An Investigation of the Vocal Phonic Abilities of Children with Normal Speech and Articulation Disorders

Orville Wilson Wensley

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AN INVESTIGATION OF THE VOCAL PHONIC ABILITIES OF CHILDREN WITH NORMAL SPEECH AND ARTICULATION DISORDERS

A Thesis
Submitted to the Faculty of
Western Michigan College of Education

In Partial Fulfillment of the Requirements for the Degree
Master of Arts

by
Orville Wilson Wensley
January 1956
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CHAPTER I

INTRODUCTION

Much of the recent literature dealing with the etiology and treatment of functional articulatory defects, has been concerned with perceptual aspects of the problem. Many clinicians feel that it is in the area of perceptual deficiencies that most of the causes of articulatory defects occur, even though research does not support that opinion.  


It has been the purpose of this study to investigate the vocal phonic synthesizing ability among groups of children with functional articulatory defects and normal speaking children. According to Johnson vocal phonics consists of those activities related to the analysis and synthesis (breaking down and recombining) of sound sequences. Regarding those children in whom this ability is lacking or entirely deficient, Johnson says:


3 Ibid., p. 86.
A child who has this 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.

Ridenour\(^4\) working with remedial reading cases found that difficulty blending sounds into words is characteristic of many children who have been unable to learn to read by regular school methods. Jones\(^5\) found a positive relationship between speech training and silent reading achievement. Mulder and Curtin\(^6\) found a relationship between vocal phonic ability and silent reading achievement.

It has been found clinically that systematic training in the synthesizing and analytic forms of vocal phonics has facilitated therapy with most cases of functional articulatory defects\(^7\). Regarding the development of speech

---


\(^5\) Morris Val Jones, "The Effect of Speech Training on Silent Reading Achievement", *Journal of Speech and Hearing Disorders*, 16: 3, 1951.


\(^7\) Van Riper, *op. cit.*, p. 196.
Van Riper says:

The child usually learns to talk by making two very obvious but very important discoveries: first, that each sound has distinct visual, auditory, and kinesthetic features; and second, that words are made up of a series of consecutive sounds.  

\[8\] *Ibid.*, p. 31

With these obvious implications for therapy, in both speech and reading, this study was undertaken.

**RELATED STUDIES**

The average child achieves complete mastery of the speech sounds during the early portion of the seventh year. West, Kennedy, and Carr\(^9\) consider speech to be defective if articulation errors persist beyond the age of seven and one half years. Thus, if a child exhibits articulation errors above the age of seven and one half years, we may assume that a deficiency of speech sound acquisition has occurred.

Many of the facets of speech sound acquisition remain obscure at the present time. Although, according to Van Riper\(^10\), there are certain basic factors and abilities
which are requisite for adequate speech development. These factors are: (1) emotional adjustment, (2) need for speech, (3) adequacy of organic structures and physical health, (4) motor control of speech organs, (5) intellectual development, and (6) auditory acuity and recognition. Without these in satisfactory degrees and combinations, speech development may be defective, or lacking completely. 

Irwin\textsuperscript{11}, \textsuperscript{12} and Templin\textsuperscript{13} have provided considerable information regarding speech acquisition during the early years.

Most authorities feel that sensory perception assumes one of the most important aspects with relationship to functional defects of articulation. For only through
the senses, can the speaker monitor his productions during
the act of speaking. According to West, Kennedy, and Carr\textsuperscript{14},

\footnotesize
\begin{footnotesize}
\begin{enumerate}
\item Robert West, Lou Kennedy, and Anna Carr, \textit{op. cit.}, p. 27.
\end{enumerate}
\end{footnotesize}

the majority of speech sounds are at first quite meaningless
to the child. Before he can acquire meaning from the
simplest words, he must learn to analyze them into their
acoustic elements. Before he can reproduce these words he
must learn the time order in which these sounds occur.

\textsuperscript{15} Davis\textsuperscript{15} lends further support to this view. He considers

\footnotesize
\begin{footnotesize}
\begin{enumerate}
\item Hallowell L. Davis, "Auditory Communication", \textit{Journal of Speech and Hearing Disorders}, 16: 3-8, 1951.
\end{enumerate}
\end{footnotesize}

the auditory perceptive mechanism to be superior to all
others, as a monitoring system for speech. \textsuperscript{16} Van Riper\textsuperscript{16}

\footnotesize
\begin{footnotesize}
\begin{enumerate}
\item Van Riper, \textit{op. cit.}, p. 157-69.
\end{enumerate}
\end{footnotesize}

stresses kinesthesia as an adjunct to the auditory process
of speech monitoring. Backus\textsuperscript{17} states regarding short

\footnotesize
\begin{footnotesize}
\begin{enumerate}
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\end{footnotesize}

auditory memory span:

\footnotesize
\begin{footnotesize}
\begin{enumerate}
\item This condition does not predicate poor hearing in the
usual sense of that term. It means that the child's
range of memory for the time order of sounds has not
developed normally for his age.
\end{enumerate}
\end{footnotesize}

