University of the Pacific
Scholarly Commons

University of the Pacific Theses and Dissertations

Graduate School

1973

The Effectiveness Of Two Types Of Visual Aid Treatments On Eye Movement Performance Of Educationally Handicapped Pupils In The Elementary School

Jeffrey C. Lee
University of the Pacific

Follow this and additional works at: https://scholarlycommons.pacific.edu/uop_etds

 Part of the Education Commons

Recommended Citation

Lee, Jeffrey C.. (1973). *The Effectiveness Of Two Types Of Visual Aid Treatments On Eye Movement Performance Of Educationally Handicapped Pupils In The Elementary School*. University of the Pacific, Dissertation. https://scholarlycommons.pacific.edu/uop_etds/3047

This Dissertation is brought to you for free and open access by the Graduate School at Scholarly Commons. It has been accepted for inclusion in University of the Pacific Theses and Dissertations by an authorized administrator of Scholarly Commons. For more information, please contact mgibney@pacific.edu.

THE EFFECTIVENESS OF TWO TYPES OF VISUAL AID TREATMENTS ON EYE MOVEMENT PERFORMANCE OF EDUCATIONALLY HANDICAPPED PUPILS IN THE ELEMENTARY SCHOOL

A Proposal

Presented to

The Department of Educational and Counseling Psychology

The University of the Pacific

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Education

---

by

Jeffrey C. Lee

This dissertation, written and submitted by

Jeffrey Craig Lee

is approved for recommendation to the Committee on Graduate Studies, University of the Pacific

Dean of the School or Department Chairman:

J. Marc Jantzen

Dissertation Committee:

Harold W. Lawing Chairman

R C Coleman

Wilfred M. Mitchell

Clifford J. Hand

Preston Gleason

Dated April 11, 1973

Copyright by

JEFFREY CRAIG LEE

1973

ACKNOWLEDGMENT

The author wishes to express his sincere appreciation to Dr. Heath W. Lowry, under whose direction this study was accomplished, and to the other members of his Dissertation Committee: Dr. Preston W. Gleason, Dr. Thomas C. Coleman, Dr. Wilfred M. Mitchell and Dr. Clifford J. Hand.

Special thanks go to Dr. William C. Theimer for his assistance in selecting the research design and directing the procedures for collecting and analyzing the data. My appreciation is also given to Jeff West, James Shannon, Dr. Stanley France, Donald Evans, and to the many principals, teachers, and students of the Stockton Unified School District for their cooperation in this research study.

Finally, the author gratefully acknowledges the patience and understanding of his wife. This study is dedicated to Pamela who willingly made many sacrifices to make it possible.

J. C. L.

THE EFFECTIVENESS OF TWO TYPES OF VISUAL AID TREATMENTS ON EYE MOVEMENT PERFORMANCE OF EDUCATIONALLY HANDICAPPED PUPILS IN THE ELEMENTARY SCHOOL

Abstract of Dissertation

PURPOSE: The study was designed to test the effectiveness of two visual aid treatments: Controlled Reader and Tachistoscopic-X machines on educationally handicapped students in elementary school. In addition, this study was conducted to test the effectiveness of such an instructional program on efficient eye-movements on the educationally handicapped student during the reading act.

POPULATION: The study was conducted in nine elementary Stockton Unified Schools. The selection of the schools was based on the fact that these nine schools had an educationally handicapped learning disability program. From the pool of seventy-eight students, seventy-four subjects were selected for study. The subjects in this study included fifty-eight boys and sixteen girls ranging in age from six to thirteen.

PROCEDURE: The subjects were randomly assigned to a modified Solomon pre-post six group design. One control group received both pretesting and posttesting, and a second control group received only posttesting. An experimental group received pretesting, the experimental controlled reader visual aid treatment, and posttesting; a third control group received the controlled reader visual aid treatment and posttesting, but not pretesting. A second experimental group received pretesting, the experimental tachistoscopic-X visual aid treatment and posttesting. A fourth control group received the tachistoscopic-X visual aid treatment and posttesting, but not pretesting. The test instruments used in the pretesting and posttesting included the word knowledge, word discrimination, and reading subtests of the Metropolitan Achievement Test Form II: Primary Battery, the Developmental Test of Visual-Motor Integration, and Reading Eye I Camera Test: Fixation and Regression. The treatments involved twice-weekly visual motility training sessions conducted by the investigator for ten weeks. Six separate two-way analyses of variance were made to test the main effects of visual aid treatments, of pretesting, and of the interreaction of the two. Dependent variables were the subjects' posttest scores on the three test instruments. Also, the Neuman-Keuls Test was used to show statistically that there existed a difference between treatments.

FINDINGS: Groups receiving visual aid motility training had significantly lower eye fixation and regression scores on the posttest administered. There was no significant difference in the raw scores of the visual aid treatment and nonvisual aid treatment subjects on the reading achievement instrument. No significant differences were found in visual-motor integration among visual aid treatment and nonvisual aid treatment students. There were no apparent differences between controlled reader and tachistoscopic-X treatments. The investigator concluded that visual aid motility training demonstrated encouraging results as a model in decreasing the number of fixations and regressions among educationally handicapped learning disability students in elementary schools. The use of visual motility training did not improve reading performance. However, many experts feel that a correlation exists between eye movement skills and reading. Since such skills are considered essential to satisfactory progress in reading, this study may provide some helpful information in future studies on reading.

TABLE OF CONTENTS

Chapter | Page

Chapter — Page

LIST OF TABLES

CHAPTER I

THE PROBLEM, DEFINITIONS, AND PROCEDURES

INTRODUCTION

Children with specific learning disability have been identified for some time. Historically, the earliest investigators such as Hinshelwood[1] and Orton[2] were concerned with specific factors causing dyslexia or specific reading disabilities. Shortly thereafter Gillingham, Stillman,[3] and Fernald[4] specified remedial techniques for children with reading disabilities. In the decades of the fifties and early sixties, development of instructional systems concerning problems of speech and language were made by McGinnis[5] and Barry.[6] The 1960's saw an increased emphasis upon programs that seek to develop or remedy perceptual-motor processes in children. Based upon the contributions of Strauss and

---

[1]James Hinshelwood, Congenital Word Blindness (London: H. K. Lewis, 1917).

[2]Samuel Orton, Reading, Writing, and Speech Problems in Children (New York: Norton, 1937).

[3]Ann Gillingham, and Bessie Stillman, "Remedial Training for Children with Specific Disability in Reading, Spelling, and Penmanship" (Cambridge, Massachusetts: Educators Publishing Service, 1960), pp. 16-54.

[4]Grace M. Fernald, Remedial Techniques in Basic School Subjects (New York: McGraw-Hill, Inc., 1939), pp. 152-161.

[5]Mildred McGinnis, F. R. Kleffner, and R. Goldstein, "Teaching Aphasic Children," Volta Review, 58:223-244, 1959.

[6]Hortense Barry, "The Young Aphasic Child: Evaluation and Training," Volta Review, 1961, p. 198.

Lehtinen,[7] Kephart,[8] Cruickshank,[9] Getman,[10] Barsch,[11] Frostig, and Horne,[12] and Delacato,[13] these systems have come into some prominence today.

From the literature, one notes that there are numerous reported studies dealing with methods and procedures which have made extensive use of visual aid instruments in remedial programs. However, little has been reported on the use of specific visual programs in meeting the reading needs of educationally handicapped children at the elementary level. Some attempts have been made by teachers of the educationally handicapped to analyze children's styles of learning. This is particularly true in the area of reading instruction with visual instruments. When attempts have been made to use visual instruments in working with educationally handicapped students with reading disability, teachers seem to have

---

[7]Alfred A. Strauss and Laura E. Lehtinen, Psychopathology and Education of the Brain-Injured Child (New York: Grune and Stratton, 1947), p. 174.

[8]Newell C. Kephart, The Slow Learner in the Classroom (Columbus, Ohio: Charles E. Merrill Books, Inc., 1961), pp. 13-26.

[9]William M. Cruickshank, F. A. Bentzer, F. H. Ratzeburg, and T. A. Tannhauser, "Teaching Methods for Brain-Injured and Hyperactive Children" (Syracuse, New York: Syracuse University Press, 1961), pp. 146-49.

[10]G. N. Getman, "The Visuomotor Complex in the Acquisition of Learning Skills," in J. Hellmuth, Learning Disorders Vol. I (Seattle: Special Child Publication, 1965), pp. 49-76.

[11]Ray H. Barsch, "Counseling the Parent of the Brain-Damaged Child," Journal of Rehabilitation, Vol. XXVII, No. 3 (May-June, 1961), pp. 1-3.

[12]Marianne Frostig and D. Horne, The Frostig Program for the Development of Visual Perception (Chicago, Follett, 1964), pp. 241-247.

[13]Carl H. Delacato, The Diagnosis and Treatment of Speech and Reading Problems (Springfield, Illinois: Charles C. Thomas, 1963), p. 280.

selected their media by chance rather than by following a carefully planned program.

D'Evelyn has stated that there is a definite need for these children to gain a sense of accomplishment in school performance, particularly in the area of reading. Such accomplishments gender self-confidence through their learning experiences.[14] What is required beyond the teaching act is the awareness, by both teachers and the school, that this need exists. Thus it becomes their responsibility to develop and implement a satisfactory program for success in learning.[15] The current investigation focused on the identification and assessment of one such program.

PROBLEM

Statement of the Problem

This study was involved (1) with evaluating the effect of using two visual aid instruments, the Educational Developmental Laboratories' Controlled Reader and Tachistoscope-X; and (2) with assessing, by means of eye-movement records, the amount of improvement in reading performance of educationally handicapped students displaying reading disability. More specifically, it attempted to answer two questions;

1. Does the extended use of this visual program by educationally handicapped students with reading disability significantly affect their reading performance?
2. What effect does such an instructional program have on efficient eye-movements during the reading act?

---

[14]Katherine D'Evelyn, Meeting Children's Emotional Needs (Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1959), p. 8.

[15]Ibid., pp. 9-10.

Significance of the Study

The utilization of visual aid instruments may help to determine the amount of, and types of, instructional programs needed in improving reading skills among educationally handicapped students. A crucial part of this study was the recorded data of eye-movement. These data were of particular relevancy when using various visual-aid instruments in the remedial program. Such information can guide the diagnostician: first, to decide whether visual aid training is advisable; and secondly, these data may serve to indicate the types, speeds, and breadth of exposures desirable for a successful learning experience. Further, eye-movement records may give directions as to whether speed or span training, or emphasis upon directional attack, or some modification of these would be suitable in a remedial program. The researcher intended that the data gathered would provide administrators, parents, and/or teachers with needed observable and objective evidence concerning the measured progress made and the reading success of educationally handicapped students with reading disability, who were involved in the prescribed program.

Identification of Population

For the purpose of undertaking this study, the researcher set forth the following delimitations:

The students had been legally admitted into the educationally handicapped learning disability program based upon (1) teacher's referral, (2) results on an individualized intelligence test and (3) the recommendation of Stockton Unified School District's Admission Committee.

This study was limited to seventy-four educationally handicapped students currently enrolled in nine elementary schools in the Stockton Unified School District. Subjects in this study included fifty-eight

boys and sixteen girls.

PURPOSE OF THE STUDY

"No skill in education is more fundamental than reading. It remains the chief means by which anyone can continue his education independently long after his school days have passed."[16] These words provide the basic rationale for this study, as well as those studies concerned with the teaching of reading. If visual aid programs can be shown to be an effective supplement to the educationally handicapped student in his reading, many of these students will be given opportunities for success that they may not have otherwise enjoyed. Visual aid programs can be devised to help the educationally handicapped students in the elementary schools to develop their reading potential to the fullest. These benefits would not be limited to these students, but would be shared with society as well.

This study was further justified and was of educational importance in that this visual program can be replicated and incorporated into a program for elementary educational handicapped classrooms throughout the country. If the efficacy of this technique can be demonstrated, it may well lead to achievement of the "right to read" goal expressed by Allen.[17]

PROCEDURE

The procedure used in this study was:

---

[16] Contemporary Issues in Elementary Education (Washington: The Educational Policies Commission of the National Education Association, 1960), p. 10.

[17] Report on Education Research (Washington: Capitol Publications Inc., October 1, 1969), p. 3.

1. Selection of Sample: The sample for the study was seventy-four (74) elementary students who had been legally admitted to and were participating in the educationally handicapped learning disability program in the Stockton Unified School District.

2. Treatment Procedure: The seventy-four participants were randomly assigned into six groups as follows:

   GROUP A. This group consisted of twelve students and was one of the control groups. Group A was given pretests in order to determine each student's reading level at the start of this study. No treatment was given to this group. After ten weeks, this group was given the posttest.

   GROUP B. This group consisted of twelve students and was one of the control groups. Group B was not pretested and no treatment was given to the students. After ten weeks, this group was given the posttest.

   GROUP C. This group consisted of thirteen students and was one of the treatment groups. Group C was given pretests in order to determine each student's reading level at the start of this study. This group was given bi-weekly sessions of twenty (20) minutes each with the EDL Controlled Reader machine. After ten weeks, this group was given the posttest.

   GROUP D. This group consisted of thirteen students and was one of the treatment groups. Group D was not pretested. This group was given bi-weekly sessions of twenty (20) minutes each with the EDL Controlled Reader machine. After ten weeks, this group was given the posttest.

   GROUP E. This group consisted of twelve students and was one of the treatment groups. Group E was given pretests in order to determine each student's reading level at the start of this study. The group was given bi-weekly sessions of twenty (20) minutes each with the EDL Tachistoscope-X machine. After ten weeks, this group was given the posttest.

   GROUP F. This group consisted of twelve students and was one of the treatment groups. Group F was not pretested. This group was given bi-weekly sessions of twenty (20) minutes each with the EDL Tachistoscope-X

---

[18]Deobald B. Van Dalen, Understanding Educational Research: An Introduction, Revised edition (New York: McGraw-Hill, 1966), pp. 266-67.

machine. After ten weeks, this group was given the posttest.

3. Collection and Analysis of Data: The method for collecting data in this study was based on pretest and posttest scores from administering (1) the Developmental Test of Visual-Motor Integration Test by Beery,[19] (2) Metropolitan Achievement Test[20] (Form A: Primary II Subtests on Word Knowledge, Word Discrimination, and Reading), and (3) EDL Reading Eye I Camera[21] which records eye-movement photographically.

The data were then treated statistically by means of (1) two-way analysis of variance and (2) the Neuman-Keuls Test for the differences between treatments.[22]

HYPOTHESES

The hypotheses upon which this study was based follow:

Hypotheses

H_1 : Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader and Tachistoscope-X machine will show significantly greater gains in reading performance as measured on the Metropolitan Achievement Test, Subtest Word Knowledge than educationally handicapped students who are not given an instructional program.

---

[19]Keith E. Beery and Norman A. Buktenica, Developmental Test of Visual-Motor Integration (Administration and Scoring Manual), (Chicago, Illinois, Follett Publishing Company, 1967), pp. 11-13.

[20]Walter N. Durost ed., Metropolitan Achievement Test (Primary II: Battery for grade 2), (New York: Harcourt, Brace & World, Inc., 1959), p. 3.

[21]Stanford E. Taylor, Eye Movement Photography with the Reading Eye, (Huntington, New York: Educational Developmental Laboratories, Inc., 1960), p. 10.

[22]B. J. Winer, Statistical Principles and Experimental Design (New York: McGraw-Hill, 1962), pp. 100-104.

H_2 : Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader and Tachistoscope-X machine will show significantly greater gains in reading performance as measured on the Metropolitan Achievement Test, Subtest Word Discrimination than educationally handicapped students who are not given an instructional program.

H_3 : Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader and Tachistoscope-X machine will show significantly greater gains in reading performance as measured on the Metropolitan Achievement Test, Subtest Reading than educationally handicapped students who are not given such an instructional program.

H_4 : Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader and Tachistoscope-X machine will show significantly greater gains in visual motor performance as measured on the Developmental Test of Visual-Motor Integration than educationally handicapped students who are not given such an instructional program.

H_5 : Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader and Tachistoscope-X machine will show significantly greater gains in eye-movement performance as measured on the EDL Reading EYE I Camera Test: Fixation than educationally handicapped students who are not given such an instructional program.

H_6 : Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader approach, will show significantly greater gains in eye-movement performance as measured by the EDL Reading Eye I Camera Test: Fixation than educationally handicapped students who are given the Tachistoscope-X instructional program.

H_7 : Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader and Tachistoscope-X machine will show significantly greater gains in eye-movement performance as measured on the EDL Reading Eye I Camera Test: Regression than educationally handicapped students who are not given such an instructional program.

H_8 : Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader approach, will show significantly greater gains in eye-movement performance as measured by the EDL Reading Eye I Camera Test: Regression than educationally handicapped students who are given the Tachistoscope-X instructional program.

ASSUMPTIONS AND LIMITATIONS

Assumptions

From the onset of the study certain assumptions were necessary. These included the following:

1. Children in educationally handicapped classes in Stockton Unified School District have been selected and placed as directed by the California State Education Code.[23]

2. Emotional disturbance of varying intensity accompanies learning disability and cannot be considered as a separate factor.[24] In this study the researcher has not considered the question of emotionality as cause or effect of learning disability.

3. The instructional materials utilized in this study were appropriate for the particular grade levels assigned in the study as designated by Educational Developmental Laboratories.[25]

4. The tests used in this study accurately measured the intellectual and developmental functions for which they were intended.

5. The information recorded in the Special Education Office of Stockton Unified School District on each student regarding birth date, grade retention, intelligence quotient, health history, and attendance was accepted as valid.

Limitations

In addition to the stated assumptions, the following limitations were set for this study:

1. Those inherent in the nature and scope of the instruments selected to define reading performance.

2. Those inherent in the administration of an individual and group test to seventy-four children located in varying school settings and those variations due to uncontrollable time factors relating to the scheduling of examinations or large

---

[23]Laws and Regulations Relating to Education and Health Services for Exceptional Children in California, Section 6750 (Sacramento: California State Department of Education, 1969), p. 21.

[24]Leon Eisenberg, "Epidemiology of Reading Retardation," The Disabled Reader, eds. John Money and Gilbert Schiffman (Baltimore: John Hopkins Press, 1966), p. 254.

[25]Stanford E. Taylor and Helen Frackenpohl, EDL Tach-X, Flash-X (Teacher's Guide) (Huntington, New York: Educational Developmental Laboratories, 1968), pp. 124-134: Controlled Reader (Teacher's Guide) Huntington, New York: Educational Developmental Laboratories, 1970), pp. 41-45.

numbers of school children.

3. Those inherent in the provision of treatment by one individual.

DEFINITIONS OF TERMS USED

1. Controlled Reader Training: An instructional program using an instrument that projects visual material in line-by-line or left-to right patterns at controllable rates. The student is encouraged to read each line of print in a more efficient and sequential manner. Because there is no possibility of rereading, he learns to concentrate, read aggressively and accurately, organize his thoughts rapidly, and remember well.[26]

2. Educationally Handicapped Minor: Those minors who by reason of marked learning or behavior disorder, or both, require the special education program (learning disability groups, special day classes; home, hospital, or regular established nonprofit, tax-exempt, licensed children's institution programs) . . . with the intention of full return to the regular school program. Such learning or behavior disorder shall be associated with a neurological handicap or emotional disturbance and shall[27] not be attributed to mental retardation.[28]

3. Eye-Movement Efficiency: The term is also known as "visual efficiency" or "oculo-motor efficiency." It consists of: Ocular activity

---

[26]Stanford E. Taylor and Helen Frackenpohl, op. cit., p. 14.

[27]California Administrative Code, Title 5, Provisions Pertaining to Programs for Educationally Handicapped Minors, Section 3230 (Sacramento: California State Department of Education, November, 1969).

[28]Ibid., Section 6750.

(use of as few fixations as necessary), Duration of fixation, Directionality of visual survey, Accuracy of fixation (ability to direct the eyes with relative precision) and Motility (ability to make ocular excursions quickly and easily in carrying out a visual survey at near point).[29]

4. Learning Disability Groups (Elementary): A program in which the pupil remains in his regular class but is scheduled for individual or small group instruction by a special teacher. Since funding is a reality of educational planning, a one-to-one teacher pupil ratio is not, in most cases, possible. For learning disability groups the maximum class enrollment shall be 32; however, participation in any given learning disability shall be for at least 30 minutes and shall not exceed eight pupils at any one time.[30]

5. Reading Eye I Camera: An instrument that photographs the eye-movement of the subject. As the subject reads a selection at his grade level, as determined by an oral pre-test, beads of lights are reflected from his eyes through lenses onto moving film.[31]

6. Reading Performance: Accomplishments that are exhibited as a result of a cerebral process where printed symbols stimulate a reorganization of past experiences into a new and meaningful entity.[32]

---

[29]Stanford E. Taylor and H. Alan Roberson, The Relationship of the Oculo-Motor Efficiency of the Beginning Reader to His Success in Learning to Read (Paper presented to the American Educational Research Association, February, 1963).(Huntington, New York: Educational Developmental Laboratories, 1963), pp. 5-6.

[30]California Administrative Code, op. cit., Section 6751b.

