A STUDY OF THE EFFECTS OF AN INTENSIVE SPECIFIC
REMEDIAL PROGRAM FOR DYSLEXIC CHILDREN

THESIS

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By

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The remedial effects of specific techniques outlined
by the Frostig Developmental Test of Visual Perception were
studied in two groups of children diagnosed as dyslexic: a
treatment group of thirty, and a control group of thirty who
were not available for immediate treatment. Initial testing
indicated that all children utilized in the study were dys-
lexic, and after a treatment period of three months, post-
testing was administered to both groups. The following
hypotheses were investigated:

1) The experimental group will not show a significantly
higher mean gain that the control group on Scale I of the
Frostig Developmental Test of Visual Perception. This test
measures eye-hand coordination involving the drawing of
continuous straight, curved, or angled lines between bound-
daries of various width, or from point to point without guide
lines.

2) The experimental group will not show a significantly
higher mean gain than the control group on Scale II of the
Frostig Developmental Test of Visual Perception. This test
measures shifts in perception of figures against increasingly
complex grounds. Intersecting and "hidden" geometric forms
are used.

3) The experimental group will not show a significantly higher mean gain than the control group on Scale III of the Frostig Developmental Test of Visual Perception. This test measures recognition of certain geometric figures presented in a variety of sizes, shadings, textures, and positions in space, and their discrimination from similar geometric figures. Circles, squares, rectangles, ellipses, and parallelograms are used.

4) The experimental group will not show a significantly higher mean gain that the control group on Scale IV of the Frostig Developmental Test of Visual Perception. This test measures the discrimination of reversals and rotations of figures presented in series. Schematic drawings representing common objects are used.

5) The experimental group will not show a significantly higher mean gain that the control group on Scale V of the Frostig Developmental Test of Visual Perception. This test measures the analysis of simple forms and patterns. These consist of lines of various lengths and angles which the child is required to copy, using dots as guide points.

The results indicated that only two of the hypotheses significantly differentiated between the experimental and the control group. These were subtests III, Constancy of Shape, and IV, Position in Space. This could indicate that the subtests in general do actually measure discrete
sensory functions, that possibly subtests II and IV measure those functions amenable to remediation, and that the other three measure some organic factors which are not subject to remediation in a three-month intensive training program. Speculation as to difficulties in controls and self-concept variables, as well as other personality factors influencing the results, was presented. Recommendations included more rigid controls, longer treatment times, additional concurrent psychological investigations as well as family investigation, inclusion of a sample large enough to include female subjects, and follow-up studies to assess more effectively the results of these training procedures on perceptually handicapped children.
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CHAPTER I

INTRODUCTION

Only in the last few decades has there been concentrated and unified interest in the diagnosis and treatment of children possessing a marked reading disability. Previously, isolated and uncoordinated interest was reported by some investigators, but lack of coordinated research obviated the development of remedial techniques. However, growing interest and new literature in this area, although it initially merely tended to label the disability and to speculate about causal factors, initiated sufficient interest to stimulate further investigation, resulting in more coordinated efforts in the direction of the assessment and use of specific remedial techniques.

While most of the research in this area was initially confined to medical circles, beginning in Great Britain, then in Europe, and still later in America, more recently psychologists and educators have become intensively involved in what has become known as "developmental or specific dyslexia."

Perhaps there is no more important endeavor in science than the study of learning, as it entails all aspects of man's behavior, normal and abnormal. Frequently the psychiatrist, neurologist, psychologist, and educator are faced with the need to understand deterrents of learning. A
psychologist or neurologist might be observing the case of a child who is not learning to talk, or not learning in other areas as the average child learns according to the demands of the society in which he lives. He might have an adult patient who because of a stroke or a blow on the head has lost specific aspects of his learned behavior, such as the ability to read. The problem is to diagnose the case and prescribe therapy. The cases would likely be diagnosed as being some type of aphasia.

From the diagnostic perspective, Coleman has stated that "it is often helpful to understand causation of abnormal behavior, and subsequently categorize the causative factors into either organic or functional mental syndromes, i.e., infectious diseases of the brain, or where there exists no known organic brain pathology, and the disorder is presumably based on reactions to psychological stresses" (1, p. 42).