\footnotesize
\begin{footnotesize}
\begin{enumerate}
\item \textsuperscript{14} Van Riper, \textit{op. cit.}, p. 157-69.
\item \textsuperscript{15} Ollie Backus, \textit{Speech in Education} (New York: Longmans Green and Company, 1951), p. 133.
\end{enumerate}
\end{footnotesize}
It has been shown\textsuperscript{18} that many functional articulatory de-
fectives are completely unaware of their speech deviations until some awareness develops through the reactions of the auditors, i.e., the speaker does not recognize articulatory deviations which are readily apparent to others. For this reason Van Riper\textsuperscript{19} and Ainsworth\textsuperscript{20} have stressed the im-
portance of ear training. Phillips\textsuperscript{21} evaluated speech therapy using ear training procedures by comparing articulatory errors of matched groups of articulatory defectives previous to, and following speech improvement classes of first, second, and third grades. Second and third grade classes taught by ear training methods, exhibited significantly fewer errors, at the 1 per cent level of confidence, following speech therapy than did the classes taught using other methods. Jones\textsuperscript{22} investigated

\textsuperscript{18} Van Riper, op. cit., p. 205.

\textsuperscript{19} Van Riper, op. cit., p. 209-13.


\textsuperscript{22} Jones
the effect of speech training on silent reading achievement. He found a positive relationship between speech and silent reading ability at the third grade level.

It is felt that the auditory senses assume greater significance in the role of monitoring speech. 23, 24, 25

These auditory factors are usually postulated to be: (1) auditory acuity, (2) phonetic or auditory discrimination, and (3) auditory memory span. That a hearing loss is often associated with an articulatory defect has been shown by Sullivan 26.


Phonetic discrimination refers to the ability to distinguish small differences between phonemes or within a particular phoneme. If this ability is deficient, the speaker may be unable to discern variations in his own speech.
Travis and Rasmus\textsuperscript{27} found significantly more errors in the defective group than within the normal speakers. Their test consisted of 366 pairs of syllables. Each phoneme of the English language was paired with itself and each remaining phoneme in the language. The defective group seemed to have more difficulty discriminating those elements which were defective in their own speech. Templin\textsuperscript{28} used one hundred of the 366 items on the Travis-Rasmus test. She moved the discriminative element from the initial position to the medial and final positions. With the discriminative element thus transposed, she was able to report more difficulty at the 1 per cent level of confidence. Hall\textsuperscript{29} employed two measures of phonetic discrimination. The first was the Travis-Rasmus test. The second was termed a \textit{complex speech}
sound discrimination test. It required the subjects to remember an unfamiliar coined word, imbedded within a five word phrase, and then to select one of the six spoken alternatives, which was identical to the original item. This test probably involved the factor of auditory memory span as well as auditory acuity. Statistical analysis revealed no significant differences between the defective group and the normal speaking group, on either of the tests used. Hansen investigated the discriminatory abilities of thirteen untrained and thirteen trained functional articulatory defectives. These results were then compared to those of thirteen normal speaking subjects. Three measures of discrimination were used: (1) Travis-Rasmus, (2) the Seashore Measure of Timbre, and (3) a vowel discrimination test, devised by Hansen. He reports no significant differences on any of the measures used. Mase reports no differences between the functional articulatory


31 Darrell F. Mase, Etiology of Articulatory Speech Defects (New York: Bureau of Publications, Teachers College, Columbia University, 1946)
defective group and the normal speaking group on any of the items tested. Two tests were administered to fifty-three fifth and sixth grade boys, with functional articulatory defects. In the first test, the subjects were asked to judge if an indicated word in each of one hundred sentences was articulated correctly or incorrectly. One hundred paired words, to which the subjects were to respond "same" or "different" comprised the second test.

Metraux using all types of speech defectives found auditory memory span for vowels slightly higher for speech defectives than for normal speakers, while the auditory memory span for consonants was lower for speech defectives than for normal speakers. Robbins suggests that a high correlation exists between auditory memory span and articulation. Reid used a shortened form of the Travis-Rasmus test.
She concluded that speech sound discrimination is related to severity of the articulatory disorder.

Perhaps the factors measured are not the essential ones, regarding the skills needed in vocal phonics, but it appears that they are all interrelated with regard to this synthesizing ability. If we accept the premise that increasing age is an index to maturation and learning, we may conclude that vocal phonic synthesizing ability develops proportionately with regard to normal speaking children and functional articulatory defective children dependent upon the severity of the disorder.
CHAPTER II

STATEMENT OF THE PROBLEM

The purpose of this study is to test the vocal phonetic synthesizing ability of children with functional defects of articulation as compared to children with normal speech.

