1-1-1991

The Effects of Discrimination Therapy Administered to Preschool Children

Steven E. Deal

This research is a product of the graduate program in Communication Disorders and Sciences at Eastern Illinois University. Find out more about the program.

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The Effects of Discrimination Therapy

Administered to Preschool Children.

(TITLE)

BY

Steven E. Deal

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

Master of Science

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

1991

YEAR

I HEREBY RECOMMEND THIS THESIS BE ACCEPTED AS FULFILLING
THIS PART OF THE GRADUATE DEGREE CITED ABOVE

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Abstract

Recent research in the area of phonological development has indicated phonemes are mastered earlier than previous research demonstrated. Research has also indicated phoneme discriminatory skills are acquired with a similar pattern of development as phoneme production skills. Additionally, many research studies have demonstrated a relationship between children's ability to discriminate phonemes and their ability to articulate phonemes. Phonological skill development at younger ages implies that children will be eligible for articulation therapy at younger ages. Traditionally, articulation remediation begins with sensory/perceptual or discrimination training. Currently, available research has not addressed the effectiveness of discrimination training at pre-school age levels.

Six subjects were included in the research study. The subjects consisted of one female and five male children between the ages of 3:5 and 4:11. Children meeting the requirements for subject selection were included in the study. Subjects had normal hearing, adequate speech mechanisms, and came from monolingual homes. Subjects had normal receptive and expressive
language skills as indicated by the Preschool Language Scale (Zimmerman, Steiner, & Pond, 1979). In addition, subjects scored between the 10th and 75th percentile and misarticulated the /r/ phoneme on the Goldman-Fristoe Test of Articulation (Goldman & Fristoe, 1986).

Pretesting involved two nine item deep tests of articulation and discrimination skills. These tests examined the subjects' ability to articulate the /r/ phoneme and discriminate between the /r/ sound and the /w/ sound in various phonetic contexts. The deep tests and the Goldman-Fristoe Test of Articulation were the dependant variables in the research design.

Three subjects were assigned to the experimental group and the control group by matching similar pretesting scores and age levels in each group. The independent variable, individualized discrimination therapy, was administered to the experimental group during the research time period. The control group, group B, was not involved in the therapy program. Discrimination training was administered during eight 30 minute sessions over four weeks.

Discrimination training concentrated on the
sensory-perceptual step of treatment in the traditional model of articulation therapy (Van Riper, 1947). Therapy was administered on an individual basis and focused on discrimination training at the isolation, syllable, and word level. Motivational activities and reinforcers were incorporated into the therapy sessions.

After treatment, the subject's performance on the deep tests of phoneme production, phoneme discrimination and the Goldman-Fristoe Test of Articulation (Goldman & Fristoe, 1986) was analyzed in a pre/post therapy comparison. Post therapy comparisons were made with testing immediately and one month following the conclusion of therapy.

T-tests were used to analyze the pre/post test comparisons for significant changes. These comparisons did not yield any statistically significant differences in the dependant variables. This indicated that a change was not demonstrated as a result of the application of the independant variable. However, improvements were documented during the discrimination stage of therapy at all levels of treatment. This
indicated that the experimental group’s discrimination skills improved, even though the improvements were not demonstrated in the dependant variables.

The improvements observed through therapy results indicate further research is needed in this area. A replication of the present study may determine if significant differences exist given a larger n or a longer therapy duration or if the use of different phonemes would yield different results. Another related study could be designed to look at the long term effects of a discrimination therapy program on discrimination and articulation skills.
Acknowledgements

I want to extend my appreciation to the many individuals who provided assistance and encouragement for the completion of this project.

I would like to thank Dr. Nilsen who provided the most support throughout my thesis experience. She was able to help whenever I had questions, ideas, or problems related to my thesis. Dr. Nilsen urged me to work harder and understood when progress was slow.

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Additionally, I would like to thank the directors of the daycare centers that provided the subjects for my research and the parents of the children that were chosen as subjects. Their support was encouraging following initial difficulties in finding subjects.

I am appreciative of Donald Finan and Julie Mannion who answered questions, provided support, and demonstrated that it could be done. Additionally, I want to thank Matt Mitchell for his assistance with the reliability check.
Finally, I wish to thank the faculty, staff, and students of Eastern's Communication Disorders and Sciences Department. The faculty members are committed to professional practices and consistently provided positive learning experiences. The graduate students I worked with provided encouragement, humor, and unique outlooks on education and life.
Dedication

Dr. Augustine and Dr. Nilsen have had the most impact on my professional growth. They have supported my education through my undergraduate work and my graduate studies. They have enhanced my personal and professional development as a speech pathologist. I have learned about education and my own abilities in many different professional areas. Although they helped in different ways, both have encouraged me to improve my areas of weakness and increase my areas of strength. The completion of this project is dedicated to both Dr. Augustine and Dr. Nilsen.
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Chapter I
Introduction

There are many stages involved in training phoneme production skills. Both traditional therapy models and phonological remediation models outline a series of steps to follow when treating a speech sound delay. Both of these remediation strategies attempt to utilize the child's ability to attend to the auditory characteristics of a sound.

Phonological treatment begins with auditory bombardment and utilizes this stimulation technique throughout treatment (Hodson, B.W. & Paden, E.P., 1983). Each therapy session begins and ends with auditory bombardment of the target process. The auditory stimulation step in phonological remediation involves bombarding the client with the target sound or process at a low level of amplification. It is assumed that these children will "profit from attending to the auditory characteristics of sounds" (p. 49).

The traditional model of articulation therapy (Van Riper, 1947) also uses auditory training or sensory-perceptual training as the initial phase of each level of therapy. Therapy initially focuses on stabilizing
discrimination skills before addressing production skills. Van Riper's therapy model exposes the speech sound to the client and then requires the client to be able to hear differences in sounds presented auditorily. Therapy focuses on these skills at all levels of treatment from isolation to sentence.

