THE DEVELOPMENT OF AUDITORY DISCRIMINATION
IN THIRD-GRADE STUDENTS BY USE OF
TAPE-RECORDED MATERIALS

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DISSERTATION

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CHAPTER I

INTRODUCTION

Hearing is one of the most important senses through which we learn. Gates (15, p. 94) states that parents and teachers do not always recognize partial deafness in a student even when it is of marked degree. More often than not the student is considered to be lazy, indifferent, or inattentive. Emotional tensions are likely to occur in the student as a result of mistakes in his comments, or recitations, which were caused by misunderstandings or failures to hear what was presented. The unknown hearing loss presents a major obstacle to effective teaching.

There are two principal factors connected with the ability to hear: acuity and discrimination. Acuity is the intensity at which the stimulus is heard, whereas discrimination is a judgment or comparison among sounds (20). Acuity for pure tones is usually regarded as a good index by which to evaluate hearing capacity and is receiving an increasing amount of attention in today's schools. This is good, but auditory discrimination is also important and perhaps deserves more attention than it is being given (16, p. 121). Eisenson (12, p. 105) stresses the importance of discrimination as a part of language. He says that once a child begins to learn

a language, the functions of generalization and discrimination become so important that it is almost unnecessary to speak of them. No sound is ever reproduced exactly the same way, even by the same individual. It is even more true that no two individuals will reproduce a sound in the same manner. It is for this reason that the listener must generalize and react to a general phoneme. There are some forty-odd phonemes in the English language and if there were no discrimination, all of these forty-odd phonemes would sound the same. Recognition of the phonetic elements in utterances of a speaker at different times, or of different speakers, is a function of generalization whereas the recognition of different phonemes is a function of discrimination. It takes discrimination to make language possible and generalization to make it practical.

Discrimination has been neglected even though Munroe (20, p. 95) pointed out in 1932 that a lack of auditory discrimination of words may be a special defect in hearing just as color-blindness is a special defect in vision. A person may be color-blind and yet show acuity for forms. In a similar manner, a person may have a weakness in auditory discrimination and pass a hearing test for acuity. Newton (21, p. 21) concurs with this finding.

The teaching of phonics does not assure the development of auditory discrimination, according to Gates (10, p. 43). He found that numerous children came to reading clinics after many years

of phonics instruction and were surprised to find that words "have sounds in them." Newton (21, p. 21) says that "a child . . . is likely to profit little from phonic instruction until discrimination between the sounds of letters have been taught." Strang (26, p. 313) reports a corresponding view.

As early as 1921, Filds (14) stated that as a group, non-readers showed a lowering of auditory powers. Studies by Eames, Robinson, Bond, and Conkey tend to support the earlier Filds study (11, 23, 1, 5). Durrell (10, p. 42) sums up the situation by saying that visual and auditory discrimination of word elements are two background abilities known to be important to a beginning reader. The student must be able to notice the separate sounds in spoken words such as the "m-m-m sound in mother, most, magic, machine." If a student cannot perceive the separate sounds in a word as it is spoken, the spelling of a word makes no sense to him. He may develop a small sight vocabulary, but he has no system which will help him to avoid the confusion produced by new words or words that look alike. Heilman (17, p. 62), however, says that there seems to be a lack of experimental agreement as to what constitutes discrimination. The inclusion of such abilities as discrimination between the pitch of musical tones, discrimination between the intensities of sounds, and acuity in hearing different frequencies in the speech range, do not, in general, differentiate between good and poor readers.

Carrell, Hudson, Durrell, and Russell describe auditory discrimination as being closely related to spelling (4, 18, 9,

25). Gates (15, p. 293) maintains that the spelling lesson is the most natural opportunity for training in word study and word analysis.

From the foregoing material, it was surmised that by improving the auditory discrimination of the student, his reading and spelling skills would have a much better chance of improving. It was the general consensus of several authors (2, 3, 8, 10, 18, 21, 22, 27) that auditory discrimination could be developed and that it should be developed. However, there was no prescribed manner for developing it. In previous studies, a combination of auditory and visual materials has been presented to the student, resulting in an increase in spelling and reading achievement (8, 2, 18).

From the Hudson study (18), it was known that a program of a combination of auditory and visual materials would produce good results, but in a classroom situation, the contribution of the separate factors was not known. In a clinical situation, it has been, and still is, common practice for the speech or hearing therapist to present auditory material to children with hearing defects (6, 7, 13, 24). This clinical knowledge and help has been denied the many students who have unknown hearing defects. The purpose of this experimental program was to attempt to put into the classroom some of the knowledge and special training which was routine in clinical practice, and at the same time attempt to evaluate the value of auditory materials when presented alone.

Statement of the Problem and Hypotheses

This study was designed to determine whether or not auditory discrimination could be improved in a group of third-grade students by the use of a tape-recorded program of auditory exercises. Of additional interest was the effect that the program of auditory exercises would have upon the word recognition skills and the spelling skills of the third-grade students involved.

The problems investigated in this study are stated as follows:

1. Will there be a significant change in the auditory discrimination ability of the experimental group?

2. Will there be a significant change in the word recognition skills of the experimental group?

3. Will there be a significant change in the spelling skills of the experimental group?

4. Will the program have more effect on those students with initially good discrimination or those students with initially poor discrimination?

To evaluate the effectiveness of the experimental program, the following hypotheses were formulated:

1. There will be no significant difference in mean change between the experimental and the control groups as measured by a composite of the Rush Hughes Auditory Test, the electronically filtered Central Institute of the Deaf (C. I. D.) Auditory Test W-22, the Gray Oral Reading Paragraphs, and the Durrell

Spelling Test when the variables of intelligence quotient, chronological age, and sex are statistically controlled.

2. There will be no significant difference in mean change between the experimental and the control groups as measured by the Rush Hughes Auditory Test when the variables of intelligence quotient, chronological age, sex, the electronically filtered C. I. D. Auditory Test W-22, the Gray Oral Reading Paragraphs, and the Durrell Spelling Test are statistically controlled.

3. There will be no significant difference in mean change between the experimental and the control groups as measured by the electronically filtered C. I. D. Auditory Test W-22 when the variables of intelligence quotient, chronological age, sex, the Rush Hughes Auditory Test, the Gray Oral Reading Paragraphs, and the Durrell Spelling Test are statistically controlled.

4. There will be no significant difference in mean change between the experimental and the control groups as measured by the Gray Oral Reading Paragraphs when the variables of intelligence quotient, chronological age, sex, the Rush Hughes Auditory Test, the electronically filtered C. I. D. Auditory Test W-22, and the Durrell Spelling Test are statistically controlled.

5. There will be no significant difference in mean change between the experimental and the control groups as measured by the Durrell Spelling Test when the variables of intelligence quotient, chronological age, sex, the Rush Hughes Auditory Test, the electronically filtered C. I. D. Auditory Test W-22, and

the Gray Oral Reading Paragraphs are statistically controlled.

6. There will be no significant difference in mean change between the upper one-third and the lower one-third of the experimental group as measured by a composite of the Rush Hughes Auditory Test, the electronically filtered C. I. D. Auditory Test W-22, the Gray Oral Reading Paragraphs, and the Durrell Spelling Test when the variables of intelligence quotient, chronological age, and sex are statistically controlled.

7. There will be no significant difference in mean change between the upper one-third and the lower one-third of the experimental group as measured by the Rush Hughes Auditory Test when the variables of intelligence quotient, chronological age, sex, the electronically filtered C. I. D. Auditory Test W-22, the Gray Oral Reading Paragraphs, and the Durrell Spelling Test are statistically controlled.

8. There will be no significant difference in mean change between the upper one-third and the lower one-third of the experimental group as measured by the electronically filtered C. I. D. Auditory Test W-22 when the variables of intelligence quotient, chronological age, sex, the Rush Hughes Auditory Test, the Gray Oral Reading Paragraphs, and the Durrell Spelling Test are statistically controlled.

9. There will be no significant difference in mean change between the upper one-third and the lower one-third of the

experimental group as measured by the Gray Oral Reading Paragraphs when the variables of intelligence quotient, chronological age, sex, the Rush Hughes Auditory Test, the electronically filtered C. I. D. Auditory Test W-22, and the Durrell Spelling Test are statistically controlled.

10. There will be no significant difference in mean change between the upper one-third and the lower one-third of the experimental group as measured by the Durrell Spelling Test when the variables of intelligence quotient, chronological age, sex, the Rush Hughes Auditory Test, the electronically filtered C. I. D. Auditory Test W-22, and the Gray Oral Reading Paragraphs are statistically controlled.

Related Literature

In the opening section it was pointed out that auditory discrimination is important to the child in developing his reading and spelling skills as well as to his general classroom performance. Even though this has been known for many years, and has been restated by many authors, very little, if anything, has been done to improve the situation or to utilize what was known.