Much has been written concerning the auditory factors involved with speech sound development. (See related studies in Chapter I) These auditory factors are commonly thought of as: (1) auditory acuity, (2) auditory memory span, and (3) auditory or phonetic discrimination. Davis\(^1\) has pointed out the importance of auditory perception as an important speech monitoring system. According to Van Riper\(^2\) many children persist in their articulatory errors because they never learn that words are composed of a series of consecutive sounds. Many texts on speech disorders\(^3, 4, 5\) point out the

\(^3\) Ibid p. 127
importance of mastering the necessary skills of analysis
and synthesis of sound sequences. Stinchfield\(^6\) reports that

\[\text{skill in breaking down and recombining sound sequences is}
greatly facilitated through remedial reading training. Monroe}^{7}\text{ felt that lack of skill in discriminating speech}

\[\text{sounds might impede progress in reading.}

The dichotomy of views regarding the actual role of
individual sounds in the development of speech is wide
spread. Johnson\(^8\) says:

\[\text{We don't listen to a series of connected sounds; we}

\text{4 Robert West, Lou Kennedy, and Anna Carr, \textit{The}
Rehabilitation of Speech} (New York: Harpers Brothers, 1937), p. 163

\text{5 Wendell Johnson, editor, \textit{Speech Problems of Children}
(New York: Grune and Stratton, Inc., 1950), p. 36

\text{6 Sarah Stinchfield and Edna Young, \textit{Children with
Delayed or Defective Speech} (Stanford University, California:
Stanford University Press, 1940), p. 25

\text{7 Marion Monroe, "Reading Aptitude Tests in Beginning

\text{8 Wendell Johnson, et al., \textit{Speech Handicapped School
Children} (New York: Harpers Brothers, 1943), p. 114}
listen to words, or phrases or sentences. For most of
us, adults as well as children, the speech sound is not
an entity, a meaningful unit of any sort, and we don't
hear it as an entity. What we hear and what we learn,
are words, and the individual sounds which go together
to make up those words, are for the most part amorphous
and undifferentiated pieces of the whole auditory pattern.

Thomas\textsuperscript{9} says on the other hand:

\begin{quote}
\textsuperscript{9} Charles K. Thomas, \textit{Phonetics of American English}
\end{quote}

The distinctive sound unit, or phoneme, is basic to our
understanding of speech, and the non-distinctive
variations, whether, personal, regional, or contextual,
are of secondary importance.

Van Riper has the following to say, regarding the development
of speech.

If we are to help a child master pronunciation we must
help him acquire the skill of taking words apart and
putting them together. Again we must follow the natural
tendency of the child. Normal children eventually learn the
principles of vocal phonics, the synthesis and analysis of words, by rhyming, by punning by distorting
their sequences.\textsuperscript{10}

\begin{quote}
\textsuperscript{10} Charles Van Riper, \textit{Teaching Your Child to Talk}
\end{quote}

This study was undertaken first, because of the
general acceptance of these auditory factors, and secondly
because of the apparent divergence of opinion as to the
actual role played by these factors.
SYNOPSIS OF THE STUDY

The test items consisted of twenty-four words. These words were broken into four sub-groups of six words each. Group one consisted of two phoneme words. The second group consisted of six three phoneme words. Six four phoneme words comprised group three. Group four consisted of six five phoneme words. These twenty-four words were recorded on a magnetic tape recorder with a two second delay between individual phonemes of any given word. Ten seconds delay were allowed between presentations of individual words.

The results are based on the number of correct words (phonemes synthesized into meaningful words) for the normal speaking children as compared to the functional articulatory defective group. The experimental subjects, both the defective and the normal speaking groups were drawn from grades one, two, three, and four. All subjects were matched according to: (1) age, (2) sex, and (3) intelligence quotients.

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

Hypothesis one. THERE IS NO DIFFERENCE IN THE VOCAL PHONIC SYNthesIZING ABILITY AMONG GROUPS OF CHILDREN IN GRADES ONE, TWO, THREE, AND FOUR WITH FUNCTIONAL ARTICULATORY
Hypothesis two. There is no difference in the vocal phonic synthesizing ability among groups of children in grades one, two, three, and four who have functional articulatory defects.

Hypothesis three. There is no difference in the vocal phonic synthesizing ability among groups of children in grades one, two, three, and four who have normal speech.
CHAPTER III

METHODS AND PROCEDURES FOR SELECTION AND PREPARATION OF THE MATERIALS, SELECTION OF SUBJECTS, AND TESTING OF SUBJECTS

All subjects were tested individually, and each under the same control conditions; that is, the same room, the same use of equipment and the same instructions.

The stimulus material consisted of twenty four words. These words were divided into four sub-groups of six words each. These sub-groups were arranged in order of increased difficulty, i.e., two phoneme, three phoneme, four phoneme, and five phoneme words.

