An Investigation into the Possible Relationship Between Reading Ability and Functional Articulatory Defective Speech

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AN INVESTIGATION INTO THE POSSIBLE RELATIONSHIP BETWEEN READING ABILITY AND FUNCTIONAL ARTICULATORY DEFECTIVE SPEECH

by

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CHAPTER I

INTRODUCTION

The purpose of this study is to investigate the relationship between reading disability and defective articulation. An attempt has been made to determine whether or not children with functionally defective articulation have difficulty in reading.

It is conceivable that a deficiency in one or several areas of language development might impede or retard a child's academic achievement and might interfere with his emotional adjustment. This study was, therefore, undertaken, first to determine whether or not there is a difference in the reading ability of speech defective children as determined by valid and reliable measures, and the reading ability of comparable children with normal speech. Since reading and speech are both components of language skills, and because communicative skills are of primary educational importance, the results of this study could prove to be assistive in the total educational program of the speech defective child.

Secondly, this study was undertaken because of the widespread conflicts of opinion regarding the effect of unsuccessful acquisition of one language skill upon other language skills. Although a considerable amount of research has been carried out concerning the total inter-relatedness of language skills, there
is still an apparent need for further investigation of relationship between speech and reading disabilities. This will become apparent as a result of our survey of the literature.

**Related Studies**

The linguistic abilities of school children have been examined by three major disciplines. Educational research in the area of language arts has contributed information concerning normal language development, procedures for language training and techniques for remedial instruction. Psychology has investigated the relationship of various language abilities to specific personality traits and mental abilities. Speech pathology has explored the effect of preschool language development on subsequent language growth and has contributed much to our knowledge of the relationship between expressive and receptive language skills.

In the area of psychology, Strauss and Lehtinen\(^1\) point out that failure or partial failure to master reading processes is an experience shared by large numbers of brain-injured children. Also, Dunn's review of the literature in reading, as cited in

Cruickshank and Johnson\textsuperscript{1}, has shown that investigators have found that mentally handicapped children read below their expectancy or mental age level. Wood\textsuperscript{2}, in her discussion of the child with language disorders, writes:

> Every child with a language disorder needs special procedures, all basically aimed at helping him organize the stimuli he receives so that he can develop useful concepts. Dull and rote procedures will not serve his purpose.

Reading readiness as a function of maturation in language skills, (motor, perceptual, conceptual and behavioral) all of which involve the development of integration is described by de Hirsch\textsuperscript{3} who emphasizes the importance of evaluation in this statement:

> A very careful analysis of the fineness of a child's comprehension of language, his organization of sounds and words in spoken language, his grammar, and rhythm and rate of speaking is needed. His ability to cope with verbal abstractions and his facility in dealing with concepts is also carefully evaluated.


\textsuperscript{2}Wood, N. E., "Language Disorders; Major Barriers to Communication." School Life, XLIII (June, 1961), 6.

In her discussion of language as related to personality traits, de Hirsch\(^1\) points out:

Language is a means of self-expression and a bridge to another human being. Language dysfunctions, thus, might reflect a disturbance of self, a difficulty with interpersonal relationships, or trouble with the instrumentalities of verbal communication.

Similarly, with respect to the developmental aspects of language, educational studies have shown that language abilities develop in an orderly sequence and are dependent upon each other. Both Betts\(^2\) and Johnson\(^3\) support the thesis of the interrelationship of these skills and state that a disturbance in one facet of language would not be expected without accompanying disturbances in other abilities. de Hirsch\(^4\) also supports this idea by stating:

Both the strephosymbolic associative disordered and the speech defective child, as well as the other members of his family, frequently reveal difficulty with the handling of all verbal symbols, spoken, written or printed.

\(^3\)Johnson, M. S., "Factors Related to Disability in Reading." \textit{Journal of Experimental Education}, XXVI (1957), 3.
\(^4\)de Hirsch, Katrina, "Specific Dyslexia or Strephosymbolia." \textit{Folia Phoniatrica}, IV (1952), 245.
Betts\textsuperscript{1} emphasizes that language growth in one stage contributes to readiness for the ensuing stage, and that if one level is retarded, the succeeding skill will be impaired. Seemingly, and in agreement with Betts, Johnson\textsuperscript{2} says:

> In view of the sequential development of language abilities, it would seem likely that retardation in general language development and retardation in reading might be related.

Since speech is one of the first language skills to be acquired, it is conceivable that the school subjects such as reading, spelling and writing are directly related to the acquisition of adequate speech skills. In addition, those subjects acquired through reading and writing (social studies, mathematics) can also be affected. The literature in speech pathology also presents this possibility. Van Riper\textsuperscript{3} states that the speech defective child on the average is retarded one year educationally, with extra expense for the school and frustration for the child. In accordance with Van Riper, Murray\textsuperscript{4}, in a study in which he

\begin{itemize}
\item[1] Betts, E., \textit{op. cit.}, p. 6.
\end{itemize}
compared stutterers to normal speakers paired with respect to age, mental ability and grade level, found stutterers to be approximately one grade level below normal speakers in comprehension and two grade levels below normal speakers in rate of silent reading.