Aphasias such as dyslexia are very disabling and complicated conditions; however, due to research within the past decade, many aphasic individuals have been taught to lead otherwise normal and useful lives. It is estimated that the incidence of reading retardation in this country affects at least 10 percent of all children prior to the seventh grade.

As Rabinovitch (3) points out, however, much semantic confusion still exists with terms such as dyslexia. The
culturally disadvantaged child, for example, is often language-deprived and manifests problems in learning to read which may result in the diagnosis of dyslexia. A similar problem often exists with children reared in bilingual home environments. Therefore, it is apparent that different investigators appear to regard the perceptually handicapped on a continuum which ranges from intellectual inadequacy at one end of the scale to neurosis on the other. In view of such problems, this study was limited to children of Anglo-American origin with similar socio-economic backgrounds and whose intellectual level is within normal limits.

Statement of the Problem

The problem with which this study was concerned was to determine if diagnoses and specific remedial techniques were effective with dyslexic children referred to Region III Educational Service Center from an eleven-county public school population.

Purpose of the Study

In order to clarify the problem with which this study was concerned, the following specific purposes were established:

1) To diagnose those children referred to Region III Service Center as being dyslexic.

2) To determine whether or not specific remedial techniques are valuable in reversing the dyslexic syndrome
in those children so diagnosed.

3) To report these findings to professional individuals concerned with the dyslexic child.

Hypotheses

To carry out the purposes of this study, the following hypotheses were formulated.

**Hypothesis I:** The experimental group will not show a significantly higher mean gain than the control group on Scale I of the Frostig Developmental Test of Visual Perception. This test measures eye-hand coordination involving the drawing of continuous straight, curved, or angled lines between boundaries of various width, or from point to point without guide lines.

**Hypothesis II:** The experimental group will not show a significantly higher mean gain than the control group on Scale II of the Frostig Developmental Test of Visual Perception. This test measures shifts in perception of figures against increasingly complex grounds. Intersecting and "hidden" geometric forms are used.

**Hypothesis III:** The experimental group will not show a significantly higher mean gain than the control group on Scale III of the Frostig Developmental Test of Visual Perception. This test measures recognition of certain geometric figures presented in a variety of sizes, shadings, textures, and positions in space, and their discrimination from similar
geometric figures. Circles, squares, rectangles, ellipses, and parallelograms are used.

**Hypothesis IV:** The experimental group will not show a significantly higher mean gain than the control group on Scale IV of the *Frostig Developmental Test of Visual Perception*. This test measures the discrimination of reversals and rotations of figures presented in series. Schematic drawings representing common objects are used.

**Hypothesis V:** The experimental group will not show a significantly higher mean gain than the control group on Scale V of the *Frostig Developmental Test of Visual Perception*. This test measures the analysis of simple forms and patterns. These consist of lines of various lengths and angles which the child is required to copy, using dots as guide points.
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CHAPTER II

BACKGROUND AND SIGNIFICANCE

Before the early 1800's, there were few, if any, attempts to localize brain dysfunction in specific cerebral areas. Flourens (5) believed that the entire brain served one and the same function and declared that any part of it could take over the functioning in lieu of any other part in case of injury or disease to the brain cells. Others attempted to localize the various "faculties" by placing them in different areas of the brain, depending upon the bias of the particular investigator.

The first systematic attempt to set up an anatomical-physiological concept of aphasia was by Wyllie in the mid-1800's (20). He expressed the idea, for example, that the speech faculty is both supramotor and suprasensory. Starr (17), Maudley (14), and others all opposed localization hypotheses, yet they and many others believed learning disturbances were more or less matters of physiology and anatomy. Nielsen (15), on the other hand, was primarily interested in cerebral localization. He wrote an outstanding book, Agnosia, Apraxia, Aphasia, in 1936. A revised edition of this classic text was published in 1946. Many prominent specialists in this subject endorsed Nielsen's viewpoint. A second revision of this was published in 1962.
Interest in the atomistic viewpoint of aphasia arose in the latter part of the Nineteenth century. Research students of aphasia generally held the point of view that the disorder was a result of a lesion in a localized area of the brain (7, p. 3). In 1864 it was demonstrated that the speech of right-handed persons was affected by injuries to the left brain hemisphere, and that right hemisphere lesions did not affect the speech of right-handed persons. Many neurologists attempted to demonstrate that localized and specific brain areas were responsible for different aspects of speech, and that injuries to given areas resulted in different types of aphasia.

