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A handwriting analysis of the achievement of sinistrals in grades three through six

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SCHOOL OF EDUCATION

Thesis

A HANDWRITING ANALYSIS OF THE ACHIEVEMENT
OF SINISTRALS IN GRADERS THREE THROUGH SIX

Submitted by

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B.A., Regis College, 1944

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

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ACKNOWLEDGEMENTS

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th>TITLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>REVIEW OF RESEARCH</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td>PLAN OF PROCEDURE</td>
<td>14</td>
</tr>
<tr>
<td>IV</td>
<td>ANALYSIS OF DATA</td>
<td>18</td>
</tr>
<tr>
<td>V</td>
<td>SUMMARY AND CONCLUSIONS</td>
<td>34</td>
</tr>
<tr>
<td>VI</td>
<td>LIMITATIONS AND SUGGESTIONS FOR FURTHER STUDY</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>BIBLIOGRAPHY</td>
<td>38</td>
</tr>
</tbody>
</table>
LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. A Comparison of the Speed Attainment of Left Handed Children in Grades 3 - 4 - 5 - 6 and Speed Standards for All Children</td>
<td>19</td>
</tr>
<tr>
<td>II. A Study of the Quality Achievement of Left-Handed Children in Grades 3 - 4 - 5 - 6</td>
<td>20</td>
</tr>
<tr>
<td>III. A Comparison of the Quality Achievement of 279 Left-Handed Children in Relation to Position</td>
<td>21</td>
</tr>
<tr>
<td>IV. A Comparison of the Speed Attainment of Left-Handed Children in Grade 3 in Relation to Position</td>
<td>22</td>
</tr>
<tr>
<td>V. A Comparison of the Speed Attainment of Left-Handed Children in Grade 4 in Relation to Position</td>
<td>23</td>
</tr>
<tr>
<td>VI. A Comparison of the Speed Attainment of Left-Handed Children in Grade 5 in Relation to Position</td>
<td>24</td>
</tr>
<tr>
<td>VII. A Comparison of the Speed Attainment of Left-Handed Children in Grade 6 in Relation to Position</td>
<td>25</td>
</tr>
<tr>
<td>VIII. A Comparison of the Quality Achievement of 279 Left-Handed Boys and Girls</td>
<td>26</td>
</tr>
<tr>
<td>IX. A Comparison of the Speed Attainment of Left-Handed Boys and Girls in Grade 3</td>
<td>27</td>
</tr>
<tr>
<td>TABLE</td>
<td>PAGE</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>X. A Comparison of the Speed Attainment of Left-Handed Boys and Girls in Grade 4</td>
<td>28</td>
</tr>
<tr>
<td>XI. A Comparison of the Speed Attainment of Left-Handed Boys and Girls in Grade 5</td>
<td>29</td>
</tr>
<tr>
<td>XII. A Comparison of the Speed Attainment of Left-Handed Boys and Girls in Grade 6</td>
<td>30</td>
</tr>
<tr>
<td>XIII. A Comparison of the Speed Attainment of Left-Handed Children in Grade 4 in Relation to Implements</td>
<td>31</td>
</tr>
<tr>
<td>XIV. A Comparison of the Speed Attainment of Left-Handed Children in Grade 5 in Relation to Implement</td>
<td>32</td>
</tr>
<tr>
<td>XV. A Comparison of the Speed Attainment of Left-Handed Children in Grade 6 in Relation to Implement</td>
<td>33</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

The intention of this study is to examine the quality and quantitative achievements of two hundred seventy-nine left handed children located in the elementary schools of New England.

The investigation is concerned with left handedness in relation to writing position, comparing those pupils using a variety of "over approaches" in which the hand turns toward the body (in a position more comparable with that taken by right handed children) to those children using a "correct" left hand position. The position considered as "correct" in this study involved the following criteria: the paper was placed so that the lower right hand corner was pointing toward the center of the body. The paper was slanting at an approximate $45^\circ$ angle. The position of the pen or pencil assumed to be correct was that the blunt end should be pointing over the left shoulder. The direction of the downstrokes were toward the left elbow.\(^1\) Any variations of the above described position were denoted as "incorrect".

Theories regarding the correct and incorrect positions for left handers have been numerous and in the samples obtained for this study,\(^1\) Norton, John K. and Margaret A. Norton. Foundations of Curriculum Building. Boston, Massachusetts: Ginn and Company, pp. 245-267.
positions varied according to fixed habit by pupils and educational efforts by parents and teachers. Here, however, no emphasis was placed on the method of how these positions came about - only on their present status. While the children were writing the standard sentence, "A quiet frog jumps when vexed by lazy ducks", their position was recorded as "Correct" or "incorrect" with emphasis on paper placing and pen holding. No further breakdown in position was treated. A more detailed analysis of the many positions assumed by left handers may be found in the work of Ambrose.¹ It seems relevant to mention that in later discussions with individual teachers regarding this study, it became apparent that recommended approaches to position were improvised or altered to meet the needs of each child.