[31]Ibid., Section 6751.1.

[32]Stanford E. Taylor, "Eye-Movement Photography: Script to Accompany the Filmstrip," (Huntington, New York: Educational Developmental Laboratories, 1962), pp. 3-4.

7. Remedial Reading: Reading instruction designed for children experiencing serious difficulty in learning to read.[33]

8. Span of Perception: What the eye can encompass during a fixation.[34]

9. Specific Language Disability: The term is applied to those who have found it very difficult to learn to read and spell, but who are otherwise intelligent, and usually learn arithmetic more readily. More recently any language deficit, oral, visual or auditory, is referred to by this term.[35]

10. Tach-X Training: A method of instruction making use of time exposures where images are snapped in and out of sharp focus. The tach-X training stresses teaching habits of aggressive seeing, orderly perception, and minute, careful scrutiny of visual material, all of which result in more effective retention.[36]

11. Visual Perception: The interpretation of visual sensory information. The mechanism by which the intellect recognizes and interprets visual-sensory stimulation.[37]

SUMMARY

This chapter has presented an introduction to the dissertation.

---

[33]George Kaluger and Clifford J. Kolson, Reading and Learning Disabilities (Columbus, Ohio: Charles E. Merrill Publishing Co., 1969), pp. 3-4.

[34]Ibid

[35]Ibid.

[36]Stanford E. Tayor and Helen Frackenpohl, EDL Tach-X, Flash-X. op. cit., p. 5.

[37]Edward C. Frierson and Walter B. Barbe, Educating Children With Learning Disabilities: Selected Reading (New York: Appleton-Century Crofts, 1967), p. 493.

It has stated the problem, delineated the significance of the study, proposed hypotheses, specified the assumptions and limitations upon which the research is based, and has defined the important terms used in the report.

Four additional chapters complete the remainder of the study. They are as follows: (1) Chapter II: Review of the Literature Related to the Study, (2) Chapter III: Description of the Experimental Design and Procedures of the Study, (3) Chapter IV: Presentation of the Collected Data as Revealed by the Investigation, and (4) Chapter V: Conclusions Based Upon the Investigation, with Implications for Educators, and Recommendation for Further Study.

CHAPTER II

REVIEW OF THE LITERATURE RELATED TO THIS STUDY

The literature examined and reviewed for the current study was concerned with expert opinion and research related to educationally handicapped elementary children with a measured, normal intelligence quotient, who have reading disabilities. In this review three specific areas of the literature have been selected: (1) that dealing with an Overview of Reading Disabilities, (2) that specifically reporting the Values of Visual Training in the Remedial Reading Program, and (3) that which assesses the effectiveness of EDL Machines and Materials in Eye Movement Training.

OVERVIEW OF READING DISABILITIES

The nature of the remedial program depends upon the severity of the student's disability and the multiplicity of experiences affecting the student's behavior and performance. Most communities need at least two types of programs: (1) Special classrooms for those whose learning adjustment problems are so severe that they cannot succeed from regular classroom instruction, and (2) a second type, for others who do not need to be removed from the regular group all day and can learn from many regular classroom activities. In this study, the latter type of program was of primary concern. Such a pull-out program should be differentiated from tutorial programs, in which a teacher provides only supplemental

help in academic subject matter. According to Johnson[1] emphasis should be given to the improvement of the disability so the child can acquire information for himself or from normal classroom experiences.

The Reading Process

Kress[2] has asserted that one of the most recurrent topics on the educational scene for the past decade has been concerned with reading instruction. The number of textbooks, articles, and reports of research in reading, which have been written for professional personnel, and the number of books, articles, and editorials, which have been written for lay consumption, have far outstripped the volume of writing about reading in any other period in our history. In order to diagnose the child with learning disabilities, one should study what variables are involved in the reading process.

Many authorities would agree with Edgington when she states:

> The variables in the reading process are so complex, that when one thinks of how many things must all work together correctly, it is amazing that there are not more people who are poor readers or who are completely unable to read.[3]

According to Fries[4] and Gates,[5] the basic process of reading

---

[1]Doris J. Johnson, Educational Principles for Children with Learning Disabilities, in Donald D. Hammill and Nettie R. Barrel (eds.) Educational Perspectives in Learning Disabilities, (New York: John Wiley and Son, Inc., 1971), p. 142.

[2]Roy A. Kress, "When Is Remedial Reading Remedial?" Education 80:540, May, 1960.

[3]Ruth Edgington, Helping Children with Reading Disability (Chicago, Illinois: Developmental Learning Materials), 1962, p. 7.

[4]Charles C. Fries, Linguistics and Reading (New York: Holt, Rinehart, and Winston, 1962), p. 8.

[5]Arthur I. Gates, "Teaching Reading Tomorrow" Paper presented at the Third General Session, International Reading Association, Kansas City, Missouri, May 2, 1962.

involves the recognition of symbols. The child learns to associate sounds and letters, and he learns that letters go together to form words. These authors further state that the child must, then, learn to discriminate one letter from another and one word from another.

Edgington further points out that reading not only requires recognizing and remembering the shape of the letters, but she also states:

> One will need to know the exact order of the letters in each word, and the word's meaning which is built on past experience and on the use of the word in the sentence.[6]

Aside from the above mentioned factors which are involved in the process of reading, there is the need to recognize the significance of efficient visual skills as essential if successful reading is to be achieved. Thus, an important contributing factor in the reading process is vision.

Behrmann sees vision as a learned process:

> . . . a person is not born with vision; he is only born with the elements of sight. By means of a series of experiences during the early life of an individual, vision is then developed. The degree of vision development is dependent upon the quality and quantity of these prior sensory exposures.[7]

This writer further states that although there is a variety of sense modalities--visual, auditory, tactual, kinesthetic and olefactory, it has been estimated that about eighty-five percent of all information coming into the body enters through the visual system.[8]

---

[6]Edgington, op. cit., p. 30.

[7]Polly Behrmann, "Activities for Developing Visual-Perception," Academic Therapy Publication (San Rafael, California, 1970), pp. 5-7.

[8]Ibid.

Robbins concurs with Behrmann's ideas about vision. He states that the ability to see is in part maturational and in part educational or learned.[9]

The Importance of the Perceptual Process in Reading

An important aspect of visual development is the role of perception in reading. This visual process which involves receiving, integrating, and decoding or interpreting visual stimuli has been commonly referred to as visual perception.[10] For many years visual perception was viewed as a passive process which was mainly dependent upon the stimuli reaching the sense organs. This would be a relatively simple process; however, Chalfant and Scheffelin have indicated that:

> The processing of visual stimuli is not only a more complex act than previously supposed, but a highly active and investigatory process.[11]

According to Hildreth, "perception is the mind's response to sensations received from the outside world."[12] Further, she states:

> Without the capacity to perceive, the human mind would be unable to form association with symbols and their meanings, to store up memories of word forms, and to discover similarities and differences in word forms. These skills are fundamental in reading and in learning to read.[13]

---

[9]N. A. Robbins, "The Visual Aspects of Reading Problems," Nursery Outlook, 1:5, 1953, p. 278.

[10]James C. Chalfant, and Margaret A. Scheffelin, Central Processing Dysfunctions in Children: A Review of Research, National Institute of Neurological Diseases and Stroke Monograph No. 9, U. S. Department of Health, Education, and Welfare, Bethesda, Maryland, 1969, p. 21.

[11]Ibid.

[12]Gertrude Hildreth, "Some Principles of Learning Applied to Reading," Education, 74 (May, 1954), pp. 546-547.

[13]Ibid.

Hildreth also points out that in reading, visual perception of word forms must operate smoothly, swiftly, and simultaneously. She explains that although the words printed in English are actually either longer or shorter combinations of but 26 different letter forms, "learning to distinguish among confusing word symbols becomes a formidable task for any child."[14]

Kaluger and Kolson believe that the development of visual perception serves several purposes:

> (1) visual discrimination will be needed to differentiate between like and unlike and to identify symbols in their proper spatial and temporal relationships.
>
> (2) visual scrutiny, awareness, and differentiation of details in the environment will be needed for cognitive development which will in turn have an effect upon reading performance.[15]

In much of the research undertaken by Frostig[16] it was discovered that visual perception deficits are often common among children with reading difficulties. However, she cautions that lack of normal development of visual perception was rarely the only cause of reading failure.[17] From referrals treated at the Marianne Frostig Center, it was found that even at an older age, the most frequent cause of learning difficulties was due to visual perception difficulties.[18]

---

[14]Ibid.

[15]George Kaluger and Clifford J. Kolson, Reading & Learning Disabilities (Columbus, Ohio; Charles E. Merrill Publishing Co., 1969), p. 34.

[16]Marianne Frostig, "Visual Modality and Reading," in Helen K. Smith (ed.), Perception and Reading, International Reading Association, Newark, Delaware, 12:4, 1968, pp. 25-31.

[17]Ibid.

[18]Frostig, Loc. cit.

A review of the research summaries by Weintraub[19] disclosed that visual perception deficiencies had more effect than auditory perception deficits resulting in difficulties in reading with primary grade children.[20] However, another authority, Kottmeyer, has stated that the numerous studies of the relationship of vision to reading are not conclusive because of the following:

> The wide variety of measures used, the many kinds of visual defects which exist, and the normal variations in vision among subjects of different ages.[21]

Hence it seems clear that the reading process does not only involve recognition, retention and recall skills, but rather other complex cerebral processes. The learner, as described by Kephart,[22] makes a variety of cerebral responses in the reading situation. He does this by organizing sensory complexes (perceptual processes) into stable, meaningful recognized patterns of percepts (conceptual processes). He further states that one of the major aspects of the learning problem with regard to reading is the child's inability to organize and integrate both perceptually and conceptually.

Educationally Handicapped Learners

Teachers at any level may often state that they have disabled readers in their classes. Sometimes there would be only one or two, or it

---

[19]Samuel Wintraub, "What Research Say to The Reading Teacher," The Reading Teacher, 20 (March, 1967), pp. 551-558.

[20]Ibid.

[21]William Kottmeyer, Teacher's Guide for Remedial Reading (St. Louis, Montana: Webster Publishing Company, 1959), p. 17.

[22]Newell C. Kephart, "Learning Disability: An Educational Adventure," Kappa Delta Pi, West Lafayette, Indiana, 1968.

may include as much as a third of the group. Usually the teacher may feel that these children read too poorly to succeed with the work of the class at its anticipated level.

Dolch asked:

> What happens when a class contains these disabled readers? Obviously, the disabled readers cannot be getting what they should, even though they may listen carefully and in other ways be doing their best. Still more important, the rest of the class may be held back while the teacher tries to do something for the disabled individual. Thus the total loss in time and in educational values which disabled readers cause in our school system is enormous.[23]

Surveys by Kephart,[24] Harris,[25] and Wepman[26] revealed that ten to fifteen percent of all the children enrolled in typical elementary schools have cases of mild or severe reading disability. Also the loss in happiness, self-confidence, and security on the part of the disabled reader himself is beyond calculation.

According to Kirk[27] no area of education or special education presently has become more controversial or is receiving more publicity than special learning disabilities. The problem has become of sufficient magnitude, as identified by improved scientific instruments for measurement and educational programming, to command the attention of federal and

---

[23]Edward W. Dolch, Remedial Reading, (Garrard Publishing Company: Champaign, Illinois, 1953), pp. 3-4.

[24]Kephart, op. cit., pp. 4-5.

[25]Albert J. Harris, How to Increase Reading Ability, (4th edition) (New York: David McKay Company, Inc., 1961), p. 3.

[26]Joseph M. Wepman, "Modality Concept-Including a Statement of the Perceptual and Conceptual Levels of Learning," in Helen K. Smith (ed.), Perception and Reading (International Reading Association, Newark, Delaware, 1968), 12:4, p. 1.

[27]Samuel A. Kirk, Educating Exceptional Children, (2nd edition) (Boston: Houghton Mifflin Company, 1972), p. 43.

and state agencies.

In its annual report on special education for handicapped children to the U. S. Commissioner of Education, the National Advisory Committee on Handicapped Children maintained that "the problem of special learning disabilities should be considered as a part of a larger issue of classification of handicapped children."[28] A federally funded study, sponsored jointly by (1) the National Institute of Neurological Diseases and Blindness, (2) the National Society for Crippled Children and (3) the Office of Education, is currently in progress. The researchers are attempting to define clearly the nature and extent of the problem confronting disabled learners and to provide a basis for the planning of more effective programs of research and services to these students.[29]

Besides the attention being given on the national level, the State of California has also focused considerable attention on the education of children of normal intelligence who have learning problems. According to the Waldie Bill (California Assembly Bill 464) which established such programs, an educationally handicapped child is a minor who is

> . . . not physically handicapped or mentally retarded, whose learning problems are associated with behavioral disorder or a neurological handicap or a combination thereof, and who exhibits a significant discrepancy between ability and achievement.[30]

---

[28]National Advisory Committee on Handicapped Children: First Annual Report, Special Education For Handicapped Children, Washington, D.C., U. S. Department of Health, Education and Welfare, Office of Education, 1968.

[29]Loc. cit.

[30]California Administrative Code, Section 2, Article 27, Subchapter 1 of Chapter 1 Title V.

Causes of Reading Disability

Edgington has stated that there is a long list of possible causes for learning disabilities:

> The child is unable to learn to read without special help. He is not lazy. He is not retarded. He is not able to do better if he just would. He is not likely to outgrow his disability without special help; nor is he just a slow reader in terms of speed.[31]

Some of the disabilities exhibited by the disabled reader in reading are described by her as follows:

1. He confuses letters that look alike, because they face in different directions, (p-q, d-b, m-w, u-n, d-g).
2. Also he often confuses letters whose sounds are similar (d-t, v-f, c-g, b-p).
3. He may also have great difficulty with short words, especially if they are sensible when read backwards (saw-was, no-on).
4. Short words are harder for him than long ones because the short words have fewer distinguishing characteristics.
5. He often will read a word correctly in one sentence, and later on the page the same word is a complete stranger to him.
6. He will sometimes invent or substitute a word which fits the thought of the sentence for a word which he does not recognize.[32]

Johnson and Myklebust have further stated that the student with a learning disability often "has deficits in acquiring the spoken word, in learning to read, to use written language, to spell, to tell time, to judge distance, size, length, and height or to calculate."[33]

---

[31]Edgington, op. cit., p. 7.

[32]Ibid.

[33]Doris J. Johnson and Helmer R. Myklebust, Learning Disabilities: Educational Principles and Practices (New York: Grune and Stratton, 1967), p. 148-152.

Kephart in a lengthy discussion about what causes the incidence of learning disability among school children focuses on three major areas: (1) brain injury, (2) emotional disturbance, and (3) experience.[34] A fourth area needing attention is concerned with maturational lag.

1. Brain Injury and Learning

Kephart states that the degree of neurological damage has a direct relationship to reading impairment. A symptom described for children with the disability is the manner in which the learner receives information:

> The disabled reader receives in bits and pieces rather than in total integral wholes. These bits and pieces remain isolated and do not come together in clusters. Thus the great organizing ability of the central nervous system is disrupted.[35]

Kephart asserts that such disruptions exist not only on the symbolic level, but also on the perceptual and psycho-motor levels. He concludes by saying that the learner is continually confused and there is considerable conflict among items of learning.

Other authorities who have investigated neurological impairment as a possible cause of reading disability seem to hold various points of view.

Hinshelwood,[36] believes that reading disability is often due either to destruction, or improper development, of certain areas of the left cerebral hemisphere (memory centers). He has classified learners with reading disability into three groups and employed three different

---

[34]Kephart, op. cit., pp. 11-14.

[35]Kephart, op. cit., p. 5.

[36]James Hinshelwood, Congenital Word Blindness (London: H. K. Lewis, 1917), p. 64.

terms to describe the cause: (1) congenital word-blindness, (2) congenital dyslexia and (3) congenital alexia. According to Gates,[37] the term "congenital word-blindness" was popular at one time, but it has fallen into disrepute. He stated that he had "not yet encountered a case of disability which seemed to be best described as 'word-blindness.'"

Rabinovitch asserts that the capacity to learn to read is impaired by brain damage manifested by clear-cut neurologic deficits:

> The picture is similar to the early-described adult dyslexic syndrome. Other definite aphasic difficulties are generally present. History usually reveals the cause of the brain injury, common agents being prenatal toxicity, birth trauma or anoxia, encephalitis, and lead injury. These cases are diagnosed as brain injury with reading retardation.[38]

Orton,[39] attempting to discover the cause of reversals in reading, found that, in many cases of reading disability, postmortem examination of the brain did not reveal defects in structure. Therefore, he theorized that the disturbance was a manifestation of defective storage of visual memory resulting from incomplete cerebral dominance. He conceptualized pictorial representations stored in the brain, with each hemisphere forming its own record of the word form which was seen. Orton thought that the recorded representations in the dominant hemisphere were oriented oppositely but under normal circumstances were not utilized in reading. He speculated that those individuals who did not develop would

---

[37]Arthur I. Gates, The Improvement of Reading (New York: MacMillan Company, 1927), p. 273.

[38]Ralph D. Rabinovitch, "Reading and Learning Disabilities," in Silvano Arieti (ed.), American Handbook of Psychiatry (New York: Basic Books, 1959), p. 865.

[39]Samuel T. Orton, Reading, Writing, and Speech Problems in Children (New York: Norton, 1937).

suffer from competition of response of the reversed representations and that this situation would lead to the improper identification of printed symbols.[40]

Orton's theory concerning the visual patterns being stored in the brain has been disproved by Park's studies,[41] who has demonstrated that such learning disabilities may be simply an expression of emotional dissatisfaction.

More recent work by Johnson and Myklebust[42] stress that visual modality often interferes with ability to read and that this might be due to a central system dysfunction. They state that a child may be able to see but that he may have difficulties in differentiating, interpreting, or remembering words.

Through their analysis of diagnostic findings and observations, the following characteristics seem to prevail among visual dyslexics:

1. They have visual discrimination difficulties and confuse letters or words which appear similar.
2. Their rate of perception is slow. They cannot rapidly recognize words as being the same or different.
3. Many show reversal tendencies both in reading and writing.
4. Some have inversion tendencies and misread u for n or m for w.
5. Visual dyslexics have difficulty following and retaining visual sequences. They know all of the letters in the word but cannot remember their order.
6. They have many visual memory disorders which include non-verbal or verbal experiences.

---

[40]Ibid.

[41]George E. Park, "Nature and/or Nurture Cause Reading Difficulties?" Archives of Pediatrics 69:432-444, November, 1952.

[42]Doris G. Johnson and Helmer R. Myklebust, Learning Disabilities; Educational Principles and Practices (New York: Grune & Stratton, 1967), Pp. 152-6.

7. Their drawings tend to be inferior and lack in detail.

8. They have visual analysis and synthesis problems. They are unable to arrange the parts properly.[43]

Peripheral dominance has also been studied by these researchers who assess hand, foot, and eye preference for different activities. Handedness, eyedness and the correspondence between them have been of particular concern to investigators of reading retardation. According to Johnson[44] many studies of lateral preference in peripheral activities have suffered from several inadequacies. They are that:

(1) investigators differ in their criteria for determination of handedness or eyedness and

(2) investigators have emphasized handedness or eyedness inappropriately because of special theoretical interest.

As a result of these inadequacies, Johnson has suggested that only two conclusions seem tenable:

> Neither eye nor hand preference appears to be, in itself, a significant factor in reading disability, nor does it appear that preference for one eye and the opposite hand is a factor of significance either.[45]

Some attempt has been made to discuss some of the causes of reading disability due to neurological explanations, especially when there are serious behavioral problems evident in the learning disability student in the classroom situation.

Stevens and Birch,[46] have specified that the neurologically

---

[43]Ibid.

[44]Johnson and Myklebust, op. cit., pp. 292-295.

[45]Ibid.

[46]Godfrey D. Stevens and Jack W. Birch, "A Proposal for Clarification of the Terminology Used to Describe Brain-Injury Children," Exceptional Children, 23:8 May, 1957 , pp. 348-349.

impaired child appears to have varying degrees of the following traits:

1. Erratic and inappropriate behavior upon mild provocation.
2. Increased motor activity disappropriate to the stimulus.
3. Poor organization of behavior.
4. Distractibility of more than ordinary degree under ordinary conditions.
5. Persistent hyperactivity.

Strauss and Lehtinen have described the behavior of the neurologically impaired child in the school setting:

> All of these children show evidence of general disturbance in the classroom: distractibility, hyperactivity, and inhibition as expressed in difficulty in conforming to the usual standard of group and classroom management.[47]

Summary. One generalization that is apparent from the review of the literature relative to reading disabilities is that the concept of brain-injury applies to reading disabilities and has found acceptance among professional special educators. A variety of viewpoints concerning organic impairment have been developed to explain the disturbance in perception, thinking, and inappropriate behavior during reading. Some theorists have felt that reading disabilities may be due to either structure, or improper development of certain areas of the left cerebral hemisphere, while others felt that the cause was due to a manifestation of defective storage of visual memory resulting from incomplete cerebral dominance. Peripheral dominance was also studied as a possible cause for reading disability.