Weisenburg and McBride (19), Goldstein (7), and Head (8) were opposed to a strict localization theory, although they agreed that the cerebral hemisphere on the side opposite the dominant hand is in control of speech functions. Head (8) believed that the capacity to use language in any form is the result of physiological activities of certain parts of the brain cortex. When these parts are disturbed, no matter what the cause, the result is a disorder of some degree in the individual's general capacity to use language.

Jackson (9) described sensory loss and language difficulty, which he viewed as the direct result of impairment of the substratum, as "negative" symptoms. Negative symptoms appear in certain aspects of initial motor aphasia in which the speech and/or language mechanisms lose only part
of their functions. Recovery from these damaged functions may be brought about spontaneously by two factors: (1) Restriction of the damaged substratum and (2) Thorough retraining. In other instances of expressive (motor) aphasia, the negative symptoms may be alleviated by systematic use of speech exercises.

Jackson (9) likewise believed that aphasic disturbances could not be considered solely dependent on the location of the lesion in the cortex. He felt that aphasic symptoms might result from an unimpaired area of the brain being isolated from an impaired one and stated positively that each area within the central nervous system works in relation to the whole. If there is a loss of ability in one area, other dependent performances will be affected. Jackson described such symptoms as "positive" symptoms. Goldstein (7) termed them "depending" symptoms, because they occurred as the result of dependence of an undamaged area on a damaged area. He felt that impairment resulting from damage to the substratum by a scar or tumor often was relieved or improved after operative techniques (7, p. 9).

Current neurological conceptions of specific types of difficulty in learning to interpret printed symbols originated from a background of acquired brain disease out of a process of analogy. Almost as long as aphasia has been studied, neurology has traditionally taught that in some cases of acquired speech loss, the patient may lose his
capacity of attaching meanings to words, either printed or written. This has often been linked to autopsy evidence of brain lesion, and therefore the assumption of brain damage has been assumed in dyslexic cases.

Most neurologists presently, however, are reluctant to attribute dyslexia to any focal brain lesion, dysphastic, traumatic or otherwise, despite this analogy of the acquired cases of dyslexia after brain damage. To do so would be to ignore the important factor of immaturity as applied to chronological age, cortical development, and processes of learning. In all probability, the cases of reading retardation which have been observed after brain trauma at birth are of a different nature from the genuine instances of developmental, i.e., specific dyslexia. This point illustrates the confusion which pervades much of the literature upon the subject of reading retardation.

MacFadden (13) compared the nervous system of the body with a telephone system. The gray matter represented the central offices, the white matter the wires, the end-organs represented the local telephones. The gray matter, or "central office," had one great exchange and many smaller ones. The "great central exchange" is the brain, the smaller ones found along the spinal cord and in other parts of the body are composed of small collections of gray matter called ganglia. The white matter, "the wires," divides and subdivides just as do the blood vessels or the wires for a
telephone system until it is reduced to very fine threads.
The spinal cord is the largest of the trunk lines (13, p. 242).

Frederick H. Lund (1959) summarized the working of the brain as follows:

1. The real answers to the nature of brain function and to the characteristics of mental performance are to be found less in the structural arrangements of the brain than in the chemical processes which infuse life and vitality into these structures.

2. The function of the brain can only be understood in terms of the totality of body functions of which they are an integral part.

3. The brain is the most alive and chemically active organ of the body. This is evident in the fact that the brain, while comprising only two percent of body weight, is responsible for 25 percent of total oxygen consumption.

4. Mental performance involves nerve circuits with relatively specific brain localization.

5. Shifts in performance involve shifts in blood flow patterns, each of which is controlled by identifiable hormones or hormone-life substances. These shifts in blood flow serve to sensitize appropriate tissues through increased metabolic rate.

6. As evidence of such control attention is called to the effects upon behavior of hormone administration and the atrophy of particular areas of the cortex which may result from elimination of given hormones from the blood stream.

7. Hormones function as adjuncts of the tissue enzymes. It appears that it is through their joint action that changes in metabolic rate are affected.

8. Intelligence and adaptability can be seen to depend upon the integrity and efficiency of the hormone and enzyme systems and, to a degree, upon the flexibility of the arterial blood supply.

