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LEE, William Kennedy. THE RELATION OF SPEECH THERAPY TO SPEECH IMPROVEMENT AMONG FIRST GRADE PUPILS.

University of Michigan, Ph. D., 1957
Speech - Theater

Negative microfilm received from university.

# THE RELATION OF SPEECH THERAPY TO SPEECH IMPROVEMENT AMONG FIRST GRADE PUPILS

by
William Kennedy Lee

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy in the
University of Michigan
1957

Committee in charge:

Professor Irving H. Anderson, Chairman
Assistant Professor Finley Carpenter
Assistant Professor George Herman
Professor Byron O. Hughes
Associate Professor Warren A. Ketcham

## Abstract

THE RELATION OF SPEECH THERAPY TO SPEECH IMPROVEMENT AMONG FIRST GRADE PUPILS

by William K. Lee

The primary purpose of this study was to determine whether speech correction as carried on in a public school system improves functional articulatory defects in the speech of a group of first grade children more than does increasing maturity alone. Specifically, the study was designed to answer the question: Is there a significant difference between the speech improvement of a group of first grade children who have functional articulatory defective speech who have had speech correction training and the speech improvement of a comparable group of first grade children with functional articulatory defective speech who have not had speech correction training?

Measurements were also made of a number of maturation variables to determine their relationship to improvement of functional articulatory disorders. These variables included height, weight, dental, and carpal ages, behavior problem tendency scores, a prediction of first grade readiness, a final evaluation of first grade accomplishment, hearing acuity, and school and speech class attendance.

Two groups, consisting of twenty-five children

each, were matched for severity of functional articulatory speech defects, chronological ages, mental ages, intelligence quotients, sex, and race. In addition, no child was included who had had prior speech correction training or was repeating the first grade.

By random selection, the subjects were divided into an experimental group and a control group. The children in the experimental group were scheduled to be seen by a certified speech therapist, as part of the regular speech correction program and without special consideration, in thirty-minute classes twice a week for twenty-seven weeks.

Before matching, randomizing, and enrollment in speech correction classes, a two-minute tape recording of the speech pattern of each subject was made. These tape recordings were submitted to a three-member listening jury for evaluation of severity of the speech defects. When the speech patterns had been recorded at the end of the study, each child's two-minute segment was spliced after his first sample for comparative purposes, and the tapes again submitted to the listening jury for evaluation of severity of speech defects and improvement. The judges had no way of knowing which children had had speech therapy and which had not.

For statistical evaluation, the basic experimental and control groups were divided into the following subgroups on the basis of agreement by any two of the three judges: a speech-improved experimental group, a speech-nonimproved

experimental group, a speech-improved control group, and a speech-nonimproved control group. Where no statistical difference was shown between subgroups, these subgroups were combined for statistical treatment into a total speech-improved group and a total speech-nonimproved group.

The following statements summarize the principal discoveries of the investigation: (1) First grade children who receive speech therapy directed at improving functional articulatory speech defects show no greater improvement as a group than a group of first grade children with similar defects who receive no speech therapy. (2) As a group, first grade children who have functional articulatory speech defects are more academically retarded than first grade children as a whole. (3) First grade children who have functional articulatory speech defects present a greater number of behavior problems and behavior problem tendencies than do children as a whole. (4) Physical growth and improvement or lack of improvement of functional articulatory speech defects are not correlated in first grade children. (5) First grade children with functional articulatory speech defects whose speech improves with speech training show increased behavior problems.

## ACKNOWLEDGMENTS

The writer wishes to express his gratitude to all members of the committee for their cooperation and helpful suggestions. Special thanks are expressed to Dr. Irving H. Anderson for his helpfulness throughout the doctoral program.

The writer is also indebted to Dr. D. E. Morley, formerly committee co-chairman, whose ideas and interest helped formulate this project. Further gratitude is extended to Dr. Morley, Dr. George Herman, and Miss Prudence Brown for time and effort spent as a listening jury.

The helpfulness of Miss Esther Schaeffer with the statistical necessities is gratefully acknowledged.

Without the cooperation of Paul W. Briggs, Superintendent, Miss Harriett Van Antwerp, Director of Elementary Education, the aid of the speech correctionists, and the help of the first grade teachers and their principals in the Bay City Public Schools, the data for this study could not have been collected. Grateful acknowledgment is extended to all of them, and to the Special Education staff and other school personnel who aided in this study.

The writer is further grateful to Dr. F. T. Meisel and many other friends who assisted with the myriad details which arose during the gathering of the data, and wishes

to acknowledge the financial assistance of the Veterans Administration through Public Law 346.

Finally, this writer wishes to express limitless appreciation to his wife for her active help and encouragement.

W. K. L.

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# CHAPTER I

## INTRODUCTION

The main purpose of this study was to determine whether speech therapy, as carried on within the framework of a public school speech correction program, is more effective with first grade children with functional articulatory speech defects than is increasing maturity alone. The concept of increasing maturity refers to the unassisted development which occurs as a function of time and experience.

Attempts to deal with speech defects have existed for many centuries, as early examples are cited in both the Old and New Testaments of the Bible (43). However, it was not until as late as 1787 that Tiedemann (28), who is credited with being the first person to use scientific methods of observing the behavior of young children, began systematic recording and inquiry into speech problems.

Of the many avenues of research examined since that time, the ones of interest to this study are those attempting to establish the best time to begin the correction of functional articulatory speech defects, and those which report results of the effect of training on this type of defect.

Functional articulatory speech defects are the most

common, and children with defects thus classified make up 70 to 85 per cent of public school speech correction classes. Practical speech correction experience shows that 2 to 3 per cent of school children have serious articulatory defects, and another 2 to 3 per cent have less severe defects (19).

Investigations have established norms for the age of onset of various speech sounds in a child's speech vocabulary from birth to maturity of articulation.

Other studies show the decrease in articulation errors due to maturation from the first grade through the twelfth grade, but reveal that speech defects still exist at all those levels and are, in fact, still a real problem in college.

Further research cited and done by a host of writers indicates that children with functional articulatory defects suffer from academic retardation and various problems of social and emotional maladjustment.

Experts in the field of speech correction agree that children with functional articulation defects need help, but are divided regarding the time to begin it. The literature reveals empirical and scientific opinions supporting both those who favor beginning speech therapy in the preschool, kindergarten, and first grade period, and those who favor starting speech therapy in second grade and beyond.

Thus, considering these problems of academic retardation and social and emotional maladjustment in terms of

the welfare of the child, the question as to when speech correction starts to be effective in a public school setting becomes one of utmost significance.

In the following chapter a report on the survey of the literature gives a background for this study which includes pertinent thinking and studies from 1888 to the present.

## CHAPTER II

## BACKGROUND MATERIAL FOR THE STUDY

Currently there are two major divisions of thought and practice regarding the best age at which to begin work with children having functional articulatory speech defects. Those of the "early" school of thought advocate corrective training for children in nursery school, kindergarten, and first grade, while the "late" division insists that second grade and beyond is soon enough to begin correction.

In part, the support of the "early" thinking comes from the writings and work of pioneer investigators whose prestige is still strong. It is possible that even though there is some modification of their early work, this early influence still exists, affecting current thinking. However, recent publishings and practices also support the "early" theory.

### Support for Starting Speech Therapy Early

In support of the practice of giving a child speech correction at an early date, Morrison says in a work published in 1914, "As most authorities agree that speech habits become fairly well fixed at the age of four years, it seemed reasonable to suppose that incorrect habits persisting at five and six years of age might in many cases

remain uncorrected if the child were given no assistance in forming correct habits" (26, p. 138). In 1916 publication, Blanton (6) advocated speech training in kindergarten and first and second grades because this was where the speech defects began and, therefore, mild cases could be cured and many defects could be prevented. In 1918, Swift (48) advised that speech correction be sponsored by the schools by using its personnel in homes to correct speech a year before a child went to school, and that schools further concentrate on speech defects in kindergarten.

Sommer's (44) experiment in 1933 showed that speech therapy was responsible for a significant increase in improvement in the speech of nursery school and kindergarten children. In a 1935 report, Bryngelson (38) says that if a child does not have intelligible speech by age four, help should be sought, although he concedes that many mild disorders subside during the elementary school life and credits this to maturation. Brown (38), in a publication appearing in 1936, states that children with defective articulation entering kindergarten and first grade may improve after a year or two, but do so at an inestimable cost to their learning. He thinks that most "baby talkers" find learning to read and write difficult and are handicapped in understanding and remembering what they read. He also contends that these children find it difficult to make necessary social adjustments to the authority and routine of classrooms. Reporting in 1937, Mueller (27) felt that

there had come a recognition of the need for speech training during the first plastic years of childhood.

In a book published in 1941, Pintner, Eisenson, and Stanton state that "by the time a normal child is ready for school infant inaccuracies should have entirely disappeared. Persistence of infantilisms at school age becomes a matter of real concern for the parent, the teacher, and the child" (36, p. 325). A study by Reid (38) in 1947, which included first grade children, recommended that first grade be included in speech therapy programs.

Many school systems favor and are giving speech correction in kindergartens and first grades.

## Support for Starting Speech Therapy Late

Opposed to these theories and studies is a discussion on gathering statistics of defective articulation by Mac Leod (22), who says in an article in 1888 that it was necessary to exclude those under eight years of age because of slow [speech] development. In study results published in 1942, Roe and Milisen (41) show a drop from a mean of 13.30 to 9.99 articulatory errors per child from grades one to two. Templin's (49) study, in 1947 publication, indicates that 94.8 per cent of articulation defects disappear by eight years of age, which is an age usually well past first grade.

In a report submitted in 1949, Hahn states that "if infantile speech continues into and beyond the second grade, these children will need more help than the average

classroom teacher can provide" (16, p. 343).

In 1953 Nelson says, "...remedial attention to articulatory speech disorders at the earliest feasible opportunity is desirable. From a practical point of view this would mean, in most instances, providing correction for children in the second grade and above" (30, p. 215). Malone's (25) dissertation in 1954 extends the age of speech maturity for phoneme frequency beyond the age of eight and states that ability to make a sound does not establish the frequency of usage in a child's conversation. This concept would also indicate a later need for speech correction.

## Studies Supporting Starting Speech Therapy Both Early and Late

In addition, there are those who support both sides of the question. Poole (37), publishing in 1934, indicates strong leanings toward the "late" thinking when she reports in her study that the median girl approaches maturity of articulation shortly after six years of age and the median boy at seven, and that functional articulatory defects need no special help prior to these ages. Further, she says that if noticeable development does not take place after these ages, the children should be examined to determine if special help is needed. Her conclusions indicate that a normally developing child should have reached maturity of articulation by at least the age of eight. Her study indicates, then, that although speech correction help may be necessary during the first grade ages for the obviously

deviant, it should not be necessary until the third grade for those whose speech has not deviated markedly, but also has not progressed satisfactorily.

In 1948, Johnson (20), speaking of the age group from five to eight, says that some children have such faulty articulation as to stand out even though at those ages articulation errors tend to be the rule, and that these children need special help which should not be delayed.

## Discussion of Associated Problems

In view of these conflicting results and statements, the question of just when therapy should begin in a school system was brought to the fore. The emphasis here is especially on the term "school system" because all previously reported findings were based on procedures of clinics or special procedures rather than on the typical public school practice of meeting a group of children twice a week for a thirty minute period each time.

Persistence of speech errors.--The study of Roe and Milisen (41) shows the drop in the mean number of articulation errors per child from grades one to four to be 6.68. The drop from the first grade mean error per child to the second grade mean error per child was 3.40. From fourth grade to sixth grade no significant difference was shown. Sayler (42) extended the work of Roe and Milisen from the seventh grade to the twelfth. Her survey showed little improvement between grades seven and ten, some

between ten and eleven, and practically no improvement between grades eleven and twelve. The summation of this study showed only a slight amount of improvement from grades six through twelve.

That articulatory speech defects still exist at the higher education levels is shown in the studies of Stinchfield (47) in 1927, Steer (46) in 1936, and Auston (2) in 1953. Their studies indicate that about one third of the speech defects which were referred to the college speech clinics cited were those of articulation, and that the total of speech referrals in two of the colleges surveyed was above a quoted national average of 10 per cent, while in the third it was below that average. These totals are sufficient to cause real concern at the college level.