Reading Disability and its Relationship to Articulatory Defective Speech

Much disagreement exists in the literature concerning the causal relationship between reading disturbances and articulatory speech defects. Artley submits that where speech defects exist as a cause of silent reading defects, an explanation may be found in the fact that negative conditioning to oral reading spreads to silent reading, resulting in lack of practice and hence, a lack of proficiency. Monroe, in her discussion of reading disability, states that defective speech may be considered a factor in reading disability, either as one cause of the reading defect, or as the result of a common cause. Monroe elaborates upon


this point by saying:

Speech defects occur more frequently among poor readers than among good readers. Regarding reading and speech as language related skills, ability in one might possibly be predicted by the others.

Eames\(^1\) concludes that both speech and reading troubles are very likely to stem from the same basic defect. However, he states:

There is no general agreement about the relationship between reading and speech defectiveness.

Artley\(^2\), in his discussion of factors associated with reading and speech difficulties, states that difficulties in the language skills are the result of an interplay among several factors. He states that:

Reading difficulties as well as difficulties in arithmetic, spelling, or any other area, are usually the result of an interplay among several factors. Such factors may be speech defects, visual or auditory defects, lack of motivation, improper instructional procedures, limitations in intelligence and the like.

Wepman\(^3\) believes that children delayed in their auditory-discrimination skills after six years of age represent a sizable proportion of the children who have defective articu-

\(^1\)Eames, Thomas H., "The Relationship of Reading and Speech Difficulties." *Journal of Educational Psychology*, XLII (1950), 54.

\(^2\)Artley, A. S., op. cit., p. 351.

\(^3\)Wepman, Joseph M., "Nature of Effective Speech in Oral Reading." *Conference on Reading*, (1955) p. 34.
lation and oral reading. Hildreth\textsuperscript{1} mentions a number of types of language difficulties that retard reading. She lists inadequate or immature motor co-ordination in articulation, inaccurate articulation, inhibited emotional conflicts due to speech defects that interfere with articulation in oral reading and poor auditory discrimination of speech sounds.

Johnson\textsuperscript{2} states that a disturbance in one of the phases of the usually orderly sequence of language development will result in disturbances in other facets. She concludes that difficulties in speech might easily result in reading and spelling problems. The conclusion of Johnson's\textsuperscript{3} investigation of factors related to reading disabilities is as follows:

In normal developmental sequence, ability to interpret language precedes ability to reproduce it. Ability to deal with oral language precedes ability to deal with visual language symbols. Hence, the order of development is understanding of spoken language, speaking, understanding of printed symbols (reading) and reproduction of visual language symbols (writing). Unless success has been achieved in one of these areas, attempts to go to the next step will be futile.

\textsuperscript{1}Hildreth, Gertrude, "Speech Defects and Reading Disability." \textit{Elementary School Journal}, XLVI (1946), 327.

\textsuperscript{2}Johnson, M. S., op. cit., p. 3.

\textsuperscript{3}Johnson, M. S., op. cit., p. 4.
Ham, in his study of forty elementary school children, found that there was a significant relationship between mis-spelling and misarticulation. In the discussion of his findings he reports:

Since the spelling process can be hindered by defective speech, speech correction is seen as an important factor in aiding the acquisition of spelling skill. If, and this is a very tentative hypothesis, there is a certain degree of direct or close relationship between spelling and articulation, the same may also hold true for reading. The acquisition of reading skill also begins in the early grades, and could conceivably be aided by speech correction in those grades.

Accordingly, Johnson and House, in their study of forty-one children with functional articulation disorders, found that 12% of the articulation cases had not only been delayed in the acquisition of speech sounds, but also were reported by their teachers as having reading and/or spelling difficulties.

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Auditory Perceptual Factors with Relationship to Articulation and Reading Abilities

Investigation of the auditory perceptual factors (auditory memory span, phonetic discrimination, vocal phonic ability) and

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their relation to reading and speech skills has shown much disagreement. Although research does not support a positive relationship between auditory processes and other language skills, many writers seem to believe that one exists. John-

son\(^1\) says that:

A child who has auditory discrimination difficulty cannot determine when sounds are alike or unlike and he usually has difficulty in associating the sound with the printed or written symbol representing them.

Hall\(^2\) also assumed that errors in speech sound discrimination had some relation to articulation errors and that both were related to specific defects in acuity. To support her hypothesis, she studied the process of auditory abilities in functional articulatory speech defective children and compared them to normal speaking children. She found, however, that:

Results of intercorrelations in the study would seem to indicate that ability in discriminating between sounds in complex patterns and remembering series of speech sounds is more probably a function of general intelligence rather than of auditory acuity. Functional articulatory speech defectives as a group appear to possess no auditory deficiencies to account for their speech.

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Durrell and Murphy, in their investigation of auditory discrimination ability and reading ability, also support the negative relationship between auditory deficiencies and articulation errors. They state:

There was no relationship between auditory analysis of word elements and speed of articulation, accuracy of articulation, auditory acuity records or singing ability. However, almost every child who comes to a reading clinic with a reading achievement below first grade has a marked inability to discriminate sounds in words.

Mange investigated the hypothesis that one of the principal causative factors in certain functional defects is the presence of some auditory deficiency or immaturity which permits continued defective articulation beyond the normal period. In his study of five factors of auditory perception, he found:

There is a significant, but low, partial correlation between phonetic word-synthesis ability and number of articulation errors.

Wensley also made an investigation of the vocal phonic or word synthesis ability of articulatory defective children as

1Durrell, D. and Murphy, E., "Auditory Discrimination Factor in Reading Readiness and Reading Disability." Educational Digest, XIX (1953), 15.


compared to normal speakers of the same grade level. The results, in agreement with Mange's study, showed there to be a significant difference in the synthesizing ability among groups of functional articulatory defective children. In addition, the results of his study showed there to be a trend for normal speaking children to perform this skill more proficiently than the articulatory defective children of the same grade level.