In an article written in 1949, Caffrey (3, p. 310) said that an exhaustive study has yet to be made to determine the relationship between reading and auding. Although there are approximately one hundred references to "listening" in educational literature, there are no coherent theories or reliable data upon which to build a corrective auding program.

Upon surveying the current literature, it was found that today, fifteen years later, this statement is still true. More studies involving "listening" have been added to the literature, but very few articles or experiments involving auditory discrimination can be found. It seems that audiologists do not want to get into the field of education, and that educators do not want to get into the area of audiology. Leading the current field in audiology are Hirsh, Goetzinger, and Wepman. Unfortunately, they have confined their activities and investigations to the area of measurement of auditory discrimination. Durrell seems to be the only educator who has been working to bridge the gap between the two areas. A survey of the literature revealed only four studies in which attempts were made to increase or improve auditory discrimination, and one of the studies was not a controlled study, but a report on an informal classroom experiment.

In a non-controlled study, Brandon (2, p. 28) reported that the utilization of a record player, with records emphasizing sounds, appeared to help the children improve their "listening habits." This article did not depict "listening" in the usual context but rather as an example of auditory discrimination.

In a study of auditory discrimination, spelling, and reading with bilingual and monolingual children in grades four and five, Love (19) reported that auditory discrimination was a skill that could be taught as an isolated process. He presented specially composed drill sheets involving discrimination

between similar and dissimilar groups of letters and words, which consisted of words or letters in groups of six. The child was to underline the word that was the same as a given word which was written to the side of the group. Also, the child was to select a word that began or ended like an orally presented word. The program lasted for seven weeks, consuming 300 minutes per week. This program actually combined visual and auditory discrimination under the one category of auditory discrimination, leaving unanswered the question "Can auditory discrimination be improved by using purely auditory exercises?"

Hudson and Tolar (18) conducted a study in the Tulsa Public Schools in which spelling achievement was chosen as the criterion for evaluating the effectiveness of an auditory and visual discrimination program. In this study, Tulsa Public Schools presented a program of auditory and visual discrimination, as outlined by Durrell and Sullivan (8), to 259 pupils in grades 4, 5, and 6 who were considered to be poor spellers as determined by an initial spelling test. The program was presented as special remedial work, and not as a part of the regular classroom experiences. The average gain in spelling after one semester of the program was 85.2 per cent over prior performance. The greatest gain was made by the fourth-grade students, who showed a 103.4 per cent improvement. No effort was made to evaluate the effect of the experiment upon auditory discrimination or word-recognition skills.

A study by Murphy was reported by Durrell (8, p. 3) as proving the merits of auditory and visual exercises, when used

separately or in combination. Five hundred forty students were divided into 4 groups of approximately 130 each, with the groups being equated on the basis of mental age, chronological age, ability in visual and auditory discrimination, and rate of learning new words. Group I had 30 lessons of 10 minutes per day in auditory discrimination. Group II had 30 lessons of 10 minutes per day in visual discrimination. Group III had a program of both auditory and visual discrimination which replaced a portion of the regularly scheduled reading session. Group IV did not receive any special material, but followed the regularly scheduled routine, acting as a control group. At each measuring period, the experimental groups showed superiority over the control group in reading achievement. The method of determining auditory discrimination was not mentioned in the Durrell report and no provision was made for the detection of growth in this area.

Although there can be no doubt as to the value of the four studies mentioned, each has its own limitations. This study was unique in that it

1. Provided for the use of auditory materials only.

2. Controlled the teacher variable and outside visual influences by utilizing a tape-recorded program.

3. Provided for the measurement of auditory discrimination both at the beginning and at the end of the experiment by approved clinical methods.

4. Measured the effect of an auditory program upon word recognition skills.

5. Measured the effect of an auditory program upon spelling skills.

Definition of Terms

Some common words or phrases are subject to a variety of interpretations. Terms used in a unique or specific manner, for the purposes of this study, are defined as follows:

1. Auditory discrimination: The capacity to distinguish between phonemes, or individual sounds, used in the production of speech.

2. Auding: A term used by Caffrey (3) to denote the ability to discriminate auditory sounds.

3. Speech reception threshold (SRT): The point at which a subject can repeat simple words or understand running speech. The loudness at which simple speech must be for the subject to understand it.

4. Acuity: The intensity at which a stimulus can be heard.

5. Word recognition skills: The ability to visually recognize words and voice them correctly.

6. Spelling skills: Those skills used by the student to write words correctly after having heard them.

7. PB word list of monosyllables: A list of fifty monosyllabic words scientifically chosen in order that it

will contain samples of speech sounds in the same proportion in which they occur in running speech.

8. The upper one-third of the experimental group: Those students in the experimental group who comprised the upper one-third of the sample as determined by a composite of their initial scores on the Rush Hughes Auditory Test and the electronically filtered C. I. D. Auditory Test W-22.

9. The lower one-third of the experimental group: Those students in the experimental group who comprised the lower one-third of the sample as determined by a composite of their initial scores on the Rush Hughes Auditory Test and the electronically filtered C. I. D. Auditory Test W-22.

Limitations of the Study

This study was limited to an investigation of eight sections of third-grade students enrolled in two elementary schools located in a large northeastern Oklahoma city. There were 233 students involved in this study; 4 sections containing 118 students consitituted the experimental group while 4 sections containing 115 students constituted the control group. This sample is shown in Table I.

The study was further limited by the following conditions:

1. No student with a known speech defect or with a hearing defect other than a difficulty in auditory discrimination was used in this study.

TABLE I

NUMBER OF TEACHERS AND STUDENTS IN THE STUDY

Teacher	Experimental		Control		Total
	Males	Females	Males	Females	
1	13	15	14	13	55
2	15	17	13	16	61
3	19	10	18	13	60
4	15	14	12	16	57
Total	62	56	57	58	233

2. No student who had been previously retained was used in this study.

3. There was no visual material presented as this study was concerned only with the auditory aspects of discrimination.

4. Only the effect of the experiment on word recognition skills were evaluated, not the effect on reading as a whole.

Basic Assumptions

To lend stability to this study, it was necessary to accept three basic assumptions. These are as follows:

1. Fifteen minutes was the maximum length of time that a tape-recorded program would hold the attention of third-grade students.

2. The instruments used to measure progress were valid for the purpose of this study.

3. The sex of the speaker on the tape-recording would not be a significant factor in the success or failure of the experiment.

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CHAPTER II

PROCEDURES, EVALUATION INSTRUMENTS, AND THE EXPERIMENTAL PROGRAM

Description of the Sample

The subjects in this experiment consisted of eight sections of third-grade students from two elementary schools located in a large northeastern Oklahoma city. This comprised a total sample of 233 students, of which 119 were male and 114 were female. In this school district, a semi-departmental system was in operation allowing each teacher to have two homeroom sections which she met for one half-day, each day of the school week. Within this time allotment, the teacher was responsible for the instruction of arithmetic, reading, language arts, and social studies. The student spent the remaining half-day in classes of music, art, science, and physical education.

The two schools used in this study were selected by the research department of the system, using the following criteria as a guide.

1. Each school should have two third-grade teachers who taught two sections of third-grade students.

2. The schools involved should be schools that used heterogeneous grouping only.

3. Both schools should be from the same general socio-economic level.

4. The teachers and principals involved should express a willingness to participate in the study.

5. Space should be available for testing.

The schools selected fully met the criteria stipulated. They were then given the code names of school A and school B, with their respective teachers arbitrarily coded as teacher one and teacher two.

A further arbitrary assignment was made in both school A and school B, in that the morning class of teacher one and the afternoon class of teacher two were designated as the experimental groups, leaving the afternoon class of teacher one and the morning class of teacher two to function as the control groups. This designation was made so that both the experimental and the control group would contain two morning sections and two afternoon sections in an effort to eliminate any differences due to time of day influences.

Class size and the sex ratio were determined at the beginning of the school year by the administration and were found to be relatively well equated in the two schools.

Routine screening for speech and hearing defects is practiced in this school system. The results of the screening program were used to locate students with speech or hearing problems that had been discovered. As no student with a known speech defect or a hearing defect other than a difficulty

with auditory discrimination was to be used in this study, two students were eliminated from the original number of 262 students. An additional three students were eliminated as having been retainees. At the end of the experiment, eleven students had moved away and seven students had moved in, giving incomplete data on eighteen students. Intelligence scores were unavailable for an additional 6 students, leaving a total of 233 out of an original sample of 262 students. A sample of this size was considered to be sufficient for the purposes of this study. Therefore, it was from this sample of 233 students that the data for this experimental study was drawn.