Inasmuch as these articulation defects start early in a child's life and chance decrees that they may last into adulthood, the question then arises as to whether it matters or not that a child--or an adult--has a speech defect, and at what age this difference becomes a liability. In addition to this question, the literature revealed several problems concomitant with articulatory defective speech.

Time spent in speech activities.--According to Johnson (19), speech is the most used of all the language functions both in school and out. The amount of time spent in formal speech activities in school is shown in the first printed report of A Cooperative Study for the

Better Utilization of Teacher Competencies (1). Stop watch calculations of the time length of classroom activities reported for ten first grade teachers a mean of 97.5 minutes per day spent in recitation. The range was from 8.4 to 199.7 minutes. A breakdown of sequence of activities showed that there were eleven different recitation periods. This recitation time is exclusive of opening exercises, group planning, recess, and other incidental opportunities for speech activity by the children.

For comparative purposes, the rooms where there was a first and second grade combination showed a recitation mean of 135.4 minutes, with a range of 25.3 to 248.2 minutes. The second grade mean for five teachers was shown as 168.3 minutes, with a range of 66.0 to 252.5 minutes. The third grade mean was 115.0 minutes, with a range of 59.1 to 182.1 minutes. In the fourth grade, the mean of recitation times was 103.7 minutes, with a range of 35.1 to 158.8 minutes. In this grade, twenty oral discussion periods were listed in the daily sequence.

The relation between speech defects and academic achievement and social adjustment.--Academic retardation or ineffectiveness has been mentioned in studies from the first grade to college. Closely allied with this problem are those of emotional deviations, social nonacceptance, personality problems, and behavior problems. Pintner (36) reports the consensus of research findings as indicating that children with speech defects do not make as rapid

progress in school from elementary school to college as do children with normal speech.

In a study by Carrell of grades one through twelve, it is reported that "some significance may be attached to the fact that the retardation of the speech defective is greater in school achievement than in intelligence" (7, p. 188). In a girls' college, Stinchfield (36) found that the students who needed speech correction failed in their school work even though they possessed a high intelligence. More recently Auston (2) reports that with the data at hand it can be inferred that disorders of oral expression will seriously interfere with educational efficiency.

Several studies illustrate peer nonacceptance and social and personal maladjustment encountered by children with speech defects.

Kleffner (21) reports that fourth grade children (note fourth grade recitation figures, page 10) reacted less favorably to recordings of defective articulation than to recordings of nondefective articulation. Further, the recording of the slightest defect was classified lower by the total group than any of the recordings of nondefective speech. The implication here would be that in fourth grade defective articulation is recognized and penalized.

Sonnega (45) reports that children with speech defects in elementary classes were chosen less often when the basis for selection was predominantly speaking.

In a recent study of the social position of the

speech defective child, Perrin (33) found that 16 per cent of the children with speech defects in the first grade were considered isolates, while only 3.3 per cent of the non-speech-defective children were considered isolates. She concluded from her data that the assumption was probably correct that many speech defective children are not readily accepted members of their classrooms.

Nelson (30) found that teacher ratings of the Haggerty-Olson-Wickman Behavior Rating Schedule showed less desirable behavior for an experimental group of children with functional articulatory speech defects than for a control group.

It is Berko's contention that a speech defect must be considered as a physical defect and in the consideration of the personality of a speech defective individual, one must bear in mind the close relationship between the personality development and a physical defect. Therefore, because speech is involved in nearly all higher "...psychosocial adjustments of individuals, any severe deficiency of speech must have an effect upon total adjustment patterns" (5, p. 93).

It has been shown in the foregoing survey of the literature that children with speech defects, when compared with children without speech defects, are rated more frequently as isolates, are chosen less often in speech situations, have less desirable behavior patterns, are more academically retarded, and have more numerous emotional

problems. Without knowing what additional causal factors were present in these concomitant problems, it can be assumed that children with speech defects need help with their speech as a partial aid to their total problems. These considerations are reinforced when it is realized that speaking is the major form of communication in the early grades. The question then arises as to how and when help can best be provided for these children with speech defects.

## Discussion Related to Beginning Speech Therapy in First Grade

It is hypothesized that the place to start this help is at the earliest feasible level of formal education while the maturation process is still taking place, before erroneous speech patterns become solidly set habits, and before unwholesome peer relationships and personal problem patterns become established. For many school systems, therapy begins at the first grade level, but experts have varying opinions as to the advisability of this practice.

McCarthy, speaking from the point of view of the child psychologist, warns that "too early introduction of formal speech training of young children who may outgrow their infantile speech without help, or whose speech infantilisms are only a symptom of general emotional immaturity, may make these children speech-conscious and result in their refusal to talk" (23, p. 541). In contrast to this, Van Riper states, "Many children are said to outgrow their defective consonant sounds. Actually, they overcome them

through blundering methods of self help, and far too many of them never manage the feat" (51, p. 28).

Poole's (37) widely quoted results report that a child's sound vocabulary is not necessarily complete before the age of eight. Using this finding, the investigator surveyed the results reported by fifteen writers from 1888 to the present to determine what sounds were consistently recorded as being among the last to form in a child's sound vocabulary. These results are reported in Table 1.

TABLE 1

DATA FROM FIFTEEN WRITERS* SHOWING SOUNDS FORMING LAST IN CHILDREN'S VOCABULARIES

| Order of Reported Frequency of Sound | | Frequency of Sound Reported Alone | Frequency of Sound Reported in Combination |
|---|---|---|---|
| 1. | s | 11 | 7 |
| 2. | r | 8 | 2 |
| 3. | l | 8 | 1 |
| 4. | tʃ | 8 | - |
| 5. | θ | 7 | - |
| 6. | z | 6 | 2 |
| 7. | ʒ | 5 | 1 |
| 8. | dʒ | 5 | 1 |
| 9. | d | 5 | 5 |
| 10. | ʃ | 4 | 8 |
| 11. | t | 4 | 7 |

*Data obtained from (22, 26, 37, 41, 44, 50, 52, 53, 54, and 9).

These sounds, or any combination of these sounds, are possibly not found in the sound vocabulary of the first grade child.

However, during the first grade reading readiness

and reading stages the sound vocabulary is a very important facet of the child's development, going beyond its use in speech alone. Whether or not a child is called upon to use certain sounds or sound combinations by the nature of his vocabulary during conversation may be largely an accidental combination of circumstances; but that a child is called upon to use certain other sounds or combinations of sounds in his reading vocabulary is a matter of design, and if he is to progress satisfactorily he must assimilate and utilize those sounds. Consequently, whether a child is ideally ready for certain sounds or sound combinations, he is not only exposed to them but expected to conquer them. In substantiation, when the writer applied the developmental order of sounds reported by West, Kennedy, and Carr (53) to his own phonetic analysis of a widely used first grade basal reading series,[1] it was found that 48 per cent of the sounds contained in the preprimers and primers were within the last ten sounds to develop in the sound vocabulary of the "normal" child.

The implication of this finding, coupled with the results from studies reporting that functional articulation defects are either directly or indirectly responsible for academic, social, and emotional maladjustments, brought this investigator to the decision that a necessary research step was to determine what effect speech therapy had in

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[1] The New Basic Readers, Curriculum Foundation Series. Chicago: Scott, Foresman and Company, 1951.

changing the patterns of functional articulation defects of first grade children in order to establish a beginning point for effective therapy. Of additional importance was the question of which factors of maturation are significant in relation to improvement or lack of improvement of functional articulation defects in these first grade children.

# CHAPTER III

## THE PROBLEM

The purpose of this study was to determine whether speech correction as carried on in a public school system improves functional articulatory defects in the speech of a group of first grade children. Specifically, the present study was designed to answer the question: Is there a significant difference in the speech improvement of a group of first grade children who have functional articulatory defective speech who have had speech correction training and of a group of first grade children with functional articulatory defective speech who have not had speech correction training?

The possible results of the study may be indicated as follows:

1. Children who have been enrolled in a speech correction class improve significantly more than a matched group who have not been enrolled in a speech correction class. This result would show that speech correction improves functional articulatory defects at the first grade level to a greater degree than does increasing maturity.

2. The group which receives no speech correction training might improve significantly more than that which had been given speech correction. This result would

indicate that there is a possibility that speech correction at the first grade level does more harm than good.

3. Both groups might improve the same amount. Here the implication would be that although speech correction does no harm, it does not seem to benefit at the first grade level and, therefore, is wasted on that age group.

4. Neither group will improve. Such a finding would show that no improvement should be expected at the first grade level either through unassisted development or through speech therapy.

Of additional interest to this study is the question of what factors of maturation or change were present or absent with improvement or lack of improvement of functional articulatory speech defects.

To this end, additional data were sought, including height ages, weight ages, dental ages, carpal ages, Haggerty-Olson-Wickman Behavior Rating Schedule (13) scores, first grade achievement, and school attendance.

The procedure and method used in the collection of these data are discussed in the following chapter.

# CHAPTER IV

## PROCEDURE

Since the aim of this study was to determine whether speech correction as provided for first graders in a typical public school program is beneficial to their speech at that grade level, it was first important to obtain permission to conduct the study, then to select and match experimental and control groups, and finally to collect speech and maturation data at the beginning and end of a specified period of time.

Permission to use the children in the Bay City Public Schools for this study was secured from the Superintendent of Schools, and cooperation assured from the Director of Elementary Education.

A planning session was held with the principals and first grade teachers from whose buildings the children would be drawn in order to orient all concerned to the general outline of the problem, the purpose, and the methodology of the study.

### Selecting Children for the Study

It is customary in the Bay City Public Schools for all first grade children to be surveyed at the beginning of each school year to determine those who shall be

enrolled in speech correction classes. This speech survey was begun in the second week of the 1955-1956 school year and consisted of eliciting verbal responses from the children by showing them familiar objects to name and by asking questions. The objects and questions were designed to bring responses containing sounds which are frequently found to be defective.

The three speech correctionists employed for the school year carried out the survey and recorded each child's defective sounds in phonetic symbols.

Approximately nine hundred children were surveyed, in thirteen school buildings, from sixteen first grade rooms and nine first and second grade combination rooms. Ninety-six children were thought to be possible subjects for this study.

## Matching

The children selected for participation in this study were taken from the total population of the first grades of the Bay City Public Schools. They had functional articulatory defective speech severe enough to permit their enrollment and certification in speech correction classes, had not had previous speech correction training, were entering the first grade for the first time, and had speech defects which were audible on a two-minute tape recording.

This procedure resulted in a beginning number of twenty-two girls and thirty boys. These children were paired as well as possible according to sex, type of speech

defect, severity of speech defect, chronological age, mental age, and intelligence quotient. The individual code numbers which had previously been assigned to these children were then put into a bowl a pair at a time. The one which was drawn was placed in the experimental group, and the one which remained was assigned to the control group. Evidence as to how well these groups were matched will be presented in Table 2. Those in the experimental group were then enrolled in speech correction classes which were conducted in their schools. Those of the control group remained in their classrooms and received no help from the speech correctionists.

## Tape Recording

To insure the utmost accuracy in judging both the initial severity and subsequent improvement of the speech patterns of the children with functional articulatory defective speech, these speech patterns were recorded by means of a tape recorder.

The initial tape recordings were done at a speed of 7.5 inches per minute on a Magnicorder Tape Recorder, model PT 6v, serial number 00847, with new Scotch Sound Recording Tape with plastic backing, number 111 A-12, manufactured by the Minnesota Mining Company. A limited number of recordings were done with new paper backed Sound Mirror "Magic Ribbon" tape manufactured by the Brush Development Company.

Children were taken to the quietest room available

in their schools either singly, or a few at a time, for these recording sessions. For the initial recordings, a high school senior who had had considerable experience in using this tape recorder worked as an assistant and handled the technical aspects of the recording session.

Approximately two minutes of each child's speech pattern, as timed by a stop watch, was recorded. This speech was elicited by means of an interview type situation, with a series of questions asked unless the child spoke for the full period by self motivation in response to a question.