In the area of phonic training, Zedler[^1], in her study of 117 second grade children, found that speech sound discriminative ability increases significantly with phonic training. Concluding her study, she states:

Since speech-sound discrimination plays an important part in many aspects of learning, and since the results of this study show that phonic training improves speech-sound discrimination, regular training in phonics probably would influence favorably all aspects of learning in which speech-sound discrimination is included, such as reading readiness, independent word attack and speech correction.

Metraux[^2] studied the auditory memory span for speech sounds of children with normal speech and children with all types of defective speech. She found that the auditory memory span for


speech defectives was lower than for normal speakers.

Specifically, in the area of memory span disabilities and allied disorders, Saunders\(^1\) reports:

> While it cannot be stated that all reading disabilities are allied with poor memory spans, it can be stated with certainty that all poor memory spans are allied with difficulty in reading and spelling.

It appears, then, that the functional articulatory defective may have limited auditory perceptual abilities, and that these abilities could be specifically related to other language skills.

**Speech Training and Reading Achievement**

Some experimental evidence can be found in the literature concerning the possible relationships between speech training and reading achievement. The small amount of experimental evidence is inconclusive, being both negative and positive in findings. Jones\(^2\) found that the experimental subjects who received speech improvement lessons improved significantly in silent reading achievement compared with their matched group who did not receive this treatment. On the other hand, in her

\(^{1}\)Saunders, Mary Jane, "The Short Auditory Span Disability." *Childhood, VIII* (1931), 64.

\(^{2}\)Jones, M. V., "The Effect of Speech Training on Silent Reading Achievement." *Journal of Speech and Hearing Disorders, XVI* (1951), 261.
study of kindergarten children, Wilson\textsuperscript{1} found that speech improvement had a significant effect upon articulation errors and other speech sounds not included in the speech improvement lessons. However, she did not find that the speech improvement lessons had a direct effect upon the reading readiness ability of these children. Additional experimental evidence, however, does not support Wilson's findings. Sommers\textsuperscript{2} studied the effects of speech improvement and speech therapy upon the articulation and reading skills of speech defective and normal speaking children. With respect to speech improvement he said:

Speech improvement was effective in producing significantly higher reading factor scores for groups of first-grade children normal in articulation and also for first-grade children with misarticulations.

Since the effectiveness of speech improvement in correcting errors in school children beyond the first grade has received little investigation, Sommers\textsuperscript{3} and his associates continued their study as to the effects of various durations of speech improvement.


\textsuperscript{3}Sommers, Ronald K., "Effects of Various durations of Speech Improvement Upon Articulation and Reading." \textit{Journal of Speech and Hearing Disorders}, XXVII (1962), 59.
improvement upon articulation and reading. The results of this exhaustive study showed that children who were provided with speech improvement both in the first and second grades made significantly higher reading factor scores at the end of the second grade than did the subjects who were not provided with speech improvement.

Reading Ability of Normal and Defective Speakers

A review of the investigations dealing with the existence of differences of reading ability between normal speakers and articulatory defective speakers also indicates disagreement.

Bennett\(^1\) states that a child with a persistent speech defect is seldom a good oral reader. However, he adds that the presence of such a defect need not preclude adequate ability to interpret the printed page through silent reading. To emphasize this point, Bond\(^2\) noted that poor silent readers in general were not differentiated by peculiarities of speech. His investigation found the incidence of defective speech in poor silent readers was no higher than in normal or average silent readers. In


contrast, however, Jackson\textsuperscript{1}, in his study found 22% of the retarded readers had speech defects and 10% of the advanced readers had speech defects. He concluded that:

Since the tests administered measured the rate and comprehension of silent reading and not oral ability, it is noteworthy that reading retardation may occur on the basis of speech defects.

Moore\textsuperscript{2}, in his investigation of articulatory defective ninth graders and their silent reading ability, found that the children on a whole were not deficient in reading ability. The results of investigations in which lower elementary children were studied are in direct contrast to Moore's findings. Gibbons\textsuperscript{3} matched the scores of Gray's Standardized Oral Reading Test of twenty speech defective second grade children with normal speaking second grade children and found a significant difference. In addition, he found the scores of the Monroe Diagnostic Reading Examination showed that the speech defectives average eight tenths of a grade below their grade level achievement. Gibbons pointed out that this reading retardation of eight tenths of a

\textsuperscript{1}Jackson, J., "A Survey of Psychological, Social and Environmental Differences between Advanced and Retarded Readers." \textit{Journal of Genetic Psychology}, LXV (1944), 127.

\textsuperscript{2}Moore, Charles, "Reading and Arithmetic Abilities Associated with Speech Defects." \textit{Journal of Speech and Hearing Disorders}, XII (1947), 85.

point of a school year was relatively great because the possible
degree of retardation was limited by the fact that the children
were at the early levels of academic growth. Also the results
of Yedinack's\textsuperscript{1} study of second grade children show that children
with functional articulation defects are significantly inferior
in both oral and silent reading to children with normal speaking
ability. In agreement with the conclusions reached in Yedinack's
study, Moss\textsuperscript{2} stated, in her study of the reading achievement of
second grade speech defectives, that:

> It is evident from this study that speech defects
> are a definite handicap in oral reading in the
> second grade, both in reading and in the number
> of errors made.