2. Emotional Disturbance and the Learner

---

[47]Strauss and Lehtinen, op. cit., pp. 169-170.

Emotional disturbance is one of a number of factors that may prevent or impede a normal learning process for the educationally handicapped child. According to Edgington,[48] as learning proceeds, emphasis shifts from specific items of information to intricate organization among items of information. If the pressures for organization become too great, emotional behavior such as confusion and failure results. For the disabled reader, such is the case more frequently than not. Edgington states:

> The child is confused because he does not understand the word being presented. He may be bored because he cannot follow the classwork: he is frustrated by his inability to learn; he is upset because he cannot do what his parents and teachers urge him to do; he is further upset because he cannot achieve as do his classmates; and he is lacking in an acceptable way to relieve his feelings of inadequacy.[49]

As to the child's day-to-day performance, Edgington states that one can expect great variability in his work. She explains further:

> A bit of knowledge or skill apparently mastered one day, may be completely strange to the child the following day. Over a period of several days the child may be alert, cooperative and able; the next day he may be clumsy, listless, and unable to learn. Even a youngster who is usually good-natured will occasionally be irritable, destructive and unapproachable.[50]

Two reasons were given by Edgington to explain this day-to-day variability: (1) the child is extremely responsive to his surroundings such as events at home or disagreement with his peers, and (2) the child is frustrated by his own "forgetting" from lesson to lesson. Emotionally, this can be very disturbing and embarrassing for the disabled reader.[51]

Some earlier studies attempted to show that there was a

---

[48]Edgington, Loc. cit.

[49]Ibid.

[50]Ibid.

[51]Ibid.

relationship between emotional factors and reading performance. Ladd,[52] found that the "poor" readers she studied were less happy, less successful in school, less persistent, less adequate in self-control and less able to get along well in school than were the good readers.

According to Robinson,[53] approximately one third of the reading problem cases studied by her displayed emotional maladjustments which were described by a psychiatrist as severe. Another study by Fernald,[54] stated that all cases of severe reading disability appearing at her clinic also demonstrated emotional disorder. However, Bennett's study[55] found no difference in behavioral or adjustment factors between so called "good" and "poor" readers.

Monroe[56] has identified other personality traits that have been suggested as leading to reading disability. These are (1) maternal dependency, (2) lack of responsibility, (3) excessive timidity and (4) predilection against school activities and reading.

Although many investigators have undertaken to find a possible causal relation between emotional factors and reading disability, their results are confusing. Gates asserted that "on scarcely no important professional issue in reading is there more disagreement."[57]

---

[52]Margaret Rhodes Ladd, The Relation of Social Economic and Personal Characteristics to Reading Ability (New York: Columbia University, Contribution to Education, no. 582, 1933), p. 69.

[53]Helen M. Robinson, Why Pupils Fail in Reading (Chicago: University of Chicago Press, 1946), pp. 76-92.

[54]Grace M. Fernald, Remedial Techniques in Basic School Subjects (New York: McGraw-Hill, Inc., 1943), pp. 7-20.

[55]Chester Clarke Bennett, An Inquiry into the Genesis of Poor Reading (New York: Teachers College, Columbia University, 1938), p. 93.

[56]Marion Monroe, Children Who Cannot Read (Chicago: University of Chicago Press, 1932), p. 110.

[57]Arthur I. Gates, "The Role of Personality in Reading Disability," Journal of Genetic Psychology, 57 (January, 1941), p. 77.

A survey of literature on reading and emotional factors conducted by Sampson,[58] indicated that there exists some weaknesses in many investigations, thus making it impossible to state definitively the role of emotions in reading disability or the effect of dyslexia on personality organization.

On studying 100 programs for the emotionally handicapped, Morse[59] and his collaborators found that teachers characterize the emotional difficulties of these children as: "needs assurance," "has a poor self image," "needs affection," "fears rejection," "wants recognition," "has insufficient control at home," and "is rejected by parent."

Park and Linden,[60] state in their summary of causation certain general conclusions by Johnson concerning emotional factors on reading disability:

1. There seems to be no single personality trait or combination of traits which is associated invariably with either success or failure in reading.

2. Emotional problems which lead to inability to attend and concentrate will, most probably, have a deleterious effect on the development of reading ability.

3. The presence of many, or very serious, symptoms of emotional problems tends to be found more frequently in dyslexiacs than in those who read well.

4. Emotional problems and reading problems, when they occur together, are apt to aggravate each other in a circular reaction.

---

[58]Olive C. Sampson, "Reading and Adjustment: A Review of the Literature," Educational Research, 8 (June, 1966), pp. 184-190.

[59]William C. Morse, Richard L. Cutter and Albert H. Finks, Public School Classes for the Emotionally Handicapped: A Research Analysis (Washington, Council for Exceptional Children, 1964), pp. 42-43.

[60]George E. Park and James D. Linden, "The Etiology of Reading Disabilities: A Historical Perspective," Journal of Learning Disabilities, 5:327, May, 1968.

5. The influence of home conditions has great effect in determining both emotional adjustment and reading ability.

Summary. The question naturally arises whether emotional disturbance causes or is caused by reading disability. The literature makes suggestive comments regarding the relationship. There is general agreement that children with emotional disturbance face more than average likelihood that they will find the art of reading difficult to master. Also there seems equal agreement that a serious retardation in reading is apt to have detrimental effects upon the general development of the child's personality and emotional stability.

3. Background Experiences and Learning

The child experiential background is basic to his learning to read. Kephart[61] affirms that the child because of previous experience tends to respond to details or rote memory items rather than to the total implications of concepts. In other words, the child continues to respond to items rather than to situations, and his behaviors are at the level of specific skills rather than the level of adaptive responses. This, according to Kephart, has a definite effect on what should be presented to the child for learning. He states: "Learning presentations which we offer him in school frequently do not become basic experiences but remain isolated presentations of data."

He uses the term rigidity to describe the learning experience. He explains that in the context of education, the child has preference for a repetition of a previous activity rather than a change to a new activity. This is due either to a disruption of the learning processes

---

[61]Kephart, op. cit., pp. 43-44, 56.

or a psychological avoidance of change in the interest of reducing his probability of failure.[62]

Edgington[63] specifies two other major weaknesses resulting from the child's experiential background as causes of reading disability: (1) the child confuses space orientation of right and left; first, middle, and last; up and down; top and bottom; and front and back; and (2) he experiences difficulty in word attack skills. She also states:

> Effective word attack may be delayed by perceptual problems (for example, looking at words from the right side of the word instead of the left), failure to consciously pay attention to the beginning letters of a word, and the failure to consider the meaning of words, or phrases as they are used in sentences. These delaying factors are, in a large measure, the cause of word reversals and word confusions.[64]

Further cause for such reading disability has also been attributed to environmental factors. Recent studies on environment by Labov,[65] and Napoli,[66] have done much to enlighten educators concerning the ghetto life of children and the effect of such an environment on their reading performance. These authors mention such factors as (1) the child's ability to hear the same sounds as the teacher, (2) the child's inability to come prepared with certain specific skills necessary for reading, and (3) even more important, the child's ability to develop an interest in reading.

---

[62]Ibid.

[63]Edgington, op. city., pp. 34-38.

[64]Ibid.

[65]George Kaluger and Clifford K. Kilson, op. cit., p. 117.

[66]Joseph Napoli, "Environmental Factors and Reading Ability," The Reading Teacher (March, 1968), pp. 552-557.

Summary. It appears evident that the educationally handicapped child needs to be trained to look and listen with the intent of learning the distinction in word forms. It also seems that because of the child's learning disabilities, it would be difficult for the child to form habits which result in synchronizing a set of regimented, arbitrary eye movements, with perception and interpretation during the reading process. Finally, the conclusion to be drawn from the studies dealing with environmental factors would indicate that the child is likely to learn to read with less difficulty if he has had a rich background of relevant experience, and the child from an impoverished background may lack experiences which would aid him in developing reading skills.

4. Maturational Lag and Learning

Besides brain injury, emotional disturbance, and experiential causes mentioned by Kephart, a fourth factor needs some attention. This is the effect of maturational lag* on reading. DeHirsch[67] states that although for most children chronological age does reflect maturation, other children, with adequate intelligence, suffer from maturational lags and present a high risk of reading failure.

Money[68] has indicated that the most useful hypothesis relating brain function and reading disability is that of a maturational lag in the development of the brain and nervous system. In fact, he feels that

---

*Kaluger and Kolson define Maturational Lag as the concept of delayed development of areas of the brain; of the perceptual process which matures according to recognized patterns longitudinally.

[67]Katrina DeHirsch, Jeannett Jansky, and William Langford, Predicting Reading Failure (New York: Harper and Row, 1966), p. 73.

[68]John Money, Reading Disabilities (Baltimore, Maryland; The John Hopkins Press, 1962), p. 254.

the greatest majority of reading disability cases can be accounted for on this basis.

Kaluger and Kolson,[69] state that no known studies have yet been able to indicate what percent of children are hindered in their reading by handicaps related to maturational lag. However, from their own clinical investigations, they feel that perhaps one-fourth to one-third of the disabled readers in primary grades have maturational lag.

Bender, [70] postulates that language disorders are presumably caused by maturational lag. She states:

> The underlying concept of maturational lag involves "Functional areas of the brain and of personality which mature according to a recognized pattern longitudinally." A lag indicates slow differentiation but does not necessarily suggest a lesion, deficiency or loss of cortical functioning. Neither does it necessarily imply limited potentialities since it is possible for maturation at varied levels to advance rapidly though often unevenly.[71]

According to Bender, children with learning disabilities show lags in neurological patterning, sometimes referred to as "soft neurological signs." She describes the disabled children:

> They are clumsy and more variable in motor tone. They show left-right confusion or lack of orientation involving their own bodies. They are immature, dependent, impulse ridden children who suffer to a great degree from anxiety and feelings of inadequacy. They also show weakness in drawing, form perception, distorted figure-ground relationships and poor body image concepts.[72]

---

[69]Kaluger and Kolson, op. cit., pp. 21-22.

[70]Loretta Bender, "Specific Reading Disability as a Maturational Lag," Bulletin of the Orton Society, Vol. XIII, 1963, pp. 25-44.

[71]Ibid.

[72]Ibid.

Summary on Reading Disability.

In Section I of the present chapter, the researcher has presented a broad overview of expert opinions and research evidence. It seems that a sizable number of children now attending public elementary schools are experiencing some degree of reading retardation. A number of surveys has revealed that at least ten to fifteen percent of these disabled readers belong in the category known as "educationally handicapped." From the review of the literature, unquestionably, sensory handicaps, neurological impairments, maturation, metabolic disorder and cultural psychological influences have some contributory effect on these educationally handicapped children. In recent years, there has been growing concern about the educationally handicapped child and as a result, many remedial aids and programs have been developed to assist these children in their particular learning disabilities. However, there presently does not exist a planned program of visual training to provide remediation for the educationally handicapped child in his reading, even though many of these disabled readers experience some degree of visual difficulties. The second section will review the literature relating to visual training as it pertains to the current study.

VALUE OF VISUAL TRAINING IN THE REMEDIAL READING PROGRAM

Although most teachers have learned to face the facts of individual differences in reading, they are often not able to meet these needs adequately. The reasons are many: (1) too many pupils, (2) too much variation in one class, (3) too little time, and (4) too much required course content. Although some superb teachers have managed to meet the challenges in spite of the obstacles, many teachers have been forced to

concentrate on a developmental reading program, spending some time with those pupils whose growth is slower than average, but feeling inadequate about their efforts with most retarded and disabled readers.

It is for these reasons that remedial reading programs are made part of the activities of most schools. First, so that each child will be given every opportunity to read as well as his potential permits, even though he does not fit in the same learning pattern as his classmates. Secondly, so that teachers will be given every opportunity to teach well what can be taught in a regular classroom situation.

1. Types of Remedial Reading Programs

McCarthy and McCarthy state:

> Techniques that are proving useful with learning disability children are derived from two orientations: (1) the process orientation, and (2) the tool subject orientation.[73]

These authors explain that the first approach, process orientation, attempts to identify the learning process responsible for the defective performance and apply remediation at this level, hoping for improvement in all tool subjects which rely on the adequate functioning of that learning process. Whereas, the latter approach, tool subject orientation, attempts to develop techniques to teach a tool subject such as reading, and arithmetic to children who have failed to learn via methods employed in the regular school class. In other words, to first identify the specific areas of poor performance, and then apply these specific remedial measures.

When compared with the regular classes, the remedial reading programs for children with learning disability are distinctive in their

---

[73]McCarthy and McCarthy, op. cit., pp. 74-87.

materials or methods, or both.

Three types of programs have been found successful in aiding the learning disability child who is having reading difficulties. The program descriptions which follow include: (1) Visual-Perceptual-Motor Program, (2) Linguistic Program, and (3) Diagnostic Remedial Program.[74]

1. According to McCarthy and McCarthy,[75] the visual-perceptual-motor approach stresses that academic learning is dependent upon the prior establishment of perceptual and motoric skills. In the area of reading materials and methods, the child reads aloud his own pack of flash cards. The words are those the child wants to learn, some being rather difficult. The child also reads from books written for him using words he knows from the flash cards and written about people and situations with which he is familiar. Visual training is also stressed through the use of various materials developed by Frostig and Kephart. Through such training the child begins to overcome his perceptual-motor problems.

2. In rather vivid contrast to the visual-perceptual-motor program, the linguistic program considers the linguistic problems of the child with learning disabilities as paramount. In general the activities are oriented to language. These activities initiated in the linguistic program demanded that the child constantly develop his language ability and practice what ability he possessed. Major stress is placed on exposing the child to many auditory experiences and then helping him to verbalize

---

[74]James J. McCarthy and Joan F. McCarthy, Learning Disabilities (Boston: Allyn and Bacon, Inc., 1969), pp. 75-81.

[75]Ibid.

these experiences. A great variety of word games is used to enhance the linguistic training of the child.[76]

3. The diagnostic remedial program is characterized by the coordinated involvement of a broad assortment of educational specialists working within the boundaries of the regular classroom to meet the problems of disabled learners to the greatest extent possible. Some remedial specialists stress that this eclectic approach should also be used to aid the disabled reader. They feel there are differing degrees of severity among childrens' learning disabilities which would require diversification of services. Therefore, the intensity of the services would depend on the severity of the problem. McCarthy and McCarthy state:

> The core of this program is a Psycho-Educational Diagnostic Center for Children with Severe Learning Disorder. Personnel involved with the Center include the Director, School Psychologist, psycho-educational Diagnosticians, resource room teachers, classroom teachers who have children in the program and other special personnel such as speech correctionists, physical education teachers, school nurses, and school social workers.[77]

If a child is accepted into the diagnostic remedial program, he is processed through the following general plan: (1) a screening process which involves intensive individual tests, then (2) either a psycho-educational diagnostician or itinerant learning disabilities teacher begins working with the child out of the child's classroom but in his own school, and (3) finally one of three programs is carried out with the child.

(a) When an effective remedial approach to teaching the child has been evolved, the program is mapped out with the classroom teacher and thus carried on in the classroom.

---

[76]Ibid.

[77]McCarthy and McCarthy, op. cit., p. 82-87.

The psycho-educational diagnostician no longer works directly with the child, but serves as a consultant, program planner, and material resource person for the teacher.

(b) For children with more severe problems, a resource room program is begun. Under this plan the child is still assigned to a regular classroom, but is taken out during certain periods each day for more specific work. The resource room teacher remains in the child's school all day, working with about ten children whose schedules have been arranged flexibly, according to their needs.

(c) The third and final program is considered the most intensive approach since the child is a member of a self-contained classroom. However, whenever possible, the child is integrated with regular classroom activities. The child is only assigned to this particular program if he is unable to work in the regular itinerant or resource room programs.[78]

While these three illustrative programs by no means exhaust the variety of remedial approaches to educating children with learning disabilities, they are typical of some of the major directions of remedial classroom approaches currently in use.

2. The Teaching Strategies of Remediation Programs

Many different opportunities may exist in a remedial reading program. However, success in such programs will depend greatly on a number of factors: (1) achievement level, (2) prior experiences of the reader, (3) fundamental need for self-respect and self-esteem, (4) appropriate level of teaching materials, and (5) the importance of the teacher.

Kaluger and Kolson state:

> Remediation is concerned with doing away with bad habits, establishing good habits, and bringing the child's achievement up to learning expectancy level.[79]

---

[78] Ibid.

[79] Kaluger and Kolson, op. cit., p. 213.

Within the typical remedial program, provisions are made for the learning disability child's acquisition of reading skills on appropriate level. It is important for him to feel sufficient success in the reading skills so that he will attempt to learn to read successfully.

Kress describes how significant remediation for the disabled reader can be:

> Considerable amount of patience and skill is needed in working with a child with remedial problems. . . . He is faced with the difficulty of reading materials on an inappropriate level and is further handicapped by a basic neurological and psychological difficulty. Also this child has an associative learning problem. When the usual teaching techniques are employed, this child cannot relate meaning from his own experience background to the symbols-words which he is trying to learn. He asks, again and again, for help with the same new word as it appears in a story.[80]

Monroe explains further:

> Most of the work has to be done individually or in small groups. Such a situation allows the teacher to study the child more carefully than in a group. The child, also, is relieved of group competition in reading and distracting social and emotional stimuli.[81]

Along with considerable individual guidance as the child progresses, there should be some emphasis on helping the child to modify inappropriate ideals of self and to build more suitable ones. Dalberg and his collaborators mention that in the remedial reading program, the child should be given some degree of choice in setting up the framework in the program.

> The child learns to feel responsible when involved in a collaborative learning experience. However, it is necessary to estimate the child's capacity for choice and decision early since certain children whose standards have always been rigid find it too difficult to make decisions.[82]

---

[80]Kress, Loc. cit.

[81]Monroe, op. cit., pp. 113-115.

[82]Charles C. Dahlberg, Florence G. Roswell, and Jeanne Chall, "Psychotherapeutic Principles as Applied to Remedial Reading," Elementary School Journal, 53 (December, 1952), pp. 211-17.

The remedial programs take into account the appropriate level of reading materials. If learning goals are adjusted to the learning disability child's educational status and are geared to his rate of learning, progress will usually be steady. A number of remedial specialists have developed some very successful remedial procedures: (1) Arthur Gates has pioneered in offering poor readers varied experience with appropriately graded materials, directing special attention to the desirability of repeating words in varied contexts.[83] (2) Samuel Kirk, on the other hand, has recommended a reading program for slow-learning children which stresses to a greater extent phonic training.[84] Kirk explains:

> Much drill is provided and is accompanied by repeated associations of objects with sounds. The child says a new sound, writes it, and uses it in words with other sounds he has learned.[85]

(3) Grace Fernald also devised an effective approach in working with very poor readers through the use of multi-media materials. The pupil is taught to write the words and read the printed copy, then to proceed slowly to materials of varied kinds with emphasis on concept expansion and comprehension.[86]

Not only is the student's role important in the remedial reading program, but, as pointed out by Bryant,[87] so is the teacher's role.

---

[83]Arthur I. Gates, The Improvement of Reading (New York: The MacMillan Co., 1947), p. 310.

[84]Samuel A. Kirk, Teaching Reading to Slow-Learning Children (Boston: Houghton Mifflin Co., 1940), pp. 156-7.

[85]Ibid.

[86]Grace M. Fernald, Remedial Techniques in Basic School Subjects (New York: McGraw-Hill Book Company, 1943), pp. 152-61.

[87]N. Dale Bryant, "Some Principles of Remedial Instruction for Dyslexia," Reading Teacher, 18:7 (April, 1965), pp. 567-72.

In the educational programming for remediation, the teacher should know not only how the child learns, but he must also know (1) ways by which the child can be taught, (2) what the child needs in order to be able to learn, and of major importance, (3) the units and elements which make up the skills to be achieved.[88]

Early studies by Bennett,[89] and Monroe[90] emphasized that the teacher needed to be skilled and use patient guidance to help the disabled reader. More recent articles by Crowley,[91] and Lanning and Robbins[92] also stressed the importance of successful experience if progress is to be made by the slow learner. Both writers concluded: "Whatever can be done to help the disabled reader in the classroom can be done only when there exists an attitude of complete acceptance of him by his teacher."[93]

Besides the praise of good effort and recognition for successful work, Edgington[94] notes that the child cannot be pushed or forced to learn faster than, what for him, is his normal speed.

Other authorities have suggested that teachers explore alternative remedial plans in working with the disabled reader because of delay

---

[88]Kaluger and Kolson, op. cit., p. 163.

[89]Bennett, op. cit., pp. 6-8.

[90]Monroe, op. cit., p. 114.

[91]Regis F. Crowley, "Teaching the Slow Learner," Today's Education, 58 (January, 1969), pp. 48-49.

[92]Frank Lanning and Russel Robbins, "The Slow Learner," The Instructor, 77 (October, 1967), p. 183.

[93]Ibid.

[94]Edgington, op. cit., pp. 6-7.

and failure in the acquisition of reading ability. Asklock and Stephen[95] suggest that the teacher direct more attention to the specific deficiencies in the child's learning process and, once identified, to remedy these deficiencies. Bateman,[96] using a "Diagnostic-Remedial Approach," indicates that an analysis of the patterns of cognitive abilities should serve as a basis for curriculum planning and also the education of underlying abilities.