The interview type situation was chosen rather than a word or picture response so that at the end of the study the use of sounds in a more normal conversational pattern could be tested. Even though Templin's (49) conclusion that there is no difference in measured articulation when a sound is tested in a word spontaneously uttered or in a word repeated after the examiner would hold true for the initial recordings, this method could not be used for the final recordings because of the association with the speech correction process. The interview technique as used here would also serve to disassociate this process from speech correction classes and, therefore, be a truer measure of carry-over ability.

Before being sent to the listening jury, composed of three faculty members of the Speech Clinic of the University of Michigan, the tapes were cut and spliced in the random order in which they were paired and chosen for

experimental and control grouping. This method insured the effective elimination of the problems of all girls or all boys following one another consecutively, all the experimental or control groups following each other, or of any set pattern between sexes or groups being established.

The randomizing was not an important factor for the listening jury on the first set of tape recordings, as no child had yet received any speech therapy. However, the randomizing was of extreme importance during the second jury listening to insure unbiased judgments. It assured that the jurists had no way of knowing which children had been given speech therapy and which had not.

The children on the tapes were known only as code numbers to the listening jury, these code numbers corresponding to the code numbers on the rating sheets[1] which were prepared for the jurists. The jury was asked to rate each child's speech pattern on the first tape on a three-point scale of severity of defects--slight, moderate, or severe.

Time conflicts in the use of the recorder and helper used for the initial recordings necessitated a change in recording machines for the second recordings. The machine used, therefore, was a Revere, number T-1100, Model 6487. Again new Scotch brand tape was used.

The plan of bringing the children in one or a few at a time was again followed, as was the interview technique

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[1]See Appendix A, p. 72.

for eliciting verbal response. The same interview questions were used. A stop watch was again used to approximate the two-minute tape time, and the recording speed remained at 7.5 inches per minute.

When these tapes were completed, they were spliced after the first sample of the same child for comparative purposes. The tapes were again sent to the same listening jury at the University of Michigan Speech Clinic for evaluation. An evaluation sheet[1] was prepared to check the child's speech pattern for improvement on a scale listing the values of the same, better, much improved, and without defect. It also checked again for severity on the same scale reported above.

The results tabulated from these evaluation sheets were used for severity and improvement scores and as the basis for forming speech-improved and speech-nonimproved groupings. To assure results as accurate as possible, the formulation of these groups was based on an agreeing judgment of at least two of the three judges. These groupings form the basis for much of the statistical data which are reported later.

## Measures of Physical Growth

In order to determine what factors of maturation were significant in the improvement of functional articulatory defective speech, data were gathered in the following

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[1]See Appendix A, p. 72.

areas.

Height age.--The first measurement of height was taken by the teacher during the first two weeks of October of the 1955-1956 school year. The child was measured without shoes to the nearest one-fourth inch. The second measurement was taken in a like manner during the first week of June, 1956.

The purpose of this measurement was to determine initial heights of the groups and the change in height during the study as a means of comparison of increasing maturity of subjects in the experimental and control groups.

These heights were converted to height ages by reference to the conversion tables of Olson and Hughes (32).

Weight age.--This measurement was also taken twice and at the same times as the height measurements. Each child was weighed without shoes and his weight recorded to the nearest one-fourth pound.

The purpose of this measurement was to determine initial group weights and to show weight change during this study as a measure of increasing maturity. Again the Olson-Hughes (32) tables were used to convert weights to weight ages.

Because the acquisition of the tooth count and carpal X-ray for each child required removing the children from their school buildings, precautions had to be taken, including: securing the permission of the parents for the necessary trips; informing the principals and teachers of

the time and procedure to be followed, thus keeping interruptions of their planning at a minimum; and arranging details for the children's maximum safety and well being.

A letter[1] was sent to the parents explaining the necessity and plans for obtaining X-rays and tooth counts, and requesting the signature of parent or guardian on an attached form granting permission for the investigator to take the child to a downtown dental office on two occasions for a wrist X-ray and tooth count. These permission forms were to be signed and returned to the child's teacher.

Both the fall and spring trips were included in the permission to eliminate the possibility of a parent granting permission in the fall and refusing it in the spring, with or without sufficient reason. The child in question was named in the permission slip for the protection of the investigator and for purposes of designation in the event of siblings. These permissions were kept on permanent file to allay complications.

The permission slips were returned with few exceptions, and a home call to provide further information secured the remainder.

When arrangements were completed for the second series of X-rays and tooth counts in the first week of June, 1956, notes[2] were again sent home to parents informing them of the date so that they would know approximately when

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[1] See Appendix A, p. 70.
[2] See Appendix A, p. 71.

the children would be away from the school building.

Dental age.--The tooth count to determine dental age was made at the beginning and end of the study. This count was made by a practicing dentist and consisted of a count of erupted permanent teeth for each child.

The process of establishing dental ages for these children consisted of comparing the total number of erupted permanent teeth with the conversion ages in months corresponding to the same number of teeth shown in the table prepared by Olson and Hughes (32). These dental ages were established with due regard for sex differences.

In some instances, the initial dental age could not be determined until the final tooth count had been taken because the child had no erupted permanent teeth at the first count, and the conversion table begins its ages with the eruption of one tooth. In order to arrive at a beginning dental age for statistical analysis in such cases, it was necessary to know how many permanent teeth had erupted at the end of the study.

As an example of how the dental age was determined for these children, assume that at the first count a boy had no erupted permanent teeth, and at the second count he had four erupted permanent teeth. The dental age for four permanent teeth for boys is seventy-eight months. The time lapse between counts was seven months. The age for one permanent tooth is given as seventy. It was then assumed that the initial dental age was less than seventy, which

would be at most sixty-nine. To arrive, then, at the initial dental age, it was assumed that if no teeth had erupted in the seven month period, the initial dental age would have been, at most, sixty-two months. However, since four teeth had erupted during that seven month period, it was further assumed that one month of dental age could be added for each tooth which erupted during that time. Thus, in the example cited here, the initial dental age would be sixty-six months.

Carpal age.--The X-rays to determine the carpal ages were also made in a dental office at the beginning and end of the study.

The radiographs were made using a Ritter machine, model D, on Eastman five inch by seven inch no-screen medical film. An exposure time of one second with ten milliamperes and sixty kilovolts was used. The distance was twenty-four inches from source to film with an angulation of ninety degrees to the flat film surface. Routine processing of all film was utilized.

Carpal ages were estimated by the investigator by comparing hand and wrist X-rays of subjects in the study with the standards published by Flory (11).

The one hundred X-rays were read once for practice without regard for difference in sex. Following that, the X-rays were divided according to sex, and each set, consisting of the initial and final plate, was read an additional three times. Each of these readings was done independently,

without reference to the results of any previous readings and with a lapse of at least twenty-four hours between readings.

The general pattern of reading these radiographs was one of answering a series of questions. Each X-ray was put on a radiographic box and compared to Flory's standards (11). The first consideration was, "Which standard does this most approximate?" The next question was, "Is it equal to, or more, or less?" And then, "If it is more (or less), is it more or less than half? If it is not half, is it one month, two months, or three months different?" This process was followed with each X-ray with its appropriate plusses and minuses until a month age was reached and recorded.

When all three readings had been done for both the boys and girls, a comparison of recorded results was made. If all three readings resulted in the same month age, the conclusion was accepted. If the results of any two readings were the same, with the third varying not more than three months, the agreeing figure was accepted. If all three were different, but with no one more than three months from any other, an average was taken and that average accepted as the carpal age.

For the exceptions to the criteria listed above, a fourth independent reading was made, and the above procedure again followed.

As a final check against a possible error of

averages, all of the radiographs of like sex with the same assigned age were put on the table together and compared. During this process, four adjustments were made.

To eliminate as much bias as possible, the chronological ages of these children were not known during these readings. To further eliminate bias, a different code number was assigned to the X-rays than to the other data gathered so that the reader did not know which plate belonged to which child at the time of reading.

## Other Measures

Chronological age.--The date of birth was taken from official school records and converted into months. This age was used for matching purposes and as an essential factor in determining the intelligence quotient of the child.

Mental age and intelligence quotient.--The basic instrument for determining both the mental ages and the intelligence ratings for children in this study was the Pintner-Cunningham Primary Test: Form A (34). These tests were administered between October 1 and 15, 1955.

The mental age was determined from the raw score achieved on this test by conversion from Table 5 in the test's Manual of Directions and Key (d) (35). The mental age was used in computing the intelligence quotient by the ratio method of dividing the mental age by the chronological age. Both the mental ages and the intelligence quotients were used for matching purposes and statistical computations.

Haggerty-Olson-Wickman Behavior Rating Schedules.--

These Haggerty-Olson-Wickman behavior ratings were made and for the most part scored by the teachers. The purposes of these ratings were to compare the measures of maladjustment, or the problem tendencies, of these children on a group basis, and to determine the significance of any changes. These schedules were completed at both the beginning and the end of the study period.

In one instance, a child changed schools during the period of this study. The first rating schedule was done by one teacher and the second by another. As the pattern of the results was not unique, this child was included in the final results of this study.

Readiness score.--The Metropolitan Readiness Tests, Form R (18) were used to obtain readiness scores. The tests were administered and, in nearly all instances, scored by the teachers. The purpose of the tests was to determine how well prepared each child was for first grade work.

As a follow-up to this prognostication, each teacher was asked, at the end of the school year, to evaluate each pupil by predicting his probable degree of success in second grade or by indicating that the child had been retained in first grade for another year.

The purpose of this teacher rating was to compare the teacher's opinion regarding the degree of academic success for each child with that of a standardized prognosis to see if any significant deviation occurred in terms of change in functional articulatory speech defects, and also

to establish an actual rate of academic retardation as indicated by the number of nonpromotions.

Hearing test.--An individual audiometric sweep test was given each child in the study. About 95 per cent of these tests were given by a hearing technician certified by the Michigan State Department of Health. The remainder were done either by a speech and hearing therapist employed by the Bay City Board of Education, or by the investigator.

All hearing tests were done with a Beltone Audiometer, number 3939, at a level of thirty decibels for frequencies between 500 and 4,000 in each ear.

The children were given complete instructions regarding the testing procedure and were tested individually in the quietest place available in their school.

Attendance.--At the end of the school year, the number of days each child was absent from school was obtained from the teacher. The purpose in securing this information was to determine if there were a difference in the attendance of either the experimental or control group and if it correlated in any manner with speech improvement or lack of it. In addition, the attendance of members of the experimental group was taken to determine whether or not there was a relationship of speech class attendance between those who improved and those who did not improve.

Sex.--The only concern for sex distribution was to have an equal number of girls and boys in each of the groups. There were fewer girls than boys reported as

having functional articulatory defective speech in the initial survey, and this pattern carried down to the final groupings. The final groups contained fifteen boys and ten girls each, or a total of thirty boys and twenty girls. Two girls had been lost to the study after the original matchings of thirty boys and twenty-two girls.

Race.--Although the school census consists mostly of white children, some of the children attending the Bay City Public Schools are Negro or Mexican. Therefore, the item of race was considered at the outset for matching purposes. Both Negro and Mexican children were included in the initial data, but were lost in the matchings. Race status was supplied by the teachers.

Before test scores were used in statistical analyses, they were checked by the investigator to insure accuracy.

## Description of the Speech Correction Program

Inasmuch as this study was carried on within the organization of a state approved speech correction program in a public school system serving all its children, the children in the experimental group were enrolled in classes composed of a heterogeneous primary level grouping of ages, grades, and types of defects. The children in this study were only a minor part of the total program and were treated no differently from any other children receiving speech correction.

The philosophy of the speech correction program in

the school system in which the study was carried out is partially based on a recognition of the individuality of the speech therapists' methods, which results from their divergent backgrounds and training. This philosophy allows them to accomplish certain broad goals by their own methods.

These goals include helping each pupil to accomplish the training or retraining of the process of articulation to permit the correct formation of a sound in all positions in all speaking situations, training the child's ear to recognize a correct sound when spoken either by others or himself, and changing the symbolization pattern for the pupil--i.e. teaching him to not translate red to wed when he thinks it, says it, hears it, or sees it.

In addition, a certain amount of mental hygiene is omnipresent because of the trained, understanding listening ability of the therapist and the permissiveness present in the therapy classes. The amount and value of the mental hygiene depends on the training, experience, and ability of the therapist.