However, in disagreement with the studies of both Yedinack\textsuperscript{3} and
Moss\textsuperscript{4} and after considerable review of the literature concerning
the causal relationship between reading disabilities and defects
in articulation, Robinson\textsuperscript{5} says:

> Articulatory defects have been associated with read-
> ing disability both as a cause and as a concomitant,
> but there is no conclusive relationship between them.

\textsuperscript{1}Yedinack, J., "A Study of the Linguistic Functioning of
Children with Articulatory and Reading Disabilities." Journal
of Genetic Psychology, LXXIV (1949), 57.

\textsuperscript{2}Moss, M. A., "The Effect of Speech Defects on Second Grade
Reading Achievement." Quarterly Journal of Speech, XXIV (1938), 654.

\textsuperscript{3}Yedinack, J., op. cit., p. 56.

\textsuperscript{4}Moss, M. A., op. cit., p. 653.

\textsuperscript{5}Robinson, Helen M., Why Pupils Fail in Reading. Chicago:
This chapter has attempted to review the possible relationship between certain types of reading disabilities and defective speech. The research reviewed suggests that children with reading disabilities tend to show articulation defects. Also, evidence supports that speech defective children tend to have some reading disability. Similarly, many studies have shown that a possible relationship might exist between the two disabilities as a result of their association with each other.

Considerable disagreement is shown in the research which has been done concerning the oral and silent reading abilities of speech defective children. As we have seen, certain investigators have shown that there is no significant correlation between defective speech and silent reading ability. Other investigations have shown there to be no significant correlation between oral reading and defective speech. On the other hand, some researchers have shown there to be a slight significance between defective speech and both oral and silent reading ability. However, little is known as to what types of speech defects were studied, or on what basis the defects were determined, and what specific reading skill the tests actually measured. In addition, there is little experimental evidence reporting the relationship of speech defects and reading ability in the upper elementary grades.

In summary, this chapter has shown that there is no general
agreement regarding the relationship between reading and defective speech. Similarly, it has shown the need for more research concerning the relationship between functionally defective articulation and adequate verbal reading skills. It is the purpose of the present study to provide such data.
CHAPTER II

STATEMENT OF THE PROBLEM

The purpose of this study is to investigate the word reading ability as evidenced in eight, nine, and ten year old children with functionally defective articulation as measured by the Word Reading Test of the Wide Range Achievement Test and to compare their scores with matched control subjects.

As we have seen in Chapter I, many investigations concerning language skills with respect to their interrelatedness have been carried out. These skills, as cited by Johnson\(^1\) are considered to be those of (1) speech, (2) reading, and (3) writing. Research has shown that it is conceivable that a deficiency in one or several areas of language development might impede or retard a part of a child's skill development or total academic achievement. Betts\(^2\), in his discussion of language skill development, submits that there are six levels of language proficiency which an individual must achieve. He further stresses that the growth in one stage contributes to readiness for the ensuing stage. Schneiderman\(^3\), in her research of speech and linguistic abilities, 

\(^1\)Johnson, M. S., "Factors Related to Disability in Reading." Journal of Experimental Education, XXVI (1957), 3.


found that articulation ability was significantly associated with high scores in language ability.

Specifically, within the scope of reading and speech skills, investigations have shown that speech defects and reading disabilities have a tendency to occur simultaneously. Monroe\(^1\) found that children with reading defects had many more speech defects and that defective speech should be considered a factor in reading disability. Similarly, Anderson and Kelly\(^2\) recognized the tendency for more speech defects to occur in reading disability cases. There is, however, a less certain relationship when silent reading ability and oral reading ability of speech defective children is assessed. Bond\(^3\) has shown that the effect of a speech defect is more pronounced when reading is appraised by the oral method than when it is measured by the silent reading method. Bennett\(^4\) also submits

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that a child with a persistent speech defect is seldom a good oral reader.

However, he feels the speech defect need not preclude the ability to read silently. In contrast, Artley\(^1\) and Gates\(^2\) both point out that speech defects may result in deficiency in silent reading skills which were brought about by inadequate oral reading skills.

Although Gaines\(^3\) recognizes that some relationship between speech defects and reading ability can be suspected, she feels that the amount of research done has been too small and incomplete to substantiate or to disprove any assumption. With respect to this view, she states:

> The absence of reliable norms of speech adjustment, accurate standardized tests and the unstandardized terminology and exact-types of reading used as a means of comparison make any deductions regarding the relationship between defective speech and reading disabilities inconclusive.

The present study was undertaken first, because of the general acceptance of the inter-relatedness of reading and speech skills, and secondly, because of the apparent divergence of opinion concerning the direct relationship.


\(^3\)Gaines, F., "Interrelations of Speech and Reading Disabilities." *Quarterly Journal of Speech*, XXVII (1941), 109.
Rationale for Reading and Speech Assessment Instruments

The average child achieves complete mastery of the speech sounds during the early months of the seventh year. West, Kennedy, and Carr¹ consider speech to be defective if articulation errors persist beyond the age of seven and one half years. In the same vein, Roe and Milisen², in their study of speech skills of school age children, found that maturation eliminated many sound errors in grades one through three. Thus, with a child who has no known organic anomalies or central nervous system impairment, and who exhibits articulation errors at eight years or older, we may assume that a deficiency of speech sound acquisition has occurred and that he is a functionally speech defective child. With this assumption in mind, a reliable diagnostic test of articulation ability was sought. The Templin-Darley Screening Test of Articulation³ consisting of fifty items which discriminated good and poor articulation was selected. This instrument was selected as the tool for


²Roe, Vivian and Milisen, Robert L., "The Effect of Maturation Upon Defective Articulation in Elementary Grades." Journal of Speech and Hearing Disorders, VII. (1942), 44.

determining the degree of defective articulation on the basis of its reliability as reported by Templin\textsuperscript{1}. She reports that:

The test-retest reliability coefficients ranged from .93 to .99 on single age groups for both tests. The coefficients between the scores on the word and the word-in-sentence test obtained at a single session ranged from .97 to .99.

