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A PHONOLOGICAL APPROACH TO REMEDIATION: AN APPLIED BEHAVIOR ANALYSIS

A Thesis

by

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ABSTRACT

A PHONOLOGICAL APPROACH TO REMEDIATION:
AN APPLIED BEHAVIOR ANALYSIS. (December 1985)
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The purpose of this study was to determine the effectiveness of Hodson's phonological remediation program over a period of five months, on three severely phonologically impaired children. The children were all kindergarten students who had been identified as severely phonologically impaired by the school speech/language pathologist using the Assessment of Phonological Processes.

In Hodson's phonological remediation program, each subject's goals involved facilitation of certain phonological patterns. Phonemes in carefully selected words were used to increase auditory and kinesthetic awareness of phonological patterns. Typically, each pattern was targeted for a few sessions at a time, incorporating a succession of phonemes in words within the pattern. Each of the time periods during which a group of patterns was targeted was referred to as a cycle. Most patterns were targeted one or more times. Each cycle became increasingly more challenging for the subjects as more difficult phonemes within a pattern were added.

The results of the program showed that Christy (Subject 1) made progress. Her CPD was reduced from 55.7 which is considered severely phonologically impaired to 40.8 which is considered moderately phonologically impaired. Further, the results showed that the percentage of occurrence for all targeted major deficient patterns was lowered.

Holly (Subject 2) also showed significant progress during her remediation program. Her CPDS was reduced from 60.2 which is considered severely phonologically impaired to 23.60 which is considered mildly phonologically impaired. By the end of the five month program, she was showing good carry-over into conversation of most targeted patterns and based on the results of the APP, she was dismissed from the program.

Mikie (Subject 3) made limited progress with his remediation program. Although his CPDS did not change significantly from pretest to posttest (52.6 to 50), the percentage of occurrence scores for some of the major deficient patterns was lowered. Results also showed that the miscellaneous pattern of stopping was suppressed slightly.

Utilizing a multiple baseline across subjects design the analyses of the study showed that all three subjects made progress at the word and sentence levels and that two of the subjects made progress at the conversation level. These results show that Hodson's remediation program can be an effective and sometimes expedient method of phonological remediation.

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Chapter 1

INTRODUCTION

Since 1970, speech-language pathologists have begun to recognize the special needs and problems of children with the most severe sound production problems and as a result, have changed the way in which these problems are remediated. The majority of these problems have come to be viewed as disorders in the development of the phonological system. As such, they are considered to be language disorders rather than speech disorders, since they involve an incomplete mastery of the rules of sound selection and production. In contrast, the term "articulation disorder" has been narrowed to refer to the inability to make the necessary movements for reaching the target position of sounds.

In the past, these unintelligible children have been enrolled in therapy programs that targeted one phoneme at a time, and the therapy program could last five to six years or more. Contributions, however, in the areas of distinctive features (Blache, 1978; Singh, 1978), phonological rules (Compton, 1978) and phonological processes (Ingram, 1976; Shriberg & Kwiatkowski, 1980) have helped speech-language pathologists to develop more efficient remediation programs for these children. These remediation programs focus on the phonological patterns which are in error rather than on isolated sound stimulation.

In the mid 1970s, Hodson and Paden (1983) developed an experimental program that was designed especially for children with the most severe sound production problems. The program operated for six years and included over 100 children between the ages of three and eight years. The children were seen in a clinical setting, once a week, with the average length of their weekly sessions being 75 minutes. The children involved in this program were all dismissed within 18 months or less with intelligible speech. The results from this program were recorded in the form of case studies with data collected by administering pre- and posttests. By gathering data only on two occasions, Hodson and Paden did not rule out threats to internal validity, such as maturation.

In gathering therapy outcome data, it is important to choose an appropriate research design, one that allows for a controlled and valid study. The single-subject design is a controlled research design that rules out threats to internal validity. In addition, this research approach addresses the issue of accountability, and meets the increasing demand for professionals to demonstrate the effectiveness of their treatment programs. Since single-subject research is treatment-oriented, its application by researchers to the study of communication disorders may result in information that will assist speech-language pathologists in becoming more accountable. Speech-language pathologists may be able to use the results of these carefully controlled studies of the communication-handicapped to assist them in formulating treatment programs for clients with similar characteristics.

Statement of the Problem

The purpose of this study was to determine the effectiveness of the Hodson Remediation Program (HRP), over a period of five months, on three severely phonologically impaired children.

Limitations

1. This study was limited to three subjects, ages five to six years. All were severely phonologically impaired and attended the same elementary school.

2. Each subject was seen by the same speech-language pathologist, five times a week for one hour sessions.

Delimitations

To the extent that the subjects selected for this study were not representative of the phonologically impaired population at large, results will not be generalizable beyond the sample investigated.

Assumptions

The following assumptions were made in this study:

1. That the speech-language pathologist providing the remediation program was qualified to carry out all procedures.

2. That the Assessment of Phonological Processes (Hodson, 1980) is a reliable and valid assessment on whose results an appropriate remediation program may be planned.

Research Questions

The following three questions about the effectiveness of the HRP were addressed:

1. Will the subjects show an improvement in intelligibility at the word level as a result of the HRP?

2. Will the subjects show an improvement in intelligibility at the phrase level as a result of the HRP?

3. Will the subjects show an improvement in intelligibility in conversation as a result of the HRP?

Chapter 2

REVIEW OF LITERATURE

Nature of Phonology

The phonological component of language includes two levels. The bottom level involves overt speech or speech which is heard and produced. The top level involves covert speech, the formulation of sequences of sounds based on knowledge of the phonological system of language. Most adults have become so accustomed to hearing and producing speech that they need to be reminded that there is a covert level of knowledge guiding overt speech. For example, they may find it hard to recall more than four or five of the phonological rules of language, even though they follow these rules every time they speak (Edwards & Shriberg, 1983).

The covert level of the phonological component has two features: (a) a systematic repertoire of meaningful sounds (phonemes); and (b) a finite set of rules defining how these phonemes can be arranged (Edwards & Shriberg, 1983). For example, standard American English has 42 phonemes and adheres to such rules as requiring the plural morpheme to be produced as /əz/ when following the sibilant sounds /s, z, ʃ, ʒ, tʃ, dʒ/. These rules of phoneme combination have been the focus of considerable recent study, especially in the area of child phonology.

The overt level of the phonological component is composed of four features: segments, suprasegmentals, syllables, and phonotactics. Segments or speech sounds are the fundamental structures of the phonology of a language. Phonologists are interested in learning which segments are "meaningful" in a language and how these meaningful segments are represented at the covert level of phonology (Edwards & Shriberg, 1983).

Suprasegmentals or prosodic elements differ from sound segments in that they are "distributed over" a string of segments, syllables, or words. Length, tone (intonation) and stress are suprasegmentals. Length refers to the amount of time that a sound lasts. Tone and intonation are related to the rate of vibration of the vocal folds which can be controlled by the rate of airflow through the glottis and by the tension of the muscles of the larynx. Stress is related to increased muscular effort and subglottal pressure (Lehiste, 1970). Increased effort enhances the intensity of the sound wave; thus, stressed syllables are perceived as being louder than unstressed syllables.

Syllables have three parts: an onset (or releasing consonant), a nucleus, and an offset, also called the arresting consonant. The only part of a syllable that must be present is the nucleus. In other words, the most important part of a syllable is the vowel which takes the stress (Edwards & Shriberg, 1983).

Phonotactics refers to the inventory of distinctive sound segments of a language and the rules for combining those segments. The English language has several rules concerning where specific sounds

can occur. For example, /ŋ/ is always in the final position of a syllable as in "ring" and "singer" (Edwards & Shriberg, 1983).

Since 1970, one of the major concerns of phonology has been the study of phonological processes. A phonological process refers to any systematic sound change that affects a class of sounds (e.g., velars) or a sound sequence, such as /s/ plus sonorant /sw, sl/. Weiner (1979) identified three major phonological process categories: syllable structure processes, harmony processes, and feature contrast processes. Syllable structure processes simplify the structure of syllables. Through the use of this process, there is a tendency toward reducing adult forms in the direction of CV syllables. Harmony processes tend to create internal symmetry within words. Symmetry is achieved when a sound becomes similar to another sound within the word (e.g., dog /gag/), or when there is duplication of a syllable within a word (e.g., bottle /baba/). Feature contrast processes include substitution errors and account for the replacement of one sound by another without reference to neighboring sounds (e.g., sun /tʌn/).

Children use phonological processes as they acquire their phonological systems. They cannot learn immediately all the phonemes of their language, so they gradually move from the mastery of simpler sounds to more complex ones. They use the few sounds and sound patterns they have in place of the ones they have not yet mastered, or simply omit sounds and sequences. Children make these substitutions or reductions in generally predictable or systematic ways (Hodson & Paden, 1983).

Contributions to Child Phonology

Three major contributions to the study of child phonology focus on the systematic nature of children's sound productions. These include the notions that: (a) sounds are considered to be made up of groups of distinctive features (Jakobson, Fant, & Halle, 1952; Chomsky & Halle, 1968; Singh, 1976); (b) children use strategies to reduce a complex adult language model to levels with which they can cope; and (c) various word forms may be the output of the same phonological rule (Smith, 1973; Compton, 1975).

Until the 1980s, most speech-language pathologists believed that sound production problems were a result of phonetic rather than phonemic differences. Although they noted whether error sounds were members of a traditional sound class, such as velars, they did not capitalize upon the systematic nature of phonemic inadequacies. For example, they did not account for the regular variations in sound production patterns through the use of distinctive features, phonological processes, or phonological rules.

Compton (1970) and Oller (1973) were among the first to show that children with abnormal speech had phonological systems which were just as structured and regular as children with normal speech. Their sound repetoires were based upon systematic alterations from the adult model. Compton and Oller found that many of the processes observed in disordered speech were the same as those which younger normal children used. Children's productions of words not yet said were predictable, providing their underlying system had been ascertained, and they had not already experienced intervention which

might have contaminated their system. When investigators realized that even unintelligible speech had regular structure, the way was paved for a phonological approach to remediation.

Phonological Approaches to Remediation

Phonological approaches to remediation depend on the systematic nature of sound production deviations. They target the basic sound system rather than focusing on individual sound errors and perfecting phoneme segments. For example, a failure to produce /s/ may be the result of different processes in operation in different word contexts. The /s/ could be omitted at the end of words because of postvocalic singleton obstruent omissions. It might even be replaced by /t/ because of stopping. Teaching /s/ as an isolated unit, therefore, does not assure its acceptable use in all situations. Remediating a phonological process, however, may influence all of the sounds that are similarly affected, providing some other process does not interfere (Hodson & Paden, 1983). Suggestions for remediation procedures based on phonological principles have begun only recently to appear in the literature. So far, these have consisted of specific techniques for perception and production training. These techniques included the application of distinctive features and phonological processes.

Application of Distinctive Features to Phonological Remediation

Weiner and Bankson (1978) used distinctive features to train underlying phonological rules. An assumption underlying their approach is that when children can successfully produce the positive and negative aspects of the target feature in a minimally

contrasting pair of sounds (e.g., k/g), generalization of correct feature usage should affect other phonemes in which the feature is in error. By teaching a feature, all the error phonemes within the feature class should improve without any direct treatment. In contrast to other approaches, this technique attempted to teach a feature (frication), not in the context of a single sound, but in a variety of sounds containing the feature. Weiner and Bankson developed a 10 step paradigm for teaching children to associate a particular concept with a sound feature (e.g., frication - "running water" / stopping - "dripping water"). Thus, the clinician applied a label to the phonetic property. Their 10 step paradigm was as follows:

1. Teach the concept of the flowing and dripping nature of sounds;

2. Administer a probe-test consisting of 20 consonant-vowel-consonant (CVC) words beginning with a fricative;

3. Present auditorily 20 new CV and CVC words, 10 with dripping sounds and 10 with flowing sounds, so that the children can identify whether the syllables begin with the flowing or dripping sound. The criterion for moving to the next step was 18/20 on two consecutive trials;

4. Present probe-test again to assess progress;

5. Present stimulus word and exaggerate the initial sound for the child to imitate; criterion is 18/20 on two consecutive trials;

6. Present probe-test again;

7. Repeat Step 5 but do not exaggerate sound;

8. Present probe-test again;

9. Name the pictures of 20 objects containing target feature; criterion was 18/20 on two consecutive trials; and

10. Present probe-test.

Weiner and Bankson (1978) administered their training protocol to three subjects. One subject showed improvement while the other two did not. The subject who showed improvement proceeded quickly through Steps 1, 2, and 3. This subject produced correctly 16/20 responses on the first trial and reached criterion in five trials. In Step 7, the subject reached criterion in four trials and in Step 9, the subject reached criterion in two trials. Following Step 9, the probe-test of frication was readministered to determine whether generalization of frication had occurred on nontrained items. On the final test, the subject scored 19/20 correct, indicating that generalization had taken place. According to the authors, these findings were encouraging and indicated that it was possible for a child to focus on a given distinctive feature and bring that feature to a level of awareness within a relatively short period of time.

Two children were unsuccessful with this approach, and the authors stated that they were uncertain whether negative results were caused by the program itself or the inability of some children to benefit from this kind of approach. They believed that while bringing a feature to a level of awareness appears to be a sound strategy, changes and additions to the program need to be made (Weiner & Bankson, 1978).

Blache and Parsons (1980) developed another distinctive feature approach. In their method, words were used to teach distinctive features, rather than using distinctive features to teach the composition of words. In this approach, teaching the child the distinctive function of the feature is more important than the recognition and production of features or phonemes. Once a specific feature for remediation is chosen, a sound pair is selected to create minimal-pairs and four steps are followed to improve production:

1. Concept Training - involves presenting the child with the word pair and asking the child simple either/or questions to determine if he/she understands the meaning of the word. For the front/back contrast, the clinician might ask, "Does a key or tea open a door."

2. Comprehension Training - involves presenting the child with pictures of the word pair and requiring the child to point to the picture representing the word spoken by the clinician.

3. Production Training - involves requiring the child to produce spontaneously the words in response to pictures or objects. The child says the words and the clinician points to the objects named.

4. Generalization Training - involves incorporating the words into communication situations outside of remediation. The clinician uses traditional procedures to help the child generalize from treated words to untreated words, from words to connected speech, and from treatment settings to nontreatment settings.

Application of Phonological Processes to Phonological Remediation

Weiner (1981) based his remediation strategy on Stampe's (1969) theory of natural phonology. Stampe defined a phonological process as a rule in which an opposition in adult phonology, like voiced-voiceless, is realized as "that member of the opposition which least tries the restriction of the human speech capacity" (p. 443).

According to Weiner (1981), to be consistent with theoretical dictates of natural phonology, a remediation strategy must allow for the suppression of phonological processes manifested in the child's sound system by a method that is conceptual rather than motoric. Weiner described a conceptual method as one that encourages the suppression of phonological processes as a means to greater differentiation of expression. In a motoric strategy, specific articulatory descriptions of sound productions are provided and followed by practice to produce the speech sounds in error.

According to Weiner, a remediation approach that supports this conceptual method and allows for the suppression of phonological processes is minimal contrast therapy (Cooper, 1968) or the lexical approach (Ferrier & Davis, 1973). In this approach, pairs of words are selected which become homonyms in the child's sound production system. For example, when a child who deletes final consonants attempts to say the words "boat" and "bow," the surface form for both words will be "bow." The child is then requested to differentiate production of the words by altering pronunciation.

Based on this strategy, Weiner (1981) designed a treatment program for two children at the Child Speech Program at Pennsylvania

State University. In this procedure, minimal pairs were selected and the treatment strategy involved confronting the children with the fact that their productions of both target words were the same. The strategy was employed in a game situation and the objective was to show children that their misarticulations were resulting in miscommunication. For a child who employed final consonant deletion, the stimuli might be five pictures of a "boat" and four pictures of a "bow." The child had to get the clinician to pick up all five pictures by saying the word correctly. Weiner reported that his method was successful in reducing the frequency of the following processes in both children: final consonant deletion, stopping of fricatives, and fronting of velars. He also reported evidence of response generalization to nontreatment words.

During the mid 1970s, Hodson and Paden (1983) designed a different type of phonological remediation program for the highly unintelligible child. Over 100 children were evaluated and deficient patterns were identified for each child. The goals for each child's remediation involved facilitation of certain phonological patterns. Auditory and kinesthetic awareness of phonological patterns was increased by using phonemes in carefully selected target words. For example, voiceless word-final stops were used for facilitating emergence of final "consonantness." Concern was not with how the final consonant was produced, but with whether the child produced any final consonants in a CVC (consonant-vowel-consonant) word. When facilitating "syllableness," the correct number of syllables in

equal-stress compound words was elicited without requiring the production of precise phoneme segments with the syllables.

This remediation program is different from traditional programs. It involves targeting all critical patterns in succession, including liquids, rather than waiting for generalization to occur on each pattern or phoneme before progressing to the next pattern. This program attempts to help unintelligible children develop a total phonological system rather than trying to perfect a part of it.

Data on the effectiveness of Hodson's and Paden's program come primarily from a series of case studies. In their book Targeting Intelligible Speech, Hodson and Paden (1983) discuss six of these case studies. The seventh case study was published separately (Hodson, 1983). A review of these seven case studies follows. For a summary of the before and after Composite Phonological Deviancy Score for the seven subjects, Jerry, Danny, Tim, Allen, Bobby, Barry, and Candi, see Table 1.

Jerry, age five years and seven months, was enrolled in the program the summer before he entered first grade. He had received two previous years of speech remediation while attending an early childhood program and kindergarten. His phonological pretest indicated that his performance was at the severe level. His major deficient patterns included velar fronting, cluster reduction, stridency deletion, liquid deviations, and stopping. His remediation program required three cycles which covered a period of eight months.