In selecting these words, it was necessary to determine whether or not all potential subjects used each of the test items, in his or her spontaneous speech. This was ascertained through the use of two measures. First, the classroom teachers were requested to check each potential subject, relative to the occurrence of each stimulus word during the regular classroom activities. Secondly, the examiner prepared a picture card of each stimulus word. Each subject was then examined to determine whether or not he could identify each card. In no instance was any subject unable to identify any of the pictures. It was not required that
these words be articulated correctly, only that each subject have a commonality of usage. Through these two measures, it was determined that all subjects were familiar with, and used each of the stimulus words in his or her propositional speech.

A Webcor Magnetic Tape Recorder, Model 2010, with crystal microphone attachment was used in recording all stimulus words. The recorder was operated at a speed of 7½ cycles per second. Each of the stimulus words were recorded in the same manner. No individual phoneme was prolonged for more than .50 of a second. The average time of phonation was between .25 and .50 of a second. This variation was dependent upon the sound characteristics of the particular phoneme being recorded. A two second delay was held constant between any consecutive phonemes of a given word, such as $\text{ʃ}:\text{u}$ or $\breve{a}:\breve{a}$, Ten seconds were allowed for subject responses between stimulus presentations.

INSTRUCTIONS FOR SUBJECTS

Each subject was given the same directions as regard to performance procedure. The recorded instructions were as follows:
You are going to hear some sounds, and if you listen very carefully, you will see that these sounds will go together to make a real word. Like this...

\[ \text{K-k-a-r} \quad \ldots \] Do you know what word that was? Alright, let's listen to that once more...

\[ \text{K-k-a-r} \quad \ldots \] That's right, it was car wasn't it?

Let's try a different word now. But remember to listen very carefully to all the sounds so that you may put them together to make a word. Ready? What word is this? \[ \text{K-e-K} \quad \ldots \] That's right it was \text{cake} wasn't it?

After each word, you will hear a bell, like this. \text{bell}

This bell will tell you that it is the end of the word. When you hear this bell, then you are to try to put these sounds together. So that you may tell me what word it is. Let's see if you can listen to these sounds and then tell me what word they make when you put them together. Ready? \[ \text{p-e-p-e} \quad \ldots \]

\text{bell}. That's right, that word was \text{paper} wasn't it?

Get ready, here we go. But be sure to listen very carefully to each sound, and try to tell me what words these sounds will make when you put them together.

\[ \text{p-e-n-e} \quad \ldots \]

That's right, those sounds make the word \text{pen} wasn't it?

\[ \text{bell}. \]

That's right, that word was \text{pen} wasn't it?

SUBJECTS

There were eighty subjects used in this study. Forty normal speaking children, ten from each of the first four grades; and forty functional articulatory defective children, ten from each of the first four grades. See Table I for the distribution of boys and girls in each grade.

The age range was between six and eleven years of age, for all grade levels. The mean age for each grade level is
TABLE I

NUMBER OF MALES AND FEMALES IN EXPERIMENTAL AND CONTROL GROUPS, FOR GRADES ONE THROUGH FOUR

<table>
<thead>
<tr>
<th>Grade</th>
<th>Experimental Boys</th>
<th>Experimental Girls</th>
<th>Control Boys</th>
<th>Control Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Two</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Three</td>
<td>9</td>
<td>1</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Four</td>
<td>7</td>
<td>3</td>
<td>7</td>
<td>3</td>
</tr>
</tbody>
</table>

shown in Table II.

Table III contains the mean intelligence quotients for all grade levels.

Two criteria were set up to screen all potential subjects. One, what shall constitute functional articulatory defective speech? And two, what will be accepted as representative of normal speech? Van Riper defines a speech defect as:

Speech is defective when it deviates so far from the speech of other people that it calls attention to itself, interferes with communication or causes its possessor to be maladjusted.  

---

TABLE II

MEAN AGE, FOR EXPERIMENTAL AND CONTROL SUBJECTS IN GRADES ONE THROUGH FOUR

<table>
<thead>
<tr>
<th></th>
<th>Experimental* *</th>
<th>Control*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade One</td>
<td>6.3</td>
<td>6.4</td>
</tr>
<tr>
<td>Grade Two</td>
<td>8.3</td>
<td>7.3</td>
</tr>
<tr>
<td>Grade Three</td>
<td>9.3</td>
<td>9.0</td>
</tr>
<tr>
<td>Grade Four</td>
<td>10.5</td>
<td>10.0</td>
</tr>
</tbody>
</table>

** Functional articulatory defective children
* normal speaking children

---

TABLE III

MEAN INTELLIGENCE SCORES FOR EXPERIMENTAL AND CONTROL SUBJECTS IN GRADES ONE THROUGH FOUR

<table>
<thead>
<tr>
<th></th>
<th>Experimental* *</th>
<th>Control*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade One</td>
<td>103</td>
<td>102</td>
</tr>
<tr>
<td>Grade Two</td>
<td>100</td>
<td>104</td>
</tr>
<tr>
<td>Grade Three</td>
<td>97</td>
<td>100</td>
</tr>
<tr>
<td>Grade Four</td>
<td>104</td>
<td>110</td>
</tr>
</tbody>
</table>

** Functional articulatory defective children
* normal speaking children
Conversely this definition has been accepted as the criteria regarding the normal speaking subjects. In the functional articulatory defective group the following criteria were set up: (1) No subject was accepted who possessed organic abnormalities which contributed to defective speech. (2) No subject was accepted who has fewer than three consonant speech sound errors. (3) All subjects met the standard certification requirements for a speech handicapping condition in the state of Michigan.