Many and varied conclusions have been arrived at by educators, parents and individuals themselves regarding the problem of left handedness. How handedness comes about in the first place, what develops as a result of it and what can be done about it are unsettled questions. More research is needed. But one thing is important - handedness is important. Here an attempt has only been made to examine the results of an already existing situation.

CHAPTER II

REVIEW OF RESEARCH

Throughout history man has been perplexed by the occurrence of left-handedness among all peoples of the world. Challenges have arisen as to whether handedness is hereditary or environmental, whether sinistrality, left sidedness, was a sign of moral or mental weakness, and whether stuttering was an exhibit of ambidextrality.

According to dictionary definition the right represents permanence, force, power, strength, grace, godliness, rectitude, truth, goodness, masculinity and sanctity. The left hand represents the opposite, the reverse, the lack, the negative of all the traits and characteristics attributed to the right hand. Cushing\(^1\) clarifies the entire philological issue:

\begin{quote}
The hand of man has been so intimately associated with the mind of man that it has molded intangible thoughts no less than the tangible products of his brain. So intimate was this association during the very early manual period of man's growth that it may be affirmed to be, like so many other hereditary traits still dominantly existant in the hands of all of us to a greater or lesser degree.
\end{quote}

There are, however, probably as many definitions of left-handedness as there are theories. Operationally defined, "Handedness is the exhibi-

tion of a consistent laterality preference during the performance of com-
plex and highly differentiated manual adoptive patterns."

Throughout the ages we find references to thinking as to a cause of
handedness. Frequent disadvantages of left-handedness were recognized
and even exaggerated. An ancient Italian psychiatrist called it a sign of
degeneracy because he found that the condition was prevalent in criminals.
An earlier philosopher believed that the child held on to the mother's neck
with one arm thus leaving the other arm free to grasp objects. If this were
ture every other generation would have opposite laterality.

Selzer\textsuperscript{3} concludes:

The whole situation seems to indicate that handedness cannot be
definitely determined by any one test. A battery of tests should
perhaps be used and most value placed on those that test simple
functions that have not been influenced by training. Tests of
this nature given during infancy or early childhood would per-
haps show a 50-50 division with all degrees and kinds of handed-
ness, ranging from extreme right-handedness to extreme left-
handedness.

Blau believes that individuals do not have any dominance but that
training alone determines which side will take over the dominant activity.

He says that preferred laterality is an acquired function and not inherited:\textsuperscript{4}

\footnotesize
\begin{itemize}
  \item \textsuperscript{1}Lynn, D.R. and J.G. Lynn. "Hand Dominance in Relation to Basic
Modes of Adaptation," \textit{Journal of Abnormal Psychology} 39:84-96;
January 1944.
  \item \textsuperscript{2}Ibid.
  \item \textsuperscript{3}Selzer, Charles A. Lateral Dominance and Visual Fusion.
  \item \textsuperscript{4}Blau, Abram. The Master Hand, New York: The American Ortho-
\end{itemize}
1. Imitation of left handed parents, nurses or other children.
2. Temporary physical injury to the right hand which causes him to use his left hand.
3. Emotional negativism; as an active emotional contrariness in childhood, and the most common cause of left-handedness. The child who feels unwanted may become left-handed as a means of expressing hostility, resentment, and aggression in a conflict situation.¹

"Negativistic sinistrality" can be analyzed as a negativistic symptom due to maternal rejection in very early childhood. Left-handedness may then be regarded not only as a neurotic symptom, but as one of the signs of a childish psychoneurosis. It so happens that the symptoms of sinistrality soon become ingrained in the constitution in the course of normal development of the brain. Later, even if there is an amelioration of the disturbing emotional situation and of the neurosis, sinistrality still remains as implied evidence of early development disturbance.²

Much controversy has arisen over the problem of cerebral dominance and stuttering and other speech defects. Haefner³ claims that

Children who have had their natural hand preference interfered with appear somewhat more likely to exhibit speech defects than those who have not experienced such a change.

