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# Analysis of auditory functions in grades one, two, and three.

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ANALYSIS OF AUDITORY FUNCTIONS  
IN  
GRADES ONE, TWO, AND THREE

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INTRODUCTION

## INTRODUCTION

Research has indicated that skill in auditory perception appears to have a significant influence on the attainment of success in beginning reading. Many other factors may be important in the learning process. This study is an attempt to discover the relationship between auditory discrimination, as measured by the ability to identify word sounds, and the following factors:

1. Mental age
2. Reading vocabulary
3. Accuracy of articulation
4. Speed of articulation
5. Extent of vocabulary
6. Auditory acuity
7. Singing ability

Sex differences will be studied in the same factors.

The study will be carried on with children in grades one, two, and three.

**CHAPTER I**

**SUMMARY OF PREVIOUS RESEARCH**

## CHAPTER I

### SUMMARY OF PREVIOUS RESEARCH

The importance and complexity of hearing in education, especially in reading, cannot be overemphasized. In 1937 Gates<sup>1</sup> wrote:

There is evidence that several types of defects of hearing may be a major contributing cause of reading difficulty. Several studies have shown that teachers are often unaware of hearing deficiencies so serious that the pupils cannot clearly understand what is being said or read to them. Children suffering from such defects are often thought merely to be inattentive, indifferent or lazy. There is some evidence, furthermore, that some children have deficiencies for tone within a certain range only and other specific types of defects that may make it especially difficult for them to follow phonic exercises.

Since then, studies have been made, not only with children but with adults, which show such beliefs to be true. These and other studies have contributed much to what is known today about auditory factors.

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<sup>1</sup>Arthur I. Gates. "Diagnosis and Treatment of Extreme Cases of Reading Disability." Thirty-Sixth Yearbook of the National Society for the Study of Education, Part I. Bloomington, Illinois: Public School Publishing Company, 1937. p. 399-400.

Auditory Acuity

A hearing survey was done among Syracuse school children by Laurer<sup>1</sup> in 1926-1927, to determine the amount of deafness and partial deafness. Four thousand, four hundred and nineteen children of eight schools in grades three through eight had an audiometer test and he found:

1. The impaired hearing amounted to 11.3 per cent of all the pupils examined in grade school -- slightly higher among girls (12 per cent) than among boys (10.6 per cent).
2. The amount of impaired hearing in different schools at all ages varies considerably. The minimum amount found was 1.9; the maximum, 17.6 per cent.
3. The highest per cent of impaired hearing was found in the fourth grade where the average age is ten years.
4. We believe a language handicap may influence the result of the examination in the lower grades.
5. Among the 4,419 pupils examined, the findings were as follows:
  - 88.6 per cent with normal hearing
  - 9.6 per cent with hearing loss of 9-12 sensation units
  - 1.2 per cent with moderate degree of hearing loss
  - 0.6 per cent with severe degree of hearing loss
6. Proper medical attention could be expected to restore to normal or nearly normal eighty per cent of the pupils with impaired hearing.

A similar survey was undertaken in Washington, D. C. and Hagerstown, Maryland in 1927. One thousand, eight hundred and

<sup>1</sup>Frank A. Laurer. "A Hearing Survey Among a Group of Pupils of Syracuse Schools." American Journal of Public Health 18: 1353-1360; November 1928.

sixty children in grades three through nine were tested by means of an audiometer and eight ear phones. Sterling and Bell<sup>1</sup> reported the following findings:

1. In the whole group studied, there appeared to be more normal or above normal hearing among the older children.
2. Among the actually hard of hearing (loss of nine or more units), the older children were in the majority.
3. In general, there was slightly more significant impairment among the boys of all ages than among the girls.
4. In no group at any age, when both sexes were taken together, did the rate of children with significant hearing loss rise as high as four per cent.
5. In general, there was a higher proportion of left ears with good hearing than of right ears.
6. The percentage of children with insignificant hearing loss was generally greater in the overage-for-grade group.
7. Among the children doing the poorest school work in the youngest and oldest groups, there was the largest amount of significant hearing loss.
8. The highest percentage of children with significant hearing loss was found in the group with the lowest intelligence quotient.

The following year Fletcher<sup>2</sup> tested with a phonograph audiometer, and reported that

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<sup>1</sup>E. Blanche Sterling and Elizabeth Bell. "Hearing of School Children as Measured by the Audiometer and as Related to School Work." U. S. Public Health Report 45: 1117-1130; May 16, 1930.

<sup>2</sup>Harvey Fletcher. "Discovering Children with Defective Hearing." Elementary School Journal 29: 172-173; November 1928.

...of over 4,000 school children thus tested by J. B. Kelly of our laboratories and his assistants, it was found that 595, or 14.4 per cent, were hard of hearing, 3.2 per cent had defects in both ears, and 11.2 per cent had defects in one ear only.

Waldman, Wade and Aretz<sup>1</sup> surveyed partial deafness among 1,079 children in two public schools in grades four to eight to determine the effect of impaired hearing upon school achievement. They found:

1. The correlations between hearing and retardation were slightly higher than those between hearing and the educational quotients.
2. ...poor hearers are one year behind the good hearers in average achievement, poor hearers are required to repeat grades more often than the good hearers in the proportion of nine to five--double and triple grade repetitions occur more frequently with poor hearers, that the divergence in achievement between good hearers and poor hearers is greater than their divergence in intelligence.
3. Hard of hearing children are handicapped in learning the subjects in the public elementary school curriculum. Even minor losses in hearing tend to lower the level of school attainment.
4. Achievement in all subjects tested in this investigation is disturbed by hearing loss...as hearing loss becomes greater, the more marked is the loss in subject achievement and in total achievement.
5. Children suffering from partial deafness very commonly have speech defects.
6. The effort made by children with the greater hearing loss, however, declines perceptibly.
7. It is plainly evident that hearing is a most important sense in education.

<sup>1</sup>John L. Waldman, Francis A. Wade and Carl W. Aretz. Hearing and the School Child. Washington: The Volta Bureau, 1930.

The authors also learned that more children in the fourth grade had serious hearing defects than in any other grade, and that impairment decreased through the grades till the eighth, then increased. Unlike similar studies, they found more girls than boys had impaired hearing.

Madden<sup>1</sup> used a 4-A Audiometer to test the children in grades three through six. Forty-six non-hearers were matched with the same number of normal hearers and were given the Stanford-Binet Test of Intelligence and Stanford Achievement Tests. He reported:

1. The relationship between auditory acuity and scores on tests of intelligence is expressed by a coefficient of correlation of  $.124 = .029$ .
2. There is no indication that hard-of-hearing children have a language problem.
3. Correlation coefficients between auditory loss and achievement, with intelligence partialled out, are all very small, and cluster around zero. They are positive almost as often as negative.

Moreover, when the amount of intelligence was held constant, or when deficiency in hearing was increased, there was no difference in achievement.

Conway<sup>2</sup> in 1937, tested hearing among Toronto public school

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<sup>1</sup>Richard Madden. "The School Status of the Hard-of-Hearing Child." Contributions to Education, No. 499. New York: Teachers College, Columbia University, 1931.

<sup>2</sup>C. B. Conway. "The Hearing Abilities of Children in Toronto Public Schools." Ontario College of Education, Department of Educational Research, Bulletin Number 9. Toronto: University of Toronto Press, 1937.

children. Nine hundred and thirty-three were found to have normal hearing. He says that when retardation is based on age instead of tests, there was none among children with no hearing loss, 2.3 months for children with a ten per cent loss, and 12.2 months for those with a twenty per cent loss. Retardation was not determined by standardized tests, however.

Ansberry<sup>1</sup> compared tests with ear phones and microphones and reported:

1. There appears to be no real difference between hearing with the speaker and with phones.
2. Vowels tend to be but slightly more intelligible than consonants under the conditions prevailing in these tests, showing an average intelligibility of 99.36 per cent on the amplified tests as compared to 98.69 per cent for the consonants, a difference of 0.67 per cent and 99.83 per cent on the control test as compared with 99.53 per cent for the consonants, a difference here of 0.30 per cent.
3. That transmission system which proved best for vowel transmission was least efficient for consonants and the opposite was also true.
4. Persons familiar with English speech sounds are not handicapped in understanding or discriminating between speech sounds when frequencies above 4,000 are eliminated.

In 1943, Plummer<sup>2</sup> tested sixteen "high frequency" consonants and said:

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<sup>1</sup>Merle Ansberry. "The Effect Upon the Ability to Discriminate Between Speech Sounds by the Elimination of Frequencies Above 4,000 Cycles." Quarterly Journal of Speech 24: 381-389; October 1938.

<sup>2</sup>R. N. Plummer. "High Frequency Deafness and Discrimination of High Frequency Consonants." Journal of Speech Disorders 8: 375-381; 1943.

...nine out of fifty-two had mild to severe cases of high frequency deafness, ... (but) no appreciable difficulty in discriminating between the consonants which heretofore have been said to depend highly upon sensitivity to the higher frequencies. It also appears that no given consonant sound is dominantly dependent for its discrimination upon any specific frequency along the range said to be used in speech.

Tentative conclusions from the experiment were:

1. High frequency deafness seems to have no appreciable influence upon an individual's ability to discriminate between the so-called "high frequency" sounds of speech.
2. The ability to discriminate between these sounds appears to be chiefly influenced by the amount of hearing loss and the extent of the loss among the speech range, particularly the extension of the loss toward the fundamental frequencies.
3. Specific consonant sounds do not appear to be dependent for their discrimination upon specific frequencies in the higher ranges.

Rossignol<sup>1</sup> studied the relationships between hearing acuity and speech production, and between the latter and reading performance. Tests were given in hearing acuity, oral comprehension, intelligence, reading and speech, with the following conclusions:

1. ...there is a significant difference between the relationship of hearing acuity and speech production as measured by the articulation test, and the relationship between hearing acuity and speech production as measured by the Sound Repetition Test.

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<sup>1</sup>L. J. Rossignol. "The Relationships Among Hearing Acuity, Speech Production and Reading Performance in Grades 1A, 1B and 2." Contributions to Education, No. 936. New York: Teachers College, Columbia University, 1948.

2. The relationships between hearing acuity and speech production in the learning of new words, between hearing acuity and reading performance, and between reading performance and speech production are significantly non-chance.

She also found the relation between hearing acuity and reading performance different from zero, which is significant, except when it is biased by mental age. In the relationship between reading performance and speech performance, the former varied significantly with the latter.

Fielder<sup>1</sup> attempted to follow the development problems of hard-of-hearing children, especially in regard to personality development, and problems of school adjustment. This study reported only the first year findings. The hearing of 1,180 children in grades one through three was tested by an ADC pure-tone audiometer. A questionnaire was sent to teachers requesting information on who, among the pupils tested, had problems in reading, spelling, or voice, those who had a suspected hearing loss, and those who had academic or behavior difficulties. The results showed:

1. A significantly large proportion of the children with defective hearing were named by the teachers as presenting classroom problems.
2. Those children were not, in general, recognized by the teachers as children with a hearing loss.
3. The factor of mental maturity did not appear significantly related to the results of the hearing tests.

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<sup>1</sup>M. F. Fielder. "Teacher's Problems with Hard-of-Hearing Children." Journal of Educational Research 42: 618-622; April 1949.

4. The findings suggest (a) the value of hearing tests for primary school children and (b) the need of increased awareness among classroom teachers of the possibility of hearing defects as a factor in school achievement and adjustment.

Sprunt and Finger<sup>1</sup> studied the academic achievement of hard-of-hearing pupils in a rural community in Virginia. Six hundred and ninety-two children in grades three through seven, in five schools, were involved. The children were given the Pintner-Durost Elementary Test, Verbal Series, and the Pintner General Ability Test, Non-Language Series, also the Stanford Achievement Test. They found:

1. Hearing loss amounting to ten decibels or more in the better ear (Maico D-5 audiometer) were found in forty-six (6.6%) of the subjects.
2. No significant I. Q. Differences were found between normal hearing and the hard-of-hearing in grades four to seven, although the group averages in grade three differed by 7.4 I. Q. points.
3. Twenty-eight hard-of-hearing children in grades four to seven scored 3.53 points lower on the Stanford Achievement Test than did twenty-eight normal hearing controls, matched on the basis of non-verbal I. Q., age, sex, and number of years in school. This difference, equivalent to approximately 0.5 years of school progress, was significant at the 4 per cent level of confidence.
4. It is concluded that when hearing loss and academic achievement are measured objectively, and intelligence considered in terms of a non-verbal test, the hard-of-hearing child will progress more slowly in the typical school situation than the normal hearing child.

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<sup>1</sup>Julie W. Sprunt and Frank W. Finger. "Auditory Deficiency and Academic Achievement." Journal of Speech and Hearing Disorders 14: 26-32; March 1949.

### Auditory Discrimination

Murphy<sup>1</sup> constructed exercises designed to develop auditory discrimination and evaluated their effectiveness on beginning reading. The experimental group was superior in the auditory test, Detroit Word Recognition Test, and the individual auditory test for identifying sounds. Their learning rate increased significantly.

Hester<sup>2</sup> undertook a study in the Reading Laboratory at the University of Pittsburgh of 194 children who were admitted before 1942. Each child was given the Durrell Analysis of Reading Difficulty. Sixty-four of them scored at or above the third grade level both in word recognition and word analysis; eighteen had no trouble with letter names, sounds or blends; one hundred and twelve children, or fifty-eight per cent of the group, lacked wholly or partly the necessary knowledge of phonics for word attack. The rating of letters and sounds as Hester discovered them was:

Capital letters: Most difficult letter, V and Y;  
 next, B, H and S;  
 easiest, X.  
 Small letters: q, l, b, p, difficult;  
 a, h, s, x, easiest.

Capital letters were recognized more easily than small ones.

<sup>1</sup>Helen A. Murphy. "An Evaluation of Exercises for Developing Auditory Discrimination in Beginning Reading." Unpublished Master's Thesis, Boston University School of Education, 1940.

<sup>2</sup>Kathleen B. Hester. "A Study of Phonetic Difficulties in Reading." Elementary School Journal 43: 171-173; November 1942.

Letter sounds: q, hardest; x, next;  
 u, i, w, l, next;  
 c, k, s, t, easiest.

Letter sounds were not properly known, as was seen by comparing the total number of errors on letter names with the total number of letter sounds. The author stated that, this being the case, they should be taught specifically if reading difficulties were to be avoided. Tw and cl were the hardest; sh and st, the easiest.