The following criteria applied to all subjects:
(1) No subject was selected who had an intelligence quotient lower than eighty on any intelligence test administered in the schools. (2) Each subject was administered an individual audiometric sweep test. A loss of fifteen or more decibels in any frequency excluded potential subjects. (3) All subjects who participated in this study were enrolled in the Portage Township Public Schools, Portage, Michigan, during the 1953-1954 school year.
CHAPTER IV

ANALYSIS OF DATA

This chapter is concerned with an analysis of the findings of this study. The purpose of this thesis was a study of the vocal phonic synthesizing ability of functional articulatory defective children as compared with normal speaking children in grades one, two, three, and four.

Figures one through eight show the number of times the words were identified correctly at each grade level by the experimental and control groups\(^1\).

Appendix A

The number of correct words for each grade level expressed in terms of means, standard deviations, and the significance of the difference between the means expressed as t values, are summarized in Tables IV, V, VI, and VII. The standard deviations were computed using the formula\(^2\).

\[
S.D. = \frac{1}{N} \sqrt{N \sum f x^2 - (\sum dx)^2}
\]

To determine whether there were significant differences between all grades in the normal speaking group as compared with all the grades in the functional articulatory defective group Fishers' $t$ test was used.

The following formula was used to compute all $t$ values:

$$t = \sqrt{\frac{\sum x_1^2 + \sum x_2^2}{N_1 + N_2 - 2} \left( \frac{N_1 + N_2}{N_1 N_2} \right)}$$

The $t$ value for all grades was found to be 2.0143 with 39 degrees of freedom. A $t$ of 2.1335 is significant at the 5 per cent level of confidence, with 39 degrees of freedom. Thus indicating that a $t$ of 2.0143 could occur 10 per cent of the time as a result of pure chance. Therefore we may conclude that the two populations used in this study could not have come, except by chance in 10 per cent of the samples, from the same total population. There is a significant difference in the abilities of these two groups, to synthesize sound phonemes into meaningful words. Having determined that these two samples differed significantly from one another, the three null hypotheses, stated in Chapter III, were tested using Fishers' formula for $t$. 

---

Hypothesis one: There is no difference in the vocal phonic synthesizing ability among groups of children in grades one through four, who have functional defects of articulation, and children who have normal speech.

Grade one. As shown in Table IV, the means of the distributions were 1.2 for the experimental group, and 3.5 for the control group. The standard deviations were 2.05 and 2.73 respectively. A comparison of these variables gave a t value of 2.06 with nine degrees of freedom, as shown in Table V. A t of 2.262 is significant at the five per cent level of confidence.

Grade two. The means of the two distributions were 3.1 and 6.8 (as shown in Table IV). The standard deviations were 3.49 and 3.65. A comparison of these variables gave a t value of 2.545 with nine degrees of freedom. This was significant at the five per cent level of confidence.

Grade three. The means (Table IV) were 8.7 and 10.0, the standard deviations were 5.23 and 6.68 respectively. The t value was .541 with nine degrees of freedom. A t value of .543 is significant at the 60 per cent level of confidence.

Grade four. With nine degrees of freedom, the t value of 5.86 was significant at the one per cent level of
<table>
<thead>
<tr>
<th>Grade</th>
<th>Experimental</th>
<th>Control</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td></td>
<td></td>
<td>1.2</td>
<td>2.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.5</td>
<td>2.73</td>
</tr>
<tr>
<td>Two</td>
<td></td>
<td></td>
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<td>6.8</td>
<td>3.65</td>
</tr>
<tr>
<td>Three</td>
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<td>5.23</td>
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<tr>
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<td></td>
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<td>10.1</td>
<td>6.68</td>
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<td>Four</td>
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<td>5.40</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20.2</td>
<td>2.07</td>
</tr>
</tbody>
</table>

* functional articulatory defective children
** normal speaking children
### TABLE V

<table>
<thead>
<tr>
<th>Grade one</th>
<th>Grade 2</th>
<th>Grade 3</th>
<th>Grade 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade one</td>
<td>2.065*</td>
<td></td>
<td></td>
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<tr>
<td>Grade two</td>
<td>2.545*</td>
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<tr>
<td>Grade three</td>
<td>.641</td>
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<td>Grade four</td>
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* significant at the 5 per cent level of confidence
** significant at the 1 per cent level of confidence
confidence. The means of the two distributions were 9.0 and 20.2, the standard deviations were 5.40 and 2.07.