²Ibid.
In a study of laterality of stutterers and normal speakers, two differences were noted in the two groups: a shift in handedness and ambidextrality. There were seventy-eight persons in each group, a considerably greater number of the experimental group had experienced a shift in handedness and a larger percent of the experimental group than the control group were ambidextrous. The experimental group had fifty percent more enuretics than the control group which persisted beyond school age. This is indicated because workers believe that there is a possible relationship between an unstable nervous system and enuresis. Of 1,421 patients studied at the Minnesota Speech Clinic, data shows shifting of handedness in seventy-three percent and ambidexterity in fifty-three percent.1

Weiner, in his study of Cybernetics, states that early brain injury to the dominant hemisphere is not as noticeable as if it had happened later in life. This is quite in accordance with the greater flexibility shown by the nervous system in the early weeks of life. Though dominance is set long before school age, many people have changed the handedness of their children by education, though, of course, they could not change the physiological basis in hemispherical dominance. These hemispheric "changlings" often become stutterers and develop other defects of speech,

Weiner further states:

With the education of the secondary hand there has been a partial education of that part of the secondary hemisphere which deals with skilled motions such as writing. Since these emotions are carried out in the closest possible association with reading and speech and with other activities which are connected with the dominant hemisphere, the neurone chains involved in these processes must cross over from hemisphere to hemisphere and in any complex activity they must do this again and again. Consequently, the interhemisphere traffic must go roundabout routes, but they are certainly long, scanty and subject to interruption. As a consequence the process associated with speech and writing are very likely to be involved in a traffic jam and stuttering is the most natural thing in the world.

Weiner believes that changing handedness results in disharmony of neurological action which in turn brings about confusions, hesitations and blocking of movements and thinking which leads to emotional and functional disturbance.

Johnson (1942) found there was no correlation between stuttering and ambidexterity. "Sinistrality or restraining from it, is no more a cause of stuttering than it could be a cause of deliquency or any other psychopathy."

---


Blau states:

Although the neurological theory sounds plausible, actual experience does not confirm it. That a reversal in writing-handedness seldom results in stuttering or other speech defects has been demonstrated through experiments in the schools of Elizabeth, New Jersey where some years ago a campaign to "cure" left-handedness was launched. In the course of four years the left handedness of two hundred and fifty cases was reduced to sixty-six and not a single instance of defective speech resulted.¹

Had they tried to work further on the remaining sixty-six cases, however, there might have begun to show nervous symptoms; among them certain speech disorders. For any type of persistent antagonism toward children will have a disturbing effect upon their emotional balance and is likely to produce neurotic symptoms.²

Much has been written and said thus far regarding the child who is able to use both hands, but what about the child who loses the use of the right hand through injury, amputation or brain trauma? In the case of spastics, for instance, if a child with right handed tendencies has a severe spastic involvement of the right side his complete inability to use the right hand will force him to the left hand from the beginning. If the degree of paralysis is only brought down to the efficiency of the left hand there will result ambidexterity with consequent maladjustment and frustration.³

² Ibid., p. 58
This latter declaration is contrary to Blau's theory which states that the frustration and maladjustment are caused by other emotional disturbing conditions just as the loss of an eye may cause personality disturbance.

For a long time, workers in the field of exceptional children have looked for an explanation to the high incidence of left-handedness among inmates of institutions for the feeble minded. The rate at which dextrality is acquired seems to be correlated with intelligence; the bright child becomes right-sided earlier than the dull one. That sinistrality is more common among mental defectives does not imply that left-handed persons are less intelligent than dextrals. The relationship of intelligence to dextrality is mainly in terms of learning capacity. Mental inadequacy tends to retard this type of learning quite the same way as in other fields and there is thus a lesser and slower response to educational pressures and social training.¹

Specialized education is also interested in what is commonly called mirror writing. Mirror writing is probably as old as writing itself. A classic example is that of Leonardo da Vinci; all of his notes were mirror written; that is, to appear normal to most readers they would have to be held before a mirror and then read off the mirror. Mirror writing is a product of spacial disorientation and the right-left confusions are normal in young children who are in the process of acquiring the lateralization habit:

When the transition stage of spacial confusion persists we note distortions or abnormalities in hand movements, reading, writing and speaking. Mirror writing or reading represents essentially arrested development or faulty fixation in a phase of learning spacial orientation.¹

Education, parents, psychologists and others who work with children would do well always to be conscious of this normal phase of development especially for remedial purposes and to prevent persistence of confusions in later life. Children need training in all fields; speech requires auditory and visual training and writing a visual-manual directional orientation. Most young children must have their sinistral urge corrected when first learning to shake hands. Parental guidance is toward the dextral greeting; such objects as rattles, spoons, pencils and playthings, utensils and instruments must be placed in the right hand repeatedly until the child develops the correct hand approach.²