Templin<sup>1</sup> studied the sound discrimination ability of elementary school children to discover if there was any difference in their ability to discriminate between like and unlike syllables when the discriminative element was changed from the initial to the medial or final position. In addition, the author wanted to discover whether a short test of sound discrimination could be used with satisfactory results. Two tests similar to the Travis-Rasmus Test of Sound Discrimination of 100 items in each were given to children in grades two through six. She found:

1. That there is a real difference produced in the scores made on a sound discrimination test when the discriminative element is changed from the initial to the medial or final position. The children in all grades made more errors when the consonant or combination was in medial or final position. In the second grade, the results obtained with respect to this positional effect could have been obtained by chance 24 per cent of the time; in all other grades, and for the group as a whole, they could have been obtained by chance less than 1 per cent of the time.

<sup>1</sup>Mildred Templin. "A Study of Sound Discrimination Ability of Elementary School Pupils." Journal of Speech Disorders 8: 127-132; June 1943.

2. That a relatively short test of sound discrimination can be effectively used.

In 1945 Biggy<sup>1</sup> studied the relative order of difficulty of some word elements and reported:

Of initial sounds, g was the easiest; w, the hardest. Other difficult ones were r, h, s, p, i, n, t, l, m, and v. Of initial blends, ch was the easiest; sh, the hardest. Also difficult were sp, tr, and st. Among final consonants, the easiest was y and the hardest d, with other hard ones being n, l, g, m, p, and d. More easy ones were s and y, and t, k, and g were in between. The easiest rhyme was ing, then an and un. Harder was at but not as hard to tell as the least difficult final consonant.

The relationship in order of difficulty of those letters which were used as both beginning and final consonants is as follows: s was easiest in both; g was the easiest initial and second most difficult final; l was much easier to tell when final; n stayed in the same position both times; p was easier when final; t was much harder when a beginning consonant.

Barden<sup>2</sup> worked with third and fourth grade children and reported:

In the auditory discrimination test scores at the beginning of the experiment, the experimental group and the control group were very close, the difference in the means being only .39 in favor of the experimental group. At the close of the experiment, the mean score for the experimental group was 14.83 points higher than the controlled-group with a critical ratio of 3.13 which is statistically significant. From this gain it is evident that specific training improves auditory discrimination of words in third and fourth grades.

<sup>1</sup>Mary V. Biggy. "The Establishment of a Relative Order of Difficulty of Word Elements in Auditory Discrimination." Unpublished Master's Thesis, Boston University School of Education, 1945.

<sup>2</sup>Mary C. Barden. "The Construction and Evaluation of Exercises for Specific Training in Auditory and Visual Discrimination in the Third and Fourth Grades." Unpublished Master's Thesis, Boston University School of Education, 1945.

Crossley<sup>1</sup> evaluated the effectiveness of lantern slides on auditory and visual discrimination for first grade children. A total of forty-two word elements were taken from five basal reading systems, the I. K. U. List,<sup>2</sup> and Murphy's study. Material was presented on four types of lantern slides, their purpose being to teach auditory perception of word elements. Four hundred and sixteen children from twenty first grades in nine communities were divided heterogeneously into ten control and ten experimental groups. Her results showed:

1. The experimental group was superior to the control group in all analyses of auditory discrimination.
2. From the results of this testing it can be assumed that it is possible to teach letters as beginnings and endings at the same time without causing confusion.
3. Children who are subject to auditory discrimination of vowel sounds profit by such training.
4. In general, children who had higher scores in auditory discrimination attained higher scores in reading, even though they were equal on the basis of mental age.

Kelley<sup>3</sup> compared difficulty of consonants and vowels, and of vowels themselves. A group test for this factor, with the

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<sup>1</sup>B. Alice Crossley. "An Evaluation of the Effect of Lantern Slides on Auditory and Visual Discrimination of Word Elements." Unpublished Doctor's Dissertation, Boston University School of Education, 1948.

<sup>2</sup>International Kindergarten Union. "A Study of Vocabulary of Children Before Entering First Grade." 1932.

<sup>3</sup>Helen I. Kelley. "Relative Difficulty in Auditory Perception of Word Elements." Unpublished Master's Thesis, Boston University School of Education, 1948.

Murphy Group Test of Auditory Discrimination for Grade I used as a basis, was given to 314 children in four communities. The analysis showed:

1. The short sound of vowels at the beginning of the word ranged in the following order from easy to difficult: o, i, a, u, e.
2. The short sounds of vowels in the middle of the word fell in the following order from easy to difficult: o, a, e, i, u.
3. The long sounds of vowels in the middle of the word ranged in the following order from easy to difficult: e, a, u, o, i.
4. When the short sounds of the vowels were tested against consonants, they are not more difficult to discriminate than many of the consonants and blends.
5. When the short vowels are tested against different vowel sounds, they are much more difficult to discriminate.
6. Short sounds of vowels in the middle of the word are more difficult to hear than consonants as beginning sounds.
7. Long sounds of vowels in the middle of the word are more difficult to hear than consonants as beginning sounds, with the exception of hard e.

Moreover vowel sounds were much harder to hear than beginning or end consonants, and when they were in the middle of the word, whether long or short, they were hard for children to hear. The short sounds of vowels as first sounds were the easiest to tell.

Fahy<sup>1</sup> evaluated a program in ear training in grade one and compared her results with those of Biggy<sup>2</sup> and Kelley.<sup>3</sup> This study showed:

1. There is apparently no set order of difficulty which remains constant in every situation.
2. Insofar as can be ascertained from this study, positions in terms of difficulty before teaching does not influence the learning as much as one might believe.
3. Though both short and long sounds of vowels showed definite improvement after teaching, the percentages of error in this study indicated that in general vowels were more difficult than consonants.
4. In many specific instances, however, vowel sounds showed gains equal to or larger than those for final consonants, blends and rhymes.
5. The results of this study support the theory that long vowels are easier than short vowels.
6. Sounds which in the testing situation required recognition as being alike were apparently more readily recognized than those which require identification as different. For a true picture of the difficulty of a sound, therefore, testing in more than one situation in a single test appears to be advisable for each letter.

Petit<sup>4</sup> compared auditory discrimination skill in grades four, five and six with reading and spelling.

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<sup>1</sup>Ann Fahy. "Evaluation of Ear Training in Grade One." Unpublished Master's Thesis, Boston University School of Education, 1949.

<sup>2</sup>Biggy, op. cit.

<sup>3</sup>Kelley, op. cit.

<sup>4</sup>E. M. Petit. "The Construction and Evaluation of Tests in Auditory Discrimination for Grades Four, Five and Six." Unpublished Master's Thesis, Boston University School of Education, 1950.

There were two parts to her test, the first for initial, middle and final sounds, and for final blends. The second part measured ability to identify whole words. In order to tell the efficacy of her own test, and for purposes of comparison, the Metropolitan Achievement Test, Elementary and Intermediate Partial Form T was given to 173 children. She found that most scores on the auditory discrimination test were high, that there was a strong relationship between it and the spelling achievement test, and that there was some relationship between ability in auditory skills and reading achievement. She also found Part One of the test more difficult. In addition she says:

The fact that the reading and spelling scores are kept up to grade expectation or above would seem to indicate that the pupils in grades four, five and six have received excellent training in auditory skills and in all phases of reading throughout the grades. There is, therefore, no need in special work in auditory discrimination, except in the case of slow readers.

From the fact that some slow readers have low scores in auditory discrimination, it may be concluded that poor auditory perception is a salient factor affecting the child's slow progress in reading and spelling.

The high scores in word analysis obtained by the poor readers indicate that poor auditory discrimination may not be the reason for these failures in reading.

### Other Auditory Factors

In 1934 Danner<sup>1</sup> attempted to discover if the auditory pacing method of coaching could improve speed and comprehension in silent reading. He used an electrical device that showed the reader the pace, which could be changed in intensity, pattern and speed. He found:

The average reading rate of many subjects advanced from 250 words per minute to double or even treble speeds. The paced group gained an average of 33.4 percentiles in comprehension and 40.3 in speed on the modified Iowa Silent Reading Test. Their equated controls, coached but impaced, gained 35.5 percentiles in comprehension, 30.7 in speed. College grades and other measures indicate improved comprehension for both groups.

Elliott<sup>2</sup> did a study to discover which kind of presentation, visual or auditory-visual, was the more effective in persuading students to come to college. From 1933-1935 he worked with 92,681 high school pupils, 15,510 seniors were in the visual group and were shown printed literature. In the audio-visual group were 77,171 seniors, exposed to printed materials and oral presentation. The author found that there were seven times as many inquiries as a result of the audio-visual presentation.

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<sup>1</sup>W. M. Danner. "The Effect of Auditory Pacing on Reading Speed and Comprehension." Psychological Bulletin 31: 606; October 1934.

<sup>2</sup>Frank R. Elliott. "Response to Visual vs. Visual-Auditory Presentation in a Go-To-College Program." Journal of Educational Psychology 38: 703-707; December 1937.

Tireman and Woods<sup>1</sup> worked with forty-seven Spanish speaking children in grades five through eight, to compare their aural and visual comprehensions. The pupils were given the Durrell-Sullivan Capacity Achievement Tests, including the aural and visual ones. The authors found that visual comprehension was better, and:

A correlation of only .075 between superiority on the visual test and on the percentage of hearing loss ruled out the hypothesis that the differences in the ratings on the two tests resulted from poor hearing.

In 1941 Schmidt<sup>2</sup> experimented with 308 children who all had one reading habit in common, a desire for an auditory image of the material read. They also preferred the auditory presentation of facts to the visual. The pupils were placed into two groups, those using visual association, and those using visual-auditory association. Both were given a test having three parts, with two parts included in each section.

Part I A. Pictorial:pictorial association  
           B. Pictorial:auditory:pictorial association  
 Part II A. Non-pictorial:pictorial association  
           B. Non-pictorial:auditory:pictorial association  
 Part III A. Non-pictorial:non-pictorial association  
           B. Non-pictorial:auditory:non-pictorial association

The children were divided into those preferring visual learning and those preferring the auditory. Then, an efficient

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<sup>1</sup>L. S. Tireman and V. E. Woods. "Aural and Visual Comprehension of Spanish-Speaking Children." Elementary School Journal 40: 204-211; November 1939.

<sup>2</sup>Bernadine Schmidt. "Auditory Stimuli in the Improvement of Reading." Elementary English Review 18: 149-154; April 1941.

way of auditory teaching was found and evaluated, according to the needs of these pupils. So the auditory group was divided into the experimental group, getting only auditory instruction, and the control group, getting non-auditory instruction. The first group received (1) oral initial presentation of the basic sight vocabulary of words and phrases; (2) pupil-teacher discussion of the contents of the paragraphs for comprehension purposes; (3) rhythm and motor devices for sentence recognition; (4) help from the radio, to develop a basic phonetic vocabulary. They learned all new material by auditory methods. Schmidt found that with the experimental group, there was an average gain per pupil of 3.2 grades. In the control group there was an average gain of 1.19 grade. She said:

If the initial presentations are made by auditory methods, and varied associative abilities developed co-incident with the teaching of reading skills, auditory learners can reach a high degree of thoughtful silent reading.

## Reading

Beginning in 1934, Gates, Bond, and Russell<sup>1</sup> analyzed tests or measures of reading readiness. The following findings are pertinent:

1. Among the tests used in this study the best for predicting reading progress were: (a) tests of word recognition, (b) tests of ability to complete a partially told story... (c) tests of giving words which end with (or rhyme with) and begin with the same sound as the given example, (d) tests of blending word sounds given orally, (e) tests of reading letters of the alphabet, and (f) ratings of previous instruction in reading. In this study, tests of ability to listen, to understand, and to make use of the teacher's instruction in beginning reading also ranked high in predictive value...
2. Aside from these tests, the only others of marked value were the Stanford-Binet Mental Age and test of auditory acuity.
3. The correlations of the several types of tests mentioned...and reading progress vary very appreciably with the emphasis which the pupils place on various techniques in learning to read. Thus, if a teacher effectively emphasized early phonetic attack, tests of blending, rhyming, etc., are likely to give a higher correlation with reading progress in her class than in a class of a teacher who places less emphasis on her phonetic approach.
4. In schools in which classes are large or surroundings are noisy or both, it is important to determine the hearing of the pupils and to give favorable positions to those showing poor auditory acuity.

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<sup>1</sup>A. I. Gates, G. L. Bond and D. H. Russell. "Methods of Determining Reading Readiness." Elementary School Journal 40: 165-167; March 1939.

Between 1933 and 1937, Wilson<sup>1</sup> investigated progress from kindergarten through grade three of children in the Horace Mann School. The following tests were used: the Metropolitan Readiness Tests for Kindergarten and Grade One, the Van Wagener-Reading Readiness Tests, and the Stone and Grover Classification Test for Beginners in Reading. Sub-tests of Gates Reading Diagnostic Tests, Gates Primary Reading Tests and the Hildreth First Grade Reading Analysis Test were given. In addition, a questionnaire from home and school records, and a case study of each child was used. After three years of investigation the authors found:

The results of the second and third years' work substantiate the conclusions reached in the first year, namely, that the relations between abilities with letter forms and sounds on the one hand and reading ability, in terms of word, sentence and paragraph reading on the other hand, are remarkably close for children learning to read in the Horace Mann School.

Two of the same authors, Wilson and Flemming,<sup>2</sup> continued the study the following year to discover the attention that young children give to the form and sound of letters. Gates Primary Reading Word Recognition Test and a phonic combination test was administered. The authors concluded that the children were letter-conscious in the early stages of reading, and that

<sup>1</sup>F. Wilson, C. W. Flemming, A. Burke, and C. G. Garrison. "Reading Progress in Kindergarten and Primary Grades." Elementary School Journal 38: 442-449; February 1938.

<sup>2</sup>F. T. Wilson and W. C. Flemming. "Letter Consciousness of Beginning Reading." Pedagogical Seminary and Journal of Genetic Psychology 53: 273-286; December 1938.

the best method was to give them help in the functional way for the forms and sounds of letters. This eliminated phonic and letter drills, and gave methods and materials that could be used when pupils wanted to read for their own purposes.