The test also has a high degree of validity as reported by Templin and Darley\textsuperscript{2}. They state:

The correlation of the 50 items with mental age and chronological age are .71 and .64 respectively. The correlations computed at eight age levels between the total number of words and the number of different words uttered by a child in a controlled situation and the 50 item screening test were similar in magnitude. At no age is the difference between the correlations greater than .06 and the mean difference for 16 pairs is .02.

Because there are many skills involved in reading, a test which eliminates all but the actual mechanics (word reading) was sought. The paragraph type reading test which requires the child to complete the sense of a passage by writing words was excluded because it measured comprehension rather than actual word reading. The oral reading paragraph type of test was excluded because it provides too many contextual clues and encourages indiscriminate word guessing from clues provided from preceeding and succeeding words in the sentence. These

\textsuperscript{1}Templin, M. C. "Norms on a Screening Test of Articulation for Ages Three Through Eight." \textit{Journal of Speech and Hearing Disorders}, XVIII (1953), 323.

factors introduced in a test of reading often interfere with the actual skill being measured. Since the purpose of this study is to test word reading ability, eliminating the context and comprehension from the reading skill required the selection of a test of individual word reading. The test selected was the Word Reading Test. It was chosen for its reliability and validity in evaluating reading as a motor skill, as reported by Jastak. He states:

In a study of 389 cases of seventh and eighth graders, the Word Reading Test correlation with the New Stanford Paragraph Reading Test is .81 and with the New Stanford Word Reading Test is .84.

Synopsis of the Study

The testing of the word reading ability of children of normal and functionally defective speech was conducted through the administering of the Word Reading Test of the Wide-Range Achievement Test. The evaluation of articulation ability was determined by the administration of the Templin-Darley Screening Test of Articulation. Subjects were matched according to: (1) age, (2) sex, (3) grade level, and (4) academic achievement.

The results were expressed in terms of grade level scores as determined by the Word Reading Test of the Wide-Range Achievement Test. These grade level scores were reached by converting

the raw scores into grade level scores as determined by the norm table provided on the Word Reading Test sheet. The reading performance of the group of normal speaking children was compared with that of the functional articulatory defective group of children. The term "normal speaking" children applies to children who showed no articulation errors as measured by the Templin-Darley Screening Test of Articulation.

The purpose of this study is to determine the difference between the word reading abilities of the two groups in order to find if a relationship between word reading ability and articulatory defective speech exists. Phrased in terms of the null hypothesis, this study may be stated as follows:

There is no significant difference in the grade level scores on the Word Reading Test of the Wide-Range Achievement Test between a group of normal speaking and a group of functional articulatory defective third and fourth graders.
CHAPTER III

EXPERIMENTAL PROCEDURES

Subjects

There were sixty subjects used in this experiment: thirty functional articulatory defective speaking children and thirty normal speaking children selected from grades three and four. Eighteen third grade and twelve fourth grade articulatory defective boys and girls were tested and then matched with their normal speaking equivalent controls. The children were matched according to: (1) sex, (2) age, (3) grade level, and (4) academic achievement as evidenced and reported by the classroom teacher. All speech defective subjects were selected when their articulation index was less than the cutting score of 44 on the Templin-Darley Screening Test of Articulation. A score less than 44 indicates inadequate articulation performance for all children eight years and older. No subject was accepted if his defective speech was accompanied by an organic abnormality or dysfunction. No stutterers who possessed articulation errors were used in this experiment. See TABLE I for distribution of Templin-Darley Speech scores.

The following criteria applied to all subjects: (1) No subject was selected whose performance fell below grade level as evidenced and reported by the classroom teacher. (2) No subjects possessed organic speech disorders or stuttering.
(3) All subjects were enrolled in the third and fourth grades of the Portage Township Schools, Portage, Michigan, during the spring semester of the 1961-1962 school year. TABLE II shows the age range of the subjects used in this study. TABLE III indicates the sex frequencies of the subjects studied.

All subjects were tested individually, and each under the same control conditions; that is, the same materials and the same instructions were used.

