllabic complexity of sentences and clause embedding significantly contributed to errors of sentence inaccuracy, i.e., omission, substitution, addition, and transposition errors. Complex phonological strings (syllabic structures) were more difficult to produce than simple strings. Likewise, subjects made more syntactic errors for embedded sentences than unembedded sentences, which supports findings of a study by Stick and Norris (1975) cited by Panagos and Prelock (1982). Results of this study support the hypothesis that there is an interrelationship between children's syntactic and phonological deficits (i.e., as the sentence increases in complexity and length, articulation errors increase).

Semantic factors may also influence phonological behavior. In a recent study by Camarata and Schwartz (1985), the relationship between phonology and semantics via production of object words and action words was examined in six young language-impaired children (age range 2:8-3:4) and six normally developing children (age range 1:5-2:1). Spontaneous speech samples were elicited at each subject's home and were audio- and videotape-recorded. Results revealed that for all subjects, in both groups, the percentage of consonants produced correctly in object words (e.g., nouns - flag, bone, grill) was significantly higher than the percentage of consonants produced correctly in action words (e.g., verbs - hop, spin, kneel). Since object words were produced more accurately than action words, Camarata and Schwartz hypothesized that this may be related to the increased semantic or cognitive complexity associated with action words.

Findings that deficits in various aspects of linguistic behavior (i.e., morphology, syntax, semantics, pragmatics) may co-exist with phonological disorders have led to a synergistic view of linguistic disorders (Shriner, Holloway, and Daniloff,1969). This viewpoint maintains that there are complex interrelationships and interdependencies among various aspects of linguistic behavior. In a study by Schwartz, Leonard, Folger, and Wilcox (1980), various aspects of early phonological behavior of three normal-speaking (mean

age 1:8) and three language-disordered children (mean age 3:1) were compared. Children were matched for mean length of utterance, sex, and cognitive development. Results indicated that phonologies of both groups of children were extremely similar; no significant group differences were noted. Schwartz et al. contend that their finding that the "phonological behavior of the language disordered children was developmentally consistent with their mean length of utterence at this point in development which supports the assumption of an underlying organizational deficit" (p. 375). They also assert that this result provides further support for the idea of a synergistic view of linguistic disorders.

In discussing clinical implications of their study, Schwartz et al. suggest that treatment strategies be developed which consider disorders of phonology and other linguistic aspects in an interrelated manner, not in traditionally isolated manner. They further maintain that "piecemeal approaches to remediation seem to be a far less efficient means of dealing with concomitant deficits in different aspects of language than integrated approaches" (p. 376). Schwartz et al. also suggest that a horizontal approach to remediation (in some cases) may be more effective than a vertical approach, with respect to normal development. "A horizontal approach to remediation would involve training aspects of different facets of language at the same developmental level before proceeding to train later

developing aspects of those individual domains of language. For example, a child being trained to produce two-word utterances would simultaneously receive training only on those facets of phonology that are consistent with that level of syntactic development. A vertical approach, alternately, would involve training for each individual deficit without regard to relative developmental levels of training across language domains" (p. 376).

An Alternative Model: Parallel Distributed Processing

A recently proposed model of human information processing, parallel distributed processing (PDP) (Rumelhart and McClelland, 1986), may provide salient considerations for an alternative approach to remediation of phonological disorders in young misarticulating children that is different from the discrete component models traditionally used, including "phonological processes." The major aspects of the parallel distributed processing model will be discussed first. This will be followed by a discussion of the possible application of this model to remediation of phonological disorders in young 3-4 year old multiple misarticulating children. This section will lead into the purpose of the present investigation.

Major Aspects of the PDP Model

According to the PDP model, a model of human information

processing, human thought is too swift for sequential processing; therefore, it must involve parallel processing. The PDP model offers an alternative to the serial model. Parallel distributed processing assumes that information processing occurs through interactions of a vast number of simple processing elements called units which send excitatory and inhibitory signals to other units. Units connect into whole patterns of units that form meaningful entities, not one unit representing one concept. These patterns of units can represent features, sounds or letters, words, concepts, or abstract elements - i.e., various levels of processing. There are two important characteristics of this model:
(1) The system is parallel in nature. That is, many units can carry out their computations simultaneously. Humans can process information at a number of different levels at the same time. It is only when one starts to break down at a particular level that we focus on lower levels.
(2) The system is distributive in nature. That is, the higher levels are all combinations of connections between patterns of units occurring at lower levels. Connections also occur between levels going higher up, allowing feedback throughout the system.

Units (bits of information) interact by transmitting signals to neighboring units. The strength of their signals is determined by their degree of activation. The pattern of connectivity between and among units determines what the

system knows and how it will respond to arbitrary input. The strengths of the connections are modified through experiences, and this, essentially, constitutes learning. Knowledge is stored in the strengths of the connections between and among units. According to this model, our system of meaning consists of a network of connections. This network, consisting of interconnections among units, processes information simultaneously across all levels of units (i.e., features, sounds/letters, words, etc.). Our knowledge is our ability to network connections between the lower level features and higher and higher pieces of information. We learn to connect with more and more information that is received. This model implies that learning is an additive process - one in which we make better and more complete connections as we go along. Knowledge is acquired through tuning of connections as these are used in processing. Any behavior is the result of a large set of interconnecting components, and not the product of a single, separate, or linear component of the cognitive system.

Application of the PDP Model

In relation to the PDP model, a network is formed to create a synergistic system. This synergistic system involves interaction among cognition, social environment, and semiotics (i.e., study of the use of signs). The theory

of pragmaticism methodology developed by Arwood (1983) provides a synergistic model of semantic development in children. "Pragmaticism as a methodology deals with language use as the study of semiotics or sign users' effects or consequences on other speakers" (p. 10). Arwood (1983) based several principles of her pragmaticism methodology on the works of Peirce (1850-1900) who was concerned with pragmaticism as it dealt with the consequences of language. That is, the speaker's utterance is the practical consequence of the signs that he/she uses. Pragmaticism methodology deals with the dynamic process of semiotics and the synergistic quality of social and cognitive development of sign representation. In Arwood's model, knowledge is a description of semantic development and is organized according to both social and cognitive processes. Knowledge is represented by the child through the use of signs. An important assumption of the pragmaticism methodology used to explain semantic development is that signs only exist as the expression of a speech act within a speech event; they cannot exist independently of their use.

According to Searle (1969), language used in communication between speaker and listener must adhere to the principles and conventions of genuine speech acts. The semantic constituents of a speech act include the following: propositional content, preparatory set, sincerity condition, and essential elements (Arwood, 1983). A proposition is a

meaningful relationship of referring and predicating; propositional content refers to the meaning of a message. Semantic information about the proposition that is shared by both speaker and hearer is called the preparatory set and allows the speaker to produce a desired effect on the hearer. The sincerity condition refers to the condition in which the speaker intends to perform the utterance act as specified and the hearer assumes that the speaker is sincere and does intend to perform the act. The essential elements of a speech act include all nonverbal and verbal signs shared by a society (e.g., gestures, eye contact, body position, intonational pattern, facial movements). By interacting with his environment, the child acquires these essential elements of a speech act.

According to Arwood's pragmaticism methodology, the synergistic system is a speech act paradigm consisting of an interaction among social needs and cognitive abilities of the active learner. That is, the child and a caregiver have a need to interact in order to express something meaningful about the environment. As long as the need for communication exists between the two individuals, the child will develop several verbal and nonverbal means of representing semantic development. "Each piece of sensory information that is received and acted upon becomes part of the child's system that facilitates the need for more learning" (p. 69). As the child's information becomes

refined through audition, the child becomes a more sophisticated language user.

Consistent with the PDP model (Rumelhart and McClelland, 1986), the child's cognition, social environment, and semiotics (symbol system) all interact and interrelate as a synergistic system. Cognition refers to the child's network which changes every moment in time. Two things that influence the network are the child's rate of establishing connections and ability to organize relationships. Speech acts occurring in the social environment influence the child's network (cognition); they are quite powerful. With respect to semiotics, or the symbol system, most of us use oral language as our predominant symbol system. Through the semiotic system, we can take any visual or auditory stimulus and tag it with a concept. We can activate the system through input from the sensory system (e.g., auditory, visual) and thought(or thinking). Concepts exist only as relationships between bits of information; concepts occur at the moment of activation. Likewise, thought (or thinking) only exists in terms of relationships. For example, take two concepts- boy and chair. We can form a proposition by saying: e.g.,The boy is sitting in the chair. Thus a proposition is formed by taking two concepts and activating them simultaneously. Propositions are not words but the network. We can tag a proposition with words in order to convey it to someone else. Words are also part of

the network. Language is the connection strength between concepts and words. How well a person's system (of meaning) is organized will usually determine how well words are going to connect into propositions and how well propositions are connected to words.

Meaningful language occurs within a communicative setting involving genuine speech acts. A speech act involves a proposition (i.e., a meaningful relationship) and is purposeful. That is, we can use speech acts to alter the cognition, beliefs, or behavior of our listeners. When providing treatment to young, phonologically-impaired children (e.g., 3-4 years old), whole language training would occur within the setting of a genuine speech act, i.e., purposeful communication. In traditional articulation approaches, utterances that the child is frequently expected to produce may not be meaningful and purposeful. If they are not meaningful speech acts, the child may fail to "generalize" because the training was not provided within a useful, functional context.

At the propositional level, there are various levels of difficulty of response. For example, the lowest level of response is labelling- e.g., This is a boy (given a picture of a boy). The next level is description- e.g., The boy is smiling. Here, we are establishing a relationship between the boy and the expression on his face (i.e., smile). The next level is attribution- e.g., The boy is happy; then

inference- e.g., The boy is happy because he has some candy; then evaluating/judging/predicting- e.g., The boy will be sick because he ate so much candy. The more inferences made, the more complex the response becomes. According to this approach, we would not teach labels; therefore, therapy would begin at the description level- i.e., describing pictures. Pictures that depict relationships (e.g., situational pictures) could be used, with the goal of helping the child establish relationships and connect the constituents. By doing this, we are providing an opportunity for the child to strengthen his connections. The focus in treatment would be on maintaining social interaction, establishing relationships among constituents in the pictures, keeping it organized, relational, and at the child's level of communicative functioning. Perhaps the best way to do this is within speech acts that are meaningful. For example, we would show a situational picture and ask for a description of what's happening in the picture. We would then help establish relationships among constituents through modeling. Thus, we are adding information into the child's system. We take what the child says at his level of communicative functioning, add information to it, bring it up to a higher level, and give it back to the child. By doing this, we are refining his system by adding complexity. New connections are formed and connection strengths are modified at all levels of the system including feature perception, categorical perception of

phonemes, syllabic structure, word structure, concept formation, and propositional meaning. For example, referring to a situational picture, if a child says: "The boy is getting a tool (instead of stool), the clinician would say: "Well, the boy is getting a stool to stand on - not a tool. You see, this is a tool (shows picture of hammer). This little boy is getting a stool from the kitchen to stand on. So explain that part of the story to Melvin (mouse puppet)." If he makes an error with the phonology, we would add it in a meaningful context and go on with establishing other relationships. We would never "drill" on a particular sound or word in error with this approach. In treatment, we may want to keep track of the child's phonetic inventory and syllabic shapes. For instance, a phonetic inventory would give us a list of speech sounds that the child uses. We could ask ourselves- what do we need to add to this child's phonetic inventory to make him a better approximator of English (e.g., velar place of production; class of fricatives)? We could then incorporate this into therapy. We could also look at the syllabic shapes the child uses. For example, some of the sounds may be restricted to certain positions within syllables (e.g., CV, CVC). Therefore, we could work on increasing syllabic shapes. As a measurement device, we could periodically check the child's spontaneous connected speech to determine whether he has added any new sounds to the phonetic inventory and if he has added any new

syllabic shapes that were not in his initial repertoire.

According to the "phonological process" approach to articulation remediation, if a child says [dɔ] for [dɔg] "dog", for example, he is described as having the process of Final Consonant Deletion. It is assumed that the child knows that there is a "g" at the end of "dog"; therefore, he is actively deleting the final consonant. However, with respect to the Parallel Distributed Processing (PDP) model, we could say that the child seems to have the connections for putting together consonants and vowels, but he has not yet established the right connection strengths that would allow him to add final consonants or consonant clusters to words. Looking at this situation from an additive approach, perhaps we could suggest that the child just hasn't "added in" certain things yet, instead of suggesting that he is actively "deleting" something.

Purpose of the Study

Generalization in articulation training refers to the accurate production of a target sound learned in training to untrained contexts or situations. Generalization has been a persistent problem in articulation remediation and is quite variable across phonologically disordered children.

Perhaps one reason why generalization in articulation training does not readily nor reliably occur is because clinicians too often assume that children will automatically

incorporate newly acquired sound(s) into spontaneous speech after having "generalized" the sound(s) to situations in which one or two stimuli were varied from treatment. This restricted type of generalization may be a basically different task from generalization to a naturalistic environment in which many stimuli may be different from treatment (Warren and Kaiser, 1986).

Perhaps another possible explanation as to why generalization of trained sounds to spontaneous, conversational speech does not occur is that the utterances required from the child (e.g., repeating nonsense syllables, words, sentences) are not meaningful or purposeful and are unlike utterances encountered in his everyday environment, that is, they are not genuine speech acts.

Traditionally, phonology has been viewed as a separate component of language, in addition to morphology, syntax, semantics, and pragmatics. Therefore, treatment techniques have been speech sound oriented, thus focusing on remediation of misarticulated sounds via the multiphonemic approach, coarticulation approach, minimal pair contrast method, phonological process analysis, and a host of other treatment procedures.

However, increasing evidence has shown that phonology is part of an overall language processing ability that is cognitive in nature and, therefore, should not be viewed as a separate entity. Particularly, young children (e.g., 3-4

years of age) who have multiple articulation errors and are also limited at other levels of language processing, may need to be treated differently from the older child who appears to have an intact language system and primarily needs low level kind of motoric practice to remediate articulation errors.