Posttest results showed he had corrected all processes except liquid deviations. His speech was judged to be intelligible by his

Table 1

Pre- and Posttest Percentage of Occurrence and Frequency of Occurrence Scores for Hodson's Seven Subjects

	Percentage of Occurrence													
	Allen		Jerry		Danny		Tim		Bobby		Barry		Candi	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
BASIC DEFICIENT PATTERNS														
Syllable Reduction	10	0	0	0	0	0	5	0	71	5	0	0	0	0
Cluster Reduction	106	26	86	0	97	11	131	26	171	14	66	43	114	60
Obstruent Singleton														
Omission														
Prevocalic	8	0	3	0	11	3	42	5	89	0	8	3	3	0
Postvocalic	97	0	10	0	83	7	37	7	100	0	13	7	70	3
Stridency Deletion	100	0	59	0	91	14	100	18	100	2	25	14	100	5
Velar Deviations	100	0	54	0	46	4	100	17	100	4	21	8	50	17
Liquid Deviations														
/l/	92	69	100	38	85	23	92	31	100	54	77	38	100	62
/r,ɚ/	100	88	100	77	58	15	100	12	100	100	100	77	100	73
Nasal Deviations	53	0	0	0	0	0	5	0	89	0	5	0	58	0
Glide Deviations	60	40	30	0	10	30	50	0	50	10	90	80	100	70
Total	736	223	442	115	481	107	662	113	970	189	405	290	700	290
Average	74	22	44	12	48	11	66	11	97	19	41	29	70	29

Table 1 continued

	Frequency of Occurrence													
	Allen		Jerry		Danny		Tim		Bobby		Barry		Candi	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
OTHER LEVEL 1 and 2 PATTERNS														
Vowel Deviation	5 1	4 1			5 1		1		14 4		4 1	1	12 4	2
Prevocalic Voicing	14 4	2					6 2				2	1	14 4	0
Prevocalic Devoicing		3 1		4 1	5 1	4 1					5	4 1	25 6	4 1
Glottal Replacement	1						8 2	3 1					3 1	4 1
Backing			3 1		12 4									
Stopping	14 4	5 1	19 6		5 1	1	19 6	5 1			4 1	1		
Coalescence							1				6 1			
Epenthesis	2	1	5 1	1	1		1			5 1		1	10 3	1
Metathesis	1	1	1	1	1						1			
Assimilation												1		
Nasal	6 2													
Velars		1			3 1	1						1		
Labial	5 1	1	6 2				3 1							
Idiosyncratic Patterns														
Glide Syllable	13 4													

Table 1 continued

	Frequency of Occurrence													
	Allen		Jerry		Danny		Tim		Bobby		Barry		Candi	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Final /n,ŋ /→/m/					11 3									
Nasal Add/Replacement														
Total Add Pattern Points	16	3	10	1	12	1	13	2	4	1	4	1	18	2
Percentage Average	74	22	44	12	48	11	66	11	97	19	41	29	70	29
Additional Pattern Points	16	3	10	1	12	1	13	2	4	1	4	1	18	2
Age Points	10	20	10	15	10	15	10	15	5	5	20	20	5	10
Total CPDS	100	45	64	28	70	27	89	28	106	25	65	50	93	41
Severity Intervals	P	S	S	M	S	M	P	M	P	M	S	S	P	M

M = Moderate

S = Severe

P = Profound

teachers and relatives, and his mother reported that he was experiencing success in his first grade reading, phonics, and spelling classes.

Danny, age five years and six months, also began the program during the summer. His parents had decided to have him repeat kindergarten because of his speech problems, although cognitive testing indicated that he was in the gifted range. He had already received one year of speech therapy in his school. Results from his pretest placed him at the severe level with his major deficient patterns including cluster reduction, postvocalic singleton obstruent omission, stridency deletion, prevocalic backing, stopping, and liquid deviations. His remediation program required three cycles over an 11 month period.

Danny's posttest results showed that he was producing most singleton consonants correctly, and that many consonant clusters were emerging. He was also producing initial /l/ and /r/ correctly. It was noted, however, that a few minor deficient patterns were persisting: prevocalic devoicing of /g/, and labializing of final nasals. After Danny was dismissed from the program, his phonological system continued to improve although he received no additional therapy. His speech still had some errors, but he was intelligible and reportedly was experiencing success with his first grade lessons.

Tim, age five years, entered the program the summer before he began kindergarten. He had been receiving speech therapy for two years in his local school district. He had a repaired cleft palate

and a history of recurrent otitis media. Tim's speech mechanism was judged by his cleft palate team to be adequate for speech purposes. Results from his pretest placed him in the profound level of severity. The Level I patterns which Tim demonstrated were singleton obstruent omission, cluster reduction, velar fronting, and glottal replacement. He also evidenced stridency deletion and /l/ deviations. His remediation program required four cycles over a 13 month period. Although his speech still contained some errors at time of dismissal, it continued to improve without further targeting of singleton obstruents, velars, stridents, liquids, or consonant clusters. Tim continued intervention in his public school, however, with the focus on improvement of voice quality and elimination of some Level III patterns. His parents reported that he was a high achiever in first and second grades.

Allen, age 5 years and 11 months, entered the program in the middle of a Fall semester, when he was in his third year in a special education school. It was believed that he could not succeed in a regular classroom because of his unintelligibility. Results from his pretest placed him at the profound level of severity. His major deficient patterns were omission of final singleton obstruents, velar fronting, prevocalic voicing, postvocalic cluster deletion, stridency deletion, cluster reduction, stopping, liquid deviations, and nasal and labial assimilation. His remediation program required five cycles during a period of 18 months.

Allen's posttest results showed only the deficient patterns of liquid deviation, stopping, and cluster reduction. He was quite

intelligible, and the following Fall semester, he was achieving in school on a high level.

Bobby, age three years and six months, entered the program with Level 0 phonological patterns. His expressive language consisted mainly of monosyllables but his receptive language was above average. Results from his pretest placed him at the profound level of severity. He needed to develop both prevocalic and postvocalic obstruent singletons, clusters, stridents, velars, liquids, and the ability to produce more than one syllable. His remediation program required three cycles during a period of 11 months.

When dismissed, Bobby's deficient patterns included /l/ and /r/ deviations, and some cluster reduction. He entered kindergarten the following year and received therapy from the school speech-language pathologist for /r/ deviations. Reportedly, he was doing well in kindergarten and excelled in prereading activities.

Barry, age eight years and nine months, attended the program for one summer, one day a week for five weeks. He had already had five years of speech therapy, but still had a great deal of difficulty with liquids and glides. During his five sessions, he worked on /s/ clusters, prevocalic /r/ and /l/ clusters, and medial /l/. The phoneme /j/ was also stimulated. Although five weeks was not enough time to completely eliminate his deficient patterns, he did show some gains. Liquid production was more facile, there were fewer occurrences of cluster reduction, and he was able to produce /j/.

Candi was 3 years 11 months when she entered the program, and it was estimated that only 5% to 10% of her spontaneous utterances could be interpreted. The goal for her phonological remediation program was to facilitate emergence in spontaneous speech of the following phonological patterns: final consonants, glides, liquids, stridents, and consonant clusters. In her program, phoneme combinations in words were used to facilitate development of these five phonological patterns.

During pretesting, Candi omitted all glides, liquids, stridents, and consonant clusters. The only final obstruent she produced was /t/. During the posttest, she produced singleton /w/, prevocalic /l/ singletons, some /l/ clusters, word final /ʒ/, and all final obstruents except /ʃ/. She produced the strident targets or substituted other strident phonemes for the targets in all of the productions except two. When Candi was dismissed, her speech was not perfect but she was judged to be "generally intelligible" by her relatives and friends. She demonstrated that her phonological performance continued to improve even without further intervention.

Case studies such as the seven by Hodson and Paden are a typical method of studying remediation. Other case studies include those by Compton (1970), Weiner (1981), and Blache (1980). Although these studies are useful, researchers in the area of communication disorders are becoming increasingly interested in applied behavior designs.

Case Studies

Case studies have been defined in many ways, but in general, a case study consists of uncontrolled reports in which one individual and his or her treatment is carefully reported and inferences are drawn about the basis of therapeutic change. A case study does not have to consist of only one individual, but may include a group of persons. Often cases are treated on an individual basis, but the information is aggregated across cases, as for example, reports about various treatments (Kazdin, 1982).

Kazdin (1982) refers to studies as preexperimental designs or demonstrations that do not completely rule out the influence of extraneous factors. Case studies are considered preexperimental, because they do not allow internally valid conclusions to be reached. The threats to internal validity are usually not addressed in case studies in such a way to provide conclusions about particular events.

Two factors that often interfere with validity of case studies are the type of data used and the assessment occasions. Often, anecdotal information is used for data instead of objective information. The anecdotal information could include reports by the client or clinician that change had been achieved. This type of data collection does not rule out that external factors such as maturation led to the change. Many case studies, such as those by Hodson and Paden (1983), collect information on a one-or-two-shot basis (e.g., pre- and posttest). When information is collected on one or two occasions, threats to internal validity (e.g., testing,

instrumentation, statistical regression) are especially difficult to rule out.

Applied Behavior Analysis Designs

The growing use of AB analysis research in clinical psychology and special education has demonstrated the importance of this approach. Researchers using AB analysis designs attempt to determine what factors can be used to alter a chosen target behavior so that once identified, these factors can be incorporated into therapeutic programs to modify the same behavior in the clinical setting. In this sense, AB analysis research is applied research that has direct clinical applications (Barr, Wolf, & Risley, 1968).

Five attributes of single-subject design described by Lovitt (1975) are: (a) the direct measurement of the child's behavior; (b) the continuous measurement of the child's behavior on a daily or near daily basis; (c) an understanding of the idiosyncrasies of the intervention and the child's behavior; (d) the demonstration of a functional relationship between the intervention and the child's behavior; and (e) interventions that are described adequately and therefore are replicable. As such, AB analysis designs are highly compatible with clinical activities due to the emphasis placed upon the individual child.

In the implementation of AB analysis designs, three steps must be followed: (a) the behavior or skill to be modified must be adequately defined; (b) the behavior must be measured over time, and a baseline of the behavior must be obtained prior to intervention;

and (c) a treatment or intervention must be initiated, and the impact upon the baseline behavior must be monitored.

The first step in implementing an AB analysis design is to select and define the target behavior which the researcher wishes to change. The target behavior that is selected must be both observable and measurable (Reynolds, 1968). For example, a subject's behavior could be observed by seeing it or hearing it. The behavior may be measured by timing the length of each occurrence or by counting the number of times it occurs. After selecting the target behavior, the behavior is defined. The definition of the target behavior must include both an objective description of the observable behavior and the procedures used to measure or record that behavior.

After defining the target behavior, the level at which the behavior naturally occurs prior to intervention must be measured. This measure serves as a standard or "baseline" against which the effectiveness of the intervention procedure can be evaluated. It is important to ensure that baseline measures are taken over a sufficient period of time. Barlow and Hersen (1973) recommend that baseline data be gathered for a minimum of three sessions prior to beginning an intervention. At least three data points are necessary to reveal the presence of a pattern in the baseline data. For example, with a minimum of three points, a researcher can determine if there is an upward, downward, or stable trend in the data. McNamara and McDonough (1972) believe that baseline measurements continue until stability in the baseline data is attained. They

contend that baseline data should be gathered until there is little change in the occurrence of the behavior between sessions. Therefore, if change in the behavior occurs after the intervention, it can be more easily attributed to the intervention.

After the baseline data are gathered, the intervention is introduced. The intervention may be an instructional or treatment technique which the researcher believes will modify the occurrence of the target behavior. Data collection continues during intervention and throughout the remainder of the evaluation. It is important that the data collection procedures are identical during the baseline and intervention conditions (Russell & Bernal, 1977).

The three most basic types of AB analysis evaluation procedures are: (a) A-B, (b) reversal, and (c) multiple baseline. The A-B design is the simplest with A representing the baseline condition and B the intervention condition. In the A-B-A reversal design, the baseline period (A) is followed by an intervention (B), a return to the baseline or withdrawal of the intervention (A), and finally a return to intervention (B). A third, more complex single-subject design, is the multiple baseline which is useful when the target behavior is potentially irreversible, or when it is inappropriate to institute a reversal condition. The multiple baseline technique is based upon two attributes: (a) each of the individual target behaviors follows an A-B procedure which allows for a comparison between the baseline and intervention conditions, and (b) control measures for the target behavior under intervention are found in the concurrent baseline measure. The choice of which design to use is

determined by the behavior to be modified, the instructional techniques to be evaluated, and the goals of the researcher.

Summary of Related Literature

One of the major concerns of phonology is the study of phonological processes. A phonological process refers to any systematic sound change that affects a class of sounds or a sound sequence.

From 1975 to 1985, speech/language pathologists began to realize that children with abnormal speech exhibited phonological systems just as structured as children with normal speech. With this realization, the way was opened for a phonological approach to remediation.

A phonological approach to remediation works on the basic sound system rather than focusing on individual sound errors. One of the first phonological approaches was the use of distinctive features (Weiner & Bankson, 1978) which was followed by the use of minimal contrast therapy (Ferrier & Davis, 1973; Weiner, 1981).

In the mid 1970s, Hodson and Paden (1983) developed a new type of phonological remediation program which involved facilitation of certain phonological patterns. Data on the effectiveness of their program come primarily from a series of case studies.

Although case studies are often used in speech-language pathology, they have certain drawbacks. Often anecdotal information is used for data in case studies which does not rule out the fact that external factors such as maturation may have led to the change. In case studies, such as those by Hodson and Paden (1983), the

investigators may collect information on a one-or-two shot basis which makes threats to internal validity hard to rule out.

The use of AB analysis designs improves the inferences that can be drawn from case studies. The use of objective information and the continuous assessment of performance over time (time-series analysis) are part of the requirements of this design. Single-subject designs, however, go beyond these characteristics and apply the intervention in special ways to rule out threats to internal validity. The way in which the situation is arranged varies as a function of the specific experimental designs.

Chapter 3

DESIGN OF STUDY

The design used for this study was a multiple-baseline across subjects design. In this design, the subjects do not serve as their own controls; instead, other subjects function as controls. The same target behavior is measured concurrently across two or more children. After the baseline data are collected, the children receive the intervention program.

Participants of Study

The subjects in this study were three five-year-old children who had been identified as severely phonologically impaired by the school speech-language pathologist using The Assessment of Phonological Processes (APP) (Hodson, 1980). All subjects were enrolled in kindergarten at Midway Elementary School in Davidson County, North Carolina, and were of average intelligence as determined by the Slosson Intelligence Test for Children and Adults (SIT) (Slosson, 1978). None of the subjects had received previous speech therapy for sound production problems. For a description of pertinent subject characteristics, see Table 2.

To determine severity of phonological impairment, the percentage of occurrence for 10 basic phonological processes was computed and averaged. To this average score, a point was added for each

Table 2

Pertinent Characteristics of the Subjects

Subjects	Age In Months	Sex	SLT	CPDS
1	64	F	93	55.7
2	68	F	105	60.2
3	62	M	88	52.6
Range	62-68		93-105	52.6-60.2
Mean	64.67		95.33	56.16

SLT - Slosson Intelligence Test for Children and Adults

CPDS - Composite Phonological Deviancy Score

three occurrences of the following miscellaneous processes: backing, glottal replacement, stopping, prevocalic voicing, postvocalic devoicing, coalescence, epenthesis, and metathesis. For definitions of these terms, see Appendix A. Since percentage-of-occurrence scores do not, in and of themselves, indicate the extent of a phonological impairment, it was necessary to add compensatory points for age: 5 points for four-year-olds, 10 points for five-year-olds, 15 points for six-year-olds, and 20 points for seven-year-olds.

The result of these calculations is a measure of severity called the Composite Phonological Deviancy Score (CPDS). Hodson and Paden (1983) identify a child with a CPDS of 24 and below as mildly involved, 25-49 as moderately involved, 50-74 as severely involved, and over 74 as profoundly involved. The formula for deriving a CPDS is shown in Appendix B.

The three children in the present study scored in the severe range of severity. Subject 1 had a CPDS of 55.7 and exhibited the following phonological processes: cluster reduction, stridency deletion, velar deviations, glottal replacement, stopping, and depalatalization. Subject 2 had a CPDS of 60.2 and exhibited stridency deletion, velar deviations, glottal replacement, stopping, and depalatalization. Subject 3 had a CPDS of 52.6 and demonstrated cluster reduction, stridency deletion, and velar deviations. A process was considered in operation if it occurred 40% or more of the time. For a complete summary of performance on the APP, see Appendix C.

Materials

The assessment protocol used to identify the subjects as phonologically impaired was The Assessment of Phonological Processes (APP) (Hodson, 1980). This instrument elicits 55 spontaneous utterances as children select and name objects. All American English phonemes are assessed at least twice, both prevocalically and postvocalically, except /w/ and /h/ for which only prevocalic productions are possible. In addition, 31 common consonant clusters are assessed. This protocol, however, was designed mainly to identify 10 basic phonological processes which have been found to be prevalent in the speech of children with phonological impairment, including syllable reduction, cluster reduction, prevocalic singleton obstruent omissions, stridency deletion, velar deviations, postvocalic singleton obstruent omissions, liquid /r, / deviations, liquid /l/ deviations, nasal deviations, and glide deviations. For definitions of these terms, see Appendix A.

The phonological remediation protocol used in this study was developed by Hodson and Paden (1983). This approach is based on cyclical programming which repeatedly facilitates the emergence of targeted phonological patterns. According to the authors, this procedure is in synchrony with the gradual pace of phonological acquisition in children and allows time for whatever generalization the child may do on his own. In this approach, the whole phonological system is stimulated and facilitated to emerge rather than only segments of it. Patterns are targeted in a developmental progression dependent upon each child's individual abilities and disabilities.

For further information on the fundamental principles of this program, see Appendix D.

Procedures

Hodson and Paden (1983) have grouped the intelligibility of phonologically impaired children into four levels which are characterized by certain deficient patterns. For an explanation of these levels, see Appendix E.