The ability to listen to speech sounds, attend to sound characteristics, and discriminate sound differences are essential parts of phoneme production treatment. Both traditional and phonological treatment strategies utilize these skills throughout therapy. Literature was reviewed to investigate the effectiveness of sound stimulation therapy at various age levels.
Chapter II
Review of Literature

Development of Phonological Skills

Investigations in the area of phonological development have consisted of two research areas, phoneme acquisition and phonological simplification process suppression. Recent studies in both areas have demonstrated that children are acquiring articulatory skills at younger ages (Dyson, 1988; Engleman, 1988; Prather, Hedrick, & Kern, 1975) than the earlier research indicated (Poole, 1934; & Wellman, Case, Mengert, & Bradbury, 1931).

Currently, phoneme acquisition research has lowered the expected age of sound mastery. The /r/ phoneme, considered a late developing sound, was demonstrated to be mastered at a significantly younger age in the latest research (Dyson, 1988; Engleman, 1988; Prather, Hedrick, & Kern, 1975). Figure 1 displays the acquisition of the /r/ phoneme according to seven different investigations. (Engelman, 1988; Dyson, 1988; Prather, Hedrick, & Kern, 1975; Sander, 1972; Poole, 1934; Templin, 1957; & Wellman, Case, Mengert, & Bradbury, 1931).
Each of the authors employed different criteria for determining phoneme accuracy. The criteria ranged from 50% production accuracy in one phoneme position to 100% production accuracy in all positions. The majority of the researchers utilized 75% production accuracy in two phoneme positions as criteria for phoneme mastery.

Figure 1: Mastery of the /r/ phoneme according to seven different investigations (Engelman, 1988; Dyson, 1988; Prather, Hedrick, & Kern, 1975; Sander, 1972; Poole, 1934; Templin, 1957; & Wellman, Case, Mengert, & Bradbury, 1931).

DEVELOPMENT OF ACCURATE /r/ PRODUCTION

AGE - MONTHS

<table>
<thead>
<tr>
<th>PREVIOUS RESEARCH</th>
<th>24</th>
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<th>32</th>
<th>36</th>
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<th>48</th>
<th>52</th>
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<tr>
<td>Dyson (1988)</td>
<td>50% mastery</td>
<td>72 months</td>
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<td>Prather. Hedrick. Kern (1975)</td>
<td>75% mastery</td>
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<td>Sander (1972)</td>
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<td>72 months</td>
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<td>Templin (1957)</td>
<td>100% mastery</td>
<td>75% mastery</td>
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<td>Poole (1934)</td>
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<td>Wellman et.al. (1931)</td>
<td>75% mastery</td>
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The earliest acquisition studies found children mastered the /r/ phoneme at older ages. Poole (1934) employed 100% accuracy as the criteria for mastery of phonemes. Poole's research stated the /r/ phoneme was
mastered at age 6. Wellman, Case, Mengert, and Bradbury (1931) indicated that the /r/ phoneme developed to 75% accuracy at age 5:0.

Later phoneme acquisition studies indicated phoneme mastery developed at younger ages (Templin, 1957; & Sander, 1972) than the original studies demonstrated (Poole, 1934; & Wellman, Case, Mengert, & Bradbury, 1931). Templin (1957) indicated that the /r/ phoneme was mastered at age 4:0. The author identified 75% production accuracy as mastery criteria. Sander (1972) employed 90% accuracy as criteria for sound mastery. The author stated that acquisition of the /r/ phoneme began at age 3:0, but was not mastered until age 6:0.

The latest research has demonstrated that phoneme mastery occurred at younger ages than Templin's and Sander's research data indicated. Prather, Hedrick and Kern (1975) investigated the acquisition of correct speech sound production. The authors indicated that the /r/ sound is produced with 75% accuracy by age 3:4. Engelman (1988) investigated sound acquisition of children aged 2:0 to 4:11. The author indicated the /r/ phoneme developed and was present in 75% of children at age 3:8. Dyson (1988) collected sound
acquisition data for children between the ages 2:0 and 3:3 with the criteria of 50% production accuracy. The author stated that /r/ was produced accurately 50% of the time by children aged 3:4. Stoel-Gammon (1987) investigated the phonetic inventories from spontaneous samples of thirty-four 2-year-old children. The author stated that /r/ was present in 50% of the two year old's inventories.

In addition to phoneme acquisition research, phonological research has indicated the /r/ phoneme is developing at younger ages (Preisser, Hodson, & Paden, 1988; & Haelsig & Madison, 1986). Recent phonological studies have investigated the acquisition of the liquid /r/ by examining the age by which gliding is suppressed.

Preisser, Hodson, and Paden (1988) investigated children's suppression of phonological simplification processes between the ages of 1:6 and 2:5. Liquid deviations decreased in prevalence from 91% to 64% over the 11 months of the investigation. This data would suggest the emergence of liquid /r/ occurs during these ages. Haelsig and Madison (1986) investigated the presence of phonological processes in the speech of children aged 3:0 to 5:0. The gliding of liquids was
the most prevalent process used at age 3:0. The authors (1986) found that liquids were used correctly 76% of the time by age four and with 100% accuracy at age 5:0. The results of these studies corroborate the results of the phoneme acquisition investigations.

The results of current research in phoneme acquisition and suppression of phonological simplification processes have indicated that sounds are acquired and mastered at young ages. (Engelman, 1988; Dyson, 1988; Prather, Hedrick, & Kern, 1975; Stoel-Gammon, 1987; Preisser, Hodson, & Paden, 1988; Haelsig & Madison, 1986). These authors demonstrated that acquisition and mastery of the /r/ phoneme occurred at significantly younger ages than the earlier studies indicated (Sander, 1972; Poole, 1934; Templin, 1957; & Wellman, Case, Mengert, & Bradbury, 1931).