The primary purpose of this study was to compare generalization or phonological change that occurs in young 3-4 year old phonologically-impaired children when two different treatment procedures are employed: a phonological process targeting approach and a whole language treatment approach.

The following questions were addressed in this study:

(1) Does a whole language treatment approach result in comparable improvements in single word performance as compared with a discrete phonological process targeting approach?

(2) Does a whole language treatment approach result in greater improvements in connected speech performance on higher level language tasks (e.g., storytelling, relating familiar experiences) as compared with a discrete phonological process targeting approach?

(3) Does a whole language treatment approach result in greater improvements in higher levels of language (e.g., syntax, semantics, pragmatics) as compared with a discrete phonological process targeting approach?

CHAPTER III

METHODOLOGY

This study compared phonological and language changes that occurred in preschool phonologically-impaired children following treatment via a discrete phonological process targeting approach or a whole language approach. The following sections describe subjects, treatment programs, dependent measures used to compare effectiveness of the treatment programs, and data analysis.

Subjects

Subjects were eight preschool children, ranging in age from 3 years, 3 months to 4 years, 4 months, who were evaluated at a University Speech and Language Clinic and were placed on a waiting list for subsequent treatment. Subjects were selected for inclusion in this study based on the following criteria:

(1) Preschool children, 3-4 years of age.

(2) Multiple articulation errors of unknown etiology.

(3) Oral mechanism examiniation revealing no obvious organic basis for misarticulations.

(4) Hearing acuity within normal limits for both ears (i.e., passing a hearing screening test at 20dB HL for octave interval frequencies 500-4000 Hz).

(5) No documented neurological nor other handicapping

conditions (i.e., physical or mental).

(6) Not presently receiving speech and/or language therapy.

A letter was sent to parents of subjects requesting permission for inclusion in the study. A copy of this letter appears in Appendix A. Subjects were randomly assigned to one of the two treatment approaches. Subject characteristics and group assignment are given in Table 1.

Treatment Programs

Subjects participated in three, 45-minute, individual treatment sessions each week for a total of six weeks, excluding pretreatment and posttreatment assessment. Assessment and treatment were conducted solely by the author (M.C.D., CCC-Speech Pathology). The two treatment programs are described below.

Phonological Process Approach

The phonological process approach targeted the most salient error pattern exhibited by subjects in this group during pretreatment assessment via minimal pair contrast training. Subjects S1, S2, and S4 received specific training for remediation of Cluster Reduction, which occurs when any consonant(s) in a sequence is/are deleted. For example, "slide" --> "lide"; "string" --> "ring" or "ing". Subject S3 received specific training on the phonological process of Fronting, which occurs when a more forward place of

Table 1

Subject Characteristics

Treatment Approach	Subject	Age	Sex
Phonological Process Group	S1	4-1	M
	S2	3-9	M
	S3	4-2	F
	S4	3-8	M
Whole Language Group	S5	3-4	M
	S6	4-4	M
	S7	3-3	M
	S8	3-4	M

Note. Age given in years-months.

articulation is used. For example, "key" --> "tea"; "some" --> "thumb". A list of ten minimal pair contrasts, that were produced identically as a result of these error patterns, was constructed and exemplified with pictures. A complete list of the minimal pairs used in treatment for both Cluster Reduction and Fronting appears in Appendix B. Each child's list of minimal pairs was constructed to meet individual needs. That is, subjects S1 and S4 needed remediation of [s] and [r] clusters, therefore, these were included in treatment. For example, [s] clusters included the minimal pairs "pin"-"spin", "wing"-"swing", "tool"-"stool"; [r] clusters included "room"-"broom", "red"-"bread", "Rick"-"brick". Subject 2 needed training of [s], [r], and [l] clusters, therefore, some of each of these were included in his treatment program. Examples of [l] clusters are "lip"-"clip", "loud"-"cloud", "lock"-"block". Subject S3, for whom the process of Fronting was targeted in treatment, dentalized several phonemes including /t,d,s/, therefore, treatment focused on alveolar placement via minimal pair contrasts such as "tie"-"thigh", "day"-"they", "some"-"thumb".

The treatment goals used in the phonological process approach are listed in Table 2 and are similar to those suggested by Young (1983). For the first six goals, each minimal pair had to be perceived or produced with at least 80% accuracy on two successive days before progressing to the

Table 2

Treatment Goals Associated with Successive Stages of the Phonological Process Approach

Step 1: Receptively identify words in each minimal pair by pointing to the picture named by the clinician, e.g., "Point to the room." "Point to the broom."
Step 2: Produce words in each minimal pair after clinician points to the picture and provides a model, e.g., "This is a broom. What is this called?" (pointing to broom)
Step 3: Spontaneously produce words in each minimal pair when clinician points to the picture, e.g., "What is this?" (pointing to broom)
Step 4: Produce words in each minimal pair in a carrier phrase, such as "This is a room" or "This is a broom" when the picture is pointed to by the clinician.
Step 5: Produce words in each minimal pair in sentences modelled by clinician, e.g., "The room is big." "The broom is dirty."
Step 6: Spontaneously produce sentences using words in each minimal pair when the picture is pointed to by the clinician, e.g., "Tell me something about a broom."
Step 7: Produce, for example, words containing consonant clusters in narratives told with reference to pictures depicting familiar childhood experiences.

next step. The final goal was continued until the end of the treatment period. As the child attained criterion level for a particular minimal pair through the first six stages, additional minimal pairs were incorporated into the treatment program.

In order to maintain the child's interest and attention, a game-like interaction (e.g., fishing or matching game) was used for the first six goals, and correctly produced responses were reinforced via verbal feedback such as "I like the way you said broom". Incorrect production of target words was followed by corrective feedback regarding its articulation such as "No, that's not a room. It's a broom." During construction of narratives in Step 7, situational pictures were used, and the clinician continued to give positive or corrective feedback regarding accuracy of consonant cluster production or alveolar placement, depending on the specific phonological process targeted in treatment (i.e., Cluster Reduction or Fronting).

Whole Language Approach

The whole language approach was directed at communicating a meaningful story that was complete, incorporated elements of story structure, and was clearly stated to the listener. Situational pictures from the Apricot I set (Arwood, 1985), depicting complete stories with each character contributing one event to the story, were used as stimuli. In addition to the pictures, after establishing basic relationships among

characters and events in the story, small objects representing characters or objects pictured were used to add interest and a three-dimensional aspect to the depiction of the story. The clinician started each story by describing some of the events in the story and discussing what the characters were doing and why, using a variety of language forms. The child was then asked to tell the story to a puppet "listener". The clinician followed each of the child's conversational turns with one of the following response types.

Clarification:

If any part of the child's explanation was unclear, inaccurate, or poorly stated, the puppet "listener" would ask for clarification. The clinician would then supply relevant information to be incorporated into the child's response, restate the event in many different ways using a variety of language forms, and ask the child to retell the event to the puppet. For example, if a child described a picture of a father and his children washing the family car by saying "Him washing car", the clinician would supply information regarding message inaccuracy as it was communicated, such as: "No, that's not what I see happening. The car isn't washing him, but <u>he</u> is washing the car. See the rag in his hand? He is using it to wash the car. Nothing is washing him; <u>he</u> is the one who is washing the car." The clinician would then provide an opportunity for

the child to restate this information (e.g., "... so tell that part of the story to the puppet"). If the child continued to misstate the information, the clinician would continue providing the child with information to enable him/her to discover the difference between what was communicated and what he/she intended to communicate. All feedback was based on meaning rather than structure, so that no direct prompts were given, such as "Say, 'He is washing the car'".

Adding Events:

If the child adequately stated an event, the clinician would add another event for the child to incorporate into his story, providing a variety of language forms that could be used in stating the new information. The child was then given an opportunity to restate the story, incorporating the new information. For example, if the child said "The man is washing the car", the clinician might seek to expand the child's perception of this event by adding more details to the event or relating "The man" to the rest of the family by saying something like "That's right, the man is washing the car. He is the Daddy and his children are helping him wash the car. The children are helping their Daddy wash the car."

Increasing Complexity:

If the child adequately described a series of events, the clinician would seek to increase complexity of the child's story by discussing relationships among events such as

motives of the characters, cause-effect relationships, interpretation of the characters' feelings, time and space relationships, and making predictions about events. For example, if the child said "The Daddy is washing the car and the little girl is playing with the hose", the clinician might link these two events in time and space by saying "That's right, while the Daddy is washing the car, his little girl is playing with the water hose, getting them all wet. So tell that part of the story to the puppet ..."

In each of these interactions, the clinician presents information and gives the child ample opportunity to incorporate that information into formulation of new utterances. The child's speech attempts allow for rehearsal in the production of syntactic, morphological, and phonological forms which should result in increased organization of these cognitive levels. Stories were retold frequently throughout the intervention period. During later retellings of a particular story, narratives were expanded and extended to include more episodes and predictions about past or future events, thus increasing the story's complexity. Table 3 summarizes the treatment goals associated with the whole language approach (Hoffman, Norris, & Monjure, 1988).

Dependent Measures

Pretreatment and posttreatment measures of phonological

Table 3

Treatment Goals Associated with the Whole Language Approach

Step 1: The clinician points out one event that initiates the story and talks about what the characters are doing and why, using a variety of language forms.

Step 2: The child is then asked to tell that part of the story to a puppet "listener".

Step 3: The clinician follows each of the child's conversational turns with one of the following response types.

(a) Clarification:

If any part of the child's explanation is unclear, inaccurate, or poorly stated, the puppet would ask for clarification. The clinician would then supply more information, restate the event using a variety of language forms, and ask the child to recommunicate the information to the puppet.

(b) Adding Events:

If the child adequately states an event, the clinician would add a new event, continuing the interactive story telling.

(c) Increasing Complexity:

If the child adequately describes a series of events in the story, the interactive story telling would begin to increase in complexity by adding elements,

Table 3 (cont.)

such as cause-effect relationships, interpreting motives and feelings of the characters and making predictions and inferences.

Step 4: Stories are retold frequently during the intervention period, increasing in elaboration to include more episodes and predictions. New stories are told at a more basic level, with emphasis placed on accurately establishing all relationships among characters and events, and stating ideas using appropriate language.

and language performance were used to compare the efficacy of the two treatment approaches. Pretesting and posttesting each extended over three-day periods. Connected speech/language sampling was elicited on each of the three days for pretesting and for posttesting. Results were averaged over the three-day periods. The assessment battery included general phonological measures, specific phonological process measures, and language measures described in the following sections.

General Phonological Measures

General phonological measures included the Templin-Darley Articulation Screening Test (Templin & Darley, 1969), The Assessment of Phonological Processes (Hodson, 1986), The Primary Articulation Survey, an informal sentence imitation task, and the Percentage of Consonants Correct (Shriberg & Kwiatkowski, 1982) in connected speech. The first general phonological measure used was the number of correctly produced target sounds (i.e., raw scores) from the Templin-Darley Articulation Screening Test, a 50-item picture test eliciting single words and testing one target phoneme per word. This measure was chosen because it provides a standard measure of phonological performance and contains a large number (i.e., 26) of word-initial consonant clusters for measurement of improvement in the phonological process approach. The second general phonological measure was the phonological deviancy score derived from The Assessment of

Phonological Processes. This is also a 50-item test eliciting single words via mostly objects with a few pictures included. The phonological deviancy score is based on the percentage of occurrence of phonological processes, or error patterns, in the child's speech. The third general phonological measure was the number of errors from administration of the Primary Articulation Survey, an informal sentence imitation task, similar to the one used by Haynes and Steed (1987), consisting of 83 sentences, testing one target phoneme per sentence, including 15 consonant clusters and 23 single consonant phonemes occurring in various word positions.

As a measure of general articulation improvement in connected speech, the Percentage of Consonants Correct (PCC) was obtained from subjects describing four situational pictures from the Apricot I set (Arwood, 1985) (i.e., The Doctor's Office, The Sprinkler, The Kitten, and Going Fishing), relating familiar experiences (i.e., getting ready for dinner, grocery shopping, making cookies, and a birthday party), and telling the Three Bears story. Situational pictures used during pre and posttreatment assessment were different from those used in the whole language treatment sessions.

Specific Phonological Process Measures

The specific phonological processes targeted in treatment for the phonological group, that is, Cluster Reduction and

Fronting, were analyzed from subjects' performance on pre- and posttreatment administrations of The Assessment of Phonological Processes (single word elicitation) and during connected speech sampling via describing situational pictures and relating familiar experiences (as described above).

As a measure of control, three phonological processes not specifically targeted in treatment were analyzed and compared. These processes were Strident Deficiencies, Glide Deficiencies, and Stopping and were also derived from pre- and posttreatment administrations of The Assessment of Phonological Processes, and are described in the following chapter.

Language Measures

Language measures were derived from pre- and posttreatment administrations of the Test of Language Development: Primary (Newcomer & Hammill, 1982), and syntactic/morphological and semantic/pragmatic measures obtained from the connected speech/language sampling, consisting of subjects describing situational pictures, relating familiar experiences, and telling the Three Bears story. These measures are described below.

The following subtests from the Test of Language Development: Primary were given: Oral Vocabulary, Grammatic Completion, Sentence Imitation, Picture Vocabulary, and Grammatic Understanding. The Oral Vocabulary, Grammatic Completion, and Sentence Imitation subtests are expressive

language tasks, while the Picture Vocabulary and Grammatic Understanding subtests are receptive language tasks. Raw scores were used because standard scores and percentiles are not given on this test for children below 4 years, 0 months. (Five of the eight subjects were below 4 years of age.)