Carroll<sup>1</sup> studied sex differences in reading readiness. A battery of tests of auditory and visual discrimination plus articulation was used in two studies. With a critical difference of 2.0-2.09, the girls were superior in auditory discrimination, while the boys were better in audio-visual ability. With a critical difference of 0.9 the boys were superior in sounding letters, and below that critical difference, they were superior in auditory discrimination. Carroll concluded:

...all significant differences are in favor of the girls; that of the critical difference of 2.0-2.9, four items favor the girls as compared to one for the boys; that of all the tests, twenty-four favor the girls as compared to fourteen for the boys.

McFarland<sup>2</sup> compared the relationships between certain reading readiness factors--auditory and visual discrimination and learning rate. The correlation between auditory discrimination and reading achievement was .655- , probable error .039. There was almost no difference between the boys and girls in this type of discrimination.

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<sup>1</sup>Marjorie Carroll. "Sex Differences in Reading Readiness." Unpublished Master's Thesis, Boston University School of Education, 1941.

<sup>2</sup>M. E. McFarland. "The Relationship of Readiness Factors in Beginning Reading." Unpublished Master's Thesis, Boston University School of Education, 1947.

From 1923 to 1926 Gates<sup>1</sup> compared phonetic training to his own form of intrinsic methods. The first experiment concerned two groups of children from the Horace Mann School who had practice periods of fifteen to thirty minutes a day from November 1923 to May 1924. The second experiment, from October 1925 to April 1926, was done with four groups from a New York public school. The equivalent group technique was used. The control group had no work in phonics, but they did have training in word perception and comprehension exercises. Gates found that in knowledge of many phonetic elements, the phonic group had only a slight advantage; in the quick recognition of words, the non-phonetic group was slightly better; in accurate pronunciation, there was not much difference between the two groups. The children trained by the two different methods perceived words in different ways, and the non-phonetic training seemed superior. This was because it emphasized words as a whole, not as parts, and unique characteristics of words. The non-phonetic group appeared superior in silent reading comprehension and general efficiency, especially in the quick appraisal of words.

In 1928 Sexton and Herron<sup>2</sup> conducted the Newalk Phonics experiment, to determine the value of phonics in beginning reading. Almost 1,000 pupils were involved, 441 in a phonics

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<sup>1</sup>A. I. Gates. "Studies of Phonetic Training in Beginning Reading." Journal of Educational Psychology 18: 217-226; April 1927.

<sup>2</sup>E. K. Sexton and J. S. Herron. "The Newalk Phonics Experiment." Elementary School Journal 28: 690-701; May 1928.

group and 488 in a non-phonics group. After five months of instruction, four reading tests were administered. After ten months, 346 in the phonics group and 363 in the non-phonics group were tested. A total of 426 continued in the control group through the first half of the second grade and they were tested again. The authors reported:

1. The results clearly indicate that the teaching of phonics functions very little or not at all with beginners in reading during the first five months. It begins to be of some value during the second five months but is of greater value in the second grade.
2. ...there is immeasurably less difference between classes taught with and without phonics than between different schools.

Another study of phonetic and non-phonetic groups was done by Garrison and Heard<sup>1</sup>. Children in grades one through three were used, with one classroom for each group. Methods of teaching were similar, except for the training in phonetics in one case, and exercises for word discrimination and thought stimulation on the other. The experimenters claimed:

1. Training in phonetics makes children more independent in the pronunciation of words.
2. Children with no phonetic training make smoother and better oral readers in the lower grades.
3. In teaching children to read in the early part of the primary grades, first and perhaps second, bright children seem to be helped more by training in phonetics than are dull.

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<sup>1</sup>S. C. Garrison and M. T. Heard. "An Experimental Study in the Value of Phonetics." Peabody Journal of Education 9: 9-14; July 1931.

4. In the teaching of reading it now seems probable that much of the phonetic training now given should be deferred to the second and third grades.
5. It seems that work in meaningful exercises which are planned to increase comprehension and to teach discrimination of words is more important than phonetics.
6. First grade children with no phonetic training seem to lose less during vacation than do children with such training.

The influence of phonics on silent reading was studied by Tate.<sup>1</sup> For an eight week period he used thirty-seven children in control and experimental groups, and he discovered that the phonic method of instruction and drill was superior to the look-and-say method in developing ability to recognize words, but that the latter was better in developing the power to understand sentences and paragraphs of directions. Also, thirty minutes daily for phonic instruction resulted in a poor balance of abilities that were necessary to understand words, sentences, and paragraphs.

Dolch and Bloomster<sup>2</sup> studied children in grades one and two where phonics was taught to see the children's phonic attainment and the relation to their mental development. Mental development was measured by the Pintner-Cunningham Primary Mental Test and the Detroit First Grade Intelligence Test.

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<sup>1</sup>H. L. Tate. "The Influence of Phonics on Silent Reading in Grade One." Elementary School Journal 37: 752-763; June 1937.

<sup>2</sup>E. W. Dolch and M. Bloomster. "Phonic Readiness." Elementary School Journal 38: 201-205; November 1937.

Phonic achievement was determined by using experimental issues of the Dolch-Gray Basic Reading Tests, Word Attack Series, Tests One and Two. Phonic achievement and mental age were correlated by the Pearson-Product Moment Method for each group. For safety purposes the experiment was repeated, and the two results agreed. Conclusions were:

1. When consideration is given to the difficulty of accurate measurement of young children in both the fields concerned, the relationship between mental maturity and the use of phonics is remarkably high.
  - (a) Children of high mental ages sometimes fail to acquire phonic ability, but children of low mental age are certain to fail.
  - (b) ...a mental age of seven years seems to be the lowest at which a child can be expected to use phonics.
2. This study does suggest, however, that the schools are perhaps expecting results from phonics training far too soon.
  - (a) But "ear training", which is the basis of phonics, may begin early.

Phonics is not limited to the primary grades. In 1938 Rogers<sup>1</sup> studied it, as relating to some aspects of reading at the college level. The specific purpose was to find the relationship between mispronunciation and comprehension, and to discover the effect of phonics training upon some reading aspects. To accomplish this, seventy-two freshmen, who were poor readers, were selected. One half were placed in the control

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<sup>1</sup>Maurine Rogers. "Phonic Ability as Related to Certain Aspects of Reading at the College Level." Journal of Experimental Education 6: 381-395; September 1938.

group, one half in the experimental group, the latter receiving about sixteen individual hours of training in phonics. Results of the study showed phonics training at the college level was effective for improving pronunciation, oral reading, and reading vocabulary.

Agnew<sup>1</sup> studied the effects of phonetic training on primary reading. In 1939 he took 300 grade school pupils in one public school and 110 in another, who were divided into three groups, according to the amount of training they had received. A battery of eight tests were given. Auditory and speech results were:

Phonetic training, when given consistently in large amounts (a) increases independence in recognizing words already learned; (b) aids in "unlocking" new words by giving the pupil a method of sound analysis; (c) encourages correct pronunciation; (d) improves the quality of oral reading.

An inquiry to discover practices in phonetic training was undertaken by Brownwell<sup>2</sup> in 1941. Check lists covering important points were returned by 627 teachers in grades one, two and three. According to results, rural teachers seemed to emphasize phonetic analysis more than city teachers. There was both an increase in emphasis and a large overlapping from grade to grade.

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<sup>1</sup>Donald Agnew. "The Effect of Varied Amounts of Phonetic Training on Primary Reading." Quarterly Journal of Speech 26: 449; October 1940.

<sup>2</sup>William A. Brownell. "Current Practices with Respect to Phonetic Analysis in the Primary Grades." Elementary School Journal 42: 195-206; November 1941.

Geogal<sup>1</sup> constructed and evaluated a phonic program to help in reading, spelling and language. An experimental group was given phonic lessons for fifteen minutes a day, while the control group used a regular reading system. Standard tests and informal ones constructed by the writer were used. The results showed no significant differences.

Kiernan<sup>2</sup> built a group auditory test of word analysis and administered it to ninety-six second grade children. The same week the Stanford Reading Achievement Test and the Otis Group Intelligence Test were given in order to find the relationship of the auditory test to reading and to intelligence scores. No definite pattern appeared between the auditory test scores and intelligence scores. In relation to achievement to reading, she found that her test had some sensitivity, and that the section dealing with phonograms was the best.

In 1926 Hincks<sup>3</sup> made a psychological analysis, including emotional and intellectual factors, to find out about reading disability. Fifteen children were selected because of their difficulty in learning to read. They were given tests in form-color, form-sound-color, form-sound-meaning, and form-meaning

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<sup>1</sup>B. S. Geogal. "Construction and Evaluation of a Phonic Program that Will Promote Reading, Spelling and Language." Unpublished Master's Thesis, Boston University School of Education, 1946.

<sup>2</sup>Anna Kiernan. "Construction and Evaluation of an Auditory Test of Word Analysis." Unpublished Master's Thesis, Boston University School of Education, 1950.

<sup>3</sup>Elizabeth Hincks. "Disability in Reading and Its Relation to Personality." Harvard University Monographs in Education No. 7. Cambridge: Harvard University Press, 1926.

associations. For hearing, they took tests for auditory memory, the Seashore Test for Pitch Discrimination, and a test for repeating sentences and digits. The relationship between reading difficulty and defective pitch discrimination was surprising and hard to explain, but she could not state what the relationship was. Research has shown that the letters u, o, a, e, i are ascending tones about an octave apart. She thought perhaps her subjects could not hear these octave differences, and this lack of pitch discrimination could explain their difficulty with phonetic sounds. Hincks also found that the auditory factor was only a causal factor in poor reading.

Monroe<sup>1</sup> studied the influence of poor auditory discrimination upon reading defects. Thirty-two unselected children in first grade were compared with a group of non-readers. They were both given twenty pairs of words, some alike and some different, and asked to tell which was which. The control group, or unselected children, who were younger chronologically and mentally, made fewer errors in auditory discrimination, and did better in the visual-auditory learning test. Monroe concluded:

Lack of precise auditory discrimination was found to impede the learning which involves auditory impressions. A correlation coefficient (method of rank), .51 .093, was obtained between the number of errors made in the auditory word-

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<sup>1</sup>Marion Monroe. Children Who Cannot Read. Chicago: The University of Chicago Press, 1932. p. 93-97.

discrimination test and the number of successes in the visual-auditory learning tests, for the thirty-two non-readers. A correlation coefficient was not obtained for the group of thirty-two controls. Their auditory word-discrimination errors were very few in number and had a small standard deviation, so that while the test differentiated the control group as a whole from the reading defect cases, it did not differentiate very well among the children of the control group.

Monroe did another study to find to what degree reading defect cases were handicapped in their perception of sound elements of words. One hundred and twenty-six children in the control group were matched with 269 reading-defect cases. Fifteen words were enunciated sound by sound. The children were told two sounds a second at first but the rate of speed increased to six. The author learned:

The reading-defect group was significantly different from the control in the ability to combine the isolated sounds into words. Some of the reading defect group had extreme difficulty with the test, and the group as a whole made a lower mean score than the control.

A study of psychological factors in reading and spelling was reported by Acomb.<sup>1</sup> He wanted to find the relationship between ten different factors, including auditory recognition of words produced. Three hundred and eighty children in grades three through six were included. He found the following correlations: visual-auditory .84; auditory recognition of words

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<sup>1</sup>Allan Acomb. "A Study of the Psychological Factors in Reading and Spelling." Unpublished Master's Thesis, Boston University School of Education, 1936.

pronounced and reading grade .71; auditory recognition of words pronounced and spelling grade .74; auditory recognition of words pronounced and speed of handwriting from copy .50 (depending on the visual memory of word patterns). Auditory recognition of words pronounced has a significant relationship to these: chronological and mental ages, reading and spelling grades, visual memory of word pattern, and speed of handwriting. Moreover, Acomb concluded:

1. The ability to distinguish through visual and auditory means, small differences between words with accuracy and rapidity, depends somewhat on mental age.
2. Visual and auditory discrimination, perception and associability, are highly significant factors in relation to reading ability.
3. Visual and auditory factors are significantly related to spelling ability.
4. Visual and auditory factors are definitely interrelated with one another, each recalling the other automatically during the reading process.

Schmidt<sup>1</sup> studied children with a reading disability for which no other cause of retardation could be found to discover the types of associative learning these pupils preferred. The 306 children were given six informal tests. One hundred and thirty-three, or 43 per cent, showed an auditory preference. They were divided into two groups, the experimental one, who

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<sup>1</sup>Bernadine Schmidt. "Teaching the Auditory Learner to Read." Chicago School Journal 19: 208-211; May 1938.

received auditory instruction, and the control one, who had non-auditory instruction. The results showed:

1. For the total eighty-two cases receiving auditory instruction, the average gain per pupil was found to be 2.32 grades; the median I. Q. for this group was 77.20 and the average amount of instruction per pupil was 86.6 clock hours.
2. In the total of fifty-one auditory learners given non-auditory instruction only an average gain of 1.83 grades was made per pupil, although the median I. Q. was 91 and the average amount of instruction per pupil was 109.6 clock hours. With lower I. Q.'s and less instruction than that given the non-auditory group, the average gain per pupil in the experimental group still exceeded that of the pupils in the control group.

In 1942 Bennett<sup>1</sup> studied errors in word recognition made by poor readers, as shown by 34,274 mistakes. They were collected by tutors. The results showed:

1. ...it was found that the beginning of words, the ending of words, and the presence of similar word parts of varying length are the dominant visual and auditory clues which call forth associated responses.
2. Errors in which the stimulus word and the response have like beginning and endings constitute 33 per cent of the total tabulation.
3. Reversals proved to be a close rival to median vowel errors and constituted 12 per cent of the total tabulation.
4. Although dominant letters or word parts played a very important part as visual and auditory clues in word recognition and pronunciation, nevertheless, the structure of the context in which the stimulus word was incorporated played its role in governing the verbal response.

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<sup>1</sup>Annette Bennett. "An Analysis of Errors in Word Recognition Made by Retarded Readers." Journal of Educational Psychology 33: 25-38; January 1942.

Robinson<sup>1</sup> attempted to identify severe reading retardation and evaluate reasons for it. Thirty poor readers were examined by specialists, who made appraisals of abnormalities responsible for below-average reading. Pertinent findings are that speech and functional auditory difficulties were causal factors in less than one-fourth of the cases, and that hearing loss was present in less than one-tenth of the cases.