Development of Discriminatory Skills

Several studies have investigated the development of discriminatory skills (Edwards, 1974; Garnica, 1973; Shvachkin, 1973). These investigations suggested that the ability to discriminate phonemes develops gradually with a pattern similar to that of phoneme production skills. Research has demonstrated children develop the ability to discriminate the /r/ phoneme later than
other phonemes (Garnica, 1973; Shvachkin, 1973), which is similar to production acquisition (Engleman, 1988; Dyson, 1988).

Edwards (1974) analyzed articulatory production and perception data from children aged 1:8 to 3:11. Four hypotheses were tested related to the acquisition of perceptual abilities. The author discussed several conclusions from the study. Edwards stated that "phonemic perception develops in a gradual and patterned way" (p. 218). Additionally, the author indicated that "Phonemic perception of a given sound difference generally precedes correct production of the difference" (p. 218). Edward's study determined that the perception of phonemes was acquired gradually and the perception of a sound usually preceded the production of a sound.

Garnica (1973) studied the acquisition of phonemic perception in children aged 1:5 to 1:10. The author compared the acquisition of discrimination between several pairs of phoneme classes. Periodic testing demonstrated an increase in the ability to differentiate between liquids and glides over four months. Additionally, the author stated perception of phoneme differences is usually acquired in a specific
pattern. However, Garnica indicated that slight variations were present between participants in the development of perception.

Shvachkin (1973) studied perception development of Russian phonemes in children aged 0:10 to 2:0. The author classified twelve stages of perception development from vowel sounds to liquids. The discrimination between liquids and glides is learned in the last stage of perception development. Shvachkin indicated that perceptual skills developed in a uniform pattern.

Research investigating the development of discriminatory skills has suggested that the ability to discriminate the /r/ phoneme occurs later than the discrimination of other phonemes (Garnica, 1973; Shvachkin, 1973). This is similar to the acquisition of production skills for the /r/ phoneme (Engleman, 1988; Dyson, 1988). The research has also demonstrated that the ability to discriminate phonemes generally preceded the ability to produce phonemes (Edwards, 1974). Discriminatory skills were found to develop gradually with a pattern similar to that of phoneme production skills (Edwards, 1974). This suggests a
possible relationship between the production and
discrimination of phonemes.

Articulation and Discrimination

The relationship between articulatory skills and
discriminatory abilities has been the focus of numerous
investigations since the early 1930s. Preschool through
first grade children have been investigated by many of
these studies. The majority of the research in this
area has indicated a direct relationship between
articulatory ability and discriminatory skills.

Travis and Rasmus (1931) compared articulatory
skills and discriminatory skills of first graders
demonstrating normal and delayed articulation
development. The authors stated that the children with
articulatory delays demonstrated more discriminatory
errors. As articulatory errors increased in severity,
additional discriminatory errors were observed. The
results of this early study precipitated additional
research studies which investigated the relationship
between articulation and discrimination.

Several later studies examined the relationship
between articulatory abilities and discriminatory
skills based on children's skills with all speech
sounds. These investigations compared the results of an
articulation test to the results of a discrimination test.

Sherman and Geith (1967) examined the articulatory skills of first graders who scored high on discrimination testing. A comparison was made between the production skills of first graders with good and poor discriminatory skills. The authors found that articulation scores of children with good discriminatory skills were significantly higher than the scores of the children with discrimination difficulties (Sherman & Geith, 1967). Sherman and Geith indicated that prior to initiating articulation therapy, "the determination of whether there is a deficiency in speech sound discrimination skill" (p. 279) is very important.

Monnin and Huntington (1974) examined the discrimination errors of articulatory delayed and normally developing kindergarteners. The authors found that children delayed in articulatory abilities demonstrated a discrimination "deficiency only for those sounds which they misarticulated" (p. 364). Monnin and Huntington indicated that articulatory delayed children did not have general discriminatory deficiencies. Prins (1963) reported similar results.
Later research investigated the relationship between the discrimination and the production of specific phonemes. These studies continued to examine the relationship between the two skill areas.

Strange and Broen (1981) examined the relationship between the perception of phonemes and the ability to produce phonemes in normally articulating and misarticulating children. The subjects, aged 2:11 to 3:2, were required to perceive differences between /r/ and /w/ and /l/ and /w/ in minimal difference word pairs. The authors discovered that children who were "poor /r/ producers made more errors [in discrimination] than children with perfect /r/ productions" (p. 91).

Hoffman, Daniloff, Bengoa, and Schuckers (1985) compared subjects' ability to discriminate /r/ and /w/. The subjects were normally articulating and misarticulating children aged 6:0 to 6:11. It was found that the overall ability to discriminate /r/ and /w/ was poorer in the misarticulating child. The "majority of the misarticulating children" (p. 51) performed at chance levels in identifying the experimental phonemes.

Some studies revealed only a slight relationship between articulatory and discriminatory skills (Broen,
Strange, Doyle, Heller, 1983; McReynolds, Kohn, & Williams, 1975). These investigations indicated that some children with articulation deficits had difficulty discriminating the phonemes that were misarticulated. However, the prevalence of children with difficulty in both skill areas was considered insignificant by the authors. One study indicated that there was not a relationship between discriminatory and articulatory skills (Bukowski, 1986).

Few studies have not found a significant relationship between articulation/phonological skills and discriminatory abilities. The majority of research has established that a relationship exists between the two skill areas. The relationship between articulatory ability and discriminatory skills supports the use of discrimination training in traditional articulation therapy.