Syntactic/morphological measures and semantic/pragmatic measures were derived from spontaneous connected speech/language elicitation during pre- and posttreatment assessment, consisting of children describing situational pictures, relating familiar experiences, and telling the Three Bears story (as described previously). Syntactic/ morphological measures included the percentage of correct usage and total number of attempts made for the following grammatical morphemes: plural and possessive nouns (e.g., books, Mommy's); regular past, irregular past, and regular third person singular verbs (e.g., jumped, came, plays); subjective, objective, and possessive pronouns (e.g., he, him, his). Morphemes for plural and possessive nouns, and regular past, irregular past, and regular third person singular verbs are included in the 14 grammatical morphemes discussed by Brown (1973). Two additional syntactic measures were derived from children's telling of the Three Bears story, that is, mean length of utterance (MLU) in morphemes, and mean number of morphemes in the longest sentence. A "morpheme" is the smallest meaningful unit of a language (e.g., "boy" or plural -s). An "utterance" consisted of at

least two structurally related morphemes (Tyack & Gottsleben, 1974). Procedures described by Tyack and Gottsleben were used in computing MLUs.

Semantic/pragmatic measures related to propositional content and included the number of events, responses, and no responses given by the subject, and the number of prompts, clozes, and direct questions given by the examiner. An event/prompt ratio and a conversational turn/prompt ratio were also calculated and are described subsequently.

An "event" was defined as an occurrence or action that the child spontaneously reports or a change in state or action. A "response" consisted of information specifically elicited from the child. "No response" included "Um ...", "I don't know", etc. A "prompt" was defined as an open-ended question by the examiner (e.g., What happened? Anything else?), or a restatement of what the child said with rising inflection. A "cloze" consisted of a fill in the blank type of prompt (e.g., Papa Bear's porridge was very ...). A "direct question" was aimed at asking for specific information (e.g., What did Goldilocks say when she tasted Papa Bear's porridge?). An event/prompt ratio refers to the mean number of events related per prompt given, while the conversational turn/prompt ratio was calculated by dividing the number of events and responses (given by the subject) by the number of prompts, clozes, and direct questions (given by the examiner).

Weekly Connected Speech/Language Samples

As a measure of articulatory performance on a continuing basis, connected speech/language samples were elicited by having subjects describe one or two situational pictures (Arwood, 1985) during 5-10 minutes of each treatment session. A different picture was used every day, and pictures differed from those used in assessment and whole language treatment. As there were three treatment sessions per week, the connected speech/language sample from the middle session each week was transcribed and analyzed. The Percentage of Consonants Correct (PCC) was calculated for these weekly connected speech/language samples.

Data Analysis

Subjects were seated in a sound treated booth with the experimenter during treatment sessions and pre- and posttreatment assessment. Subjects' responses to articulation tests and connected speech/language tasks during pre- and posttreatment assessment, and daily connected speech/language samples were audio recorded using a TEAC V-707RX tape recorder located inside the booth. Single word responses and connected speech/language samples were glossed and transcribed using the International Phonetic Alphabet (IPA).

In order to assess individual subject improvement from pre- to posttreatment, t-tests were conducted on phonological

and language measures taken from subjects describing situational pictures and relating familiar experiences. Phonological measures included Percentage of Consonants Correct, percentage of consonant clusters reduced, number of consonant clusters attempted, and percentage of occurrence of the process Fronting. Language measures have been described previously, including grammatical morphemes and semantic/ pragmatic measures.

In order to compare pre- and posttreatment performance on subjects' telling of the Three Bears story, a three-way analysis of variance was performed for main treatment effects and group interaction effects on phonological and language measures. The three factors used in performing the ANOVA were the two treatment groups by three days (of pretesting and posttesting) by two treatment times (pretest and posttest). Phonological measures included Percentage of Consonants Correct, percentage of initial cluster reduction, percentage of final cluster reduction, and percentage of occurrence of the process of Fronting. Language measures were the same as described in the previous section with two additional syntactic measures - mean length of utterance (MLU) in morphemes, and mean number of morphemes in the longest sentence.

Interjudge Reliability

Phonological measures were assessed in terms of interjudge reliability. Children's performance was evaluated

by a single experimenter (M.C.D., CCC-Speech Pathology). A second experimenter (Ph.D, CCC-Speech Pathology) transcribed one APP (Hodson, 1986) (i.e., single word elicitation test), and one connected speech/language sample for each child. Half of these were from pretreatment and half were from posttreatment assessment. Comparisons were made between the two judges' assignments of a correct/incorrect score for each consonant phoneme transcribed. Agreement for the single word APP task ranged from 93% to 97% with a mean of 95%. Agreement for the storytelling task ranged from 93% to 97% with a mean of 94%.

CHAPTER IV

RESULTS

The following chapter is composed of four major sections: (1) comparison of pretreatment and posttreatment performance on tests administered, (2) comparison of pretreatment and posttreatment performance during construction of picture stories and relating familiar experiences, (3) comparison of pretreatment and posttreatment performance on the Three Bears story, and (4) results of weekly connected speech/language samples. The first section includes test scores divided into general phonological measures, specific phonological process measures, and language measures. The second and third sections compare pre and posttreatment performance on the connected speech/language analysis including phonological and language measures. Section two specifically addresses the tasks of constructing picture stories and relating familiar experiences, while section three compares subject performance on telling of the Three Bears story. The last section presents the Percentage of Consonants Correct for weekly connected speech/language samples.

Comparison of Pretreatment and Posttreatment Performance on Tests Administered

The following section presents comparison of pretreatment and posttreatment subject performance on specific tests

administered including (1) general phonological measures, (2) specific phonological process measures, and (3) language measures. General phonological measures (1) include results from the Templin-Darley Articulation Screening Test, The Assessment of Phonological Processes, and the Primary Articulation Survey. Specific phonological process measures (2) include the percentage of occurrence of Consonant Sequence Reduction and number of occurrences of Fronting, both scores derived from The Assessment of Phonological Processes. Language measures (3) include results from the Test of Language Development: Primary.

General Phonological Measures

Table 4 displays the number of correct responses produced by each subject during pretreatment and posttreatment administrations of the Templin-Darley Articulation Screening Test (Templin & Darley, 1969), differences in raw scores from pre- to posttest, and group averages. Inasmuch as 26 out of 50 scored items contain word initial consonant clusters, it was expected that the children in the consonant cluster reduction treatment program would show improvement in these scores. Three out of four subjects in each treatment group demonstrated improved scores, showing that the two treatments resulted in similar improvements. Pre- and posttest scores for one subject in each treatment group (i.e., S1 and S8) remained constant. The average improvement for the whole language group was 7.50, while the average improvement for

Table 4

Pretreatment (Pre) and Posttreatment (Post) Raw Scores from Administration of the Templin-Darley Articulation Screening Test, Raw Score Differences (Diff.) from Pretreatment to Posttreatment for each Subject, and Group Means

	Subject	Pre	Post	Diff.
Phonological Process Group	S1	20	20	0
	S2	12	19	+7
	S3	11	21	+10
	S4	30	40	+10
	Group Mean:	18.25	25	6.75
Whole Language Group	S5	6	22	+16
	S6	11	20	+9
	S7	9	14	+5
	S8	4	4	0
	Group Mean:	7.50	15	7.50

Note. Scores given are total number correct out of a possible 50.

the process targeting group was 6.75.

Table 5 shows the phonological deviancy scores for each subject derived from The Assessment of Phonological Processes (Hodson, 1986). Differences in scores from pretreatment to posttreatment, percentage of improvement from pre- to posttest, and group means are also given in this table. The phonological deviancy score is based on the percentage of occurrence of phonological processes in the child's speech. This score decreases as phonological performance improves. As Table 5 indicates, posttreatment scores decreased for all subjects. The percentage of improvement was calculated by dividing the difference in scores from pre- to posttest by the pretreatment score. Average improvement for the phonological process group was 26%, while average improvement for the whole language group was 34%. Therefore, while all subjects showed some improvement, results indicate that taken collectively, the whole language group showed more improvement on this particular measure than the phonological process group.

Table 6 displays pretreatment and posttreatment number of errors from administration of the Primary Articulation Survey, an informal sentence imitation task consisting of 83 sentences testing one target phoneme per sentence, including 15 consonant clusters and 23 single consonant phonemes occurring in various word positions (i.e., initial, medial, and final). Differences in the number of errors made from

Table 5

Pretreatment (Pre) and Posttreatment (Post) Phonological Deviancy Scores from Administration of The Assessment of Phonological Processes, Differences (Diff.) in Scores from Pretreatment to Posttreatment, Percentages of Improvement for each Subject (% Change), and Group Means

	Subject	Pre	Post	Diff.	% Change
Phonological Process Group	S1	18	15	3	17%
	S2	30	22	8	27%
	S3	15	14	1	7%
	S4	15	7	8	53%
Group Mean:		19.50	14.50	5	26%
Whole Language Group	S5	57	20	37	65%
	S6	50	32	18	36%
	S7	41	30	11	27%
	S8	47	44	3	6%
Group Mean:		48.75	31.50	17.25	34%

Table 6

Pretreatment (Pre) and Posttreatment (Post) Number of Errors from Administration of the Primary Articulation Survey, Differences (Diff.) in Scores from Pretreatment to Posttreatment, Percentages of Improvement for each Subject (% Change), and Group Means

	Subject	Pre	Post	Diff.	% Change
Phonological Process Group	S1	28	23	5	18%
	S2	29	27	2	7%
	S3	39	30	9	23%
	S4	15	9	6	40%
	Group Mean:	27.75	22.25	5.50	22%
Whole Language Group	S5	52	31	21	40%
	S6	34	26	8	24%
	S7	45	28	17	38%
	S8	54	51	3	6%
	Group Mean:	46.25	34	12.25	27%

pre- to posttest, percentage of improvement for each subject, and group means are also given in this table. Average improvement for the phonological process group was 22%, while average improvement for the whole language group was 27%. Thus, as results indicate, while all subjects demonstrated a decrease in the number of errors made from pre- to posttest, the whole language group showed a somewhat higher degree of improvement over the phonological process group.

Specific Phonological Process Measures

The specific phonological processes targeted in treatment for the phonological group were Consonant Cluster Reduction and Fronting. Subjects S1, S2, and S4 received specific training for remediation of Consonant Cluster Reduction, while subject S3 received specific training on the phonological process of Fronting. All four subjects in the whole language group demonstrated the process of Cluster Reduction in their speech prior to treatment, while three of the four subjects in this group (i.e., S6, S7, S8) demonstrated the process of Fronting during pretreatment assessment. Tables 7 and 8 show results of the occurrence of these processes during pre- and posttreatment administrations of The Assessment of Phonological Processes (Hodson, 1986).

Table 7 shows the percentages of occurrence of Consonant Sequence Reduction during pre- and posttreatment administrations of The Assessment of Phonological Processes, differences in scores from pretreatment to posttreatment,

Table 7

Pretreatment (Pre) and Posttreatment (Post) Percentages of Occurrence of Consonant Sequence Reduction from Administration of The Assessment of Phonological Processes, Differences (Diff.) in Scores from Pretreatment to Posttreatment, Percentages of Improvement for each Subject (% Change), and Group Means

	Subject	Pre	Post	Diff.	% Change
Phonological Process Group	S1	35	25	10	29%
	S2	68	50	18	26%
	S4	48	18	30	63%
Group Mean:		50	31	19	39%
Whole Language Group	S5	148	50	98	66%
	S6	73	30	43	59%
	S7	80	58	22	28%
	S8	88	80	8	9%
Group Mean:		97	55	43	41%

percentages of improvement for each subject, and group means. This particular phonological process of Consonant Sequence Reduction is also referred to as Consonant Cluster Reduction. This process occurs when any consonant(s) in a sequence is/are deleted. For example, "string" --> "tring," "ring," or "ing." There are 34 consonant sequences assessed in the APP and 40 opportunities for reduction of consonant sequences to one consonant (e.g., "star" --> "tar"). However, six of the consonant clusters involve three consonants and can be reduced one or two times (e.g., "string" --> "tring," or "ring"), while 28 of the consonant clusters have two consonants in the sequence (e.g., "glove," "slide"). According to Hodson (1986), since the formula for the percentage of occurrence for Consonant Sequence Reduction was based on reduction to one element, it is possible for this score to exceed 100%, that is, when the entire cluster is omitted (e.g., "string" --> "ing"). Consonant clusters were often deleted entirely in the speech of subject S5, hence he attained a percentage of occurrence pretest score of 148.

One would expect the percentage of occurrence of Consonant Sequence Reduction to decrease following treatment that focused on direct remediation of this phonological process. As results indicate, posttreatment percentages for Consonant Sequence Reduction decreased for all subjects, including those in the whole language group where no particular emphasis was given to remediation of this process.

The percentage of improvement for each subject was calculated by dividing the difference in scores from pre- to posttreatment by the pretreatment score. Average improvement for the phonological process group was 39%, while average improvement for the whole language group was 41%. The data indicate that the whole language approach resulted in slightly higher degree of improvement in Consonant Sequence Reduction than the phonological process approach.