**TABLE I**
DISTRIBUTION OF SCORES RECEIVED ON THE TEMPLIN-DARLEY SCREENING TEST OF ARTICULATION

<table>
<thead>
<tr>
<th>Score</th>
<th>Experimental**</th>
<th>Control*</th>
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</thead>
<tbody>
<tr>
<td>50-48</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>47-44</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>43-39</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>38-34</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>33-31</td>
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<td>30-26</td>
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<td>0</td>
</tr>
<tr>
<td>22-18</td>
<td>1</td>
<td>0</td>
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</table>

*Normal Speaking Children
**Functional articulatory defective children
TABLE II

AGE RANGE OF EXPERIMENTAL AND CONTROL SUBJECTS IN THIRD AND FOURTH GRADES

<table>
<thead>
<tr>
<th>Age</th>
<th>Third Graders</th>
<th>Fourth Graders</th>
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<tr>
<td>Eight years</td>
<td>Experimental</td>
<td>8</td>
</tr>
<tr>
<td>Third Graders</td>
<td>Control</td>
<td>8</td>
</tr>
<tr>
<td>Nine years</td>
<td>Experimental</td>
<td>8</td>
</tr>
<tr>
<td>Third Graders</td>
<td>Control</td>
<td>8</td>
</tr>
<tr>
<td>Ten years</td>
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<td>2</td>
</tr>
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<td>Third Graders</td>
<td>Control</td>
<td>2</td>
</tr>
<tr>
<td>Nine years</td>
<td>Experimental</td>
<td>3</td>
</tr>
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<td>Fourth Graders</td>
<td>Control</td>
<td>3</td>
</tr>
<tr>
<td>Ten years</td>
<td>Experimental</td>
<td>9</td>
</tr>
<tr>
<td>Fourth Graders</td>
<td>Control</td>
<td>9</td>
</tr>
</tbody>
</table>

*Normal Speaking Children
**Functional Articulatory Defective children

TABLE III

NUMBER OF MALES AND FEMALES IN EXPERIMENTAL AND CONTROL GROUPS FOR THIRD AND FOURTH GRADES

<table>
<thead>
<tr>
<th>Grade</th>
<th>Experimental</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>Grade Three</td>
<td>9 9</td>
<td>9 9</td>
</tr>
<tr>
<td>Grade Four</td>
<td>11 11</td>
<td>11 11</td>
</tr>
</tbody>
</table>

* Normal Speaking Children
**Functional articulatory defective children
Assessment Instruments

The test used to determine the presence of functional articulatory defects was the Templin-Darley Screening Test of Articulation. The screening test consists of fifty items printed in picture form on sixteen plates of the Templin-Darley Tests of Articulation Manual. Templin \(^1\) reports the test-retest reliability of these items ranged from .93 to .99 on single age groups for both tests. These fifty test items also have a high degree of validity as reported by Templin and Darley \(^2\). They report that the fifty items correlate with mental age and chronological age at .71 and .64 respectively. Also, the correlations computed at eight age levels between the 50 items and the number of words uttered by a child in a controlled situation showed a difference of no greater than .06 and showed a mean difference for 16 pairs of .02. The adequacy of the children's articulation ability was determined by the use of a table of cut-off scores which was provided in the test manual. For the purpose of this study, if the child fell below the cut-off score of 44 (speech age of eight years), his articulation performance was considered to be inadequate for his age.

\(^1\)Templin, M. C., "Norms on a Screening Test of Articulation for Ages Three Through Eight." Journal of Speech and Hearing Disorders, XVIII (1953), 323.

The Word Reading test of the Wide-Range Achievement Test was used to measure reading ability. The reading test consists of 120 words which must be read aloud to the examiner. The test is an individual word reading test. Its correlation with the New Stanford Paragraph Reading Test is .81 and with the New Stanford Word Reading Test it is .84 as reported by Jastek.\(^1\)

The reading range of each child was determined after ten consecutive word failures. Any mispronunciations due to provincialisms, foreignisms, and articulation errors were accepted as correct. Only the incorrect responses were marked. A response was recorded when an incorrect reading occurred due to faulty sequence of letters or to ignorance or confusions of phonic values or to improper stress and accent. The raw score (number of words correctly read) was then converted into a grade level rating.

**Testing Procedures**

The Templin-Darley Screening Test of Articulation was administered to all subjects. Each child was shown sixteen plates containing the fifty items used in the speech screening test. The child was asked to respond to the question regarding the picture shown. An articulation error on the consonant or

consonant blend being tested within the response word was considered a failure. The children were given the following instructions:

I am going to show you some pictures and ask you some questions about these pictures. You can answer them after you have heard my question. Do you understand? Okay, let's begin with the first picture.

The Word Reading Test of the Wide-Range Achievement Test was administered to all sixty children. Each child was presented a copy of the test consisting of 120 words arranged in lines according to achievement difficulty and was given the following instructions:

Look at each word carefully and read it aloud as well as you can. Begin at the first word and read the words across the page. Read the first line first, then the next, and so on. Do you understand the directions? Okay, let's begin with the first word.

**Scoring Procedures**

The scoring of the Templin-Darley Screening Test of Articulation was done in the following manner. In order to determine a raw score, the sum of all failures (articulation errors) was subtracted from the total fifty items. If the raw score was below 44 which is the cut-off score for adequate articulation of children eight years or older, the child's articulation was considered to be inadequate.

In scoring the Word Reading Test of the Wide-Range Achievement Test, a grade level rating was determined. The rating was
determined by converting the raw score (number of words read correctly) into a grade level by means of a grade norm table which is printed on each test sheet. This norm table omits raw scores 19 through 54 because the grade rating at these levels corresponds to the number of the raw score. Thus, 19 correct words gives a grade level rating of 1.9 (first grade, ninth month) and so forth up to 54 correct words which gives a grade rating of 5.4 (fifth grade, fourth month).

**Statistical Procedures Used for Analysis of Data**

The reading grade level ratings for the matched pairs were computed and expressed in terms of means and standard deviations. The significance of the difference between the means were expressed as \( t \) values. The standard deviations were computed using the formula:

\[
S. D. = \sqrt{\frac{\sum x^2}{N}}
\]

To determine whether there was a significant difference in the word reading grade level ratings of the normal speaking group as compared with the word reading grade level ratings of the functional articulatory defective group, a critical ratio or, \( t \) value, was procured.