In Michigan, speech therapists must be specially certified to do speech therapy work. The requirements for this certification are at least as high as are those for basic certification for the speech field in the American Speech and Hearing Association. Speech therapists must meet their classes twice each week for a period of thirty minutes each meeting, and must carry a total case load of one hundred and fifty pupils. (This case load number has

been reduced to one hundred pupils since the data for this study were collected.) The cases carried by the speech therapists are required to be certified by a specialist who meets additional state qualifications.

The results obtained from these procedures will be reported in the following chapter.

## CHAPTER V

## TREATMENT OF THE DATA AND RESULTS

When the various data described in the last chapter were accumulated, they were assayed to ascertain the results of this study. Eleven factors were examined to determine their presence or absence concurrently with improvement or lack of improvement in articulatory defective speech patterns of first grade children divided into experimental and control groups, the former receiving speech correction training, the latter receiving none.

These factors were: height age, weight age, dental age, carpal age, chronological age, mental age, intelligence quotient, emotional maladjustment measurement, first grade readiness and first grade achievement measurements, and the number of days absent.

Various statistical procedures were used in the analyses discussed in this chapter. Because of the nature of some of the data, it was necessary only to calculate a simple arithmetic mean or median, or simply arrive at a difference. At times, for comparative purposes, a percentage figure was used. In other instances, it was necessary to compare the mean results of two equated groups or two random groups. When doubt existed as to the homogeneity of one group, the F test was used. To determine whether the

difference between the means of any two groups was significant, the Student-Fisher t-test was used. At times the limited samples necessitated use of the Chi-Square formula, either unmodified or with Fisher's exact method using Yates' correction or Finney's Tables. If it were useful to determine a gain from zero, Fisher's t-test was used.

Only those statistical results which showed significance at the 5 per cent level of confidence and beyond are reported. Results less than those are considered nonsignificant.

Comparison between Experimental and Control Groups

Status at beginning of study.--Of first consideration will be the appraisal of how well the experimental and control groups were matched as total groups at the beginning of the study. This matching is shown in Table 2.

This table shows that when the t-test for significance between the means was applied, there was no statistical difference between the two groups in any of the factors measured at the beginning of the study. The implication, then, is that because at the beginning of the study all factors were equal on a group basis, any changes between the groups might indicate relationship to speech improvement or lack of it.

In addition to what Table 2 shows, there was an equal number of boys and girls in each group, all of whom were white. Also one boy in each group had an insignificant deviation from the hearing standard. Later detailed

analysis will cover these factors more fully.

TABLE 2

COMPARISON BETWEEN EXPERIMENTAL AND CONTROL GROUPS AT BEGINNING OF STUDY

| Factor | Experimental Group's Mean | Control Group's Mean | Difference | Significance |
|---|---|---|---|---|
| Speech Severity | 4.76 | 4.28 | .51 | -- |
| Height Age in Months | 77.84 | 79.12 | 1.28 | -- |
| Weight Age in Months | 83.96 | 80.32 | 3.64 | -- |
| Dental Age in Months | 79.04 | 76.88 | 2.16 | -- |
| Carpal Age in Months | 70.52 | 70.28 | .24 | -- |
| Chronological Age in Months | 76.24 | 77.08 | .84 | -- |
| Mental Age in Months | 75.85 | 73.20 | 2.65 | -- |
| Intelligence Quotient | 99.36 | 96.04 | 3.32 | -- |
| H-O-W* | | | | |
| Schedule A | 20.24 | 19.60 | .64 | -- |
| Schedule B | 68.56 | 73.44 | 4.88 | -- |
| Total | 89.20 | 93.04 | 3.84 | -- |
| Metropolitan Achievement Test Results | 2.00 | 1.84 | .16 | -- |

*Haggerty-Olson-Wickman Behavior Rating Schedules

Status at end of study.--The data in Table 3 show the results of matching the experimental and control groups in the various factors recorded at the end of the study.

TABLE 3

COMPARISON BETWEEN EXPERIMENTAL AND CONTROL GROUPS AT END OF STUDY

| Factor | Experimental Group's Mean | Control Group's Mean | Difference | Significance |
|---|---|---|---|---|
| Speech Severity | 4.60 | 4.48 | .12 | -- |
| Height Age in Months | 87.88 | 85.56 | 2.32 | -- |
| Weight Age in Months | 88.56 | 86.04 | 2.52 | -- |
| Dental Age in Months | 85.40 | 83.84 | 1.56 | -- |
| Carpal Age in Months | 77.32 | 77.00 | .32 | -- |
| H-O-W* | | | | |
| Schedule A | 36.32 | 32.88 | 3.44 | -- |
| Schedule B | 69.60 | 72.92 | 3.22 | -- |
| Total | 106.32 | 105.80 | .52 | -- |
| Teacher Ratings | 2.00 | 1.76 | .24 | -- |
| Absences | 14.94 | 16.68 | 1.74 | -- |

*Haggerty-Olson-Wickman Behavior Rating Schedules

Table 3 shows that when the t-test for significance between the means was applied, there was no statistical difference between the two groups in any of the factors measured at the end of the study. This indicates that the groups both started and ended the study statistically matched in (1) the factors used to match them at the beginning of the study only; (2) the factors taken at both the beginning and end of the study; and (3) in additional items available at the end of the study only.

Difference between initial and final status.--

The arithmetical differences between those factors measured at both the beginning and end of the study and the comparison between these differences appear in Table 4.

TABLE 4

DIFFERENCE BETWEEN BEGINNING AND FINAL FIGURES

| Factor | Experimental | | | Control | | |
|---|---|---|---|---|---|---|
| | Beginning Scores | Final Scores | Diff. | Beginning Scores | Final Scores | Diff. |
| Speech Severity | 4.79 | 4.60 | .19 | 4.28 | 4.48 | .20 |
| Height Age in Months | 77.84 | 87.88 | 10.04 | 79.12 | 85.56 | 6.44 |
| Weight Age in Months | 83.96 | 88.56 | 4.60 | 80.32 | 86.04 | 5.72 |
| Dental Age in Months | 79.04 | 85.40 | 6.36 | 76.88 | 83.84 | 6.96 |
| Carpal Age in Months | 70.52 | 77.32 | 6.80 | 70.28 | 77.00 | 6.72 |
| H-O-W* | | | | | | |
| Schedule A | 20.24 | 36.32 | 16.08 | 19.60 | 32.88 | 13.28 |
| Schedule B | 68.56 | 69.60 | 1.04 | 74.44 | 72.92 | 1.52 |
| Total | 89.20 | 106.32 | 17.12 | 93.04 | 105.80 | 12.76 |
| Metropolitan Achievement Test and Teacher Ratings | 2.00 | 2.00 | 0.0 | 1.84 | 1.76 | .08 |

*Haggerty-Olson-Wickman Behavior Rating Schedules

Statistically these groups were matched evenly for all variables at the beginning, at the end, and in the amount of change during the study.

There are, however, some nonstatistical implications and some statistically significant intra-group findings. These will be discussed individually.

## Treatment of Tape Recordings

What was considered one of the study's best features during the period of its formulation has resulted in one of the study's limitations. Putting the speech patterns of the children to be used on a tape recording was expected to serve as a live record which could be used for comparative purposes at the end of the study; to eliminate the necessity for reliance on written records and symbols; and to provide the best possible measure of any change in the child's speech pattern. Having the tapes evaluated and classified by a listening jury was planned in order to eliminate any bias, conscious or unconscious, that might creep into the process if evaluated by the investigator alone.

However, even though the best of equipment, in good working order, was used, the first tape recordings were not of sufficient quality to allow more than fifty-two of the ninety-six voices taped to be sent to the listening jury for evaluation. Many children with defective sibilants and fricatives, which could easily be discerned in personal contact, were eliminated because these defects were not distinguishable on the tapes or were so muted that they were all but inaudible.

In some instances, there were known reasons for

unusable tapes. Even though there had been considerable effort made to gain rapport with these children, when they were taken from their rooms to the recording session many of them seemed to be insecure. It was impossible to get some of them to speak loudly enough to be able to use a normal gain range, with the result that at some times there was an interfering feedback. At other times, even though due precautions were taken, outside noises interfered with the clarity of the recording.

The listening jury reported that the quality of the second recordings was better than the first. It was felt that this was due, primarily, to the fact that the children were better able to participate in the interview because of talking experiences in first grade and in speech classes, and because of increased maturity.

It is possible, then, because the second recordings were better than the first, that some gains made by members of both groups were not noticeable because the true degree of severity was not shown on the first tape. It must also be recognized that if this be true, all gains which were noticeable enough to cross intra-severity scale borders must have been real gains. There is also the possibility with so coarse a scale as three points that gains were made within any given rating on the scale which were not sufficient to cross the border. For example, if a child's speech were rated as borderline moderate-severe and were classified as moderate, even with noticeable improvement

this speech pattern could still be classified as moderate. Thus, on the numerical point scale of severity there is no gain shown, although on the improvement scale this speech pattern might be checked as being better.

The implication here, then, is that improvement might have taken place although not to a degree measurable by this method.

The complete anlaysis of the speech factor as tape recorded was done after the second set of recordings had been judged by the listening jury. In order to treat these data, it was necessary to assign a value to all judgments. An arbitrary numerical value for severity was assigned as follows: slight, 1; moderate, 2; severe, 3. An arbitrary value for improvement was also assigned: the same, 0; better, 1; much improved, 2; without defect, 3.

The analysis of data compiled from check sheets of the listening jury is shown in Table 5, which shows no significant difference between the experimental and the control groups in severity or improvement of speech defects. The analysis also shows that there was measurable decrease in severity in the experimental group by 3.37 per cent and measurable increase in severity in the control group by 4.72 per cent. Even though neither loss nor gain was statistically significant, this change in severity ratings indicates that the speech of the experimental group became better, while that of the control group became worse, and is felt to be an important trend.

TABLE 5

NUMERICAL VALUATION OF TAPE RECORDING JUDGMENTS

| Item | Experimental Group | Control Group | Difference | Significance |
|---|---|---|---|---|
| Total, first tape | 119 | 107 | 12 | -- |
| Total, second tape | 113 | 114 | 1 | -- |
| Mean, first tape | 4.76 | 4.28 | .48 | -- |
| Mean, second tape | 4.52 | 4.56 | .04 | -- |
| Severity points, gain or loss | -6 | +7 | 13 | -- |
| Number improved, all judges, any amount | 11 | 12 | 1 | -- |
| Number improved, two judges, any amount | 7 | 8 | 1 | -- |
| Total severity, first judgment, 3-6 points | 16 | 17 | 1 | -- |
| Improved 1 point or more on second tape | 6 | 2 | 4 | -- |
| Total severity, first judgment, 7-9 points | 7 | 5 | 2 | -- |
| Improved 1 point or more on second tape | 4 | 4 | 0 | -- |
| Remained same | 14 | 13 | 1 | -- |

Results of the judges' ratings expressed in percentages are shown in Table 6.

This tabulation implies that the first grade children with functional articulatory speech defects which were

judged as slight or moderate (3-6 severity group) show a greater percentage of improvement with speech correction help than do those in a like classification who did not receive speech correction help. Conversely, those children in the control group whose functional articulatory defects were classified as more severe (7-9 severity group) showed a greater percentage of improvement than those of the experimental group.

TABLE 6

ANALYSIS OF JUDGES' RATINGS EXPRESSED IN PERCENTAGES

| Judgment | Experimental | Control |
|---|---|---|
| Judged improved by any one judge | 44%* | 48%* |
| Judged improved by any two judges | 28%** | 32%* |
| Classified in 3-6 severity group | 64% | 68% |
| Improved one or more points | 37% | 12% |
| Classified in 7-9 severity group | 28% | 20% |
| Improved one or more points | 57% | 80% |
| Judged nonimproved by all judges | 56% | 52% |

* Significant gain from zero beyond the 1% level of confidence
**Significant gain from zero beyond the 2% level of confidence

## Analysis of Findings with Reference to Maturation Variables

In an attempt to find factors of maturation which are either present or absent concurrently with the improvement or lack of improvement of the functional articulatory defective speech patterns of first grade children, other data were gathered to see if any significant relationship existed with a single variable or combination of variables.