As previously mentioned, subjects S1, S2, and S4 received specific training on Consonant Cluster Reduction, whereas for subject S3, focus in treatment was on remediation of the phonological process of Fronting. Table 8 shows the number of occurrences of Fronting during pre and posttreatment administrations of The Assessment of Phonological Processes, differences in scores from pretreatment to posttreatment, and percentages of improvement for each subject. The phonological process of Fronting occurs when a more forward place of articulation is used (e.g., "key" --> "tea"; "some" --> "thumb"). Three of the four subjects in the whole language group (i.e., S6, S7, S8) demonstrated occurrence of the phonological process of Fronting on the pretreatment administration of the APP. As with the process of Cluster Reduction, one would expect the number of occurrences of Fronting to also decrease following treatment aimed at remediation of this phonological process. As Table 8 indicates, the only subject in the phonological process

Table 8

Pretreatment (Pre) and Posttreatment (Post) Number of Occurrences of Fronting from Administration of The Assessment of Phonological Processes, Differences (Diff.) in Scores from Pretreatment to Posttreatment, and Percentages of Improvement for each Subject (% Change)

	Subject	Pre	Post	Diff.	% Change
Phonological Process Group	S3	31	5	26	84%
Whole Language Group	S6	11	5	6	55%
	S7	9	0	9	100%
	S8	14	12	2	14%
	Group Mean:	11.33	5.67	5.67	56%

group, S3, for whom Fronting was selectively targeted in treatment, showed a decrease in the number of occurrences of this process from pre- to posttest, resulting in an improvement of 84% based on the initial number of occurrences. For the whole language group, in which no specific emphasis was given to remediation of Fronting, all three subjects (i.e., S6, S7, S8) also demonstrated a decrease in the number of occurrences of this process with a percentage of improvement of 55%, 100%, and 14% respectively, with average group improvement of 56%.

As a measure of control, results of three phonological processes not targeted in either treatment group were analyzed and compared. These results were also derived from pretreatment and posttreatment administrations of The Assessment of Phonological Processes. The three phonological processes were Strident Deficiencies, Glide Deficiencies, and Stopping.

Table 9 shows pretreatment and posttreatment percentages of occurrence of Strident Deficiencies from the APP, differences in scores from pretreatment to posttreatment, percentages of improvement for each subject, and group means. Hodson (1986) defines stridency as "the noisiness that results from an airstream against the upper teeth" (p. 23). Strident phonemes include /s, z, , , t , d , f, v/ and Strident Deficiencies refer to deletion of a strident phoneme (e.g., "soap" --> "oap") or substitution of a nonstrident

Table 9

Pretreatment (Pre) and Posttreatment (Post) Percentages of Occurrence of Strident Deficiencies from Administration of The Assessment of Phonological Processes, Differences (Diff.) in Scores from Pretreatment to Posttreatment, Percentages of Improvement for each Subject (% Change), and Group Means

	Subject	Pre	Post	Diff.	% Change
Phonological Process Group	S1	44	35	9	20%
	S2	60	37	23	38%
	S3	16	16	0	0%
	S4	14	7	7	50%
	Group Mean:	34	24	10	27%
Whole Language Group	S5	91	72	19	21%
	S6	21	0	21	100%
	S7	26	14	12	46%
	S8	93	81	12	13%
	Group Mean:	58	42	16	45%

phoneme (e.g., "soap" --> "toap," "hoap," or "woap"). Three out of four subjects in the phonological process group (i.e., S1, S2, S4) and all four subjects in the whole language group showed a decrease in the percentage of occurrence of Strident Deficiencies from pretreatment to posttreatment. Average improvement was 27% for the phonological process group, while average improvement for the whole language group was 45%.

Table 10 shows pretreatment and posttreatment percentages of occurrence of Glide Deficiencies from the APP, differences in scores from pretreatment to posttreatment, percentages of improvement for each subject, and group means. Glide Deficiencies refer to omission or substitution of the glides /w/ or /j/ (e.g., "watch" --> "atch" or "batch"). Three subjects in the phonological process group (i.e., S1, S2, and S4) and all four subjects in the whole language group demonstrated occurrence of Glide Deficiencies on the pretreatment administration of the APP. One subject in the phonological process group (i.e., S4) and two subjects in the whole language group (i.e., S5 and S7) showed a decrease in the percentage of occurrence of Glide Deficiencies from pretreatment to posttreatment. Average improvement for the phonological process group was 8%, while average improvement for the whole language group was 25%.

Table 11 shows the number of occurrences of Stopping during pretreatment and posttreatment administrations of the APP, differences in scores from pre- to posttreatment,

Table 10

Pretreatment (Pre) and Posttreatment (Post) Percentages of Occurrence of Glide Deficiencies from Administration of The Assessment of Phonological Processes, Differences (Diff.) in Scores from Pretreatment to Posttreatment, Percentages of Improvement for each Subject (% Change), and Group Means

	Subject	Pre	Post	Diff.	% Change
Phonological Process Group	S1	10	10	0	0%
	S2	20	20	0	0%
	S4	40	30	10	25%
Group Mean:		23	20	3	8%
Whole Language Group	S5	30	10	20	67%
	S6	50	50	0	0%
	S7	60	40	20	33%
	S8	10	10	0	0%
Group Mean:		38	28	10	25%

Table 11

Pretreatment (Pre) and Posttreatment (Post) Number of Occurrences of Stopping from Administration of The Assessment of Phonological Processes, Differences (Diff.) in Scores from Pretreatment to Posttreatment, Percentages of Improvement for each Subject (% Change), and Group Means

	Subject	Pre	Post	Diff.	% Change
Phonological Process Group	S1	13	12	1	8%
	S2	12	3	9	75%
	S3	8	8	0	0%
	Group Mean:	11	8	3	28%
Whole Language Group	S6	5	2	3	60%
	S7	5	2	3	60%
	S8	25	24	1	4%
	Group Mean:	12	9	2	41%

percentages of improvement for each subject, and group means. The phonological process of Stopping occurs when a stop consonant /p, b, t, d, k, g/ is substituted for a continuant phoneme (e.g., "fan" --> "tan," "love" --> "dove"). Three subjects in each treatment group demonstrated occurrence of Stopping on the pretreatment administration of the APP. Two subjects out of three in the phonological process group (i.e., S1 and S2) and all three subjects in the whole language group (i.e., S6, S7, and S8) showed a decrease in the number of occurrences of the phonological process of Stopping from pretreatment to posttreatment. Average improvement was 28% for the phonological process group, while average improvement for the whole language group was 41%.

As the data in Tables 9-11 indicate, the whole language group demonstrated greater improvement than the phonological process group on three phonological processes not targeted in treatment: Strident Deficiencies, Glide Deficiencies, and Stopping, as represented by a decrease in the occurrence of these processes from pre- to posttreatment administrations of the APP.

Language Measures

Tables 12 - 16 show pre- and posttreatment results of the Oral Vocabulary, Grammatic Completion, Sentence Imitation, Picture Vocabulary, and Grammatic Understanding subtests from the Test of Language Development: Primary (Newcomer & Hammill, 1982). Raw scores were used because standard scores

and percentiles are not given on the TOLD-P for children below 4 years, 0 months. (Five of the eight subjects were below 4 years of age.) Results of the expressive language tasks, that is, Oral Vocabulary, Grammatic Completion, and Sentence Imitation, will be discussed first followed by receptive language subtests of Picture Vocabulary and Grammatic Understanding.

As raw scores indicate in Table 12, all subjects improved from pre- to posttreatment on the Oral Vocabulary subtest of the TOLD-P. However, as a group, subjects receiving whole language treatment demonstrated greater degree of improvement over subjects receiving phonological process training. Average improvement for the whole language group was 5.00, while average improvement for the process targeting group was 2.75.

Table 13 shows pre- and posttreatment raw scores from the Grammatic Completion subtest. With the exception of subject S1, whose pre- and posttest scores remained constant, all other subjects showed improvement in their scores from pre- to posttreatment. Group averages indicate, however, that the whole language group demonstrated more improvement than the phonological process group, with average improvements of 4.75 and 3.25, respectively.

As Table 14 indicates, three out of four subjects in each treatment group demonstrated improved scores on the Sentence Imitation subtest of the TOLD-P. Pre- and posttest scores for

Table 12

Pretreatment (Pre) and Posttreatment (Post) Raw Scores from the Oral Vocabulary Subtest of the Test of Language Development: Primary, Raw Score Differences (Diff.) from Pretreatment to Posttreatment for each Subject, and Group Means

	Subject	Pre	Post	Diff.
Phonological Process Group	S1	5	7	+2
	S2	2	4	+2
	S3	7	8	+1
	S4	1	7	+6
	Group Mean:	3.75	6.50	2.75
Whole Language Group	S5	1	7	+6
	S6	7	11	+4
	S7	2	8	+6
	S8	1	5	+4
	Group Mean:	2.75	7.75	5.00

Note. Scores given are total number correct out of a possible 20.

Table 13

Pretreatment (Pre) and Posttreatment (Post) Raw Scores from the Grammatic Completion Subtest of the Test of Language Development: Primary, Raw Score Differences (Diff.) from Pretreatment to Posttreatment for each Subject, and Group Means

	Subject	Pre	Post	Diff.
Phonological Process Group	S1	4	4	0
	S2	5	7	+2
	S3	12	17	+5
	S4	5	11	+6
	Group Mean:	6.50	9.75	3.25
Whole Language Group	S5	2	3	+1
	S6	10	14	+4
	S7	2	9	+7
	S8	0	7	+7
	Group Mean:	3.50	8.25	4.75

Note. Scores given are total number correct out of a possible 30.

Table 14

Pretreatment (Pre) and Posttreatment (Post) Raw Scores from the Sentence Imitation Subtest of the Test of Language Development: Primary, Raw Score Differences (Diff.) from Pretreatment to Posttreatment for each Subject, and Group Means

	Subject	Pre	Post	Diff.
Phonological Process Group	S1	1	1	0
	S2	0	1	+1
	S3	11	16	+5
	S4	2	3	+1
	Group Mean:	3.50	5.25	1.75
Whole Language Group	S5	0	1	+1
	S6	0	2	+2
	S7	0	1	+1
	S8	1	1	0
	Group Mean:	.25	1.25	1.00

Note. Scores given are total number correct out of a possible 30.

one subject in each treatment group (i.e., S1 and S8) remained constant. Group averages indicate that both treatment groups showed similar improvements. Average improvement for the phonological process group was 1.75, while average improvement for the whole language group was 1.00.

On the Picture Vocabulary subtest, a receptive language task, one subject in the phonological process group (i.e., S4) and three out of four subjects in the whole language group (i.e., S5, S7, S8) showed improvement in their performance from pre- to posttreatment as indicated in Table 15. Group averages show that the whole language group demonstrated more improvement on this subtest than the phonological process group, with average improvements of 1.25 and .25, respectively.

As results indicate in Table 16, comparable gains were made by subjects in both treatment groups on the Grammatic Understanding subtest, another receptive language task. Three out of four subjects in each treatment group demonstrated improved scores, with the average improvement for both groups being identical, that is, 2.50.

Table 17 presents a summary of average improvements for the phonological process and whole language treatment groups on tests administered. On the general phonological measures, that is, the Templin-Darley Articulation Screening Test, The Assessment of Phonological Processes (APP) phonological

Table 15

Pretreatment (Pre) and Posttreatment (Post) Raw Scores from the Picture Vocabulary Subtest of the Test of Language Development: Primary, Raw Score Differences (Diff.) from Pretreatment to Posttreatment for each Subject, and Group Means

	Subject	Pre	Post	Diff.
Phonological Process Group	S1	7	7	0
	S2	9	5	−4
	S3	9	9	0
	S4	1	6	+5
Group Mean:		6.50	6.75	.25
Whole Language Group	S5	2	4	+2
	S6	10	10	0
	S7	4	5	+1
	S8	4	6	+2
Group Mean:		5	6.25	1.25

Note. Scores given are total number correct out of a possible 25.

Table 16

Pretreatment (Pre) and Posttreatment (Post) Raw Scores from the Grammatic Understanding Subtest of the Test of Language Development: Primary, Raw Score Differences (Diff.) from Pretreatment to Posttreatment for each Subject, and Group Means

	Subject	Pre	Post	Diff.
Phonological Process Group	S1	4	11	+7
	S2	7	10	+3
	S3	9	11	+2
	S4	14	12	-2
	Group Mean:	8.50	11	2.50
Whole Language Group	S5	10	13	+3
	S6	11	12	+1
	S7	10	9	-1
	S8	2	9	+7
	Group Mean:	8.25	10.75	2.50

Note. Scores given are total number correct out of a possible 25.

Table 17

Summary of Average Improvements for Phonological Process and Whole Language Treatment Groups on Tests Administered

	Treatment Type	
	Phonological	Whole Language
Phonological Measures:		
Templin-Darley Screening Test	6.75	7.50
APP deviancy scores	26%	34%
Primary Articulation Survey	22%	27%
Cluster Reduction from *APP*	39%	41%
Fronting from *APP*	84% (1 subject)	56% (3 subjects)
Language Measures:		
TOLD-P:		
Oral Vocabulary	2.75	5.00
Grammatic Completion	3.25	4.75
Sentence Imitation	1.75	1.00
Picture Vocabulary	.25	1.25
Grammatic Understanding	2.50	2.50

Note. *APP* = *The Assessment of Phonological Processes*; *TOLD-P* = *Test of Language Development: Primary*.

deviancy scores, and the Primary Articulation Survey, average improvement for the whole language group was greater than average improvement for the phonological process group. On the specific phonological process of Cluster Reduction derived from the APP, the whole language treatment group demonstrated slightly higher average improvement than the process targeting group. With the phonological process of Fronting from the APP, the one subject in the phonological process group for whom Fronting was specifically targeted in treatment, showed 84% improvement on this test. The three subjects in the whole language group who evidenced Fronting in their speech during pre-assessment also improved on this test, with average improvement of 56%, without having specific training to remediate this phonological process. With the language measures, that is, the five subtests of the Test of Language Development: Primary (TOLD-P), average improvement for the whole language group exceeded that of the phonological process group on the Oral Vocabulary, Grammatic Completion, and Picture Vocabulary subtests. Comparable improvement was shown by both treatment groups on the Sentence Imitation and Grammatic Understanding subtests.