---

1. Appendix A
A \( t \) value is defined as the ratio of a standard deviation to a standard error. It measures the validity of the difference between two means by accounting for the probable amount of variation from those means which might be expected to occur on the basis of normal distribution. The \( t \) value, therefore, determines whether the difference between the means of the groups tested is or is not significant. In addition, translating the \( t \) value into confidence levels assists in determining the degree of significance. If the \( t \) value reaches a five per cent level of confidence, it can be said that the difference between the means is a significant difference and that the results could probably occur again in ninety-five cases out of one hundred on the basis of chance variations in sampling. It can be said, also, that if a \( t \) value reaches the one per cent confidence level, in ninety-nine cases out of one hundred, the difference would probably occur again if the experiment was repeated. In addition, the greater the number of subjects, the lower the \( t \) value needed to be significant. This is because a greater freedom of difference in variation is allowed. This variation in freedom is called a degree of freedom, which is the number of subjects used in the investigation minus one. In other words, the greater the degrees of freedom, the more the deviations can be scattered about the mean and still have a significant difference.

The following formulae were used to compute the standard
error of the deviations and the $t$ value$^1$.

$$\sigma_{ED} = \sqrt{\sigma^2_m + \sigma^2_{ma}}; \quad t = \frac{M_a - M_b}{\sigma_{ED}}$$

CHAPTER IV

RESULTS

This chapter is concerned with the analysis of the results of this study. The purpose of this experimental research was to investigate the word reading ability of functional articulatory defective third and fourth grade children as compared with normal speaking third and fourth graders.

Appendix B provides the raw scores of the word reading test at each grade level for the experimental and control groups. Summarized in TABLE IV is the word reading ability for the experimental and control groups expressed in terms of means, standard deviations and the significance of the difference between the means expressed as a \( t \) value.

**TABLE IV**

Table of Means, Standard Deviations, \( t \) value, and the Difference Between Means, of Reading Ability for Experimental and Control Groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>( t ) value</th>
<th>( t ) value</th>
<th>Difference Between Mean(_1) and Mean(_2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Experimental</td>
<td>4.30</td>
<td>2.67</td>
<td></td>
<td>.25655</td>
<td>.88</td>
</tr>
<tr>
<td>Number = 30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>**Control</td>
<td>5.08</td>
<td>2.14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number = 30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Functional Articulatory Defective Children</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>**Normal Speaking Children</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Experimental

**Control

W Functional Articulatory Defective Children

**Normal Speaking Children

36
As shown in Table IV, the means of distributions were 4.30 for the experimental group and 5.08 for the control group. A difference of .98 was found between the means of the two groups. The standard deviation for the experimental group was 2.67 while the standard deviation for the control group was 2.14. A comparison of these variables gave a t value of .25655 with twenty-nine degrees of freedom. According to Fisher's Table of \( t \), a t value of at least 2.045 with twenty-nine degrees of freedom is required to be significant at the five per cent level of confidence. It is evident that the t value of .25655 with twenty-nine degrees of freedom obtained in this experiment is far less than the acceptable amount. Therefore, it can be said that the difference in word reading scores between the two groups is not significant. That is, the obtained value of t and the difference between the means on which it was based could have occurred from chance variation of sampling from the same population. On the basis of this information, the following null hypothesis must be accepted.

There is no significant difference in the grade level scores on the Word Reading Test of the Wide-Range Achievement Test between a group of normal speaking and a group of functional articulatory defective third and fourth graders.

From the analysis of the data obtained in this study, it may be concluded that no significant difference exists between

the word reading scores of a group of third and fourth grade functional articulatory defective children as compared to a group of normal speaking third and fourth graders. It is interesting to note, however, that examination of the raw data indicates that several functional articulatory defective subjects had very low scores which were inconsistent with the performance of the group as a whole.
CHAPTER V
CONCLUSIONS, IMPLICATIONS AND LIMITATIONS

The t value obtained from a comparison of word reading abilities of a group of functional articulatory defective children and a group of normal speaking youngsters was .25655. A t value of this amount is far below the value needed to show a significant difference in two variables. Thus, the results of this experiment reveal that there is no significant difference in the word reading abilities of the two groups.

Word reading ability can not specifically be regarded as a silent reading skill, nor can it be entirely regarded as a skill of oral reading. Therefore, the existence of no significant difference in the word reading abilities of the two groups generally supports the research done by Bond and Moore, as previously stated in the review of related studies. However, the results of this study do not specifically support their findings because both investigations found there to be no significant difference in the silent reading abilities of speech defective and normal speaking children. Since this study was concerned, also, with an aspect of oral reading ability, the results are in general contrast to the findings of Gibbons, Yedinack and Moss which were reviewed in the chapter concerned with related studies. These investigations revealed that speech defective children were significantly inferior in oral reading
ability as compared to normal speaking children. However, since their findings were based on tests of comprehension, and because the present study's findings were based only upon word reading ability, a direct contrast to their findings cannot be made.