**Hypothesis two:** THERE IS NO DIFFERENCE IN THE VOCAL PHONIC SYNTHESIZING ABILITY AMONG GROUPS OF CHILDREN IN GRADES ONE THROUGH FOUR, WHO HAVE FUNCTIONAL DEFECTS OF ARTICULATION.

This hypothesis was tested using Fisher’s \( t \) formula for testing the differences between pairs of uncorrelated means. Comparisons were made, using the six possible combinations between grade levels. These were: The first grade to the second, first to the third, and the first to the fourth. The second grade was compared to the third, and the second to the fourth. The third grade was compared to the fourth. The means and standard deviations which served as a basis for these comparisons are shown in Table IV.

Table VI contains the \( t \) values for these comparisons. The \( t \) value for the comparison of grade one to grade two was 2.04, significant at the 10 per cent level of confidence. The \( t \) value for the comparison of the first to the third grade was 4.14, which was significant at the 1 per cent level of confidence. Grade one compared to
### Table VI

*T Values for the comparison of responses for twenty four words, for two groups of ten children each, with functional articulatory problems, in grades one through four*

<table>
<thead>
<tr>
<th></th>
<th>Grade two</th>
<th>Grade three</th>
<th>Grade four</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade one</td>
<td>2.04</td>
<td>4.14**</td>
<td>5.06**</td>
</tr>
<tr>
<td>Grade two</td>
<td>2.82*</td>
<td></td>
<td>3.02*</td>
</tr>
<tr>
<td>Grade three</td>
<td></td>
<td>1.30</td>
<td></td>
</tr>
</tbody>
</table>

*significant at the 5 per cent level of confidence
**significant at the 1 per cent level of confidence
grade four, yielded a \( t \) value of 5.06 with nine degrees of freedom. This was significant at the 1 per cent level of confidence. Grade two compared with grade three, had a \( t \) value of 2.82. This was significant at the 5 per cent level of confidence. The second grade compared to the fourth, had a \( t \) value of 3.02. This was significant at the 2 per cent level of confidence. The third grade compared to the fourth grade had a \( t \) value of 3.02. A \( t \) of 1.89 with nine degrees of freedom is significant at the 90 per cent level of confidence. Signifying that this relationship could occur 10 per cent of the time by chance.

**Hypothesis three:** THERE IS NO DIFFERENCE IN THE VOCAL PHONIC SYNTHESIZING ABILITY AMONG GROUPS OF CHILDREN IN GRADES ONE THROUGH FOUR WHO HAVE NORMAL SPEECH.

This hypothesis was also tested using Fisher's formula for \( t \), testing the differences between pairs of uncorrelated means. The same six comparisons were made as in hypothesis two, but using the scores for the normal speaking subjects. These comparisons were: The first grade to the second, the first to the third, and the first to the fourth. The second grade to the third, and the second to the fourth. The third grade was compared to the fourth. The \( t \) values for these comparisons are shown.
on Table VII. The $t$ value for the comparison of grade one
to grade two was 2.19. A $t$ value of 1.33 with nine degrees
of freedom is significant at the 10 per cent level of
certainty. The $t$ value for the first to the third grade
was 3.08. This was significant above the 2 per cent level
of confidence, but below the 1 per cent level of con-
fidence. The first to the fourth grade had a $t$ value of
17.9 which was significant at the 1 per cent level of
confidence. The second grade compared to the third had a
$t$ value of 1.41. This was significant at the 20 per cent
level of confidence. The second to the fourth grade had a
$t$ value of 10.07 which was significant at the 1 per cent
level of confidence. The third grade compared to the
fourth grade showed a $t$ value of 4.02 which was significant
at the 1 per cent level of confidence.
<table>
<thead>
<tr>
<th>d.f.</th>
<th>Grade two</th>
<th>Grade three</th>
<th>Grade four</th>
</tr>
</thead>
<tbody>
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<td>Grade one</td>
<td>2.19</td>
<td>3.08*</td>
<td>17.91**</td>
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<tr>
<td>Grade two</td>
<td>1.41</td>
<td>10.12**</td>
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<td>Grade three</td>
<td></td>
<td></td>
<td>4.02**</td>
</tr>
</tbody>
</table>

* significant at the 5 per cent level of confidence  
** significant at the 1 per cent level of confidence
CHAPTER V

INTERPRETATION OF RESULTS

This chapter is concerned with the interpretations of the results, conclusions and recommendations for future research.

The t value for the comparison of all the normal speaking subjects with all the articulatory defective subjects, in grades one through four, was found to be 2.0143 with 59 degrees of freedom. A t of this size indicates that these two samples could not be from the same population, except by chance in 10 per cent of the samples; and that there is a significant difference between these two groups in their ability to synthesize sound phonemes into meaningful words.

Hypothesis one. THERE IS NO DIFFERENCE IN THE VOCAL PHONIC SYNTHESIZING ABILITY AMONG GROUPS OF CHILDREN IN GRADES ONE THROUGH FOUR, WHO HAVE FUNCTIONAL ARTICULATORY DEFECTS, AND CHILDREN WHO HAVE NORMAL SPEECH.