What can be done about the child who persists in using his left hand? If we cannot change a certain percentage of the population's preferred laterality we must provide "southpaw" situations if we are to have those who are left-handed operate at their greatest possible efficiency. Democracy is committed to provide an education for every child to the limit of

his capacity. We are not doing our duty when we provide desks with only right arms as is so common especially in our high schools and colleges. Lighting systems that make it necessary for a left handed student to write in his own hand's shadow; work benches in the manual art classes which cater only to the dextral are equally discriminating. Successful left-hand work involves left-hand work set-ups; work benches and supboard arrangements, tool holders, irons, scissors etc.¹

Remedial measures are necessary for the child who writes with his palm curled toward his body, his whole arm hooked around so that he traces the letters with pencil gripped in his fingers which are close to his flexed wrist. The left handed writer who adopts this position has all of the muscles of the lower arm and wrist cramped, the fingers held so that they have little control of fine muscle movements. The radius of one of the lower arm bones is tipped on its side causing difficulty and fatigue in writing. If the radius is held parallel with the tablet, the muscles relax, the back of the hand flattens and fingers hold the pencil more easily. If a teacher holds a finger lightly on the radius until the writer gets the habit of holding the bone flat, very little practice will bring such physical relief that the child for the first time will enjoy writing.²

Freeman suggests for the position a left-hander should assume:

¹Stanford, M.A. "It's No Fun to Be a Southpaw," Parents Magazine 18:24; November 1943.
²Ibid.
paper tilted toward the right and arm placed perpendicular to the lower edge of the paper, so that as the child moves his forearm back and forth the pen will be carried along the line of writing. ¹

Norton² states that left-handed writers require some adjustments and he recommends that the position of the paper be placed opposite from that of the right-handed writers, that is: the lower right hand corner of the paper should be pointing toward the center of the body. The position of the pen or pencil should be such that the blunt end is pointing over the left shoulder. The direction of the down strokes are toward the left elbow and the ink bottle placement is on the left side of the desk. He suggests also that if a left-handed child has formed other habits of position that no change is advised unless the pupil is willing.

Hildreth³ claims:

The first rule in working with a left-handed problem is to study his natural "off the record" writing tendencies and his handedness tendencies in a variety of motor skills. When it is certain that he will be a more successful left-than right-handed writer, he should be taught the letters forms, a comfortable position for his paper (usually the


² Ibid.

converse of the right-handed position) and be permitted to make his own movement adaptations. His writing position will always look awkward to the right-handed writer. Instead of permitting him to twist his hand around the writing, and to write in the circle between his hand and wrist, a position naturally chosen to preserve visibility, the teacher should encourage natural hand pronation, with the fingers extended toward the top rather than the bottom of the paper. In this position, ink causes more trouble than pencil because the hand will smear the writing as it passes along. To prevent this difficulty encourage keeping the fingers well below the writing, the pen extended. From the standpoint of visibility, children who develop a back-hand style are better off than those who slant to the right. Keeping the fingers below the writing, and the paper slanting to the right, rather than to the left, will also help.

Writing with the left hand is at best difficult and awkward. Therefore all efforts should be made to induce dextrality preference where at all possible. Learning to use the non-preferred hand is mainly an educational problem which requires only the ingenuity and patience of a good teacher on the one side and interest and patience by the child or adult on the other. Being the most logical person to whom the parents and others would go for advice and reassurance about the development of laterality habits, the teacher should be ready to answer such questions with authority. ¹

CHAPTER III

PLAN OF PROCEDURE

It was the purpose of this study to investigate the quality and speed achievements of left-handed children in grades three, four, five and six in relation to position, writing implement and sex.

This study has been confined to seventeen different communities in New England where the same plan of handwriting program is in operation. Two hundred seventy-nine samples were obtained from boys and girls using the implements of pen and pencil.

Throughout the investigation no mention was made to pupils or teachers of the purpose for which the samples were gathered.

The standard sentence, "A quiet frog jumps when vexed by lazy ducks.", was used as a basis for the testing as this contains all of the small letters of the alphabet and is one with which the children are familiar. Prior to the testing it was arranged that this sentence be placed directly in front of the child so that any eye movements to other parts of the room would be avoided when the timing started. The time element involved was two minutes as this seemed to be the most satisfactory for determining an average in view of slow starts or fatigue. Also, this time element afforded an adequate sample of handwriting for examination. A stop watch was employed as the instrument of measurement for the speed
element of the samples. While the children were taking the timed tests, their position was recorded as left-hand "correct" or left-hand "incorrect." This information was later transferred to the top of each respective page.