All patterns demonstrated by the three subjects in this study may be categorized at Levels I and II. Velar fronting, a Level I pattern, was the first pattern targeted for remediation for all three subjects. The order of targeted patterns for all three subjects was velar fronting, stridency deletion with cluster reduction, and liquid deviations. The complete remediation sequence for all cycles is shown in Tables 3, 4, and 5.

The remediation program begins in what Hodson and Paden (1983) refer to as Cycle I. Hodson and Paden do not continuously target a phonological pattern until it has reached a predetermined criterion of adequacy. Instead, they focus on a pattern only a few weeks so that several patterns can be targeted inside of a time block, such as a semester. Within a process, each target phoneme receives about one hour of therapy. This sequential targeting of several patterns is called a cycle. The first presentation of a series of phonological patterns is referred to as Cycle I. A second presentation is Cycle II; a third, Cycle III; and so on. Usually, each pattern must be recycled two or more times before it is eliminated. Hodson and Paden believe that this "cycle programming" provides limited but

Table 3

Remediation Cycle for Subject 1 (Christy)

Cycle I (6 Sessions)	Cycle II (10 Sessions)	Cycle III (14 Sessions)	Cycle IV (17 Sessions)
Velars	Velars	Velars	Velars
/k/ F	/k/ F	/k/ I	/g/ I
	/k/ I	/g/ I	
Stridents	Stridents	Stridents	Stridents
/sm/ I	/sm/ I	/sp/ I	/st/ I
/sn/ I	/sn/ I	/ns/ F	/f/ F
/sp/ I	/sp/ I	/ps/ F	/dʒ/ I
/ns/ F	/ns/ F	/st/ I	/st/ F
/ps/ F	/ps/ F	/f/ F	/tʃ/ I
	/st/ I	/f/ I	/tʃ/ F
	/f/ I	/dʒ/ I	
		/tʃ/ I	
	Liquids	Liquids	Liquids
	/l/ I	/l/ I	/l/ F
		/l/ F	/r/ I
		/r/ I	/bl/ I
			/fl/ I
			/kl/ I
			/sl/ I
			/gl/ I

Table 4

Remediation Cycles for Subject 2 (Holly)

Cycle I (7 Sessions)	Cycle II (18 Sessions)	Cycle III (18 Sessions)	Cycle IV (19 Sessions)
Velars	Velars	Velars	Velars
/k/ F	/k/ F	/k/ I	/g/ I
	/k/ I	/g/ I	
	/g/ I		
Stridents	Stridents	Stridents	Stridents
/sm/ I	/sm/ I /st/ I	/st/ I /ts/	/ts/ F /dʒ/ F
/sn/ I	/sn/ I /f/ I	/f/ F /ks/	/ks/ F
/sp/ I	/sp/ I /dʒ/ I	/dʒ/ I /ʃ/ F	/dʒ/ I
/ns/ F	/ns/ F /ʃ/ I	/ʃ/ I /dʃ/ F	/st/ I
/ps/ F	/ps/ F /tʃ/ I	/tʃ/ F /tʃ/ I	/tʃ/ I
Liquids	Liquids	Liquids	Liquids
/l/ I	/l/ I	/r/ I	/r/ F /fr/ I
	/r/ I	/l/ F	/l/ M /gl/ I
	/l/ F	/r/ F	/br/ I /fl/ I
		/l/ I	/gr/ I /sl/ I
			/kr/ I
			Miscellaneous
			/θ/ I

Table 5

Remediation Cycles for Subject 3 (Mikie)

Cycle I (8 Sessions)	Cycle II (12 Sessions)	Cycle III (14 Sessions)	Cycle IV (17 Sessions)
Velars	Velars	Velars	Velars
/k/^{F}	/k/^{F}	/k/^{I}	/g/^{I}
	/k/^{I}	/g/^{I}	
Stridents	Stridents	Stridents	Stridents
/sm/^{I}/ps/^{F}	/sm/^{I}/ps/^{F}	/sm/^{I}/ʃ/^{I}	/f/^{I} /dʒ/^{F}
/sn/^{I}/ns/^{F}	/sn/^{I}/ns/^{F}	/sn/^{I}/dʒ/^{I}	/ʃ/^{I}
/sp/^{I}	/sp/^{I}/f/^{I}	/sp/^{I}	/dʒ/^{I}
/st/^{I}	/st/^{I}/ʃ/^{I}	/ns/^{F}	/f/^{F}
/ts/^{F}	/ts/^{F}	/f/^{I}	/ʃ/^{F}
	Liquids	Liquids	Liquids
	/l/^{I}	/l/^{I}/bl/^{I}	/l/^{F}/fl/^{I}
		/r/^{I}/sl/^{I}	/r/^{I}/kl/^{I}
		/l/^{F}	/r/^{F}/gl/^{I}
			/bl/^{I}
			/sl/^{I}
			Miscellaenous
			/θ/^{I}

successful experiences in producing a target pattern and allows children to go about whatever generalization of its use that they typically do on their own.

Before beginning the actual remediation program, baseline production for target words was obtained for each subject. The purpose of the baseline was to determine whether a change in sound production would occur without intervention. During collection of baseline information, the subjects came to the speech therapy room and participated in such activities as puzzles, arts, crafts, and board games. At the end of this 30 minute play period, five target words were presented to the subjects for them to produce. This continued daily until each set of target words for the HRP had been produced by the subjects. After the baseline was obtained, the subjects attended speech therapy five days a week for 30 minute sessions. Each subject was seen on an individual basis.

At the beginning of each therapy session, the subject was introduced to the target phoneme by listening for about two minutes while the clinician read a list of 15 words containing the target phoneme for that session. Subjects wore auditory trainers to help them focus on the sound pattern. Hodson and Paden (1983) refer to this phase as auditory bombardment.

The next phase of therapy involved the production of two to five target words. The child drew a picture of each word and the words were then elicited using whatever techniques were required for correct production. Then the cards were used in two to three experiential play activities such as hide-and-seek or fishing. After

these activities were completed, the next session's target phoneme was selected by determining which of the sounds within a pattern being targeted, or to be targeted, was easiest to elicit. Each session ended with a rereading by the speech-language pathologist of the listening word list that was used at the beginning of the session. See Table 6 for a sample outline of a therapy session.

At home, the subject's parents were asked to read the listening list to the child once a day during some relaxed, quiet time. The cards used that week for production practice were also sent home for the child to produce 10 times each day. The parents were also asked to play one of the experiential games with the child. A check sheet was kept by the clinician to determine how much the parents participated in the program.

Data Analysis

At the end of each therapy session, data were taken on the production of the three to five words targeted during the session. The data were graphed to determine the level of progress made by each subject.

At the end of every five sessions, data were collected at the phrase level to determine if there had been any generalization of correct production of target phonemes to phrases. At the end of every 10 sessions, data were collected at the conversation level to check for generalization.

Table 6

A Typical Therapy Session

10:00	Review last session's picture-word cards
10:05	Auditory bombardment of words for this session's target
10:10	Child draws three to five picture cards
10:20	Activity No. 1
10:30	Activity No. 2
10:40	Activity No. 3
10:50	Probing to determine next session's target
10:55	Repeat auditory bombardment
11:00	Dismissal

Chapter 4

RESULTS

All three subjects in this study made progress during the course of their remediation program. As shown in Figures 1 through 3, each subject's skill level remained stable during the baseline condition. Following the start of the instruction, changes occurred in each child's performance. The degree to which the occurrence of the individual target behaviors changed during intervention relative to baseline suggest that each subject's intervention was effective. See Table 7 for pre- and posttest results and percentage and frequency of occurrence scores for each subject.

Christy's (Subject 1) Results

Results obtained from Christy's phonological pretest indicated that her performance was at the severe level (CPD = 55.7). Her major deficient patterns included: cluster reduction, stridency deletion, prevocalic and postvocalic velar fronting, liquid deviations, and glide deviations.

Table 3 shows the order of phonemes targeted during each cycle. Cycle I included velars and stridents and Cycles II, III, and IV, included velars, stridents, and liquids. During Cycle I, strident clusters were targeted prior to singleton stridents as recommended by Hodson and Paden (1983). Liquids were targeted as early as

Table 7

Pre- and Posttest Percentage of Occurrence and Frequency of Occurrence Scores for Three Subjects

	Percentage of Occurrence					
	Christy		Holly		Mikie	
Basic Deficient Patterns	Pre	Post	Pre	Post	Pre	Post
Syllable Reduction	9	0	4	0	4	0
Cluster Reduction	80	51	74	42	74	63
Obstruent Singleton Omission						
Prevocalic	11	0	5	0	0	0
Postvocalic	13	7	30	0	13	0
Stridency Deletion	52	23	57	2	52	41
Velar Deviations	58	17	71	0	58	42
Liquid Deviations						
/l/	77	62	69	0	69	62
/r,ɝ/	62	58	46	31	46	42
Nasal Deviations	5	0	16	11	10	0
Glide Deviations	50	30	70	0	50	40
Total	417	248	442	860	370	290
Average	41.7	24.8	44.2	8.6	37.6	29
Other Level 1 & 2 Patterns	Frequency of Occurrence					
Vowel Deviation						
Prevocalic Voicing						
Prevocalic Devoicing						

Table 7 continued

	Frequency of Occurrence					
	Christy		Holly		Mikie	
Other Level 1 & 2 Patterns	Pre	Post	Pre	Post	Pre	Post
Glottal Replacement	1 4	1	1 4	1	1 5	2 6
Backing			1			
Stopping	3 10	1 5	5 16		4 12	3 11
Coalescence	1	1				
Epenthesis						
Metathesis						
Assimilation						
Nasal	2					
Velars					1	1 3
Labial						
Idiosyncratic Patterns						
Glide Syllable						
Final /n,ŋ/ → /m/						
Nasal Addition/Replacement						
Total Add. Pattern Points	4	1	6	0	5	6
Percentage Average	41.7	24.8	44.2	8.6	37.6	29
Additional Pattern Points	4	1	6	0	5	6
Age Points for Age (CPD)	10	15	10	15	10	15
Total	55.7	40.8	60.2	23.60	52.6	50
Severity Intervals	S	Mod	S	M	S	S

M - Mild. Mod - Moderate. S - Severe.

possible because even though progress was slow, early liquid facilitation results in improved production of these sounds by dismissal (Hodson & Paden). During Cycle III, it was still difficult for Christy to produce an acceptable consonantal /r/ so the vocalic /ɚ/ was used in its place (e.g., rock was pronounced: /ɚ/, followed by a brief pause, then /ɚ:k/).

The results from the posttest show that the percentage of occurrence for all major deficient patterns was reduced. The miscellaneous patterns of stopping, glottal replacement, affrication and palatalization were also suppressed as Christy learned to produce appropriate consonants, particularly the strident phonemes.

The graphs in Figures 1 through 3 show how Christy's sound production changed over time. As shown in Figure 1, Christy went from a baseline of 0% correct with velars at the word level to 70% correct by the end of session 10. By session 20, she had improved to 80% and by session 40, she could produce velars at the word level with 100% accuracy. At the phrase level, Christy showed the same type of gradual improvement. She progressed from an average of 70% correct at session 10 to 80% correct at session 20, and 100% correct at sessions 30 and 40. At the conversation level, Christy's progress was much steeper than at either the word or the phrase levels. By session 10, she was using velars in conversation on the average of only 10%, but by session 20, correct production was up to 51% and at session 40, which was near the end of the program, she was producing all targeted velars correctly in conversation 70% of the time.

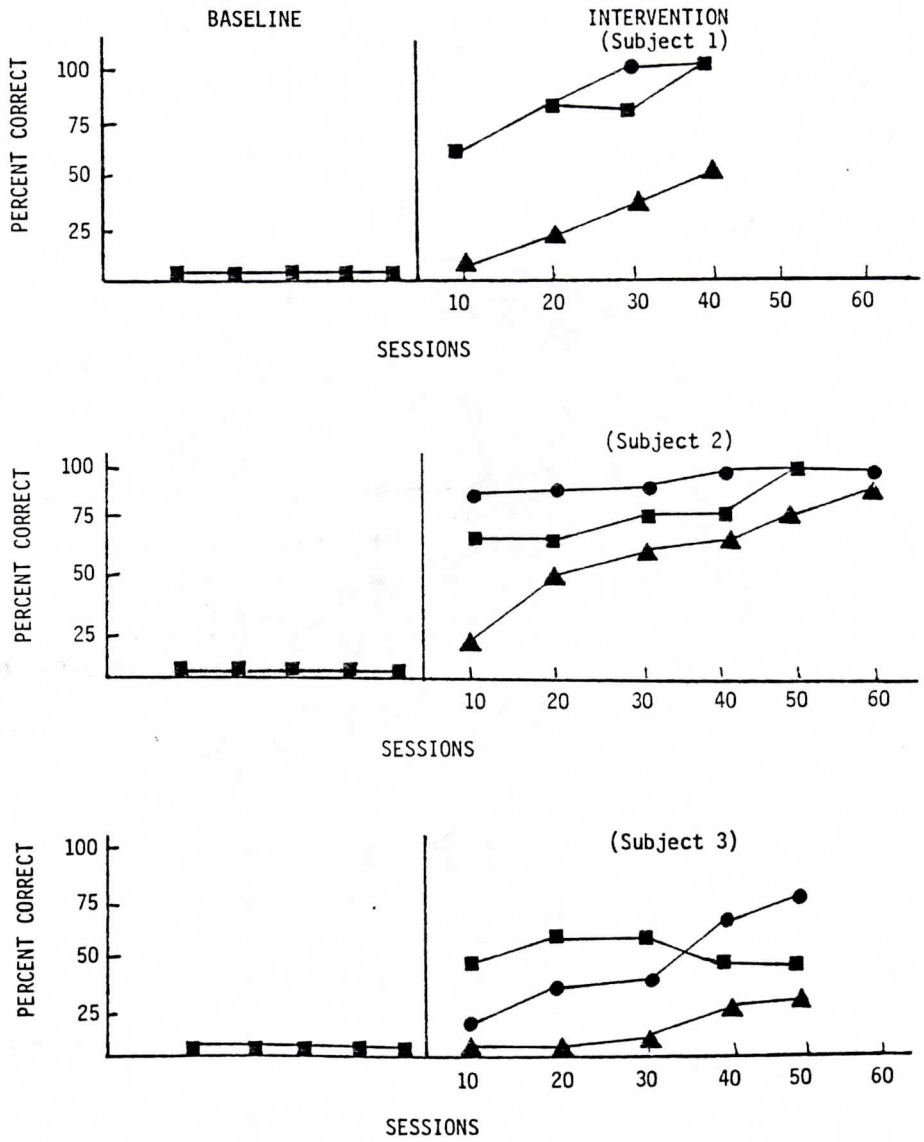

Figure 1. Correct production of velars.

● Word Level ■ Phrase Level ▲ Conversation

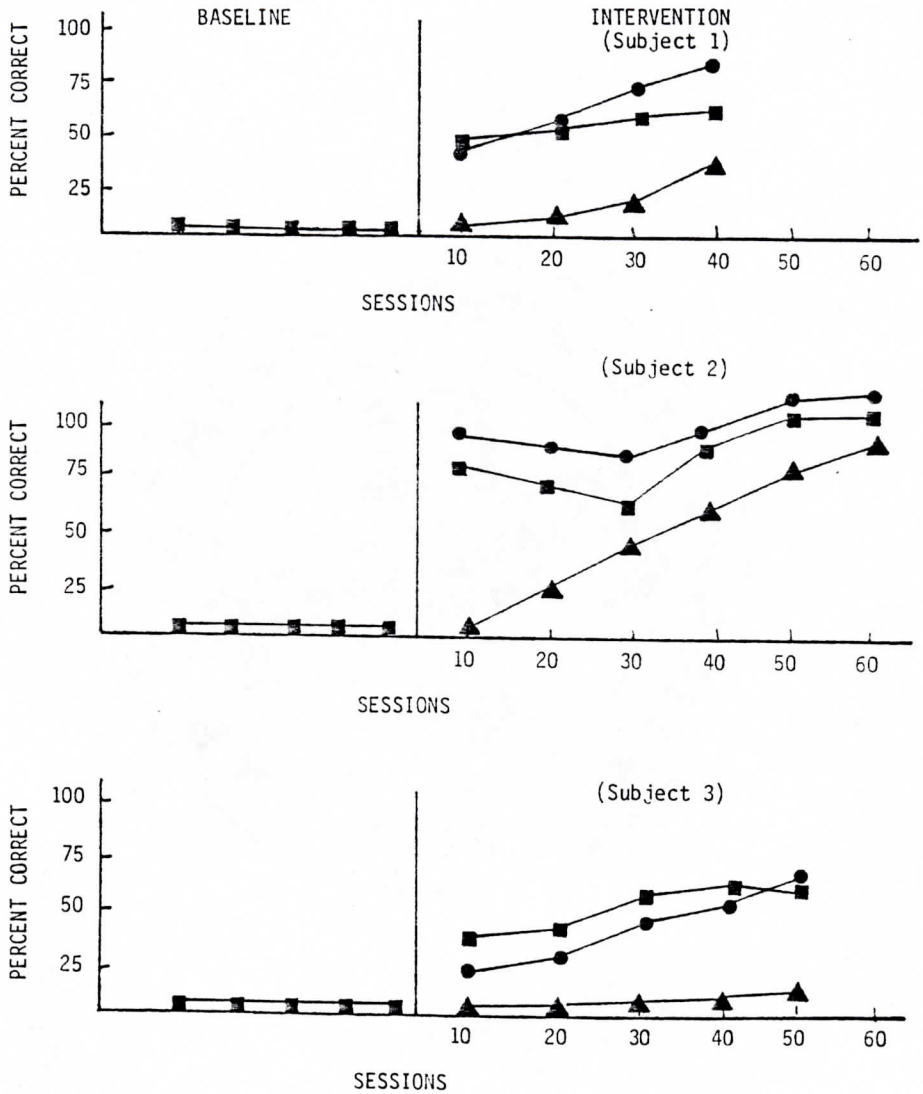

Figure 2. Correct production of stridents.