As noted in Table IV, Chapter IV, the total mean increment progresses at a consistent rate for each grade level in both groups. Although vocal phonic synthesizing...
ability appears to increase with age, and/or grade placement. There is also a significant difference between each grade level, in favor of the children who have normal speech.

The $t$ values for grades one through four, with regard to the functional articulatory defective and the normal speaking subjects, are shown in Table V, Chapter IV. Inspection of this table indicates that this ability increases proportionately in grades one, two, and four. The hypothesis that there is no difference can be rejected for these grade levels. The $t$ value for the comparisons of the two groups in the third grade, was not significant and the hypothesis could not be rejected. While this occurrence is not readily explainable through the statistical analyses or the experimental design of this study, it is of interest to note that the least difference between any of the mean scores, for the defective and normal speaking groups occurs at the third grade level. Examination of the raw scores for grade three (appendix C) indicates that several of the functional articulatory defective subjects had high scores inconsistent with the performance of the group as a whole.

**Hypothesis two.** THERE IS NO DIFFERENCE IN THE VOCAL PHONIC SYNTHESIZING ABILITY AMONG GROUPS OF CHILDREN IN GRADES ONE THROUGH FOUR, WHO HAVE FUNCTIONAL ARTICULATORY DEFECTS.
In comparing the functional articulatory defective subjects in grade one, against the defective subjects in grades two, three, and four, the hypothesis was rejected for grades three and four, with differences at the 1 per cent level of confidence. The hypothesis that there is no difference was accepted for grade two. The second grade differed significantly from both the third and fourth grades at the 5 per cent level of confidence, and the hypothesis was rejected. Therefore, in all but two instances the performance of the children as indicated by their ability to synthesize words broken into their phonetic elements, as shown by t values, differed significantly from grade to grade.

Table VIII, indicates the percentage of two, three, four, and five phoneme words correctly synthesized, by the functional articulatory defective, and the normal speaking, subjects in grades one through four.

Hypothesis three. THERE IS NO DIFFERENCE IN THE VOCAL PHONIC SYNTHESIZING ABILITY AMONG GROUPS OF CHILDREN IN GRADES ONE THROUGH FOUR, WHO HAVE NORMAL SPEECH.

Significant differences were found between grades three and four, when compared with the normal speaking subjects in grade one. These differences were significant
<table>
<thead>
<tr>
<th>Grade</th>
<th>Two Phonemes</th>
<th>Three Phonemes</th>
<th>Four Phonemes</th>
<th>Five Phonemes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grade One</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental group*</td>
<td>13.3%</td>
<td>5.0%</td>
<td>0.0%</td>
<td>0.0%</td>
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<td>Control group**</td>
<td>51.6%</td>
<td>11.6%</td>
<td>1.6%</td>
<td>0.0%</td>
</tr>
<tr>
<td><strong>Grade Two</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>36.6%</td>
<td>12.3%</td>
<td>5.3%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Control</td>
<td>63.3%</td>
<td>28.3%</td>
<td>13.3%</td>
<td>13.3%</td>
</tr>
<tr>
<td><strong>Grade Three</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>58.3%</td>
<td>41.6%</td>
<td>30.0%</td>
<td>21.6%</td>
</tr>
<tr>
<td>Control</td>
<td>82.3%</td>
<td>91.6%</td>
<td>85.0%</td>
<td>71.6%</td>
</tr>
</tbody>
</table>

- * functional articulatory defective children
- ** normal speaking children
at the 5 and 1 per cent levels of confidence, and the hypothesis that there is no difference was rejected. The hypothesis for grade two was accepted at the 5 per cent level of confidence. The second grade was not significantly different from the third grade at the 5 per cent level of confidence and the hypothesis could not be rejected. The fourth grade was significantly different from the second grade at the 1 per cent level of confidence, and the hypothesis was rejected. The hypothesis that there is no difference was rejected for the comparison of the third grade to the fourth grade. This difference was significant at the 1 per cent level of confidence. Although the differences in vocal phonic synthesizing ability do show up from grade to grade, for the normal speaking subjects as they did for the functional articulatory defective subjects, there is a higher level of significance for the normal speaking subjects at the fourth grade level, than for the articulatory defective subjects.

1. INTERPRETATIONS AND CONCLUSIONS

In general, and as a result of the statistical analyses of the collected data of this study, the following assumptions may be made.
(1) While it is apparent that vocal phonic synthesizing ability improves with age, there appears to be a trend for the normal speaking subjects in grades one through four, to demonstrate this ability at an earlier grade level than the defective subjects, and generally to perform more proficiently than those subjects of the same grade level who have articulatory defective speech.

(2) This difference between the normal speakers, and the functional articulatory defectives ability to synthesize a series of phonemes into meaningful words appears to be a differentiating factor with regard to the development of normal speech, as previously pointed out by Johnson and Van Riper in the review of the literature.