Throughout the entire testing program no mention was made regarding the left hand position and purposely so, as it was felt that this might affect the motor coordination of some of the children.

The position considered as "correct" in this study involved the following criteria: the paper was placed so that the lower right hand corner was pointing toward the center of the body. The paper was slanting at an approximate 45° angle. The position of the pen or pencil assumed to be correct was that the blunt end should be pointing over the left shoulder. The direction of the downstrokes were toward the left elbow.

Any variations of the above described position were denoted as "incorrect."

The following procedure was used in each classroom:

1. Directions were given for each child to write in pencil a heading on his paper comprising the following information: name, grade, city, date, sex, age and date of birth.


2Ibid.
2. The children were instructed to omit one space and to write as well as possible the sentence, "A quiet frog jumps when vexed by lazy ducks."

3. Directions were then given to skip one space and at the proper signal to write as many times as possible in good writing the same sentence, starting and stopping at the proper signals.

4. After a sufficient rest period this same procedure was used in grades four, five and six while the pupil wrote with a pen. (In most communities pen and ink is not introduced below grade 4.)

In order that the statistics be compiled in a concise manner an extensive table was set up comprising the following data:

1. City
2. Number (from 1 to 279)
3. Grade
4. Position Indication (Correct or Incorrect)
5. Quality numerical score
6. Sex
7. Speed with pencil
8. Speed with ink
9. Quality with pencil
   a. neatness
   b. letter forms
   c. size
d. alignment

e. spacing

f. slant

g. ending strokes

h. line quality

10. Quality with pen

a. neatness

b. letter forms

c. size

d. alignment

e. spacing

f. slant

g. ending-strokes

h. line quality
CHAPTER IV

ANALYSIS OF DATA

It was the purpose of this research to study the quality achievement and speed attainment of left-handed boys and girls in grades three, four, five and six.

To compare the speed attainment, the following speed standards were used:

- Grade 3 - Letters per minute 45
- Grade 4 - Letters per minute 55
- Grade 5 - Letters per minute 65
- Grade 6 - Letters per minute 70

In the process of analyzing for quality, a series of eight criteria were used: letter forms, size, slant, alignment, spacing, letter endings, neatness and line quality. A numerical score of "3" was assigned for each criterion satisfactorily presented; a numerical score of "2" was assigned for each criterion when an occasional error was perceived; a numerical score of "1" was assigned for each criterion consistently in error.

In summary quality ratings ranged from numerical sums of 24 to 8, categorically considered as follows:

- 21 - 24 rated Excellent
- 17 - 20 rated Good
13 - 16 rated    | Fair
9 - 12 rated    | Poor
8 rated         | Illegible

The following tables show the results of this research.

**TABLE I**

A Comparison of the Speed Attainment of Left Handed Children in Grades 3-4-5-6 and Speed Standards for All Children

<table>
<thead>
<tr>
<th>Grade</th>
<th>No.</th>
<th>Mean</th>
<th>S.E.m</th>
<th>Speed Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 3</td>
<td>98</td>
<td>37.41</td>
<td>1.02</td>
<td>45</td>
</tr>
<tr>
<td>Grade 4</td>
<td>58</td>
<td>45.80</td>
<td>1.41</td>
<td>55</td>
</tr>
<tr>
<td>Grade 5</td>
<td>70</td>
<td>57.10</td>
<td>1.45</td>
<td>65</td>
</tr>
<tr>
<td>Grade 6</td>
<td>53</td>
<td>71.93</td>
<td>1.88</td>
<td>70</td>
</tr>
</tbody>
</table>

Table I indicates the standard number of letters per minute for each grade. This table reveals only left handed children in grade 6 attained the standard number of letters for their respective grade.
TABLE II

A Study of the Quality Achievement of Left-Handed Children in Grades 3 - 4 - 5 - 6

<table>
<thead>
<tr>
<th>Grade</th>
<th>No.</th>
<th>Mean</th>
<th>S.E.m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 3</td>
<td>98</td>
<td>17.31</td>
<td>.41</td>
</tr>
<tr>
<td>Grade 4</td>
<td>58</td>
<td>19.32</td>
<td>1.83</td>
</tr>
<tr>
<td>Grade 5</td>
<td>70</td>
<td>19.32</td>
<td>.45</td>
</tr>
<tr>
<td>Grade 6</td>
<td>53</td>
<td>20.01</td>
<td>.47</td>
</tr>
<tr>
<td>Total</td>
<td>279</td>
<td>17.112</td>
<td>.21</td>
</tr>
</tbody>
</table>