Comparison of Pretreatment and Posttreatment Performance During Construction of Picture Stories and Relating Familiar Experiences

The remainder of this chapter is devoted to describing

results from the connected speech/language analysis. The following section presents comparison of pretreatment and posttreatment performance on the tasks of describing situational pictures and relating familiar experiences (i.e., getting ready for dinner, grocery shopping, making cookies, and a birthday party). Phonological measures include the Percentage of Consonants Correct (PCC), the percentage of consonant clusters reduced, the number of consonant clusters attempted, and the percentage of occurrence for the phonological process of Fronting. Language measures include syntactic/morphological measures and semantic/pragmatic measures. Syntactic/morphological measures include the percentage of correct usage and total number of attempts made for the following grammatical morphemes: plural and possessive nouns; regular past, irregular past, and regular third person singular verbs; subjective, objective, and possessive pronouns. Semantic/pragmatic measures relate to propositional content and include the number of events, responses, and no responses given by the subject and the number of prompts, clozes, and direct questions given by the examiner. An event/prompt ratio and a conversational turn/prompt ratio were also calculated and are described in this section.

Tables 18 - 22 show the number of children per treatment group obtaining pretreatment to posttreatment improvements producing t-tests with a probability level $< .05$ on

phonological and language measures taken from subjects describing situational pictures and relating familiar experiences (e.g., making cookies, grocery shopping). See Appendix C for significant t-test values for each subject for phonological and language measures on both picture stories and experiences. Tables 23 and 24 provide summaries of t-test results.

Phonological Measures

As shown in Table 18, more children in the whole language group achieved significant differences from pre- to posttreatment on all phonological measures taken. For the Percentage of Consonants Correct (PCC), two subjects out of four in the whole language group demonstrated a significant improvement in the percentage of correctly produced consonants on both tasks (i.e., picture stories and relating experiences). By contrast, on the picture stories alone, one child out of four in the phonological process group made a significant improvement in the percentage of consonants correctly produced.

As mentioned previously, three subjects in the phonological process group received specific training on remediation of the phonological process of Consonant Cluster Reduction. In the whole language group, all four subjects reduced consonant clusters in their speech prior to treatment. The second and third lines in Table 18 pertain to the percentage of consonant clusters reduced and the number

Table 18

Number of Students per Treatment Group Obtaining T-tests with Probability Level ≤ .05 on Phonological Measures from Describing Picture Stories and Relating Familiar Experiences

	Picture Stories		Experiences	
	Phon. Group	Lang. Group	Phon. Group	Lang. Group
PCC	1	2	0	2
Clusters Red.	0 (3)	3 (4)	1 (3)	2 (4)
Clusters Att.	1 (3)	2 (4)	1 (3)	3 (4)
Fronting	0 (1)	2 (3)	0 (1)	0 (3)

Note. PCC = Percentage of Consonants Correct; Red. = Reduced; Att. = Attempted; total number of subjects in each group exhibiting the specific phonological process is given in parentheses.

of clusters attempted, whether they were produced correctly or not. One might predict that during treatment in which the particular phonological process of Cluster Reduction was targeted, occurrence of this process would decrease; however, the frequency or number of attempts at producing consonant clusters may be expected to increase. While only one subject in the phonological process group showed a significant difference in reducing consonant clusters (on the experiences), three subjects in the language group (on the picture stories) and two subjects in this group (on the experiences) demonstrated significant differences in decreasing percentages of occurrence for Cluster Reduction. With regard to the number of consonant clusters attempted, two out of four subjects in the language group (on the picture stories) and three out of four subjects in this group (on the experiences) displayed a significant increase in the number of clusters attempted from pre- to posttreatment. In comparison, one out of three subjects in the phonological process group showed a significant increase in the number of attempted clusters on both tasks.

The final phonological measure shown in Table 18 pertains to the percentage of occurrence for the phonological process of Fronting. One subject in the phonological process group exhibited Fronting in the pretest analysis and this process was targeted in treatment, while three subjects in the whole language group demonstrated this process in their speech

during pre-assessment; however, no particular attention was given to remediation of this process during treatment sessions. The subject in the phonological process group, for whom the process of Fronting was specifically targeted in treatment, failed to demonstrate a significant difference in the occurrence of Fronting on either task (i.e., picture stories or experiences). However, two subjects out of three in the whole language group showed a significant decrease in the percentage of occurrence of Fronting on the picture stories' task.

Language Measures

Syntactic/Morphological Measures

Tables 19 - 21 show the number of students in each treatment group obtaining significant improvements from pretreatment to posttreatment judged by t-test values ($p < .05$) for the percentage of correct usage for certain grammatical morphemes and for the total number of attempts made for each grammatical morpheme, including correct and incorrect responses. The grammatical morphemes include plural and possessive nouns (Table 19); regular past, irregular past and regular third person singular verbs (Table 20); and subjective, objective, and possessive pronouns (Table 21).

As shown in Table 19, while none of the subjects in either treatment group demonstrated significant differences from pretreatment to posttreatment on the percentage of

Table 19

Number of Students per Treatment Group Obtaining T-tests with Probability Level ≤ .05 for Plural and Possessive Nouns from Describing Picture Stories and Relating Familiar Experiences

	Picture Stories		Experiences	
	Phon. Group	Lang. Group	Phon. Group	Lang. Group
Correct plural nouns	0	0	0	0
Plural nouns attempted	0	1	2	3
Correct poss. nouns	0	0	0	0
Poss. nouns attempted	0	0	0	0

Note. Poss. = possessive.

correct usage for plural nouns, there were some differences with the number of plural nouns attempted. On the experiences' task, three of the four children in the whole language group and two of the four children in the phonological proces group showed a significant increase in the number of plural nouns attempted from pre- to posttest. On the picture stories' task, no subjects in the phonological group and one subject in the language group showed a significant difference. With respect to correct usage of possessive nouns and number of possessive nouns attempted, none of the subjects in either group demonstrated significant differences in their performance on either measure.

As Table 20 shows, with the correct usage of regular past verbs, there were no significant differences from subjects in either treatment group, but one subject in the phonological process group displayed a significant increase in the number of regular past verbs attempted on the experiences' task. Likewise, while there were no significant differences shown on the correct usage of irregular past verbs and regular third person singular verbs, there were a few differences shown in the number of attempted verbs in each category. For the number of irregular past verbs attempted, one subject in the whole language group (on the picture stories) and one subject in the phonological process group (on the experiences) demonstrated a significant increase from pretreatment to posttreatment. Similarly, one subject in

Table 20

Number of Students per Treatment Group Obtaining T-tests with Probability Level ≤ .05 for Regular Past, Irregular Past, and Regular Third Person Singular Verbs from Describing Picture Stories and Relating Familiar Experiences

	Picture Stories		Experiences	
	Phon. Group	Lang. Group	Phon. Group	Lang. Group
Correct regular past verbs	0	0	0	0
Regular past verbs attempted	0	0	1	0
Correct irregular past verbs	0	0	0	0
Irregular past verbs attempted	0	1	1	0
Correct third per. singular verbs	0	0	0	0
Third person sing. verbs attempted	0	0	1	1

each group showed a significant increase in the mean number of regular third person singular verbs attempted on the experiences' task.

With regard to pronouns, as displayed in Table 21, while results indicated that there were no significant differences demonstrated by subjects on correct usage of pronouns, there were some significant differences on the number of attempted pronouns made. With the number of subjective pronouns attempted, two subjects in the language group (on the picture stories) and one subject in each group (on the experiences) showed a significant increase. For the number of objective pronouns attempted, one subject in the language group (on the picture stories), and on the experiences' task, one subject in the phonological process group and three subjects out of four in the whole language group demonstrated significant differences. With the number of possessive pronouns attempted, two subjects in the language group (on the picture stories) and one subject in the phonological group (on the experiences) showed a significant increase from pretreatment to posttreatment.

Semantic/Pragmatic Measures

The semantic/pragmatic measures given in Table 22 relate to propositional content and include events, responses, and no responses given by the subject; prompts, clozes, and direct questions given by the examiner; event/prompt ratio and conversational turn/prompt ratio. T-tests were based on

Table 21

Number of Students per Treatment Group Obtaining T-tests with Probability Level ≤ .05 for Subjective, Objective, and Possessive Pronouns from Describing Picture Stories and Relating Familiar Experiences

	Picture Stories		Experiences	
	Phon. Group	Lang. Group	Phon. Group	Lang. Group
Correct sub. pronouns	0	0	0	0
Sub. pronouns attempted	0	2	1	1
Correct obj. pronouns	0	0	0	0
Obj. pronouns attempted	0	1	1	3
Correct poss. pronouns	0	0	0	0
Poss. pronouns attempted	0	2	1	0

Note. Sub. = Subjective; Obj. = Objective; Poss. = Possessive.

Table 22

Number of Students per Treatment Group Obtaining T-tests with Probability Level ≤ .05 on Semantic/Pragmatic Measures from Describing Picture Stories and Relating Familiar Experiences

	Picture Stories		Experiences	
	Phon. Group	Lang. Group	Phon. Group	Lang. Group
Events	2	4	1	4
Responses	0	2	2	4
No Responses	2	2	1	1
Prompts	2	1	1	1
Clozes	0	2	1	2
Direct Questions	1	1	0	3
Event/prompt ratio	1	4	0	3
Conver. turn/ prompt ratio	3	4	1	3

significant differences ($p < .05$) from pretreatment to posttreatment in the mean number of each of these given while situational pictures were described and familiar experiences related. The event/prompt ratio refers to the mean number of events related per prompt given, while the conversational turn/prompt ratio was calculated by dividing the number of events and responses (given by the subject) by the number of prompts, clozes, and direct questions (given by the examiner).

On both describing picture stories and relating familiar experiences, all four subjects in the whole language group demonstrated a significant increase from pretreatment to posttreatment in the mean number of events related. With the phonological process group, two subjects (on the picture stories) and one subject (on the experiences) showed a significant increase. With the mean number of responses given by subjects on the picture stories' task, two subjects in the language group and none in the phonological group showed a significant increase, while on the experiences' task, all four children in the language group and two in the phonological group demonstrated significant differences. The mean number of no responses given by subjects showed a significant decrease from pretreatment to posttreatment for two subjects in each group on the picture stories and for one subject in each group on the experiences' task.

Two subjects in the phonological process group and one

subject in the whole language group (on the picture stories), and one child in each group (on the experiences) displayed significant differences in the mean number of prompts needed to be given by the examiner from pretreatment to posttreatment. With respect to the mean number of clozes given by the examiner, two subjects in the whole language group (on both picture stories and experiences), and one subject in the phonological group (on the experiences only) demonstrated significant differences. With the mean number of direct questions given by the examiner, one subject in each group (on the picture stories) and three subjects in the language group (on the experiences) showed significant differences from pretest to posttest.

On the picture stories, all four subjects in the whole language group and one subject in the phonological process group displayed a significant increase in the mean event/prompt ratio from pretreatment to posttreatment, while on the experiences' task, three subjects in the language group and none in the phonological group showed a significant increase. With the conversational turn/prompt ratio, all four subjects in the whole language group and three subjects in the phonological process group (on the picture stories), and three subjects in the language group and one in the phonological group (on the experiences) demonstrated a significant increase from pretest to posttest.

Tables 23 and 24 provide summaries of t-test results.

Table 23 presents a summary of subject performance on phonological and language measures for picture stories and experiences. Significant differences ($p < .05$) based on t-test values (given in Appendix C) are shown for each subject. Significant differences observed on the various measures for the picture stories' task are represented with a "1", while those for the experiences' task are represented with a "2".

Table 24 presents the total number of significant differences ($p < .05$) for each subject on phonological and language measures for picture stories and experiences combined. Group performance will be discussed first followed by individual subject performance.

On the phonological measures, the whole language group demonstrated more significant differences than the phonological process group; that is, 16 and 4 respectively. Likewise, on the language measures, the whole language group showed more significant differences than the phonological process group. Specifically, on the syntactic/morphological measures, the language group demonstrated 15 significant differences, while the phonological group displayed 8 significant differences. On the semantic/pragmatic measures, 41 significant differences were shown by subjects in the whole language group, whereas 18 significant differences were demonstrated by those in the phonological process group.

With respect to individual subject performance, subjects

Table 23

Subject Performance on Phonological and Language Measures for Picture Stories (1) and Experiences (2) (Significant Differences, $p \leq .05$)

	Phonological Process Group				Whole Language Group			
	S1	S2	S3	S4	S5	S6	S7	S8
Phonological Measures:								
PCC				1	1,2	1	2	
Clusters Red.				2	1,2	1	1,2	
Clusters Att.		1,2			2	2	1	1,2
Fronting							1	1
Syntactic/Morph. Measures:								
Plural nouns attempted		2	2		2		1,2	2
Regular past verbs att.			2					
Irr. past verbs attempted			2		1			
Third person sing. verbs att.	2				2			
Sub. pronouns attempted			2		1,2			1
Obj. pronouns attempted	2				1,2		2	2
Poss. pronouns attempted			2		1	1		

Table 23 (cont.)

	Phonological Process Group				Whole Language Group			
	S1	S2	S3	S4	S5	S6	S7	S8
Semantic/Prag. Measures:								
Events	1	2		1	1,2	1,2	1,2	1,2
Responses		2		2	2	1,2	1,2	2
No Responses	1	2		1			1	1,2
Prompts	2		1	1	1		2	
Clozes		2			1	1,2	2	
Direct quest.	1				2		1,2	2
Event/prompt ratio			1		1,2	1	1,2	1,2
Conver. turn/ prompt ratio	1	2	1	1	1,2	1	1,2	1,2

Note. 1 = Picture Stories; 2 = Experiences; PCC = Percentage of Consonants Correct; Red. = Reduced; Att. = Attempted; Morph. = Morphological; Prag. = Pragmatic.