The 233 students involved in this study were tested at the beginning and at the end of the experiment by use of the following four instruments:

1. The Rush Hughes Auditory Test
2. The electronically filtered C. I. D. Auditory Test W-22
3. The Gray Oral Reading Paragraphs
4. The Durrell Spelling Test

The data collected from these four instruments were compiled and statistically treated to form the basis of this dissertation.

Auditory Discrimination Tests

Audiologists and researchers commonly measure auditory discrimination by the use of a phonetically-balanced (PB) list of monosyllabic words (3, 13, 14). To eliminate

variations in test results caused by different speakers, some of these lists have been recorded. The most widely used of these recordings are the Rush Hughes Auditory Test and the C. I. D. Auditory Test W-22 (12, p. 349). The W-22 test is described by Corsco (5, p. 366) as consisting of four lists of fifty monosyllabic words. These lists are, in part, the word lists of Harvard University's Psycho-Acoustic Laboratories and have been phonetically balanced to contain speech sounds in the same relative frequency of occurence as found in running speech. These four lists were prepared in six different word orders, giving twenty-four possible tests, all of which are on phonograph records. The phrase "This is C.I.D. Auditory Test W-22, List 2-E . . . Are you ready?" introduces each test, with the carrier phrase "You will say" preceding each word. The inner band of each record is impressed with a 1000-cycle calibration tone.

The Rush Hughes Auditory Test is basically the same as the W-22 test, using the PB-50 Word List of Monosyllables developed by Egan (11), and using a different speaker. The speaker, Rush Hughes, ". . . clips his words so badly that some sounds are entirely missing (8, p. 189)." In addition, there is some distortion in the recordings as well as a speedier method of presenting the words. "Consequently in clinical practice, discrimination scores obtained with the Rush Hughes records are about 20 per cent poorer than those

obtained from the W-22 records (14, p. 125)." In a study by Goetzinger and others (13, p. 134) the W-22 test and the Rush Hughes test were administered to a control group of thirty normal reading male subjects and to an experimental group of fifteen poor reading male subjects. The groups were matched by intelligence quotient and chronological age. The findings were reported as follows:

1. The W-22 test did not significantly differentiate the groups.

2. The good readers were significantly superior to the poor readers on the Rush Hughes test at the .01 level of confidence.

3. Correlation between the Rush Hughes test and the W-22 test was a positive .58 which was significant at the .01 level of confidence.

4. Correlation between the Rush Hughes test and reading was a positive .589 which was significant at the .01 level of confidence.

5. Correlation between the W-22 test and reading was a positive .079 which was not significant at the .05 level of confidence.

From the preceding descriptions and discussion, the Rush Hughes test appeared to give a more discriminating score than did the W-22 test. Davis and Silverman (7, p. 121) agreed with this observation. From the description given of the Rush Hughes test, it was surmised that the value lies in

the fact that the Rush Hughes test was not technically perfect as was the W-22 test, and that purposely introduced distortion increased the sensitivity of the test. Audiologists have assumed this to be true, and by using modern electronics, have obtained excellent results (3, 12, 15, 17). The common practice is to use an electronic filter to remove certain pre-determined frequency ranges, usually those in the upper end of the scale. Hirsh and others (15) found that methods of measuring the intelligibility of speech have improved since they were first reported in 1929, and one of the most noted improvements is that of the use of distorted speech obtained by electronic filtering.

Information from the foregoing studies (3, 12, 15, 17), as well as verbal statements made by practicing audiologists (4, 11, 21), indicated that a filtered version of the W-22 test would be more sensitive than would the Rush Hughes test in the determination of progress in auditory discrimination. As the electronically filtered W-22 test has not been standardized, the Rush Hughes test was used as a supplement.

The electronically filtered W-22 test used in this study was the same test used by Conkey (3). It is described as being the C. I. D. Auditory Test W-22 (List 2A) purposely distorted by electronic filters to eliminate all frequencies above 1500 cycles per second (cps), with the signal from the filters being recorded on Scotch magnetic recording tape using an Ampex 601 tape deck.

Conkey describes the production of the electronically filtered tape as follows:

> . . . the word lists were played at 33-1/3 rpm (revolutions per minute) on a Grayson-Stadler (GS-162) Speech Audiometer with phonograph and microphone input. The microphone input was used to indicate which list of words (A through F) would be presented. Each word list stimulus was presented through a United Transformer Company (LS-33) transformer to match the impedance (z) of the output of the Grayson-Stadler (GS-162) Speech Audiometer, which is 10 ohms, with the input of the Spencer Kennedy Laboratories (SKL-302) filters, which is 5000 ohms. From here the stimulus was introduced into Spencer Kennedy Laboratories (SKL-302) variable filters. Four filters were used in cascade fashion to give the maximum decibel per octave slope. Each filter has an 18 db (decibel) per octave slope; thus a filter capability of 72 db per octave was used. Specific filter cutoffs of none, 1500 cps, and 1000 cps were selected . . . . (3, p. 20-21, reprinted by permission of the author)

The test with the specific filter cutoff of 1500 cps was the test used in this study.

The Rush Hughes Test and the electronically filtered W-22 test were administered after the following preliminary steps were taken. First, these directions were read to each student: "You are going to hear some words. After each word you will repeat it so that I can hear it. If you cannot understand the word completely, you are to guess and repeat what you think was said." For each child the tests were reproduced by a Wollensak 524 tape recorder and presented into a Grayson-Stadler HD 30 headphone through a custom-designed attenuator switch containing two attenuators, one of which was calibrated in single decibel steps, the

other calibrated in ten-decibel steps. The tester then determined the speech reception threshold (SRT) of the student, using standard audiological procedures (20, p. 110-114). Upon determination of the SRT, the attenuator was then used to increase intensity forty decibels above the SRT in accordance with principles set forth by Newby (20, p. 115). After the completion of these preliminaries, the Rush Hughes test and the electronically filtered W-22 test were administered. No changes were made in the testing equipment during the administration of the two tests. The tester recorded the errors made by the student on each test. Upon completion of each test, the number of correct responses made was considered to be the student's score on that test. This score was then used in the tabulation and treatment of the data.

Word Recognition Test

The Gray Oral Reading Paragraphs are described by the test manual (14, p. 3) as consisting of thirteen passages of increasing difficulty. The tests are available in Forms A, B, C, and D, all of which are similar in organization, length, and difficulty. "The first three passages are appropriate for Grades I, and the next five are appropriate for Grades II-VI while the last five are roughly equated to alternate grades." Tentative norms for grade equivalent scores are based on more than 500 students of elementary and secondary public schools from selected school districts in Florida and Illinois. Form A was used in this experiment.

This test was not reported in the Fourth Mental Measurements Yearbook (1), but Miles (19, p. 58) concluded that the Gray Oral Reading Paragraphs was the one variable among five that would best discriminate between those students needing clinical help in reading and those not needing help.

The Gray Oral Reading Paragraphs were administered by asking the student to read orally the series of paragraphs of increasing difficulty until seven or more errors were made in two consecutive paragraphs. The number of errors committed by the student in each passage was recorded along with the time in seconds required to read the passage. These data were then converted to passage scores by use of the appropriate table in the test manual (14). A total passage score was then determined. This passage score was then used as the score for word recognition skills in the tabulation and treatment of the data. No check for comprehension was made.

Spelling Test

The Durrell Spelling Test is administered by presenting orally a list of twenty words to the student and having him write the words on a sheet of paper. It is then scored on the basis of the number of correct responses. It may be administered as an individual or as a group test. Durrell (9) describes his test as consisting of two lists of twenty words. The easier list is for grades two and three, and the harder list is for grades four and above. The tests were standardized using 600 pupils per grade level with normality of

the classroom being determined by intelligence tests and other spelling tests. The norm for grade three on the easier list is twelve to fifteen words correct and on the harder list, six to eight words correct. The easier list was employed in this study.

Each student was tested individually on all tests except the Durrell Spelling Test, which was administered as a group test in each classroom. To eliminate variations in the spelling test, the word list was recorded on Scotch 175 magnetic recording tape, using a Wollensak T-1500 recorder. This gave a uniform pronunciation and time allowance to all students involved.

Answer sheets were distributed to each class. Upon this sheet the student was to write his name. The tape recording of the spelling list was then presented to the class through a Wollensak T-1500 recorder. The students were asked to write the words as they were presented. Fifteen seconds were allowed between the presentation of each word for response. Observation proved this to be ample time for the student to respond, providing he could spell the word. Answer sheets were then collected and scored. The score to be utilized in the statistical analysis was the number of words spelled correctly.