Kennedy<sup>2</sup> studied children's hearing as it relates to reading. Four hundred and thirty-three pupils between the ages of six and twelve had their auditory discrimination and acuity tested, the latter being done by an audiometer. The group selected was a cross section, but came from a similar socio-economic background. The latter is important in loss of hearing cases, the author stated. The children had above-normal intelligence, and were superior in reading. Kennedy concluded:

1. There are significant differences in the mean auditory acuity of children between the ages of six and fifteen.
2. There is a somewhat greater tendency for good hearers to become good readers, and for those somewhat handicapped in hearing to read less well. Similarly, a good reader is more likely to have good hearing while the poor reader is more likely to have poor hearing.
3. Those with high frequency loss usually become either very good or very poor readers, more often the latter.

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<sup>1</sup>Helen M. Robinson. "Causes of Reading Failure." Education 67: 422-426; March 1947.

<sup>2</sup>Helen Kennedy. "A Study of Children's Hearing as it Relates to Reading." Journal of Experimental Education 10: 238-245; June 1942.

4. Obviously there is no ready answer to the problem of the relationship between reading and hearing.

Regarding the first point, the differences were most obvious between the ages of six and seven, seven and eight, and twelve and fifteen-year olds, no important ones between eight, ten and twelve year-olds. Younger boys had better acuity, and boys had right ear superiority, as did girls under fifteen. Results of the auditory discrimination test showed that the Seashore Test of Pitch Discrimination supported the idea that there is a change which concurs with age; results of the articulation test showed that speech combinations were interpreted as wholes and not individual elements. The author stated:

In teaching reading, then, it seems important that both the visual and the auditory be given attention and that attention be directed to the total configuration, both auditorially and visually, rather than to the individual component elements.

Fagg<sup>1</sup> analyzed the relationship between auditory discrimination and reading achievement. One hundred children from six first grades were given tests to measure intelligence, reading readiness and visual discrimination. She reported:

1. Auditory discrimination, as measured by the tests used in this study, does affect reading achievement to some extent. A correlation of .51 - .050 indicates a positive though relatively slight relationship existing between these two factors.

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<sup>1</sup>Dorothy W. Fagg. "A Study of the Relationships Between Auditory Analysis and Growth of Language Art Skills." Unpublished Master's Thesis, Boston University School of Education, 1942.

2. The relationship between auditory discrimination and reading achievement is not sufficiently close to warrant use of either auditory test in predicting reading success.
3. Of the additional factors considered in this investigation, visual discrimination shows the highest correlation with reading achievement (.48 - .050), followed by that of reading readiness (.45 - .054), and that of mental age (.40 - .057). All three correlations are slightly lower than that found for auditory discrimination through the group test.
4. No relationship appears to exist between chronological age and reading achievement (.03 - .067).
5. The two auditory tests, with a self-correlation of only .47 - .010, cannot be considered valid measures of the same ability. They tend to test similar phases of auditory perceptual ability, but differ in their sensitivity as measures.
6. No sex differences of statistic significance appear in this study for auditory or visual discrimination or for reading achievement.

Henry<sup>1</sup> tried to find a possible relationship between audiograms and achievement in reading at the elementary school level. Two hundred and eighty-seven children were tested by a Maico D5 Audiometer, in both ears two times, and acuity was determined for ten specific tones.

The pupils were given three tests -- the Progressive Achievement Test, Gates Primary Reading Test, and the Durrell Analysis of Reading Difficulties. Then they were divided into

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<sup>1</sup>Sybil Henry. "Children's Audiograms in Relation to Reading Achievement." Pedagogical Seminary and Journal of Genetic Psychology 70: 211-238; June 1947 and 71: 3-63; September 1947.

three groups according to different levels of reading ability, below normal, normal, and above normal. Pertinent conclusions were:

1. Definitely, keen high tone hearing is accompanied by good reading, and just as definitely some children are able in some manner to compensate for high-tone loss.
2. ...children having a slight amount of loss in either ear at either of the high frequencies will have higher reading quotients than children with a great deal of loss in either ear at either of the frequencies.
3. ...males had more high-tone loss than females.
4. From this study it would certainly seem that for the population under consideration, high-tone loss is one of the causes of reading deficiency, even that poor reading might be viewed as symptomatic of high-tone loss.
  - (a) The relationship that has been shown to exist between reading development and high-tone loss should be considered a phenomenon applicable to group rather than individual prognosis.

From this study Henry advanced the hypothesis:

Acute hearing for the high frequencies, because of the nature and importance of the consonant sounds, is of more importance to the child than is acute hearing for the low and medium frequencies.

Auditory Factors and Speech and Spelling

In 1931 Travis and Rasmus<sup>1</sup> gave a sound test to 383 normal speaking people and 165 speech defectives, from the age of five years up. He found:

- 1. An analysis of the errors of those individuals with the most severe disorders of articulation showed that a high percentage of the sounds missed in the test were those with which these cases were having speech difficulty.
- 2. At every age the defectives made significantly more errors on the test than normals.

As a result of their studies the authors claim:

- 1. There is no doubt a close relationship between hearing and the development and integrity of external speech. Total deafness or very defective hearing if it appears in the earliest period of life has a very unfavorable influence upon the evolution of speech.
- 2. If auditory acuity is so essential for proper speech development we may rightfully expect a more complex organism in the auditory field to be an important factor as well. One such complex organism may be termed "speech sound discrimination" which involves a judgment calling for distinction among meaningful speech sounds. The individual attaches different meanings to different sounds, providing first, he hears the sounds and second, that he discriminates among them. One has every reason to believe that the latter ability is as important as the former. ...It would appear also that a relatively small weakness in discriminatory powers in the child may lead to a serious defect in the speech development of the adult.

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<sup>1</sup>E. Travis and B. Rasmus. "The Speech Sound Discrimination Ability of Cases with Functional Disorders of Articulation." Quarterly Journal of Speech 17: 217-226; April 1931.

The hearing and speech characteristics of poor readers were studied in 1935 by Bond.<sup>1</sup> Statistic methods and case studies were employed. The children were all given a battery of individual tests, including auditory and speech tests. Results of the study showed:

1. A significant difference was found between the total control and experimental groups in auditory acuity. ✓
2. A significant difference was discovered between the total experimental and control groups in auditory discrimination. ✓
3. Significant differences were isolated in all categories between the experimental groups on auditory perception techniques. ✓
4. The results from the blending (fusion) tests produced a significant difference between the good and poor readers in all classifications.
5. A significant difference was found between the total experimental and control groups in memory of digits.
6. Differences, which were probably too great to be due to chance alone, were found between the total experimental and control groups and the phonetic experimental and control groups in memory of digits.
7. No difference in incidence of speech defects was discovered between good and poor readers in any one of the categories.

Bond states that where the situation and method of instruction favor the sensory abilities of the pupils, there was little difficulty with reading.

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<sup>1</sup>Guy Bond. "The Auditory and Speech Characteristics of Poor Readers." Contributions to Education, No. 657. New York: Teachers College, Columbia University, 1935.

Hall<sup>1</sup> compared functional articulatory speech defectives with a matched group of normal speakers to determine auditory factors such as acuity, perception, and memory. She also wanted to investigate a possible difference in auditory factors at various ages. Thus, university freshmen and elementary school children were used.

In the first of two experiments, at the college level, eighty-three functional speech defectives were matched with the same number of normal speakers who were equal in age, intelligence and sex. The two groups were compared on a 2-A Audiometer which tested acuity for pure tones at eight frequencies. They had two tests in auditory discrimination -- one simple and one hard -- and another for memory of speech sounds.

The second experiment was for twenty-one functional speech defectives between the ages of seven and thirteen years. They were matched with sixty-four normal speakers of the same ages, according to age, intelligence, and sex. The I. Q.'s of the experimental group ranged from 79 to 129, and the control groups from 82 to 120. The same kind of tests were used as in the first experiment. The results showed:

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<sup>1</sup>Margaret Hall. "Auditory Factors in Functional Articulatory Speech Defects." Journal of Experimental Education 7: 110-132; December 1938.

1. Functional articulatory speech defectives at either a university freshmen or an elementary school level were found to show no inferiority to normal speakers on measures of auditory acuity, auditory discrimination of either simple or complex speech patterns or on auditory memory for speech sounds.
2. Low or zero correlations were found between articulation ratings and all of the auditory tests; between the 2-A Audiometer and all the other auditory tests, between the 2-A Audiometer and measures of general ability or I.Q. Medium correlations were found between general ability or I.Q. and each of the three tests of auditory perception of speech, and between each two of the three auditory perception tests.
3. There was a close agreement between the two age levels in the articulatory errors occurring most frequently.... In all groups consonants far exceeded vowels in frequency of error.
4. Speech defectives and normal speakers at both age levels agreed closely on sound discrimination errors made most frequently, but those errors, for the speech defectives, were found to have no relation to articulatory errors.
5. Detailed analysis of the auditory perception tests reveal that for all groups vowels were consistently more easily discriminated and more easily remembered than consonants. They were also less frequently found as articulatory errors.
6. Cases with better than average acuity showed no superiority to cases below average in acuity in mean number of errors on the three auditory perception tests.

Speech-sound discrimination was studied by Linton.<sup>1</sup> There was a positive relationship between speech-sound discrimination

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<sup>1</sup>Louise M. Linton. "An Experimental Study of Speech-Sound Discrimination." Leland Stanford Junior University, 1939.

and several other factors, the most important being:

1. The women show a superiority over the men in speech-sound discrimination which points in the directions of basic sex differences.
2. There is probably a positive relationship between training in diction and phonetics and speech-sound discrimination, although the information on the amount of training used in this study offers data which is far from conclusive.
3. Even though speech-sound discrimination is probably one of a number of factors determining the quality of the individual's speech, in the speech of normal speakers, the relationship is not evident.
4. Evidence gathered from this study and from other sources indicate that this relationship (between speech-sound discrimination and foreign language ability) is in the nature of at least a partial dependence of language skill upon speech-sound discrimination.
5. There is a positive, though slight, relationship indicated between speech-sound discrimination and auditory memory span for vowels.
6. Of the Seashore tests<sup>1</sup> given to the subjects, the Tonal Memory scores show a slight relationship to speech-sound discrimination, but the Sense of Pitch scores show none.
7. Those subjects who have had musical training present higher speech-sound discrimination scores than do those who have had none.

In 1944, Hanson<sup>2</sup> gave sound discrimination tests to functional articulatory defectives with normal hearing, to determine

<sup>1</sup>C. E. Seashore, D. Lewis and J. Saetveit. Seashore Measures of Musical Talent. Camden, New Jersey: RCA Manufacturing Company, Inc., Educational Department, 1939.

<sup>2</sup>Burrell Hanson. "The Application of Sound Discrimination Tests to Functional Articulatory Defectives with Normal Hearing." Journal of Speech Disorders 9: 347-355; December 1944.

the differences, if any, between three experimental groups. The first took the Seashore Measure of Timbre; the second, the Travis-Glaspey Speech-Sound Discrimination Test; the third, a new Test of Vowel Sound Discrimination. The three groups had normal hearing acuity and were (1) untrained functional articulatory defectives, (2) functional articulatory defectives who had received clinical therapy, and (3) normal speakers. The results indicated:

(a) Untrained defectives did not suffer significantly from normal speakers in sound discrimination ability as here measured; (b) trained defectives did not differ significantly from untrained defectives in this ability; (c) trained defectives did not differ significantly from normal speakers in this ability.

Metraux<sup>1</sup> studied the auditory memory span for speech sounds among 414 children, from the ages of four-and-a-half to twelve-and-a-half to determine the differences between boys and girls, and the relationship between auditory memory span and mental age. She concluded:

1. There are significant differences in auditory memory span among the various age groups, for both the vowel and consonant test. The difference is not always statistically significant as between adjacent year-age levels, however.
2. There is no significant difference between the auditory memory span of the boys and that of the girls on either the vowel or the consonant test.

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<sup>1</sup>Ruth W. Metraux. "Auditory Memory Span for Speech Sounds." Journal of Speech Disorders 9: 31-38; March 1944.

3. There is no significant correlation between mental age and auditory memory span for vowels or consonants, at any age, in the group studied.

Utley<sup>1</sup> wanted to find the relationship between speech sound discrimination and extreme hearing loss. Fifty-one hard of hearing children were tested by the pure tone audiometer, and other tests were given for vowel and consonant discrimination ability. Coefficients of correlation were found between scores on the two types of discrimination, between discrimination scores and loss at individual frequencies, and between percentages of loss, as figured by different methods, and sound discrimination. Also, the percentage loss methods were correlated with each other. Pertinent conclusions were:

1. Errors on the vowel test and errors on the consonant test show a high positive correlation (.84).
2. Age seems to be of little consequence in relation to speech discrimination ability as measured by these tests.
3. I.Q., likewise, has no particular relationship to speech discrimination as measured by these tests.
4. There was a general tendency for the correlation between losses at specific frequencies and sound discrimination to increase with rise in frequency.
5. The high correlation among methods for computing percentage of hearing loss and the high correlations between loss, as computed by any method, and scores on the speech discrimination

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<sup>1</sup>Jean Utley. "The Relationship Between Speech-Sound Discrimination and Percentage of Hearing Loss." Journal of Speech Disorders 9: 103-113; June 1944.

test, suggest that methods of computing percentage of loss may be more predictive of residual auditory discrimination than is often supposed.

6. The present study has shown positive relationships between percentage loss and discrimination for speech sounds to exist in children with extreme hearing loss.

Sullivan<sup>1</sup> wanted to find the relationship of auditory acuity to defective speech in a general school population. One thousand, five hundred and one speech-defective children were used, who were tested by a Maico D6 Audiometer. The author found:

1. The higher percentage of stutterers, structural articulatory cases and cases of oral inactivity show a hearing loss in one or both ears is probably symptomatic of the general condition of these pupils and should be considered in therapeutic treatment.
  - (a) ...hearing loss in the high frequencies is not to be regarded as outstanding in a significant relationship to their defective speech.

Siegenthaler<sup>2</sup> compared the relationship between measuring hearing loss and intelligibility of certain words. He used two types of hard-of-hearing people and one group of normal hearers. A word test was given to all subjects. There was a pair of words, and the one presented was to give a stimulus for the other word which was like it, while the subject told the one he thought he heard. The results showed:

<sup>1</sup>E. M. Sullivan. "Auditory Acuity and Its Relation to Defective Speech." Journal of Speech Disorders 9: 127-129; June 1944.

<sup>2</sup>Bruce M. Siegenthaler. "A Study of the Relationship Between Measuring Hearing Loss and Intelligibility of Selected Words." Journal of Speech and Hearing Disorders 14: 111-118; June 1949.