II. FOR CLINICAL PRACTICE

As a result of this study certain suggestions may be offered for therapy.

(1) It appears to be evident from the experimental findings of this thesis, as well as from a clinical point of view, that articulatory defective children may profit from work not only in the traditional aspects of ear-training; but by learning the time order of sequential speech sounds. Either by learning to sound out a given word, or by being able to synthesize isolated speech
(2) In as much as there is a slight indication that two, and three phoneme words are synthesized more easily than larger words, by all the defective subjects regardless of grade level, it might be suggested that at the stage of therapy at which the newly corrected sound is being incorporated into words, emphasis be placed on words containing no more than three phonemes.
CHAPTER VI

SUMMARY

Eighty children were used in this study in an attempt to compare the vocal phonic synthesizing ability of children with functional defects of articulation as compared to children with normal speech. Forty of these were normal speaking children, ten from each of the first four grades; and forty functional articulatory defective children, ten from each of the first four grades.

The test items consisted of twenty four words. These words were divided into four sub-groups of six words each. These sub-groups were arranged in order of increased difficulty, i.e., two phoneme, three phoneme, four phoneme, and five phoneme words.

The results are based upon the number of correct words (phonemes synthesized into meaningful words) 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:

**Hypothesis one.** THERE IS NO DIFFERENCE IN THE VOCAL PHONIC SYNTHESIZING ABILITY AMONG GROUPS OF CHILDREN IN
Hypothesis two. There is no difference in the vocal phonic synthesizing ability among groups of children in grades one, two, three, and four who have functional articulatory defects.

Hypothesis three. There is no difference in the vocal phonic synthesizing ability among groups of children in grades one, two, three, and four who have normal speech.

While it is apparent that vocal phonic synthesizing ability improves with age, there appears to be a trend for the normal speaking children in grades one through four, to demonstrate this ability at an earlier grade level than the articulatory defective children.
BIBLIOGRAPHY

ARTESIAN BORING
US CONTENT
USA


APPENDICES
APPENDIX A

NUMBER OF CORRECT RESPONSES PER WORD FOR FORTY NORMAL SPEAKING AND FORTY FUNCTIONAL ARTICULATORY DEFECTIVE CHILDREN, IN GRADES ONE THROUGH FOUR
Figure I

The number of correct responses per word for ten children with normal speech, grade one.
Figure II

THE NUMBER OF CORRECT RESPONSES PER WORD FOR TEN CHILDREN WITH FUNCTIONAL ARTICULATORY SPEECH PROBLEMS, GRADE ONE
Figure III

The number of correct responses per word for the children with normal speech, grade two.
Figure IV

The number of correct responses per word for ten children with functional articulatory speech problems, grade two
Figure V

THE NUMBER OF CORRECT RESPONSES PER WORD FOR TEN CHILDREN WITH NORMAL SPEECH, GRADE THREE.
Figure VI

The number of correct responses per word for ten children with functional articulatory speech problems, grade three.
Figure VII

The number of correct responses per word for ten children with normal speech, grade four.
Figure VIII

THE NUMBER OF CORRECT RESPONSES PER WORD FOR TEN CHILDREN WITH FUNCTIONAL ARTICULATORY SPEECH PROBLEMS, GRADE FOUR
APPENDIX B

TWENTY FOUR STIMULUS WORDS
SHOE
egg
SAW
EYES
TOE
COW
SUN
SHIRT
MATCH
SHEEP
NIGHT
STOVE
MOTHER
PASTE
SKATE
RAZOR
DAUGHTER
RADIO
CANDY
PIANO
SISTER
ROOSTER
DOCTOR
Sue
er
at
or
au
An
if
if
inf
ip
inf
ov
mar
pea
ket
rez
ata
rido
kændi
piano
rat
ruatr
daktar
APPENDIX C

RAW SCORES FOR ALL SUBJECTS IN GRADES ONE, TWO, THREE, AND FOUR
### Appendix C: Raw Scores for Grade One

<table>
<thead>
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<th>Control Group</th>
<th>Experimental Group</th>
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</thead>
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</tr>
<tr>
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<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
</tr>
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<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
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<td>4</td>
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<td>6</td>
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<tr>
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Control mean: 3.5

Experimental mean: 1.8
## APPENDIX C: RAW SCORES FOR GRADE TWO

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<td>4</td>
<td>3</td>
<td>14.44</td>
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<td>5</td>
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<td>38.44</td>
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N: 10  
68 131.40 32 65.00 327

case mean: 6.8
experimental mean: 3.2
## APPENDIX C: RAW SCORES FOR GRADE THREE

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<td>9</td>
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N 10 101 352.29 87 278.10 448

control mean: 10.1
experimental mean: 3.7
### APPENDIX C: RAW SCORES FOR GRADE FOUR

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| N    | 10             | 202           | 32.20           | 90            | 196 | 106 | 1314 |

Control mean: 20.2
Experimental mean: 9.0