On the basis of quality points used in this study it is significant that all left handed children achieved a quality score of "GOOD". It is significant also that maturity does make a difference in the quality of writing achieved by left handers.
TABLE III

A Comparison of the Quality Achievement of 279 Left-Handed Children in Relation to Position

<table>
<thead>
<tr>
<th>Position</th>
<th>No.</th>
<th>Mean</th>
<th>S.E.m</th>
<th>Diff.m</th>
<th>S.E.Diff.</th>
<th>C.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct</td>
<td>137</td>
<td>19.07</td>
<td>.34</td>
<td>0</td>
<td>1.52</td>
<td>0</td>
</tr>
<tr>
<td>Incorrect</td>
<td>142</td>
<td>19.07</td>
<td>.34</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference in quality score of 0 yields a C.R. of 0 which is statistically insignificant and can be interpreted to reveal that there is no difference in the quality achievement of left handed children writing in a correct position and left handed children writing in an incorrect position.

On the basis of the quality points used in this study it is significant that both sexes acquired a quality achievement of "GOOD" writing.
TABLE IV

A Comparison of the Speed Attainment of Left-Handed Children in Grade 3 in Relation to Position

<table>
<thead>
<tr>
<th>Position</th>
<th>No.</th>
<th>Mean</th>
<th>S.E.m</th>
<th>Diff. m</th>
<th>S.E. diff.</th>
<th>C.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct</td>
<td>41</td>
<td>36.59</td>
<td>1.50</td>
<td>1.06</td>
<td>1.93</td>
<td>.54</td>
</tr>
<tr>
<td>Incorrect</td>
<td>57</td>
<td>37.65</td>
<td>1.23</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference in speed attainment of 1.06 yields a C.R. of .54 which is statistically insignificant and can be interpreted to reveal that position makes no difference in the quantity writing of grade 3.

The speed standard set for all third grade children is 45 letters per minute. The above table indicates that left handers in grade 3 do not meet this criterion.
TABLE V

A Comparison of the Speed Attainment of Left-Handed Children in Grade 4 in Relation to Position

<table>
<thead>
<tr>
<th>Position</th>
<th>No.</th>
<th>Mean</th>
<th>S.E.m</th>
<th>Diff. m</th>
<th>S.E.diff.</th>
<th>C.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct</td>
<td>29</td>
<td>50.97</td>
<td>1.71</td>
<td>4.33</td>
<td>2.83</td>
<td>1.53</td>
</tr>
<tr>
<td>Incorrect</td>
<td>29</td>
<td>46.64</td>
<td>2.27</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference in speed attainment of 4.33 yields a C.R. of 1.53 which is statistically insignificant and can be interpreted to reveal that position makes no difference in the quantity writing of grade 4.

The speed standard set for all fourth grade children is 55 letters per minute. The above table indicates that left handers in grade 4 do not meet this criterion.
TABLE VI

A Comparison of the Speed Attainment of Left-Handed Children in Grade 5 in Relation to Position

<table>
<thead>
<tr>
<th>Position</th>
<th>No.</th>
<th>Mean</th>
<th>S.E.m</th>
<th>Diff.m</th>
<th>S.E.Diff.</th>
<th>C.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct</td>
<td>35</td>
<td>55.81</td>
<td>2.54</td>
<td>3.09</td>
<td>3.36</td>
<td>.91</td>
</tr>
<tr>
<td>Incorrect</td>
<td>35</td>
<td>58.90</td>
<td>2.20</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference in speed attainment of 3.09 yields a C.R. of .91 which is statistically insignificant and can be interpreted to reveal that position makes no difference in the quantity writing of grade 5.

The speed standard set for all fifth graders is 65 letters per minute.

The above table indicates that left handers in grade 5 do not meet this criterion.
TABLE VII

A Comparison of the Speed Attainment of Left Handed Children in Grade 6 in Relation to Position

<table>
<thead>
<tr>
<th>Position</th>
<th>No.</th>
<th>Mean</th>
<th>S.E. m</th>
<th>Diff. m</th>
<th>S.E. Diff.</th>
<th>C.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct</td>
<td>32</td>
<td>73.05</td>
<td>1.95</td>
<td>5.94</td>
<td>3.96</td>
<td>1.50</td>
</tr>
<tr>
<td>Incorrect</td>
<td>21</td>
<td>67.11</td>
<td>3.45</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference in speed attainment of 5.94 yields a C.R. of 1.50 which is statistically insignificant and can be interpreted to reveal that position makes no difference in the quantity writing of grade 6.