1. ...persons with different patterns of hearing acuity for pure tones give different and distinctive patterns of responses to selected words administered in the manner of the word test.
2. Furthermore, the concept that an equal amount of hearing loss for the pure tones usually tested with the pure tone audiometer has the effect of simply raising the threshold for speech is not supported by the experimental results.

The same author<sup>1</sup> the following year studied sustained vowels to determine how easily they were recognized, if there was a difference in the recognizability of them according to the speaker, if an expert listener could identify them better than an average person, and what was heard when a vowel was incorrectly identified. To find the answers a special type of vowel sound was used. Four instructors intoned ten vowels for fifteen to twenty seconds, so forty sounds were recorded on a magnetic tape. The listeners had a scoring sheet on which were ten short words with ten vowels for test items, and they indicated the word having the vowel sound that they heard. The forty vowel sounds were heard and judged three times by the twenty-six listeners, who were divided into two groups, the so-called "experts" and "inexperts". As conclusions for his study Siegenthaler reported:

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1. Bruce M. Siegenthaler. "A Study of the Intelligibility of Sustained Vowels." Quarterly Journal of Speech 36: 202-208; April 1950.

1. Normal hearing persons were able to identify correctly about 52 per cent of the sustained vowel sounds.
2. Certain sustained vowel sounds were more accurately identified than others. The vowel i was usually more correctly recognized than others, while the vowels u and e were usually recognized least accurately.
3. Significant differences were observed in the recognizability to both groups of listeners (experts and inexperts) of vowels as produced by different voices. Significant differences were observed in all-over recognizability of different voices for inexpert listeners, while significant differences did not appear in over-all recognizability of different voices for expert listeners. There were also significant differences in the recognizability of different vowels as produced by the same voice for both listening groups.
4. In general, expert listeners were not able to identify sustained vowels more accurately than inexpert listeners. Observed differences were not shown to be statistically significant.
5. It appears that the auditory effect of a sustained vowel sound with respect to recognizability is strongly affected by the voice which produces the sound.

In 1940 Spache<sup>1</sup> analyzed errors of good and poor spellers, by taking twenty-five average and twenty-five poor ones in the third through fifth grades. His specific purpose was to check results of other studies in spelling, and by using another formula he obtained different results. He reported:

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<sup>1</sup>George Spache. "Characteristic Errors of Good and Poor Spellers." Journal of Educational Research 34: 182-189; November 1940.

1. When errors are classified as phonic and non-phonic, there appears a definite tendency for the average spellers to make a greater number and per cent of phonic errors than do the poor spellers. Conversely, there is an equally definite tendency for the poor spellers to make a greater number and per cent of non-phonic errors than do the average spellers.
2. Specific error types in which average spellers may exceed in number or per cent to a significant extent are phonic addition of single letters and phonic substitution for a syllable.
3. Errors in which poor spellers may exceed average spellers to a significant extent are non-phonic substitutions for a syllable, incomplete and unrecognizable spellings.
4. Although not wholly recognizable differences were found in the present study, there appears to be a strong tendency for average spellers to exceed the poor in number and per cent of omission of sounded letters, omission of a syllable and total non-phonic substitutions.

Brooke<sup>1</sup> compared the recognition and recall of word elements, in measuring visual and auditory perception in spelling, to find out about the amount and position of errors in the tests given, and to see if there was any patterns to these errors. The tests consisted of configurations made up of common word elements -- prefixes, roots, and suffixes -- and they were given to 180 fourth, fifth, and sixth grade children. The auditory results showed:

1. The recall test was a little better than the recognition one in measuring auditory perception of the configurations, composed of common word elements.

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<sup>1</sup>B. A. Brooke. "The Construction and Use of a Group Test for the Analysis of Spelling Difficulties." Unpublished Master's Thesis, Boston University School of Education, 1947.

- a. The correlations made between spelling achievement and auditory perception of fourth, fifth, and sixth graders combined showed recall to be only slightly superior to recognition.
  - b. The same slight superiority existed when correlations were made in each separate group.
2. In this study, mental age was shown to have a slightly higher correlation with auditory perception than with visual perception, and a slightly higher correlation with auditory recall than with auditory perception.

Nichols<sup>1</sup> built a group test for the purpose of finding specific causes of spelling failure. About 1,600 children in grades three through six were given six sub-tests, including one in auditory discrimination. She found a correlation between spelling achievement and auditory discrimination of .63 = .04, in grade three. Thus, she concluded that the latter factor bears a significant relationship to spelling. She also discovered a high correlation between the whole test and its parts, but the relationship between the latter was negligible, proving that each part contributes to the measure of auditory discrimination.

Hudson and Toler<sup>2</sup> used auditory and visual discrimination to improve spelling. A group of poor spellers was chosen by

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<sup>1</sup>A. M. Nichols. "The Construction and Use of a Group Test for the Analysis of Spelling Difficulties." Unpublished Master's Thesis, Boston University School of Education, 1947.

<sup>2</sup>Jess T. Hudson and Lola Toler. "Instruction in Auditory and Visual Discrimination as a Means of Improving Spelling." Elementary School Journal 49: 466-469; April 1949.

means of an initial test, and they were given auditory discrimination and visual analysis, the basis of the former being Building Word Power.<sup>1</sup> A spelling test was given at the beginning and end of the period. The two kinds of training were done separately from spelling, and the idea was for discrimination to carry over into the latter. After four months, Hudson and Toler discovered:

1. The average gain made by the entire number of pupils was 5.2 words, or a gain of 85.2 per cent in terms of the number of words spelled correctly on the initial test. The largest gains were made in grade four.
2. An analysis of the results showed a considerable difference in the range of average gains made by the eighteen groups. The least gain in correctly spelled words was 1.9, made by one group of thirteen pupils in grade four. The largest gain was 8.3, made by another fourth grade group of eleven pupils. However, all but six of the eighteen groups made gains within the range of 4.4 and 4.7.

An implication of the study was that remedial auditory and visual discrimination training helped greatly in the improvement of spelling. But the authors do not suggest that these are the entire cure for spelling difficulties as there are always non-phonetic words even though the ones used in the tests were reasonably or entirely phonetic.

Smith<sup>2</sup> compared the achievement of two groups of spelling

<sup>1</sup>D. D. Durrell, H. B. Sullivan, H. A. Murphy, and K. M. Junkins, op. cit.

<sup>2</sup>Doris G. Smith. "The Effect of Specific Training in Auditory Perception on the Spelling of Twenty-Three Seventh Grade Cases of Spelling Disability." Unpublished Master's Thesis, Boston University School of Education, 1949.

disability pupils in grade seven, the experimental one having a weekly period in auditory perception for twenty weeks, and the control group who had no help. Every child was given the Otis Test of Mental Ability and the Stanford Achievement Tests.

Smith reported:

1. A comparison of the spelling grades obtained for each group at the close of their sixth and seventh years shows a greater gain in spelling for the experimental group to which was given specific drill in auditory perception.
2. In the control group, on the other hand, three pupils showed losses, according to the test results, and one registered neither gain nor loss.
3. The experimental group showed a median gain of 9.9 months as compared to a median loss of 4.8 for the control group.
4. The critical ratio of 3.71, obtained from a comparison of the gains in spelling by pupils of the experimental group with those of the control group, permits the conclusion that if the same experiment were repeated, with all the circumstances exactly repeated, the same results would be obtained nine hundred and eighty-nine times out of a thousand. Since...the members of the experimental group, to whom specific drill was given, showed 5.1 months more gain in spelling than members of the control group, who did not have this special training, it seems a reasonable assumption that specific drill in auditory perception may have some value in helping to improve the spelling of cases of spelling disability at the seventh grade level.

Research has shown that auditory discrimination is an important factor in learning to read, to spell and to speak. Therefore, this study is an attempt to study other factors important in auditory discrimination.

CHAPTER II

PLAN OF THE STUDY

## CHAPTER II

### PLAN OF THE STUDY

The data for this study was obtained from the information gathered from tests given in nine communities including large cities and smaller residential towns.

Table I shows the mean chronological and mental ages for the children included in the study.

TABLE I  
MEAN CHRONOLOGICAL AND MENTAL AGES

Grade	Number	Mean C.A.	S.D.	Mean M.A.	S.D.
1	356	78.00	4.90	82.00	1.81
2	213	89.00	6.63	100.00	9.54
3	322	101.00	8.65	104.00	12.72

Three group tests and four individual tests were given during January of 1951. The group tests included a phonics test, intelligence test, and a reading achievement test. The Detroit Word Recognition<sup>1</sup> was used in grade one and the Detroit Reading Test<sup>2</sup> in grades two and three.

<sup>1</sup>World Book Company, New York, 1925.

<sup>2</sup>World Book Company, New York, 1927.

The phonics test given in grades one and two was the Nason<sup>1</sup> test of forty items plus twenty additional items of increased difficulty. The test included sixty multiple-choice items: nineteen measuring beginning sounds; seven measuring final consonants; nineteen measuring initial and final sounds combined and fifteen measuring phonograms. There was a choice from three words for each item. The children were to circle the one word in each item that contained the same sound as the word pronounced by the examiner. The words to be circled were not in the children's reading vocabulary and were not pronounced by either the children or the teacher during the test. Words unfamiliar to the children were deliberately chosen in order to test the auditory transfer of the sounds in the words pronounced. Each test item counted one point of score. The total possible score was 60. A copy of the test and directions for scoring and administering may be found in the appendix.

The phonics test for grade three consisted of twenty-four items. Each item was made up of six single letters or blends. The teacher pronounced a word not in the children's reading vocabulary and the children circled the sounds they heard. The total possible score on the test was 144. A copy of the test with directions for administering and scoring may be

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<sup>1</sup>Doris Nason. "Phonic Analysis Test." Unpublished Thesis, Boston University School of Education, 1950.

found in the appendix.

Pintner Cunningham Test<sup>1</sup> of Mental Abilities, Primary Form was used for intelligence quotients.

Three of the individual tests given were taken from Monroe's<sup>2</sup> Reading Aptitude Test. These tests were given to all three grades.

- A. A language test measured the extent of the child's vocabulary in three areas: animals, things to eat, and toys. Thirty seconds were allowed for each item and one point of score was counted for each object named by the child.
- B. Speed of articulation was measured by asking each child to repeat three different items: banana, long ago, take a bite. Each task was continued for fifteen seconds and the score was the total number of repetitions.
- C. Accuracy of articulation was measured by having each child repeat after the teacher a list of words and phrases. One point of score was counted for each item correctly repeated. The total possible score was twelve.

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<sup>1</sup>World Book Company.

<sup>2</sup>Marion Monroe. Reading Aptitude Test. Boston: Houghton Mifflin Company, 1935.

The fourth test measured singing ability. A child was scored as an accurate singer if he could remain on pitch and carry a given tune. If this was not possible, he was listed as an uncertain singer.

The intelligence quotient, mental age, and hearing acuity were obtained from the school records. Tests for the above were given if this information was not available.

A record sheet including the child's name, sex, chronological age, mental age, intelligence quotient, hearing, singing ability, extent of vocabulary, speed of articulation, accuracy of articulation, phonics, and reading was completed for each class. A copy of the record sheet may be found in the appendix.

Correlations were completed between the ability to identify word sounds, which was the score obtained on the phonics test, and the mental age, reading score, accuracy of articulation, speed of articulation, and extent of vocabulary.

Quartile Charts were computed for mental age, ability to identify word sounds, reading scores, accuracy of articulation, speed of articulation, extent of vocabulary, hearing, singing ability, and sex differences.

The tests were analyzed and the results are presented in the next chapter.

CHAPTER III

ANALYSIS OF THE DATA

## CHAPTER III

### ANALYSIS OF THE DATA

The results of the tests were analyzed to discover if a child's ability to identify word sounds is influenced by his:

1. Mental age
2. Reading vocabulary
3. Accuracy of articulation
4. Speed of articulation
5. Extent of vocabulary
6. Hearing
7. Singing ability
8. Sex

Correlations and comparisons of quartile scores were studied.

Table II shows the relationships between the ability to identify word sounds, and the factors studied for grades one, two, and three.

TABLE II  
RELATIONSHIPS BETWEEN ABILITY TO IDENTIFY  
SOUNDS AND FACTORS STUDIED FOR GRADES I, II, III

Factors	Grade I	No. 352	Grade II	No. 213	Grade III	No. 322
	r	SE <sub>r</sub>	r	SE <sub>r</sub>	r	SE <sub>r</sub>
Mental Age	.46	.042	.31	.062	.54	.039
Reading	.56	.037	.52	.05	.52	.041
Accuracy Articulation	.07	.055	.07	.068	.24	.053
Speed Articulation	.007	.053	.23	.065	.13	.055
Vocabulary	.19	.051	.05	.069	.41	.045

The correlations for grade one ranged from .56 with reading to .007 with speed of articulation, for grade two from .52 with reading to .05 for vocabulary, and for grade three from .54 with mental age to .13 for speed of articulation.

Table III shows the comparisons between the quartiles in mental age for grade one.

TABLE III  
COMPARISON IN MENTAL AGE BETWEEN QUANTILES, GRADE I

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	85	92.88	4.35	.475	7.20	.504	14.29
3	85	85.68	1.55	.170			
3	85	85.68	1.55	.170	8.56	.489	17.51
2	85	77.12	4.2	.459			
2	85	77.12	4.2	.459	7.28	.729	9.99
1	85	69.84	5.19	.567			
4	85	92.88	4.35	.475	23.04	.739	31.18
1	85	69.84	5.19	.567			

The critical ratios between  $Q_4$  and  $Q_3$ ,  $Q_3$  and  $Q_2$ ,  $Q_2$  and  $Q_1$  are statistically significant in favor of the population in the upper quartile in each case. The range of mean scores was from 92.88 months to 69.84 months.

Table IV shows the comparisons between the quartiles in mental age for grade two.

TABLE IV  
COMPARISON OF MENTAL AGE BETWEEN QUANTILES, GRADE II

Quartiles	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	53	105	5.37	.737	7	.75	9.34
3	51	98	1.43	.20			
3	51	98	1.43	.20	8	.289	27.68
2	50	90	1.5	.209			
2	50	90	1.5	.209	9	.817	11.01
1	56	81	5.91	.79			
4	53	105	5.37	.737	24	1.08	19.99
1	56	81	5.91	.79			

There were significant differences between  $Q_4$  and  $Q_3$ ,  $Q_3$  and  $Q_2$ ,  $Q_2$  and  $Q_1$ . The range of mean scores was from 105 months to 81 months.