Intelligence Test

All students in this school system are tested in the third grade by the research department of the system, using the Kuhlmann-Anderson Intelligence Test. Johnson (18, p. 12-13)

describes the Kuhlmann-Anderson test as consisting of ten subtests designed to measure general mental ability. Each subtest score can be converted to a "mental age." The intelligence quotient is derived by dividing the median of these ten "mental ages" by the chronological age. Norms for intelligence quotients for the Kuhlmann-Anderson tests are based on more than 30,000 school children, including a survey of all school age children in one Minnesota county. Periodic checks on the norms have added more than 15,000 children from representative communities of Minnesota, New York, New Jersey, and Pennsylvania. The reliability coefficient is .91 for the Kuhlmann-Anderson test when used with third-grade children.

As the Kuhlmann-Anderson test is considered to be reasonably reliable and valid by reviewers in The Mental Measurements Yearbook (1, p. 404-406), intelligence quotients obtained from this instrument were considered to be adequate for the purpose in which they were utilized in this study. These scores were obtained from school records as were chronological age and sex.

Testing Facilities

In each school the principal provided a vacant room for testing purposes. The ambient noise level was measured prior to testing each student with a General Radio Sound Level Meter, Type 1551-2. Testing was discontinued if the ambient noise level surpassed fifty decibels (db) as measured on the C, or Flat, scale.

Construction of the Experimental Program

The experimental program consisted of forty tape-recorded exercises adapted from the program set forth by Durrell and Sullivan (8) and used by Hudson (16), with one major exception. No visual material was presented in conjunction with this experiment. In developing the experimental program, it was decided that each exercise should be of approximately fifteen minutes duration, provide adequate opportunity for student participation, and utilize a speaker with a cultural background similar to that of the students involved in the study.

Utilizing the aforementioned decisions as a guide, an initial script for each exercise was prepared. The Durrell program (8) was followed as closely as possible. Modifications were made only when necessary to provide good continuity. These scripts were then subjected to a critique by three audiologists (4, 11, 21) and a teacher of the deaf (6). Minor changes were made and the scripts were considered ready for recording. Sample scripts can be found in Appendix A.

The tape-recordings were produced on a Magnecorder PT 63-AH tape deck utilizing a Stromberg-Carlson MC 41 microphone and recording on Scotch 175 heavy-duty, all-purpose magnetic recording tape at 3-3/4 inches per second (ips). All recording was done in the acoustically-treated audiology room of the Mabee Speech and Hearing Clinic of The University of Tulsa. The ambient noise level never exceeded 35 db throughout

the recording sessions as measured on the C, or Flat, scale of a General Radio Sound Level Meter, Type 1551-2. The speaker for the tape-recordings was a male native of this city with a trained and pleasant voice, recommended by the Speech Department of The University of Tulsa. These master recordings were subjected to the scrutiny of the aforementioned personnel, with appropriate corrections being made.

Four sets of the program were made for distribution from this master copy of the experimental program. The master copy was not used for actual classroom presentation. Transcription was accomplished by joining a Wollensak T-1500 recorder, which transmitted the signal, to a Magnecorder PT 63-AH tape deck, which received the signal and recorded the secondary tape, by a jumper connection between the speaker output jack and the microphone input jack of the respective machines. For convenience, eight exercises were recorded on each reel of magnetic tape.

Presentation of the Experimental Program

Upon completion of preliminary testing, a complete set of recordings for the experimental program was delivered to each of the four teachers involved. A written copy of the scripts was also given to the teacher at this time. In addition, the following instructions were given:

1. You will begin the program on ___(the appropriate date filled in)____. Your _____section will be the experimental section.

2. There will be a fifteen minute segment of the tape-recorded program scheduled each school day for eight full weeks. This is a total of forty segments or approximately ten hours of material to be presented.

3. At some time during the homeroom session of the experimental section, you will play the segment of the program scheduled for that day.

4. You will need only to introduce the program with a simple statement to the effect that the students are now to listen to the tape-recording.

5. The program will be terminated by a simple statement to the effect that this is all of the tape-recording for the day and that the class is now ready to move into the next regularly scheduled activity.

6. The material need not be discussed with the students any more than is necessary.

7. Both of your sections will receive their normal program of instruction, the only difference being the inclusion of the tape-recorded program in the daily routine of the experimental section.

8. In the event of any difficulty, either of a technical or non-technical nature, notify the experimenter immediately so that corrective action may be taken.

The recordings were then presented to the experimental sections in accordance with the above instructions. Presentation was made in the classroom through a Wollensak 524 recorder.

Immediately after completion of the last segment of the experimental program, all students were re-tested by the same person with the same equipment used in the pre-test situation.

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CHAPTER III

STATISTICAL SIGNIFICANCE OF THE DATA

Analysis of the Data

The analysis of the data in this study was accomplished by use of the analysis of covariance technique with single classification. All computations for the analysis of covariance were performed by an IBM 1620 computer at North Texas State University. Upon completion of the analysis of covariance, it was necessary to compute corrected means for any significant F. These computations were made on a Marchant calculator. The aforementioned treatment of the data is presented in this chapter.

The Upper and Lower Experimental Groups

The establishment of the upper and lower segments of the experimental group was required before statistical analysis could be undertaken. Placement of subjects in the upper one-third and lower one-third of the experimental group was determined by a composite of the pretest scores on the Rush Hughes Auditory Test and the electronically filtered C. I. D. Auditory Test W-22. Normalization was accomplished by transforming the pretest scores into z scores in order to combine them.

A composite score of 0.9878 was found to be the lower limit of the upper one-third of the experimental group; therefore all students with a composite score of 0.9878 or above were considered to be in the upper experimental group. A composite score of -0.8691 was found to be the upper limit of the lower one-third of the experimental group; therefore all students with a composite score of -0.8691 or less were considered to be in the lower experimental group.

Age, Sex, and Intelligence Quotient

The data for age, sex, and intelligence quotient (I.Q.) were obtained from school records. The age in months for each student was determined by considering the student's birthday to be on the first of the month nearest his actual birthdate. This birthdate was then subtracted from the arbitrary date of January 1, 1957. This procedure, in effect, removed a constant of ninety-four months from each student's true age in months.

It was necessary to arbitrarily assign a numerical value to each sex for computational purposes. The numerical value of zero was assigned to all male students and the numerical value of one was assigned to all female students. These numbers were selected for their ease in computation. Using this arrangement, a mean of 0.50 would indicate an even number of male and female students in the sample. A mean of less than 0.50 indicates a predominance of male students whereas a mean greater than 0.50 indicates a predominance of female students in the sample.

The Kuhlmann-Anderson Intelligence Test was administered to all students during the first two weeks of the experimental program by the research department of the school system. Intelligence quotients used in this study were obtained from the results of this testing program.

Age, sex, and intelligence quotients are used as statistical controls in this study. The means for age, sex, and intelligence quotient for the experimental and control groups and for the upper and lower one-third of the experimental group are presented in Table II. In reading the table, comparisons should be made between the experimental and the control group and between the upper and lower experimental group.

TABLE II

MEANS FOR THE AGE, SEX, AND INTELLIGENCE QUOTIENT OF THE EXPERIMENTAL, CONTROL, UPPER EXPERIMENTAL AND LOWER EXPERIMENTAL GROUPS

Variable	Experimental	Control	Upper Experimental	Lower Experimental
Age	8.3305	8.2086	9.1794	7.5128
Sex	0.4661	0.5043	0.3589	0.5641
Intelligence Quotient	103.7372	104.9304	105.0512	103.5641

An evaluation of the means in Table II indicates that the experimental and the control group are relatively homogeneous. The upper and lower experimental groups appeared to contain

variances in all three areas. The upper experimental group was older than the lower group, there was a predominance of male students in the upper group, the lower group contained a slight predominance of female students, and the intelligence quotient of the upper group was greater than that of the lower group. A test of significance was not made as the covariance technique controlled any differences that existed.

Test Gains

Four tests, the Rush Hughes Auditory Test, the electronically filtered C. I. D. Auditory Test W-22, the Gray Oral Reading Paragraphs, and the Durrell Spelling Test, yielded results based upon pretest and post-test scores. The pretest was administered during the two weeks preceding the experiment and the post-test was administered during the two weeks immediately following the end of the experiment. There was a span of ten weeks between the pretest and the post-test. In Table III, the means of these data are presented as are the mean gains obtained from these data.

The mean gains in Table III were not statistically treated as such, but are provided for visual comparison of each group's performance on the various tests.