The speed standard set for all sixth graders is 70 letters per minute. The above table indicates that sixth grade left-handers writing in a correct position do meet this standard while those using an incorrect position do not meet the standard.
TABLE VIII

A Comparison of the Quality Achievement of 279 Left-Handed Boys and Girls

<table>
<thead>
<tr>
<th>Sex</th>
<th>No.</th>
<th>Mean</th>
<th>S.E.m</th>
<th>Diff.m</th>
<th>S.E.Diff.</th>
<th>C.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>159</td>
<td>18.57</td>
<td>.34</td>
<td>2.00</td>
<td>1.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Girls</td>
<td>120</td>
<td>20.57</td>
<td>.30</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference in quality achievement of 2.00 yields a C.R. of 2.00 which is statistically insignificant and can be interpreted to reveal that there is no difference in the quality achievement of left-handed boys and girls.

On the basis of the quality points used in this study, it is significant that both sexes acquired a quality achievement of "GOOD" writing.
TABLE IX

A Comparison of the Speed Attainment of Left-Handed Boys and Girls in Grade 3

<table>
<thead>
<tr>
<th>Sex</th>
<th>No.</th>
<th>Mean</th>
<th>S.E. m</th>
<th>Diff. m</th>
<th>S.E. diff.</th>
<th>C.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>61</td>
<td>37.10</td>
<td>.18</td>
<td>4.26</td>
<td>1.85</td>
<td>.02</td>
</tr>
<tr>
<td>Girls</td>
<td>37</td>
<td>41.36</td>
<td>1.85</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference in speed attainment of 4.26 yields a C.R. of .02 which is statistically insignificant and can be interpreted to mean that there is no difference in the speed attainment of boys and girls in grade 3.

Since the speed standard set for all third graders is 45 letters per minute, the above table reveals that this is not met by left handed boys or girls in grade 3.
### TABLE X

A Comparison of the Speed Attainment of Left Handed Boys and Girls in Grade 4

<table>
<thead>
<tr>
<th>Sex</th>
<th>No.</th>
<th>Mean</th>
<th>S.E.m</th>
<th>Diff.m</th>
<th>S.E.Diff.</th>
<th>C.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>29</td>
<td>43.73</td>
<td>2.02</td>
<td>4.04</td>
<td>2.82</td>
<td>1.43</td>
</tr>
<tr>
<td>Girls</td>
<td>29</td>
<td>47.77</td>
<td>1.98</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference in speed attainment of 4.04 yields a C.R. of 1.43 which is statistically insignificant and can be interpreted to mean that there is no difference in the speed attainment of boys and girls in grade 4.

Since the speed standards set for all fourth graders is 55 letters per minute, the above table reveals that this is not met by left-handed boys and girls in grade 4.
TABLE XI

A Comparison of the Speed Attainment of Left-Handed Boys and Girls in Grade 5

<table>
<thead>
<tr>
<th>Sex</th>
<th>No.</th>
<th>Mean</th>
<th>S. E. m</th>
<th>Diff. m</th>
<th>S. E. Diff.</th>
<th>C. R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>40</td>
<td>57.10</td>
<td>2.12</td>
<td>.50</td>
<td>3.30</td>
<td>.15</td>
</tr>
<tr>
<td>Girls</td>
<td>30</td>
<td>56.60</td>
<td>2.50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference in speed attainment of .50 yields a C. R. of .15 which is statistically insignificant and can be interpreted to mean there is no difference in the speed attainment of boys and girls in grade 5.

The speed standard for all fifth graders is 65 letters per minute. The above table reveals left-handed boys and girls in grade 5 do not meet this criterion.
TABLE XII

A Comparison of the Speed Attainment of Left-Handed Boys and Girls in Grade 6

<table>
<thead>
<tr>
<th>Sex</th>
<th>No.</th>
<th>Mean</th>
<th>S.E.m</th>
<th>Diff. m</th>
<th>S.E.Diff.</th>
<th>C.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bpys</td>
<td>29</td>
<td>70.02</td>
<td>2.42</td>
<td>4.23</td>
<td>4.95</td>
<td>.85</td>
</tr>
<tr>
<td>Girls</td>
<td>24</td>
<td>74.25</td>
<td>2.64</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference in speed attainment of 4.23 yields a C.R. of .85 which is statistically insignificant and can be interpreted to reveal there is no difference in the speed attainment of left-handed boys and girls in grade 6.