Table 24

Total Number of Significant Differences ($p \leq .05$) for each Subject on Phonological and Language Measures for Picture Stories and Experiences Combined

	Phonological Process Group				Whole Language Group			
	S1	S2	S3	S4	S5	S6	S7	S8
Phonological Measures	0	2	0	2	5	3	5	3
Language:								
Syn./Morph. Measures	2	1	5	0	8	1	3	3
Semantic/Prag. Measures	5	5	3	5	10	8	13	10
Total Number:	7	8	8	7	23	12	21	16

Note. Syn. = Syntactic; Morph. = Morphological; Prag. = Pragmatic.

in the whole language group displayed more individual significant differences than those in the phonological process group on both phonological and language measures. Regarding the total number of significant differences (i.e., phonological and language measures combined), subject S5 demonstrated the most improvement with 23 significant differences, followed by subject S7 with 21 significant differences, subject S8 with 16 significant differences, and subject S6 with 12 significant differences. With subjects in the phonological process group, subjects S2 and S3 each showed 8 significant differences, while subjects S1 and S4 each showed 7 significant differences.

As can be observed from the two summary tables, t-test results on phonological and language measures from the picture stories and experiences indicate that subjects in the whole language group demonstrated greater improvement than subjects in the phonological process group, both on individual subject performance and group performance.

Comparison of Pretreatment and Posttreatment Performance on Telling of the Three Bears Story

The following section presents comparison of pretreatment and posttreatment performance on subjects' telling of the Three Bears story. A three-way analysis of variance was performed for main treatment effects and group interaction effects on phonological and language measures. The three

factors used in performing the ANOVA were the two treatment groups by three days by two treatment times (pretest and posttest). Phonological measures included Percentage of Consonants Correct (PCC), percentage of initial cluster reduction, percentage of final cluster reduction, and percentage of occurrence of the process of Fronting. Language measures were the same as described in the previous section for the picture stories and experiences' tasks, with two additional syntactic measures - mean length of utterance (MLU) in morphemes, and mean number of morphemes in the longest sentence.

Tables 25 - 29 pertain to analysis of variance results. Tables 25 and 27 show significant F ratios for main treatment effects and group interaction effects, respectively, from a three-way analysis of variance for phonological and language measures obtained from subjects' telling of the Three Bears story. Tables 26 and 28 present pretreatment and posttreatment group means for phonological and language measures with significant F ratios for main treatment effects and group interaction effects, respectively, from subjects' storytelling of the Three Bears. Table 29 shows pretreatment and posttreatment mean number of morphemes in the longest sentence for each subject from the Three Bears story.

Main Treatment Effects

Table 25 presents significant F ratios for main treatment effects for phonological and language measures at the .05

level of confidence ($F = 5.99$, $df = 1,6$). Table 26 shows pretreatment and posttreatment group averages for measures with significant F ratios for main treatment effects from subjects' telling of the Three Bears.

Initial cluster reduction was the only phonological measure in which both groups showed a significant difference from pretest to posttest. As indicated in Table 26, pre- and posttest group means for the phonological process group were 20 and 14, respectively, while for the whole language group, means were 76 and 48, respectively, indicating that both treatment groups improved by decreasing the number of initial consonant clusters reduced.

With the syntactic/morphological measures, both treatment groups demonstrated a significant increase from pretreatment to posttreatment on the number of attempted regular past verbs, correct irregular past verbs, attempted irregular past verbs, and attempted subjective pronouns. As shown in Table 26, with the number of attempted regular past verbs, pre- and posttest group means for the whole language group were 2 and 4, while group averages for the phonological process group were 2 and 5, respectively. On the percentage of correctly used irregular past verbs, pre- and posttest group means for the whole language group were 7 and 15, while for the phonological group, means were 14 and 22, respectively. For the number of attempted irregular past verbs, pre- and posttreatment group means were 12 and 21 for the whole

Table 25

Significant F Ratios for Main Treatment Effects from Three-Way Analysis of Variance for Phonological and Language Measures Obtained from Three Bears Story

Measure	F ratio
Phonological:	
Initial cluster reduction	9.54
Language:	
[Syntactic/Morphological]	
Attempted regular past verbs	10.91
Correct irregular past verbs	24.61
Attempted irregular past verbs	8.74
Attempted subjective pronouns	10.77
[Semantic/Pragmatic]	
Responses	39.11
No responses	7.89
Direct Questions	39.24
Event/prompt ratio	9.74
Conversational turn/prompt ratio	13.96

Note. F = 5.99, df = 1,6; p < .05.

Table 26

Pretreatment (Pre) and Posttreatment (Post) Group Means for Phonological and Language Measures With Significant F Ratios for Main Treatment Effects from Storytelling of the Three Bears

	Treatment Type			
	Phonological		Whole Language	
	Pre	Post	Pre	Post
Phonological:				
Initial cluster red.	20	14	76	48
Language:				
[Syntactic/Morphological]				
Att. reg. past verbs	2	5	2	4
Correct irr. past verbs	14	22	7	15
Att. irr. past verbs	23	27	12	21
Att. sub. pronouns	19	23	10	14
[Semantic/Pragmatic]				
Responses	15	6	20	12
No Responses	.83	0	2.75	.17
Direct Questions	13	4	15	8
Event/prompt ratio	1.58	2.93	.94	3.01
Conversational turn/ prompt ratio	1.38	2.39	.91	2.06

Note. Red. = Reduced; Att. = Attempted; Reg. = Regular; Irr. = Irregular; Sub. = Subjective.

language group, and 23 and 27 for the phonological process group. With the number of attempted subjective pronouns, pre- and posttest group means for the language group were 10 an 14, while for the phonological group, means were 19 and 23, respectively.

With respect to semantic/pragmatic measures, as Table 25 indicates, both treatment groups showed a significant difference from pretreatment to posttreatment on the number of responses and no responses given by subjects, the number of direct questions given by the examiner, the event/prompt ratio, and conversational turn/prompt ratio. As shown in Table 26, the mean number of responses and no responses given by subjects, and direct questions given by the examiner decreased from pre- to posttest for both treatment groups. Pre- and posttest group means for the number of responses given by subjects were 15 and 6 for the phonological process group, and 20 and 12, respectively, for the whole language group. For the number of no responses given by subjects, pre- and posttreatment group means for the phonological process group were .83 and 0, while for the whole language group, means were 2.75 and .17, respectively. With the number of direct questions asked by the examiner, pre- and posttest group averages for the phonological group were 13 and 4, while for the language group, means were 15 and 8, respectively. On both the event/prompt ratio and the conversational turn/prompt ratio, both treatment groups

demonstrated significant increases from pre- to posttest. With the event/prompt ratio, pretreatment and posttreatment group means were 1.58 and 2.93, respectively, for the phonological process group, and .94 and 3.01 for the whole language group. With the conversational turn/prompt ratio, pre- and posttest group means for the phonological group were 1.38 and 2.39, while for the whole language group, means were .91 and 2.06, respectively.

Group Interaction Effects

The overall main effects shown may have resulted from larger improvements of one group with lesser or no improvements by the other group. This possibility is seen in the significant interaction effects. Table 27 presents significant F ratios for group interaction effects on measures obtained from the Three Bears story. Table 28 shows pretreatment and posttreatment group means for measures with significant F ratios for group interaction effects from storytelling of the Three Bears. Results indicate that the whole language group demonstrated a greater difference (increase) than the phonological process group in the mean number of events reported by subjects, the mean length of utterance (MLU) in morphemes, and the longest sentence in morphemes ($F = 5.99$, $df = 1,6$; $p < .05$).

As indicated in Table 28, pretest and posttest group means for the number of events reported were 21.25 and 29.67 for the phonological process group, while for the whole

Table 27

Significant F Ratios for Group Interaction Effects from Three-Way Analysis of Variance for Phonological and Language Measures Obtained from Three Bears Story

Measure	F Ratio
Semantic:	
Events	12.38
Syntactic:	
MLU in morphemes	6.81
Longest sentence in morphemes	18.42

Note. F = 5.99, df = 1,6; p < .05.

Table 28

Pretreatment (Pre) and Posttreatment (Post) Group Means for Measures with Significant F Ratios for Group Interaction Effects from Storytelling of the Three Bears

	Treatment Type			
	Phonological		Whole Language	
	Pre	Post	Pre	Post
Semantic:				
Events	21.25	29.67	11.50	30.42
Syntactic:				
MLU in morphemes	5.01	5.43	4.17	5.72
Longest sentence in morphemes	9.50	9.67	7.58	10.83

language group, means were 11.50 and 30.42, respectively. For the mean length of utterance (MLU) in morphemes, pretreatment and posttreatment group averages for the phonological group were 5.01 and 5.43, whereas for the language group, means were 4.17 and 5.72, respectively. With the longest sentence in morphemes, pre- and posttest group averages for the phonological process group were 9.50 and 9.67, while group means for the whole language group were 7.58 and 10.83, respectively. As results of the syntactic measures indicate, group means for the phonological process group remained mostly constant from pre- to posttreatment on both the MLU in morphemes and the longest sentence in morphemes, whereas the whole language group showed a significant increase from pre- to posttest on both of these measures.

Table 29 presents pretreatment and posttreatment mean number of morphemes in the longest sentence for each subject from the Three Bears story. These means were derived from data averaged over three days of pre-assessment and three days of post-assessment, as were means for all other measures. As results indicate, for subjects in the phonological process group, the range of sentence lengths remained static or constant from pre- to posttest, whereas subjects in the whole language group showed a wider range in sentence lengths and longer sentences from pretreatment to posttreatment.

Table 29

Pretreatment (Pre) and Posttreatment (Post) Mean Number of Morphemes in Longest Sentence for each Subject from the Three Bears Story

	Subject	Pre	Post
Phonological Process Group	S1	9.00	9.00
	S2	6.67	6.00
	S3	12.33	12.67
	S4	10.00	11.00
	Group Mean:	9.50	9.67
Whole Language Group	S5	6.00	9.00
	S6	9.33	14.33
	S7	8.00	10.00
	S8	7.00	10.00
	Group Mean:	7.58	10.83

Results of Weekly Connected Speech/Language Samples

As an ongoing measure of articulatory performance, daily connected speech/language samples were elicited by having subjects describe one or two situational pictures during 5-10 minutes of each treatment session. As there were three treatment sessions per week for each subject and six weeks for the treatment period, the connected speech/language sample from the middle session each week was transcribed and analyzed. Table 30 shows the Percentage of Consonants Correct for these weekly samples. Individual subject variation can be noted, with subjects showing varying degrees of improvement in the Percentage of Consonants Correct over time.

Table 30

Percentage of Consonants Correct for Weekly Connected Speech/Language Samples

		Weeks					
		1	2	3	4	5	6
Phonological Process Group	S1	73	73	86	80	73	70
	S2	59	80	72	75	64	77
	S3	63	76	71	76	70	65
	S4	81	89	89	86	93	95
Whole Language Group	S5	42	38	56	61	60	76
	S6	79	71	79	80	80	78
	S7	65	82	72	72	74	72
	S8	54	66	65	49	56	64

CHAPTER V

DISCUSSION

The purpose of this study was to compare phonological and language changes occurring in preschool, phonologically-impaired children when two different treatment procedures were employed: a phonological process targeting approach and a whole language approach. Overall, results of this study indicate that subjects in both treatment groups improved articulation performance. Subjects in the whole language group, however, showed a greater degree of improvement than those in the phonological process group. In addition, the whole language group showed larger gains in syntactic, morphological, semantic, and pragmatic expression.

Results of this investigation are discussed in reference to previous articulation treatment studies, clinical implications, and implications for future research. The following topics are presented in this chapter: (1) restatement of experimental questions, (2) single word performance on tests administered, (3) connected speech performance on construction of picture stories, relating familiar experiences, and telling of the Three Bears story, (4) language performance, (5) clinical implications, and (6) implications for future research.

Restatement of Experimental Questions

The following questions were addressed:

(1) Does a whole language treatment approach result in comparable improvements in single word performance as compared with a discrete phonological process targeting approach?

(2) Does a whole language treatment approach result in greater improvements in connected speech performance on higher level language tasks (e.g., storytelling, relating familiar experiences) as compared with a discrete phonological process targeting approach?

(3) Does a whole language treatment approach result in greater improvements in higher levels of language (e.g., syntax, semantics, pragmatics) as compared with a discrete phonological process targeting approach?

In order to answer these questions, comparisons were made of subjects' pretreatment and posttreatment performance on specific tests administered and on connected speech/language assessment via construction of picture stories, relating familiar experiences, and telling of the Three Bears story. Phonological and language measures were employed in each of these.

Single Word Performance On Tests Administered

Results of this study are in agreement with previous articulation treatment studies in demonstrating that generalization of correct sound production does occur across untreated items (Elbert & McReynolds, 1975, 1978; Hoffman, 1983; Powell & Elbert, 1984; Weiner, 1981), across word positions (McReynolds, 1972; Powell & McReynolds, 1969; Rockman & Elbert, 1984), and within sound sound classes (Costello & Onstine, 1976; Dinnsen & Elbert, 1984; Elbert & McReynolds, 1975; Hoffman, 1983).

In the present study, all subjects demonstrated improved general phonological performance during administration of the Templin-Darley Articulation Screening Test, The Assessment of Phonological Processes, and the Primary Articulation Survey. The whole language approach, however, resulted in greater degree of improvement than the phonological process approach. Furthermore, while targeting Cluster Reduction and Fronting provided improvement for the phonological process group on these specific phonological processes, this approach resulted in minimal improvement on non-targeted processes (i.e., Strident Deficiencies, Glide Deficiencies, and Stopping from the APP) analyzed as a measure of control. The whole language approach resulted in similar improvements on all phonological processes.

Minimal improvement shown by the phonological process

group on those processes not targeted in treatment (i.e., Strident Deficiencies, Glide Deficiencies, and Stopping) may be due partly to maturation, historical events, or other uncontrolled variables. There may have been some overlapping with Strident Deficiencies, that is, improvements with this error class may have resulted from practice provided to the phonological process group in production of [s] clusters in words, and therefore, generalization of learning may have occurred to [s] clusters or [s] singleton in words on the APP. Strident Deficiencies, however, involved errors on any of the strident phonemes, not only [s] or [s] clusters. There was no overlapping with Glide Deficiencies or Stopping errors, as these processes were unrelated to those targeted in the phonological process approach. The greater improvement of the whole language group on all of these phonological processes, including those that were targeted and non-targeted in the phonological process approach, is more likely attributable to the whole language treatment approach itself rather than to maturation or other uncontrolled variables.