Table V shows the comparisons between the quartiles in mental age for grade three.

TABLE V  
COMPARISON OF MENTAL AGE BETWEEN QUARTILES, GRADE III

Quartile	No.	Mean	S.D.	S.D.	Mean Diff.	S.E. Diff.	C. R.
4	82	122.37	7.35	.72	15.86	.91	17.42
3	80	106.51	5.19	.55			
3	80	106.51	5.19	.55	7.07	.78	9.06
2	80	99.44	4.47	.55			
2	80	99.44	4.47	.55	11.92	.86	13.86
1	80	87.52	5.19	.65			
4	82	122.37	7.35	.72	34.85	.97	35.92
1	80	87.52	5.19	.65			

There were significant differences between all of the quartiles, the largest being between Q<sub>4</sub> and Q<sub>3</sub> with a difference in mean score of 15.86 points. The difference between Q<sub>4</sub> and Q<sub>1</sub> was 34.85 points.

Table VI shows the comparison of mean scores by quartiles of the Auditory Test for grade one.

TABLE VI  
 COMPARISON OF MEAN QUARTILE SCORES  
 OF AUDITORY TEST, GRADE I

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	85	44.06	5.49	.6	11.78	.64	18.4
3	85	32.28	2.25	.245			
3	85	32.28	2.25	.245	4.08	.328	12.4
2	85	28.2	1.98	.22			
2	85	28.2	1.98	.22	9.52	.527	18.06
1	85	18.68	4.38	.48			
4	85	44.06	5.49	.6	25.36	.768	33.05
1	85	18.68	4.38	.48			

The critical ratios between  $Q_4$  and  $Q_3$ ,  $Q_3$  and  $Q_2$ ,  $Q_2$  and  $Q_1$  are statistically significant in favor of the population in the upper quartile in each case. The mean scores range from 44.06 to 18.68.

Table VII shows the comparison of mean scores by quartiles of the Auditory Test for grade two.

TABLE VII  
COMPARISON OF MEAN QUARTILE SCORES  
OF AUDITORY TEST, GRADE II

Quartiles	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	47	56.85	1.90	.275	7.37	.394	18.70
3	58	49.48	2.16	.283			
3	58	49.48	2.16	.283	9.48	.442	21.22
2	57	40.00	2.57	.341			
2	57	40.00	2.57	.341	14.76	.786	18.68
1	50	25.24	5.01	.709			
4	47	56.85	1.90	.275	31.61	.76	49.59
1	50	25.24	5.01	.709			

There were significant differences between  $Q_4$  and  $Q_3$ ,  $Q_3$  and  $Q_2$ ,  $Q_2$  and  $Q_1$ . The range of mean scores was from 56.85 for  $Q_4$  to 25.24 for  $Q_1$ .

Table VIII shows the comparison of mean scores by quartiles of the Auditory Test for grade three.

TABLE VIII  
 COMPARISON OF MEAN QUARTILE SCORES  
 OF AUDITORY TEST, GRADE III

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	82	133.16	3.00	.339	8.95	.441	20.2
3	80	124.21	2.52	.284			
3	80	124.21	2.52	.284	9.63	.48	20.0
2	80	114.58	3.57	.385			
2	80	114.58	3.57	.385	16.64	.63	26.4
1	80	97.94	6.70	.750			
4	82	133.16	3.00	.339	35.22	.26	135.0
1	80	97.94	6.70	.750			

There were significant differences between all of the quartiles. The largest difference was between  $Q_2$  and  $Q_1$ . The range of mean scores was from 133.16 to 97.94.

Table IX shows the comparison by quartiles of mental age scores, and the ability to identify word elements for grade one.

TABLE IX

COMPARISON OF MENTAL AGE SCORES AND THE  
ABILITY TO IDENTIFY WORD ELEMENTS, GRADE I

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	85	35.50	9.27	1.01	2.44	1.49	1.64
3	85	33.06	10.11	1.10			
3	85	33.06	10.11	1.10	4.55	1.41	3.23
2	85	28.51	8.07	.881			
2	85	28.51	8.07	.881	4.38	1.25	3.50
1	85	24.13	8.16	.891			
4	85	35.50	9.27	1.01	11.37	1.34	8.49
1	85	24.13	8.16	.891			

The critical ratios between  $Q_3$  and  $Q_2$  and between  $Q_2$  and  $Q_1$  are statistically significant in favor of the population in the upper quartile.

The critical ratio between  $Q_4$  and  $Q_3$  is not statistically significant. There are 88 chances in a hundred that this is a true difference in favor of  $Q_4$ . The range of mean scores is from 35.50 for  $Q_4$  to 24.13 for  $Q_1$ .

Table X shows the comparison by quartiles of mental age scores and the ability to identify word elements for grade two.

TABLE X  
COMPARISON OF MENTAL AGE SCORES AND THE  
ABILITY TO IDENTIFY WORD ELEMENTS, GRADE II

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	50	48.70	9.90	1.29	3.27	1.82	1.79
3	54	45.43	9.55	1.29			
3	54	45.43	9.55	1.29	5.63	2.50	2.25
2	50	39.80	15.40	2.17			
2	50	39.80	15.40	2.17	1.35	2.87	.47
1	55	38.45	14.40	1.91			
4	50	48.70	9.90	1.29	9.25	2.30	4.02
1	55	38.45	14.40	1.91			

There were no significant differences between any of the quartiles. The range of the mean scores was from 48.70 for Q<sub>4</sub> to 38.45 for Q<sub>1</sub>. The largest difference was between Q<sub>3</sub> and Q<sub>2</sub>, and the smallest between Q<sub>2</sub> and Q<sub>1</sub>.

Table XI shows the comparison by quartiles of mental age scores and the ability to identify word elements for grade three.

TABLE XI

COMPARISON OF MENTAL AGE SCORES AND THE  
ABILITY TO IDENTIFY WORD ELEMENTS, GRADE III

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	82	125.65	10.00	.99	8.77	1.63	5.38
3	82	116.88	12.25	1.30			
3	82	116.88	12.25	1.30	6.29	2.10	2.99
2	82	110.59	13.23	1.65			
2	82	110.59	13.23	1.65	2.34	2.41	.97
1	82	112.93	14.15	1.76			
4	82	125.65	10.00	.99	12.72	2.02	6.29
1	82	112.93	14.15	1.76			

There were significant differences between  $Q_4$  and  $Q_3$  and  $Q_3$  and  $Q_2$ . There was a difference between the means of  $Q_4$  and  $Q_1$  of 12.72 points.

Table XII shows the comparison of mean reading vocabulary scores and the ability to identify word elements by quartiles for grade one.

TABLE XII

COMPARISON OF READING VOCABULARY AND THE  
ABILITY TO IDENTIFY WORD ELEMENTS, GRADE I

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	85	20.00	9.36	1.02	5.52	1.36	4.06
3	85	14.48	8.61	.9			
3	85	14.48	8.61	.9	7.95	1.08	7.36
2	85	6.53	5.7	.6			
2	85	6.53	5.7	.6	1.80	.85	2.24
1	85	8.33	5.7	.6			
4	85	20.00	9.36	1.02	11.67	1.18	9.89
1	85	8.33	5.67	.6			

The critical ratios between  $Q_4$  and  $Q_3$  and  $Q_3$  and  $Q_2$  are statistically significant in favor of the population in the upper quartile in each case.

The critical ratio between  $Q_2$  and  $Q_1$  is not statistically significant. There are 96 chances in a hundred that this is a true difference in favor of  $Q_1$ . The range of mean scores is from 20.00 to 6.53.

Table XIII shows the comparison of mean reading scores and the ability to identify word elements by quartiles for grade two.

TABLE XIII

COMPARISON OF READING VOCABULARY AND THE  
ABILITY TO IDENTIFY WORD ELEMENTS, GRADE II

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	49	19.18	5.01	.71			
3	56	14.88	7.02	.94	4.30	1.18	3.64
3	56	14.88	7.02	.94			
2	55	10.22	6.48	.87	4.66	1.28	3.64
2	55	10.22	6.48	.87			
1	53	8.08	4.89	.67	2.14	1.10	1.95
1	53	8.08	4.89	.67			
4	49	19.18	5.01	.71			
1	53	8.08	4.89	.67	11.10	.98	11.33

There were significant differences between  $Q_4$  and  $Q_3$ , and  $Q_3$  and  $Q_2$ . The difference between  $Q_2$  and  $Q_1$  was not significant. The range of mean scores was from 19.18 for  $Q_4$  to 8.08 for  $Q_1$ .

Table XIV shows the comparison of mean reading scores and the ability to identify word elements by quartiles for grade three.

TABLE XIV

COMPARISON OF READING VOCABULARY AND THE  
ABILITY TO IDENTIFY WORD ELEMENTS, GRADE III

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	77	20.04	4.23	.445	2.61	.93	2.80
3	76	17.43	6.21	.815			
3	76	17.43	6.21	.815	.90	1.04	.87
2	76	16.53	5.82	.642			
2	76	16.53	5.82	.642	3.78	.96	3.90
1	76	12.75	6.15	.710			
4	77	20.04	4.23	.445	7.29	.84	8.67
1	76	12.75	6.15	.710			

The only significant difference was between  $Q_2$  and  $Q_1$ .  
The smallest difference was between  $Q_3$  and  $Q_2$ .

Table XV shows the comparison of accuracy of articulation  
test scores and the ability to identify word elements for  
grade one.

TABLE XV  
COMPARISON OF ACCURACY OF ARTICULATION  
AND THE ABILITY TO IDENTIFY WORD ELEMENTS, GRADE I

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	85	11.21	2.76	.301	.70	.459	1.53
3	85	11.91	3.18	.347			
3	85	11.91	3.18	.347	.53	.469	1.13
2	85	12.44	2.90	.317			
2	85	12.44	2.90	.317	.74	.458	1.62
1	85	11.70	3.03	.331			
4	85	11.21	2.76	.301	.49	.448	1.09
1	85	11.70	3.03	.331			

None of the differences were significant. The means were not in order by quartiles, the highest one being  $Q_2$  followed in descending order by  $Q_3$ ,  $Q_1$ , and  $Q_4$ .

Table XVI shows the comparison of accuracy of articulation test scores and the ability to identify word elements for grade two.

TABLE XVI  
COMPARISON OF ACCURACY OF ARTICULATION  
AND THE ABILITY TO IDENTIFY WORD ELEMENTS, GRADE II

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	48	12.63	.96	.136	.06	.167	.359
3	51	12.57	.787	.102			
3	51	12.57	.787	.102	.04	.207	.193
2	59	12.61	1.41	.183			
2	59	12.61	1.41	.183	.96	1.12	.85
1	57	11.85	.84	1.11			
4	48	12.63	.96	.136	.78	1.12	.696
1	57	11.85	.84	1.11			

There were no significant differences between any of the quartiles. The order did not remain constant with the quartiles. The highest mean score was  $Q_4$ . The order was  $Q_2$ ,  $Q_3$ , and  $Q_1$  for the remaining quartiles. The range of the mean scores was from 12.63 to 11.85.

Table XVII shows the comparison of accuracy of articulation test scores and the ability to identify word elements for grade three.

TABLE XVII  
 COMPARISON OF ACCURACY OF ARTICULATION  
 AND THE ABILITY TO IDENTIFY WORD ELEMENTS, GRADE III

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	75	11.59	2.45	.262	.26	.28	.94
3	73	11.33	1.00	.120			
3	73	11.33	1.00	.120	.19	.17	1.14
2	73	11.13	1.00	.124			
2	73	11.13	1.00	.124	.23	.20	1.17
1	73	10.90	1.41	.165			
4	75	11.59	2.45	.262	.69	.31	2.22
1	73	10.90	1.41	.165			

There were no significant differences between the quartiles. The largest difference was between  $Q_4$  and  $Q_1$ .

Table XVIII shows the comparison of speed of articulation scores and the ability to identify word elements by quartiles for grade one.

TABLE XVIII

COMPARISON OF SPEED OF ARTICULATION AND THE  
ABILITY TO IDENTIFY WORD ELEMENTS, GRADE I

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	85	49.73	8.88	.969	1.32	1.33	.99
3	85	48.41	8.31	.907			
3	85	48.41	8.31	.907	1.66	1.36	1.22
2	85	46.75	9.33	1.02			
2	85	46.75	9.33	1.02	.38	1.49	.26
1	85	46.37	9.96	1.09			
4	85	49.73	8.88	.969	3.36	1.46	2.30
1	85	46.37	9.96	1.09			

There were no significant differences. The largest difference was between  $Q_3$  and  $Q_2$ , and the smallest between  $Q_2$  and  $Q_1$ .

Table XIX shows the comparison of speed of articulation scores and the ability to identify word elements by quartiles for grade two.

TABLE XIX

COMPARISON OF SPEED OF ARTICULATION AND THE  
ABILITY TO IDENTIFY WORD ELEMENTS, GRADE II

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	49	55.63	8.75	1.25	1.36	1.70	.80
3	56	54.27	8.60	1.15			
3	56	54.27	8.60	1.15	2.55	1.92	1.33
2	55	56.82	11.40	1.54			
2	55	56.82	11.40	1.54	3.10	2.40	1.29
1	53	53.72	13.40	1.84			
4	49	55.63	8.75	1.25	1.91	2.22	.86
1	53	53.72	13.40	1.84			

There were no significant differences between any of the quartiles. The order did not remain constant with the quartiles. The highest mean score was Q<sub>2</sub>. Q<sub>4</sub>, Q<sub>3</sub>, and Q<sub>1</sub> followed in descending order. The range of mean scores was from 56.82 to 53.72.

Table XX shows the comparison of speed of articulation scores and the ability to identify word elements by quartiles for grade three.

TABLE XX

COMPARISON OF SPEED OF ARTICULATION AND THE  
ABILITY TO IDENTIFY WORD ELEMENTS, GRADE III

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	77	61.39	10.25	1.16	.26	1.61	.16
3	76	61.65	9.78	1.12			
3	76	61.65	9.78	1.12	.32	1.58	.20
2	76	61.33	9.93	1.13			
2	76	61.33	9.93	1.13	1.23	1.72	.71
1	76	60.10	11.40	1.30			
4	77	61.39	10.25	1.16	1.29	1.74	.74
1	76	60.10	11.40	1.30			

There were no significant differences between the quartiles. The largest difference was between  $Q_2$  and  $Q_1$  with a difference in mean score of 1.23 points.