The speed standard set for all sixth graders is 70 letters per minute. The above table reveals that left-handed boys and girls in grade 6 do meet with this standard.
TABLE XIII

A Comparison of the Speed Attainment of Left-Handed Children in Grade 4 in Relation to Implement

<table>
<thead>
<tr>
<th>Implement</th>
<th>No.</th>
<th>Mean</th>
<th>S.E.m</th>
<th>Diff.m</th>
<th>S.E.Diff.</th>
<th>C.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pen</td>
<td>58</td>
<td>43.64</td>
<td>1.60</td>
<td>4.02</td>
<td>2.35</td>
<td>.01</td>
</tr>
<tr>
<td>Pencil</td>
<td>58</td>
<td>47.66</td>
<td>1.73</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference in speed attainment of 4.02 yields a C. R. of .01 which is statistically insignificant and can be interpreted to reveal that the type of implement employed makes no difference in the quantity writing in Grade 4.
### TABLE XIV

A Comparison of the Speed Attainment of Left-Handed Children in Grade 5 in Relation to Implement

<table>
<thead>
<tr>
<th>Implement</th>
<th>No.</th>
<th>Mean</th>
<th>S. E. m</th>
<th>Diff. m</th>
<th>S. E. diff.</th>
<th>C. R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pen</td>
<td>70</td>
<td>56.74</td>
<td>1.94</td>
<td>2.58</td>
<td>2.69</td>
<td>.009</td>
</tr>
<tr>
<td>Pencil</td>
<td>70</td>
<td>59.32</td>
<td>1.87</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference in speed attainment of 2.58 yields a C. R. of .009 which is statistically insignificant and can be interpreted to reveal that the type of implement employed makes no difference in the quantity writing in Grade 5.
TABLE XV

A Comparison of the Speed Attainment of Left-Handed Children in Grade 6 in Relation to Implement

<table>
<thead>
<tr>
<th>Implement</th>
<th>No.</th>
<th>Mean</th>
<th>S.E.m</th>
<th>Diff. m</th>
<th>S.E.Diff</th>
<th>C.R.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pen</td>
<td>53</td>
<td>68.19</td>
<td>2.01</td>
<td>6.69</td>
<td>2.95</td>
<td>.02</td>
</tr>
<tr>
<td>Pencil</td>
<td>53</td>
<td>74.88</td>
<td>2.14</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The difference in speed attainment of 6.69 yields a C.R. of .02 which is statistically insignificant and can be interpreted to reveal that the type of implement employed makes no difference in the quantity writing in Grade 6.
CHAPTER V

SUMMARY AND CONCLUSIONS

It was the purpose of this study to compare the quality achievement and speed attainment of left-handed boys and girls in grades three, four, five and six. The data was analyzed to determine:

I Quality Achievement of:

1. All the Children
2. Boys and Girls
3. Children Using a Correct or Incorrect Position

II Speed Attainment on a Grade Basis of:

1. All the Children
2. Boys and Girls
3. Children Using a Correct or Incorrect Position
4. Children Using Pen or Pencil

As a result of the analysis of data the following tendencies are concluded:

1. Left handed children maintain a quality rating of "GOOD" in each grade from three through six.

2. Maturity does make a difference in quality as shown by the sixth grade achievement, being the best of all grades.

3. Position makes no difference in quality ratings as shown by the identical mean score of 19.07 for both correct and incorrect positions.
4. Boys and girls maintain about the same rating on quality.

5. Left-handed children in grades three, four and five do not meet the standards of speed set up for all children.

6. Grade six left-handers do meet the set speed standards.

7. Maturity does make a difference in speed as shown by the sixth grade speed attainment.

8. Position makes no difference in the speed attainment of grade three; correct position is at a slight advantage in grade four; incorrect position takes a small lead in grade five; correct position is about six letters faster in grade six.

9. In grades three, four and six girls write at a slightly faster rate than boys. Grade five boys surpassed the girls by about one letter.

10. Using pencil creates a higher speed attainment than using a pen.
CHAPTER VI

LIMITATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

LIMITATIONS

1. The sampling was limited to 279 children in New England.
2. Individual differences by teachers in the type of instruction and assistance given to the participants.
3. No Intelligence Quotients were involved in this study.
4. Type of pen implements varied from traditional "post office pens" to more conservative fountain pens to fantastic "write under water" ball points.

SUGGESTIONS FOR FURTHER STUDY

1. Expand the present type of study.
2. To study the correlation between left-handedness and reading ability.
3. To study the correlation between left-handedness and intelligence.
4. An extended study from first grade through sixth, ninth or twelfth grade.
5. An extended study from September of first grade to June of first grade.
6. Further study on the problem of stuttering and left-handedness.

7. To study teacher understanding and handling of left-handed writers.

8. Further study on speed standards and left-handedness.

9. Further research regarding the relationship of eyedness to handedness.
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