● Word Level ■ Phrase Level ▲ Conversation

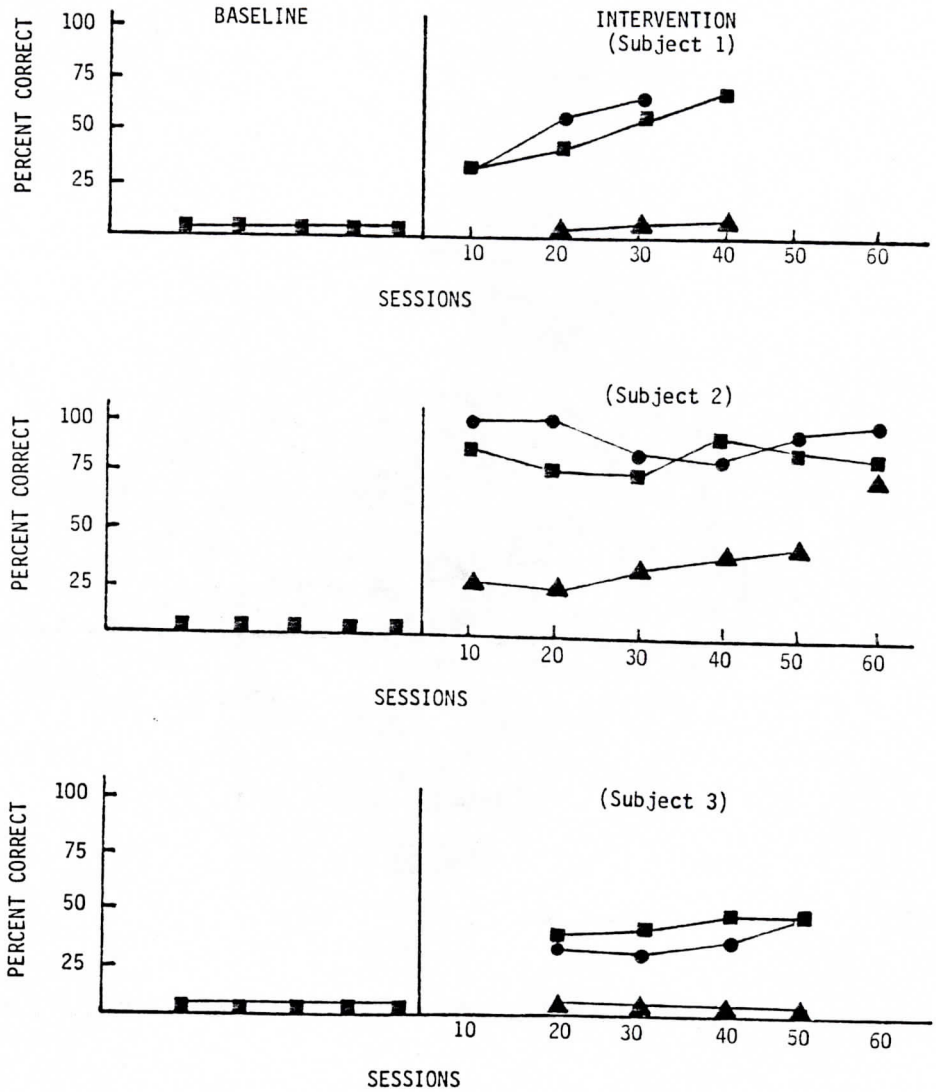

Figure 3. Correct production of liquids.

● Word Level ■ Phrase Level ▲ Conversation

Figure 2 shows Christy's progress with stridents. At the word level, she went from a baseline of 0% correct to 54% correct by the end of session 10. By session 20, she had increased her accuracy to 60%, and she continued to show gradual improvement. By session 30, she was correctly producing all targeted stridents on the average of 65% and by session 40, correct productions increased to 69%. At the phrase level, she improved from an average of 50% correct strident productions to 65% by session 20, and to 77% by session 30. During sessions 30 through 40, Christy showed a large increase in acceptable productions at the phrase level from 77% to 91%. At the conversation level, she showed only 6% correct production by session 10 but by session 20, her correct strident productions had increased to 21%. Her accuracy level continued to increase and by session 40, she was producing all targeted stridents with 45% accuracy.

Figure 3 shows Christy's progress with liquids. Since liquids were not targeted until session 16, data were not graphed until session 20. By the end of session 20, she was producing targeted liquids at the word level with 40% accuracy; by session 40 her performance had improved to 54%; and by the end of the program, she was producing all targeted liquids at the word level with an average of 60% accuracy. At the phrase level, she began by producing liquids with 40% accuracy and by the end of session 40, she was at 65% accuracy. Christy's progress at the conversation level was minimal. She did not show any correct productions until session 30 (5% accuracy) which increased to 7% by session 50.

Christy attended 47 out of 65 possible sessions. She always appeared to be cooperative with good attending behavior. Because Christy's mother was unable to help with the home assignments, a teacher's aid was asked to assist Christy by session nine. The aid worked with Christy on the assignments at school instead of at home.

Holly's (Subject 2) Results

Results obtained from Holly's phonological pretest indicated that her performance was at the severe level (CPD = 60.2). Her major deficient patterns included: prevocalic and postvocalic velar fronting, cluster reduction, stridency deletion, and liquid deviation.

Table 4 shows the order of phonemes targeted during each cycle. Cycle I, II, and III included velars, stridents, and liquids. Cycle IV was added to retarget several difficult stridents. At the end of Cycle IV, the APP was readministered to Holly and revealed a composite score of 18.4. Based on the results of this evaluation, the subject was dismissed from the program.

The pattern of Holly's progress is shown in the graphs in Figures 1 through 3. Figure 1 shows her progress with velars at the word, phrase, and conversation levels. She began with a baseline of 10% accuracy at the word level and moved to 79% by session 10, and by session 30, she had improved to 80%. She continued to show good progress and by session 50, she had reached a 100% accuracy level. Holly also started at the phrase level with a high success rate. She began at session 10 with an 85% accuracy level and moved to 87% by session 20, 93% by session 40, and 100% by

session 50. At session 60, she showed a slight reduction in her averaged accuracy level due to an inconsistency in her production of word-initial /g/. At the conversation level, she showed rapid and consistent progress. She started with 24% correct production of velars and moved to 48% by session 20. By session 30, she had reached 62% correct production, and then moved to 73% by session 40, 83% by session 50, and 96% by session 60.

Figure 2 shows her progress with stridents. She began with a baseline of 0% accuracy at the word level and moved to 75% correct by the end of session 10. By session 20, her averaged correct production level dropped to 72% and by session 30, it had dropped to 64%. This reduction was due to the introduction of more difficult phonemes into Holly's remediation program. Then, she began to show improvement again and increased her accuracy level to 84% and 92% by sessions 40 and 60, respectively. At the phrase level, she demonstrated 94% correct production of targeted strident phonemes by session 10. By session 20, five more difficult phonemes had been targeted and her success rate dropped to 89%. She remained around 87% until session 30 when she improved to 94% accuracy. By session 60, she was producing stridents correctly in phrases on the average of 97% of the time. In conversation, Holly showed rapid and consistent progress. She moved from 6% accuracy at session 10, to 29% at session 20, 46% at session 30, 59% at session 40, and finally 79% at session 50. By the end of the remediation program, she was producing stridents in conversation with an average accuracy level of 91%.

Figure 3 shows Holly's progress with liquids at the word, phrase, and conversation levels. At the word level, she began with a baseline of 0% correct and moved to 80% accuracy at session 10, although only word-initial /l/ had been targeted at this time. By session 30, word-final /l/ and word-initial /r/ had been targeted and her average correct production dropped to 73%. By session 40, she was producing targeted liquids with 93% accuracy. At the end of the remediation program, she was producing all targeted liquids with an average of 87% accuracy. At the phrase level, she began with 100% accuracy at session 10, but she dropped to 75% accuracy by session 30 when additional target phonemes were introduced. She completed the program with an average of 92% correct production of all targeted liquids. In conversation, Holly's progress was slow but consistent. She began with 30% correct production of target liquid phonemes and gradually moved to 36%, 40%, 47%, and 80% accuracy at sessions 10, 20, 30, 40, and 60, respectively.

Holly attended 62 out of 65 possible sessions. She was always alert and eager to work. The speech/language pathologist found that the subject was highly stimulable for most phonemes and quickly produced them at the word level. Holly's mother always carried out the home assignments and informed the pathologist of Holly's progress on a weekly basis. Holly's teacher was also helpful, encouraging her to produce the target sounds correctly during classroom activities.

Mikie's (Subject 3) Results

Results obtained from Mikie's phonological pretest indicated that his performance was at the severe level (CPD = 52.6). His

major deficient patterns included the following: cluster reduction, stridency deletion, prevocalic and postvocalic velar fronting, liquid deviations, and glide deviations.

Table 5 shows the order of phonemes targeted during each cycle. Cycle I included velars and stridents. Cycles II and III included velars, stridents, and liquids. Cycle IV was added to retarget several difficult phonemes. At the end of Cycle IV, the APP was re-administered. Even though Mikie still scored at the severe level (CPD = 50), an improvement on all deficient patterns was noted.

The graphs in Figures 1 through 3 show how Mikie's performance changed over time. By the end of session 10, Mikie had targeted initial and final /k/ and had progressed from a baseline of 0% correct production at the word level to 55% correct production. By session 20, his correct production rate was up to 70% and leveled off until session 30 when it dropped to 65%. The drop in his correct production rate was due in part to the difficulty he was having with /g/, and in part, to his poor attending behavior during sessions 23 through 30. At the phrase level, Mikie's progress was consistent and steady. He progressed from an average of 30% accuracy at session 10, to 50% accuracy at session 20, 60% at session 30, and by session 40, he was producing 80% of all targeted velars correctly. In conversation, his progress began slowly but increased considerably by session 40. He showed no evidence of using targeted velars in his spontaneous speech until session 30 when he showed 8% accuracy. At this time, the only velar correctly produced was word-initial /k/. By session 40, his correct production had increased to

27%, and he was occasionally producing word-initial /k/ correctly. By the end of the program, Mikie was producing all targeted velars in conversation at the 33% accuracy level. See Figure 1.

Figure 2 shows Mikie's progress with stridents. At the word level, he improved from a baseline of 0% correct to 50% correct by the end of session 10. By session 20, he had increased his accuracy to 57% and continued to make steady progress. By session 30, he was producing all targeted stridents with an average of 65% accuracy and by session 40, his correct production of stridents had increased to 69%. At the phrase level, his progress with targeted stridents increased by at least 10% each 10 sessions. He improved from an average of 31% accuracy at session 10, to 42% at session 20, 55% at session 30, 65% at session 40, and at the end of the remediation program, he was producing 76% of all targeted stridents correctly at the phrase level. In conversation, Mikie showed no evidence of using targeted stridents until session 30 when he showed 6% accuracy. At this time, the only strident produced correctly was word-initial /sm/. By session 40, his correct production had increased to 11%, and he was occasionally producing word-initial /sn/ and /st/ correctly. By the end of the program, Mikie was producing all targeted stridents in conversation with a 28% accuracy level.

Figure 3 shows Mikie's progress with liquids. Since liquids were not targeted until session 20, data were not graphed until session 20. By the end of session 20, Mikie was producing targeted liquids at the word level with 40% accuracy and by session 50, he had progressed to 48% accuracy. His progress with targeted liquids

at the phrase level was similar to his progress at the word level. He began at session 10 with 40% accuracy and did not show improvement until session 40 when he exhibited a 45% accuracy rate. By the end of the program, he was producing all targeted liquids at the phrase level with an average correct production of 48%. Mikie did not show any carryover of his correct production into spontaneous speech during his remediation program.

Mikie attended 47 out of 65 possible sessions. His attention span was short, and this made it difficult for him to attend to the stimuli. He often talked during auditory bombardment and the speech/language pathologist found it difficult to keep him on task. Mikie's mother was inconsistent in carrying out the home assignments, although she signed and returned 25 out of 47 home assignments.

Chapter 5

SUMMARY, DISCUSSION, AND RECOMMENDATIONS

Summary

The purpose of this study was to determine the effectiveness of Hodson's phonological remediation program, over a period of five months, on three severely phonologically impaired children.

The subjects were three five-year-old children who had been identified as severely phonologically impaired by the school speech/language pathologist using the Assessment of Phonological Processes (Hodson, 1980). The subjects were enrolled in kindergarten at Midway Elementary School in Davidson County, North Carolina, and were of average intelligence as determined by the Slosson Intelligence Test for Children and Adults (Slosson, 1978).

In Hodson's phonological remediation program, each subject's goals involved facilitation of certain phonological patterns. Phonemes in carefully selected words were used to increase auditory and kinesthetic awareness of phonological patterns. Typically, each pattern was targeted for a few sessions at a time, incorporating a succession of phonemes in words within the pattern (e.g., /sm/, /sn/, /st/ for targeting stridency). Each of the time periods during which a group of patterns was targeted was referred to as a cycle. The first presentation of a series of patterns was referred

to as Cycle I, a second presentation as Cycle II, a third as Cycle III, and so on. Most patterns were targeted one or more times. Each cycle became increasingly more challenging for the subjects as more difficult phonemes within a pattern were added.

The results of the program showed that Christy (Subject 1) made progress. Her CPD was reduced from 55.7 which is considered severely phonologically impaired, to 40.8 which is considered moderately phonologically impaired. Further, the results showed that the percentage of occurrence for all targeted major deficient patterns was lowered and untargeted miscellaneous patterns of stopping, glottal replacement, affrication, and palatalization were also suppressed as Christy learned to produce appropriate consonants.

Holly (Subject 2) also showed significant progress during her remediation program. Her CPD was reduced from 60.2 which is considered severely phonologically impaired to 23.60 which is considered mildly phonologically impaired. By the end of the five month program, she was showing good carryover into conversation of most targeted patterns and based on the results of the APP, she was dismissed from the program.

Mikie (Subject 3) made limited progress with his remediation program. Although his CPD did not change significantly from pretest to posttest (52.6 to 50), the percentage of occurrence scores for some of the major deficient patterns was lowered. Results also showed that the miscellaneous patterns of stopping were suppressed slightly.

Discussion

Each of the children in this study performed differently and made varying degrees of progress. This was due not only to the individual nature of each child's phonological system, but also to other external factors such as cooperation of parents, the child's behavior, and attendance.

Holly, the subject who showed the greatest amount of progress, had many factors working in her favor. Her mother was extremely helpful in carrying out home assignments. Not only did she help Holly with her assigned work, but she also helped Holly to practice correct production of target sounds during other activities such as eating supper. Holly's teacher was helpful also, encouraging her to practice correct production during "Show-and-Tell" and other classroom activities.

Holly's behavior also played an important role in her successful remediation program. She was always cooperative, alert, and eager to work. She was a highly motivated child and enjoyed the successful production of target sounds.

Holly's attendance record was excellent too. She only missed three out of 65 sessions, due to a family trip. Holly's mother reported, however, that Holly practiced her target words and listened to her auditory bombardment list during the trip.

Christy also showed significant progress in her remediation program. Her mother was unable to help with her assignments so the aide in Christy's classroom helped with her assignments at school. Because of this change in programming, Christy did not seem to realize

that "good speech" should be used at home as well as at school. Although she showed steady improvement during therapy, her teacher and parents did not notice any change in her behavior until near the end of the remediation program.

Christy was cooperative with good attending behavior; however, she seemed to lack motivation. She was a quiet child and did not show any apparent enjoyment in the games or other activities during therapy. She often asked the speech/language pathologist what she was missing in her classroom while she was at speech.

Christy's attendance record also affected her progress. She missed 18 out of 65 possible sessions. When she returned to therapy after missing several days, it was necessary to review some of the previous targeted phonemes. This was usually done by adding an additional 15 minutes to her therapy session. Since the aide could not be with Christy when she was out of school, Christy missed many valuable practice hours.

Mikie also had many factors working against him during his remediation program. First, his mother was inconsistent in carrying out the home assignments. This was noticeable in his progress. On the days when he brought his assignments back signed by his mother, his correct production rate was much higher. Mikie also had some problems with behavior. He did not receive good auditory stimulation because he usually talked during auditory bombardment. The speech/language pathologist also found it difficult to keep him on task. Finally, his attendance record was poor. He missed over half

of his 47 possible sessions. Even though his remediation program extended over a five month period, he only attended two months of therapy.

The results of this study show that Hodson's remediation program can be an effective and sometimes expedient method of phonological remediation.

Recommendations for Further Research

The following suggestions are made for further research as a result of the present study:

1. This study should be replicated on a larger sample of subjects to corroborate the present findings.

2. This study should be replicated on children with different degrees of severity.

3. A study should be conducted to compare Hodson's remediation program to other phonological remediation programs.

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APPENDIX A

Definitions of Phonological Processes

Definitions of Basic Phonological Processes

(Hodson, 1980)

1. Syllable reduction occurs in a word with two or more syllables when one or more of the syllables is deleted. Weak syllable deletion is particularly common in very young children's speech (e.g., music box /muba/).
2. Cluster reduction occurs when one or more consonant member(s) of a cluster is omitted. This is one of the most common processes among very young "normals" and also individuals with severe speech disorders (e.g., speed /pid/).
3. Prevocalic singleton obstruent omissions are less common than postvocalic omissions. Most children use initial consonants very early. Prevocalic consonants occur before vowels or syllabic liquids within a syllable. Obstruents are noise-like and nonsonorant. They include voiceless consonants and their voiced cognates /p,b,t,d,k,g,f,v,θ,ð,s,ʃ,ʒ,tʃ,z,dʒ,h/ (e.g., bed /Ed/).
4. Postvocalic obstruent singleton omissions occur fairly often in the speech of children with severe phonological disorders. Postvocalic consonants occur after vowels or syllabic liquids within a syllable (e.g., brush /brʌ/).
5. Stridency deletion appears to be one of the most common contributing factors to unintelligibility. Strident consonants are those which occur when considerable air turbulence results from a forceful stream of air being directed against the upper teeth.