Discrimination Training

Van Riper (1947) described a progressive series of four steps to train articulation. The author developed articulation therapy in a hierarchial design. The sound is trained in isolation, syllables, words, and then sentences. The author created four steps for training articulation at each level of therapy. Van Riper stated
the first step at each level of traditional articulation therapy was sensory/perceptual training. Sensory/perceptual training in Van Riper’s model consists of the four steps located in figure 2.

Figure 2: The four steps of sensory/perceptual training (Van Riper, 1947).

Steps of Sensory/perceptual Training

DISCRIMINATION
IDENTIFICATION
STIMULATION
ISOLATION

The progression through sensory/perceptual training consists of four hierarchial steps. The first step is the isolation training stage. The client separates or isolates a phoneme from surrounding contexts in a word or syllable. The second step is the stimulation training stage. The client is exposed to the target sound auditorily. The third step is the identification training stage. The client is trained to identify characteristics of the correct and incorrect
sound. The last step is the discriminatory training stage. The client is trained to compare "the correct [sound] with the error [sound], in hearing the differences between the two sounds" (p. 175). Van Riper indicated that early sensory-perceptual training needs to involve all four steps.

Research has indicated that discriminatory training is an important part of articulation therapy. Several studies have demonstrated the effectiveness of discriminatory training in first graders.

Spriestersbach and Curtis (1951) summarized several graduate research projects and developed conclusions regarding discriminatory training. The authors stated that ear training seemed more effective when it focused on the error phonemes. Spriestersbach and Curtis also suggested that a longer period of discriminatory training "may be necessary for eradicating certain types of articulation errors than for others." (p. 491). The authors felt that ear training was important to the effectiveness of articulation therapy.

Winitz has examined the training of discriminatory skills in several research projects. Winitz and Preisler (1965) trained discriminatory skills in 160
first grade children. The authors (1965) stated that discrimination pretraining "facilitates the learning of the correct sound" (p. 914). Winitz demonstrated the effectiveness of sound discrimination pretraining in the articulation therapy sequence with first graders in several studies (Winitz & Bellerose, 1963; Winitz & Preisler, 1965; Winitz & Bellerose, 1967). Winitz also determined that an important part of the articulation therapy sequence was discrimination training (Winitz & Bellerose, 1963; Winitz & Preisler, 1965; Winitz & Bellerose, 1967).

Several studies have indicated that discriminatory training is an important part of articulation therapy. Research has demonstrated that discriminatory therapy is effective in training the articulatory skills of first graders. Currently, investigations have not shown the effect of discriminatory training in younger children.

Research Questions

The research reviewed has revealed several trends. First, phonological acquisition studies indicate phonemes are mastered earlier than previous research demonstrated. Research has also demonstrated the development of phoneme discriminatory skills generally
preceded the development of phoneme production skills. Additionally, a relationship between children's ability to discriminate phonemes and articulate phonemes has been demonstrated. Finally, sensory/perceptual or discriminatory training has been found to be effective with children in first grade. These trends have prompted the following questions:

1. Does discrimination therapy alter the ability of pre-school children to discriminate phonemes?
   a. Immediately following treatment
   b. One month post-treatment

2. Does discrimination therapy impact articulation skills in pre-school children?
   a. Immediately following treatment
   b. One month post-treatment
Chapter III
Methods

Subject Selection
Six subjects between the ages of 3:5 and 4:11 served as subjects for this study. The intended n of 20 was reduced to 6 due to difficulties in finding subjects. Initially, the researcher asked 22 Charleston area speech-language pathologists to assist him in the location of possible research subjects. Two area speech-language pathologists agreed to help locate subjects by sending informational letters home to parents. Letters describing the research project were sent home with 70 preschool children and five potential subjects were identified. The researcher also contacted several community daycare centers to try to locate additional subjects. Two daycare centers agreed to help identify children for the research project, but no potential subjects were identified through this source.

Due to the inability of the researcher to identify a sufficient number of subjects in east-central Illinois, the researcher contacted daycare centers in the Chicagoland area. The directors of six daycare centers agreed to help with the identification of
potential research subjects. These included three KinderCare Learning Centers and three Children's World Learning Centers. Letters and permission forms were sent home with preschool children by the daycare center's director. The parents who returned the permission form received a letter to provide further information about testing and therapy. Examples of letters and permission forms are located in Appendix A.

Letters and permission forms were sent to 240 parents of children aged three and four. A total of 19 responses were received at the various daycare centers. Four of the children responding were above the age range for the research project and two children withdrew from the Daycare center before testing was completed. The remaining thirteen children went through the subject selection testing.

Children were included in research based on the following requirements for subject selection: (1) Subjects had normal hearing according to a screening of 1000, 2000, & 4000 Hz at 20 Db (ANSI-1969). (2) Subjects had normal receptive and expressive language skills as indicated by the Preschool Language Scale (Zimmerman, Steiner, & Pond, 1979). (3) Subjects had adequate speech mechanisms according to a brief oral
peripheral screening generated by the researcher. (4) Subjects came from monolingual homes. (5) Subjects scored between the tenth and seventy-fifth percentile and misarticulated the /r/ phoneme on the Goldman-Fristoe Test of Articulation (Goldman & Fristoe, 1986).

Seven children, two females and five males, met the research requirements. These children were between the ages 3:5 and 4:11, with a mean age of 4:1. A profile of subject selection test results is located in Appendix B.

Procedures

Pretesting

The subject's articulation and discrimination skills were assessed with deep tests of the /r/ phoneme in different prevocalic phonetic contexts. Each of these tests, developed by the researcher, consisted of nine items. The researcher utilized 35mm color photographs for visual stimuli in both deep tests. The various phonetic contexts were chosen based on the frequency of their occurrence (Griffith, J. & Miner, L.E., 1979). The words utilized for the deep tests were compiled to reflect the frequency of occurrence of the phonetic context and recognizability of the word by preschoolers. Subjects producing the /r/ phoneme
accurately on 50% or more of the deep test items were excluded from the study. A 50% accuracy level may have indicated the skill being tested was emerging.