3. Principles of Remediation

A final area of significance in the remedial reading program deals with effective instruction. Historically, the methods used in remedial instruction have varied widely. According to Bennett,[97] prior to the 1940's, these were some of the approaches utilized by noted authorities in reading remediation:

1. Hinshelwood reports that most of his "word-blind" children made progress under an "old-fashioned" spelling method appealing to auditory as well as visual memory.
2. Orton found a phonetic method better than sight reading for poor readers.
3. Fernald and Keller developed a kinesthetic method, having children trace words in conjunction with learning to read.
4. Dearborn . . . concluded that oral spelling was still better.
5. Middlebrook reported experiments with flash cards.
6. Gates stressed the need for reading materials of intrinsic

---

[95]Patrick Ashlock and Alberta Stephe, Educational Therapy in the Elementary School (Springfield: Charles C. Thomas, 1966), p. X.

[96]Barbara Bateman, "Learning Disabilities-Yesterday, Today and Tomorrow," Exceptional Children, 31 (December, 1964), p. 167.

[97]Chester Clarke Bennett, An Inquiry into the Genesis of Poor Reading (New York: Teachers College, Columbia University, 1938), pp. 6-7.

interest to the child, and for fostering wide experience in easy reading well within the child's ability.

7. Bird advocates self-conscious attention to the mechanics of the act of reading.

8. Robinson reports some success through using spaced typing and directing students in deliberate "pacing" of the eye movements.[98]

During the 1950's the role of reading in personality development of the child was stressed. At this time, Dolch,[99] helped to establish five useful general principles for corrective remedial reading:

(1) Begin where child is

(2) Build sight vocabulary and speed up recognition

(3) Teach self-help sounding

(4) Develop comprehension

(5) Secure much interesting reading at present level

In the early sixties, there were some modifications and additions regarding the remediation of the disabled reader. Learning principles were emphasized by Otto who examined teaching pupils with learning disabilities.[100] He provided a list that could be helpful to the teacher working with remedial readers:

(1) Secure the learner's cooperation

(2) Begin instruction on the learner's level

(3) Take small steps so that a correct response is virtually assured

(4) Reinforce success

---

[98]Ibid.

[99]Dolch, op. cit., pp. 24-54.

[100]Wayne Otto, "A Guide to Helping Pupils with Learning Problems," The Clearing House 40 (October, 1965), pp. 90-93.

(5) Keep learning tasks and materials meaningful

(6) Provide for overlearning and reinforce with frequent review through a variety of multi-media activities

(7) Keep learning tasks and materials meaningful

(8) Provide for overlearning and reinforce with frequent review through a variety of activities*

(9) Encourage pupil discovery of relationships so that there will exist some kind of transfer

(10) Guard against motivation that is too intense since it may create distracting emotions that interfere with efficient learning

(11) Build up a reserve of success experiences to sustain them when they encounter learning problems[101]

In comparing remedial teaching with ordinary teaching of reading, Monroe explains:

> The problem of educational instruction in reading is to find the methods which are best adapted to develop skills in reading in the majority of children. . . . whereas the problem of remedial instruction in reading is to find a possible method of learning for those children who have not been able to learn to read by methods adapted to the group.[102]

Today, according to Kaluger and Kolson,[103] a more eclectic approach is being used by teachers of disabled readers in accordance with the needs of the individual child.

Bond and Tinker,[104] however, claim that presentation of remedial

---

*More recent authorities use the term "multisensory approach" in describing the variety of activities.

[101]Ibid.

[102]Marion Monroe, Children Who Cannot Read (Chicago: University of Chicago Press, 1932), pp. 113-115.

[103]Kaluger and Kolson, op. cit., p. 3.

[104]Guy Bond and Miles Tinker, Reading Difficulties (New York: Appleton-Century-Crofts, 1967), p. 169.

reading programs simply intensify the usual methods of reading instruction. So far, they state, such remediation has failed to produce any satisfactory progress.[105]

Edgington states that one thing is certain:

> These youngsters are not responding to the normal workbooks, typical lesson plans, and tried and true methods. Massive drill and memorization used by teachers continue to increase the disabled child's hostility and creates even greater inability to learn to read.[106]

In a recent article, Wiseman states:

> Curriculum planning efforts were expressed in vague, obtruse terms, providing little direction for the special education teacher. Furthermore, methods were being applied because of availability, not reason and were relied in large measure upon incidental learning. This kind of learning process is already a basic area of deficiency in most exceptional children.[107]

Summary. The basic thesis formulated from the literature is that corrective or remedial methods used with learning disability children are in reality developmental and that remedial reading is not simply the application of special methods, but a more intense and personal application of how the child learns to read and what methods are most appropriate for a given child. It seems that the most plausible conclusions that can be made at present are stated by Dechant:

> There is not one best method for teaching reading and there is no one best remedial or corrective method. There may be a best method for a given learner. There may even be a best method for a special segment of the learning population. There may even be a

---

[105]Ibid.

[106]Ruth Edgington, Helping Children with Reading Disability (Chicago: Developmental Learning Materials, 1962), pp. 6-7.

[107]Douglas Wiseman, "Remedial Education: Global or Learning Disability Approach," Academic Therapy 5:3 San Rafael, California, 1970, pp. 165-167.

best method for a given teacher because he is most comfortable with it.[108]

In the following subsection, this investigator presents research findings and experts' opinions on visual training as an instructional approach to helping the learning disability student in his reading. Evans states a rationale for such a type of instructional practice:

> Educationally handicapped students seem to require very specific instruction of all kinds, much beyond the age of their peers. Teaching machines and self-administered programmed learning materials offer help to pupils in rejecting irrelevant stimuli and often supply much needed immediate reinforcement.[109]

Expert Opinions on Visual Training in Reading

Among the controversial questions relating to methods of teaching pupils to read, perhaps none has been debated more persistently and vigorously than the question of the importance and value of training in the mechanics of eye-movements. There continues to exist a difference of opinion concerning the significance of the relationship between eye-movements and reading skills. In an article by Traxler, he stated:

> Some authorities regard the complex of psychological factors involved in reading comprehension as the all important thing and hold that eye-movements are only symptoms of effectiveness of comprehension. They insist that if pupils are instructed in such a way that they learn to understand what they read, their eye-movement will as a rule be satisfactorily mature.
>
> Others believed that faulty eye-movements are frequently a cause of reading inefficiency and that noteworthy improvement in reading skill may be brought about by direct training of eye-movements.[110]

---

[108]Emerald Dechant, Diagnosis and Remediation of Reading Disability (New York: Parker Publishing Company, Inc., 1968), p. 180.

[109]Donald F. Evans, Resource Guide for the Educationally Handicapped Program, Curriculum Bulletin No. 228, Stockton Unified School District (Stockton: California, 1970), p. 17.

[110]Arthur E. Traxler, "Value of Controlled Reading: Summary of Research and Opinion," Journal of Experimental Education, II June, 1943, pp. 280-292.

Some reading specialists accept improvement in eye movement habits as a legitimate objective of training in reading but changed the emphasis on the training process itself. McCallister wrote:

> Training in recognition should have as its objectives accuracy of recognition, a wide span of recognition, rhythmic progress of perceptions along the line, and accurate return sweeps from the end of one line to the beginning of the next, but even more important is that such training is probably most effective when emphasis is placed on thought getting or acquiring understanding.[111]

Focusing in on the area of special education, experts place consiberable emphasis on visual training in reading, particularly on form perception. Johnson stressed that remediation for the exceptional child should consider the possibility of visual training:

> The visual training technique is used to "lead the child's looking." Consideration needs to be given to the possibilities that might be used to improve visual perception. This would incorporate the following factors: intensification of the stimulus, size of print, amount of material on a page, variation in letter cases and size, spacing between letters and symbols and lines, and length of the lines.[112]

In her closing remarks, Johnson claims that since the child cannot perceive letters in the normal workbook way to improve visual perception, vision training can be beneficial so that the child can see the similarities and differences.

Simpson stated that it is generally assumed that when a child is learning to read, the eye-movement would automatically be taken care of. However, she points out:

The eye-movement activities have most frequently been limited

---

[111]James M. McCallister, Remedial and Corrective Instruction in Reading (New York: D. Appleton-Century Company, 1936).

[112]Doris J. Johnson, "Treatment Approaches to Dyslexia," International Reading Association Conference Proceedings, Vol. 13, Part III, 1969, pp. 98-102.

> to the activities of workbook pages that have assumed that eyes are already mobile and little remains skill-wise but to practice in moving them from left to right. Unfortunately, the step by step process for developing smooth sequential left to right eye-movements has been less well defined than those for progressing from walking to skipping.
>
> Furthermore, as the child matures, he begins to recognize a difference between letters, and he learns to identify simple numbers. The letters and numbers begin to say something. Soon he gets meaning from letter combinations, such as he would when he learns to print his name. Little by little, and in different ways, the symbols make more sense to him.[113]

Kephart has stipulated that the exceptional child is unable to "see" the intricacies of form and discriminate differences and likenesses readily, not only in word shapes but their letter content as well.[114] Johnson and Myklebust[115] assert that disability reading instruction should stress the presentation of short visual units, generally single letters, which can be blended into words. Consideration also needs to be given to the training of other deficit areas, e.g., visual memory and sequentialization. They felt that the purpose of visual training would give the educationally handicapped child a systematic means of attacking words. The normal child uses many clues in reading: word form, context, structural and phonetic analysis. Due to specific learning deficits, the educationally handicapped child has only a few clues available. He is much more limited in the means whereby he can identify the words. Finally, they point out the necessity of improving

---

[113]Dorothy M. Simpson, Learning to Learn (Columbus, Ohio: Charles E. Merrill Publishing Company, 1968), pp. 25-46.

[114]Newell C. Kephart, "Visual Behavior of the Retarded Child," Monograph of the American Journal of Optometry, 35:393-406, 1958.

[115]Doris J. Johnson and Helmer R. Myklebust, Learning Disabilities: Educational Principles and Practices (New York: Grune and Stratton, 1967), pp. 156-162.

habits of "looking:"

> Frequently children with learning disabilities are not consistent or orderly in their inspection of materials. Those who are distractible skip back and forth from the beginning to the end of a word and, rather than making a careful inspection, fixate on details and do not notice important features.[116]

Furthermore, one of the most important points stressed by proponents for the use of the mechanical devices in controlled training in reading is that of motivation. Research by Dearborn,[117] Wilking,[118] Durrell,[119] and Bear[120] found that the use of such mechanical pacing devices will help to vary the classroom instruction and have an additional advantage of being extrinsic motivation. The importance of the latter point is that their novelty helps to hold attention. According to Durrell:

> Nothing is more important in an instructional program in reading than that every lesson-every exercise-be so motivated that interest and attention will be maintained at a high level.[121]

However, contrary to all the favorable information on the use of mechanical devices in controlled training in reading, there has been a

---

[116]Ibid.

[117]Walter F. Dearborn and Vincent S. Wilking, "Improving the Reading of College Freshmen," School Review, XLIX, November, 1941, pp. 668-678.

[118]Vincent S. Wilkings, "The Improvement of Reading Ability in College," Journal of the American Association of Collegiate Registrars, XVII, January, 1942, pp. 183-84.

[119]Donald D. Durrell, Improvement of Basic Reading Abilities, (Yonkers-On-Hudson, New York: World Book Company, 1940).

[120]Robert M. Bear, "The Dartmouth Program for Diagnostic and Remedial Reading with Special Reference to Visual Factors," Educational Record, XX, Supplement No. 12, January, 1939, pp. 69-88.

[121]Donald D. Durrell, Improving Reading Instruction (New York: World Book Company, 1956), pp. 353-355.

considerable amount of literature warning against purely mechanical eye-movement training. In one of his many publications dealing with eye-movement studies, Tinker stated:

> There was lack of evidence that training eye-movements, as such, developed effective habits which improved reading ability, and held that eye-movement patterns do not cause, but merely reflect, efficient or poor reading performance.[122]

Buswell,[123] and Gates,[124] have criticized at some length the use of instruments for controlling eye-movements. Both urged the need for expert knowledge if special devices for remedial training are to be used on the elementary and secondary levels. According to Buswell:

> The assumption all too frequently encountered, namely, the physiological exercises in which eye-movements are produced by sweeping the eye across a series of dots or lines will increase span of recognition, misses the point entirely. Of course, reading involves peripheral adjustments through eye-movements, but training eye-movements does not increase reading ability. Neither does the correction of visual defects, in itself, improve reading. Furthermore, a clear distinction should be made between methods of teaching reading which eventuate in the development of a broad span of recognition such as normally accompanies efficient reading and methods which attempt to gain the same end by a purely mechanical control of muscular reactions. Certain forms of apparatus may be useful in stimulating a type of reading which will result in a broad span of recognition. However, apparatus can never be a substitute for educational theory; it only implements educational theory at certain points.[125]

---

[122]Miles A. Tinker, "The Role of Eye-Movements in Diagnostic and Remedial Reading," School and Society, XXXIX, February, 1934, pp. 147-148.

[123]Guy T. Buswell, Remedial Reading at the College and Adult Levels: An Experimental Study, Supplementary Educational Monographs No. 50, Chicago: Department of Education, University of Chicago, 1939, pp. 56-57; 138-139.

[124]Arthur I. Gates, "Diagnosis and Treatment of Extreme Cases of Reading Disability," The Teaching of Reading: A Second Report, The Thirty-Sixth Yearbook of the National Society for the Study of Education, Bloomington, Illinois: Public School Publishing Company, 1937.

[125]Buswell, loc. cit.

Strang also mentioned three possible disadvantages of using instruments for controlling eye-movements: (1) an individual's own grouping and phrasing may not correspond to the groupings of words presented, some of which are decidedly not natural; (2) the focusing of attention on speed may interfere with the mature reader's habits of comprehension; and (3) attention may be attracted to mechanics rather than to meaning.[126] Sisson also felt that it would not be advisable to direct the reader's attention to the mechanics of eye-movement since such a procedure might "detract from the understanding of the reading."[127]

Research Studies on Visual Training in Reading

While there still exists controversy over methods of presentation, the way children learn, and the effectiveness of visual-aids, some related research studies seem to support eye-movement training as a successful method of reading remediation.

As a result of the point of view that noteworthy improvement in reading skill might be brought about by direct training of eye-movements, certain instruments were developed to "pace" reading speed. Prior to 1950, much of the research conducted with pacing instruments dealt exclusively with the metronoscope.*

---

[126]Ruth Strang, Problems in the Improvement of Reading in High School and College (Lancaster, Pennsylvania: The Science Press Printing Company, 1940), pp. 117-18.

[127]Donald E. Sisson, "Eye-Movement Training as a Means of Improving Reading Ability," Journal of Educational Research, XXXII, 1938, pp. 40.

*A triple action electrically operated earlier version of the tachistoscope consisting of three synchronized rotary drums designed to present successive thirds of a line of reading matter.

1. The Metronoscope

During the 1930's, Center and Persons,[128] Betts,[129] and Cole[130] all made considerable use of the metronoscope in their reading clinics. They concluded that the good reader was good because (1) he used few fixations, (2) rarely made a regression, and (3) hit the beginning of each line accurately. They further concluded that good mechanics automatically laid the foundation for good comprehension and permitted a child to understand what he read as well as he could, in view of his intelligence and experience.

Several public schools used the metronoscope as a part of the regular remedial reading program and attempted to evaluate the results in a somewhat informal way using techniques that were not highly statistical. In the fifth and sixth grades of Crockett School in El Paso, Texas, Smith used the metronoscope as only one device to supplement the existing instructional methods and procedures of teaching reading. He stated:

> The entire group made more than average progress in reading, and that some children made exceptional progress. Head turning and lip reading practically disappeared by the end of the year.[131]

Another metronoscope training program in the South Ward Elementary School of Brownwood, Texas was evaluated by Lee. He gave the

---

[128]Stella S. Center, "The Significance of the Reading Clinic," The English Journal, XXVII, May, 1938, p. 382.

[129]Emmett A. Betts, The Prevention and Correction of Reading Difficulties (Evanston, Illinois: Row, Peterson and Company, 1936).

[130]Luella W. Cole, Elementary School Subjects (New York: Rinehart and Company, 1946), pp. 168, 421.

[131]Marguerite Smith, "Metronoscope in Upper Grade Instruction," Texas Outlook, XXIX, March, 1940, pp. 13-14.

following results from the use of the metronoscope: (1) lip reading was almost eliminated, (2) the number of regressions was reduced, (3) the duration of fixations was reduced, (4) the number of fixations was reduced, (5) eye span was increased, (6) speed was increased, (7) comprehension was increased, (8) better reading attitude was created, and (9) failures in reading and reading subjects were reduced.[132] It should be noted that the techniques and conclusions of Lee's study were criticized by Moore.[133] Moore criticized especially Lee's apparent faith in the comprehension test which had been shown to be unreliable.

However, it must be noted that although these earlier investigations of the metronoscope reported increases in the rate of reading at the elementary levels, none of these studies included control groups so that a comparison of methods could be made. Gray stated:

> The general teaching procedures in reading have been supplemented by a series of special remedial techniques which have excited wide attention. One such remedial technique is the use of the metronoscope and films in presenting reading material under controlled conditions of word spacing and time in order to stimulate directional movements of the eyes in reading, to increase the span of recognition, and to increase speed of reading. Evidence has already been secured of the value of this device. Its superiority to other methods of achieving the same ends has not been experimentally established.[134]

The first studies to compare the metronoscope with other methods

---

[132]R. B. Lee, "Value of Metron-o-scope Reading," The National Elementary Principal, XVIII, February, 1939, pp. 109-111.

[133]Joseph E. Moore, "Metron-o-scope Reading: A Critical Evaluation of Mr. Lee's Study," The Peabody Reflector and Alumni News, XII, August, 1939, pp. 285-6; 294.

[134]William S. Gray, "Reading," Encyclopedia of Educational Research, edited by Walter S. Monroe (New York: MacMillan Company, 1941), p. 923.

of teaching reading was conducted by Taylor.[135] He set up experimental and control groups, each consisting of twenty-five high school pupils. Each group was given practice in rapid reading during thirty-minute practice periods on ten consecutive school days. The control group read short stories from mimeographed sheets while the experimental group read the same material from the metronoscope. The analysis of the data indicated that neither the experimental nor the control group made significant improvement in comprehension, as measured by the tests given before and after training. The importance of the latter point was emphasized by Witty and Kopel, who criticized Taylor's study. They stated that one must conclude that metronoscope reading may effect change in the mechanical process, but apparently does not influence the process of meaningful reading.[136]

2. Recent Research on Visual Training

In more recent years, such noted authorities as Kephart,[137] Frostig,[138] and Dechant[139] have stated that visual training is needed to improve word recognition and comprehension. Kephart further asserts:

---

[135]Earl A. Taylor, Controlled Reading: A Correlation of Diagnostic Teaching and Corrective Techniques (Chicago: University of Chicago Press, 1937).

[136]Paul Witty and David Kopel, Reading and the Educative Process (New York: Ginn and Company, 1939).

[137]Newell C. Kephart, The Slow Learner in the Classroom (Columbus, Ohio: Charles E. Merrill Books, Inc., 1961), pp. 132-133.

[138]Marianne Frostig, "Visual Modality and Reading," in Helen K. Smith (ed.), Perception and Reading, International Reading Association, Newark, Delaware, 12:4, 1968, pp. 25-31.

[139]Emerald Dechant, Diagnosis and Remediation of Reading Disabilities (New York: Parker Publishing Company, Inc. 1968), pp. 87-89.

> Until recently, visual training instruments and materials have been used as auxiliary sources of information, the basic core of the lesson being carried by the customary textbook presentation. In the area of remediation, where there is conflict or lack of correlation between sense avenues, audio-visual materials and multimedia presentations of the information must become the primary source of information.[140]

Taylor and Frackenpohl also claim that the use of eye-movement training in reading is not merely for the purpose of extending or reinforcing the numerous important reading skills developed by the orthodox classroom reading program, but has an essential contribution of its own to make in the development of fundamental skills prerequisite to effective instruction:

> Machine pacing and tachistoscopic training have highly significant value in terms of developing the functional skills so closely related to academic achievement-accurate visual perception and discrimination, good visual memory, effective directional attack, good coordination and mobility.[141]

Spache summarized research articles and discussions touching on programs using mechanical devices extensively. He pointed out that little attention was given to employing these devices according to its exact characteristics:

> These atomistic training courses leave unanswered such questions as the kind of remedial cases for which such a program is most or least effective. Apparently no training distinctions are made between slow readers with good comprehension and vocabulary, who might conceivably profit from mechanical acceleration, and cases with multiple difficulties in reading background-comprehension, vocabulary, and word-analysis skills. Also little attention is given to the optimum length, intervals and intensity of such training.[142]

---

[140]Kephart, Ibid.

[141]Stanford E. Taylor and Helen Frackenpohl, EDL Tach-X, Flash-X, (Teacher's Guide) Educational Developmental Laboratories, Huntington, New York, 1968, pp. 2-3.