Visual inspection reveals that on the Rush Hughes test and the filtered W-22 test, the experimental group had the lower pretest score and the higher post-test score, with the mean gain for the experimental group, in both instances,

TABLE III

MEAN SCORES OF THE PRETEST, POST-TEST, AND GAIN FOR THE FOUR TESTS

Area	Test	Group	Mean Score		Mean Gain
			Pretest	Post-Test	
Experimental vs. Control	Rush Hughes	Exp.	31.2033	35.6271	4.6949
		Cont.	32.0782	33.2434	1.1826
	Filtered W-22	Exp.	23.7288	29.6610	5.8474
		Cont.	26.1913	27.9478	1.6695
	Gray Oral	Exp.	33.0847	34.8389	1.8050
		Cont.	35.1391	36.2521	1.0869
	Durrell Spelling	Exp.	10.8983	13.5762	2.7881
		Cont.	11.2086	13.6173	2.4086
Upper vs. Lower Experimental	Rush Hughes	Upper	35.2051	37.0256	2.0769
		Lower	26.7435	33.3846	6.6410
	Filtered W-22	Upper	29.1794	32.0512	2.8717
		Lower	18.1538	27.4615	9.3076
	Gray Oral	Upper	37.3840	39.0256	1.6410
		Lower	29.9487	31.8205	1.8717
	Durrell Spelling	Upper	11.8974	14.2051	2.5641
		Lower	10.8205	13.0769	2.3333

being almost four times as great as that of the control group. On the Gray Oral test and Durrell Spelling test, the control group had the higher pretest and post-test score, but the experimental group made the greater gain between the pretest and the post-test. In all four test situations, the experimental group had the lower pretest score, and on all four tests, the experimental group made the greater gain.

When comparing the upper and lower one-third of the experimental group, it can be discerned that the upper group had the higher pretest and post-test scores on the Rush Hughes test and the filtered W-22 test, but on both tests, the lower group made almost three times as much gain as did the upper group. The upper group also had the higher pretest and post-test scores on the Gray Oral test, but the lower group showed only a small predominance in mean gain. On the Durrell Spelling test, the upper group had the higher pretest and post-test scores, but unlike the results of the other three tests, the upper group showed the greater mean gain. On all four tests, the upper group had the higher pretest and post-test scores but only on the Durrell Spelling test did the upper group gain more than the lower group.

Composite Scores

To determine a composite gain for each student on the four tests, it was necessary to normalize the data so that each test would have equal weight. This was accomplished by using the pretest scores of the total population as a basis for converting all gain scores to z scores. The means of the composite for the experimental and the control groups and for the upper and lower experimental groups are shown in Table IV.

As in Table III, the means for the composite, as shown in Table IV, were not statistically treated, but are provided for visual comparison.

TABLE IV

MEANS OF THE COMPOSITE FOR THE EXPERIMENTAL AND THE CONTROL GROUPS AND FOR THE UPPER AND LOWER EXPERIMENTAL GROUPS

Criterion	Mean Gain			
	Experimental	Control	Upper Experimental	Lower Experimental
Composite	3.1595	1.2717	1.8302	4.2509

Comparison of the experimental and control groups means on the composite indicate that the experimental group surpassed the control group. A similar comparison indicated that the lower experimental group made greater gains than did the upper experimental group.

Testing of the Hypotheses

The hypotheses of this study were tested by completing the analysis of covariance, which yielded the sums of squares for the residuals in the total and within subgroups. The mean squares were obtained by dividing the sum of squares by the degrees of freedom. The F for the analysis of covariance was found by dividing the mean square for the difference by the mean square for the within subgroup. This procedure was used in Tables V through XIV, as the testing of all ten hypotheses was accomplished in the same manner:

one variable was used as the criterion variable with the other variables used as control variables.

Hypothesis one, there will be no significant difference in mean change between the experimental and the control groups as measured by the composite when the several variables are statistically controlled, was tested using the composite as the criterion (y) variable. Age (x_1), sex (x_2), and intelligence quotient (x_3) were the control variables. The sums of squares, mean squares, and the degrees of freedom for hypothesis one are presented in Table V.

TABLE V

THE SUM OF SQUARES, MEAN SQUARES, AND DEGREES OF FREEDOM FOR HYPOTHESIS ONE

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Squares
Total	229	872.3640	
Within Subgroups	228	664.7125	2.9154
Difference	1	207.6515	207.6515

$$F^{*}_{1,228} = \frac{207.6515}{2.9154} = 71.2257$$

With 1 and 228 degrees of freedom, $F_{(.01)} = 6.76$. The F obtained exceeds the $F_{(.05)}$ value. Therefore the hypothesis was rejected.

*James Wert, Charles Neidt and Stanley Ahmann, Statistical Methods in Educational and Psychological Research (New York, 1954), p. 347.

Hypothesis two, there will be no significant difference in mean change between the experimental and the control groups as measured by the Rush Hughes Auditory Test when the several variables are statistically controlled, was tested using the Rush Hughes test as the criterion (y) variable. Age (x_1), sex (x_2), I.Q. (x_3), the W-22 test (x_4), the Gray Oral (x_5), and the Durrell test (x_6) were the control variables. The sums of squares, mean squares, and the degrees of freedom for hypothesis two are presented in Table VI.

TABLE VI

THE SUMS OF SQUARES, MEAN SQUARES, AND DEGREES OF FREEDOM FOR HYPOTHESIS TWO

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Squares
Total	226	2778.0323	
Within Subgroups	225	2449.9341	10.8886
Difference	1	328.0982	328.0982

$$F_{1,225} = \frac{328.0982}{10.8886} = 30.1323$$

With 1 and 225 degrees of freedom, $F_{(.01)} = 6.76$. The F obtained exceeded the $F_{(.05)}$ value. Therefore, the hypothesis was rejected.

Hypothesis three, there will be no significant difference in mean change between the experimental and the control groups as measured by the electronically filtered C.I.D. Auditory Test

W-22 when the several variables are statistically controlled, was tested using the filtered W-22 test as the criterion (y) variable. Age (x_1), sex (x_2), I.Q. (x_3), the Rush Hughes test (x_4), the Gray Oral (x_5), and the Durrell test (x_6) were the control variables. The sums of squares, mean squares, and the degrees of freedom for hypothesis three are presented in Table VII.

TABLE VII

THE SUMS OF SQUARES, MEAN SQUARES, AND DEGREES OF FREEDOM FOR HYPOTHESIS THREE

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Squares
Total	226	3970.0776	
Within Subgroups	225	3708.8359	16.4837
Difference	1	261.2417	261.2417

$$F_{1,225} = \frac{261.2417}{16.4837} = 15.8485$$

With 1 and 225 degrees of freedom, $F_{(.01)} = 6.76$. The F obtained exceeded the $F_{(.05)}$ value. Therefore, the hypothesis was rejected.

Hypothesis four, there will be no significant difference in mean change between the experimental and the control groups as measured by the Gray Oral Reading Paragraphs when the several variables are statistically controlled, was tested using the Gray Oral test as the criterion (y) variable. Age (x_1),

sex (x_2), I.Q. (x_3), the Rush Hughes test (x_4), the W-22 test (x_5), and the Durrell test (x_6) were the control variables. The sums of squares, mean squares, and the degrees of freedom for hypothesis four are presented in Table VIII.

TABLE VIII

THE SUMS OF SQUARES, MEAN SQUARES, AND DEGREES OF FREEDOM FOR HYPOTHESIS FOUR

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Squares
Total	226	1209.3653	
Within Subgroups	225	1112.1544	4.9429
Difference	1	97.2109	97.2109

$$F_{1,225} = \frac{97.2109}{4.9429} = 19.6668$$

With 1 and 225 degrees of freedom, $F_{(.01)} = 6.76$. The F obtained exceeded the $F_{(.05)}$ value. Therefore, the hypothesis was rejected.

Hypothesis five, there will be no significant difference in mean change between the experimental and the control groups as measured by the Durrell Spelling Test when the several variables are statistically controlled, was tested using the Durrell test as the criterion (y) variable. Age (x_1), sex (x_2), I.Q. (x_3), the Rush Hughes test (x_4), the W-22 test (x_5), and the Gray Oral (x_6) were the control variables. The sum of

squares, mean squares, and the degrees of freedom for hypothesis five are presented in Table IX.

TABLE IX

THE SUMS OF SQUARES, MEAN SQUARES, AND DEGREES OF FREEDOM FOR HYPOTHESIS FIVE

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Squares
Total	226	919.9023	
Within Subgroups	225	906.3958	4.0284
Difference	1	13.5065	13.5065

$$F_{1,225} = \frac{13.5065}{4.0284} = 3.3528$$

With 1 and 225 degrees of freedom, $F_{(.05)} = 3.89$. As the F value obtained did not exceed this level, the hypothesis was accepted. However, it is noted that with 1 and 225 degrees of freedom, $F_{(.075)} = 3.30$.