The specificity of training effects for the phonological process group is in agreement with previous research (Elbert & McReynolds, 1985; Elbert, Shelton, & Arndt, 1967) demonstrating that generalization was confined to sounds within the classes being taught. For example, training on stops in final position in syllables resulted in

generalization only to untrained words containing stops in final position. McReynolds and Elbert (1981) examined generalization of Cluster Reduction in six misarticulating children. These children were trained on [s], [r], or [l] clusters in syllables. Results indicated that four of the six children demonstrated generalization to within-class clusters only. Training in correct production of a single /r/ allophone resulted in generalization to untrained /r/ allophones (Hoffman, 1983). While such studies have shown greater improvements for targeted rather than nontargeted aspects of phonological knowledge, unexpected generalization has occurred in these studies as well. Furthermore, generalization of learning during articulation training appears to be related to the child's phonological knowledge prior to onset of therapy. In particular, children show increased generalization to phonological forms inconsistently produced prior to therapy (Elbert & Gierut, 1986). From a generative phonological perspective, this aspect of learning has been explained vis a vis the child's understanding of underlying forms of words or morphemes (Dinnsen, 1984).

Results of this investigation are in agreement with theoretical contentions of the parallel distributed processing model (PDP) (Rumelhart & McClelland, 1986). Consistent with a model such as this, phonology should be viewed as being interrelated and interdependent with various other components of language (i.e., morphology, syntax,

semantics, and pragmatics). Phonemes are related to syllable shapes that are related to word forms that are related to propositions (i.e., meaningful relationships). Findings of treatment studies that show limitations on generalization of targeted aspects of phonology (e.g., syllable shapes) to lower levels of knowledge (e.g., phonemic inventory) and higher levels of knowledge (e.g., syntactic forms) support the parallel nature of this organization. Improvements at one level are related to improvements at all other levels - that is, they occur in parallel.

Such a parallel view of processing can better explain improvements shown by subjects in the whole language group who demonstrated improvements in various aspects of language (i.e., phonology, morphology, syntax, semantics, and pragmatics), than a discrete component view. Subjects receiving the phonological process targeting approach, based on a discrete component model, only showed improvements on the specifically trained phonological process (i.e., Cluster Reduction or Fronting) and showed nominal improvements on other components of language (i.e., syntax, semantics, pragmatics). This limitation on learning likely resulted from limited exposure to discrete performance levels in training (i.e., words, phrases, sentences).

Connected Speech Performance on Construction of Picture Stories, Relating Familiar Experiences, and Telling of the Three Bears Story

Several studies have shown that it is more difficult to control articulation as linguistic complexity increases from word to sentence to conversation (Menyuk & Looney, 1972; Panagos, 1974; Panagos, Quine, & Klich, 1979; Shriner, Holloway, & Daniloff, 1969). That is, as utterances increase in length and complexity, a greater number of articulation errors occur. Results of this study revealed that targeting specific phonological processes in word forms was less efficient at fostering generalization of articulation improvement in connected speech. These findings are in agreement with previous research (Dunn & Barron, 1982; Wright, Shelton, & Arndt, 1969) in demonstrating that subjects showed very little generalization of learned phonemes into connected speech. This limitation occurred in spite of practice provided in increasingly more complex output forms (e.g., words, phrases, and sentences) in the phonological process approach.

On tasks of describing situational pictures and relating familiar experiences, more subjects in the whole language group demonstrated statistically significant improvement on the Percentage of Consonants Correct from pretreatment to posttreatment than those in the phonological process

targeting group. That is, two subjects out of four in the whole language group (on both picture stories and experiences), and one subject out of four in the phonological process group (on picture stories only) showed significant improvements on this general phonological measure.

This pattern of improvement was consistent with particular processes targeted. More subjects in the language group demonstrated significant improvements on connected speech activities than those in the phonological process group. Whole language training resulted in three out of four subjects (on the picture stories) and two out of four subjects (on the experiences) who demonstrated significant improvements by decreasing the percentage of occurrence of Cluster Reduction from pre- to posttreatment. Only one subject in the phonological process group, however, (on the experiences only) showed a significant improvement on this process, even though the process was specifically targeted in treatment. Two subjects out of three in the whole language treatment group who demonstrated the Fronting process showed significant improvement by decreasing the percentage of occurrence of this process on the picture stories' task. The subject in the phonological process group, however, for whom Fronting was specifically targeted in treatment, did not show significant improvement on either the picture stories' or experiences' task. More subjects in the whole language group also demonstrated significant

improvement with the number of consonant clusters attempted from pre- to posttreatment than subjects in the phonological process group.

These results are similar to those shown by Matheny and Panagos (1978). These investigators trained one group of children to correctly articulate error phonemes and a second group to correctly produce a variety of syntactic forms. The children in the syntactic-training group showed similar speech production improvements to the articulation-training group. Thus, targeting of higher-level aspects of speech/language organization appears to incorporate lower levels, providing for simultaneous improvements in these levels.

On the telling of the Three Bears story, results from three-way analysis of variance for main treatment effects and group interaction effects revealed that initial cluster reduction was the only phonological measure in which both treatment groups showed a significant difference from pre- to posttreatment. Both treatment groups improved by decreasing the number of initial consonant clusters reduced from pretreatment to posttreatment.

The failure of discrete language-form treatment approaches to promote use of these forms in tasks not specifically taught is a major issue and continuing problem for this type of treatment. Johnston (1988) suggested that failure of generalization may be due to the child's formation

of a "speech therapy register", that is, a manner of speaking that the child uses in specific tasks and at specific levels of analysis. The children in the whole language group received more training aimed at improved speech at a narrative level during the course of treatment than did the phonological process group. The narrative task took the form of a conversation between child and clinician about a particular topic via situational pictures depicting stories. Greater improvements shown by subjects in the whole language group may be due to incorporating articulation improvement in a context that is more naturalistic, promoting the development of better phonology in the child's conversational register.

Results of the connected speech analysis can be explained with respect to the PDP model. That is, the whole language approach that fostered articulation improvement in connected speech provided children with opportunities to refine articulation within the context of a communicative setting more similar to natural language development than techniques used when discrete components of language are targeted for remediation (Hoffman, Schuckers, & Daniloff, in press).

Language Performance

Previous descriptive research (Gross, St. Louis, Ruscello, & Hull, 1985; Smit & Bernthal, 1983) has demonstrated that phonologically-impaired children often show

deficits in other aspects of language, including syntactic, morphological, semantic, and pragmatic components. Several studies have shown evidence of an interrelationship between syntactic complexity and phonological structure in phonologically-impaired children (Panagos & Prelock, 1982; Panagos, Quine, & Klich, 1978; Paul & Shriberg, 1982; Shriner, Holloway, & Daniloff, 1969). It has been shown that as an utterance increases in linguistic complexity and length, articulation errors increase. Traditionally and currently, treatment programs have focused on perception and production activities, including teaching error phonemes in isolation and then incorporating the newly acquired sound into linguistically more complex units such as words, phrases, sentences, structured conversational activities, etc.

Subjects in the phonological process group demonstrated minimal changes on higher level language measures that may be due to uncontrolled variables. Subjects in the whole language group showed substantial improvements on higher levels of linguistic performance (e.g., syntax, semantics, pragmatics) that is more likely attributable to the treatment program than to maturation alone. Specifically, whole language training resulted in greater improvements by subjects on the expressive language subtests of Oral Vocabulary and Grammatic Completion from the Test of Language Development: Primary. Furthermore, on the tasks of

constructing picture stories and relating familiar experiences, not only did the whole language group collectively demonstrate greater improvement on syntactic, morphological, and pragmatic measures taken, but results of individual subject performance revealed that all subjects receiving whole language training individually displayed more significant differences on these measures than subjects receiving phonological process targeting.

Posttreatment analysis revealed that on telling of the Three Bears story, subjects in the whole language approach demonstrated more significant improvements than those in the phonological process approach on the mean number of events reported in the story, the mean length of utterance (MLU) in morphemes, and the longest sentence in morphemes at the .05 level of confidence. Results indicated that whereas subjects in the phonological process group showed negligible changes in MLU and with the longest sentence in morphemes, subjects in the whole language group demonstrated both longer sentences and a wider range in sentence lengths from pretreatment to posttreatment.

Consistent with a parallel processing viewpoint, speech acts occurring in a social environment influence the child's cognition. Language is produced and perceived primarily at a meaningful level within a communicative setting. Data from normal language acquisition show that various components of language (i.e., phonology, morphology, syntax, semantics, and

pragmatics) develop in parallel (Anisfeld, 1984; Nelson, 1985; Scollon, 1979). Normally-developing children alter the phonological form of utterances to enhance their communication during repeated attempts to help a listener understand their intent (Scollon, 1979). A similar finding has been made for phonologically-impaired children who increase phonological complexity of their utterances when an adult listener responds by saying, "What did you say?" (Weiner & Ostrowski, 1979). Furthermore, phonologically-impaired children produce fewer articulation errors during production of conversational comments (i.e., new information) than during restatements of conversational topics (i.e., old information) (Campbell & Shriberg, 1982). The whole language treatment approach focuses upon this level of meaning interpreted by the listener. The child is asked to reformulate utterances that are unclear or fail to incorporate needed linguistic detail. It is this necessity to communicate to a listener that provides the impetus for promoting change in the child's phonological organization. Data from this study suggest that this need to communicate may be stronger when a whole language approach is employed than with a discrete phonological targeting approach.

Qualitative Language Differences

Qualitative language differences were also noted during posttreatment analysis. Results of posttreatment assessment

revealed that examples of higher linguistic functioning occurred more frequently in the stories of subjects in the whole language treatment group than in the phonological process targeting group. Some examples of these are as follows: (1) use of introduction (Once upon a time ...); (2) causality relationships (That boy is having red dots all over him 'cuz he's sick); (3) time relationships (After she wake up, she jumped out the window); (4) inferencing ('Cuz she don't want the cat to fall); (5) predicting ('Cuz the rock might kill him); (6) giving names and attributes to characters in the picture (Rachel is standing in the sprinkler; One red-headed girl like Miss JoAnn); (7) role-playing and inferencing (I wanna sleep in the baby bed because I'm a baby); (8) interpretation (I sad because somebody broke my chair); (9) creative expression (He double-bounced right up here [referring to kitten up in a tree - this child previously had an accident while jumping on a trampoline]).

Clinical Implications

The theoretical basis of this study suggests that language should be viewed as a synergistic system of which phonology is an integrated component, not a discrete, independent process. This study purports that interrelationships and interdependence exist among various aspects of linguistic behavior (i.e., phonology, morphology,

syntax, semantics, and pragmatics). Results of this study are in agreement with previous research (Daniloff, Schuckers, & Feth, 1980; Schwartz, Leonard, Folger, & Wilcox, 1980; Shriner, Holloway, & Daniloff, 1969) in supporting a synergistic view of language and confirming that treatment programs consider phonological disorders and linguistic aspects in an interrelated manner, not as individual, discrete entities. Data from this study are also in agreement with contentions of the parallel distributed processing model (PDP) model.

Results of this study support previous research (Gross et al., 1985; Smit & Bernthal, 1983) in demonstrating that children with more severe articulation disorders often have concomitant language problems. These findings suggest important implications for clinical management of phonologically-impaired preschool children. Deficits in both phonology and language should be considered and addressed when planning treatment programs for these children.

Traditionally, treatment programs for children with phonological disorders have focused on remediation of misarticulated sounds or classes of sounds (e.g., phonological processes). Findings of this investigation, however, suggest that teaching specific phonological skills as currently described in various treatment procedures (Elbert & Gierut, 1986; Hodson & Paden, 1983; Weiner, 1981) may not be as effective as a whole language approach which

targets higher level linguistic relationships (e.g., syntax, semantics, pragmatics). The whole language approach, which incorporated construction of narratives with feedback of a semantic nature, resulted in greater improvements in both phonological performance and linguistic performance (e.g., syntactic and pragmatic measures) than the phonological process approach which targeted a specific phonological process.

These findings are in agreement with those of an experimental study (Hoffman, Norris, & Monjure, 1988) and have important clinical implications. Minimal pair contrast training (i.e., phonological process approach) may have been less effective than the whole language approach because it utilized a finite number of words labelling pictures which may not be utilitarian to the child. That is, the child may not even use some of these words in his everyday language. It is possible that articulation generalization does not occur as readily with this type of approach because words, phrases, and sentences used are more artificial and contrived and unlike utterances the child will use and encounter during adult/child communication. In order to be maximally effective, phonological practice should include familiar experiences in the child's life, thus incorporating the total language process, that is, pragmatics, semantics, syntax, and phonological characteristics of words used (Hoffman, Norris, & Monjure, 1988).

Results of this experiment suggest that treatment for the phonologically-impaired child should focus on the child's formulation and expression of meaningful language in a communicative setting (Hoffman, Schuckers, & Daniloff, in press). Whole language activities used in this study, such as construction of picture stories or narratives, can be easily and effectively incorporated into group treatment settings and may be more enjoyable for both child and clinician than the drudgery of drill activities traditionally used in articulation treatment. In a futuristic sense, whole language treatment for these children should prove to be more effective and expeditious by resulting in greater improvements in both phonological and language performance.