When the results of the listening jury's rating sheets had been tabulated, subgroups, divided according to speech improvement and speech nonimprovement, were formed for both the experimental and control groups. To determine the relationships between these groups and various maturation variables, the groups were subjected to statistical treatment. When no significance resulted from this statistical analysis, the subgroups, i.e. the speech-improved from both the experimental and control groups and the speech-nonimproved from both the experimental and control groups, were combined and the means again tested for statistical significance. These analyses used data gathered at the beginning of the study, data gathered at the end of the study, and the difference between those variables measured both at the beginning and end of the study which showed the amount of change during the period of the study.

The results of these analyses are shown in Tables 7, 8, and 9.

Of all the t-tests which have been reported in this study, only five tests showed any statistical significance at, or beyond, the 5 per cent level of confidence.

Intelligence.--One of these tests, comparing the intelligence quotient means of the control speech-improved and the control speech-nonimproved groups (see Table 7), showed the speech-improved group to be less intelligent than the speech-nonimproved group at the 5 per cent level of confidence. Because of the number of tests involved,

this result could have been chance. To check the matter, an F test was run and an F score of 1.36 was obtained. This score is not significant and indicates that the groups were drawn from a homogeneous population, which suggests that the above difference may not have been chance.

TABLE 7

RESULTS OF TESTING VARIOUS FACTORS FOR SIGNIFICANCE USING BEGINNING SCORES FOR SPEECH-IMPROVED AND SPEECH-NONIMPROVED GROUPS

| Factor | Experimental | | | Control | | | Combined | | |
|---|---|---|---|---|---|---|---|---|---|
| | t | df | p | t | df | p | t | df | p |
| Height Age in Months | .8459 | 23 | -- | .4130 | 23 | -- | .3201 | 48 | -- |
| Weight Age in Months | 1.17 | 23 | -- | .8072 | 23 | -- | .1307 | 48 | -- |
| Dental Age in Months | 1.41 | 23 | -- | .9879 | 23 | -- | .2030 | 48 | -- |
| Carpal Age in Months | .9465 | 23 | -- | 1.35 | 23 | -- | 1.52 | 48 | -- |
| Chronological Age | .0393 | 23 | -- | 1.25 | 23 | -- | 1.12 | 48 | -- |
| Mental Age | .4289 | 23 | -- | 1.65 | 23 | -- | .9013 | 48 | -- |
| Intelligence Quotient | .3450 | 23 | -- | 2.17 | 23 | .05 | | | |
| H-O-W* | | | | | | | | | |
| Schedule A | 2.10 | 23 | .05 | .8342 | 23 | -- | | | |
| Schedule B | 2.87 | 23 | .01 | .0223 | 23 | -- | | | |
| Total | 2.27 | 23 | .05 | .2238 | 23 | -- | | | |
| Metropolitan Achievement Test | .0000 | 23 | -- | .1111 | 23 | -- | .0161 | 48 | -- |

*Haggerty-Olson-Wickman Behavior Rating Schedules

Behavior problem tendencies.--Other tests which showed significance resulted from findings from the Haggerty-Olson-Wickman Behavior Rating Schedule. When the t-test was applied to the initial ratings of Schedule A, the experimental speech-improved group was shown to be significantly lower in problem behavior than the experimental speech-nonimproved group at the 5 per cent level. Applying the t-test to the initial ratings from Schedule B resulted in the speech-improved experimental group showing fewer problem tendencies than the experimental speech-nonimproved group at the 1 per cent level. These combined Schedules, A and B, also showed significantly lower scores for the speech-improved experimental group than for the speech-nonimproved experimental group at the 5 per cent level.

Further definitive tests (see Table 9) showed that the difference between the first and second ratings on Schedule B for the experimental speech-improved group and the experimental speech-nonimproved group was significant well beyond the 1 per cent level, indicating that those of the experimental group whose speech improved finished with more severe behavior problem tendencies than those whose speech did not improve. This result must be contrasted with the beginning scores (see Table 7) which showed, well beyond the 1 per cent level of confidence, that the problem tendencies of the experimental speech-nonimproved children were greater than those of children whose speech did improve. There were no significant differences or approximations

at any time betwen the control speech-improved and speech-nonimproved groups.

TABLE 8

RESULTS OF TESTING VARIOUS FACTORS FOR SIGNIFICANCE USING FINAL SCORES FOR SPEECH-IMPROVED AND SPEECH-NONIMPROVED GROUPS

| Factor | Experimental | | | Control | | | Combined | | |
|---|---|---|---|---|---|---|---|---|---|
| | t | df | p | t | df | p | t | df | p |
| Height Age in Months | .4244 | 23 | -- | .7700 | 23 | -- | .2121 | 48 | -- |
| Weight Age in Months | .6478 | 23 | -- | .2880 | 23 | -- | .2665 | 48 | -- |
| Dental Age in Months | .1165 | 23 | -- | 1.71 | 23 | -- | 1.18 | 48 | -- |
| Carpal Age in Months | 1.00 | 23 | -- | 1.10 | 23 | -- | 1.34 | 48 | -- |
| H-O-W* | | | | | | | | | |
| Schedule A | .3606 | 23 | -- | .7542 | 23 | -- | .8520 | 48 | -- |
| Schedule B | .0219 | 23 | -- | .2574 | 23 | -- | .1467 | 48 | -- |
| Total | .2700 | 23 | -- | .6530 | 23 | -- | .6492 | 48 | -- |
| Teachers' Ratings | 1.43 | 23 | -- | .0200 | 23 | -- | 1.07 | 48 | -- |
| Absences | 1.19 | 23 | -- | .0372 | 23 | -- | 1.37 | 48 | -- |

*Haggerty-Olson-Wickman Behavior Rating Schedules

It is interesting to note that on the beginning Haggerty-Olson-Wickman Behavior Rating Schedule scores on Schedule A (see Table 7), the speech-nonimproved rated significantly higher at the 5 per cent level in the experimental group than did the speech-improved group, and rated higher at the 1 per cent level on Schedule B. Contrast this with the results (see Table 8) which show that these speech-

nonimproved experimental children showed no significant difference on the final rating.

TABLE 9

RESULTS OF TESTING VARIOUS FACTORS FOR SIGNIFICANCE USING BEGINNING AND FINAL SCORES FOR SPEECH-IMPROVED AND SPEECH-NONIMPROVED GROUPS

| Factor | Experimental | | | Control | | | Combined | | |
|---|---|---|---|---|---|---|---|---|---|
| | t | df | p | t | df | p | t | df | p |
| Height Age in Months | .1775 | 23 | -- | 1.13 | 23 | -- | .6894 | 48 | -- |
| Weight Age in Months | .4873 | 23 | -- | .1329 | 23 | -- | .3000 | 48 | -- |
| Dental Age in Months | .9277 | 23 | -- | .1526 | 23 | -- | .8281 | 48 | -- |
| Carpal Age in Months | 1.88 | 23 | -- | 1.33 | 23 | -- | .9047 | 48 | -- |
| H-O-W* | | | | | | | | | |
| Schedule A | 1.36 | 23 | -- | .7469 | 23 | -- | .1515 | 48 | -- |
| Schedule B | 3.04 | 23 | .01 | -.4107 | 23 | -- | | | |
| Total | 1.57 | 23 | -- | .0784 | 23 | -- | .5500 | 48 | -- |

*Haggerty-Olson-Wickman Behavior Rating Schedules

The maturation comparison on Schedule A (see Table 9) showed no significant difference between the experimental speech-improved group and the experimental speech-nonimproved group. However, a t-score of 1.36, showing that the behavior problem tendencies on Schedule A were greater for the speech-improved experimental group than for the experimental speech-nonimproved group, contrasts with the beginning scores (see Table 7), which showed that the speech-improved experimental group had fewer behavior

problem tendencies at the 5 per cent level of confidence. These changes indicate that those whose speech improved with speech correction had a worsening of behavior as measured by teacher ratings on both Schedules A and B.

Another notable result of the Haggerty-Olson-Wickman scores is shown by a comparison of the medians, percentiles, and means of these Schedules with the published norms. Table 10 shows this comparison for the total experimental and control groups.

The difference between the medians of the experimental and control groups and the published norms of Schedule A, Behavior Problem Records shown in Table 10 should be noted. The medians for the beginning scores of both the experimental and control groups were 15.0, placing them within the sixty-first percentile. The median for the experimental group final scores on Schedule A was 28.2, which falls within the eighty-fifth percentile, and the median for the control group was 26.5, placing it within the eighty-first percentile. The published median is 8.6, with a fifty-third percentile rank.

Even greater contrasts were shown when these basic groups were subdivided into speech-improved and speech-nonimproved groups. Table 11 shows these comparisons. The range of deviations of all groups and subgroups on Schedule A is slightly less than 3 times to slightly more than 5.5 times the published norm.

Readiness tests.--A tabulation of the scores taken

TABLE 10

COMPARISON OF H-O-W* PUBLISHED DISTRIBUTION OF SCORES WITH SCORES OF EXPERIMENTAL AND CONTROL GROUPS

| Rating | Experimental | | | | Control | | | | Published Norms | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Median | Percentile | Mean | Percentile | Median | Percentile | Mean | Percentile | Median | Percentile | Mean | Percentile |
| Initial H-O-W* Scores for Schedule A | 15.02 | 61 | 20.24 | 76 | 15.02 | 61 | 19.60 | 76 | | | | |
| Final H-O-W* Scores for Schedule A | 28.18 | 85 | 36.32 | 90 | 26.5 | 81 | 32.88 | 88 | 8.6 | 53 | | |
| Initial H-O-W* Scores for Schedule B | 64.00 | 42 | 68.55 | 55 | 67.00 | 55 | 73.44 | 72 | | | | |
| Final H-O-W* Scores for Schedule B | 65.35 | 55 | 69.60 | 64 | 64.25 | 42 | 72.92 | 64 | 65.4 | 55 | 69.2 | 55 |

*Haggerty-Olson-Wickman Behavior Rating Schedules

TABLE 11

GROUP MEDIANS, MEANS, AND PERCENTILES FOR H-O-*W** BEHAVIOR RATING SCHEDULE SCORES

| Rating | Experimental | | | | | | | | Control | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Speech-Improved | | | | Speech-Nonimproved | | | | Speech-Improved | | | | Speech-Nonimproved | | | |
| | Median | Percentile | Mean | Percentile | Median | Percentile | Mean | Percentile | Median | Percentile | Mean | Percentile | Median | Percentile | Mean | Percentile |
| Initial, Schedule A | 13.5 | 61 | 13.14 | 61 | 15.5 | 70 | 23.00 | 76 | 14.5 | 61 | 17.75 | 70 | 14.8 | 61 | 20.47 | 76 |
| Final, Schedule A | 47.5 | 95 | 32.71 | 88 | 27.5 | 85 | 37.72 | 90 | 25.5 | 81 | 26.87 | 81 | 41.5 | 92 | 35.70 | 90 |
| Initial, Schedule B | 58.25 | 28 | 59.85 | 42 | 67.0 | 55 | 71.94 | 64 | 64.0 | 42 | 73.37 | 64 | 63.2 | 42 | 73.47 | 64 |
| Final, Schedule B | 63.25 | 42 | 69.71 | 64 | 66.15 | 55 | 69.55 | 64 | 62.5 | 42 | 71.62 | 64 | 67.75 | 55 | 73.52 | 64 |

| | Median | Percentile | Mean | Percentile |
|---|---|---|---|---|
| Published Norm, Schedule A | 8.6 | 53 | 69.2 | 55 |
| Published Norm, Schedule B | 65.4 | 55 | | |

*Haggerty-Olson-Wickman Behavior Rating Schedules

from both the Metropolitan Readiness Tests and the Teachers' Ratings of the second grade prognosis was made at the end of the year. So that scores could be compared, an arbitrary numerical evaluation was given to each letter grade: 4 to an A, 3 to a B, 2 to a C, 1 to a D, and 0 to an E.

Table 12 shows the relationship of the letter grades of the Metropolitan Readiness Tests and the Teachers' Rating Scales to each other and to the improvement of speech.