Hypothesis six, there will be no significant difference in mean change between the upper one-third and the lower one-third of the experimental group as measured by the composite when the several variables are statistically controlled, was tested using the composite as the criterion (y) variable. Age (x_1), sex (x_2), and I.Q. (x_3) were the control variables The sum of squares, mean squares, and the degrees of freedom for hypothesis six are presented in Table X.

TABLE X

THE SUMS OF SQUARES, MEAN SQUARES, AND DEGREES OF FREEDOM FOR HYPOTHESIS SIX

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Squares
Total	74	296.8685	
Within Subgroups	73	203.8659	2.7827
Difference	1	93.0026	93.0026

$$F_{1,73} = \frac{93.0026}{2.7927} = 33.3020$$

With 1 and 73 degrees of freedom, $F_{(.01)} = 7.01$. The F obtained exceeded the $F_{(.05)}$ value. Therefore, the hypothesis was rejected.

Hypothesis seven, there will be no significant difference in mean change between the upper one-third and the lower one-third of the experimental group as measured by the Rush Hughes Auditory Test when the several variables are statistically controlled, was tested using the Rush Hughes test as the criterion (y) variable. Age (x_1), sex (x_2), I.Q. (x_3), the W-22 test (x_4), the Gray Oral (x_5), and the Durrell test (x_6) were the control variables. The sum of squares, mean squares, and the degrees of freedom for hypothesis seven are presented in Table XI.

With 1 and 70 degrees of freedom, $F_{(.05)} = 3.98$. The F obtained exceeded the $F_{(.05)}$ value. Therefore the hypothesis was rejected.

TABLE XI

THE SUMS OF SQUARES, MEAN SQUARES, AND DEGREES OF FREEDOM FOR HYPOTHESIS SEVEN

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Squares
Total	71	896.2285	
Within Subgroups	70	846.9985	12.1000
Difference	1	49.2300	49.2300

$$F_{1,70} = \frac{49.2300}{12.1000} = 4.0686$$

Hypothesis eight, there will be no significant difference in mean change between the upper one-third and the lower one-third of the experimental group as measured by the electronically filtered C.I.D. Auditory Test W-22 when the several variables are statistically controlled, was tested using the filtered W-22 test as the criterion (y) variable. Age (x_1), sex (x_2), I.Q. (x_3), the Rush Hughes test (x_4), the Gray Oral (x_5), and the Durrell test (x_6) were the control variables. The sum of squares, mean squares, and the degrees of freedom for hypothesis eight are presented in Table XII.

TABLE XII

THE SUMS OF SQUARES, MEAN SQUARES, AND DEGREES OF FREEDOM FOR HYPOTHESIS EIGHT

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Squares
Total	71	1567.2017	
Within Subgroups	70	1507.2146	21.5316
Difference	1	59.9871	59.9871

$$F_{1,70} = \frac{59.9871}{21.5316} = 2.7860$$

With 1 and 70 degrees of freedom, $F_{(.05)} = 3.98$. As the F obtained did not exceed this value, the hypothesis was accepted.

Hypothesis nine, there will be no significant difference in mean change between the upper one-third and the lower one-third of the experimental group as measured by the Gray Oral Reading Paragraphs when the several variables are statistically controlled, was tested using the Gray Oral test as the criterion (y) variable. Age (x_1), sex (x_2), I.Q. (x_3), the Rush Hughes test (x_4), the W-22 test (x_5), and the Durrell test (x_6) were the control variables. The sum of squares, mean squares, and the degrees of freedom for hypothesis nine are presented in Table XIII.

TABLE XIII

THE SUMS OF SQUARES, MEAN SQUARES, AND DEGREES OF FREEDOM FOR HYPOTHESIS NINE

Sources of Variation	Degrees of Freedom	Sums of Squares	Mean Squares
Total	71	421.4039	
Within Subgroups	70	421.3981	6.0200
Difference	1	0.0058	0.0058

$$F_{1,70} = \frac{0.0058}{6.0200} = 0.000963$$

With 1 and 70 degrees of freedom, $F_{(.05)} = 3.98$. As the F obtained did not exceed this value, the hypothesis was accepted.

Hypothesis ten, there will be no significant difference in mean change between the upper one-third and the lower one-third of the experimental group as measured by the Durrell Spelling Test when the several variables are statistically controlled, was tested using the Durrell test as the criterion (y) variable. Age (x_1), sex (x_2), I.Q. (x_3), the Rush Hughes test (x_4), the W-22 test (x_5), and the Gray Oral test (x_6) were the control variables. The sum of squares, mean squares, and the degrees of freedom for hypothesis ten are presented in Table XIV.

TABLE XIV

THE SUMS OF SQUARES, MEAN SQUARES, AND DEGREES OF FREEDOM FOR HYPOTHESIS TEN

Sources of Variation	Degrees of Freedom	Sums of Squares	Mean Squares
Total	71	277.1433	
Within Subgroups	70	274.3437	3.9192
Difference	1	2.7996	2.7996

$$F_{1,70} = \frac{2.7996}{3.9192} = 0.7143$$

With 1 and 70 degrees of freedom, $F_{(.05)} = 3.98$. As the F obtained did not exceed this value, the hypothesis was accepted.

A summary of the results of the analysis of covariance for the ten hypothesis is presented in Table XV.

TABLE XV

A SUMMARY OF THE TEN HYPOTHESES

Hyp.	Group	Criterion	F	Disposition
1	Exp-Cont	Composite	71.2257	Rejected
2	Exp-Cont	Rush Hughes	30.1323	Rejected
3	Exp-Cont	Filtered W-22	15.8485	Rejected
4	Exp-Cont	Gray Oral	19.6668	Rejected
5	Exp-Cont	Durrell Spelling	3.3528	Accepted
6	U-L Exp	Composite	33.3020	Rejected
7	U-L Exp	Rush Hughes	4.0686	Rejected
8	U-L Exp	Filtered W-22	2.7860	Accepted
9	U-L Exp	Gray Oral	0.0010	Accepted
10	U-L Exp	Durrell Spelling	0.7143	Accepted

Hypotheses one, two, three, four, six, and seven were rejected, signifying a mean change. Hypotheses five, eight, nine, and ten were accepted, signifying no difference in means for the two groups involved.

Adjustment of Criterion Means

When a significant F is found in the analysis of covariance, it is appropriate to compute an adjusted criterion mean. Hypotheses one, two, three, four, six, and seven were rejected, indicating a mean change in the criterion variables. Adjusted criterion means were in order for these criterion variables. The formula for the computation of the correction factors can be found in Appendix B. The correction factors obtained were then subtracted from the criterion mean gains to give the adjusted criterion mean gains. The original

criterion mean gains, the correction factors, and the adjusted means are presented in Table XVI.

TABLE XVI

ORIGINAL MEAN GAINS, CORRECTION FACTORS, AND ADJUSTED MEANS FOR REJECTED HYPOTHESES

Hyp.	Criterion	Group	Original Mean Gains	Correction Factor	Adjusted Mean Gains
1	Composite	Exp. Cont.	3.1595 1.2717	-0.0017 0.0018	3.1612 1.2699
2	Rush Hughes	Exp. Cont.	4.6949 1.1826	0.9051 -0.9287	3.7898 2.1113
3	Filtered W-22	Exp. Cont.	5.8474 1.6695	0.8991 -0.9226	4.9483 2.5921
4	Gray Oral	Exp. Cont.	1.8050 1.0869	0.1645 -0.1689	1.6405 1.2558
6	Composite	Upper Lower	1.8302 4.2509	-0.0564 0.0564	1.8866 4.1945
7	Rush Hughes	Upper Lower	2.0769 6.6410	-0.6857 0.6857	2.7626 5.9553

Inspection of the mean gains indicate that the experimental group and the lower group made the greater mean gain in all instances. The inclusion of the correction factors did not alter this indication, as the corrected means maintained the original indication.

The analysis of the data has been presented in this chapter. The first phase was the establishment of the upper and lower one-third of the experimental group with placement determined by the combined z scores of the auditory tests. The variables used in the analysis of covariance were age, sex, I.Q., Rush Hughes test gains, filtered W-22 test gains, Gray Oral Reading test gains, Durrell Spelling test gains, and a composite of gains from the four tests. Age, sex, and I.Q. were obtained from school records. Gains on the four tests were determined by subtracting pretest scores from post-test scores. To form the composite score, gain scores on the four tests were converted to z scores and combined. The ten hypotheses were then tested. Hypotheses one, two, three, four, and six were rejected at the .01 level and hypothesis seven was rejected at the .05 level. Hypotheses five, eight, nine, and ten were accepted as they did not reach the .05 level. The criterion means for the rejected hypotheses were adjusted to give a true mean from which conclusions concerning this study could be drawn.