Implications for Future Research

Additional research is needed in order to better understand the relationship between phonology and language and subsequently improve treatment programs for young, phonologically-impaired children who also display difficulties in language performance. Further research is needed that is directed at comparing a more direct articulation approach with a whole language approach. Future studies could incorporate the following: (1) a larger number of subjects in treatment groups; (2) an extended treatment program (e.g., 6-9 months); (3) a longitudinal study in which preschool phonologically-impaired children are followed

over a period of time (e.g., 1-3 years); (4) various and other age groups (e.g., 5-6 year olds, 7-8 year olds, 9-10 year olds), who not only exhibit misarticulation in speech, but also exhibit deficiencies in expressive language performance. Many of these older children may be labelled "learning disabled" or "language disordered" and are likely to be having difficulties with reading and language arts.

Additional suggestions for future studies include: comparing whole language training with a discrete syntax targeting approach; manipulating variables in the whole language approach such as feedback given to the children; analyzing and comparing qualitative language differences from subjects in each treatment group; employing the whole language approach with various subpopulations (e.g., hearing-impaired, motorically-impaired, aphasics). For example, a future study could incorporate the whole language approach with young hearing-impaired children to see if articulation and language are improved when this approach is utilized as opposed to focusing on articulation training or discrete components of language (e.g., syntax, semantics).

Treatment studies are needed that examine children's generalization to connected speech (e.g., storytelling, relating familiar experiences) in order to determine effectiveness of treatment programs. An extensive review of the literature on articulation treatment studies revealed that very few studies examined generalization of

articulation improvement to connected speech including storytelling, describing pictures, etc. as incorporated in this study. In order to develop an effective treatment program to meet the specific needs of the phonologically-impaired child and to measure the effectiveness of the specific treatment program employed, it should be paramount that speech/language clinicians and researchers analyze samples of the child's connected speech/language during pre- and posttreatment assessment.

If results of subsequent studies indicate that the whole language approach is more effective than direct articulation treatment (e.g., phonological process targeting), then this would give stronger support to the theoretical contentions of this study. Results of this study and future studies will provide additional insight into understanding the interrelationship between phonology and language. This study and others like it will hopefully encourage the pursuit and realization of better, more efficient treatment programs for young phonologically-impaired children.

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APPENDIX A

Parental Consent Form

College of Arts and Sciences
Department of Speech Communication,
Theatre and Communication Disorders
LSU Speech and Hearing Clinic
LOUISIANA STATE UNIVERSITY AND AGRICULTURAL AND MECHANICAL COLLEGE
BATON ROUGE · LOUISIANA · 70803-2606
(504) 388-2545

CONSENT FORM

TITLE: Articulation Generalization In Preschool Children: A Comparison Of Two Treatment Procedures

Dear Parents:

INVITATION TO PARTICIPATE

Your child is invited to participate in a research project to help us learn how we can most effectively help young preschool children with severe articulation problems, that is, having multiple sound errors noted in their speech. Your child has been selected on the basis of his/her speech and language skills.

PURPOSE OF THE STUDY

Young preschool children who are in the stage of developing speech and language processes will often omit sounds (e.g., say "pay" for "play") or substitute sounds (e.g., say "tat" for "cat"). If their speech consists of several of these (and other) errors, it becomes difficult for them to be understood by parents, teachers, friends, etc. Therefore, speech/language therapy is often recommended for these children. In this research project we will be examining and comparing the effects of two different approaches in articulation treatment at the LSU Speech and Hearing Clinic.

EXPLANATION OF PROCEDURES

Your child will be seen for speech/language therapy services at the LSU Speech and Hearing Clinic for 30-60 minutes approximately three times per week. Appropriate activities and materials will be utilized in the treatment sessions in order to enhance your child's speech and language skills. Your child will be given appropriate speech/language tests before and after the training program to determine the amount of progress made. We are asking your permission to audio- and/or video-tape record your child during testing and/or treatment sessions.

POTENTIAL RISKS AND BENEFITS

This study does not involve any risk to your child. Activities used in therapy should be fun for your child and will take place in a caring, non-threatening environment.

ASSURANCE OF CONFIDENTIALITY

Information that we collect from this study will be treated confidentially. Identification numbers rather than names will be used on records; your child's name will not appear anywhere in

the research reports.

WITHDRAWAL FROM THE STUDY

Participation is voluntary on your part and on the part of your child. If you decide to participate, you are free to withdraw your consent and discontinue with the research project at any time.

OFFER TO ANSWER QUESTIONS

If you have any questions, please feel free to contact one of the researchers listed below. If you are willing to allow your child to participate, please sign and return this form to us. Thank you for your interest in this project.

YOU ARE VOLUNTARILY MAKING A DECISION WHETHER OR NOT TO ALLOW YOUR CHILD TO PARTICIPATE IN THE RESEARCH PROJECT DESCRIBED ABOVE. YOUR SIGNATURE INDICATES THAT, HAVING READ THE INFORMATION PROVIDED ABOVE, YOU HAVE DECIDED TO PERMIT YOUR CHILD TO PARTICIPATE. YOU WILL BE GIVEN A COPY OF THIS CONSENT FORM TO KEEP.

_____ _____

Signature of Parent/Guardian Date

_____

Relationship to Subject

JoAnn Monjure

JoAnn Monjure, M.C.D.
Doctoral Student
LSU Speech and Hearing Clinic

Janet Norris

Janet Norris, Ph.D.
LSU Speech and Hearing Clinic

Paul Hoffman

Paul Hoffman, Ph.D.
LSU Speech and Hearing Clinic

APPENDIX B

MINIMAL PAIRS

CLUSTER REDUCTION

[s] clusters:

pin-spin

top-stop

wing-swing

tool-stool

Kate-skate

leave-sleeve

no-snow

wrong-strong

key-ski

ring-string

pool-spool

nail-snail

pear-spare

[l] clusters:

lip-clip

loud-cloud

lock-block

[r] clusters:

room-broom

row-grow

red-bread

Rick-brick

Ross-cross

FRONTING

tie-thigh

tank-thank

torn-thorn

tick-thick

tree-three

Dee-the

Den-then

day-they

dumb-thumb

drew-threw

some-thumb

sick-thick

sinking-thinking

sat-that

sew-throw

APPENDIX C

Significant T-test Values for Phonological and Language Measures

Measure		Subject	Trt. Group	t value
Phonological:				
PCC	(PS)	S4	P	2.99 **
		S5	L	7.72 ***
		S6	L	4.45 ***
	(EX)	S5	L	16.35 ***
		S7	L	3.34 **
Clusters Red.	(PS)	S5	L	3.57 **
		S6	L	4.89 ***
		S7	L	2.84 *
	(EX)	S4	P	2.88 *
		S5	L	5.35 **
		S7	L	4.59 ***
Clusters Att.	(PS)	S2	P	2.98 **
		S7	L	3.38 **
		S8	L	3.46 **
	(EX)	S2	P	4.79 ***
		S5	L	3.33 **
		S6	L	2.65 *
		S8	L	2.96 **
Fronting	(PS)	S7	L	3.11 **
		S8	L	2.23 *
Language:				
Plural nouns attempted	(PS)	S7	L	2.32 *
	(EX)	S2	P	3.89 **
		S3	P	2.17 *
		S5	L	3.66 **
		S7	L	2.82 *
		S8	L	5.74 ***
Regular past verbs attempted	(EX)	S3	P	4.00 **
Irregular past verbs attempted	(PS)	S5	L	2.97 **
	(EX)	S3	P	2.26 *

Measure		Subject	Trt. Group	t value
Third per. sing. verbs attempted	(EX)	S1	P	3.02 **
		S5	L	3.02 **
Sub. pronouns attempted	(PS)	S5	L	4.69 ***
		S8	L	4.31 ***
	(EX)	S3	P	2.84 *
		S5	L	2.24 *
Obj. pronouns attempted	(PS)	S5	L	2.15 *
	(EX)	S1	P	2.57 *
		S5	L	4.00 **
		S7	L	3.40 **
		S8	L	2.30 *
Poss. pronouns attempted	(PS)	S5	L	3.22 **
		S6	L	3.16 **
	(EX)	S3	P	3.98 **
Events	(PS)	S1	P	2.43 *
		S4	P	5.33 ***
		S5	L	9.92 ***
		S6	L	3.28 **
		S7	L	4.48 ***
		S8	L	7.82 ***
	(EX)	S2	P	2.40 *
		S5	L	5.61 ***
		S6	L	2.40 *
		S7	L	5.65 ***
		S8	L	4.04 **
Responses	(PS)	S6	L	2.37 *
		S7	L	3.90 **
	(EX)	S2	P	3.96 **
		S4	P	2.56 *
		S5	L	2.86 *
		S6	L	3.28 **
		S7	L	3.84 **
		S8	L	4.76 ***
No Responses	(PS)	S1	P	3.98 **
		S4	P	4.71 ***
		S7	L	2.60 *
		S8	L	3.97 **
	(EX)	S2	P	3.55 **
		S8	L	2.20 *
Prompts	(PS)	S3	P	3.20 **
		S4	P	4.30 ***
		S5	L	4.07 **

Measure		Subject	Trt. Group	t value
	(EX)	S1	P	2.42 *
		S7	L	2.37 *
Clozes	(PS)	S5	L	3.68 **
		S6	L	2.30 *
	(EX)	S2	P	3.95 **
		S6	L	3.10 **
		S7	L	2.35 *
Direct Quest.	(PS)	S1	P	2.23 *
		S7	L	2.20 *
	(EX)	S5	L	3.74 **
		S7	L	2.16 *
		S8	L	3.96 **
Event/prompt ratio	(PS)	S3	P	3.67 **
		S5	L	5.04 ***
		S6	L	2.70 *
		S7	L	5.27 ***
		S8	L	9.29 ***
	(EX)	S5	L	5.20 ***
		S7	L	5.40 ***
		S8	L	4.15 **
Conversational turn/ prompt ratio	(PS)	S1	P	2.86 *
		S3	P	2.85 *
		S4	P	2.96 **
		S5	L	3.96 **
		S6	L	3.83 **
		S7	L	5.52 ***
		S8	L	7.36 ***
	(EX)	S2	P	4.82 ***
		S5	L	6.79 ***
		S7	L	5.70 ***
		S8	L	5.36 ***

Note. PCC = Percentage of Consonants Correct; (PS) = Picture Stories; (EX) = Experiences; Red. = Reduced; Att. = Attempted; P = Phonological; L = Language.

* $p < .05$. ** $p < .01$. *** $p < .001$.

CURRICULUM VITAE

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PERSONAL DATA

Date of Birth: August 14, 1953
Place of Birth: New Orleans, Louisiana
Marital Status: Single

EDUCATION

Ph.D. Louisiana State University, Baton Rouge, Louisiana, 1989
Major: Speech Pathology
Minor: Linguistics

M.C.D. Louisiana State University Medical Center, Shreveport, Louisiana, 1979
Major: Speech Pathology

B.S. Louisiana State University, Baton Rouge, Louisiana, 1975
Major: Speech Pathology

PROFESSIONAL EXPERIENCE

Spring Semester of 1989:	Speech/Language Therapist East Baton Rouge Parish School System Baton Rouge, Louisiana
1987-1988:	Speech and Auditory Training Teacher Louisiana School For the Deaf Baton Rouge, Louisiana
Spring Semester of 1987:	Research Assistant Department of Communication Disorders Louisiana State University
Fall Semester of 1986:	Speech and Language Specialist Caddo Parish School System Shreveport, Louisiana

1985-1986:	Teaching Assistant Department of Communication Disorders Louisiana State University
Summer of 1985:	Traineeship in Speech Pathology at Gulfport/Biloxi V.A. Medical Center Gulfport/Biloxi, Mississippi
1984-1985:	Research Assistant and Clinical Supervisor Department of Communication Disorders Louisiana State University
1980-1984:	Teacher of Young Severe Language Disordered Children and Teacher of Non-Categorical Preschool Handicapped Children, Alexander Speech Center, Caddo Parish School System, Shreveport, Louisiana
1976-1980:	Speech and Language Specialist, Sunset Acres Elementary School (Hearing Impaired/Deaf), Caddo Parish School System, Shreveport, Louisiana
1975-1976:	Speech and Hearing Clinician, Jefferson Parish School System, Gretna, Louisiana

Completed 15 hours of coursework in Sign Language (including ASL, Signed English, and Cued Speech)

PROFESSIONAL ORGANIZATIONS AND CERTIFICATIONS

American Speech, Language, and Hearing Association
Louisiana Speech and Hearing Association
Louisiana License in Speech Pathology
Louisiana Teacher Certification
Certified in Learning Disabilities
Certified Supervisor of Student Teaching
Certificate of Clinical Competency-Speech Pathology
PICA (Porch Index of Communicative Ability) Certification

HONORS

1984-1986: Louisiana Scottish Rite Foundation Scholarship
1984-1986: L.S.U. Board of Supervisor's Scholarship
1984-1987: Teaching Assistant; Research Assistant
Department of Communication Disorders
Louisiana State University

PUBLICATIONS

Hoffman, P. R., Norris, J. A., & Monjure, J. (1988). Comparison of process targeting and whole language treatments for phonologically-impaired preschool children. Manuscript submitted for publication.

PRESENTATIONS

Hoffman, P. R., Norris, J. A., & Monjure, J. Phonological improvement as a result of language therapy. Paper presented at the American Speech-Language-Hearing Association Annual Convention, Boston, 1988.

Monjure, J. Articulation generalization in preschool children: A comparison of two treatment procedures. Student Forum, Louisiana Speech-Language-Hearing Association Fall Conference, 1987.

Monjure, J., & Hoffman, P. R. Deaf adults' coarticulation of [s] with following vowels. Paper presented at the American Speech-Language-Hearing Association Annual Convention, Detroit,1986.

COURSES TAUGHT

SPCH 1050 Introduction to Speech, Language, and Hearing Disorders

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DOCTORAL EXAMINATION AND DISSERTATION REPORT

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Major Field: Speech

Title of Dissertation: Phonological and Language Improvements In Preschool Children: A Comparison of Phonological Process Targeting and Whole Language Training

Approved:

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

Date of Examination:

February 2, 1989