[142]George D. Spache, "Integrating Diagnosis with Remediation in Reading," Leo M. Schell and Paul C. Burns Remedial Reading: An Anthology of Sources (Boston, Allyn and Bacon, Inc., 1968), pp. 230-233.

A study by Mills[143] showed that different children learn to recognize words more efficiently by different teaching methods and that no one method was better for all children. However, concerning the effectiveness or the ineffectiveness of specific teaching methods for certain types of children, he had this to say:

> Children of average intelligence had good success with visual methods and that seven, eight, and nine year olds tended to get better results by visual method than by kinesthetic method.[144]

In an article by Duker,[145] the question of what kind of presentation was most effective for learning was explored. Several generalizations seem pertinent to this study:

1. Meaningful, familiar material is more efficiently presented aurally; meaningless, unfamiliar material is more efficiently presented visually.

2. The greater the intelligence of the receiver, the greater the relative advantage of a visual presentation.

3. The greater the reading ability of the receiver, the more effective the visual presentation.

4. The relative efficiency of a visual presentation increases with age. At the age of six visual presentation is less effective than aural presentation. At the age of sixteen a visual presentation may be more effective than an aural presentation.

5. The relative effectiveness of the visual presentation increases with the increasing difficulty of the material.

Finally, as a result of the recent development of the Eye-Movement Camera,** there has been renewed interest in objective scientific observation of eye-movements in the act of reading. This new eye-

---

[143]Robert E. Mills, "An Evaluation of Teachiques for Teaching Word Recognition," Elementary School Journal 56, January, 1956, pp. 221-225.

[144]Ibid.

[145]Samuel Duker, "Listening and Reading," Elementary School Journal, 65, March, 1965, pp. 321-329.

**See appendix C, for complete discussion of the history of Eye-Movement Photography.

movement camera raises a number of very real possibilities about the whole topic of eye-movement training. First, the eye-movement camera along with the use of various mechanical training devices in the remedial program would add to the diagnostic procedure and to the interpretation of training results. Presently, as mentioned above by Spache,[146] there exists no available information on the use of mechanical devices for specific types of corrective instruction. By incorporating eye-movement photographic records, the teacher will be able to decide whether machine training is advisable. Secondly, they may serve to indicate the type, speed, and breadth of tachistoscopic exposures desirable. Finally, the records will help to show whether speed or span training, or emphasis upon directional attack, or some modification of these is suitable.

Summary on Visual Training

The results of the research studies and literature prior to the 1950's did not provide any clear-cut evidence either favorable or unfavorable on visual training in reading. One reason was due to the few studies that met the criteria of an acceptable statistical study. Notwithstanding the limitations in the data as a whole, however, it appears that the studies suggest considerable improvement in reading under teaching procedures employing eye-movement training instruments. Several limitations were mentioned by these earlier studies: (1) information concerning the permanence of gains in test scores brought about by eye-movement training in reading was almost nonexistent, and (2) as Strang has pointed out, eye-movement training in reading has usually been only one

---

[146]George D. Spache, "Evaluation of Eye-Movement Photography in Reading Training," Research and Evaluation in College Reading, Ninth Yearbook of the National Reading Conference for College and Adults (Fort Worth, Texas: Christian University Press, 1960).

of a number of techniques employed and it is almost impossible to say just what procedures have been responsible for the reading improvement shown by the subject.

According to Taylor,[147] in more recent studies dealing with instrument techniques and devices, there are still many people who regard reading instruments solely as timing and motivating devices. There are very few studies that deal with the discrete training function they offer:

> The primary contribution of visual training instruments and materials lies in the control they exert and the training effect they have on the subskills (fixation, regression, directional attack, and eye-movement patterns) employed by the reader.

The investigation reported in this paper will provide some evidence favoring the use of two mechanical devices in remedial reading with educationally handicapped students. The final section considers the impact of mechanical training devices in the area of reading in the elementary schools. This section will also discuss the existing research on the Tachistoscopic-X and Controlled Reader.

USE OF TWO EDL MACHINES AND MATERIALS IN EYE-MOVEMENT TRAINING

Since 1946, the development of machine devices for teaching has become a vast new industry. The public schools with the help of the government, industry and the military have spent enormous amounts of money introducing technological aids into their schools and training programs. Architects have planned and designed new buildings to accommodate

---

[147]Stanford E. Taylor, Eye Movements in Reading: Facts and Fallacies, EDL Research and Information Bulletin No. 18 (Huntington, New York: Educational Developmental Laboratories, 1965), p. 13.

these new technological aids and to facilitate the use of new teaching methods. However, this was being done before the relative worth of the aids and the place they would take in the educational training structure had been studied carefully. The development of the technique has not kept pace with the development of the media for employing them.[148] With such an exciting revolution occurring, Kaluger and Kolson claim that by 1976:

> Every teaching area in our schools will be automated, computerized and full of some type of mechanical or electronic teaching devices. So far, the use of such devices in remedial work is just in the pioneer stages.[149]

Although most devices are still somewhat prohibitive in cost and may not be in massive supply, several traditional mechanical devices, Controlled Reader and Tachistoscopic-X machines, have managed to find their way into many public school districts and remedial classes and clinics.

The instruments discussed in this section and experimented within this study are classified in the category known as film pacers and described by Foltz as follows:

> The reading pacers are devices for controlling the speed of reading of the learner. Figures, symbols or stories are printed on films and are put through film projectors designed to enable the controller to control the speed of the film. Some control the exposure through a tapered mechanism inserted in the projector, others control it through a device which brings selected sequential parts into focus then back out of focus. Usually these films are accompanied by booklets containing materials designed to check

---

[148]Charles I. Foltz, The World of Teaching Machines, Teaching Research and Technology Division Electronic Teaching Laboratories, Washington, D.C., 1961, p. 56.

[149]George Kaluger and Clifford J. Kolson, Reading and Learning Disabilities (Columbus, Ohio: Charles E. Merrill Publishing Co., 1969), op. cit., p. 288.

> on comprehension. Manufacturers claim these pacers, too, improve eye movements and increase rate.[150]

Research studies and opinions discussed in the previous section indicate that visual training does help to improve reading. Taylor explains that the improvements through the use of such instruments can be made in (1) binocular coordination and motility by accelerated presentations, (2) visual discrimination and visual memory through flashed or timed exposure, and (3) directional attack by left-to-right presentation.[151] These areas are of real significance in considering a remedial reading program for the educationally handicapped child. Many new remedial programs and procedures are already in use in dealing with the visual deficits confronting these children. According to Johnson and Mykelbust, these children have considerable difficulties in an area of reading they refer to as "visual symbol system superimposed on auditory language."[152] They state that when a normal child learns to read:

> He first integrates nonverbal experiences directly. That is, he has to respond to the letters and symbols which appear before him. Generally, the very young child has not matured enough to be able to distinguish minute likenesses and differences. This child needs to be shown elements from his environment with which he has become familiar and which he can identify. At the next stage, he acquires auditory, then later a visual verbal system which represents both the experience and the auditory symbol. In other words, as the child matures, he begins to recognize a difference between letters, and he learns to identify simple numbers. The letters and numbers begin to say something. Soon he gets meaning from letter combinations, such as he would when he learns to print his name. Little by little, and in different ways, the symbols make more sense to him.[153]

---

[150]Foltz, Loc. cit.

[151]Sanford E. Taylor, Eye Movement in Reading: Facts and Fallacies, Loc. cit.

[152]Doris J. Johnson and Helmer R. Myklebust, Learning Disabilities: Educational Principles and Practices (New York: Grune and Stratton, 1967), pp. 148-149.

[153]Ibid.

However, with the educationally handicapped child, a disturbance or delay in these stages of reading can be expected.[154] The final section of this review deals with research regarding Educational Developmental Laboratories' two mechanical training devices: Controlled Reader and Tachistoscopic-X. At present there exists no research on the use of mechanical training devices in helping ameliorate the underlying visual deficits of the educationally handicapped children.

The Tachistoscopic-X Machine

Historically the first recorded experimental use of the tachistoscope techniques in classroom instruction was made by Katherine Aiken in 1859.[155] During the early decades of the twentieth century, many researchers used the tachistoscope.[156] However, widespread recognition of the value of training did not come about until about the time of World War II. It was used by the armed services to train spotters of airplanes and ships.[157] Today, tachistoscope training has a multitude of users. It is standard technique in the classroom: for remedial and developmental reading,[158] for spelling and vocabulary,[159] and for accurate

---

[154]Donald Evans, Resource Guide for the Educationally Handicapped Program, Curriculum Bulletin No. 288, op. cit., p. 17.

[155]Catherine Aiken, Method of Mind Training (New York: Harper and Brothers Publishers, 1896), p. 110.

[156]J. A. O'Brian, "Training in Perception as a Means of Accelerating the Silent Reading Rate," Journal of Educational Psychology, 11, 1920, pp. 402-17.

[157]Samuel Renshaw, "The Visual Perception and Reproduction of Forms by Tachistoscopic Methods," Journal of Psychology, October, 1945, pp. 217-32.

[158]J. I. Brown, "Vocabulary Via Tachistoscope: A Visual Approach to Improved Reading Ability," Educational Screen, 30, 1951, pp. 274+.

[159]C. B. Brown, "Teaching Spelling With a Tachistoscope," English Journal, 40, 1950, pp. 104-5.

perception of number combination in mathematics.[160]

Tachistoscopic training as discussed by Taylor and Frackenpohl, is based on the proposition that the activity of seeing (visual perception) is learned and that it is not a simple task. Tachistoscopic principle involves:

> The presentation of a series of timed exposures, generally ranging from 1 second to 1/100 of a second. These short exposures cause the trainee to "reach out" visually in an aggressive manner, to react to and apprehend with more attention what was seen, to form a more vivid mental impression of the visual stimuli, and to organize the material in such a way as to prolong its retention.[161]

The application of the tachistoscopic techniques are many and the purposes varied. The majority of school programs have as a goal improvement in two definite training stages:

> First, the development of general accuracy in seeing and remembering; and second, the continuation of training with subject-related material such as reading, spelling, arithmetic. Thus a tachistoscopic program is dual in nature.[162]

The review of the literature concerning tachistoscopic instruction in this section will focus only on the improvement of general accuracy although certain other related studies concerning the use of the Tachistoscope may have some relevance for this investigation.

Accuracy training is carried out with non-verbal, or non-content-related materials: numbers, letters, symbol elements, and other material that does not have meaning. Unlike words, which are recognized as wholes,

---

[160]J. J. Urbancek, "The Speed-i-o-scope (Tachistoscope) Method for Teaching Mathematics," Visual Review, No. 50-2, Society for the Visual Education, pp. 1-3.

[161]Stanford E. Taylor and Helen Frackenpohl, EDL Tach-X, Flash-X, Tachistoscopic Techniques, op. cit., pp. 20-21.

[162]Ibid.

accuracy-building material requires the student to look carefully, with attention to the placement of each element, and to remember the material in a left-to-right manner.[163]

The following improvements in visual perception are specified by Stanford and Frackenpohl as:

1. Aggressive Seeing: High-speed exposures require that the students alert themselves, focus their attention, and maintain a high level of concentration.

2. Accurate Seeing (Perception): The ability to perceive correctly and to discriminate and differentiate.

3. Rapid Seeing: A reduction of reaction time.

4. Organized Retention: Develop a stronger visual memory as well as an orderly left-to-right approach in realizing and organizing the components of perceived material.[164]

Furthermore, in an article by McLeon on the use of the Tachistoscope, he concluded: "If properly employed, the Tachistoscope can aid in the development of visual-perceptual skills. It should be a regular daily activity."[165]

While there seems to be general acceptance of the Tachistoscope as a methodology among specialists in the teaching of reading, there is a dearth of information concerning its use with educationally handicapped learning disability students; albeit Dechant has asserted:

> Tachistopic training has greatest value in the elementary school years when the pupil is learning to see. As much of the material is designed to develop accuracy of seeing and the retention of the particular placement of certain elements.[166]

---

[163]Taylor and Frackenpohl, op. cit., pp. 22-38.

[164]Ibid.

[165]Pierce H. McLeon, Readiness for Learning: A Program for Visual and Auditory Perceptual-Motor Training, California State Series, J. B. Lippincott Company, 1965, p. XIV.

[166]Emerald V. Dechant, Improving the Teaching of Reading (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1964), p. 451.

Pollack and Piekarz[167] reported that the limits of usefulness of the Tachistoscope have scarcely been tapped and that there is no doubt but that training with this Tachistoscope device increases visual capacity and accuracy. They further explained that the development of these skills were essential to satisfactory progress in reading. Bond and Tinker explored the possibilities of exposure to correcting word recognition difficulties. They stated:

> The teacher can easily measure sight vocabulary by rapid exposure techniques. . . . The child who cannot readily identify common words at a glance has failed to develop a sight vocabulary . . . . A few such indications of limited ability in recognizing words at a glance would make remedial work in developing the habit of rapid identification and in building larger sight vocabulary mandatory.[168]

In a report on tachistoscopic training, Renshaw remarked that there were large gains found in a research study he did on early grades of four elementary school systems. He stated: "Tachistoscopic training with digit patterns produced a marked increase in reading comprehension and speed measured by standardized tests."[169]

MacLatchy reported in the "Bexley Reading Study,"[170] that the use of Tachistoscope in primary grades resulted in improved accuracy of observation and that the children could be taught to see whole phrases,

---

[167]M. F. W. Pollack and Josephine A. Piekarz, Reading Problems and Problem Readers (New York: David McKay Co., 1963), pp. 215-216.

[168]Guy Bond and Miles A. Tinker, Reading Difficulties, Their Diagnosis and Correction (New York: Appleton-Century-Crofts, Inc., 1957), pp. 270-271.

[169]Samuel Renshaw, "The Visual Perception and Reproduction of Forms by Tachistoscopic Methods," Journal of Psychology, 20, 1945, pp. 217-232.

[170]Josephine MacLatchy, "Bexley Reading Study," Educational Research Bulletin, XXV, September, 1946, pp. 141-168.

thoughts, or sentences at one fixation. In a two part experimental study by Sutherland dealing with the relationship between perceptual span and rate of reading, he concluded:

> Perceptual span is related to rate of reading and to rate of perception. Also training directed at improvement of perceptual span may improve rate of reading and rate of perception.[171]

However, some researchers and educators do not agree as to the teaching value of the Tachistoscope. Strang claims:

> Some say that tachistoscopic training per se cannot influence the reading process, while others believe that the tachistoscope is a remarkable device for improving reading abilities.[172]

Goin[173] found that no positive effect was produced by the tachistoscopic training on the reading skill of the experimental group in her study.

In another study by Bormuth and Aker dealing with thirty-nine matched pairs of subjects, they found no significant advantage in using a Tachistoscope at the grade six level:

> Tachistoscopic training using meaningful word groups did not significantly increase the rate of reading over the amount achieved by other motivated practice using essentially the same material.[174]

A study conducted in the Manteca Unified School District by

---

[171]Jean Sutherland, "The Relationship Between Perceptual Span and Rate of Reading," Journal of Educational Psychology, 37, 1946, pp. 373-380.

[172]Ruth Strang, Diagnostic Teaching of Reading (New York:McGraw-Hill Book Co., 1964), p. 170.

[173]Jean T. Goin, "Visual Perceptual Abilities and Early Reading Progress," Supplementary Educational Monographs, No. 87 (Chicago: University of Chicago Press, 1958), p. 95.

[174]John R. Bormuth and Cleatus C. Aker, "Is the Tachistoscope a Worthwhile Teaching Tool?" Reading Teacher, 14, January, 1961, pp. 172-175.

Wells[175] attempted to estimate the value of the tachistoscopic training and the contribution it would make to the elementary reading program. At the end of the six week experimental period with 212 students, the author reported that no significance was found between control and experimental groups on (1) gain in reading comprehension, (2) growth in total reading achievement, and (3) gain in oral reading speed.

Summary. From the review of the literature concerning the use of the Tachistoscope as a device for improving reading, no definite agreement has been reached as to its effectiveness on reading. However, Bond and Bond claim:

> Some of the critics of the device used for controlling training in reading have perhaps neglected the fact that the instrument does not correct faulty eye-movement nor improve reading per se. Rather, it attempts to correct the poor reading techniques, of which faulty eye-movements are simply a result.[176]

Taylor also felt that one could be trained to see more easily, more rapidly, more accurately, and more objectively. He stated:

> There is every reason to believe, also, that developing efficient eye habits in distant work actually conserves the reader's vision and contributes to his general development and organization while reading.[177]

The Controlled Reader Machine

The use of the Controlled Reader to present reading materials in

---

[175]Gordon Keith Wells, Pilot Study Use of the Tachistoscope in Elementary Grades, An unpublished thesis presented to the faculty of the School of Education, College of the Pacific, Stockton, California, June, 1956, pp. 60-62.

[176]Guy L. Bond and Eva Bond, Developmental Reading in High School (New York: McMillan Company, 1941).

[177]Earl A. Taylor, Meeting the Increasing Stresses of Life (Illinois: Charles C. Thomas Publishers, 1963), pp. 94-98.

a left-to-right sequence at controlled rates was envisioned by educational authorities dating back to the early 1900's.[178] In 1922, Buswell began experiments with a device to aid readers in developing more efficient reading habits.[179] Then in 1931, one of the most significant steps in this direction was taken with the development of the Metronoscope, a triple door device which was able to present roles of printed reading material at regular speed.[180] By 1938, Harvard University released a series of motion picture films of printed material adapted to college level reading. In each series, each successive phrase received greater illumination on the screen. During the early 1950's, a similar series of projected training films was developed by Iowa for use on the high school level. Finally in 1954, the Controlled Reader was marketed as a practical classroom method for developing reading efficiency.[181]

Taylor and Frackenpohl emphasized that the key features of the Controlled Reader training were:

1. Its left-to-right guidance
2. Its variable speed range
3. The wide range of training materials that are employed to condition more efficient visual-functional and perceptual processes in reading.[182]

---

[178]Walter F. Dearborn, The Psychology of Reading, Columbia University Contribution to Philosophy, Psychology, and Education, Vol. XIV, No. 1 (New York: Columbia University Press, 1906), p. 134.

[179]Guy T. Buswell, Fundamental Reading Habits: A Study of Their Development, Supplementary Educational Monographs, No. 21 (Chicago: University of Chicago Press, 1922), pp. XIV+ 150.

[180]Earl A. Taylor, Loc. cit.

[181]Taylor and Frackenpohl, Controlled Reader, op. cit., pp. 12-15.

[182]Ibid.

Today, according to Taylor and Frackenpohl,[183] Controlled Reader programs are used in over 75,000 classrooms, reading laboratories and clinics throughout the United States, Canada, and other parts of the world. These programs are divided into five major forms of Controlled Reader Training so as to develop or to improve efficiency in reading:

1. Fluency Building
2. Comprehension Power Development
3. Visual Efficiency Training
   a. Motility Training
   b. Accelerated Discrimination
4. Pre-Reading Training
   a. Readiness Pictures
   b. Pre-Primer Pictures, Letters, Words, and Stories
5. Processing Training

Of these five areas, Controlled Reader has been shown to be helpful in improving visual efficiency, particularly binocular coordination,*** and ocular motility.**** Such improvement is accomplished as the student reads easy-to-read material printed with limited symbols-per-line at accelerated rates. Also the Controlled Reader training may provide perceptual accuracy and efficiency. The left-to-right directional attack and rapid moving projection slot can accelerate the student's reading. At the same time, this training encourages the student to approach each line of print in a more efficient and sequential manner.[184]

---

[183]Ibid.

[184]Taylor and Frackenpohl, Controlled Reader, op. cit., pp. 28-29, 112-118.

***The ability to use the two eyes together effectively.

****Ease and facility in making ocular rotations: the smooth sweeping motion of the eyes from the end of a line to the beginning of the next line.

For the purpose of this investigation, the Controlled Reader was utilized in the area of visual efficiency training since this specific and regular training approach has resulted in an improvement of more orderly directional attack and better physical adjustment to near point act of reading.[185]

In the review of the literature, only those studies relating to Controlled Reader visual efficiency training were reported. Hopefully these studies would provide some evidence toward supporting a visual training program for the educationally handicapped child.

Though there still exists much dispute concerning the importance of eye-movement training in reading, there are a number of experts and research reports that seem to support such training. Research by Berner,[186] Taylor and Solan,[187] and Schubert,[188] indicate that in using the Controlled Reader (1) distance reading would be desirable because the stresses inherent in near point work were reduced, and (2) furthermore, distance reading allowed the student the opportunity of developing higher levels of visual competence.

At the fourteenth Annual National Reading Conference held in Dallas, Texas, Frackenpohl made a report on the use of motility training

---

[185]Ibid.

[186]George E. Berner, "When is it Safe to Use the Eyes for Reading?" Twenty-Ninth Annual Schoolmen's Week Proceedings: Education in a Nation at War, University of Pennsylvania, June 26, 1942.

[187]Earl A. Taylor and Harold A. Solan, Functional Reading and School Adjustment (New York: Reading and Study Skills Center, 1955), p. 40.