9. Illustrative of these relationships are the debilitating effects of arterial corrosion in old age and the profound glandular disturbances (12, pp. 502-507).

Aside from the neurological conception, other etiological factors have evolved. The inherent complexities of a written language must not be ignored. The conversion of a spoken language into graphic symbols is a difficult problem,
for one not only must cope with the phonetic properties of the sound, but also with the problem of meaning. Therefore, both phonemics and morphemics must be satisfied. The possibility of bilingualism must be considered, as this may lay an added burden upon peer readers and, therefore, lead to an early identification in cases of dyslexia.

Undoubtedly, sight-reading, as entailed in the analytic system, presents special difficulties to dyslexics, and also to slow readers who are not actually true cases of developmental dyslexia. When this global technique was introduced into American schools in the 1920's, the progress of ordinary scholars in reading was assisted, but other students who were unable to profit by this method soon became globally confused. Estimates as high as three times as many reading problems were noted in this look-and-say method as compared to the prior phonetic approach. The final implication is that a dyslexic, once diagnosed, should be removed from a milieu where the analytic method is practiced, in order to receive special instructions along totally different lines (3, p. 16).

Spatial manipulations, reversible figures, and other neurological signs such as sequential disorders and imperfect sense of rhythm, have all been evaluated in the light of reading disability. The lack of body image and even music tone have been identified as problems of the dyslexic. The percentage of dyslexia within a community has been estimated
by many writers from 50 percent of the world's population to less than 10 percent of all American children. We do know that dyslexic children tend at a quite early age to develop neurotic reactions. Dyslexics of high intelligence who are also fortunate enough to retain their emotional stability and adequate self-concept are sometimes capable of high achievement in later life, often through overcompensation. If these specific disabilities are diagnosed correctly and early, and if there has been intensive and patient coaching, the patient may lose many of his difficulties in reading, writing, and spelling.

Aphasia in children traditionally falls into three major categories: (1) Expressive or motor, (2) Receptive or sensory, and (3) Amnesic or memory difficulty.

Expressive Aphasia is the type most frequently encountered because it theoretically involves the frontal lobes of the brain known as the frontal part of Broca's area, a part which is particularly vulnerable to lesions from violence.

Receptive Aphasia was defined by Head (1926) as

A disturbance of perception and/or recognition of noises or sounds (e.g., automobile horn, train whistle, cry of baby, etc.) and/or visible and audible symbols (written or spoken) and a disturbance or recognition and/or insignificance of animate or inanimate objects (8, p. 26).

Amnesic Aphasia is the inability to find suitable names for objects such as table, chair, or window when trying to explain a problem. His concern is not the world
about him, but himself. Amnesic Aphasia pertains to the
forgetting of names. The amnesic individual is practically
void of nouns, adjectives, adverbs, and auxiliary verbs.
There is also inability to tell the size and color of an
object. The amnesic aphasic tends to pronounce words as
though trying to pronounce a foreign word that has no meaning
to him. He may produce the sounds of the word but does not
comprehend the word.

Following are definitions of the most common forms of
aphasia:

_**Agnosia**_--the inability to recognize and understand
written or spoken words, noises, activities, or objects.

_**Aphasia**_--any partial or total loss of the power of
articulate speech not due to defects in the peripheral
organ, but to disorder in some of the cerebral centers;
loss of symbolic formulation and expression due to brain
lesions.

_**Aphemia**_--the loss of the power of speech due to a
central lesion.

_**Aphonia**_--the impairment of the ability to use one's
voice.

_**Aprasia**_--impairment of ability to use objects cor-
rectly.

_**Autism**_--morbid self-absorption.

_**Dysarthria**_--impairment in the ability to speak.
Dysphasia--difficulty in understanding or using speech due to disorder of the cerebral centers rather than to defective vocal organs.

Dyslexia or alexia--impairment of ability to read written material when visual acuity is intact.

The focus of the present study was on the last of these diagnostic categories. While concentrated remedial efforts in this sphere have a relatively short history, dyslexia was first identified by Kussmaul (11, p. 32) in 1877, when he wrote of "word blindness." Many earlier but less well substantiated references are outlined by Buchanan (2, p. 32). In the same year, Professor Berlin of Stuttgart coined the term "dyslexia" in a monograph (1, p. 32).