The deep test of articulation required the subjects to verbally identify pictures presented by the researcher. The carrier phrase "What is this?" or "What is happening here?" was verbally presented with each picture. The deep test of articulation included the following words: rain, race, reading, wreath, wrench, rinse, rip, rice, rug. If the subject had difficulty identifying the picture, additional cues were provided. If a subject continued to have difficulty, a model was provided. A female subject produced the /r/ phoneme accurately on more than 50% of the deep test items and was excluded from the study.

The deep test of discrimination focused on discriminating between the phonemes /r/ and /w/ when presented in minimal pairs. The test required the subjects to identify nine target words by pointing to a picture of the word presented auditorily. The words were recorded in four second intervals on a TDK IEC II/Type II High Position tape using two Realistic Highball 2 dual impedance microphones. The researcher
recorded word pairs using a Teac Stereo cassette deck, model W450 R with Dolby noise reduction.

The deep test of discrimination included the following word pairs: rake-wake, rail-whale, read-weed, reel-wheel, red-wed, rich-witch, ring-wing, write-white, run-one. The words underlined were recorded and presented to the subjects.

The subjects were successfully trained, over a maximum of three trials, to identify all eighteen words in the discrimination test. Training consisted of presenting pairs of pictures and requesting the child to point to the target word. During training the pictures were not presented in minimal pairs.

During the deep test of discrimination the 18 pictures were presented side by side in nine minimal pairs. The words were presented to each subject individually through Realistic Nova 66 headphones connected to a Realistic stereo cassette deck, model 11.

The six subjects were paired based on age and pretest scores. The pairs were then split and assigned to the experimental group and the control group. The experimental group, group A, participated in individualized discrimination therapy during the
research time period. The control group, group B, was not involved in the discrimination therapy program.

**Discrimination Training**

**Treatment Schedule**

Discrimination training was administered during 30 minute sessions twice a week to the experimental group. Therapy duration was four weeks consisting of a total of eight therapy sessions. Therapy sessions were conducted in an office, a store room, and a spare classroom.

The discrimination phase of therapy and all testing sessions were recorded on audiotape. A Realistic stereo cassette deck, model 11 coupled with a Realistic Highball 2 dual impedance microphone recorded the sessions on ToneMaster 60 minute cassette tapes. The sessions were recorded for later review and reliability checks.

**Therapy progression.**

The general progression of discrimination therapy used in this study is located in Appendix C. Discrimination therapy followed the traditional sequence described by Van Riper (1947) concentrating on the sensory/perceptual training step. The training of
discrimination skills progressed through the following three levels: isolation, syllables, and words. The sentence level of Van Riper’s therapy model was not reached by any of the therapy subjects.

During therapy, the researcher employed the following four hierarchical steps of Van Riper’s sensory/perceptual training for the /r/ phoneme:

Step One - The isolation training stage. Therapy concentrated on separating the /r/ phoneme from surrounding contexts in a word or syllable. This step was eliminated from the isolation level of training.

Step Two - The stimulation training stage. Therapy focused on exposing the subjects to the /r/ sound auditorily.

Step Three - The identification training stage. Therapy involved training the subjects to identify characteristics of the /r/ sound and the /w/ sound.

Step Four - The discrimination training stage. Therapy trained subjects to compare the /r/ sound with the /w/ sound and hear the differences between the two sounds.

Lesson plans, including behavioral objectives and methods, were developed for each level of therapy. The objectives were written to relate to Van Riper’s four
therapy steps. A lesson plan for each level of the therapy is located in Appendix D.

Progression criteria.

Each subject's performance was assessed for acquisition during discrimination training, the fourth step of each therapy session. A 90% accuracy level was employed as mastery criteria throughout discrimination training. When a subject achieved 90% mastery of discrimination at the target level, therapy advanced to the next level. Subjects advanced from the isolation level during the first session to the syllable level during the second and third sessions. All of the therapy subjects proceeded to the word level following the third session. The subjects remained at the word level of therapy through the final session. Therapy was discontinued for all subjects after the eighth session. A table of the subject's therapy level and discrimination score for each therapy session is located in Appendix E.

Therapy materials.

Materials from the Program of Auditory Articulation for Children - PAATCH (Hill, 1989) were utilized in conjunction with the sensory/perceptual steps. The PAATCH program was chosen because it
provides materials that follow the traditional approach to sensory/perceptual training. Pictures of the "r" sound, the growling dog sound, and the "w" sound, the blowing sound, were used during the discrimination phase of therapy. Motivational activities included simple games, such as coloring and making a chain. Reinforcement materials consisted of verbal praise and token reinforcers. Behavior modification involved the use of a point system to earn stickers after therapy. Specific information regarding materials used during each therapy session are located in Appendix D.

Post Testing

Subjects in Groups A and B were retested immediately following the eighth therapy session and again one month post therapy. The two deep tests were readministered to assess the subjects' ability to articulate and discriminate the /r/ phoneme in different contexts. The Goldman-Fristoe Test of Articulation (Goldman & Fristoe, 1986) was also readministered to assess the subjects overall articulation skills. The results of all three tests were compared individually to the pretesting scores. Appendix F contains pretest/posttest scores for the subjects in the experimental and control group.
Reliability

The interjudge and intrajudge reliability was assessed by rescoring 10% of testing and therapy sessions from data on audiotape. Randomly selected portions of therapy and testing were evaluated by the researcher and another graduate student with more than 150 clock hours of clinical experience. A Pearson product moment correlation coefficient resulted in $r = 0.99$ reliability for both of the re-evaluations.
Chapter IV

Results

The purpose of this study was to determine the effectiveness of discrimination therapy administered to preschool children. The independent variable, a traditional discrimination therapy program, was administered to the experimental group. To evaluate the effects of the treatment, the researcher examined articulation and discrimination skills before and after treatment. The dependent variables were the Goldman-Fristoe Test of Articulation (Goldman & Fristoe, 1986) and deep tests of articulation and discrimination developed by the researcher. These three measures were administered prior to treatment, immediately following treatment, and one month post treatment. Comparisons were made between the pretest scores and the two sets of posttest scores for both the experimental and control group. The comparisons were analyzed with T-tests to define any significant differences between the pre/post test scores as a result of the independent variable.