TABLE 12

LETTER GRADE DISTRIBUTION ON METROPOLITAN TESTS AND TEACHERS' RATINGS FOR SUBGROUPS

| | Metropolitan Readiness Tests | | | | Teachers' Ratings | | | |
|---|---|---|---|---|---|---|---|---|
| | Speech-Improved | | Speech-Nonimproved | | Speech-Improved | | Speech-Nonimproved | |
| | Experimental | Control | Experimental | Control | Experimental | Control | Experimental | Control |
| A | 0 | 0 | 1 | 2 | 2 | 0 | 2 | 1 |
| B | 2 | 0 | 5 | 2 | 2 | 2 | 2 | 4 |
| C | 3 | 7 | 7 | 5 | 2 | 3 | 8 | 6 |
| D | 2 | 1 | 3 | 7 | 0 | 2 | 2 | 2 |
| E | 0 | 0 | 2 | 1 | 1 | 1 | 4 | 4 |

No statistical significance was shown when the t-test was applied to the mean results of both the Metropolitan Readiness Tests and the Teacher's Rating Scale. However, assuming the reliability and validity of the Metropolitan Tests and the subsequently adapted Teacher's Rating Scale,

calculations based on Table 12 would indicate that those in the speech-improved experimental group improved also in sholastic areas, while those in the control group, even though improving in speech, lost in academic achievement more than those in the speech-nonimproved control group, but less than the speech-nonimproved experimental group.

An equal number of children in both the experimental and control groups were to repeat first grade. These nonpromotions equalled 20 per cent of the total of each group. This contrasts with an 8.40 per cent nonpromotion total for the first grade population in the entire school system. Table 12 also shows that 80 per cent of the nonpromotions in the study were speech-nonimproved children.

Without knowing the complete reason or reasons resulting in the nonpromotion of these children, the figures almost obviate the statement that they are more academically retarded than first grade children as a whole, and that among this group of children with defective speech, the greatest percentage of nonpromotions came from the group whose speech was nonimproved.

Hearing.--The results of the screening with the Beltone audiometer showed that all but two of the children tested had hearing within the prescribed range in both ears. The two boys with hearing losses were next given a complete audiometric test. One of the boys had a loss at 40 decibels in one ear at the 4,000 cycles per second

level. The other had losses in one ear at 45 decibels at 750 cycles per second, at 40 decibels at 1,000 cycles per second, and at 35 decibels at 4,000 cycles per second. However, it was decided that inasmuch as each met the standards in one ear they would be left in the study (7).

This decision was justified, as the boy with the loss at the 4,000 frequency level only, made a gain in improvement as much as the average of those who were judged improved by three judges, and more than the average of those who were judged to have improved by the two-judge standard which was used as a basis for statistical analysis in this study. The speech of the boy who had additional losses in one ear was judged by all three judges to have remained the same. As this was also true of fourteen others in the experimental group and of twelve others in his control group, it is also assumed that his deviation from the hearing stardard was of no significance.

School and speech class attendance.--At the end of the school year, an analysis of school attendance showed that there was no significance between the means of the experimental and control groups, between the speech-improved and speech-nonimproved experimental groups, between the speech-improved and speech-nonimproved control groups, and between the combined speech-improved and speech-nonimproved groups (see Table 8).

Therefore, it can be assumed that even though an examination of these means showed the speech-improved

children in all groups to have a slightly higher attendance record, this slight difference in school attendance could not be considered as a variable relating to speech improvement.

A comparison of the amount of time spent in speech correction class also yielded no significance. The difference between the means of 1.74 periods of class attendance with a t-score of .7598 in the experimental group of the speech-improved children could not logically have influenced the difference in speech improvement.

Sex.--The results shown in the investigation are based on the study of twenty girls and thirty boys. This ratio is within the expected range in an average group with articulatory defective speech (7, 42). There was no attempt to limit the number of children who participated in this study other than by the matching standards.

Race.--All the children who were included in this study were white. This totally white study population was an unexpected result, as there are Negro and Mexican children attending the Bay City Public Schools. Although both Negroes and Mexicans were included in the original collection of data, these children were eliminated because they did not fit within the matching patterns.

Because the results of previous studies have shown that the articulation errors of first grade children decreased both through maturation and through speech correction, it was expected that this study might show some

correlation between speech improvement and various measures of increasing maturity, or conversely, between speech-non-improvement and lack of increasing maturity in the various growth measures which have been discussed in this chapter. Surprisingly enough, however, no significant relationships were found for either the experimental or control group between speech improvement and any of the maturation variables which were used as a basis for this part of the study. Frankly, we are at a loss to account for this lack of relationship. Apparently, the unassisted speech improvement which occurred involves influences which are not measured by the particular measures of maturation employed in the present investigation.

The following chapter presents a brief summation of the results of this study.

# CHAPTER VI

## SUMMARY AND CONCLUSIONS

In this study, a comparison was made between the speech of a group of first grade children with functional articulatory speech defects who received speech therapy as carried on within a public school speech correction program and the speech of a matched group of first grade children with functional articulatory speech defects who received no speech therapy. The primary question to be answered was whether speech therapy is effective at the first grade level in improving defective speech patterns, or whether just as much improvement will result from unassisted development which may occur with passage of time.

### Methodology

Two groups, consisting of twenty-five children each, were matched for severity of functional articulatory speech defects, chronological ages, mental ages, intelligence quotients, sex, and race. In addition, no child was included who had had prior speech correction training or was repeating the first grade.

Measurements were also made of a number of maturation variables to determine their relationship to improvement of functional articulatory disorders. These

variables included height, weight, dental, and carpal ages, behavior problem tendency scores, a prediction of first grade readiness, a final evaluation of first grade accomplishment, hearing acuity, and school and speech class attendance.

By random selection, the subjects were divided into an experimental group and a control group. The children in the experimental group were scheduled to be seen by a certified speech therapist in regular thirty-minute classes twice a week for a period of twenty-seven weeks, subject to interruptions caused by the absence of either the child or the therapist, vacations, Parent-Teacher meetings, assemblies, and holiday parties.

Before matching, randomizing, and enrollment in speech correction classes, a two-minute tape recording of the speech pattern of each subject was made. These tape recordings were submitted to a three-member listening jury for evaluation of severity of the speech defects. When the speech patterns had been recorded at the end of the study, each child's two-minute segment was spliced after his first sample for comparative purposes, and the tapes again submitted to the listening jury so it could evaluate the severity of the speech defects and judge whether improvement had been made and to what degree. The judges had no way of knowing which children had had speech therapy and which had not.

For the purpose of further evaluation, and on the

basis of agreement of any two of the three judges, the basic experimental and control groups were divided into subgroups: a speech-improved experimental group, a speech-nonimproved experimental group, a speech-improved control group, and a speech-nonimproved control group. Where no statistical difference was shown between subgroups, these subgroups were combined for statistical treatment into a total speech-improved group and a total speech-nonimproved group.

The data for each subgroup for all variables were treated statistically to determine interrelationships with improvement or lack of improvement of functional articulatory speech patterns.

## Summary of Results

The results were as follows:

1. There was no significant difference between the amount of improvement made by the experimental group and the control group. However, the mean severity rating of the speech defects in the experimental group decreased 4.72 per cent and the mean severity rating of the speech defects in the control group increased 3.37 per cent as judged by all judges.

2. As judged by two of the three judges, 28 per cent of the experimental group showed a gain of two or more points on the rating scale of improvement, as did 32 per cent of the control group.

3. Both groups showed a greater than chance

improvement. The amount of improvement was beyond the 2 per cent level for the experimental group and beyond the 1 per cent level for the control group as judged by two of the three judges.

4. As judged by all three judges, the speech patterns of 56 per cent of the experimental group and 52 per cent of the control group remained the same on the improvement rating scale of the same, better, much improved, and without defect.

5. Children in the experimental group who were rated by two of the three judges as falling within a severity of speech defect grouping from slight to moderate (from 3 to 6 on a point scale extending from 3 to 9) improved 25 per cent more than those of a like grouping in the control group.

6. Children in the control group who were rated by two of the three judges as falling within a severity of speech defect grouping from moderate to severe (from 7 to 9 on a point scale extending from 3 to 9) improved 23 per cent more than those in a like grouping in the experimental group.

7. No significant relationship was found between speech improvement or nonimprovement and the variables of height ages, weight ages, dental ages, or carpal ages.

8. No significant relationship was found between speech improvement or nonimprovement and the variables of chronological ages or mental ages.

9. No significant relationship was found between speech improvement or nonimprovement and the number of absences from school or speech class.

10. The total nonpromotion from first grade for the experimental group was 20 per cent. The total nonpromotion from first grade for the control group was also 20 per cent. This percentage of nonpromotion should be contrasted with an 8.40 per cent of nonpromotions for all first graders in the school system utilized.

11. The speech-nonimproved group contained 80 per cent of the nonpromotions for the experimental group, for the control group, and for these groups combined.

12. The members of the speech-improved control group were significantly less intelligent at the 5 per cent level of confidence than were those of the speech-nonimproved control group.

13. No statistically significant differences were found in academic achievement between any of the various groups. However, there was a trend showing that the speech-improved experimental group improved in academic achievement. The speech-improved control group lost in academic achievement more than the speech-nonimproved experimental group, but less than the speech-nonimproved control group.

14. At the beginning of the investigation, the speech-improved experimental group showed significantly fewer behavior problems at the 5 per cent level of confidence on Schedule A of the Haggerty-Olson-Wickman

Behavior Rating Schedules than did the speech-nonimproved experimental group. However, at the conclusion of the investigation there was no significant difference between the behavior problem ratings of the speech-improved and the speech-nonimproved experimental groups.

15. On Schedule B of the Haggerty-Olson-Wickman Behavior Rating Schedules, the speech-improved experimental group showed fewer problem tendencies than the experimental speech-nonimproved group at the 1 per cent level of confidence. However, by testing the difference between the beginning scores and the final scores, it was found that the experimental speech-improved group increased more in behavior problem tendencies than did the speech-nonimproved group, well beyond the 1 per cent level of confidence.

16. On the final scores of Schedule A of the Haggerty-Olson-Wickman Behavior Rating Schedules, the median deviation of all groups and subgroups ranged from 3 to 5.5 times greater than the published norm of 8.6.

## Conclusions

Within the scope of this investigation, the above results permit the following conclusions:

1. First grade children who receive speech therapy directed at improving functional articulatory speech defects show no greater improvement as a group than a group of first grade children with similar defects who receive no speech therapy.

2. As a group, first grade children who have functional articulatory speech defects are more academically retarded than first grade children as a whole.

3. First grade children who have functional articulatory speech defects present a greater number of behavior problems and behavior problem tendencies than do children as a whole.

4. Physical growth and improvement or lack of improvement of functional articulatory speech defects are not correlated in first grade children.

5. First grade children with functional articulatory speech defects whose speech improves with speech training show increased behavior problems.

## Final Note

This study has not shown that speech correction as carried on within a public school speech correction program has a significantly greater effect at the first grade level in improving functional defects of articulation than has the unassisted development which may occur as a function of time and experience. This failure to demonstrate the effectiveness of speech correction at the first grade level raises a serious question about the place of speech correction at this level. In any case, current practices in this field should be re-examined. It is possible that in the case of functional articulation problems, speech correction might better be introduced at a later age level, giving the child further opportunity to eliminate those

articulation errors which may have been caused at this age by lack of sufficient development, and which may be eliminated simply by lapse of time. Speech correction might then be applied only to those cases where the problem persists, thus better utilizing the time of the child and the therapist.