[188]Delwyn G. Schubert, The Doctor Eyes the Poor Reader (Springfield, Illinois: Charles C. Thomas Publishers, 1957).

in learning to read. In her opening remarks, she stated:

> Research studies by educators have only recently been examining the role of motility training in reading. Visual motility training has primarily been conducted by eye-specialists. However, it is now recognized that the factors of motility, along with visual acuity and accommodation, binocular coordination, and fusion are fundamental to successful reading.[189]

In her experimental study, thirty-one subjects ranging in age from seven to fifty-five were given motility training. No absolute conclusions could be drawn from this study since its primary purpose was to gather additional information about the activity of the eyes during the reading process.

A number of investigators, Eames,[190] Gould, Henderson and Scheele,[191] Kephart,[192] and Robinson[193] reported that the role of visual motility was a factor in influencing reading success.

With regard to ocular motility and the educationally handicapped learning disability child, only one source was located that would have some significance for this investigation. Goldberg and Arnot stated:

---

[189]Helen Frackenpohl, Motility Training, Research and Information Bulletin, No. 7 (Huntington, New York: Educational Developmental Laboratories, 1965), pp. 3-7.

[190]T. H. Eames, "A Comparison of the Ocular Characteristics of Unselected and Reading Disability Groups," Journal of Educational Research, 24:1-5, March, 1932.

[191]Lawrence N. Gould et al., "Vision Motor Perception Program in the Brentwood Public Schools," In J. Allen Figurel (ed.), Improvement of Reading Through Classroom Practice, International Reading Association Conference Proceeding Volume 9 (Newark, Delaware: International Reading Association, 1964), pp. 271-76.

[192]Kephart, Slow Learner in the Classroom, op. cit., pp. 46-47.

[193]Helen M. Robinson, Why Pupils Fail in Reading (Chicago: University of Chicago Press, 1946), pp. 76-92.

> Improving ocular motility has become a widely discussed technique of assisting children who have learning disabilities. It has been assumed that learning difficulties in some cases were due to lack of binocular coordination.[194]

In their results on 25 dyslexic children and an adequate number of normal control subjects, they found that it was the degree of comprehension that produced the type of ocular movement and not ocular motility that determined the degree of comprehension. It should be noted, however, that one of the reasons for the regression in ocular motility was due to the materials used. In this experiment, the subjects were required to read words, and many of the subjects had difficulty in understanding the word or the syllable. According to Smith,[195] one cannot assume that a child who is able to match individual letters will also succeed in identifying these same letters in the context of a whole word. If words are used, it would be necessary to provide exercises with words incorporated in the practice letters in initial, middle, and final position.

Finally, Frostig presents two strong arguments for a reading program which includes eye tracking. These two points seem to have a definite bearing on this study:

1. It is common sense that erratic eye-movements must retard reading. Thus, something must be done to ameliorate these visual difficulties.
2. Also educational procedures to which helpfulness has been widely ascribed and which are certainly not damaging or

---

[194]Herman K. Goldberg and William Arnott, "Ocular Motility in Learning Disabilities," Journal of Learning Disabilities, 3:40-42, March, 1970.

[195]Robert Smith, Teacher Diagnosis of Educational Difficulties (Columbus: Ohio: Charles E. Merrill, 1969), p. 86.

> time consuming, should be disproved before they are disregarded.[196]

Summary. From the review of the literature concerning the use of the Controlled Reader and Tachistoscope, no definite conclusions or agreements have been reached as to their effectiveness in reading instruction. However, it has been expressed by many experts that these visual training instruments do (1) exert certain positive effects on ocular motor skills, (2) develop accuracy in seeing, (3) aid retention of the particular placement of certain elements, (4) decrease fixations and regressions, and (5) improve eye-movement patterns. Such skills are essential to satisfactory progress in reading.

SUMMARY

Most of the studies discussed have been limited to elementary remedial reading programs using mechanical training devices. Certain articles and studies dealing with secondary and adult population were also included since many of the experiments conducted prior to the 1950's only dealt with this age span. The question posed by Traxler[197] seems appropriate here:

> Can the experienced teacher of reading get better results through the use of instruments for controlled reading than he can obtain with more conventional procedures of reading instruction?

The same question can certainly be posed for the educationally

---

[196]Marianne Frostig, "Visual Modality and Reading," in Helen K. Smith (ed.) Perception and Reading, International Reading Association (Newark, Delaware: 12:4, 1968), pp. 25-31.

[197]Arthur E. Traxler, "Value of Controlled Reading: Summary of Research and Opinion," Journal of Experimental Education, II, June, 1943, pp. 280-292.

handicapped student with learning disabilities. Presently, no existing research can provide an answer. The investigation reported in this paper should provide some evidence toward answering that question.

The research reviewed in this chapter indicated three consensuses: (1) that reading may be improved under conditions of controlled eye movement. Much has been done with reading instruments to control directional attack, discourage regression, and reduce fixation; (2) that experiments comparing the effectiveness of reading under controlled eye movements with reading under ordinary practice brought about equal or no significant results. The reasons offered were that none of these studies had been under carefully controlled experimental conditions and that the lack of significant gain in visual efficiency may be attributed to the type of material used. The third consensus was that eye-movement training per se, is still considered to be of doubtful value by some experts. Devices for controlling eye-movements can be constructive in helping to increase form perception and improve eye-movement efficiency.

The findings relative to eye training programs using mechanical devices have not been conclusive. More specifically, eye-movement training with educationally handicapped learning disability children remains as an untested program at the elementary level. Hence this study, pursued through a carefully controlled experiment, to find out whether or not the use of two visual mechanical devices produced any improvement in eye performance among these children was indicated.

The procedures employed in this investigation are described in the next chapter. This description includes the identification of the population, experimental design, experimental procedure, description and administration of tests, and statistical procedure.

CHAPTER III

EXPERIMENTAL DESIGN AND PROCEDURE

The theoretical basis of this study, the rationale for the selection of the major variables was discussed in Chapter I, and the relevant literature was reviewed in Chapter II. The investigation provided for the use of two visual aid programs with educationally handicapped students having reading disability. The two visual aid approaches and the data provided from the scores on the three tests constituted the major variables of this study.

In Chapter III the report is developed by describing (1) the identification of the population, (2) experimental design, (3) experimental procedure, (4) description and administration of tests, (5) statistical procedure, and (7) summary.

IDENTIFICATION OF THE POPULATION

The study was conducted in the Stockton Unified School District. Approval to conduct the study was gained from the Director of Special Education, Mr. Donald Evans. Final approval for the study was granted by the Assistant Superintendent of Elementary Education, Mr. Jeff West.

Selection of the Schools

The Stockton Unified School District enrolls approximately 18,401 elementary students who attend thirty-three schools.[1] At the onset of

[1] "Racial and Ethnic Report," Stockton, California: Stockton Unified School District (October 21, 1970), p. 1.

this study, nine schools at the elementary level had learning disability programs. The subjects making up the sample consisted of an entire pool of 78 students who were legally admitted and participating in the EH learning disability program. The principals and teachers of EH classes in each of the nine schools were contacted and assurance of cooperation with the study was obtained by the investigator.

The researcher selected 74 educationally handicapped subjects from the original pool for inclusion in the current study. Four students were eliminated for the following reasons: (1) three were in the first grade and did not have sufficient experience in reading, and (2) one student who was in the sixth grade was found to be a fluent reader and it was decided that treatment would not be necessary.

Grade Placement of Subjects

The learning disability program in Stockton Unified School District is an ungraded program designed to meet the needs of elementary students. Table I gives a breakdown of the schools and grade placement for the seventy-four students participating in this study.

Selection by Sex and Race

Subjects in this study included fifty-eight boys and sixteen girls. The boys were in the following grades: twelve boys were in grade 2, eleven boys were in grade 3, seventeen boys were in grade 4, twelve boys were in grade 5, and six boys were in grade 6. The grade placement for the sixteen girls was as follows: two were in grade 2, four were in grade 3, four were in grade 4, two were in grade 5, and four were in grade 6.

Only Caucasian students participated in order to minimize the

possibility of adding uncontrolled variables in the experimental design.

Table 1

Elementary Learning Disability Population:
School and Grade Placement

SCHOOL	GRADE					SUM
	2	3	4	5	6	
Wilson	-	1	4	1	1	7
El Dorado	2	1	-	1	1	5
Madison	1	5	7	-	-	13
Tyler	4	3	-	1	1	9
Hazelton	-	1	4	1	1	7
Harrison	2	-	2	1	1	6
August	1	3	1	-	2	7
Fillmore	4	-	1	3	2	10
Montezuma	-	1	2	6	1	10
Total	14	15	21	14	10	74

EXPERIMENTAL DESIGN

Design of Experiment

The seventy-four elementary EH learning disability students were randomly assigned to a modified Solomon pre-post control group design.[2] According to Campbell, the design controls and measures both the main and interaction effects of a composite of maturation and history.[3]

The modified Solomon pre-post control group design consists of six groups to which subjects are randomly assigned. A more graphic

---

[2]Donald T. Campbell and Julian C. Stanley, Experimental and Quasi-Experimental Designs for Research (Chicago: Rand McNally & Company, 1963), pp. 24-25.

[3]Donald T. Campbell, "Factors Relevant to the Validity of Experimentals in Social Settings," Psychological Bulletin LIV (July, 1957), pp. 303-304.

portrayal of this design can be found in Figure 1. This design was chosen to control possible pretest effects since the pretest was used to establish the initial reading performance of three experimental groups. Posttest differences were used to test the validity of these hypotheses dealing with reading performance.

Group		Pretest	Treatment	Posttest
A	R	O_1		O_2
B	R			O_2
C	R	O_1	X_1	O_2
D	R		X_1	O_2
E	R	O_1	X_2	O_2
F	R		X_2	O_2

Figure 1

Solomon Pre-post Control Group Design

R = Random Assignment of Intact groups to Treatments;
O_1= Pretest Scores; X_1 = Experimental Variables (Controlled Reader);
X_2= Experimental Variable (Tachistoscope-X); O_2 = Posttest Scores

The subjects were grouped as follows:

GROUP A. This group consisted of twelve students and was one of the control groups. Group A was given pretests in order to determine each student's reading level at the start of this study. No treatment was given to this group. After ten weeks, this group was given the posttest.

GROUP B. This group consisted of twelve students and was one of the control groups. Group B was not pretested and no treatment was given to the students. After ten weeks, this group was given the posttest.

GROUP C. This group consisted of thirteen students and was one of the treatment groups. Group C was given pretests

in order to determine each student's reading level at the start of this study. This group was given bi-weekly sessions of twenty (20) minutes each with the EDL Controlled Reader machine. After ten weeks, this group was given the posttest.

GROUP D. This group consisted of thirteen students and was one of the treatment groups. Group D was not pretested. This group was given bi-weekly sessions of twenty (20) minutes each with the EDL Controlled Reader machine. After ten weeks, this group was given the posttest.

GROUP E. This group consisted of twelve students and was one of the treatment groups. Group E was given pretests in order to determine each student's reading level at the start of this study. This group was given bi-weekly sessions of twenty (20) minutes each with the EDL Tachistoscope-X machine. After ten weeks, this group was given the posttest.

GROUP F. This group consisted of twelve students and was one of the treatment groups. Group F was not pretested. This group was given bi-weekly sessions of twenty (20) minutes each with the EDL Tachistoscope-X machine. After ten weeks, this group was given the posttest.

The design was chosen to maximize both internal and external validity. The randomization provided the necessary internal controls for history, maturation, selection, testing, instrumentation, regression and experimental mortality.[4]

The treatments were unobstrusively included as a part of a total educational program in those schools which had an EH learning disability program. This served to control any selection bias that might threaten the external validity of the study. The treatments, by design, were limited to EH learning disability students, and the selection of the sample from this group did not present a problem in generalizing the results.

Extension of the Experimental Design

According to Campbell and Stanley, this design is called a

[4]Campbell and Stanley, Loc. cit.

Solomon Four-Group Design.[5] The investigator chose to augment the design. This study was experimenting with two separate visual aid treatment approaches and necessitated the use of an additional two groups in the design.

Assignment of Subjects to the Experimental Design

Subjects were randomly assigned to six groups by the following procedure:

1. Each subject was represented by a number which was written on a slip of paper. Seventy-four slips, representing the seventy-four subjects, were placed in a box (box A).
2. At the same time, the numbers one to six, representing the groups, were written on separate slips of paper and placed in another box (box B). These slips were replaced after the sixth drawing.
3. Then the slips were randomly picked from box A and matched with slips randomly chosen from box B until each subject had been assigned to one of six groups.

EXPERIMENTAL PROCEDURE

The experimental procedure used in the study is discussed under the following headings: (1) Description and Use of Visual Aid Materials, (2) Instructor and School Facilities, (3) Scheduling and Arrangment of Groups, and (4) Nontreatment Groups.

Description and Use of Visual Aid Materials

Groups C and D were involved in the use of the Controlled Reader machine and groups E and F were involved in the use of the Tachistoscope-X machine. A discussion of the materials, use of the materials and tutorial sessions follows:

---

[5]Ibid.

Controlled reader. During the first meeting, an introductory demonstration was given to each of the two controlled reader tutoring groups in order to acquaint them with the operations of the machine, and familiarize them with the materials to be used in the tutoring sessions. Since the concern was with visual efficiency training, numbers and letters from ten filmstrips in Set MT[6] were used in the tutoring.

The visual efficiency training, or motility training as it is called, concentrates on the heightening of visual discrimination while simultaneously seeking to improve directional attack.[7] The accelerated discrimination filmstrips contain lines of letters, ranging from five to twenty-five letters per line. As the lines of letters are projected in a left-to-right manner, the student counts the number of times a designated letter appears in an exercise consisting of several lines. In doing this, he learns to form and hold a strong mental image of the letter for which he is looking. This form of training develops his discrimination ability to a high level and also refines his letter recognition capability.[8] According to Taylor and Frackenpohl, the skills developed by accelerated discrimination training should

> . . . enable the reader to maintain a higher degree of accuracy in word identification and recognition when involved in the dynamic act of reading.[9]

---

[6]Stanford E. Taylor and Helen Frackenpohl, Controlled Reader, op. cit., p. 143.

[7]Taylor, op. cit., pp. 28-29.

[8]Ibid.

[9]Ibid.

Tachistoscope-X. On the first meeting, an introduction of the operation of the Tach-X machine and the materials to be utilized were given to each of the two experimental groups.

The general step-by-step procedures followed during the Tach-X training were:[10]

1. The projected image first appears in an out-of-focus state on the projection screen. While waiting for the exposure, the students are told to focus on a point near the left of the material that will be exposed and to "reach out" visually in a left-to-right manner as the exposure is made.

2. The teacher signals "Ready!" and the exposure is made as the image snaps into focus for a predetermined interval (the exposure speeds were given in the following sequence: 1-1/2, 1, 1/2, 1/4, 1/10, 1/100) and then out of focus again.

3. While the image is out of focus, the students typically write down what they have seen with careful attention to left-to-right order of the material.[11]

4. Then the image is brought into focus again so that the student can check the accuracy of his response.

The material used by the investigator with the Tach-X machine included filmstrip Set 22 and Set 31. The filmstrips contained letters and numbers, ranging from three to seven letters per line.[12]

The Instructor and the School Facilities.

The instructor. The investigator conducted each of the group visual training sessions himself. He holds a California Standard Elementary Teaching Credential, and has had previous experience in tutoring

---

[10]Stanford E. Taylor and Helen Frackenpohl, Tachistoscopic Techniques, op. cit., pp. 20-21.

[11]See Appendix A for worksheet used in Tach-X training.

[12]Taylor and Frackenpohl, op. cit., p. 42.

school youngsters in reading. For three years, he taught history to students in grades eight and nine in the public schools. He also has supervised clinicians and served as Assistant Director of the Laura Ann Sisk Memorial Reading Clinic at the University of the Pacific from 1970 to 1971.

The school facilities. For the purpose of this study, a room was assigned to the investigator at each of the nine schools participating in this study. These rooms provided by each school contained two rectangular tables and six chairs. A blank wall or a chalk board served as a screen to project the letters and numbers from the filmstrip material.

The Scheduling and Arrangement of Groups

The scheduling of groups. Data in Table 2 show the schedule adapted to meet the various time schedules of the nine schools and also to provide adequate travel time for the investigator.

Meetings occurred at the times indicated in Table 2 so that the students would not miss their regular EH learning disability classes and language arts instruction. Each subgroup attended a total of twenty group visual training sessions between March 2 and May 20, 1971.

Arrangements of participants. The principals in the nine schools arranged with each subject's teacher to excuse him from class for the visual training program. The teacher was not informed that her student or students were participating in a research study. No attempt was made to inform or discuss the program with the subject's parent. On only a few occasions did the instructor discuss the program with the students'

Table 2

Schedule for the Nine Elementary School's
Visual Training Sessions

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
11:30-12:00 Hazelton (T-X)	11:15-12:10 August (CR) (T-X)	11:30-12:00 Hazelton (T-X)	11:10-12:00 Harrison (T-X) (CR)	11:15-12:00 August (CR) (T-X)
12:30- 1:20 Wilson (CR) (T-X)	12:30- 1:20 Harrison (T-X) (CR)	12:30- 1:20 Wilson (CR) (T-X)	12:30- 1:20 El Dorado (T-X) (CR)	12:30- 1:20 El Dorado (T-X) (CR)
1:30- 2:15 Tyler (CR) (T-X)	1:30- 2:15 Fillmore (CR) (T-X)	1:30- 2:15 Tyler (CR) (T-X)	1:30- 2:15 Fillmore (CR) (T-X)	1:30- 2:15 Montezuma (CR) (T-X)
2:20- 3:00 Madison (CR) (T-X)	2:35- 3:00 Montezuma (T-X)	2:20- 3:00 Madison (CR) (T-X)	2:35- 3:00 Montezuma (T-X)	

CR = controlled reader
T-X = Tachistoscopic-X

EH learning disability teachers.

Nontreatment Groups

The thirty-seven students who were nontreatment participants in the study came from nine elementary schools in Stockton. They also were in different grade levels. Boys and girls in Control Groups A and B did not attend any of the visual training sessions. However, they received remedial help in reading given in their regular EH learning disability classes. Control Group A received the "treatment" of pretesting; Control Group B participants were not involved until the immediate post-testing phase of the study.

DESCRIPTION AND ADMINISTRATION OF THE TEST

Three tests were administered to measure the effects of visual training tutoring on the reading performance of EH learning disability students.

Description of the tests.

1. Metropolitan Achievement Test-Form A: Primary II Battery.[13] The survey consisted of three subtests: (1) word knowledge, (2) word discrimination, and (3) reading of paragraphs.

In the 37 item word knowledge subtest, the first 17 items are of the picture vocabulary type, in which the child demonstrates his recognition of a word by correctly associating it with a picture. In the remaining 20 items a stimulus word is presented in written form and the

---

[13]Walter N. Durost, ed, Metropolitan Achievement Test (Primary II Batter for grade 2) Directions for Administration (Harcourt, Brace, and World, Inc., 1959), p. 3.

child demonstrates his understanding of this word by choosing from among four alternative responses, also presented in written form.[14]

The 35 item word discrimination subtest measures the "child's ability to select an orally presented word from among a group of words similar in configuration." Success on the test depends upon both auditory and visual discrimination abilities."[15]

The Reading subtest consists of two parts: a 13 item section which "measures the pupil's ability to comprehend sentences." The second section of the reading subtest is 38 items which "measures the ability to comprehend materials of paragraph length."[16]

The split-half reliability for each of the subtest was .93, .88 and .94 respectively. The standard error of measurement for each subtest was 2.2, 2.3, and 2.8 respectively.[17] No mention of validity was made in the Direction for Administration Manual, and apparently no attempt was made by the publishers to organize the data for specific use as validity.

2. The Developmental Test of Visual-Motor Integration[18] is composed of a series of 24 geometric forms arranged in order of increasing difficulty, to be copied with pencil and paper. It was devised as a measure of the degree to which visual perception and motor behavior are integrated in young children. The correlation between the scores and

---

[14]Ibid.

[15]Ibid.

[16]Ibid.

[17]Durost, op. cit., p. 24.

[18]Keith E. Beery, Developmental Test of Visual-Motor Integration (Mongraph) (Chicago, Illinois, Follett Publishing Company, 1967), p. 34.

chronological age is .89 for the two-to-fifteen year age range. This test statistically correlates much higher with mental age than with chronological age.[19] The validity for the test was .89 between the chronological age and the number of forms correct (to three consecutive failures), which was obtained from the total suburban group using the Kuder-Richardson Formula.[20]

3. The Educational Developmental Laboratories' Reading Eye I Camera Test photographically records eye-movements.[21] The process of eye-movement photography testing is in two phases as follows:

(1) An oral reading test is provided by EDL for individual administering before the photography is done. It is described as:

> . . . in the form of 3-1/2 x 5 cards with the test selections printed on one side. The selections for grade one through three contains from 65 to 70 words (with 50 countable words). The selections for grade four and above contain from 115 to 120 words (with 100 countable words).[22]

According to Taylor the establishment of the appropriate reading level of the individual is determined as:

> The child reads orally, and the examiner listens, noting hesitancy and the number of words that are mispronounced or mis-called. Another reading of a card on a lower level is indicated if the child misses more than 5%: 4 to 5 different words in selections for grades 1-3; 6 to 7 different words in selections for grade 4 and up.[23]

(2) Once the appropriate reading level has been determined, another card on the same level of difficulty was used for the photography. While the testee reads, small beads of light are reflected from his eyes

---

[19] Ibid.