Table XXI shows the comparison of extent of vocabulary scores and the ability to identify word elements by quartiles for grade one.

TABLE XXI  
COMPARISON OF EXTENT OF VOCABULARY SCORES  
AND THE ABILITY TO IDENTIFY WORD ELEMENTS, GRADE I

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	G.R.
4	85	18.02	5.01	.55	1.18	.70	1.69
3	85	16.84	4.11	.45			
3	85	16.84	4.11	.45	.20	.607	.33
2	85	17.04	3.93	.429			
2	85	17.04	3.93	.429	.43	.659	.65
1	85	16.61	4.59	.501			
4	85	18.02	5.01	.55	1.41	.743	1.90
1	85	16.61	4.59	.501			

There were no significant differences. The order was not constant by quartiles. The highest mean score was Q<sub>4</sub> followed by Q<sub>2</sub>, Q<sub>3</sub>, and Q<sub>1</sub> in descending order.

Table XXII shows the comparison of extent of vocabulary scores and the ability to identify word elements by quartiles for grade two.

TABLE XXII  
 COMPARISON OF EXTENT OF VOCABULARY SCORES  
 AND THE ABILITY TO IDENTIFY WORD ELEMENTS, GRADE II

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
4	48	18.62	4.68	.68	0	.91	0
3	56	18.62	4.50	.60			
3	56	18.62	4.50	.60	1.77	.81	2.18
2	56	16.85	4.02	.54			
2	56	16.85	4.02	.54	.72	.79	.91
1	51	16.13	4.08	.57			
4	48	18.62	4.68	.68	2.49	.88	2.82
1	51	16.13	4.08	.57			

There were no significant differences between any of the quartiles. The greatest difference was between  $Q_3$  and  $Q_2$ . The highest mean score was 18.62 which was the same for  $Q_4$  and  $Q_3$ . The range of mean scores was from 18.62 for  $Q_4$  to 16.13 for  $Q_1$ .

Table XXIII shows the comparison of extent of vocabulary scores and the ability to identify word elements by quartiles for grade three.

TABLE XXIII  
COMPARISON OF EXTENT OF VOCABULARY SCORES  
AND THE ABILITY TO IDENTIFY WORD ELEMENTS, GRADE III

Quartile	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	G.R.
4	79	21.30	5.19	.55	.19	.79	.24
3	79	21.10	5.19	.57			
3	79	21.10	5.19	.57	.07	.85	.08
2	79	21.18	5.19	.64			
2	79	21.18	5.19	.64	.78	.80	.97
1	79	21.96	4.23	.48			
4	79	21.30	5.19	.55	.66	.72	.91
1	79	21.96	4.23	.48			

There were no significant differences between the quartiles. The largest difference was between  $Q_2$  and  $Q_1$ .

There were very few hearing difficulties reported. Second grade population had none. The third grade was the largest, probably the most accurate because results were based on audiometer test, while grades one and two had the whispering test.

Table XXIV shows the comparison of hearing difficulties and the ability to identify word elements for grade one.

TABLE XXIV

COMPARISON OF HEARING DIFFICULTIES AND THE ABILITY TO IDENTIFY WORD ELEMENTS, GRADE I

Quartile	No.	Number of Hearing Difficulties	Per Cent
4	85	2	2.4
3	85	1	1.2
2	85	1	1.2
1	85	3	3.5

The number of hearing difficulties in the population was very low, the largest number 3, was in the lowest quartile.

Table XXV shows the comparison of hearing difficulties and the ability to identify word elements for grade three.

TABLE XXV

COMPARISON OF HEARING DIFFICULTIES AND THE ABILITY TO IDENTIFY WORD ELEMENTS, GRADE III

Quartile	No.	Number of Hearing Difficulties	Per Cent
4	92	12	13
3	84	10	12
2	65	9	13
1	76	11	14

There was little difference in this factor.

Table XXVI shows the per cent of inaccurate singers in each quartile based on ability to identify word elements for grade one.

TABLE XXVI  
COMPARISON OF INACCURATE SINGERS AND THE  
ABILITY TO IDENTIFY WORD ELEMENTS, GRADE I

Quartile	No.	Per Cent	S.E.	Per Cent Diff.	S.E. Diff.	C.R.
4	25	29.41	9.1	1.18	.008	1.47
3	26	30.59	9.1			
3	26	30.59	9.1	12.94	.015	8.62
2	37	43.53	8.2			
2	37	43.53	8.2	5.88	.014	4.20
1	32	37.65	8.6			

There were significant differences between  $Q_3$  and  $Q_2$  and  $Q_2$  and  $Q_1$ . The quartiles were not in order, the highest per cent of inaccurate singers were in  $Q_2$  and  $Q_1$ .  $Q_3$ ,  $Q_4$  followed in descending order.

The second grade had only 35 children reported as inaccurate singers so this comparison was done on the total population. Table XXVII shows the comparison of singing ability and the ability to identify word elements in grade two.

TABLE XXVII  
COMPARISON OF MUSIC ABILITY AND THE  
ABILITY TO IDENTIFY WORD ELEMENTS, GRADE II

	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	G.R.
Accurate Singers	120	42.85	11.43	1.04	.29	2.22	.13
Inaccurate Singers	35	42.56	11.61	1.96			

There was little difference in the mean scores of these two groups.

Table XXVIII shows the comparison of singing ability and the ability to identify word elements for grade three.

TABLE XXVIII

COMPARISON OF INACCURATE SINGERS AND THE  
ABILITY TO IDENTIFY WORD ELEMENTS, GRADE III

Quartile	No.	Inaccurate Singers	Per Cent	S.E.	% Diff.	S.E. Diff.	C.R.
4	92	27	29.34	.047			
3	84	19	22.61	.045	6.73	.065	1.03
3	84	19	22.61	.045			
2	67	18	26.86	.054	4.25	.070	.60
2	67	18	26.86	.054			
1	79	27	34.17	.053	7.31	.075	.97

None of the differences were significant. The largest per cent of inaccurate singers were in Q<sub>1</sub>. Q<sub>4</sub>, Q<sub>2</sub>, Q<sub>3</sub> followed in descending order.

Table XXIX shows the comparison of mental ages of boys and girls in grades one, two, and three.

TABLE XXIX  
 COMPARISON OF MENTAL AGES OF BOYS AND GIRLS,  
 GRADES I, II, AND III

Grade	Sex	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
I	Boys	186	81.95	9.03	.662	.67	.941	.71
	Girls	154	82.62	8.31	.669			
II	Boys	108	94.64	10.23	.98	.69	1.36	.51
	Girls	101	95.12	9.54	.95			
III	Boys	187	106.49	12.25	.90	1.73	1.41	1.23
	Girls	134	104.76	12.25	1.15			

The mean mental age for the girls in grade one was 82.62 months compared with 81.95 months for the boys. In grade two, the mean for the girls was 95.12 months compared with 94.64 months for the boys. In grade three, the mean for the boys was 106.49 months compared with 104.76 months for the girls. None of the differences were statistically significant.

Table XXX shows the comparison of boys' and girls' ability to identify word elements in grades one, two, and three.

TABLE XXX  
COMPARISON OF BOYS' AND GIRLS' ABILITY  
TO IDENTIFY WORD ELEMENTS, GRADES I, II, III

Grade	Sex	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
I	Boys	186	29.15	2.96	.217	2.61	.883	2.96
	Girls	154	31.76	3.54	.856			
II	Boys	109	40.33	11.70	1.12	5.73	1.54	3.72
	Girls	104	46.06	10.80	1.06			
III	Boys	187	117.65	13.23	.97	.51	2.21	.23
	Girls	138	117.14	13.23	1.13			

The differences in grades one and two were significant and in favor of the girls. In grade three, the small difference was in favor of the boys.

Table XXXI shows the comparison of boys and girls in reading in grades one, two, and three.

TABLE XXXI  
 COMPARISON OF BOYS' AND GIRLS' READING,  
 GRADES I, II, III

Grade	Sex	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
I	Boys	186	12.14	8.76	.602	3.15	.927	3.40
	Girls	154	15.29	8.22	8.76			
II	Boys	109	10.85	8.07	.77	4.34	1.01	4.30
	Girls	104	15.19	6.72	.66			
III	Boys	176	15.41	7.07	.53	2.63	.678	3.93
	Girls	140	18.04	5.00	.42			

The differences in all three grades were statistically significant in favor of the girls.

The mean score in grade one for the girls was 15.29 words compared to 12.14 words for the boys, in grade two it was 15.19 words for the girls compared with 10.85 words for the boys, and in grade three it was 18.04 words for the girls compared with 15.41 words for the boys.

Table XXXII shows the comparison of boys and girls speed of articulation scores in grades one, two, and three.

TABLE XXXII  
 COMPARISON OF BOYS' AND GIRLS' SPEED OF  
 ARTICULATION, GRADES I, II, III

Grade	Sex	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
I	Boys	186	48.21	9.57	.701	.76	.83	.92
	Girls	154	47.45	5.61	.452			
II	Boys	109	55.38	11.10	1.06	.80	1.48	.54
	Girls	104	54.58	10.65	1.04			
III	Boys	178	60.15	11.20	.83	1.12	1.00	1.1
	Girls	136	59.03	10.00	.86			

The mean differences in all grades, while small, were in favor of the boys.

In grade one, the mean score for the boys was 48.21 compared with 47.45 for the girls, in grade two it was 55.38 for the boys compared with 54.58 for the girls, and in grade three it was 60.15 for the boys compared with 59.03 for the girls.

Table XXXIII shows the comparison of boys' and girls' scores on the extent of vocabulary test in grades one, two, and three.

TABLE XXXIII  
 COMPARISON OF BOYS' AND GIRLS' EXTENT OF  
 VOCABULARY, GRADES I, II, III

Grade	Sex	No.	Mean	S.D.	S.E.	Mean Diff.	S.E. Diff.	C.R.
I	Boys	186	17.07	4.56	.334	.28	.467	.60
	Girls	154	16.79	4.05	.326			
II	Boys	107	17.59	4.67	.45	.07	.62	.11
	Girls	104	17.52	4.32	.42			
III	Boys	179	21.19	5.00	.37	.84	4.12	.55
	Girls	136	20.35	4.80	.41			

The mean differences in all grades were small and in favor of the boys. There was a slight increase in each grade for both boys and girls.

The mean score for the boys in grade one was 17.07 compared with 16.79 for the girls, in grade two it was 17.59 compared with 17.52 for the girls, and in grade three it was 21.19 for the boys compared with 20.35 for the girls.

CHAPTER IV

SUMMARY AND CONCLUSIONS

## CHAPTER IV

### SUMMARY AND CONCLUSIONS

The study was an attempt to discover the relationships between auditory discrimination, as measured by the ability, to identify word sounds and mental age, reading ability, accuracy of articulation, speed of articulation, extent of vocabulary, auditory acuity, and singing ability of children in the primary grades.

Eight hundred and ninety-one children in nine communities in grades one, two, and three were given group tests of reading, auditory discrimination, and mental ability and individual tests for speed and accuracy of articulation, extent of vocabulary, and music ability. The hearing acuity was taken from the health records.

The following conclusions may be drawn:

1. None of the factors studied show a high correlation with auditory discrimination.
  - a. The highest correlation in grades one and two was with reading, .56 and .52 respectively.
  - b. The correlation with reading in grade three was about equal to the other grades, .52, but mental age was higher in this grade, .54.

- c. Mental age showed the second highest correlation in both grades one and two, .46 and .31 respectively.
  - d. Speed and accuracy of articulation showed little relationship in any grade.
  - e. Extent of vocabulary showed an increase in grade three. The correlations in this factor were .41 in grade three, .19 in grade one, and .05 in grade two.
2. A study of differences by quartiles showed that in some cases there were differences.
- a. There were significant differences in all grades between all quartiles in mental age.
  - b. There were significant differences in all grades between all quartiles in auditory discrimination.
  - c. Mental age and auditory discrimination showed significant differences in grade one between  $Q_3$  and  $Q_2$  and  $Q_2$  and  $Q_1$ . There were no significant differences in grade two, but the largest one was between  $Q_3$  and  $Q_2$  and the smallest between  $Q_2$  and  $Q_1$ . There were significant differences in grade three between  $Q_4$  and  $Q_3$  and  $Q_3$  and  $Q_2$ .

- d. Reading and auditory discrimination showed significant differences between  $Q_4$  and  $Q_3$  in grades one and two, and between  $Q_2$  and  $Q_1$  in grade three.
  - e. Accuracy and speed of articulation showed no significant differences in any quartile of any grade.
  - f. Extent of vocabulary showed no significant difference in any quartile of any grade.
  - g. The hearing acuity tests were crude, but there appeared to be little relationship in this factor in any grade.
  - h. Inaccurate singers showed significant differences in grade one, but little difference in grades two or three.
3. A sex difference study showed some significant differences in some factors and little difference in others.
- a. Girls were superior to boys in all grades in mental age and in reading.
  - b. Girls were statistically superior to the boys in auditory discrimination in grades one and two. There was little difference in the two groups in grade three, and this was in favor of the boys.

c. The differences in speed and accuracy of articulation were not significant but were all in favor of the boys in all grades.

**BIBLIOGRAPHY**

## BIBLIOGRAPHY

- Acomb, Allen. "A Study of the Psychological Factors in Reading and Spelling." Unpublished Master's Thesis, Boston University School of Education, 1936.
- Agnew, Donald. The Effects of Varied Amounts of Phonetic Training. Durham, North Carolina: Duke University Press, 1939.
- Ansberry, Merle. "The Effect Upon the Ability to Discriminate Between Speech Sounds by the Elimination of Frequencies Above 4,000 Cycles." Quarterly Journal of Speech 24: 381-389; October 1938.
- Barden, Mary C. "The Construction and Evaluation of Exercises for Specific Training in Auditory and Visual Discrimination in the Third and Fourth Grades." Unpublished Master's Thesis, Boston University School of Education, 1945.
- Bennett, Annette. "An Analysis of Errors in Word Recognition Made by Retarded Readers." Journal of Educational Psychology 33: 25-38; January 1942.
- Biggy, Mary Virginia. "The Establishment of a Relative Order of Difficulty of Word Elements in Auditory Discrimination." Unpublished Master's Thesis, Boston University School of Education, 1945.
- Bond, Guy. "The Auditory and Speech Characteristics of Poor Readers." Contributions to Education, No. 657. New York: Teachers College, Columbia University, 1935.
- Brooke, B. A. "Comparison of Recognition and Recall of Word Elements." Unpublished Master's Thesis, Boston University School of Education, 1947.
- Brownell, William. "Current Practices with Respect to Phonetic Analysis in the Primary Grades." Elementary School Journal 42: 195-206; November 1941.
- Carroll, Marjorie J. "Sex Differences in Reading Readiness." Unpublished Master's Thesis, Boston University School of Education, 1941.