Since much controversy has existed since this time regarding the role of genetic vs. environmental factors, the term "dyslexia," with its early complication or organic impairment, has largely been replaced in the last decade by such terms as "perceptually handicapped," "specific reading disability," "visual-perceptual dysfunction," "Minimal Brain Injury characterized by a reading disability." Such terms avoid the problem of etiology and facilitate treatment of the manifest disorder. Since most recognized experts in the field of learning disabilities agree that remediation of the disability under consideration can be treated with varying degrees of success whether a child has actually sustained a brain lesion or is simple delayed
in the acquisition of reading skills as the result of a lag in the maturation of visual-motor coordination. While this line of reasoning is obviously the most expedient approach for treatment, to avoid confusion in terminology the traditional term, "dyslexia," used in its broadest sense, will be used in this study.

Of the major approaches in treatment which have developed in the last twenty years, only the somewhat controversial "creep and crawl" method of Doman and Delocato (4) remains highly theory-bound. The methods of Kephart (10), Rappaport (16), Vallett (18), and Frostig (6) all focus on the effects of remediation rather than etiology. Since all of these techniques with the exception of the Frostig exercises require materials such as bean bags, balancing boards, etc., and require considerable individual instruction of the resource teachers available, the Frostig remedial measures were deemed the only feasible method to be utilized within the eleven-county area comprising the Region III Service Center territory.
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CHAPTER III

METHODS AND PROCEDURES

Basic Assumptions

1) It was assumed that the professional training of the investigator was sufficient both to diagnose and to treat dyslexic children.

2) It was assumed that those resource teachers involved in this study devoted the maximum amount of instruction to the children.

3) It was assumed that the treatment of the dyslexic child utilizing the Frostig materials would result in a reversal of the stated disability.

Instrument

The Frostig Developmental Test of Visual Perception was used in this study in an attempt to determine whether specific remedial techniques would reverse the direction of perceptual retardation through the five subtests in a group of children with the specific diagnosis of dyslexia.

The Frostig Developmental Test of Visual Perception is a test designed to detect those children whose perceptual abilities are retarded in comparison with the norm. It may be administered individually or to groups, and the scoring is objective. The five subtests are considered to assess
relatively distinct functions such as eye-motor coordination, figure-ground perception, perception of form constancy, perception of position in space, and perception of spatial relationships.

The manual reports test-retest reliability as .98 based on a sample of 50 children with learning disabilities, covering all ranges of age for which the test was designed. Another study utilizing a group of 35 first-grade and 37 second-grade students yielded a product-moment correlation coefficient for the perceptual quotient for the entire sample as .80. Considerable subtest variability existed, however, with correlations ranging from .42 on subtest II to .80 on subtest III.

Further, the manual states that "test-retest" correlation coefficients, when retesting is done after a long interval, or if training is interpolated between tests, would certainly be low because of the rapid development of visual perception, which seems to be more strongly influenced by experience than is thought to be the case with intelligence" (1, p. 490). Therefore, the control group was deemed necessary in order to rule out these variables.

The validity is also considered quite adequate as the correlations between teacher ratings of classroom adjustment and the author's hypothesis that impaired perception within the early school years would likely result in disturbances in classroom behavior are quite high.
Procedures for Collecting Data

Subjects selected to carry out the purposes of this study were children within the Region III Education Service Center area diagnosed as possessing a visual-perceptual deficit. Only males were included in this study due to the predominance of males exhibiting this disorder, and only those who were specifically diagnosed as dyslexic. These subjects were between six and eight years of age and were referred by the school systems for possible placement in special educational programs. The experimental group was immediately available for treatment procedures; the controls were subjected to the same treatment procedures the following semester. However, since a control group was deemed necessary, these subjects were administered the identical tests concurrent with the experimental group. With no treatment within this three-month period, the control group, who experienced the standard classroom procedures, was considered essential in order to contrast those with treatment versus those with no treatment, being administered the identical test.

Procedures for Analysis of Data

Data derived from both the control and experimental groups were subjected to statistical scrutiny through the utilization of \( t \) ratios for independent samples. This approach is necessary to systematically determine the mean loss of gain on the five scales of the Frostig Developmental
Test of Visual Perception.