A comparison between the experimental and control groups before treatment indicated no significant
differences among the three dependant variables at the .05 level of significance. Table 1 contains a summary of the analysis including the group's means, standard deviations, and T-values.

Table 1 - Pre-test Scores of the Control Group vs. Pre-test Scores of the Experimental Group.

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>SD</th>
<th>t value</th>
<th>p = .05*</th>
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<tr>
<td>Goldman-Fristoe</td>
<td>Control= 18.67</td>
<td>5.43</td>
<td>-0.359</td>
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<tr>
<td></td>
<td>Exp= 20.33</td>
<td>3.68</td>
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<td></td>
</tr>
<tr>
<td>Deep test of</td>
<td>Control= 0.67</td>
<td>0.47</td>
<td>0.00</td>
<td>-</td>
</tr>
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<td>Articulation</td>
<td>Exp = 0.67</td>
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<td></td>
</tr>
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<td>0.267</td>
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<tr>
<td>Discrimination</td>
<td>Exp= 6.33</td>
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</table>

*significant if t value is beyond 4.303

Comparisons were made between the pretest scores and the posttest scores immediately following treatment for both the control and experimental groups. A comparison between the pretest scores and posttest scores of the control group indicated no significant differences among the three dependant variables at the .05 level of significance. The means, standard deviations, and t values for the control group's three dependant variables are located in Table 2.
Table 2 - Pre-test Scores vs. Immediate Posttest Scores of the Control Group.

<table>
<thead>
<tr>
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</tr>
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<td>-</td>
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<tr>
<td>Deep test of</td>
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<td></td>
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<tr>
<td>Articulation</td>
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<td>-</td>
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<tr>
<td>Posttest</td>
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</tr>
<tr>
<td>Deep test of</td>
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<td></td>
</tr>
<tr>
<td>Discrimination</td>
<td>6.67</td>
<td>0.47</td>
<td>-1.00</td>
<td>-</td>
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<tr>
<td>Posttest</td>
<td>6.33</td>
<td>0.47</td>
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</table>

*significant if t value is beyond 4.303

A comparison between the pretest scores and posttest scores of the experimental group indicated no significant differences among the three dependant variables at the .05 level of significance. Table 3 contains a summary analysis of the experimental group's means, standard deviations, and t values.

Table 3 - Pre-test Scores vs. Immediate Posttest Scores of the Experimental Group.

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>SD</th>
<th>t value</th>
<th>p = .05*</th>
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</thead>
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</table>

*significant if t value is beyond 4.303
Comparisons were made between the pretest scores and the posttest scores one month following treatment for both the control and experimental groups. A comparison between the pretest scores and posttest scores of the control group indicated no significant differences among the three dependant variables at the .05 level of significance. The means, standard deviations, and t values for the control group's three dependant variables are located in Table 4.

Table 4 - Pre-test Scores vs. One Month Posttest Scores of the Control Group.

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>SD</th>
<th>t value</th>
<th>p = .05*</th>
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</thead>
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<td>Posttest=7.0</td>
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</table>

*significant if t value is beyond 4.303

A comparison between the pretest scores and posttest scores of the experimental group indicated no significant differences among the three dependant variables at the .05 level of significance. Table 5 contains a summary analysis of the experimental group's means, standard deviations, and t values.
Table 5 - Pre-test Scores vs. One Month Posttest Scores of the Experimental Group.

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>SD</th>
<th>t value</th>
<th>p = .05*</th>
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<tr>
<td>Goldman-Fristoe</td>
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<td>Posttest=18.33</td>
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</table>

*significant if t value is beyond 4.303
Chapter V

Discussion

Comparisons of the dependent variables were analyzed for significant differences using t tests. The t test scores were derived from the dependent variables' raw scores using the computer program Stat Star Version 1.0. The t values obtained were compared to values on a t test chart (Kirk, R.E., 1978) at the .05 level of significance for two-tailed tests.

A comparison of the pretreatment dependent variables was made between the experimental and control groups. The scores were analyzed using a t test for uncorrelated samples. No significant differences were found between the two groups prior to treatment. This indicated that the two groups' articulation and discrimination skills were similar as measured by the pretests.

Following treatment, comparisons were made between the control group's pretherapy and posttherapy dependent variable scores. These scores were analyzed using a t test for correlated samples. No significant differences were found among the dependent variables. This indicated the control group's scores on the dependent variables did not change significantly during the treatment time.
A comparison between the pretherapy and posttherapy dependent variable scores was made for the experimental group. The comparison was analyzed using a t test for correlated samples. Although no significant differences were seen among the dependent variables, one measure, the deep test of discrimination, approached the statistically significant level. This score demonstrated a slight change on the immediate posttest and a more significant change on the one month posttest. This suggests generalization of discrimination skills occurred following the immediate posttest. Improvements in discrimination skills were also seen in the therapy progression.