- Carter, Bernadette R. "The Construction Tests of Visual Perception, Auditory Discrimination and Kinaesthetic Factors to be Used in Diagnosing Inadequate Performance in Spelling." Unpublished Master's Thesis, Boston University School of Education, 1941.
- Conway, C. B. "The Hearing Abilities of Children in Toronto Public Schools." Ontario College of Education, Department of Educational Research, Bulletin No. 9. Toronto: University of Toronto Press, 1937.
- Crossley, B. A. "An Evaluation of the Effect of Lantern Slides on Auditory and Visual Discrimination of Word Elements." Unpublished Doctor's Dissertation, Boston University School of Education, 1948.
- Danner, W. B. "The Effect of Auditory Pacing on Reading Speed and Comprehension." Psychological Bulletin 31: 606; October 1934.
- Dolch, E. W. and Bloomster, M. "Phonic Readiness." Elementary School Journal 38: 201-205; November 1937.
- Elliott, Frank R. "Response to Visual vs. Visual-Auditory Presentation in a Go-To-College Program." Journal of Educational Psychology 28: 703-707; December 1927.
- Fagg, Dorothy W. "A Study in the Relationship Between Auditory Analysis and Growth of Language Art Skills." Unpublished Master's Thesis, Boston University School of Education, 1942.
- Fahy, Ann. "Evaluation of Ear Training in Grade One." Unpublished Master's Thesis, Boston University School of Education, 1949.
- Fielder, Miriam F. "Teachers' Problems with Hard-of-Hearing Children." Journal of Educational Research 42: 618-622; April 1949.
- Fletcher, Harvey. "Discovering Children With Defective Hearing." Elementary School Journal 29: 172-173; November 1928.
- Garrison, S. C. and Heard, M. T. "An Experimental Study in the Value of Phonetics." Peabody Journal of Education 9: 9-14; July 1931.
- Gates, Arthur I. "Studies of Phonetic Training in Beginning Reading." Journal of Educational Psychology 18: 217-226; April 1927.

- Gates, Arthur I., Bond, Guy and Russell, D. H. "Methods of Determining Reading Readiness." Elementary School Journal 40: 165-167; March 1939.
- Hall, Margaret. "Auditory Factors in Functional Articulatory Speech Defects." Journal of Experimental Education 7: 110-132; December 1938.
- Hansen, Burrell. "The Application of Sound Discrimination Tests to Functional Articulatory Defectives with Normal Hearing." Journal of Speech Disorders 9: 347-355; December 1944.
- Henry, Sybil. "Children's Audiograms in Relation to Reading Attainment." Pedagogical Seminary and Journal of Genetic Psychology 70: 211-238; June 1947 and 71: 3-63; September 1947.
- Hester, Kathleen B. "A Study of Phonetic Difficulties in Reading." Elementary School Journal 43: 171-173; November 1942.
- Hudson, Jess and Toler, Lola. "Instruction in Auditory and Visual Discrimination as a Means of Improving Spelling." Elementary School Journal 49: 466-469; April 1949.
- Kelley, Helen I. "Relative Difficulty of Auditory Perception of Word Elements." Unpublished Master's Thesis, Boston University School of Education, 1948.
- Kennedy, Helen. "A Study of Children's Hearing as it Relates to Reading." Journal of Experimental Education 10: 238-245; June 1942.
- Larsen, R. P. and Feder, D. D. "Common and Differentiated Factors in Reading and Hearing Comprehension." Journal of Educational Psychology 31: 241-252; April 1940.
- Laurer, Frank A. "Hearing Survey Among a Group of Pupils of Syracuse Schools." American Journal of Public Health 18: 1353-1360; November 1928.
- Linton, Louise. "An Experimental Study of Speech-Sound Discrimination." Unpublished Master's Thesis, Leland Stanford Junior University, 1939.
- Madden, Richard. "The School Status of the Hard-of-Hearing Child." Contributions to Education, No. 499. New York: Teachers College, Columbia University, 1931.

- McFarland, Mary E. "The Relation of Readiness Factors in Beginning Reading." Unpublished Master's Thesis, Boston University School of Education, 1947.
- Metraux, Ruth. "Auditory Memory Span for Speech Sounds: Norms for Children." Journal of Speech Disorders 9: 31-38; March 1944.
- Monroe, Marion. Children Who Cannot Read. Chicago: The University of Chicago Press, 1932. p. 93-97.
- Murphy, Helen A. "An Evaluation of Exercises for Developing Auditory Discrimination in Beginning Reading." Unpublished Master's Thesis, Boston University School of Education, 1940.
- \_\_\_\_\_. "An Evaluation of Specific Training in Auditory and Visual Discrimination on Beginning Reading." Unpublished Doctor's Dissertation, Boston University School of Education, 1943.
- Nichols, A. M. "The Construction and Use of a Group Test for the Analysis of Spelling Difficulties." Unpublished Master's Thesis, Boston University School of Education, 1947.
- Pettil, Emire M. "The Construction and Evaluation of Tests in Auditory Discrimination in Grades Four, Five, and Six." Unpublished Master's Thesis, Boston University School of Education, 1950.
- Plummer, R. N. "High Frequency Deafness and Discrimination of High Frequency Consonants." Journal of Speech Disorders 8: 373-381; 1943.
- Robinson, Helen. "Cause of Reading Failure." Education 67: 422-426; March 1947.
- Rogers, Maurine. "Phonic Ability as Related to Certain Aspects of Reading at College Level." Journal of Experimental Education 6: 381-395; September 1938.
- Rossignol, Lois J. "The Relationships Among Hearing Acuity, Speech, Production, and Reading Performance in Grade 1A, 1B and 2A." Contributions to Education, No. 936. New York: Teachers College, Columbia University, 1948.
- Schmidt, Bernadine. "Teaching the Auditory Learner to Read." Chicago School Journal 19: 208-211; May 1938.

- Schmidt, Bernadine. "Auditory Stimuli in the Improvement of Reading." Elementary English Review 18: 149-154; April 1941.
- Sexton, E. K. and Herron, J. S. "The Newalk Phonic Experiment." Elementary School Journal 28: 690-701; May 1928.
- Siegenthaler, Bruce. "A Study of the Intelligibility of Sustained Vowels." Quarterly Journal of Speech 36: 202-208; April 1950.
- Smith, Doris G. "The Effect of Specific Training in Auditory Perception on the Spelling of Twenty-Three Seventh Grade Cases of Spelling Disability." Unpublished Master's Thesis, Boston University School of Education, 1949.
- Spache, George. "Characteristic Errors of Good and Poor Spellers." Journal of Educational Research 34: 182-189; November 1940.
- Sprunt, Julie and Finger, Frank W. "Auditory Deficiency and Academic Achievement." Journal of Speech and Hearing Disorders 14: 26-32; March 1949.
- Sterling, E. B. and Bell, E. "Hearing of School Children as Measured by the Audiometer and as Related to School Work." U. S. Public Health Report 45: 1117-1130; May 16, 1930.
- Sullivan, M. E. "Auditory Acuity and Its Relation to Defective Speech." Journal of Speech Disorders 9: 127-129; June 1944.
- Tate, H. L. "The Influence of Phonics on Silent Reading in Grade One." Elementary School Journal 37: 752-763; June 1937.
- Templin, Mildred. "A Study of Sound Discrimination Ability of Elementary School Pupils." Journal of Speech Disorders 8: 127-132; June 1943.
- Tireman, L. S. and Woods, V. E. "Aural and Visual Comprehension of Spanish Speaking Children." Elementary School Journal 40: 204-211; November 1939.
- Travis, E. and Rasmus, B. "The Speech-Sound Discrimination Ability of Cases with Functional Disorders of Articulation." Quarterly Journal of Speech 17: 217-226; 1931.

Utley, Jean. "The Relation Between Speech Sound Discrimination and Percentage of Hearing Loss." Journal of Speech Disorders 9: 103-113; June 1944.

Waldman, J. L., Wade, F. A. and Aretz, C. W. Hearing and the School Child. Washington: The Volta Bureau, 1930.

Wilson, F. and Flemming, C. W. "Letter Consciousness of Beginners in Reading." Journal of Genetic Psychology 53: 273-285; December 1938.

Wilson, F., Flemming, C. W., Burke, A., and Garrison, C. G. "Reading Progress in Kindergarten and Primary Grades." Elementary School Journal 38: 442-449; February 1938.

Young, William. "The Relation of Reading Comprehension and Retention to Hearing Comprehension and Retention." Journal of Experimental Education 5: 30-39; September 1936.

Name \_\_\_\_\_ Grade \_\_\_\_\_ School \_\_\_\_\_

- 1 tranquil familiar vagabond 16 quarrelsome guide cream
- 2 matter rapidity separated 17 breakfast blunder raise
- 3 geyser capitulate petal 18 quotient guess crafty
- 4 luck differ wanderer 19 brilliant blossom drapery
- 5 deck temperature highway 20 crowd grasp job
- 6 wisdom yacht volcano 21 flutter blood tug
- 7 gasoline kaolin lariat 22 loss bantam lynx
- 8 fault vein weight 23 locust hearty grief
- 9 document blossom plentiful 24 piccolo fantastic benefit
- 10 jonquils drouth bronco 25 slender clasp crib
- 11 thorough favor tattered 26 crisis gratitude drab
- 12 broadcast blizzard domestic 27 peacock derrick pardon
- 13 choice confer classic 28 water workbench lurch
- 14 guard creak quotation 29 frontier frozen tradition
- 15 thistles whirled hatchet 30 davenport disease protect

31 rotation remark needlework

46 silky remembering napkin

32 claimed glistened glee

47 senator department stimulant

33 bullet farewell bushel

48 specimen caravan raffia

34 candidate generally cordially

49 bungalow radius swish

35 helium happiness loom

50 roster struck drydock

36 rusty radish foolish

51 bathroom bonanza apartment

37 noodles margin measles

52 clatter shamrock thick

38 dreamed transfer trampled

53 citizen librarian miracle

39 stirrup stir clamp

54 thimble Columbus crush

40 jog jib fig

55 reason harvesting cousin

41 rot nicest notion

56 champion imigrant student

42 credulous happily capacity

57 lancer slick burdock

43 but nearest number

58 pagan camel denizen

44 basketball properly beautifully

59 business alumnus radish

45 accident naughtiest nebulous

60 thimble rumbling rosin

Name \_\_\_\_\_ Grade \_\_\_\_\_ School \_\_\_\_\_

1.	ind r bl x t ing
2.	a i sp f d or
3.	o e w gr n ce
4.	i j l ous re w
5.	o i p sh l u
6.	ar t st w igh x
7.	v con f p e tion
8.	i f b m u s
9.	e x f v t a
10.	oy r j v l t
11.	tch a v x m less
12.	est v n i ing z
13.	b f a u sh d
14.	e s u z w l
15.	u i qu r o v
16.	o a r th l d
17.	u d w r n f
18.	i ph u h o n
19.	n st g k y r
20.	th i n ar i r
21.	w i d r ness l
22.	a d c e n th
23.	e igh k l wh o
24.	ur s ck t b g

Directions for Phonics Test

(The words used in this test are not in the children's vocabularies and are not to be shown in written form during the test. Unfamiliar words were deliberately chosen in order to test the ability of the children in auditory discrimination.)

Practice Exercise -- Write these groups of letters on the blackboard:-

c r i o m p  
a z o ck f bl  
v e s nt con l

Say -- "Today we are going to play a game with some letters. We are going to see how well you hear sounds. Listen to the word I say; "Mimic". I want someone to come to the board, and put a ring around the letters that you hear in mimic. There are some letters on the board that you do not hear." (The sounds m-i-c are to be encircled.)

"Now listen to another word, and think of the letters you will put rings around in this row, (points to second row). The word is blockade." (Have a child come to the board, and put a ring around the correct sounds bl-o-ck-a.)

"Let's try one more. Listen to the word convalescent." (Have child encircle the correct sounds con-v-e-l-s-nt.)

"Now look at the work on the board. Did we circle the same number of letters in each row? No. We are going to do some more on our papers. In some rows we may circle three letters, in some four or five and some six. Be sure to listen carefully and circle just the letters you hear."

(While there is no time limit, move along rapidly from one item to the other.)

"Now look at row 1 on your paper. Draw a ring around all of the sounds that you hear in the word blinding."

(Check the papers to see that all have understood the directions.)

"We will go right along now."

- Row 2 - Draw a ring around all of the sounds you hear in sporadic.
- Row 3 - Draw a ring around all of the sounds you hear in grocery.
- Row 4 - Draw a ring around all of the sounds you hear in religious.
- Row 5 - Draw a ring around all of the sounds you hear in politician.
- Row 6 - Draw a ring around all of the sounds you hear in starlight.
- Row 7 - Draw a ring around all of the sounds you hear in convention.
- Row 8 - Draw a ring around all of the sounds you hear in misfortune.
- Row 9 - Draw a ring around all of the sounds you hear in vexatious.
- Row 10 - Draw a ring around all of the sounds you hear in voyage.
- Row 11 - Draw a ring around all of the sounds you hear in matchless.
- Row 12 - Draw a ring around all of the sounds you hear in investing.
- Row 13 - Draw a ring around all of the sounds you hear in abduction.
- Row 14 - Draw a ring around all of the sounds you hear in zealous.
- Row 15 - Draw a ring around all of the sounds you hear in quiver.
- Row 16 - Draw a ring around all of the sounds you hear in threshold.
- Row 17 - Draw a ring around all of the sounds you hear in wonderful.
- Row 18 - Draw a ring around all of the sounds you hear in hyphen.
- Row 19 - Draw a ring around all of the sounds you hear in youngster.
- Row 20 - Draw a ring around all of the sounds you hear in arthritis.
- Row 21 - Draw a ring around all of the sounds you hear in wilderness.
- Row 22 - Draw a ring around all of the sounds you hear in cathedral.
- Row 23 - Draw a ring around all of the sounds you hear in whispering.
- Row 24 - Draw a ring around all of the sounds you hear in reback.