The stridents include the sibilants /s,z,ʃ,ʒ,tʃ,dʒ/ and also /f,v/ (e.g., sun /ɹʌn/).

6. Velar deviations occur with regularity in the speech of children with phonological disorders. When anterior phonemes such as /t,d,n/ or /p,b,m/ are substituted for the velar phonemes /k,g,ŋ/, the process is referred to as fronting (e.g., gun → /tʌn/).

7. Liquid /r,ɚ/ are among the most commonly misarticulated phonemes even among older essentially intelligible children. However, a few children with severe phonological disorders have been observed producing an adequate /ɚ/ in word-final position even when they produced very few other phonomes correctly. Deviations occur when the prevocalic /r/ is omitted or if a glide is substituted for /r/ (e.g., rug /wʌg/). Liquid /l/ is typically mastered earlier than /r,ɚ/. However, vowelization of syllabic or postvocalic /l/ is common even in the speech of highly intelligible young children. Deviations occur when the prevocalic /l/ is totally omitted or when a glide is substituted (e.g., leaf /wif/).

8. Nasals are usually produced appropriately even in word-final position. In addition, many children use nasal assimilation, substituting nasals for nonnasal target phonemes whenever there is any nasal in the word. Nasal deviations occur when a nasal is omitted or when a nonnasal is substituted (e.g., nose /ouz/).

9. Glides also appear to be among the earlier "established" consonants. Glides are among the more commonly substituted phonemes, particularly for liquids. Deviations occur when a glide is omitted or when there is a substitution of a nonglide (e.g., watch→/ɑtʃ/).

10. Vowels are usually produced appropriately by children with essentially normal hearing, even though many children demonstrate idiosyncratic word productions which affect vowels. Individuals with severe hearing losses tend to have more inappropriate vowel deviations; and some variations in vowels occur with dialects.

Definitions of Miscellaneous Phonological Processes

(Hodson, 1980)

1. Backing is a rather infrequently occurring process which devastates intelligibility when it occurs, perhaps partially because it is less expected than its contrasting process, fronting. The child who demonstrates backing substitutes /k,g,h/ and glottal stops for nonback target phonemes (e.g., doll→/gɑl/).
2. Glottal replacement is a phonological process which is frequently found in the speech of children with the most severe phonological disorders. Some children go through a period of using glottal stops in place of postvocalic consonants when they first demonstrate an awareness of final consonant production (e.g., gun→/gʌʔ/).
3. Stopping is a frequently occurring process appearing concurrently with stridency deletion. Stopping involves substitution of stops /p,b,t,d,k,g/ for continuant consonants including productions such as (leaf→/dip/) and (/thumb→/tʌm/). Stopping does not appear to be as crucial a process affecting intelligibility as does stridency deletion. It has been observed that children who demonstrated frequent substitutions of stops still produced many continuant phonemes without assistance, whereas a great many of the same children produced no strident phonemes whatsoever.

4. Prevocalic voicing has been observed in the speech of very young "normals" and also in children with the most severe phonological disorders. This process involves adding voicing to a voiceless target when it precedes a vowel (e.g., tub →/dʌb/).
5. Postvocalic devoicing is particularly common at the end of an utterance, even among mature speakers of English, and is considered to be more "normal" than abnormal (e.g., page /peɪtʃ/). It may result from an over-extension of the normal adult tendency to use the devoiced allophone of final voiced consonants at the end of an utterance (e.g., nose /noʊz/).
6. Affrication is a process which children often demonstrate as they are in the process of learning specific continuant phonemes (e.g., soap /tsoʊ/; thumb /pfʌm/ or /tθʌm/), and as they appear to be sorting out the stop-continuant dichotomy (e.g., shoe /tʃu/).
7. Deaffrication seems to occur also as children are learning or perhaps overlearning new sounds (e.g., chair /ʃɛɹ/).
8. Palatalization seems to affect intelligibility considerably if its occurrence is widespread. Some children go through a state of adding palatalization to phonemes, particularly sibilants and clusters (e.g., soup /tʃoʊp/).
9. Depalatalization does not generally seem to reduce intelligibility a great deal. Examples of depalatalization are (chair /tsɛɹ/) and (shoe /su/).
10. Coalescence occurs when two contiguous consonants are replaced by a single one which shares features of the two original ones.

Examples are (e.g., smoke→/fouk/ where the stridency of /s/ and the labialness of /m/ are combined in /f/) and (e.g., star /tʃɑɹ/ palatalization also being added).

11. Epenthesis involves insertion of a phoneme. Children sometimes maintain a preference for CV structures when attempting a consonant cluster by inserting a vowel between the two consonants, resulting in CVCV rather than CCV (e.g., tree→/tʌri/).

12. Matathesis pertains to exchanging positions of phonemes or syllables. The most common example is the transposition of /s/ and /k/ in words such as mask and basket (e.g., /mæks/ and /bæksIt/).

APPENDIX B

Formula for Composite Phonological Deviancy Score

Formula for Composite Phonological Deviancy Score

(Hodson & Paden, 1983)

1. Determine percentage-of-occurrence score for each basic deficient pattern.

	No. of Occurrences		No. of possible Occurrences		Percentage-of-Occurrence score	
(Example:	26	÷	35	=	74	)

2. Obtain the mean of 10 basic deficient patterns.

	Sum of 10 Deficient Pattern Scores		No. of Deficient Patterns		Mean Deficient Pattern Score	
(Example:	442	÷	10	=	44.2	)

3. Add points for other deficient patterns and for age.

	Mean Pattern Score		Points for Other Critical Patterns*		Age Compensatory Points**	
(Example:	44.2	+	10	+	10	)

4. The resulting total is the Composite Phonological Deviancy Score. (Example = 64)

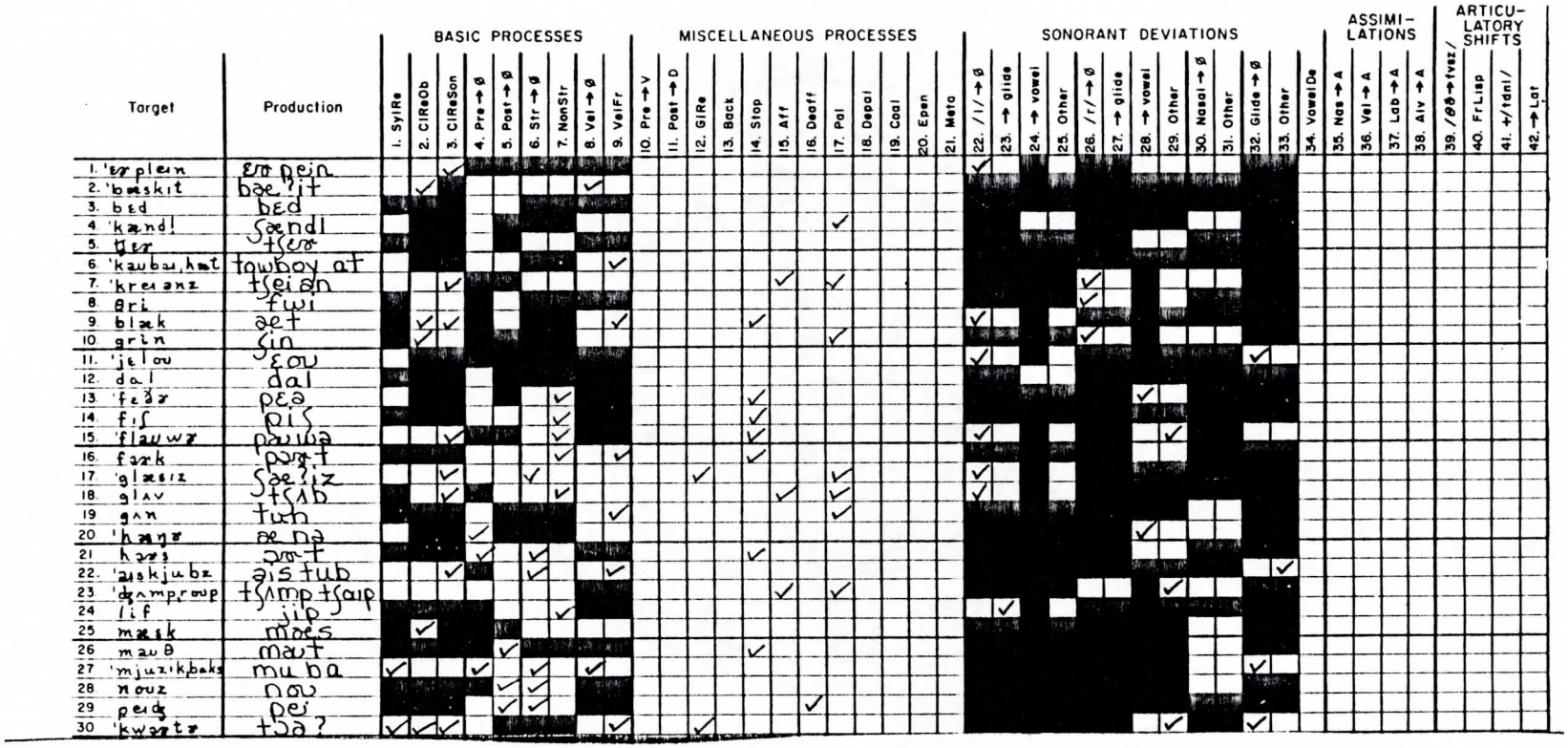
*Add one point for each three occurrences of any Level I and II patterns.

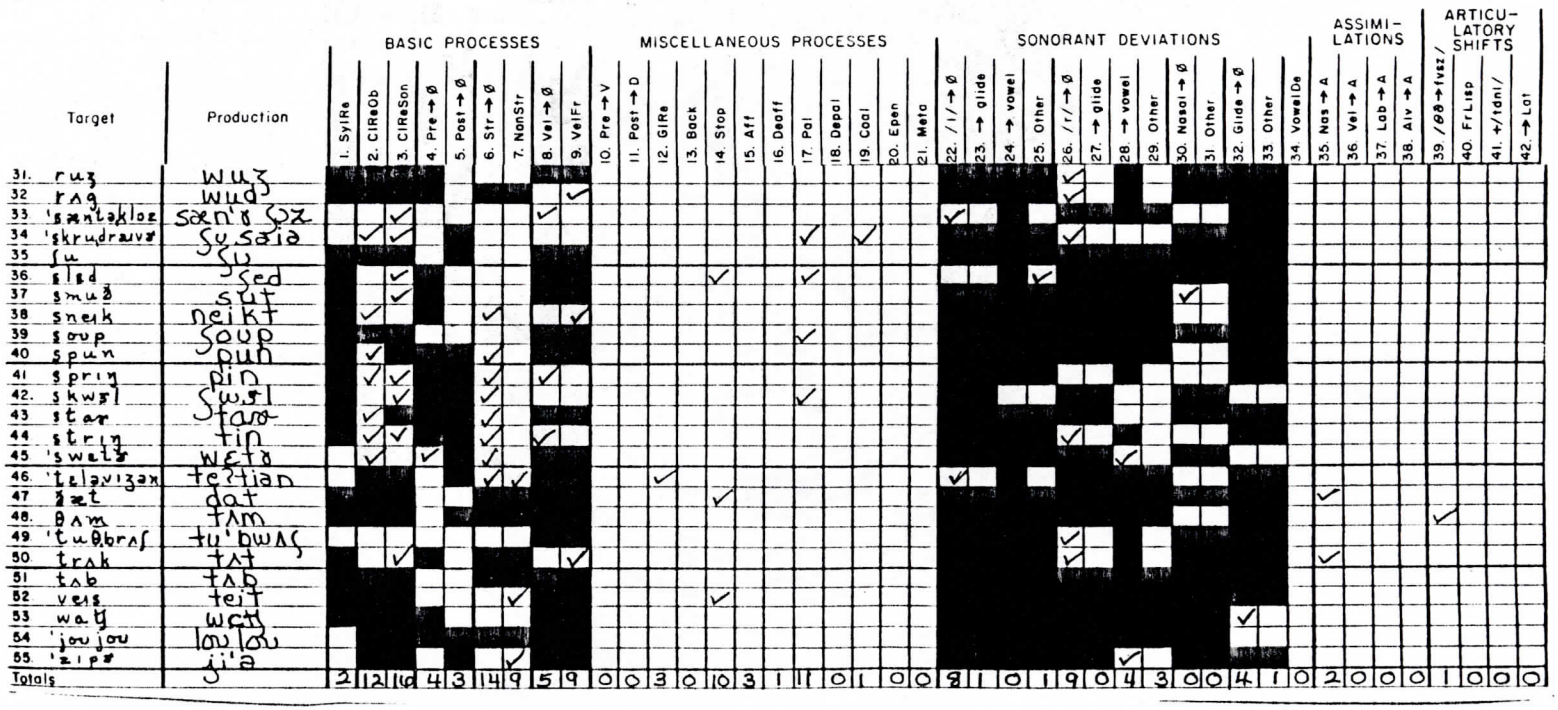
**Add 5 points for four-year-olds, 10 points for five-year-olds, 15 points for six-year-olds, and 20 points for seven-year olds and older.

APPENDIX C

Phonological Evaluation Results
For Three Subjects

Christy's (Subject 1) Pretest




BASIC PROCESSES
MISCELLANEOUS PROCESSES
SONORANT DEVIATIONS
ASSIMI-LATIONS
ARTICU-LATORY SHIFTS
Target
Production
1. SylRe
2. ClReOb
3. ClReSon
4. Pre→Ø
5. Post→Ø
6. Str→Ø
7. NonStr
8. Vel→Ø
9. VelFr
10. Pre→V
11. Post→D
12. GlRe
13. Back
14. Stop
15. Aff
16. Deaff
17. Pal
18. Depal
19. Coal
20. Epen
21. Meta
22. /l/→Ø
23. →glide
24. →vowel
25. Other
26. /r/→Ø
27. →glide
28. →vowel
29. Other
30. Nasal→Ø
31. Other
32. Glide→Ø
33. Other
34. VowelDe
35. Nas→A
36. Vel→A
37. Lab→A
38. Alv→A
39. /θð→fvsz/
40. FrLisp
41. +/tdnl/
42. →Lat
31. ruʒ wuʒ
32. rʌg wud
33. 'sʌnlʌkloz sʌn'ɑ ʃɔz
34. 'skrudrauz ʃu saɪə
35. ʃu ʃu
36. sɪɡd ʃed
37. smuð sut
38. sneɪk neiKt
39. soup ʃoup
40. spun pun
41. sprɪŋ piN
42. skwɛl ʃwɛl
43. star ʃtɑə
44. strɪŋ tiN
45. 'swɛtɚ wɛtə
46. 'tɛlɑvɪzən teʔiən
47. ðæt dat
48. θʌm tʌm
49. 'tuθbrʌʃ tu'bwʌʃ
50. træk tʌt
51. tʌb tʌp
52. veɪs teiʃ
53. weɪt wet
54. 'joujou lou lou
55. 'zɪpɚ ji'ə
Totals
2 12 16 4 3 14 9 5 9 0 0 3 0 10 3 1 11 0 1 0 0 8 1 0 1 9 0 4 3 0 0 4 1 0 2 0 0 0 1 0 0 0

Phonological Evaluation Results

Christy's (Subject 1) Pretest Summary

Basic Phonological Processes

	Number of Occurrences	Possible Occurrences	Percentage of Occurrence
Syllable Reduction	2	21	9
Cluster Reduction			
Obstruent Omissions	12		
Sonorant Omissions	16		
Total	18	35	80
Singleton Obstruent Omissions			
Prevocalic	4	38	11
Postvocalic	4	30	13
Total	8		
Stridency Deletion			
Omissions	14		
Non-strident Substitutions	9		
Total	23	44	52
Velar Deviations			
Omissions	5		
Fronting	9		
Total	14	24	58

Sonorant Deviations

	Number of Occurrences	Possible Occurrences	Percentage of Occurrence
Liquid /l/			
Omissions	8		
Gliding	1	10	
Vowelization	0	3	
Other	1		
Total	10	13	77
Liquid /r,ɝ/			
Omissions	9		
Gliding	0	12	
Vowelization	4	14	
Other	3		
Total	16	26	62
Nasals			
Omissions	1		
Other	0		
Total	1	19	5
Glides			
Omissions	4		
Other	1		
Total	5	10	50
Vowel Deviations			