# A P P E N D I X E S

# APPENDIX A

FORMS FOR DATA RECORD SHEET, COMMUNICATIONS TO PARENTS, LISTENING JURY, AND TEACHER RATING SCALE

# DATA RECORD SHEET

Name_____ Code No._____ Sex_____

School_____ Teacher_____

| | Date | Result | Date | Result |
|---|---|---|---|---|
| HEIGHT | | | | |
| WEIGHT | | | | |
| HAGGERTY-OLSON-WICKMAN BEHAVIOR RATING SCHEDULE SCORES: Schedule A | | | | |
| Schedule B | | | | |
| Total | | | | |
| METROPOLITAN READINESS TEST RESULTS | | | | |
| TEACHER'S RATING SCALE | | | | |
| PINTNER-CUNNINGHAM PRIMARY TEST RESULT | | | | |
| CHRONOLOGICAL AGE | | | | |
| MENTAL AGE | | | | |
| CARPAL AGE | | | | |
| DENTAL AGE | | | | |
| RACE | | | | |
| HEARING TEST RESULT | | | | |
| SPEECH DEFECT | | | | |
| ATTENDANCE Days Absent from School | | | | |
| Days Present in Speech Class | | | | |

October 24, 1955

Dear Parents:

The Bay City Public Schools and the University of Michigan are doing some research with first grade pupils. This study is in the area of speech and should be both interesting and worth while.

We should like to check the physical growth of about one hundred children between now and June 1. This would include such things as height, weight, number of permanent teeth, and bone growth. The bone growth is to be determined by two simple wrist X-rays. The first will be taken soon and the second late in the spring.

We should like to have your permission to do two things:

(1) take your first grade child from school to a downtown office for a wrist X-ray now and again in the spring;

(2) count the number of permanent teeth.

There will be absolutely no cost nor effort required from you. Your child, along with the others from his school, will be picked up by a responsible adult, taken for the X-ray, and returned to school.

In order that we may arrange transportation and make scheduling possible, will you please sign and return the enclosed permission slip by Monday, October 31.

Thank you for cooperating in this study.

Sincerely,

William K. Lee
Director of Special Education

WKL:er

## ATTACHED PERMISSION FORM

October 24, 1955

_____
(Child's name)

I hereby give permission to take my first grade child for a wrist X-ray and tooth count now and again in the spring.

_____
Parent's signature

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

## SPRING REMINDER TO PARENTS

May 29, 1956

Dear Parents:

Thursday morning, May 31, has been set as the date for the second X-ray and dentition check for which you gave your permission for your first-grade child last fall.

The children will again be picked up and returned to school by the same adults that cared for them in November, and will again be gone from school for only a short time.

Thank you for your continued cooperation in this study.

Sincerely,

William K. Lee
Director of Special Education

## LISTENING JURY'S RATING SHEET FOR USE IN JUDGING FIRST TAPE RECORDING

Code number _____

Is the defect

_____SLIGHT

_____MODERATE

_____SEVERE

Remarks:

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

## LISTENING JURY'S RATING SHEET FOR USE IN JUDGING SECOND TAPE RECORDING

How does the speech of _____-2 compare with that of
(code number)
_____?
(code number)

_____SAME

_____BETTER

_____MUCH IMPROVED

_____WITHOUT DEFECT

Is _____'s defect
(code number)

_____NOT EVIDENT

_____SLIGHT

_____MODERATE

_____SEVERE

Remarks:

# TEACHER'S RATING SCALE

NAME_____CODE NO._____

HEIGHT. . . . . .

WEIGHT. . . . . .

DAYS ABSENT FROM SCHOOL . . . . . .

READING EVALUATION: Circle one.

A Superior.
Excellent risk for second grade work.

B High Normal.
A good risk for second grade work.

C Average.
Likely to succeed in second grade work.

D Low Normal.
Likely to have difficulty in second grade work.

E Poor Risk.
Probable second grade failure. Retained in first grade.

June, 1956

# APPENDIX B

## DATA TABULATED FROM LISTENING JURY RATINGS, MATCHINGS, AND RELATED MATURATION VARIABLES

TABLE 13

TABULATION OF JUDGES' RATINGS FROM FIRST TAPE RECORDINGS

| Code Number | Defect | | | | | | | | | Total Severity Rating |
|---|---|---|---|---|---|---|---|---|---|---|
| | Slight=1 | | | Moderate=2 | | | Severe=3 | | | |
| | Judge | | | Judge | | | Judge | | | |
| | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | |
| 3A | x | x | x | | | | | | | 3 |
| 3B | x | x | x | | | | | | | 3 |
| 7A | x | | x | | | | | | | 2 |
| 7B | x | | x | | x | | | | | 4 |
| 9A | | | | | x | | x | | | 5 |
| 9B | x | x | x | | | | | | | 3 |
| 15A | | | | x | x | x | | | | 6 |
| 13A | x | | x | | x | | | | | 4 |
| 19A | | | | | x | x | x | | | 7 |
| 43A | | | | | x | x | x | | | 7 |
| 20A | | | x | | x | | | | | 3 |
| 20B | | x | x | x | | | | | | 4 |
| 21A | x | x | x | | | | | | | 3 |
| 12B | | | x | x | x | | | | | 5 |
| 21B | | | | | | x | x | x | | 8 |
| 36B | | | x | | | | x | x | | 7 |
| 23A | | | x | x | x | | | | | 5 |
| 23B | x | x | x | | | | | | | 3 |
| 25A | x | x | x | | | | | | | 3 |
| 14A | | | x | x | x | | | | | 5 |
| 28A | x | | x | | | | | | | 2 |
| 28B | | | | x | x | x | | | | 6 |
| 29A | x | x | x | | | | | | | 3 |
| 29B | x | x | x | | | | | | | 3 |
| 30A | x | x | x | | | | | | | 3 |
| 30B | x | x | x | | | | | | | 3 |
| 33A | x | x | x | | | | | | | 3 |

TABLE 13--Continued

| Code Number | Defect | | | | | | | | | Total Severity Rating |
|---|---|---|---|---|---|---|---|---|---|---|
| | Slight=1 | | | Moderate=2 | | | Severe=3 | | | |
| | Judge | | | Judge | | | Judge | | | |
| | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | |
| 33B | x | x | x | | | | | | | 3 |
| 34B | x | | x | | | | | | | 2 |
| 35A | x | | x | | | | | | | 2 |
| 36A | x | x | x | | | | | | | 3 |
| 27B | x | x | x | | | | | | | 3 |
| 37A | | | | | x | x | x | | | 7 |
| 1B | | x | x | x | | | | | | 4 |
| 38B | x | x | x | | | | | | | 3 |
| 39A | x | x | x | | | | | | | 3 |
| 2A | | | x | x | x | | | | | 5 |
| 44A | x | | x | | | | | | | 2 |
| 44B | | x | x | x | | | | | | 4 |
| 51B | | | | x | x | x | | | | 6 |
| 1A | | | | | | x | x | x | | 8 |
| 26B | x | x | x | | | | | | | 3 |
| 57A | x | x | x | | | | | | | 3 |
| 5A | | | | | | x | x | x | | 8 |
| 55A | | | | | | x | x | x | | 8 |
| 6B | | | | | | x | x | x | | 8 |
| 6A | | | | x | | x | | x | | 7 |
| 31B | | | | x | x | x | | | | 6 |
| 40A | | | | x | | x | | x | | 7 |
| 40B | | | | | | x | x | x | | 8 |

TABLE 14

TABULATION OF JUDGES' RATINGS FROM SECOND TAPE RECORDINGS

| Code Numbers | Defect | | | | Improvement | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Not Evident =0 | Slight =1 | Moderate=2 | Severe=3 | Same=0 | Better=1 | Much Improved=2 | Without Defect=3 | Defect | Improvement |
| | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | | |
| 3A-2 | | | x x x | | x x x | | | | 6 | 0 |
| 3B-2 | | | x x x | | x x x | | | | 6 | 0 |
| 7A-2 | | x x | x | | | x x x | | | 4 | 3 |
| 7B-2 | | | x x | x | x x x | | | | 6 | 0 |
| 9A-2 | | x x | x | | x x | x | | | 4 | 1 |
| 9B-2 | | x | x x | | x x | x | | | 5 | 1 |
| 15A-2 | | | x x x | | x x x | | | | 6 | 0 |
| 13A-2 | | x x x | | | x | x x | | | 3 | 2 |
| 19A-2 | | x x | x | | | x x | x | | 4 | 4 |
| 43A-2 | | x x x | | | | x x | x | | 3 | 4 |
| 20A-2 | | x x x | | | x x x | | | | 3 | 0 |
| 20B-2 | | x x | x | | x | x x | | | 4 | 2 |
| 21A-2 | | | x x x | | x x x | | | | 6 | 0 |
| 12A-2 | | x x | x | | x | x x | | | 4 | 2 |
| 21B-2 | | | x x | x | x x x | | | | 6 | 0 |
| 36B-2 | | x | x | x | x x | x | | | 5 | 1 |
| 23A-2 | | x | x x | | x x x | | | | 5 | 0 |
| 23B-2 | x x x | | | | | x | x | x | 0 | 6 |
| 25A-2 | x x x | | | | | x | | x x | 0 | 7 |
| 14A-2 | | | x x x | | x x x | | | | 6 | 0 |
| 28A-2 | x x x | | | | x | | | x x | 0 | 6 |

TABLE 14--Continued

| Code Numbers | Defect | | | | Improvement | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Not Evident =0 | Slight =1 | Moderate=2 | Severe=3 | Same=0 | Better=1 | Much Improved=2 | Without Defect=3 | Defect | Improvement |
| | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | | |
| 28B-2 | | | x x x | | x x x | | | | 6 | 0 |
| 29A-2 | | x | x x | | x x x | | | | 5 | 0 |
| 29B-2 | | x x | x | | x x x | | | | 4 | 0 |
| 30A-2 | | x x | x | | x x x | | | | 4 | 0 |
| 30B-2 | | x x x | | | x x | x | | | 3 | 1 |
| 33A-2 | | x x | x | | | x x | x | | 4 | 4 |
| 33B-2 | | x | x x | | x x x | | | | 5 | 0 |
| 34B-2 | | x x | x | | x x x | | | | 4 | 0 |
| 35A-2 | x x | x | | | x | x | | x | 1 | 4 |
| 36A-2 | x x x | | | | x | x | | x | 0 | 4 |
| 27B-2 | | x x x | | | x | x x | | | 3 | 2 |
| 37A-2 | | | x x x | | x x | x | | | 6 | 1 |
| 1B-2 | | | x x x | | x x x | | | | 6 | 0 |
| 38B-2 | x x | x | | | x x | x | | | 1 | 1 |
| 39A-2 | | x x | x | | x x | x | | | 4 | 1 |
| 2A-2 | | x | x x | | x x x | | | | 5 | 0 |
| 44A-2 | | x x | x | | x x x | | | | 4 | 0 |
| 44B-2 | | x | x x | | x x x | | | | 5 | 0 |
| 51B-2 | | x | x x | | x x x | | | | 5 | 0 |
| 1A-2 | | | | x x x | x x x | | | | 9 | 0 |
| 26B-2 | | x x | x | | | x x x | | | 4 | 3 |
| 57A-2 | | x x | x | | x x | x | | | 4 | 1 |

TABLE 14--Continued

| Code Numbers | Defect | | | | Improvement | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Not Evident =0 | Slight -1 | Moderate=2 | Severe=3 | Same=0 | Better=1 | Much Improved=2 | Without Defect=3 | Defect | Improvement |
| | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | Judge 1 2 3 | | |
| 5A-2 | | | | x x x | x x x | | | | 9 | 0 |
| 55A-2 | | | x | x x | x x x | | | | 8 | 0 |
| 6B-2 | | x | x | x | | x x x | | | 6 | 3 |
| 6A-2 | | | x x x | | x x x | | | | 6 | 0 |
| 31B-2 | | | x x x | | x x x | | | | 6 | 0 |
| 40A-2 | | | x x x | | x x x | | | | 6 | 0 |
| 40B-2 | | | x | x x | x x x | | | | 8 | 0 |