The null hypothesis that there would be no significant differences between the two groups was tested at the .05 level of significance.
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CHAPTER IV

RESULTS

The principal statistical results, from which the judgments as to the tenability of the working hypotheses were made, are presented in Table I. Following are the decisions reached in this regard. Since the table is relatively self-explanatory, no attempt will be made to connect specifically each hypothesis with each tabular entry.

1) Hypothesis I, that there would be no significant differences between the mean gain on eye-motor coordination, a test of eye-hand coordination involving the drawing of continuous straight, curved, or angled lines between boundaries of various width, or from point to point without guidelines, was supported, indicating no significant mean gain of the experimental group over the control group.

2) Hypothesis II, that there would be no significant difference between the mean gain on figure-ground, a test involving shifts in perception of figures against increasingly complex grounds utilizing intersecting and "hidden" geometric forms, was supported, indicating no significant mean gain of the experimental group over the control group.

3) Hypothesis III, that there would be no significant differences between the mean gain on constancy of shape, a
test involving the recognition of certain geometric figures presented in a variety of sizes, shadings, textures, and positions in space, and their discrimination from similar geometric figures consisting of circles, squares, rectangles, ellipses, and parallelograms, was rejected, indicating a significant mean gain of the experimental group over the control group.

4) Hypothesis IV, that there would be no significant difference between the mean gain on position in space, a test involving the discrimination of reversals and of rotations of figures presented in series with schematic drawings representing common objects, was rejected, indicating a significant mean gain of the experimental group over the control group.

5) Hypothesis V, that there would be no significant differences between the mean gain on spatial relationships, a test involving the analysis of simple forms and patterns consisting of lines of various lengths and angles to be copied using dots as guide points, was supported, indicating no significant mean gain of the experimental group over the control group.
TABLE I
MEANS, STANDARD DEVIATIONS, "t" VALUES, AND LEVELS OF SIGNIFICANCE BETWEEN THE CONTROL AND EXPERIMENTAL GROUPS ON FIVE SCALES OF THE FROSTIG DEVELOPMENTAL TEST OF VISUAL PERCEPTION (1963 STANDARDIZATION) AFTER THREE MONTHS OF TREATMENT.

<table>
<thead>
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<th>Subtest</th>
<th>Control Group*</th>
<th>Experimental Group*</th>
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<td>Range of Raw Scores</td>
<td>Mean</td>
<td>Standard Deviation</td>
<td>Range of Raw Scores</td>
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<tr>
<td>I</td>
<td>7-13</td>
<td>9.875</td>
<td>2.15</td>
<td>8-16</td>
</tr>
<tr>
<td>II</td>
<td>7-16</td>
<td>12.000</td>
<td>3.02</td>
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<td>III</td>
<td>4-8</td>
<td>5.875</td>
<td>1.06</td>
<td>7-12</td>
</tr>
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<td>IV</td>
<td>3-7</td>
<td>4.625</td>
<td>1.37</td>
<td>5-8</td>
</tr>
<tr>
<td>V</td>
<td>2-5</td>
<td>3.875</td>
<td>1.25</td>
<td>3-5</td>
</tr>
</tbody>
</table>

*N = 30 control and 30 experimental subjects with ages ranging from 6 years, 0 months to 7 years, 11 months

**p < .05 level of significance
CHAPTER V

DISCUSSION, CONCLUSIONS, AND SUMMARY

The problem of this study was to determine whether specific techniques for diagnosis and treatment of dyslexic children, as outlined by Frostig, would significantly reverse their "reading retardation." The purposes of this study were (1) to determine whether diagnostic techniques can successfully identify the dyslexic child, (2) to determine whether specific remedial techniques are valuable in reversing the dyslexic syndrome in those patients so diagnosed, and (3) to report these findings to the various professions concerned with the dyslexic child.

Initial testing showed all sixty subjects of this study to be dyslexic. They were selected from a number of elementary school students suspected of having reading disability. These students had been referred for treatment from the eleven counties served by the Region III Education Service Center. For the purposes of this study, the sixty students were divided into two thirty-member groups: an experimental group, which was available for immediate treatment, and a control group, which was scheduled for treatment during the following semester. Before and after the treatment of the experimental group, both groups were administered the Frostig Developmental Test of Visual Perception.
Following the collection and tabulation of the data, the results were analyzed through the utilization of Fisher's \( t \) for independent samples. Randomization was considered sufficient by the scheduling of those receiving treatment and no treatment due to scheduling in the different school systems. The .05 level of significance was designated as appropriate to reject the null hypotheses and assume significant differences between mean gains.