Christy's (Subject 1) Pretest Summary

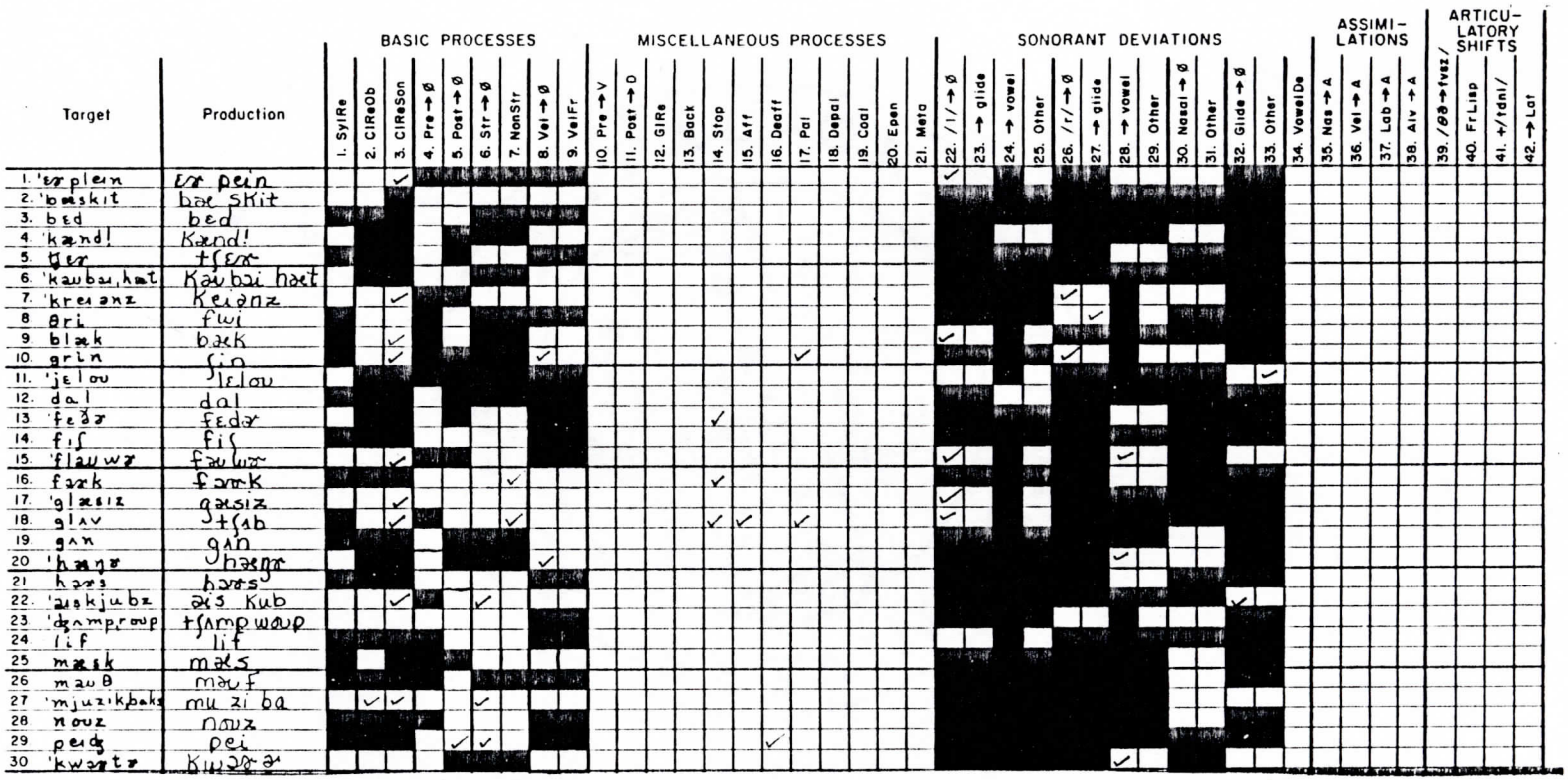
Miscellaneous Phonological Processes

	Number of Occurrences
Prevocalic	0
Postvocalic Devoicing	0
Glottal Replacement	4
Backing	0
Stopping	10
Coalescence	1
Epenthesis	0
Metathesis	0

Assimilation Processes

	Number of Occurrences
Nasal	2
Velar	
Labial	
Alveolar	

Christy's (Subject 1) Posttest



	Target	Production	BASIC PROCESSES 1. SylRe	2. ClReOb	3. ClReSon	4. Pre → Ø	5. Post → Ø	6. Str → Ø	7. NonStr	8. Vel → Ø	9. VelFr
31.	ruʒ	wuʒ									
32	rʌg	wʌg									
33.	'sæntəkloz	sænə kɔz									
34	'skrudraivɚ	ʃu saiə		✓	✓						
35	ʃu	ʃu									
36.	slɛd	sɛd			✓						
37	smuð	sut			✓						
38.	sneik	snei									✓
39	soup	soup									
40	spun	spun									
41	spriŋ	spiŋ									
42.	skwɝl	ʃwɝl			✓			✓			
43	star	saɚ		✓							
44	striŋ	swiŋ		✓							
45	'swɛtɚ	swɛtɚ									
46	'tɛləvɪʒən	tɛ'ʃən						✓	✓		
47	ðæt	dæt									
48.	θʌm	fʌm									
49	'tuθbrʌʃ	tuf bwʌʃ									
50	trʌk	tʌk			✓						
51	tʌb	tʌb									
52	veis	vei					✓	✓			
53	watʃ	watʃ									
54	'jouˌjou	lou lou									
55.	'zipɚ	jipɚ							✓		
Totals			0	4	14	0	2	6	4	2	1

	MISCELLANEOUS PROCESSES 10. Pre → V	11. Post → D	12. GlRe	13. Back	14. Stop	15. Aff	16. Deaff	17. Pal	18. Depal	19. Coal	20. Epen	21. Meta
31.												
32												
33.												
34								✓		✓		
35												
36.												
37					✓							
38.												
39												
40												
41												
42.								✓				
43												
44												
45												
46			✓									
47					✓							
48.												
49												
50												
51												
52												
53												
54												
55.												
Totals	0	0	1	0	5	0	1	4	0	1	0	0

	SONORANT DEVIATIONS 22. /l/ → Ø	23. → glide	24. → vowel	25. Other	26. /r/ → Ø	27. → glide	28. → vowel	29. Other	30. Nasal → Ø	31. Other	32. Glide → Ø	33. Other
31.						✓						
32						✓						
33.	✓											
34					✓							
35												
36.	✓											
37												
38.												
39												
40												
41					✓							
42.												
43												
44						✓						
45								✓				
46	✓											
47												
48.												
49						✓						
50					✓							
51												
52												
53												✓
54												
55.												
Totals	8	0	0	0	5	5	4	1	0	0	1	2

	34. VowelDe	ASSIMILATIONS 35. Nas → A	36. Vel → A	37. Lab → A	38. Alv → A	ARTICULATORY SHIFTS 39. /θð → fvsz/	40. FrLisp	41. +/tdnl/	42. → Lat
31.									
32									
33.									
34									
35									
36.									
37									
38.									
39									
40									
41									
42.									
43									
44									
45									
46									
47									
48.									
49									
50									
51									
52									
53									
54									
55.									
Totals									

Christy's (Subject 1) Posttest Summary

Basic Phonological Processes

	Number of Occurrences	Possible Occurrences	Percentage of Occurrence
Syllable Reduction	0	21	0
Cluster Reduction			
Obstruent Omissions	5		
Sonorant Omissions	14		
Total	18	35	51
Singleton Obstruent Omissions			
Prevocalic	0	38	0
Postvocalic	2	30	7
Total	2		
Stridency Deletion			
Omissions	6		
Non-strident Substitutions	4		
Total	10	44	23
Velar Deviations			
Omissions	3		
Fronting	1		
Total	4	24	17

Sonorant Deviations

	Number of Occurrences	Possible Occurrences	Percentage of Occurrence
Liquid /l/			
Omissions	8		
Gliding	0	10	
Vowelization	0	3	
Other	0		
Total	8	13	62
Liquid /r,ɚ/			
Omissions	5		
Gliding	5	12	
Vowelization	4	14	
Other	1		
Total	15	26	58
Nasals			
Omissions	0		
Other	0		
Total	0	19	0
Glides			
Omissions	1		
Other	2		
Total	3	10	30
Vowel Deviations			

Christy's (Subject 1) Posttest Summary

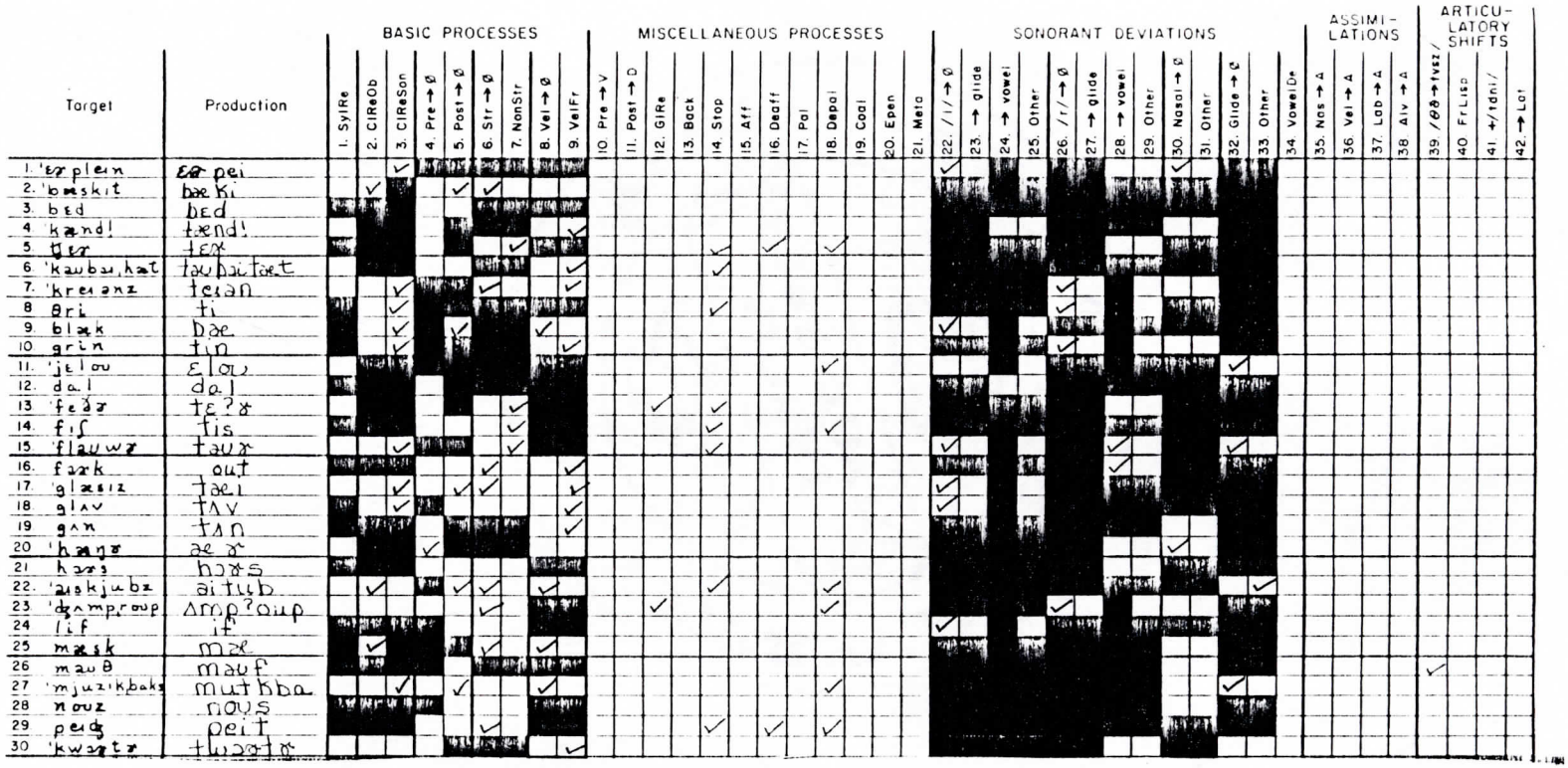
Miscellaneous Phonological Processes

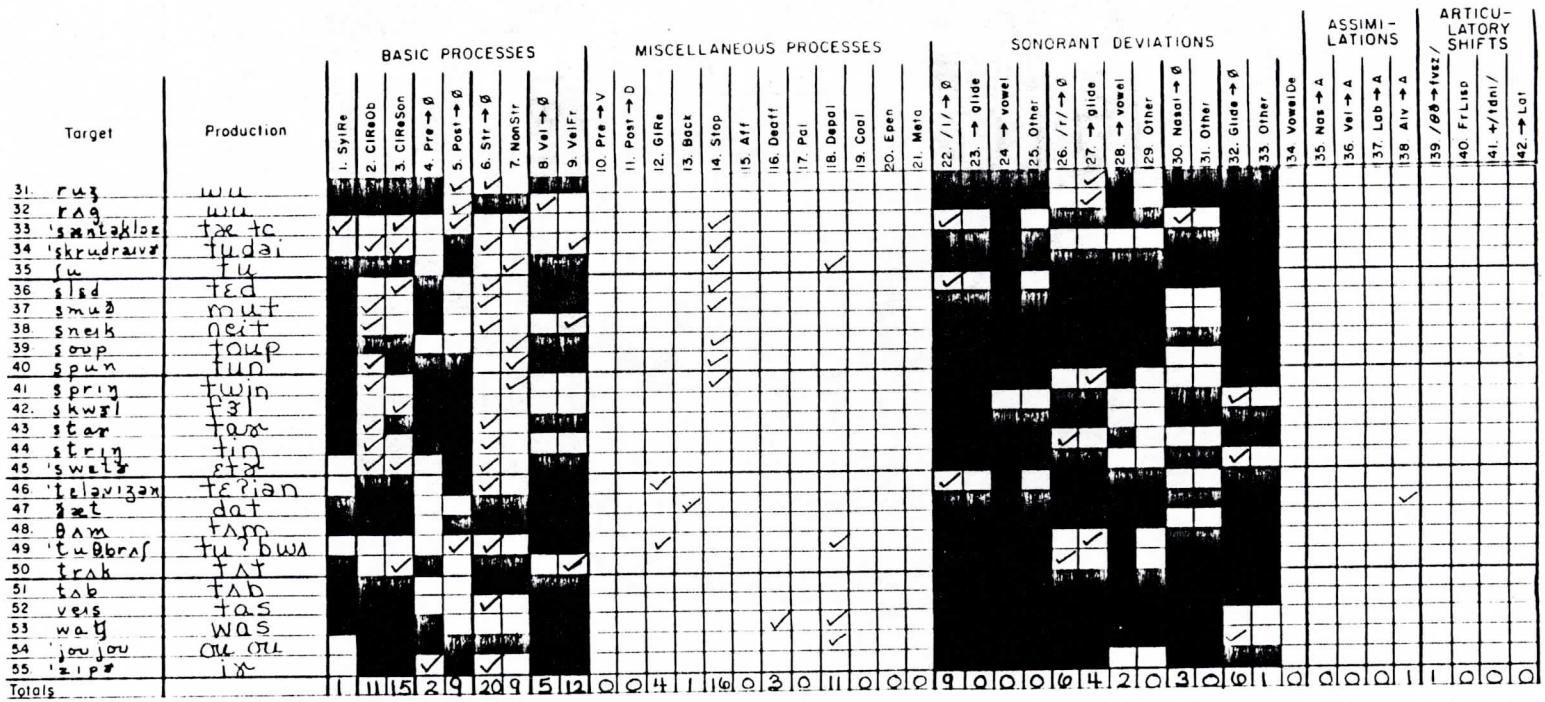
	Number of Occurrences
Prevocalic Voicing	
Postvocalic Devoicing	
Glottal Replacement	1
Backing	
Stopping	5
Coalescence	1
Epenthesis	
Metathesis	

Assimilation Processes

	Number of Occurrences
Nasal	
Velar	
Labial	
Alveolar	

Holly's (Subject 2) Pretest




BASIC PROCESSES
MISCELLANEOUS PROCESSES
SONORANT DEVIATIONS
ASSIMI-LATIONS
ARTICU-LATORY SHIFTS
Target
Production
1. SylRe
2. ClReOb
3. ClReSon
4. Pre→Ø
5. Post→Ø
6. Str→Ø
7. NonStr
8. Vel→Ø
9. VelFr
10. Pre→V
11. Post→D
12. GlRe
13. Back
14. Stop
15. Aff
16. Deaff
17. Pal
18. Depal
19. Cool
20. Epen
21. Meta
22. /l/→Ø
23. → glide
24 → vowel
25. Other
26. /r/→Ø
27. → glide
28. → vowel
29. Other
30. Nasal→Ø
31. Other
32. Glide→Ø
33. Other
34. VowelDe
35. Nas→A
36. Vel→A
37. Lab→A
38. Alv→A
39. /θð→fvzz/
40. FrLisp
41. +/tdnl/
42. →Lat
31. ruʒ
32. rʌg
33. ˈsɹntʃkloz
34. ˈʃkrudraivɹ
35. ʃu
36. ʃɛd
37. ʃmuð
38. ʃneik
39. ʃoup
40. ʃpun
41. ʃpriŋ
42. ʃkwɹl
43. ʃtar
44. ʃtriŋ
45. ˈʃweiʃ
46. ˈʧelaviʒən
47. ʒɹt
48. θʌm
49. ˈtuθbɹʌʃ
50. tɹʌk
51. tʌb
52. veɹs
53. waʧ
54. ˈjouˌjou
55. ˈzipɹ
Totals
1 11 15 2 9 20 9 5 12 0 0 4 1 16 0 3 0 11 0 0 0 9 0 0 0 6 4 2 0 3 0 6 1 0 0 0 0 1 1 0 0 0

Holly's (Subject 2) Pretest Summary

Basic Phonological Processes

	Number of Occurrences	Possible Occurrences	Percentage of Occurrence
Syllable Reduction	1	23	.04
Cluster Reduction			
Obstruent Omissions	11		
Sonorant Omissions	15		
Total	26	35	74
Singleton Obstruent Omissions			
Prevocalic	2	38	.05
Postvocalic	9	30	30
Total	11		
Stridency Deletion			
Omissions	20		
Non-strident Substitutions	9		
Total	29	44	67
Velar Deviations			
Omission	5		
Fronting	12		
Total	17	24	71

Sonorant Deviations

	Number of Occurrences	Possible Occurrences	Percentage of Occurrence
Liquid /l/			
Omissions	9		
Gliding	0	10	
Vowelization	0	3	
Other	0		
Total	9	13	69
Liquid /r,ɝ/			
Omissions	6		
Gliding	4	12	
Vowelization	2	14	
Other	0		
Total	12	26	46
Nasals			
Omissions	3		
Other	0		
Total	3	19	16
Glides			
Omissions	6		
Other	1		
Total	7	10	70
Vowel Deviations	0		