[20] Ibid

[21] Taylor, Loc. Cit.

[22] Taylor, op. cit., p. 16.

[23] Taylor, op. cit., p. 20.

and photographed onto moving film. Each student is asked to read three lines of print. When he has finished, identifying initials are flashed onto the film. The filmed record is then analyzed to reveal information about the overall efficiency and organization of the reader. As each student reads three lines, a photographic recording is made on the number of fixations (eye stops) and number of regressions (reverse eye-movement).[24] The eye-movement graphs of reading served as a measure of the development of certain functional skills: coordination, mobility and directional attack.[25]

In terms of reliability coefficient, Tinker's study[26] comes closest in establishing it for eye-movement scores and varying amounts of material. The highest correlation obtained for a single measure was .88. This was for fixation frequency in the case of the easier material using a test-retest method. Other studies by Eurich,[27] Frandsen,[28] and Litterer,[29] established on a test-retest basis, finding correlations from .59 to a high of .91 for the factors of fixations, regressions, durations, and rate. According to Taylor and Frackenpohl, the wide range of

---

[24]Taylor, op. cit., pp. 36-39.

[25]Ibid.

[26]Miles A. Tinker, "Reliability and Validity of Eye-Movement Measures of Reading," Journal of Experimental Psychology, XIX (December, 1936), pp. 732-746.

[27]Alvin C. Eurich, "The Reliability and Validity of Photographic Eye-Movement Records," Journal of Experimental Psychology, 24:118-122, 1933.

[28]Arden Frandsen, "An Eye-Movement Study of Objective-Examination Question," General Psychological Monographs, 16:79-138, 1934.

[29]Oscar F. Litterer, "An Experimental Analysis of Reading Performance," Journal of Experimental Education, 1:28-33, 1932.

correlations would seem to stem from the different test materials used, but that the degree of reliability is quite dependent on the suitability and comparability of the material read.[30]

Pretesting Procedure

During the month of February, 1971, each of the thirty-seven students in groups A, C, and E in the nine schools was individually pretested with the three instruments by the investigator. At each of the schools, the principal arranged with the teachers to have the participating student dismissed from his respective classroom for the pretesting administration.

Individual students received their pretesting as follows: (1) the Word Knowledge, Word Discrimination, and Reading subtests of the Metropolitan Achievement Test Form II: Primary II Battery were administered during the first hour; (2) both the Developmental Test of Visual-Motor Integration and (3) the Educational Developmental Laboratories' Reading Eye I Camera test were administered the following half hour. The administration of the three tests was conducted in accordance with standard psychometric procedures. A separate room in each of the schools was the testing location.

Posttesting Procedure

During the second and third week of May, 1971 following the conclusion of the group visual training treatment, the investigator

---

[30]Stanford E. Taylor, Helen Frackenpohl, and James L. Pettee, "A Report on Two Studies of the Validity of Eye-Movement Photography As a Measure of Reading Performance," Reading in a Changing Society, International Reading Association Conference Proceedings, Volume 4, 1959, p. 3.

administered the three testing instruments to all seventy-four students assigned to the modified Solomon pre-post control groups. The students were given posttesting by the researcher in a manner similar to that used for pretesting. Tests were given slightly before the close of school in an attempt to avoid the "end of the year" malaise.

STATISTICAL PROCEDURES

Each of the hypotheses stated in Chapter I was restated in the null form and tested by appropriate statistical tests. Two-tailed tests were applied in all cases, and the level of significance for rejecting the null hypotheses were set at .05. This level of conservatism was judged appropriate by the investigator for this initial test of the use of visual aid training in reading for elementary EH learning disability students.[31] Ultimately, educational significance as well as statistical significance must guide decisions regarding educational practice.

In analyzing the data, the researcher used two different statistical tests to test the null hypotheses: (1) two-way analysis of variance, and (2) Neuman-Keuls test.[32]

The following hypotheses were tested by means of a two-way analysis of variance.

H_1 : Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader and Tachistoscope-X machine will not

---

[31]Henry E. Garrett, Statistics in Psychology and Education (New York: Longmans, Green and Company, 1958), p. 222.

[32]B. J. Winer, Statistical Principles in Experimental Designs (New York: McGraw-Hill , 1962), pp. 100-104.

show significantly greater gains in reading performance as measured on the Metropolitan Achievement Test, Subtest Word Knowledge than educationally handicapped students who are not given an instructional program.

H_2 : Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader and Tachistoscope-X machine will not show significantly greater gains in reading performance as measured on the Metropolitan Achievement Test, Subtest Word Discrimination than educationally handicapped students who are not given an instructional program.

H_3 : Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader and Tachistoscope-X machine will not show significantly greater gains in reading performance as measured on the Metropolitan Achievement Test, Subtest Reading than educationally handicapped students who are not given such an instructional program.

H_4 : Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader and Tachistoscope-X machine will not show significantly greater gains in visual motor performance as measured on the Developmental Test of Visual-Motor Integration than educationally handicapped students who are not given such an instructional program.

H_5 : Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the

controlled reader and Tachistoscope-X machine will not show significantly greater gains in eye-movement performance as measured on the EDL Reading Eye I Camera Test: Fixation than educationally handicapped students who are not given such an instructional program.

H_7 : Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader and Tachistoscope-X machine will not show significantly greater gains in eye-movement performance as measured on the EDL Reading Eye I Camera Test: Regression than educationally handicapped students who are not given such an instructional program.

All of the posttest scores on the three test instruments were typed into the terminal at the University of the Pacific to an IBM 360 Model 67 computer located at Stanford University for the statistical analyses.[33] The computer analyzed the data for six dependent variables obtained in posttesting. Data were reported from the computer analyses in the following manner: (1) means and standard deviation and (2) six separate two-way analyses of variance.

Data components for the two-way analyses of variance included: (1) the within cells, sum of squares and mean squares, (2) the treatment variability, (3) the pretesting variability, and (4) the interaction effect. The F values, the treatment variability, the pretest variability, and the interaction effect were also reported.

Since this investigation involved the use of two experimental

---

[33]Cf. infra, Appendix B, for subjects' raw scores.

treatments, the data collected may indicate a real difference among the treatment groups. The following two hypotheses were tested by means of separate application of the Neuman-Keuls test.

H_6 : Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader approach, will not show significantly greater gains in eye-movement performance as measured by the EDL Reading Eye I Camera Test: Fixation than educationally handicapped students who are given the Tachistoscope-X instructional program.

H_8 : Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader approach, will not show significantly greater gains in eye-movement performance as measured by the EDL Reading Eye I Camera Test: Regression than eductionally handicapped students who are given the Tachistoscopic-X instructional program.

SUMMARY

In this chapter of the research report, the investigator has described the design and procedures of this study in five areas: (1) the identification of the population, (2) experimental design, (3) experimental procedure, (4) description and administration of tests, and (5) statistical procedure.

The study was conducted in the elementary Stockton Unified Schools. The selection of the schools was based on the fact that these nine schools had an EH learning disability program. From the pool of seventy-eight

students, seventy-four subjects were selected for study. The subjects in this study included fifty-eight boys and sixteen girls, who were randomly assigned to a modified Solomon pre-post control group design. The design was modified to include not one but two experimental treatments: Controlled Reader and Tachistoscope-X machines.

Testing instruments used in the study included: (1) the Metropolitan Achievement Test Form II: Primary II Battery (Subtest on Word Knowledge, Word Discrimination and Reading), (2) Developmental Test of Visual-Motor Integration, and (3) Reading Eye I Camera Test: Fixation and Regression.

The group visual training procedure was described in detail, including: (1) pretesting procedure, (2) visual motility materials, (3) instructor and school facilities, (4) group visual training process, (5) nontreatment groups, and (6) posttesting procedure.

Six hypotheses, stated in null form, were presented for acceptance or rejection at the .05 level of significance. Statistical procedures to test the null hypotheses included two-way analyses of variance. Subjects' posttest scores on the three testing instruments were used as dependent variables.

Two hypotheses, stated in null form, were tested by means of the Neuman-Keuls test to show statistically that there existed a difference between treatments.

Chapter 4 of this report will present an analysis of the statistical data drawn from the experimental study. Brief interpretations follow each of the sets of data presented.

CHAPTER IV

ANALYSIS OF THE RESULTS

It was the primary purpose of this experimental study to incorporate the use of two visual aid instruments, (1) the Educational Developmental Laboratories' Controlled Reader and (2) the Tachistoscope-X in an effort to improve the reading performance and eye movement efficiency of elementary students classified as educationally handicapped-learning disabilities.

The data presented in Table 3 indicate the number of students and the treatment of the groups participating in the study. Seventy-four subjects were randomly selected and assigned to a modified Solomon pre-post controlled group design. Groups A, C, and E received pretesting; Groups B, D, and F did not. Groups C, D, E, and F were administered twice-weekly visual aid training for a period of ten weeks. All six groups received posttesting at the conclusion of the study.

Of the 52 students selected originally for the visual training treatments in the educationally handicapped learning disability program, data were available for 50 students. Of the 26 students selected originally for the controlled group, data were available for 24 students. These losses of subjects from experimental and controlled groups were caused by: (2) three students being in the first grade and not having sufficient experience in reading, and (b) by one student in the sixth grade being a fluent reader for whom it was decided that treatment would not be necessary or beneficial.

This chapter presents the analyses of the collected data of the

Table 3

In Each Group the Number of Students Tested and Treated

Groups	Number of Students		
	Pretest	Treatment	Posttest
Control Group A	12	--	12
Control Group B	--	--	12
Controlled Reader C	13	13	13
Controlled Reader D	--	13	13
Tach-X E	12	12	12
Tach-X F	--	12	12
Totals	37	50	74

investigation. Three assessment instruments were used: (1) the Metropolitan Achievement Test (Form A: Primary Batter II), (2) Developmental Test of Visual-Motor Integration, and (3) the Educational Developmental Laboratories' Reading Eye Camera Test. In Sections (1) through (3) of the report, the relevant research hypotheses are stated in null form and the results of the statistical tests employed to test these hypotheses are reported. Six separate two-way analyses of variance were made on an IBM 360 Model 67 computer. The two-way analysis design was used to test the (1) main effect of group visual aid treatment, (2) the main effect of pretesting, and (3) the interaction between the two main effects. Subjects' posttest scores were dependent variables.

Metropolitan Achievement Test Form A: Primary Battery II

1. Metropolitan: Work Knowledge

The first hypothesis was stated in Chapter I regarding Metropolitan Achievement Test: Word Knowledge. The null hypothesis is:

H_1 Educationally handicapped students underachieving in reading, when given visual-aid reading instruction using the controlled reader and tachistoscopic-X machine will not show significantly greater gains in reading performance as measured on the Metropolitan Achievement Test, Subtest Word Knowledge, than educationally handicapped students who are not given such an instructional program.

The analysis of the data reported in Table 4 does not reject the first null hypothesis since data show the $P > .05$. Hence the groups receiving visual aid training failed to achieve higher word knowledge scores in the posttesting period than groups not receiving the special

visual aid training treatment. Furthermore, neither the pretest effect nor the interaction of pretesting with visual aid instruction effect reached levels of significance.

Table 4

Summary of Analysis of Variance for Metropolitan Achievement Test: Subtest Word Knowledge

Source	Sum of Squares	DF	Mean Squares	F Values	P Less Than
Treatment	3.496	2	1.748	0.028	0.973
Pretesting	47.551	1	47.551	0.756	0.388
Interaction	12.470	2	6.235	0.099	0.906
Within Cells	4279.848	68	62.939	---	---

2. Metropolitan: Word Discrimination

The second hypothesis was stated in Chapter I regarding Metropolitan Achievement Test: Word Discrimination. The null hypothesis is:

H_2 Educationally handicapped students underachieving in reading, when given visual-aid reading instruction using the controlled reader and Tachistoscopic-X machine will not show significantly greater gains in reading performance as measured on the Metropolitan Achievement Test, Subtest Word Discrimination, than educationally handicapped students who are not given such an instructional program.

The analysis of the data reported in Table 5, does not reject the second null hypothesis since data show the $P > .05$. Hence the groups receiving visual aid training failed to achieve higher word discrimination scores in the posttesting period than groups not receiving the special visual aid training treatment. Furthermore, neither the pretest effect

nor the interaction of pretesting with visual aid instruction effect reached levels of significance.

Table 5

Summary of Analysis of Variance for Metropolitan Achievement Test: Subtest Word Discrimination

Source	Sum of Squares	DF	Mean Squares	F Values	P Less Than
Treatment	17.469	2	8.734	0.229	0.796
Pretesting	90.333	1	90.333	2.373	0.128
Interaction	24.578	2	12.289	0.323	0.725
Within Cells	2588.772	68	38.070	---	---

3. Metropolitan: Reading

The third hypothesis was stated in Chapter I regarding Metropolitan Achievement Test: Reading. The null hypothesis is:

H_3 Educationally handicapped students underachieving in reading when given visual-aid reading instruction using the controlled reader and Tachistoscopic-X machine will not show significantly greater gains in reading performance as measured on the Metropolitan Achievement Test, Subtest Reading, than educationally handicapped students who are not given such an instructional program.

The analysis of the data reported in Table 6, does not reject the third null hypothesis since data show the $P > .05$. Hence the groups receiving visual aid training failed to achieve higher reading scores in the posttesting period than groups not receiving the special visual aid training. Furthermore, neither the pretest effect nor the interaction

of pretesting with visual aid instruction effect reached levels of significance.

Table 6

Summary of Analysis of Variance for Metropolitan Achievement Test: Subtest Reading

Source	Sum of Squares	DF	Mean Squares	F Values	P Less Than
Treatment	87.059	2	43.529	0.305	0.738
Pretesting	299.253	1	299.253	2.097	0.152
Interaction	117.043	2	58.521	0.410	0.665
Within Cells	9702.051	68	142.677	---	---

Developmental Test of Visual-Motor Integration

The fourth hypothesis was stated in Chapter I regarding visual motor integration. The null hypothesis is:

H_4 Educationally handicapped students underachieving in reading, when given visual-aid reading instruction using the controlled reader and Tachistoscopic-X machine will not show significantly greater gains in visual-motor performance as measured on the Developmental Test of Visual-Motor Integration than educationally handicapped students who are not given such an instructional program.

The analysis of the data reported in Table 7, does not reject the fourth null hypothesis since data show the $P > .05$. Hence the groups receiving visual aid training failed to achieve higher visual-motor integration scores in the posttesting period than groups not receiving the special visual aid training. Furthermore, neither the pretest effect

nor the interaction of pretesting with visual aid instruction effect reached levels of significance.

Table 7

Summary of Analysis of Variance for Developmental Test of Visual-Motor Integration

Source	Sum of Squares	DF	Mean Squares	F Values	P Less Than
Treatment	2.624	2	1.312	0.078	0.925
Pretesting	1.252	1	1.252	0.074	0.786
Interaction	8.229	2	4.115	0.245	0.784
Within Cells	1143.746	68	16.820	---	---

EDL Reading Eye Camera Test: Fixation

The fifth hypothesis was stated in Chapter I regarding eye fixation movements. The null hypothesis is:

H_5 Educationally handicapped students underachieving in reading, when given visual-aid reading instruction using the controlled reader and Tachistoscopic-X machine, will not show significantly greater gains in eye-movement performance as measured on the EDL Reading Eye I Camera: Fixation than educationally handicapped students who are not given such an instructional program.

The analysis of the data reported in Table 8, support rejection of the fifth null hypothesis since the data show that $P < .05$. Hence the groups receiving visual aid training were significantly lower in number of eye fixations in the posttesting period than groups not receiving special visual aid treatment. However, neither the pretest effect nor

the interaction of pretesting with visual aid instruction effect reached levels of significance.

Table 8

Summary of Analysis of Variance for EDL Reading Eye Camera Test: Fixation

Source	Sum of Squares	DF	Mean Squares	F Values	P Less Than
Treatment	1783.321	2	891.660	9.415	0.001
Pretesting	58.235	1	58.235	0.615	0.436
Interaction	19.520	2	9.760	0.103	0.902
Within Cells	6440.270	68	94.710	---	---

The sixth hypothesis was stated in Chapter I regarding difference in visual aid motility training treatment on fixation. The null hypothesis is:

H_6 Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader approach, will not show significantly greater gains in eye-movement performance as measured on the EDL Reading Eye I Camera: Fixation than educationally handicapped students who are given the Tachistoscopic-X instructional program.

Data recorded in Table 9 show the posttest means for the number of eye fixations for each group. The controlled reader treatment groups and the Tachistoscopic-X treatment groups appear to be similar in the decreased number of eye fixations.

Since there were treatment differences, it was necessary to determine where these differences occurred. The Neuman-Keuls Test

Table 9

Group Means: Pretest and No Pretest for Control, Controlled Reader and Tachistoscopic-X Groups on Eye Regressions

	Treatment			
	Control	Controlled Reader	Tach-X	Row Means
Pretest	42.462	29.923	32.587	35.054
No Pretest	39.727	29.692	31.250	33.278
Column Means	41.208	29.807	31.918	34.187

Table 10

Differences in Column Means Used in Computing Neuman-Keuls Test

	Controlled Reader	Tach-X	Control
Controlled Reader	---	2.11	11.40*
Tach-X	---	---	9.29*
Control	---	---	---

*P less than .05.

(Table 10) uses the difference between means to test for significance.

The analysis of the data shown in Table 10, using the Neuman-Keuls Test, does not reject the sixth hypothesis since data show that $P > .05$. Although the Controlled Reader groups and the Tachistoscopic-X groups were found to be significantly better in decreasing the number of eye fixations than the control groups, no significant difference was found between the Controlled Reader groups and Tachistoscopic-X treatment groups.

EDL Reading Eye Camera Test: Regression

The seventh hypothesis was stated in Chapter I regarding eye regression movements. The null hypothesis is:

H_7 Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader and Tachistoscopic-X machine, will not show significantly greater gains in eye-movement performance as measured on the EDL Reading Eye I Camera: Regression than educationally handicapped students who are not given such an instructional program.

The data reported in Table 11 support rejection of the seventh null hypothesis since the data show that $P < .05$. Hence the groups receiving visual aid training were significantly lower in number of eye regressions in the posttesting period than groups not receiving special visual aid treatment. However, neither the pretest effect nor the interaction of pretesting with visual aid instruction effect reached levels of significance.

Table 11

Analysis of Variance Results for Posttesting in EDL Reading Eye Camera Test: Regression

Source	Sum of Squares	DF	Mean Squares	F Values	P Less Than
Treatment	230.880	2	115.440	4.514	0.014
Pretesting	5.527	1	5.527	0.216	0.644
Interaction	37.654	2	18.827	0.736	0.483
Within Cells	1739.071	68	25.575	---	---

The eighth hypothesis was stated in Chapter I regarding difference in visual aid motility training treatment on regression. The null hypothesis is:

H_8 Educationally handicapped students underachieving in reading, when given visual aid reading instruction using the controlled reader approach, will not show significantly greater gains in eye-movement performance as measured by EDL Reading Eye I Camera: Regression than educationally handicapped students who are given the Tachistoscopic-X instructional program.

Data recorded in Table 12 show the posttest means for the number of eye regressions for each group. The controlled reader treatment groups and the Tachistoscopic-X treatment groups appear to be similar in the decreased number of eye regressions.

Since there were treatment differences, it was necessary to determine where these differences occurred. The Neuman-Keuls Test (Table 13) uses the difference between means to test for significance.

Table 12

Group Means: Pretest and No Pretest for Control, Controlled Reader and Tachistoscopic-X Treatment on Eye Regressions

	Treatment			
	Control	Controlled Reader	Tach-X	Row Means
Pretest	13.308	7.615	9.500	9.631
No Pretest	10.818	8.077	10.167	9.611
Column Means	11.333	7.846	9.834	9.621

Table 13

Differences in Column Means Used in Computing Neuman-Keuls Test

	Controlled Reader	Tach-X	Control
Controlled Reader	---	1.98	4.32*
Tach-X	---	---	2.34
Control	---	---	---

*P less than .05.

The analysis of the data shown in Table 13 above, using the Neuman-Keuls Test, does not reject the eighth null hypothesis since data show that $P > .05$. The Controlled Reader groups were not significantly better in decreasing the number of eye regressions than either the control groups or Tachistoscopic-X groups. No significant difference

existed between Controlled Reader and Tachistoscopic-X treatment groups.

SUMMARY

The fourth chapter of this report presented the data of the study which had been subjected to six separate two-way analyses of variance. Data for the posttesting of the following variables were reviewed: (1) word knowledge, word discrimination and reading, (2) visual-motor integration, and (3) eye-movement performance. Two hypotheses were subjected to the Neuman-Keuls Test to find out if either one of the two visual aid instructional approaches resulted in improved eye-movement performance.