The subjects in the experimental group demonstrated improvement at each level of the treatment progression. Evaluation of discrimination skills in therapy was conducted by providing auditory stimuli of the /r/ or /w/ phoneme. The subjects indicated which sound was heard by pointing to a picture representing either the /r/ or /w/ phoneme. A similar pointing task was utilized for the deep test of discrimination. This suggests that the slight improvement seen on the post therapy deep test was related to the progress demonstrated in therapy. The improvements seen on both the deep test and in therapy indicated the children receiving therapy were able to increase their ability to
discriminate speech sounds. Specific information on treatment and accuracy levels for all therapy sessions is located Appendix E.

Some weaknesses were present in the research design which may have decreased the effectiveness of the study. The small number of subjects may have affected the ability to find statistically significant changes in the dependent variables. When the n of a study is small, the change in the dependent variable needs to be large in order to show a statistical significant difference (Shearer, W. M., 1982).

Another weakness of the research was the inability of the subjects to complete the therapy progression during the eight weeks allotted. The subjects finished the isolation and syllable levels of therapy and were demonstrating improvements in the word level at the end of the treatment time. Although improvements were shown in therapy, these results did not carry over to the dependent variables.

The results of this study have several implications for future research. The improvements demonstrated in therapy warrant further research into the area of preschool discrimination therapy. Research could determine if a larger n and the completion of the therapy progression would significantly affect the research outcomes. This would assist in demonstrating the effectiveness of discrimination
therapy with preschool children. The current study suggests that children's discrimination skills benefit from the discrimination portion of therapy. Another study could quantify these assumptions by demonstrating statistically significant changes in discrimination and possibly articulation skills as measured by the dependent variables.

Research could also determine the long term effects of a discrimination therapy program. Discrimination training may teach the client listening skills which would improve production skills over time. Significant results may not be seen until the discrimination skill is allowed to generalize.

Another area for related research would be to determine the effects of discrimination therapy with a different target phoneme. The phonemes which usually develop early may be affected by discrimination therapy differently than later developing phonemes. Differences would be significant when determining the appropriate error phoneme to target in therapy.

This research project was the first to examine preschoolers' ability to benefit from discrimination therapy. By separating the discrimination training from production training, the researcher was able to determine the effectiveness of the discrimination portion of therapy.
Although no improvements were seen in articulation skills, the research indicated that preschool children's discrimination skills improved following discrimination training. The research results suggested that a discrimination training program was beneficial at the preschool level. Traditional articulation therapy and phonological treatment techniques for improving phoneme production skills utilize discrimination training. This study suggests discrimination training is an appropriate part of a therapy program for preschool children.
References


Appendix A.1
Preschool letter - initial contact

Date

Director
Preschool Learning Center
Address

Dear Preschool Director:

I am a graduate student in the department of Communication Disorders and Sciences at Eastern Illinois University. Currently, I am completing a master's thesis involving pre-school children with sound errors. I am looking for children between the ages of 3:6 and 4:9 with some pronunciation errors, including the /r/ sound. Children also need to have normal language, normal hearing, and come from a monolingual home.

I appreciate your assistance with my research and if you have any questions, please contact me at 555-5555.

Sincerely,

Steven Deal, B.S.
Graduate Student
Appendix A.2
Parental permission form

PLEASE RETURN BEFORE FEBRUARY 8, 1991

CHILD'S NAME ____________________________________________

BIRTHDATE __________________________ BOY  GIRL (circle)

PARENT'S NAME __________________________________________

ADDRESS ____________________________________________

PHONE ____________________________________________

I give permission for my child to participate in speech
therapy research conducted by Steven Deal.

_________________________  _________________________
Parent Signature             Date
Appendix A.3
Parent letter - initial contact

Dear Parent:

I am a graduate student in the Department of Communication Disorders and Sciences at Eastern Illinois University. Currently, I am involved in a research project to develop ways of improving speech sound productions in preschool age children. I am looking for three and four year old children to participate in speech therapy research beginning in February, 1991. Children will be given an initial screening to determine their eligibility for the program. Those that are found to be eligible will participate in speech therapy which will focus on improving speech sound productions. The location and times of therapy can be arranged for you according to your schedule. There will be no charge for these therapy sessions.

If you are able to assist with this research by having your child participate in this program, please complete one of the following before February 8, 1991: fill out the attached information sheet and return it to the preschool learning center or contact me at (708) 555-5555. You will then be provided with further information and instructions and I would be happy to answer any questions.

Your assistance with this important project is very much appreciated. It will help us to find better ways of helping children.

Sincerely,

Steven Deal, B.S.
Graduate Student
Appendix A.4
Parent letter - additional information

Dear Parent:

Thank you for showing interest in the articulation therapy program. This letter will hopefully answer many of the questions you may have about the program. The therapy program is part of my master's thesis and children selected will be subjects for the study. The study is important and will be helpful in determining the benefits of providing speech therapy to preschool children.

Initially, children will be tested to determine their eligibility for the program. Children that meet the research requirements will be split into two groups. Both groups will be tested before and after the therapy program. Group A will participate in the therapy program described below. Group B will be tested, but will not participate in therapy. Comparisons will then be made between the two groups. Children will be randomly selected for placement in the two groups.

Therapy will take place twice a week over four weeks at the preschool learning center. Children will be seen individually for thirty minute sessions. Therapy will concentrate on improving the children's ability to produce speech sounds. The testing and therapy is currently scheduled to begin later this month.

If you have any additional questions about the therapy or research project you may write me a note in care of the preschool learning center or contact me at (708) 555-5555.