Holly's (Subject 2) Pretest Summary

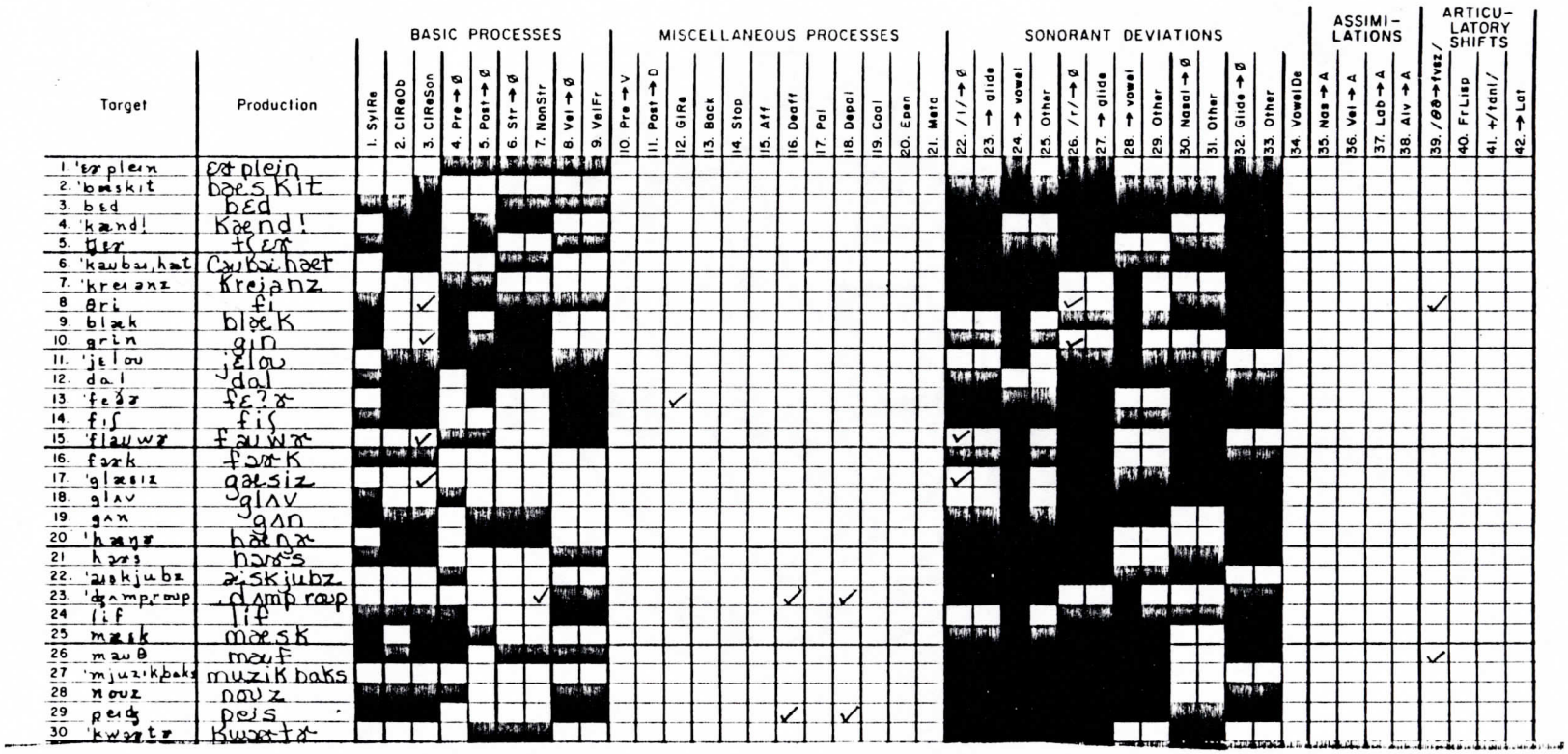
Miscellaneous Phonological Processes

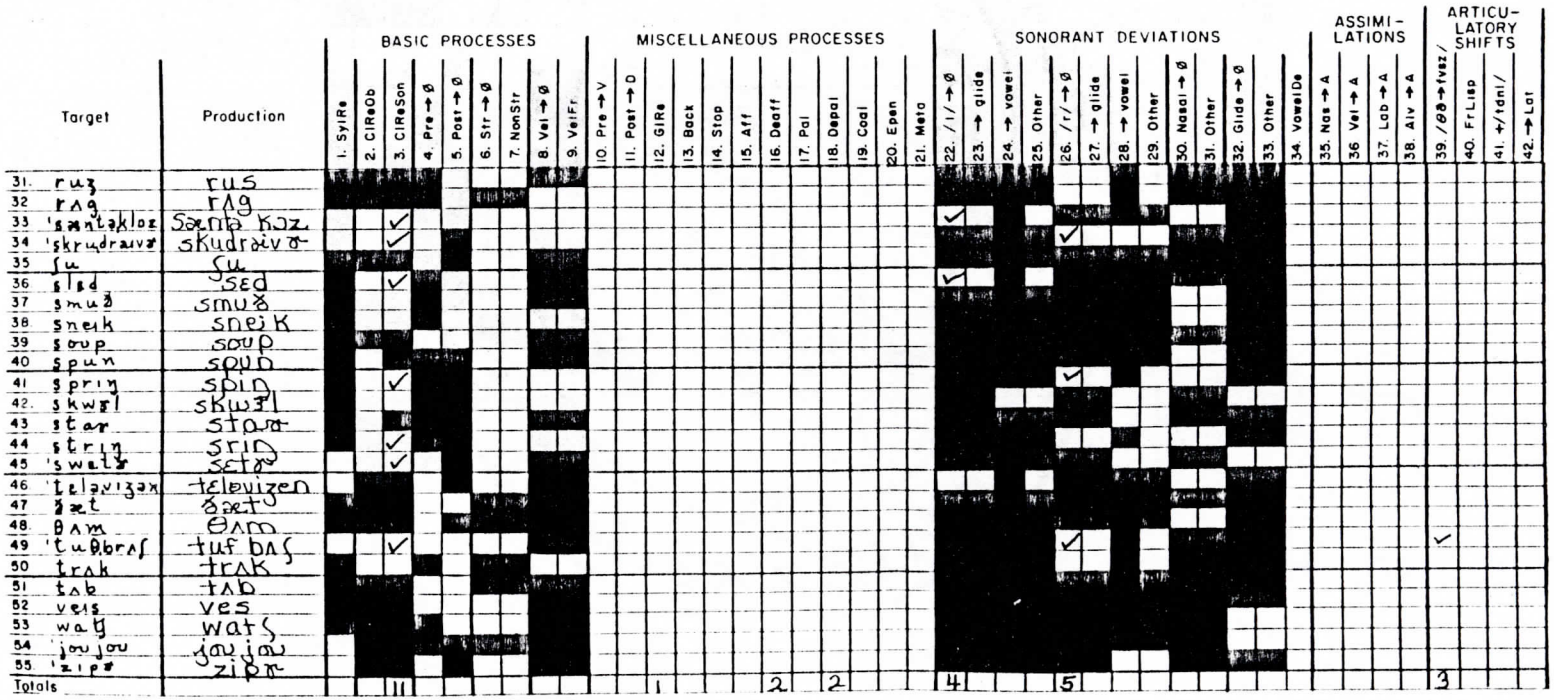
	Number of Occurrences
Prevocalic Voicing	
Postvocalic Devoicing	
Glottal Replacement	
Backing	
Stopping	
Coalescence	
Epenthesis	
Metathesis	

Assimilation Processes

	Number of Occurrences
Nasal	0
Velar	0
Labial	0
Alveolar	1

Holly's (Subject 2) Posttest




BASIC PROCESSES
MISCELLANEOUS PROCESSES
SONORANT DEVIATIONS
ASSIMI-LATIONS
ARTICU-LATORY SHIFTS
Target
Production
1. SylRe
2. ClReOb
3. ClReSon
4. Pre→Ø
5. Post→Ø
6. Str→Ø
7. NonStr
8. Vel→Ø
9. VelFr
10. Pre→V
11. Post→D
12. GlRe
13. Back
14. Stop
15. Aff
16. Deaff
17. Pal
18. Depal
19. Coal
20. Epen
21. Meta
22. /l/→Ø
23. → glide
24. → vowel
25. Other
26. /r/→Ø
27. → glide
28. → vowel
29. Other
30. Nasal→Ø
31. Other
32. Glide→Ø
33. Other
34. VowelDe
35. Nas→A
36 Vel→A
37. Lab→A
38. Alv→A
39. /θð→fvsz/
40. FrLisp
41. +/tdnl/
42. →Lat
31. ruz rus
32 rʌg rʌg
33 'sæntəkloz Santa Kaz
34 'skrudraivə skudraivə
35 ʃu ʃu
36 sɪɹd sɛd
37 smuð smuð
38 sneɪk snejK
39 soup soup
40 spun spun
41 sprɪŋ spiŋ
42. skwɛɹl skwɛɹl
43 stɑr stɑɹ
44 strɪŋ sriŋ
45 'swɛtɚ sɛtə
46 'tɛləvɪʒən tɛlevizen
47 θɪɛt θɛtʃ
48 θʌm θʌm
49 'tʌðbrʌʃ tuf bʌʃ
50 trʌk trʌK
51 tʌb tʌb
52 veɪs ves
53 weɪ watʃ
54 'ʤoʊʤoʊ joujou
55 'zɪpɚ zipə
Totals
11
1
2
2
4
5
3

Holly's (Subject 2) Posttest Results

Basic Phonological Processes

	Number of Occurrences	Possible Occurrences	Percentage of Occurrence
Syllable Reduction	0	21	0
Cluster Reduction			
Obstruent Omissions	0		
Sonorant Omissions	11		
Total	11	35	42
Singleton Obstruent Omissions			
Prevocalic	0	38	0
Postvocalic	0	30	0
Total	0		
Stridency Deletion			
Omissions	0		
Non-strident Substitutions	1		
Total	1	44	2
Velar Deviations			
Omissions	0		
Fronting	0		
Total	0	24	0

Sonorant Deviations

	Number of Occurrences	Possible Occurrences	Percentage of Occurrence
Liquid /l/			
Omissions	4	10	
Gliding	0	3	
Vowelization	0		
Other	4	13	31
Total			
Liquid /r,ɚ/			
Omissions	5		
Gliding	0	12	
Vowelization	0	14	
Other	5	26	11
Total			
Nasals			
Omissions	0		
Other	0		
Total	0	19	0
Glides			
Omissions	1		
Other	0		
Total	1	10	11
Vowel Deviations	0		

Holly's (Subject 2) Posttest Results

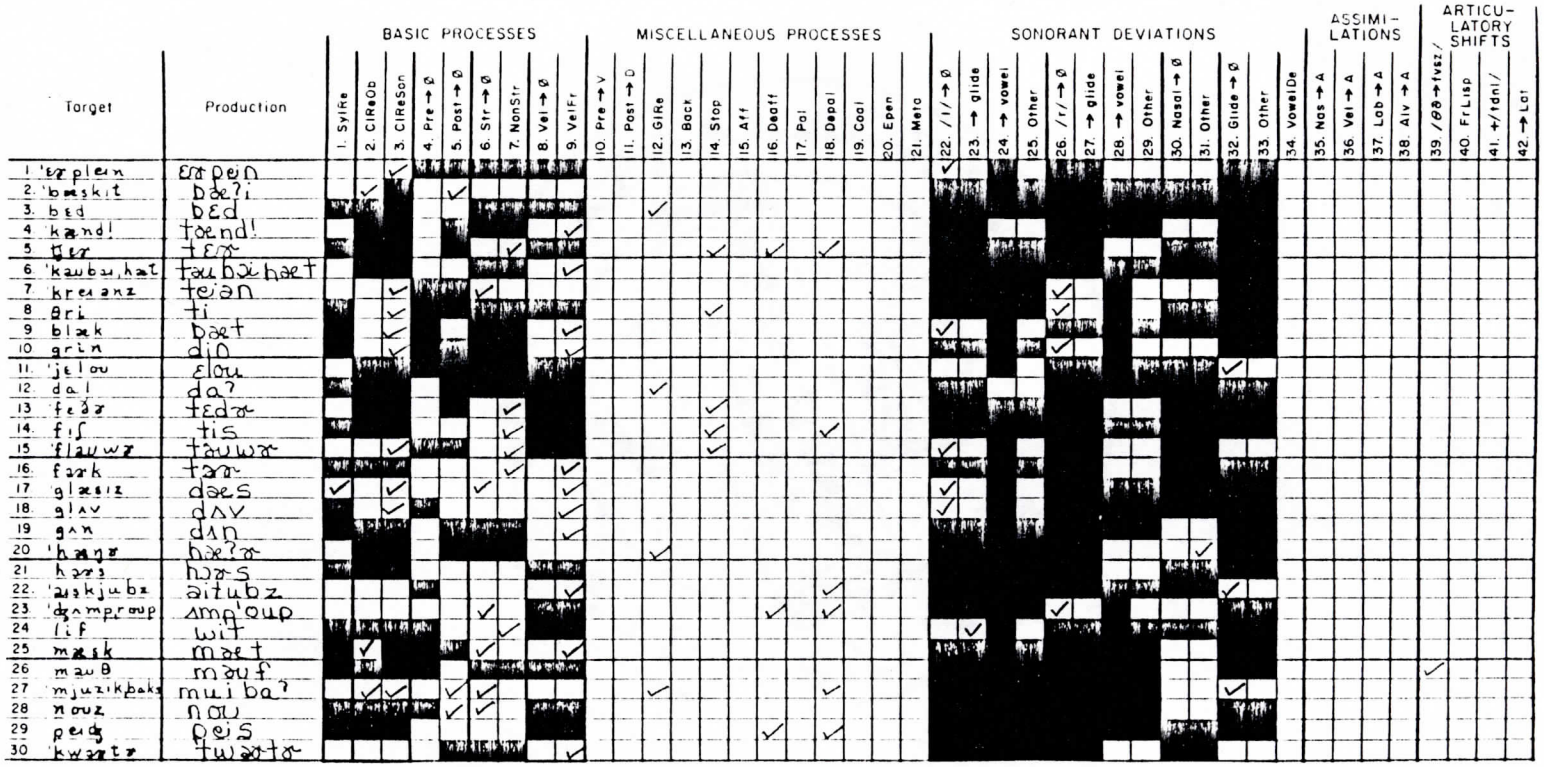
Miscellaneous Phonological Processes

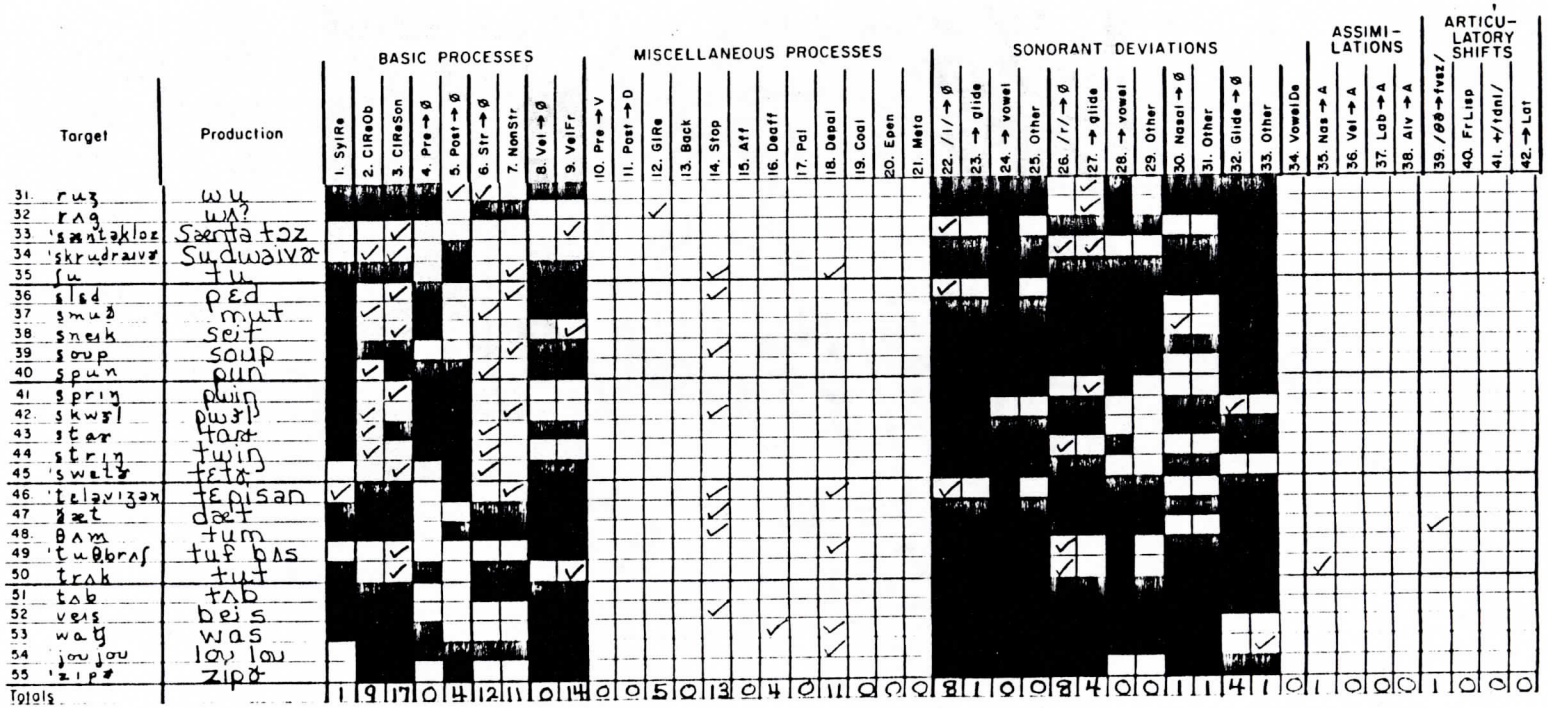
	Number of Occurrences
Prevocalic Voicing	
Postvocalic Devoicing	
Glottal Replacement	1
Backing	
Stopping	
Coalescence	
Epenthesis	
Metathesis	