## TABLE 15

TABULATION OF DATA ON CHRONOLOGICAL AGE, MENTAL AGE, INTELLIGENCE QUOTIENT, DAYS ABSENT FROM SCHOOL, AND NUMBER OF SPEECH CLASSES ATTENDED

| Code Number | Sex and Group | | C.A. in Months | M.A. in Months | I.Q.* | No. Days Absent from School | No. Days Present in Speech Class |
|---|---|---|---|---|---|---|---|
| | Exp. | Control | | | | | |
| 3A | | M | 71 | 78 | 108 | 10½ | |
| 3B | M | | 72 | 78 | 107 | 19 | 41 |
| 7A | | M | 73 | 59 | 82 | 9 | |
| 7B | M | | 73 | 59 | 82 | 7½ | 38 |
| 9A | M | | 72 | 78 | 107 | 12 | 36 |
| 9B | | M | 71 | 73 | 102 | 17 | |
| 15A | | M | 80 | 75 | 94 | 25½ | |
| 13A | M | | 78 | 79 | 101 | 1 | 44 |
| 19A | M | | 89 | 66 | 72 | 1 | 42 |
| 43A | | M | 93 | 67 | 71 | 28½ | |
| 20A | | F | 76 | 92 | 118 | 14 | |
| 20B | F | | 71 | 86 | 118 | 14 | 40 |
| 21A | | F | 75 | 67 | 90 | 15 | |
| 12A | F | | 76 | 67 | 89 | 15 | 41 |
| 21B | | F | 75 | 71 | 95 | 10 | |
| 36B | F | | 79 | 78 | 99 | 18 | 39 |
| 23A | F | | 74 | 76 | 103 | 30 | 39 |
| 23B | | F | 71 | 72 | 101 | 4 | |
| 25A | M | | 75 | 92 | 120 | 8 | 39 |
| 14A | | M | 70 | 83 | 114 | 14 | |
| 28A | F | | 72 | 78 | 107 | 32 | 35 |
| 28B | | F | 73 | 78 | 106 | 2½ | |
| 29A | | M | 72 | 75 | 103 | 7 | |
| 29B | M | | 77 | 72 | 95 | 9½ | 35 |
| 30A | M | | 83 | 90 | 108 | 21½ | 41 |
| 30B | | M | 82 | 88 | 107 | 16½ | |
| 33A | | F | 80 | 82 | 102 | 11 | |

TABLE 15--Continued

| Code Number | Sex and Group | | C.A. in Months | M.A. in Months | I.Q.* | No. Days Absent from School | No. Days Present in Speech Class |
|---|---|---|---|---|---|---|---|
| | Exp. | Control | | | | | |
| 33B | F | | 75 | 73 | 98 | 6½ | 43 |
| 34B | M | | 76 | 86 | 112 | 21 | 42 |
| 35A | | M | 75 | 76 | 101 | 37½ | |
| 36A | F | | 74 | 73 | 99 | 7 | 43 |
| 27B | | F | 80 | 75 | 94 | 6 | |
| 37A | M | | 72 | 71 | 99 | 26½ | 36 |
| 1B | | M | 77 | 62 | 82 | 64 | |
| 28B | F | | 76 | 86 | 112 | 11 | 36 |
| 39A | | F | 79 | 94 | 117 | 23 | |
| 2A | F | | 78 | 92 | 116 | 9 | 46 |
| 44A | | F | 80 | 79 | 98 | 8½ | |
| 44B | F | | 82 | 82 | 102 | 7 | 41 |
| 51B | | M | 74 | 69 | 95 | 8 | |
| 1A | M | | 75 | 72 | 96 | 31 | 20 |
| 26B | | F | 81 | 70 | 87 | 7½ | |
| 57A | | M | 75 | 67 | 75 | 17 | |
| 5A | M | | 70 | 62 | 88 | 36 | 39 |
| 55A | M | | 81 | 61 | 71 | 3 | 47 |
| 6B | | M | 79 | 56 | 70 | 16½ | |
| 6A | | M | 87 | 84 | 95 | 18 | |
| 31B | M | | 73 | 76 | 104 | 12 | 40 |
| 40A | | M | 83 | 66 | 79 | 26½ | |
| 40B | M | | 78 | 62 | 79 | 15 | 40 |

*Pintner-Cunningham Primary Test: Form A

TABLE 16

TABULATION OF BEGINNING AND FINAL SCORES OF HEIGHT AGE, WEIGHT AGE, DENTAL AGE, CARPAL AGE, HAGGERTY-OLSON-WICKMAN BEHAVIOR RATING SCHEDULES, AND ACADEMIC PROGNOSIS

| Code Number | Sex and Group | | Height Age | | Weight Age | | Dental Age | | Carpal Age | | H-O-W* Sched. A | | H-O-W* Sched. B | | Readiness | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Exp. | Control | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Metropolitan | Teacher |
| 3A | | M | 75 | 85 | 71 | 78 | 78 | 83 | 51 | 56 | 14 | 42 | 58 | 67 | B | D |
| 3B | M | | 75 | 85 | 74 | 78 | 83 | 83 | 63 | 69 | 18 | 18 | 77 | 70 | D | C |
| 7A | | M | 72 | 71 | 71 | 78 | 66 | 78 | 75 | 81 | 12 | 26 | 75 | 64 | C | C |
| 7B | M | | 71 | 72 | 80 | 81 | 76 | 83 | 42 | 48 | 41 | 67 | 95 | 81 | E | E |
| 9A | M | | 91 | 95 | 89 | 107 | 83 | 83 | 67 | 72 | 28 | 0 | 69 | 68 | C | C |
| 9B | | M | 71 | 75 | 70 | 83 | 63 | 70 | 57 | 63 | 12 | 22 | 59 | 62 | D | B |
| 15A | | M | 114 | 120 | 103 | 118 | 78 | 83 | 99 | 108 | 20 | 14 | 95 | 63 | B | D |
| 13A | M | | 69 | 71 | 72 | 75 | 76 | 81 | 63 | 68 | 14 | 34 | 56 | 60 | B | B |
| 19A | M | | 85 | 93 | 97 | 104 | 92 | 101 | 91 | 96 | 18 | 58 | 58 | 76 | C | D |
| 43A | | M | 77 | 82 | 78 | 83 | 78 | 85 | 87 | 96 | 38 | 62 | 97 | 100 | D | C |
| 20A | | F | 78 | 95 | 80 | 83 | 69 | 77 | 84 | 90 | 14 | 14 | 51 | 63 | A | A |
| 20B | F | | 83 | 88 | 85 | 87 | 71 | 74 | 73 | 80 | 14 | 22 | 64 | 63 | A | C |
| 21A | | F | 78 | 80 | 71 | 79 | 77 | 80 | 78 | 84 | 20 | 71 | 81 | 98 | E | D |
| 12A | F | | 71 | 80 | 75 | 78 | 74 | 89 | 75 | 81 | 14 | 53 | 81 | 103 | E | D |
| 21B | | F | 83 | 84 | 81 | 85 | 73 | 77 | 75 | 81 | 14 | 8 | 61 | 76 | B | C |
| 36B | F | | 77 | 83 | 78 | 80 | 69 | 77 | 72 | 78 | 14 | 28 | 63 | 74 | E | C |
| 23A | F | | 77 | 83 | 76 | 78 | 80 | 89 | 78 | 84 | 12 | 28 | 66 | 65 | D | C |
| 23B | | F | 84 | 88 | 78 | 84 | 71 | 77 | 78 | 84 | 0 | 0 | 67 | 62 | B | C |
| 25A | M | | 88 | 102 | 100 | 101 | 73 | 85 | 72 | 81 | 12 | 20 | 48 | 55 | A | B |
| 14A | | M | 72 | 85 | 80 | 88 | 70 | 81 | 41 | 46 | 14 | 18 | 56 | 60 | C | C |
| 28A | F | | 78 | 88 | 78 | 81 | 73 | 86 | 63 | 72 | 12 | 14 | 51 | 54 | B | C |
| 28B | | F | 80 | 84 | 76 | 81 | 73 | 80 | 72 | 78 | 14 | 34 | 50 | 52 | C | D |

TABLE 16--Continued

| Code Number | Sex and Group | | Height Age | | Weight Age | | Dental Age | | Carpal Age | | H-O-W* Sched. A | | H-O-W* Sched. B | | Readiness | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Exp. | Control | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Metropolitan | Teacher |
| 29A | | M | 76 | 90 | 83 | 92 | 62 | 69 | 69 | 76 | 42 | 98 | 65 | 82 | C | C |
| 29B | M | | 74 | 85 | 75 | 78 | 83 | 83 | 42 | 48 | 54 | 132 | 80 | 95 | C | C |
| 30A | M | | 80 | 80 | 82 | 95 | 85 | 96 | 84 | 93 | 44 | 109 | 98 | 103 | C | C |
| 30B | | M | 104 | 117 | 117 | 124 | 96 | 101 | 84 | 93 | 12 | 18 | 90 | 72 | C | C |
| 33A | | F | 80 | 83 | 75 | 79 | 80 | 86 | 72 | 78 | 16 | 12 | 65 | 62 | C | C |
| 33B | F | | 81 | 91 | 92 | 87 | 92 | 97 | 72 | 78 | 14 | 14 | 65 | 51 | A | B |
| 34B | M | | 91 | 100 | 97 | 102 | 81 | 83 | 96 | 105 | 12 | 12 | 65 | 57 | B | B |
| 35A | | M | 69 | 75 | 75 | 74 | 76 | 88 | 72 | 78 | 12 | 24 | 80 | 62 | D | C |
| 36A | F | | 91 | 108 | 96 | 103 | 73 | 80 | 87 | 96 | 8 | 28 | 61 | 77 | C | C |
| 27B | | F | 99 | 107 | 96 | 109 | 77 | 89 | 87 | 96 | 24 | 42 | 59 | 59 | C | C |
| 37A | M | | 85 | 98 | 93 | 92 | 81 | 83 | 48 | 54 | 14 | 26 | 59 | 61 | C | C |
| 1B | | M | 71 | 75 | 77 | 78 | 73 | 83 | 63 | 69 | 33 | 61 | 95 | 106 | E | E |
| 38B | F | | 88 | 99 | 115 | 131 | 80 | 86 | 96 | 105 | 8 | 20 | 56 | 69 | C | B |
| 39A | | F | 76 | 81 | 81 | 84 | 80 | 92 | 63 | 73 | 12 | 36 | 56 | 61 | B | A |
| 2A | F | | 73 | 77 | 83 | 84 | 80 | 92 | 69 | 75 | 14 | 14 | 58 | 52 | B | A |
| 44A | | F | 84 | 97 | 84 | 84 | 80 | 86 | 69 | 75 | 12 | 0 | 57 | 60 | C | B |
| 44B | F | | 69 | 80 | 77 | 83 | 92 | 97 | 69 | 75 | 14 | 14 | 53 | 48 | A | B |
| 51B | | M | 71 | 80 | 75 | 79 | 73 | 83 | 63 | 69 | 8 | 4 | 91 | 88 | D | D |
| 1A | M | | 80 | 80 | 86 | 95 | 76 | 85 | 75 | 81 | 24 | 32 | 95 | 82 | E | D |
| 26B | | F | 71 | 80 | 75 | 84 | 103 | 103 | 66 | 75 | 12 | 16 | 57 | 62 | B | C |
| 57A | | M | 81 | 86 | 86 | 89 | 85 | 88 | 72 | 78 | 35 | 87 | 91 | 82 | E | D |
| 5A | M | | 69 | 72 | 66 | 76 | 66 | 78 | 63 | 69 | 29 | 67 | 97 | 95 | E | D |
| 55A | M | | 44 | 55 | 64 | 71 | 76 | 78 | 78 | 83 | 24 | 26 | 76 | 63 | C | E |
| 6B | | M | 71 | 75 | 74 | 78 | 92 | 96 | 84 | 90 | 28 | 33 | 87 | 102 | E | D |
| 6A | | M | 69 | 72 | 71 | 73 | 66 | 78 | 48 | 54 | 18 | 34 | 62 | 67 | C | C |

TABLE 16--Continued

| Code Number | Sex and Group | | Height Age | | Weight Age | | Dental Age | | Carpal Age | | H-O-W* Sched. A | | H-O-W* Sched. B | | Readiness | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Exp. | Control | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Initial | Final | Metropolitan | Teacher |
| 31B | M | | 81 | 95 | 82 | 92 | 83 | 85 | 62 | 70 | 24 | 34 | 63 | 55 | C | B |
| 40A | | M | 72 | 72 | 80 | 84 | 83 | 83 | 48 | 54 | 54 | 46 | 131 | 101 | E | D |
| 40B | M | | 75 | 137 | 87 | 75 | 78 | 81 | 63 | 72 | 26 | 38 | 60 | 63 | C | D |

*Haggerty-Olson-Wickman Behavior Rating Schedules

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