Within the limitations of this study, several conclusions may be drawn. As the results of the present study have shown, functional articulatory defective children do not differ from normal speaking children in terms of word reading ability. Since this study concerned itself with only the actual mechanics of reading (word reading) and since it did not include the comprehension skill or paragraph reading skills of total reading ability, it can be concluded that there is no difference in the actual reading ability of functional articulatory defective children as compared to normal speaking children. On the basis of this conclusion, it can be assumed that the total educational program of functional articulatory defective children need not differ from that of the normal speaking children, except to the degree that it should include speech therapy as a tool to eliminate the articulation errors. From this conclusion, it can be assumed that the speech therapy program need only to include the techniques usually presented in the correction of articulation errors. That is, the design of speech therapy would not need to include special procedures evolved from theories of language disorders, as previously suggested by
The most important implication brought forth from this study is the need for further research into the evaluation of comprehension skill and paragraph reading skills as well as the word reading skill in comparing the reading abilities of functional articulatory defective and normal speaking children. Researchers might study the interrelationship of these skills and, also, investigate the degree of severity (number of phoneme errors) of the articulation problem and its relationship to the word reading ability. Limitations resulting from the present study are first, the possible lack of accurate measures of academic achievement, and second the absence of the measurement of intelligence. It is suggested that researchers employ reliable and valid measures of both intelligence and academic achievement when further investigations regarding functionally defective articulation and reading ability are made.

Wood¹.

Sixty children were used in this study in an attempt to investigate the word reading ability of children with functional defects of articulation as compared to children with normal speech. Thirty of these were normal speaking children, eighteen third graders and twelve fourth graders; and thirty were functional articulatory defective children, eighteen third graders and twelve fourth graders. The subjects were matched according to: (1) age, (2) sex, (3) grade level, and (4) academic achievement.

The Templin-Darley Screening Test of Articulation was employed to determine defective articulation. The word reading ability of all subjects was measured by the Word Reading Test of the Wide-Range Achievement Test. The results are based upon the word reading grade level scores for the normal speaking children as compared to the functional articulatory defective children.

Phrased in terms of the null hypothesis, this study may be stated as follows:

There is no significant difference in the grade level scores on the Word Reading Test of the Wide-Range Achievement Test between a group of normal speaking and a group of functional articulatory defective third and fourth graders.
The statistical analysis of the data expressed in terms of a critical ratio, or, t-value demonstrated that this null hypothesis could be accepted. That is, on the basis of the results of this study, it can be stated that there is no difference in word reading ability between the experimental and control groups.


de Hirsch, Katrina, "Specific Dyslexia or Strephosymbolia." Folia Phoniatrica, IV (September, 1952), 231-248.

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Moore, Charles E., "Reading and Arithmetic Abilities Associated with Speech Defects." Journal of Speech and Hearing Disorders, XII (1947), 85-86.


Roe, Vivian and Milisen, Robert L., "The Effect of Matura


Templin, M. C., "Norms on a Screening Test of Articulation for Ages Three through Eight." *Journal of Speech and Hearing Disorders, XVIII* (1953), 323-331.


SAMPLE OF READING TEST OF WIDE RANGE ACHIEVEMENT TEST

A B C S E R T H
to see cat milk red tree big book was city
eat him animal letter then himself how deep
spell between weather lip block awake size aboard
felt chin tray approve cliff stalk split huge
plot quality escape urge collapse grieve abuse
residence quarantine contagious glutton exhaust imply
image contemporary theory threshold participate ethics
desolate eliminate triumph tranquility humidity
contemptuous alcove humiliate conspiracy aeronautic
predilection emphasis municipal recinded luxurious
unanimous intrigue protuberance audacious benign prevalence
repugnant peculiarity rudimentary pugilist mitosis
bibliography anomaly decisive mosaic deteriorate
spurious irascible expugn coercion discretionary
enigmatic regime centrifugal itinerary abysmal
soliloquize inchoate oligarchy exigencies mnemonic
ingratiating covetousness aborigines emaciated seismograph
pseudonym usurp idiosyncrasy schism misogyny desuetude
exophthalmic succinct longevity remiges vehemence
regicidal evanescence heinous omniscience conduit
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<tr>
<td>3</td>
<td>0.7</td>
</tr>
<tr>
<td>4</td>
<td>0.9</td>
</tr>
<tr>
<td>5</td>
<td>1.0</td>
</tr>
<tr>
<td>6, 7</td>
<td>1.1</td>
</tr>
<tr>
<td>8, 9</td>
<td>1.2</td>
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<td>10, 11</td>
<td>1.3</td>
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<tr>
<td>12, 13</td>
<td>1.4</td>
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<tr>
<td>14</td>
<td>1.5</td>
</tr>
<tr>
<td>15</td>
<td>1.6</td>
</tr>
<tr>
<td>16</td>
<td>1.7</td>
</tr>
<tr>
<td>17, 18</td>
<td>1.8</td>
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etc.

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<tr>
<td>60</td>
<td>6.1</td>
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</tr>
<tr>
<td>62</td>
<td>6.4</td>
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etc.
RAW SCORES ON WORD READING TEST
OF THE
WIDE RANGE ACHIEVEMENT TEST

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<td>39</td>
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<tr>
<td>K. W.</td>
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<td>31</td>
</tr>
<tr>
<td>R. M.</td>
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<td>64</td>
</tr>
<tr>
<td>E. S.</td>
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<td>50</td>
</tr>
<tr>
<td>D. D.</td>
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<td>44</td>
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<td>C. B.</td>
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<tr>
<td>S. K.</td>
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APPENDIX B (continued)

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<td>44</td>
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<tr>
<td>B. E.</td>
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<td>48</td>
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<td>J. O.</td>
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<td>42</td>
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<td>Subject</td>
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