Assimilation Processes

	Number of Occurrences
Nasal	
Velar	
Labial	
Alveolar	

Mikie's (Subject 3) Pretest




BASIC PROCESSES
MISCELLANEOUS PROCESSES
SONORANT DEVIATIONS
ASSIMI-LATIONS
ARTICU-LATORY SHIFTS
Target
Production
1. SylRe
2. ClReOb
3. ClReSon
4. Pre→Ø
5. Post→Ø
6. Str→Ø
7. NonStr
8. Vel→Ø
9. VelFr
10. Pre→V
11. Post→D
12. GlRe
13. Back
14. Stop
15. Aff
16. Deaff
17. Pal
18. Depal
19. Coal
20. Epen
21. Meta
22. /l/→Ø
23. → glide
24. → vowel
25. Other
26. /r/→Ø
27. → glide
28. → vowel
29. Other
30. Nasal→Ø
31. Other
32. Glide→Ø
33. Other
34. VowelDe
35. Nas→A
36. Vel→A
37. Lab→A
38. Alv→A
39. /θð→fvsz/
40. FrLisp
41. +/tdnl/
42. →Lat
31. ruz
32. rʌg
33. 'sæntaklɔz
34. 'skrudraivɚ
35. ʃu
36. ʃɛd
37. ʃmuʊ
38. ʃnek
39. ʃup
40. ʃpʌn
41. ʃpriŋ
42. ʃkwɚl
43. ʃtar
44. ʃtriŋ
45. ʃwetɚ
46. 'tɛlɛvɪʒən
47. ʒæt
48. θʌm
49. 'tuθbrʌʃ
50. trʌk
51. tʌb
52. veɪs
53. weɪ
54. joʊ joʊ
55. 'zɪpɚ
Totals
wu
wʌ?
Santaclaz
Sudwaivɚ
tu
pɛd
mut
set
soup
pun
pwin
twɛl
tar
twin
tɛtɚ
tɛlɛvɪʒən
dæt
tum
tuf bʌs
tut
tʌb
beis
was
lov lov
zipɚ

Mikie's (Subject 3) Pretest Summary

Basic Phonological Processes

	Number of Occurrences	Possible Occurrences	Percentage of Occurrence
Syllable Reduction	1	21	4
Cluster Reduction			
Obstruent Omissions	9		
Sonorant Omissions	17		
Total	26	35	74
Singleton Obstruent Omissions			
Prevocalic	0	38	0
Postvocalic	4	30	13
Total	4		
Stridency Deletion			
Omissions	12		
Non-strident Substitutions	11		
Total	23	44	52
Velar Deviations			
Omissions	0		
Fronting	14		
Total	14	24	58

Sonorant Deviations

	Number of Occurrences	Possible Occurrences	Percentage of Occurrence
Liquid /l/			
Omissions	8		
Gliding	1	10	
Vowelization	0	3	
Other	0		
Total	9	13	69
Liquid /r,ɚ/			
Omissions	8		
Gliding	4	12	
Vowelization	0	14	
Other	0		
Total	12	26	46
Nasals			
Omissions	3		
Other	0		
Total	3	19	10
Glides			
Omissions	4		
Other	1		
Total	5	10	50
Vowel Deviations	0		

Mikie's (Subject 3) Pretest Summary

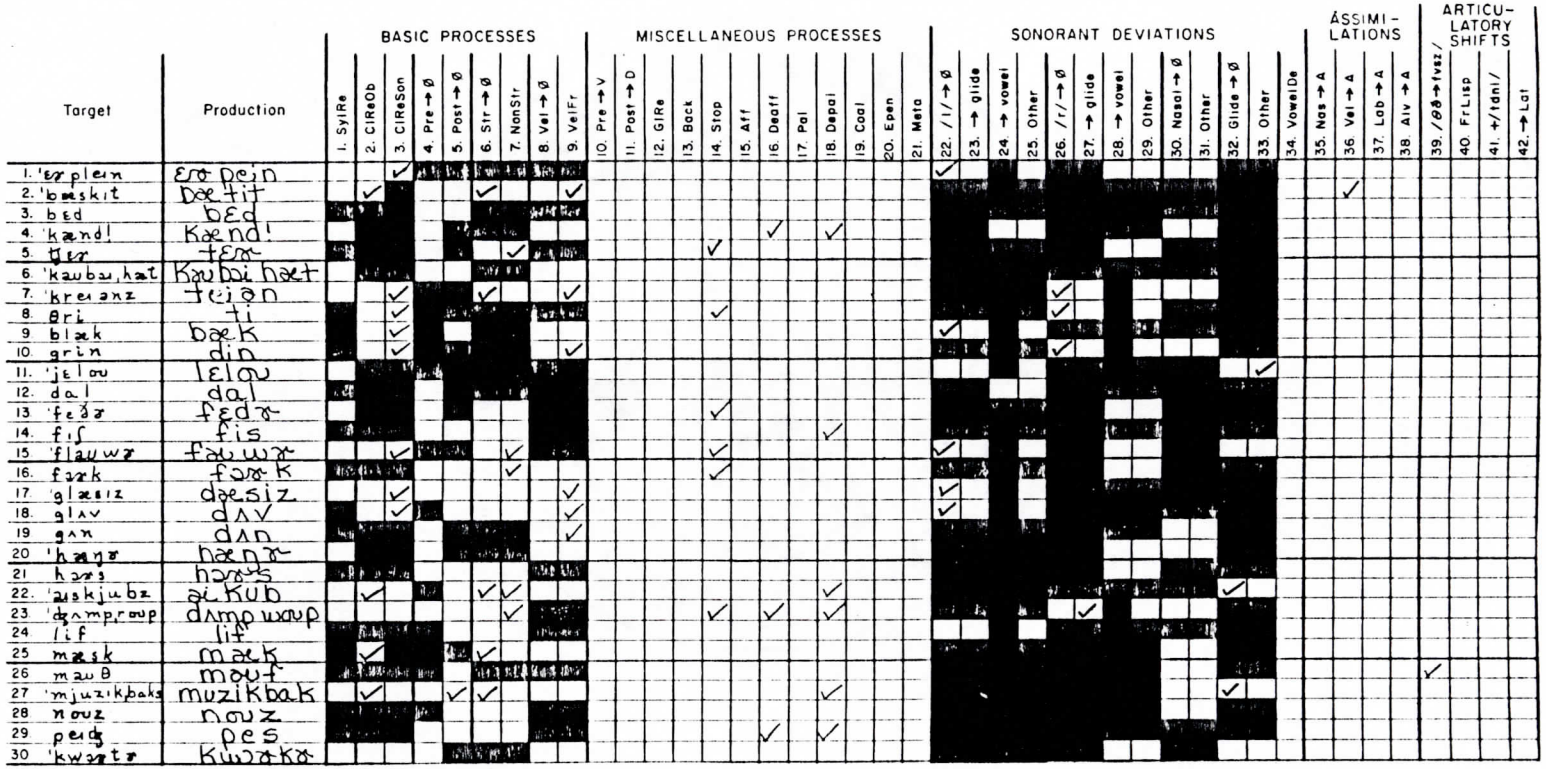
Miscellaneous Phonological Processes

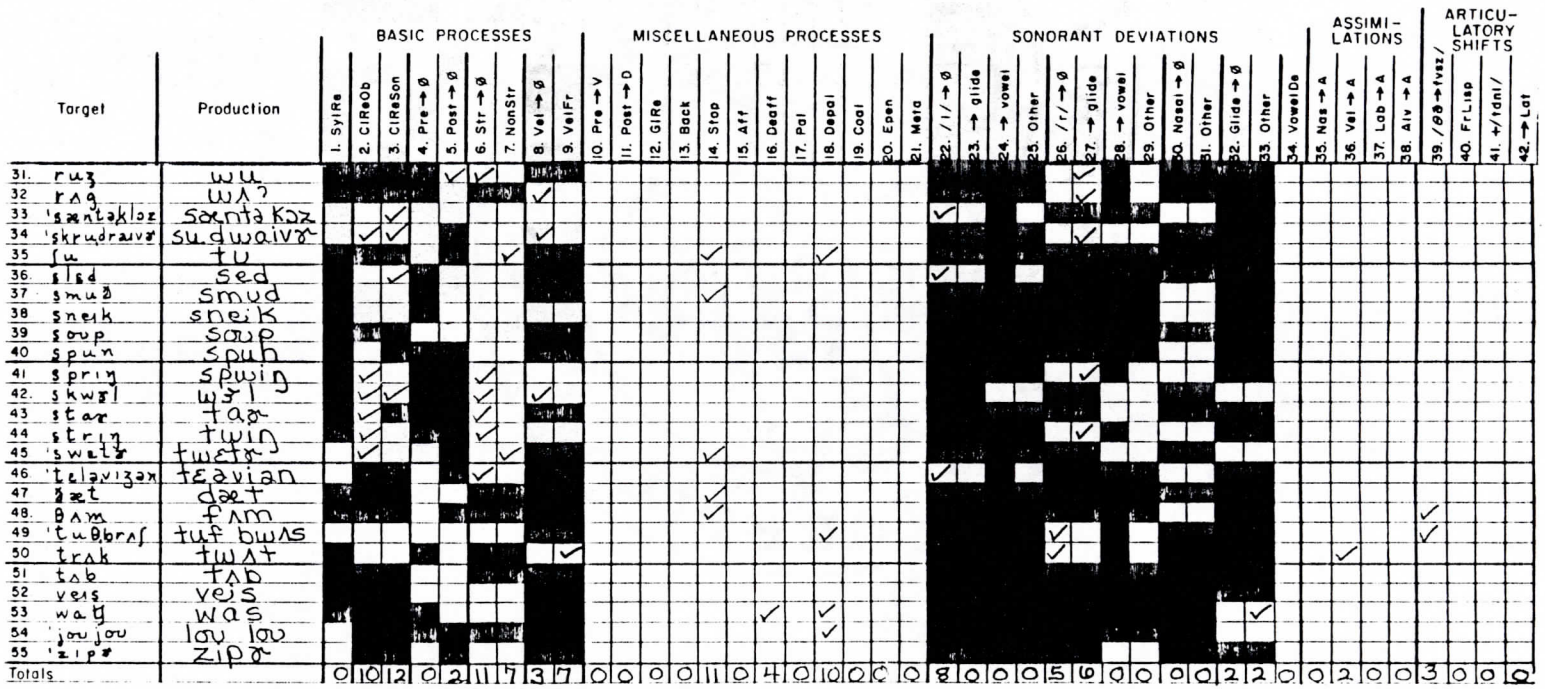
	Number of Occurrences
Prevocalic Voicing	0
Postvocalic Devoicing	0
Glottal Replacement	5
Backing	0
Stopping	13
Coalescence	0
Epenthesis	0
Metathesis	0

Assimilation Processes

	Number of Occurrences
Nasal	1
Velar	0
Labial	0
Alveolar	0

Mikie (Subject 3) Posttest




BASIC PROCESSES
MISCELLANEOUS PROCESSES
SONORANT DEVIATIONS
ASSIMI-LATIONS
ARTICU-LATORY SHIFTS
Target
Production
1. SylRe
2. ClReOb
3. ClReSon
4. Pre→Ø
5. Post→Ø
6. Str→Ø
7. NonStr
8. Vel→Ø
9. VelFr
10. Pre→V
11. Post→D
12. GlRe
13. Back
14. Stop
15. Aff
16. Deaff
17. Pal
18. Depal
19. Coal
20. Epen
21. Meta
22. /l/→Ø
23. → glide
24. → vowel
25. Other
26. /r/→Ø
27. → glide
28. → vowel
29. Other
30. Nasal→Ø
31. Other
32. Glide→Ø
33. Other
34. VowelDe
35. Nas→A
36. Vel→A
37. Lab→A
38. Alv→A
39. /θð/→fvsz/
40. FrLisp
41. +/tdnl/
42. →Lat
31. ruʒ ɯɯ
32. rʌg ɯʌʔ
33. ˈsæntəkloz sæntəkɑz
34. ˈskrudraivɚ su.dwaivɚ
35. ʃu tu
36. ˈsɛd sed
37. smuð smud
38. sneik sneik
39. soup soup
40. spun spuh
41. spriŋ spwiŋ
42. skwɚl ɯɚl
43. star tar
44. striŋ twiŋ
45. ˈswetɚ twɛtɚ
46. ˈtɛləvɪʒən tɛəvɪən
47. ðæt dæt
48. θʌm fʌm
49. ˈtʌbbrʌʃ tuf bwʌs
50. træk twʌt
51. tʌb tʌb
52. veis veis
53. weɪ was
54. ˈjoujou ɪou ɪou
55. ˈzipɚ zipɚ
Totals
0 10 12 0 2 11 7 3 7 0 0 0 0 11 0 4 0 10 0 0 8 0 0 0 5 6 0 0 0 0 2 2 0 0 0 2 0 0 3 0 0 0

Mikie's (Subject 3) Posttest Summary

Basic Phonological Processes

	Number of Occurrences	Possible Occurrences	Percentage of Occurrence
Syllable Reduction	0	21	0
Cluster Reduction			
Obstruent Omissions	10		
Sonorant Omissions	12		
Total	22	35	63
Singleton Obstruent Omissions			
Prevocalic	0	38	0
Postvocalic	0	30	0
Total	0		
Stridency Deletion			
Omissions	9		
Non-strident Substitutions	2		
Total	11	44	41
Velar Deviations			
Omissions	3		
Fronting	7		
Total	10	24	42

Sonorant Deviations

	Number of Occurrences	Possible Occurrences	Percentage of Occurrence
Liquid /l/			
Omissions			
Gliding		10	
Vowelization		3	
Other			
Total		13	62
Liquid /r,ɝ/			
Omissions			
Gliding		12	
Vowelization		14	
Other			
Total		16	42
Nasals			
Omissions	0		
Other	0		
Total	0	19	0
Glides			
Omissions	2		
Other	2		
Total	4	10	40
Vowel Deviations	0		

Mikie's (Subject 3) Posttest Summary

Miscellaneous Phonological Processes

	Number of Occurrences
Prevocalic Voicing	0
Postvocalic Devoicing	0
Glottal Replacement	1
Backing	0
Stopping	11
Coalescence	
Epenthesis	
Metathesis	

Assimilation Processes

	Number of Occurrences
Nasal	0
Velar	3
Labial	0
Alveolar	0

APPENDIX D

Fundamental Principles for Remediation of Phonological Disorders

Fundamental Principles for Remediation of
Phonological Disorders
(Hodson, 1980)

1. A full phonological evaluation must precede planning the remediation program. The child can experience immediate and tangible success if he/she starts with the appropriate target.
2. The general order of progression of phonological process targets is dependent on individual performance, but must be compared and contrasted with speech performance of other children with phonological disorders to ascertain which of the individual's processes are most in need of intervention.
3. Specific order of progression within the phonological process being targeted depends on probing to identify the most stimulable phoneme or cluster within the grouping (e.g., choice of targeting /sp/, /st/, or /sn/ would be dependent on which is easiest for the child to produce when facilitating stridency and consonant clusters).
4. Auditory input is crucial. A few minutes of auditory bombardment at the beginning and ending of each session has been found to be highly beneficial, especially when aided by an auditory training unit set at a low level. Furthermore, daily reading (by parents or teacher aides) of a word list containing the week's target phoneme or cluster has been found to be helpful to the client.

5. Provide an opportunity for the child to develop new kinesthetic images and articulatory skills. Children with phonological disorders appear to rely on inaccurate kinesthetic images which feel "OK." They usually need to learn to match auditory and kinesthetic patterns. (It has been found to be more efficient for the speech/language pathologist to provide opportunities for experiential practice employing a limited number of productions rather than to require a child to repeat a target word a number of times in a "parrot-like" fashion.)
6. Facilitate emergence of patterns. During the first cycle, present one target at a time, but move on to the next phoneme or cluster within the specified process (i.e., do not stay on a phoneme to wait for its establishment). During later cycles, former targets which have not yet begun to emerge may be grouped together (e.g., /sp/ and /st/ in one session and /sm/ and /sn/ during the next). New targets during ensuing cycles should still be presented individually.
7. Provide examples to enable the child to understand semantic differences of targets as opposed to the child's original productions (e.g., stop vs. top; boats vs. boat). Even very young children can profit by understanding the meaningfulness of the targets and can become involved in their remediation program.

APPENDIX E

Deficient Patterns According to Levels

Deficient Patterns According to Levels

1. Level 0 consists of omissions. Children who utilize Level 0 omissions only produce vowels and sometimes glides and nasals.
2. Level I consists of (a) omissions of syllables, prevocalic singletons, postvocalic singletons, and cluster reduction; (b) major place substitutions of fronting of velars, and backing; (c) glottal replacement; (d) voicing alterations such as prevocalic voicing and prevocalic devoicing; (e) miscellaneous patterns of reduplication; (f) vowel deviations; and (g) idiosyncratic patterns.
3. Level II consists of (a) omissions such as cluster reduction and strident phonemes; and (b) major phonemic substitutions of stopping, liquid gliding, and vowelization.
4. Level III patterns do not seriously impair intelligibility. They consist of (a) nonphonemic alterations such as tongue protrusion and lateralization; (b) major phonemic substitutions such as affrication or deaffrication, minor place shifts such as palatalization or depalatalization; and (c) devoicing of final consonants.

VITA

Nancy Epps Kendall was born in Concord, North Carolina on February 2, 1957 to Mr. and Mrs. P. V. Epps, Jr. She attended Mt. Pleasant Elementary School in Mt. Pleasant, North Carolina and graduated from Mt. Pleasant High School in 1975. She attended Western Carolina University and received a Bachelor of Science degree in the field of Speech Pathology and Audiology in May 1979. Since that time she has worked as a Speech and Language Pathologist in Davidson County School System and attended Appalachian State University on a part-time basis. In December 1985, she completed the requirements for a Master of Arts degree in Speech, Reading Pathology and Exceptionalities.

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