CHAPTER IV

SUMMARY, CONCLUSIONS AND IMPLICATIONS, AND RECOMMENDATIONS

Summary

This study was undertaken primarily to investigate the effect of a tape-recorded program of auditory exercises on the auditory, word recognition, and spelling skills of a group of third-grade students. Of secondary consideration was the effect of the program on these same skills when applied to the upper and lower one-third of the experimental group, with the division having been based on auditory pre-test scores.

The sample used in this investigation was comprised of 233 students from 8 sections of third grade in 2 elementary schools located in a large northeastern Oklahoma city. Four teachers taught both an experimental and a control section each. There were 115 students in the control group and 118 students in the experimental group. To investigate the effect of the program on the upper and lower one-third of the experimental group, pretest auditory scores were normalized and combined, with the top thirty-nine scores and bottom thirty-nine scores forming the upper and lower groups respectively.

The experimental program used in this study consisted of forty daily sessions of auditory exercises, each of which was of approximately fifteen minutes duration, covering a span of eight weeks. The auditory exercises were adapted from Durrell's book, Building Word Power, with minor changes where necessary to provide continuity in the recordings. These exercises were presented to the students by magnetic tape recordings so as to eliminate visual and teacher variables. Provision was made in the recordings for student participation.

The age, sex, and I.Q. of the students were obtained from school records and were used as statistical controls. The effect of the tape-recorded program was measured by the mean gain scores obtained from pretest and post-test scores on the Rush Hughes Auditory Test, the electronically filtered C. I. D. Auditory Test W-22, the Gray Oral Reading Paragraphs, and the Durrell Spelling Test. A composite score was obtained by combining the normalized scores from the above tests.

The analysis of covariance with single classification was the statistical technique used in this investigation. There were ten hypotheses in this study. Hypotheses one through five pertained to the experimental and the control groups, whereas hypotheses six through ten pertained to the upper and lower one-third of the experimental group. All hypotheses were basically the same: one variable was used as the criterion and the others were statistical controls.

A summary of the hypotheses and the results of the statistical analysis follows:

1. The composite gains for the experimental and control groups were the criterion variable; and age, sex, and I.Q. were the control variables. The null hypothesis was rejected with the data indicating a greater mean change for the experimental group than for the control group.

2. The Rush Hughes gains for the experimental and control groups were the criterion variable; and age, sex, I.Q., filtered W-22 gains, Gray Oral gains, and the Durrell Spelling gains were the control variables. The null hypothesis was rejected, with the data indicating a greater mean change for the experimental group than for the control group.

3. The filtered W-22 gains for the experimental and control groups were the criterion variable; and age, sex, I.Q., the Rush Hughes gains, the Gray Oral gains, and the Durrell Spelling gains were the control variables. The null hypothesis was rejected with the data indicating a greater mean change for the experimental group than for the control group.

4. The Gray Oral Reading gains for the experimental and control groups were the criterion variable; and age, sex, I.Q., the Rush Hughes gains, the filtered W-22 gains, and the Durrell Spelling gains were the control variables. The null hypothesis was rejected with the data indicating a greater mean change for the experimental group than for the control group.

5. The Durrell Spelling gains for the experimental and control groups were the criterion variable; and age, sex, I.Q., the Rush Hughes gains, the filtered W-22 gains, and the Gray Oral gains were the control variables. The null hypothesis was accepted, indicating no difference in mean change between the two groups.

6. The composite gains for the upper and lower one-third of the experimental group were the criterion variable; and age, sex, and I.Q. were the control variables. The null hypothesis was rejected with the data indicating a greater mean change for the lower group than for the upper group.

7. The Rush Hughes gains for the upper and lower one-third of the experimental group were the criterion variable; and age, sex, I.Q., the filtered W-22 gains, the Gray Oral gains, and the Durrell Spelling gains were the control variables. The null hypothesis was rejected with the data indicating a greater mean change for the lower group than for the upper group.

8. The filtered W-22 gains for the upper and lower one-third of the experimental group were the criterion variable; and age, sex, I.Q., the Rush Hughes gains, the Gray Oral gains, and the Durrell Spelling gains were the control variables. The null hypothesis was accepted, indicating no difference in mean change between the two groups.

9. The Gray Oral gains for the upper and lower one-third of the experimental group were the criterion variable; and age,

sex, I.Q., the Rush Hughes gains, the filtered W-22 gains, and the Durrell Spelling gains were the control variables. The null hypothesis was accepted, indicating no difference in mean change between the two groups.

10. The Durrell Spelling gains for the upper and lower one-third of the experimental group were the criterion variable; and age, sex, I.Q., the Rush Hughes gains, the filtered W-22 gains, and the Gray Oral gains were the control variables. The null hypothesis was accepted, indicating no difference in mean change between the two groups.

Conclusions and Implications

The results of this study indicate the following conclusions and some of their more important related implications:

1. Conclusion

The auditory discrimination ability of third-grade students can be improved by use of a tape-recorded program of auditory exercises.

Implication:

a. The auditory discrimination ability of students in other grade levels can be improved.

2. Conclusion

Word recognition skills improve as auditory discrimination improves.

Implications:

a. Word recognition skills are related to auditory discrimination.

b. Some reading problems can be avoided or alleviated by a program of auditory discrimination exercises.

c. A background of auditory readiness will enhance the reading program.

d. Auditory readiness is as important to a beginning reading student as is visual readiness.

3. Conclusion

Spelling skills, as measured by the Durrell Spelling Test, do not improve as auditory discrimination is improved.

Implications:

a. Spelling by sound does not always produce correct spelling.

4. Conclusion

Using the composite variable as the criterion, students with poor auditory discrimination will derive more benefit from a tape-recorded auditory program than will students with good discrimination.

Implications:

a. The testing of auditory discrimination should be a routine practice as is testing for acuity and vision.

b. A program of remedial work in auditory discrimination is in order for students with poor auditory discrimination.

Recommendations for Future Studies

The investigation of auditory discrimination and the effect on the scholastic skills of the learner has a multitude of

possibilities. Based on the information gained in this study, the following recommendations for future study are presented:

1. A replication of this study should be made in the first and second grades. This would enable the schools to assess the value of a program of auditory discrimination in the lower primary grades.

2. A study consisting of a pilot program of auditory discrimination as a part of the readiness program of the kindergarten or first grade could evaluate the possibilities of developing auditory discrimination before the lack of this ability creates a reading problem.

3. A replication of this study in all elementary grade levels, using children of different racial and/or ethnic groups to determine the effect of the cultural and lingual background of the student on his auditory discrimination and word recognition ability.

4. A study of the auditory discrimination ability of the children from various cultural and/or socio-economic backgrounds might indicate the need for a program of auditory discrimination in particular schools within the school system rather than no program or a complete program for the entire system.

5. An experiment in which the results obtained by a classroom teacher and those obtained by use of the tape-recorded program are compared could indicate the best approach available for the improvement of auditory discrimination.

6. A study in which a more sensitive spelling test or a greater span of time is used might reveal a possible connection between auditory discrimination and spelling.

APPENDIX A

SAMPLE SCRIPTS*

Lesson 1

Hello boys and girls. Today we are going to start a new program. We hope that it will help you to better hear and understand the various sounds in words. The first lesson will be an introduction to several different letters and the way that they sound at the beginning of a word. From this you can see that each letter has a sound all of its own.

First, I am going to say some words that begin with S, like in seven. Listen and see if you can hear the S. said see sent set say sand sister Did you hear the S at the beginning of each word? Can you think of a word that begins with an S? All together now, each of you, very softly, say a word that starts with an S. Did you hear a lot of different words that begin with S, when you said your word? Listen carefully for the S sound as I say the words again. said see sent set say sand sister.

Now I'll say some words that begin with R, like in room. Listen carefully for the R sound. rabbit robin rolls run Did you hear R in all of the words? I will say them

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*A complete set of scripts is on file in the Library of the School of Education at North Texas State University.

again, and you say them after me. rabbit . . . robin . . . rolls . . . run . . . .

Listen carefully now. These next words begin with F, like father. feet fall fit fairly funny Can all of you think of another word that begins with an F? How many of you have a name that starts with an F? Raise your hand if your name starts with an F. Let's play a game now. Close your eyes and listen. I'll say some words that begin with F, like For. When you hear a word that does not begin with F, clap your hands. Listen carefully for the F in each word. face fairy fall room family farm fat That was pretty good for the first time, but do you think that you can do better next time? Let's try it again. Ready? Close your eyes, and listen again. Be sure to clap your hands when you hear a word that does not begin with F. Listen. first finger fish fit fix far box feed find

That was better. Now listen to these words. Keep your eyes closed. gun give got girl gate What letter did these words begin with? . . . . . that's right, the G, like in girl. Listen again to the words, and listen for the G sound. gun give got girl gate Now, keep your eyes closed. If you hear a word that does not begin with G, clap your hands. Are you ready? Listen carefully. garden gift gum fun goods going golf Good, can you tell me what word did not start with G? That is right, fun did not start with G, it started with with . . . an F, didn't it?