Sincerely,

Steven Deal, B.S.
Graduate Student
Appendix B

Test results for 13 children identified as potential research subjects.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Subject</th>
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<th>Subject</th>
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<td>no</td>
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</table>

- indicates test not administered
Appendix C

Figure 3: Discrimination Therapy Progression (Van Riper, 1947)

90% accuracy
2 sessions

SENTENCE

90% accuracy

WORD

90% accuracy

SYLLABLE

90% accuracy

ISOLATION
Appendix D.1
Therapy lesson plans

Session 1 - Isolation Level

Objectives

1. The client will listen to the /r/ phoneme in isolation.

2. The client will state differences between the /r/ and /w/ sounds with 90% accuracy.

3. The client will point to the /r/ and /w/ sound cards with 90% accuracy when presented with the sounds in isolation auditorily. See appendix D.4 - Sound cards

Methods

1. The clinician will present the /r/ phoneme in isolation twenty times.

2. The clinician will demonstrate visual and auditory differences between the production of the /r/ and the /w/ phoneme.

3. The clinician will produce the /r/ and /w/ phoneme twenty times in isolation.

Motivational Activities for first session
1. Making a chain.
Appendix D.2
Therapy lesson plans

Sessions 2 and 3 - Syllable Level

Objectives

1. The client will identify the /r/ phoneme and the vowel sound with 90% accuracy when presented auditorily with the following syllables:
   /ra, re, ri, rɪ, rɛ, rae, ro, ru, rʌ /

2. The client will listen to the /r/ phoneme in the above syllables presented auditorily.

3. The client will state differences between the /r/ and /w/ sounds with 90% accuracy.

4. The client will point to the /r/ and /w/ sound cards with 90% accuracy when presented with the following syllables auditorily:
   /ra, re, ri, rɪ, rɛ, rae, ro, ru, rʌ /
   /wa, we, wi, wɪ, wɛ, wae, wo, wu, wʌ /

Methods

1. The clinician will present the /r/ phoneme in 10 syllables.

2. The clinician will present the /r/ phoneme in 18 syllables.

3. The clinician will demonstrate auditory and visual differences between the production of the /r/ and the /w/ phoneme.

4. The clinician will produce the /r/ and /w/ phonemes in 20 syllables.

Motivational Activities
1. Making a chain.
2. Making an ice cream cone.
Appendix D.3
Therapy lesson plans

Sessions 4, 5, 6, 7, and 8 - Word Level

Objectives

1. The client will identify the /r/ phoneme and the vowel sound with 90% accuracy when presented auditorily with the following words:
   /rap, ret, rip, rId, raet, rob, rud, rʌm/

2. The client will listen to the /r/ phoneme in the above words presented auditorily.

3. The client will state differences between the /r/ and /w/ sounds with 90% accuracy.

4. The client will point to the /r/ and /w/ sound cards with 90% accuracy when presented with the following words auditorily:
   /wIr-rIr, wo-ro, wik-rik, wird-rird, wauk-rauk, wild-ril, wIm-rIm, wor-ror, wInk-rInk, wail-rail/

Methods

1. The clinician will present the /r/ phoneme in 10 words.

2. The clinician will present the /r/ phoneme in 20 words.

3. The clinician will demonstrate auditory and visual differences between the production of the /r/ and the /w/ phoneme.

4. The clinician will produce the /r/ and /w/ phonemes in 20 words.

Motivational Activities

1. Making a chain.
2. Coloring /r/ words.
3. Making an ice cream cone.
4. Coloring their names.
5. Sticker hunt

Behavior Modification and Reinforcement
1. Speech bucks
2. Stickers
3. Verbal praise
Appendix D.4
Sound cards

THE GROWLING DOG SOUND

rrrrrrrr

THE BLOWING SOUND

wwwwwwww
Appendix E

Therapy and accuracy levels during discrimination step of therapy.

<table>
<thead>
<tr>
<th>Subject 1</th>
<th>Subject 2</th>
<th>Subject 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Isolation Level</strong></td>
<td></td>
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<tr>
<td>Session 1</td>
<td>100%</td>
<td>91%</td>
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<tr>
<td><strong>Syllable Level</strong></td>
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<td></td>
</tr>
<tr>
<td>Session 2</td>
<td>79%</td>
<td>83%</td>
</tr>
<tr>
<td>Session 3</td>
<td>93%</td>
<td>92%</td>
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<tr>
<td><strong>Word Level</strong></td>
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<td></td>
</tr>
<tr>
<td>Session 4</td>
<td>Subjects did not achieve discrimination step of therapy.</td>
<td></td>
</tr>
<tr>
<td>Session 5</td>
<td>58%</td>
<td>63%</td>
</tr>
<tr>
<td>Session 6</td>
<td>60%</td>
<td>75%</td>
</tr>
<tr>
<td>Session 7</td>
<td>70%</td>
<td>73%</td>
</tr>
<tr>
<td>Session 8</td>
<td>60%</td>
<td>75%</td>
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### Appendix F
Pretest, immediate posttest, and one month posttest scores for the dependent variables.

<table>
<thead>
<tr>
<th></th>
<th>Experimental group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject Subject Subject</td>
<td>Subject Subject Subject</td>
<td>Subject Subject Subject</td>
</tr>
<tr>
<td>1 2 3</td>
<td>4 5 6</td>
<td></td>
</tr>
</tbody>
</table>

#### Pretesting

**Goldman-Fristoe Test of Articulation**

- Number of errors: 16 20 25 17 26 13
- Deep tests - Number Correct
  - Articulation: 1 0 1 0 1 1
  - Discrimination: 4 7 8 7 7 6

#### Posttesting - Immediately following treatment

**Goldman-Fristoe Test of Articulation**

- Number of errors: 13 18 23 17 22 13
- Deep tests - Number Correct
  - Articulation: 0 2 1 0 0 1
  - Discrimination: 8 9 9 7 6 6

#### Posttesting - One month following treatment

**Goldman-Fristoe Test of Articulation**

- Number of errors: 18 16 21 12 23 7
- Deep tests - Number Correct
  - Articulation: 0 0 0 0 0 4
  - Discrimination: 7 9 9 7 7 7