Conclusions

The following conclusions were formulated, based upon the results of this study. Since significant mean gain was noted on only two of the subtests of the Frostig Developmental Test of Visual Perception, it appears reasonable to speculate that

1) These subtests are indeed independent measures of visual perception, and possibly remediation occurs more rapidly in the spheres measured by subtests III and IV.

2) Possibly deficiencies on the other subtests (I, II, and V) may represent actual brain lesions or disrupted firing patterns, while the other two (III and IV) may represent developmental lags in visual-motor coordination that are amenable to remediation by the Frostig techniques in a relatively short period. This conclusion would lead one to speculate that

3) The actual training program should have been extended over a longer period of time, perhaps at least two semesters.
4) Since during this age span rapid perceptual development is occurring in both the experimental and control groups, perhaps unintentionally remediation occurs in the control group through the sophistication of the teachers in the more conventional classroom settings.

Results broken down by subtest lead to the following speculations:

1) Subtest I, Visual Motor: When the child is unable to perform up to the expectations of parents, siblings, and teachers, his self-concept becomes so poor that he has learned to fear competition with others. This phenomenon could account for no significant differences between the groups, especially since both groups were below the perceptually "retarded" mean initially, judging by the Frostig manual and clinical experience.

2) In subtest II, the child's self-concept may also play a vital role in that he apparently has difficulty in "filtering out" irrelevant stimuli and therefore, frequently receives much criticism from "significant others." Thus, the child is often perceived as inattentive and disorganized, i.e., stimulus-bound. The criticisms stimulated by this phenomenon further decrease his self-concept, often resulting in rebellion.

3) There appears to be considerable overlap between subtests II and III, as well as in the remedial techniques used (form-constancy training utilized as Frostig recommends,
along with figure-ground exercises). Also, shape-constancy depends at least partially upon movement and touch. Therefore, the child apparently obtained more training quantitatively in form-constancy. In fact, Frostig states that "familiarity with a perceived object and the condition under which it is seen is not enough by itself to achieve shape-constancy. The object must also be perceived correctly in relation to other objects around it (its ground). No matter how familiar an object is, its actual size will not be recognized at a distance unless the surrounding field or ground provides appropriate cues" (1, p. 32). She further believes that training in shape-constancy should be administered concurrently with training in figure-ground perception.

4) It is surprising that subtest IV was significant, while subtest V showed no difference, since the functions required in both appear to overlap in their requirements of visual-perception. However, it may be speculated that more of the sensory modalities are necessary for subtest IV in this training program, especially the kinesthetic and tactical. This change could well facilitate success in this short-term training program. Thus, this heightened training in sensory modalities must have been a contributing factor to the significant mean gains found on subtest IV.
Summary

With a highly structured, well-controlled study over a three-month period, significant measurable gains were made on two of the subtests of the Frostig Developmental Test of Visual Perception. This signifies that perceptual difficulties may be reversed in a short period of time in at least two modalities. Perhaps all subtests may be capable of being altered in a positive direction with a more lengthy program following the Frostig techniques. This would be extremely beneficial to all aspects of the psycho-socio-cultural adjustment of the perceptually handicapped child, as research and clinical experience indicate that perceptual handicaps "spill over" into all areas of adjustment, especially in the development of his self-concept, which is so vital to his future advancement and adjustment. If a more lengthy program would result in remediation of all of the subtest measures, it would appear essential to include these techniques into all special education programs for the perceptually handicapped. If, however, the same results were obtained upon replication, perhaps more insight might be gained into the organic versus functional dispute currently predominant within the literature concerned with these disabilities.

In any case, it is strongly recommended that replication studies be instituted with larger sample sizes, that more instruments be used which are applicable to the problem,
and possibly that measures of the subjects' self-concept and of other personality factors be incorporated into further studies. Possibly a more rigid matching of subjects subsequent to pre-treatment testing could be instituted, and sessions conducted over a longer period of time would help to determine whether the other modalities will change or if there may be, in fact, an organic basis for these subtests. In addition, it could be valuable to engage a large enough sample to include females in further studies. It might also be valuable to investigate the family situation of all subjects and to instigate follow-up procedures to assess more clearly the effects of these training procedures.
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