You are listening better already. Now open your eyes and listen carefully. This time I will say some words that begin with M like Mary. Listen for the M sound in these words. man match mail many move meat Monday Did you hear M in each word? Now listen again. This time, raise your hand when you hear a word that does not begin with M. Ready? man made mail make me meadow mother mouse movies music name my mark market Did some of you make a mistake and clap instead of raising your hand? Remember, I want you to listen carefully to everything, including the directions.

This time I will say some words that begin with a different letter. These words begin with H like hat. If you hear a word that does not begin with H, raise your hand. Listen carefully and see who will be the first one to hear a word that does not start with H. had hall hand handkerchief have help his horse hungry hurry hold hot hammer hair boy head heel Good. What was the word? . . . . that's right, boy. You are doing very well.

Let's do that one more time. Close your eyes, and listen carefully. Raise your hand when you hear the words that do not begin with H. Ready? OK, let's begin. half hard hatchet stop horn house hurrah hill mail hope hunt hungry hit sing gold hello him herself How many found more than one word that did not begin with H? Raise your hand. That is good. You are listening much better already and this is only our first day. Today was a review

of different letter sounds found at the beginning of words. Tomorrow we will start working on one letter a day, and see if we can become better listeners. Thank you for listening. Good-bye for today.

Lesson 21

In our last lesson, we talked about words that began with two letters. Do you remember what they were? . . . Yes, the TH and WH sounds. I will say some words and you tell me if it starts with TH or WH. Ready? why . . . the . . . they . . . when . . . where . . . throw . . . thirty . . . wheel . . . threw . . . while . . . whiskers . . . throat . . . thumb . . . whether . . . That was a good start. Now, I would like for you to listen carefully and clap your hands when you hear a word that begins with a TH or a WH. Let's close our eyes and listen. Remember to clap only when you hear a word that begins with a TH or a WH. Ready? Let's begin: as book <u>the</u> carrot certainly cellar <u>why</u> cottage when December dime fifteen fireman <u>they</u> father furnace good <u>white</u> grade gun <u>then</u> <u>that</u> iron turkey too <u>where</u> water <u>throw</u> <u>wheel</u> tomato

O.K., now open your eyes. I think that you are hearing these sounds very well, and are improving every day. Let's go on to a new sound. Today we are going to listen for words that begin like the words <u>chop</u> <u>child</u> and <u>chase</u>. Let me say them again. <u>chop</u> <u>child</u> <u>chase</u> The first two letters are what? . . . Good for you. C and H were the first two letters. Here are the names of some things to eat that begin with CH. Listen to these words and say them after me. cherries . . . chestnuts . . . chicken . . . chocolates . . . cheese . . . .

Good. Now I am going to say some sentences and I want you to tell me a word that begins with CH to finish each sentence. We sit on a ..... We write on the blackboard with ..... We use our teeth to ..... The farmer gets eggs from ..... Santa Claus comes down the ..... Boys and girls are ..... How many of you said children? Here is our last sentence. The head Indian is called the ..... What letters did all of our answers begin with? . . . That's right, the C and H. I am going to say some words that have a CH in them and you see if you can tell me how they are different from the words that we have been using. Listen carefully: peach branch ouch What did you notice about all three of these words? . . . How many of you found that all three of these words ended in CH?

We have been listening to letters at the beginning of a word, now we are going to hear some words that have our letters at the end of the word. Listen to these words and see if you can hear the CH sound when it is at the end of the word. teach touch ranch Did you hear the CH at the end of these words? Listen and say some words after me: beach . . . birch . . . branch . . . bunch . . . catch . . . couch . . . ditch . . . hitch . . . march . . . match . . . ouch . . . patch . . . peach . . . punch . . . ranch . . . such . . . switch . . . teach . . . touch . . . which . . . .

Good. Are you ready to try a game with these sounds? I am going to say some words. When you hear a word that

begins with CH, raise your hand. If you hear a word that ends with CH, clap your hands. Ready? Remember, raise your hand if it begins with CH and clap your hands if it ends in CH. chimney . . . children . . . such . . . cat . . . mouse . . . ouch . . . chair . . . camel . . . car . . . cherry . . . bunch . . . lunch . . . crunch . . . sack . . . catch . . . watermelon . . . . Good for you. Did some of you get mixed up and clap or raise your hand at the wrong time? You will have to listen more carefully if you did.

What have we been listening for today? . . . That's right, CH at the beginning and ending of a word. Listen carefully to your friends and see how many times you can hear this sound, and for our next meeting, we will hear another combination of letters that is commonly found at the beginning and ending of words. Until then, goodbye.

Lesson 37

Hello, boys and girls. Today, let's start by doing something that we have not done in a long time. Just for fun, let's say our A, B, C's together. I'm sure that all of you know them, but just for a review, say the letters with me. A B C D E F G H I J K L M N O P Q R S T U V W X Y Z (do not leave very much time between letters) We are going to review this time, and listen for the ending of words. We have listened to words ending with 13 different letters. I am going to say some words in groups of three, and after I say the three words, you tell me what letter they ended with. Ready? hop skip jump What letter did those words end with? . . . . That's right, they ended with P. Listen to these next three. car deer burr What letter was last? . . . . yes, R was the final letter. Here are three more. kick stuck oak. These words ended with a. . . . yes, a K. Try these next three. bun tan hen What letter ended each of these three words? . . . . It was N, wasn't it? The next three words are bus mess balls. What was the last letter? . . . . An S, wasn't it? Here are three more: pot hat wet. They ended with what letter? . . . . That's right, a T. Ready for the next group. Jelly already every. What letter was last? . . . . Yes, a Y was the last letter in each word. Try these. mud had sound The last letter of each word was a . . . a D, wasn't it? The next three are ham bottom cream. They ended with . . . an M, didn't they? Here are

three more: ball ill rail. What did that end with? . . . Yes, an L. Try these now. cub crab rib These ended with . . . yes, a B. Our next to last group of words are bug leg . . . . Yes, they ended in G. Listen to this last group: stiff wolf bluff. This last group ended in what? . . . . They ended with an F, didn't they? You have done very well. I am going to say some words. You tell me what letter the word ends with. Are you ready?

calf	elf	loaf
dog	rug	flag
club	cab	knob
doll	hill	mail
ham	gun	from
red	mad	road
help	up	nap
car	hear	dinner
work	back	kick
run	been	ten
hits	bus	glass
cat	nut	rabbit
any	body	my

Now let's turn around, and I will say a letter, and you give me a word that ends with that letter. Let's let the teacher pick the person to answer each time. OK? Here we go.

F	R	G
G	K	B

B	N	L
L	S	M
M	T	D
D	Y	P
P	F	R
K	N	S
T		Y

(ALLOW MORE TIME FOR THE STUDENT
TO ANSWER THAN WE USUALLY HAVE)

Our time for today has passed. We are doing very well, and tomorrow, we are going to review some more. Listen for these ending sounds so that you can recognize words when you hear them. Until next time, listen carefully. Good-bye.

APPENDIX B

FORMULAS FOR COMPUTING CORRECTION FACTORS FOR SIGNIFICANT F'S

For the Experimental Group:

$$y_{exp} = (\bar{X}_{1_{exp}} - \bar{X}_{1_t})a_1 + (\bar{X}_{2_{exp}} - \bar{X}_{2_t})a_2 +$$

$$(\bar{X}_{3_{exp}} - \bar{X}_{3_t})a_3 + (\bar{X}_{4_{exp}} - \bar{X}_{4_t})a_4 + \ldots .$$

For the Control Group:

$$y_{con} + (\bar{X}_{1_{con}} - \bar{X}_{1_t})a_1 + (\bar{X}_{2_{con}} - \bar{X}_{2_t})a_2 +$$

$$(\bar{X}_{3_{con}} - \bar{X}_{3_t})a_3 + (\bar{X}_{4_{con}} - \bar{X}_{4_t})a_4 + \ldots .$$

To Find the Corrected Means:

$$\bar{Y}_{cor} = \bar{X}_{crit} - y$$

Terms Defined:

Exp	:	The Experimental Group
Con	:	The Control Group
Cor	:	Corrected
Crit	:	Criterion
y	:	The Correction Factor
$\bar{Y}$	:	The Corrected Mean
$\bar{X}$	:	The Mean of a Control Group Variable. The Subscript Denotes the Proper One to be Used.
a	:	The a Values From the Within Subgroup Regression Equation
t	:	The Total Group

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