The .05 level of significance was required for the rejection of the null hypotheses. There was no interaction of pretest with visual aid instruction. Furthermore, no pretest effect was found in posttesting. Of the eight hypotheses presented in Chapter 3, only the treatment hypothesis dealing with eye movement performance showed significance. Groups receiving the visual-aid motility training scored significantly lower in posttesting in the number of fixations and regressions than groups not receiving the special visual aid motility training treatment.

A second null hypothesis pertaining to which visual-aid treatment, controlled reader or Tachistoscopic-X, helped to decrease the number of fixations and regressions in eye movement performance was rejected when results favoring the groups receiving controlled reader and Tachistoscopic-X treatments proved to be highly significant over the control groups.

The final chapter of this study, Chapter V, presents the investigator's interpretation of the findings reported in this chapter. In addition, the investigator offers recommendations for further study based upon the findings of the investigation.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The current experimental research made use of two visual aid instruments: the Controlled Reader and Tachistoscopic-X machines in order to explore their effects on reading improvement and eye-movement performance among elementary educationally handicapped learning disability students.

SUMMARY OF THE STUDY

In this chapter, the investigator has presented: (1) a summary of the study, (2) conclusions reached from analyzing the research data, (3) implications drawn from the study, and (4) recommendations for further research.

The Setting and Selection of Participants

The setting for the study making use of visual aid instruction included nine elementary schools of the Stockton Unified School District in Stockton, California which had an educationally handicapped learning disability program. Subjects in the nine schools were limited to seventy-four boys and girls in grades two through six who were participating in the learning disability program.

The Procedure of the Study

Seventy-four subjects were randomly assigned into six groups to a modified Solomon Pre-Post Control Group Design. The research design

was organized and conducted according to the detailed procedure outlined in Chapter III.

One control group received both pretesting and posttesting, and a second control group received only posttesting. An experimental group received pretesting, the experimental controlled reader visual aid treatment, and posttesting. A third control group received the Controlled Reader visual aid treatment and posttesting, but not pretesting. A second experimental group received pretesting, the experimental Tachistoscopic-X visual aid treatment, and posttesting. Finally, a fourth control group received the Tachistoscopic-X visual aid treatment and posttesting, but not pretesting.

Twice weekly for ten weeks the two experimental groups and the two control groups involved in treatment met for twenty minutes of visual motility training sessions. The aim of the sessions was to decrease the number of fixations and regressions in eye movement performance.

During each Controlled Reader visual efficiency session, lines of letters were projected in a left-to-right manner on the blackboard. The student counted the number of times a designated letter or number appeared in an exercise. The controlled reader, using filmstrips Set MT, concentrated on heightening visual discrimination while simultaneously seeking to improve directional attack. Further, this type of training refined the student's letter or number recognition capability.

In each Tachistoscopic-X session, lines of letters and numbers were brought into focus for a predetermined interval of seconds (1 1/2, 1, 1/2, 1/4, 1/10, 1/100) and then out of focus again. The Tachistoscopic-X using filmstrips Set 22 and Set 31, attempts to force the student to form and hold a strong mental image of the letters, or numbers

for which he is looking. The Tachistoscopic-X visual training sessions also stressed visual discrimination and improvement in directional attack.

Analysis of the Data

The investigator used three instruments in the testing phases of the study, including: (1) the Metropolitan Achievement Test-Form A: Primary II Battery, Subtests Word Knowledge, Word Discrimination and Reading, (2) the Developmental Test of Visual Motor Integration, and (3) the EDL Reading Eye Camera Test.

Following the final posttesting, the investigator submitted the obtained data to six separate two-way analyses of variance. Dependent variables were the subjects' posttest scores on the three testing instruments. A .05 level of significance determined the rejection of the null hypotheses.

The findings of this study, to be reviewed in the next section, "Conclusions From Analysis of Variance Research," should be viewed with the following limitations in mind:

1. The investigator recognizes the danger in drawing final conclusions from one experimental study and urges the reader to observe the same caution in reading the contents of this chapter.

2. Readers should only generalize conclusions and implications drawn from this study to second through sixth grade educationally handicapped learning disability students.

3. Readers should be aware in their generalizing of the conclusions and implications drawn from this study that one investigator was responsible for the investigation. In order that the study could be replicated in other settings, he gave a detailed presentation of the

procedures in Chapter III which he had followed in the group visual efficiency training.

4. Readers should be aware in their generalizing of the conclusions and implications drawn from this study that there was a small number of subjects participating who attended the limited number of twenty group visual aid sessions extended over a ten week period.

CONCLUSIONS FROM ANALYSIS OF VARIANCE RESEARCH

The primary objectives of this study were to investigate the effectiveness of visual aid instruction in improving the reading performance of educationally handicapped learning disability students.

Secondary objectives of this study were to investigate the effectiveness of two visual aid instruments in decreasing the number of eye movement fixations and regressions during the reading act.

The first, second, and third hypotheses were not substantiated. These indicated that visual efficiency training did not have a positive impact on the reading performance of educationally handicapped learning disability students in elementary schools. This finding is consistent with those reported by Taylor and Roberson,[1] Freeman,[2] and Goldberg and Arnott,[3] which have found no known scientific evidence to support claims

---

[1]Stanford E. Taylor and H. Alan Roberson, The Relationship of the Oculo-Motor Efficiency of the Beginning Reader to His Success in Learning to Read (Paper presented to the American Educational Research Association, February, 1963), Huntington, New York: Educational Developmental Laboratories, 1963, pp. 5-6.

[2]R. D. Freeman, "Controversy Over Patterning as a Treatment for Brain Damage in Children," Journal of the American Medical Association, 202:385-388, October 30, 1967.

[3]H. K. Goldberg and W. Arnott, "Ocular Motility in Learning Disabilities," Journal of Learning Disabilities, 3:160, March, 1970.

for improving academic abilities, i.e., reading of learning disabled children with treatment based solely on visual training.

The fourth hypothesis likewise was not confirmed. This indicated that visual efficiency training has little or no effect on visual motor integration for educationally handicapped learning disability students in the elementary school. The most obvious explanation for the discrepancy in the findings relative to visual motor integration and visual efficiency training lies with the question of congruence between the instructional content which required recognition of unlike letters and number symbols, and the Visual-Motor Integration Test which stresses the copying of geometric forms.

However, the findings of this study supported the fifth and seventh hypotheses that groups receiving visual motility training would have significantly lower eye-movement fixation and regression scores during reading than those not receiving the special visual treatment. Both the Controlled Reader and Tachistoscopic-X treatment groups' post-test scores were significantly lower than scores of the control group.

Finally, the sixth hypothesis was also not confirmed. This indicated that neither one of the visual aid treatment approaches, Controlled Reader and Tachistoscopic-X machines, was more successful in decreasing the number of eye fixations of the educationally handicapped learning disability students. Clearly related to this matter are the findings of the eighth hypothesis. This hypothesis was not confirmed, indicating that although the Controlled Reader groups were significantly better in decreasing the number of eye regressions than either the controlled group or Tachistoscopic-X groups, no significant difference existed between the Controlled Reader and Tachistoscopic-X treatment groups.

IMPLICATIONS OF THE STUDY

Bearing in mind the limitations of the study, the investigator viewed the results with encouragement. The significant changes in eye movement fixation and regression, which the seventy-four educationally handicapped learning disability students had shown after receiving group visual aid treatment experienced, indicate that both the Controlled Reader and Tachistoscope-X machines can help these students who are having reading difficulties.

In dealing with the educationally handicapped learning disability children, the Eye Movement Camera can be used as a comprehensive diagnostic tool to indicate the child's strengths and weaknesses in visual skills. From the results indicated by using the Camera, a specific, systematic plan of remedial visual treatment can be developed and applied. It is important to remember that each reading disabled child is different, and no single methodology can be described as the one method for him. Specific methods should be prescribed to fit the individual child. These methods are to be stimulating to him as well as beneficial.

The problem of learning disability in reading has become a matter of increasing public concern. A child's inability to read with understanding as a result of defects in processing visual symbols is a major obstacle to school learning and has far-reaching social and economic implications. Since clues in letter and word recognition are transmitted through the eyes to the brain, it has become common practice to attribute reading difficulties to subtle ocular abnormalities presumed to cause faulty visual perception.

The causes of reading disability are almost too varied to tabulate, but it is important for us to know that the visual process as well as the

nervous system can break down at many places. When a disabled reader has difficulty in learning to read, the nature of his problem must be taken into consideration. Whether his reading disability is the result of malformation, birth trauma, later brain injury, infection, an inherited characteristic or a maturational lag is only a partial explanation. What is important is determining whether this disability is permanent or whether it is nonpermanent or changing. If there is a possibility of the latter, some initial remedial program utilizing visual aid as one possibility to help improve the reading disability faced by the educationally handicapped student should be attempted.

According to Cerami,[4] there is need to stress better education of the public at large as well as school personnel concerning the importance of visual care which treats near point skills involved in reading.

Present techniques on visual efficiency are as yet unproven and, frequently, quite inadequate in terms of the total remedial reading problem for the educationally handicapped student. This observation does not imply that there are no worthwhile ideas available but that the parent, teacher, and psychologist who wish to work with the educationally handicapped student in need of visual remediation must know enough about the processes of reading and visual subskills to make quality judgments concerning visual remediation in terms of specific needs of a particular child with reading disability. Even though the use of specific visual exercises for near point remedial reading is largely artificial in character, inherently there seems to be no legitimate argument against the practice.

---

[4]C. Cerame, "Your Child's Vision Can Be Improved," Woman's Day, April, 1966.

RECOMMENDATIONS FOR FURTHER STUDY

The promising findings at the conclusion of the two visual aid treatments do give evidence that the methods could be helpful in assisting the educationally handicapped learning disability student in improving his eye movement efficiency during reading. Since one must not conclude from a single study that visual aid is the final solution to the problem of eye movement performance in reading, the investigator recommends that further study be made in the following areas:

1. Other investigators should perform replications of the group visual aid methods in an effort to substantiate the study's findings and to generalize them to wider school population than just educationally handicapped students.

2. Investigators should conduct further research with students of differing socio-economic and racial backgrounds to find the impact which visual efficiency training might have in assisting those who are experiencing some disability in learning to read.

3. Such visual aid machines leave no ambiguity in response and would permit careful investigation and discovery of the different rate of learning between the children with differing learning disabilities. In general, the teaching with visual aid instruments in motility training can help provide an increased understanding of specific physiological subskills required during the reading process. Furthermore, consideration needs to be given to research on the rate of learning, the size of steps in a program, and also the type of response required in motility training.

4. Investigators should experiment to find the effectiveness of regulated automatically timed exposure material utilized in visual

efficiency training on educationally handicapped learning disability students. Possibly longer durations of exposure time might increase lasting effects of visual memory on the part of the educationally handicapped students.

5. Educationally handicapped learning disability students of varying grade levels who are given visual efficiency training should undergo visual aid treatment so that conclusions can be drawn regarding the method's effectiveness with educationally handicapped learning disability students of each grade level.

6. Researchers should investigate to ascertain the effect of visual motility training on educationally handicapped learning disability students found to have poor eye movement efficiency under varying definitions of underachievement and for specific determined causes of learning disability in reading.

7. Reading specialists, teachers of educationally handicapped learning disability students, and classroom teachers should conduct studies to find visual material which have the greatest value for certain types of students with learning disabilities that would aid in developing visual subskills during the reading process.

8. Researchers recognizing that most remedial groups will vary considerably should consider control studies with stratified treatment groups. That is, it might be best to select groups with homogeneous problems and apply homogeneous treatment procedures, rather than treating all types of problems together.

9. Researchers should investigate to ascertain whether or not the reduction of the subskills of eye movement fixation and regression can lead to an improvement in reading performance.

SUMMARY

The investigator has summarized the experimental study in the visual aid treatment and reviewed its findings. Although stated limitations should be observed, the significant findings of the study indicated that visual aid treatment demonstrated effectiveness as a model in decreasing the number of eye fixations and regressions among educationally handicapped learning disability students in elementary schools.

The use of visual motility training did not improve reading performance. However, many experts feel that a correlation exists between eye movement (or ocular motor) skills and reading. Since such skills are considered essential to satisfactory progress in reading, this study may provide some helpful information in future studies on reading.

APPENDIX A

TACHISTOSCOPE WORKSHEET

NAME:	R	W
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
WORK LEVEL: TOTAL		

APPENDIX B

GROUP	SUBJECT	PRETEST						POSTTEST					
		MAT			BEERY	EYE-MOVEMENT		MAT			BEERY	EYE-MOVEMENT	
		WORD KNOWLEDGE	WORD DISCRIMINATION	READING		FIXATION	REGRESSION	WORD KNOWLEDGE	WORD DISCRIMINATION	READING		FIXATION	REGRESSION
A	11	11	27	3	15	36	9	16	31	13	18	52	12
	17	11	16	21	8	59	19	14	14	15	9	41	10
	16	13	25	19	17	23	5	23	32	23	22	47	6
	19	22	28	34	15	41	17	25	25	37	99	27	6
	24	11	7	11	11	67	43	14	12	23	10	49	24
	25	5	17	9	15	52	35	24	16	13	13	47	16
	41	14	25	15	12	34	7	31	22	24	14	55	21
	39	8	22	8	12	40	15	20	25	10	9	43	24
	51	10	16	9	15	44	19	15	16	18	12	37	11
	59	31	27	27	15	35	9	30	28	33	17	25	5
	61	3	21	4	12	51	14	9	22	2	19	39	13
	74	18	29	33	18	67	26	27	27	34	16	48	13

PRETEST AND POSTTEST RAW SCORES ON METROPOLITAN ACHIEVEMENT TEST (FORM A: PRIMARY II BATTERY), BEERY'S DEVELOPMENTAL TEST OF VISUAL-MOTOR INTEGRATION, AND EYE-MOVEMENTS FOR CONTROL GROUPS A AND B

GROUP	SUBJECT	PRETEST						POSTTEST					
		MAT			BEERY	EYE-MOVEMENT		MAT			BEERY	EYE-MOVEMENT	
		WORD KNOWLEDGE	WORD DISCRIMINATION	READING		FIXATION	REGRESSION	WORD KNOWLEDGE	WORD DISCRIMINATION	READING		FIXATION	REGRESSION
	5							10	23	12	17	38	10
	10							23	31	40	17	44	12
	21							10	11	10	10	48	18
	22							26	31	39	20	36	6
	26							36	29	48	11	42	14
B	30							15	16	13	14	38	9
	31							18	29	28	6	77	28
	34							37	35	45	18	24	3
	36							28	32	38	11	42	12
	46							23	28	28	19	26	9
	62							19	26	16	15	50	8
	66							30	31	44	15	14	2

POSTTEST RAW SCORES ON METROPOLITAN ACHIEVEMENT TEST (FORM A: PRIMARY II BATTERY), BEERY'S DEVELOPMENTAL TEST OF VISUAL-MOTOR INTEGRATION, AND EYE-MOVEMENTS FOR CONTROL GROUP B

GROUP	SUBJECT	PRETEST						POSTTEST					
		MAT			BEERY	EYE-MOVEMENT		MAT			BEERY	EYE-MOVEMENT	
		WORD KNOWLEDGE	WORD DISCRIMINATION	READING		FIXATION	REGRESSION	WORD KNOWLEDGE	WORD DISCRIMINATION	READING		FIXATION	REGRESSION
	7	33	33	41	16	38	16	33	32	48	16	29	7
	9	17	19	19	10	47	17	25	26	23	10	31	8
	13	29	31	26	9	54	22	25	27	27	21	30	9
	15*	11	7	5	7	--	--	3	12	14	11	32	10
	32	14	25	9	16	25	6	19	27	12	13	20	4
C	35	18	25	9	17	25	8	22	23	17	17	19	5
	45	16	13	14	14	33	12	17	17	26	20	24	66
	49	27	29	34	17	29	10	34	34	43	15	20	4
	54	14	22	12	5	38	11	18	25	29	10	36	12
	55	29	33	34	20	33	6	31	33	37	21	40	10
	65	7	12	10	13	67	26	9	21	18	9	39	7
	69	32	30	42	10	37	13	35	30	43	19	31	9
	72	14	25	9	9	34	10	14	20	13	6	38	8

* This subject was unable to move her eyes from left to right during eye-movement pretest.

PRETEST AND POSTTEST RAW SCORES ON METROPOLITAN ACHIEVEMENT TEST (FORM A: PRIMARY II BATTERY, BEERY'S DEVELOPMENTAL TEST OF VISUAL-MOTOR INTEGRATION, AND EYE-MOVEMENTS FOR CONTROLLED READER GROUP C

GROUP	SUBJECT	PRETEST						POSTTEST					
		MAT			BEERY	EYE-MOVEMENT		MAT			BEERY	EYE-MOVEMENT	
		WORD KNOWLEDGE	WORD DISCRIMINATION	READING		FIXATION	REGRESSION	WORD KNOWLEDGE	WORD DISCRIMINATION	READING		FIXATION	REGRESSION
	18							23	30	37	9	18	2
	23							32	32	45	13	30	5
	48							30	30	34	14	39	13
	50							34	20	23	10	37	11
	53							24	33	29	16	38	11
	56							8	18	13	13	27	11
D	57							13	30	18	16	35	14
	63							16	20	44	16	35	8
	64							26	25	29	21	26	3
	67							35	35	46	17	12	1
	70							20	17	20	10	33	9
	71							15	22	15	15	30	10
	73							20	23	22	10	26	7

POSTTEST RAW SCORES ON METROPOLITAN ACHIEVEMENT TEST (FORM A: PRIMARY II BATTERY), BEERY'S DEVELOPMENTAL TEST OF VISUAL-MOTOR INTEGRATION, AND EYE-MOVEMENTS FOR CONTROLLED READER GROUP D

GROUP	SUBJECT	PRETEST						POSTTEST					
		MAT			BEERY	EYE-MOVEMENT		MAT			BEERY	EYE-MOVEMENT	
						FIXATION	REGRESSTION					FIXATION	REGRESSION
		WORD KNOWLEDGE	WORD DISCRIMINATION	READING				WORD KNOWLEDGE	WORD DISCRIMINATION	READING			
	2	24	32	38	16	35	10	32	34	48	17	34	7
	4	13	19	9	15	35	9	19	23	18	16	28	6
	14	18	24	18	9	40	10	20	23	23	13	36	8
	27	5	11	12	12	94	37	12	23	19	12	37	8
	20	13	17	21	12	44	16	16	17	20	16	34	16
E	33	18	21	7	13	25	8	13	20	11	19	41	20
	37	21	20	8	13	33	6	18	29	27	19	22	6
	40	13	22	8	10	62	29	20	19	15	15	33	9
	42	10	17	11	17	35	12	17	25	14	9	22	6
	43	22	27	20	15	33	10	27	25	36	12	28	7
	47	16	23	15	16	31	11	26	23	18	9	40	8
	58	30	34	37	16	43	11	31	33	46	15	36	13

PRETEST AND POSTTEST RAW SCORES ON METROPOLITAN ACHIEVEMENT TEST (FORM A: PRIMARY II BATTERY), BEERY'S DEVELOPMENTAL TEST OF VISUAL-MOTOR INTEGRATION, AND EYE-MOVEMENTS FOR TACTISTOSCOPIC-X GROUP E

GROUP	SUBJECT	PRETEST						POSTTEST					
		MAT			BEERY	EYE-MOVEMENT		MAT			BEERY	EYE-MOVEMENT	
		WORD KNOWLEDGE	WORD DISCRIMINATION	READING		FIXATION	REGRESSION	WORD KNOWLEDGE	WORD DISCRIMINATION	READING		FIXATION	REGRESSION
	1							19	29	25	17	44	16
	3							20	29	16	17	43	15
	6							30	34	39	16	38	11
	8							33	32	46	19	29	8
	12							19	20	20	14	16	2
F	28							27	23	21	13	34	11
	29							27	30	38	12	30	11
	38							21	29	24	7	27	13
	44							24	20	27	18	31	9
	52							28	24	28	17	15	3
	60							17	27	23	19	39	14
	68							19	32	19	9	29	9

POSTTEST RAW SCORES ON METROPOLITAN ACHIEVEMENT TEST (FORM A: PRIMARY II BATTERY), BEERY'S DEVELOPMENTAL TEST OF VISUAL-MOTOR INTEGRATION, AND EYE-MOVEMENTS FOR TACTISTOSCOPIC-X GROUP F

APPENDIX C

EYE MOVEMENT PHOTOGRAPHY - A HISTORY OF PROGRESS

The principles of eye movement recording was scientifically observed and researched as early as 1826. Since that time, a multitude of ingenious methods have been used in an effort to learn more about how man's eyes serve him. The evolution of these methods are divided into three stages: (1) direct observation, (2) through the development of mechanical and electrical devices for recording eye movement, and (3) to the more refinded approach of eye movement photography. A more complete history dealing with eye movement recording has been examined by Carmichael and Dearborn,[1] and Taylor.[2] This review is primarily concerned with a brief historical description of representative examples of methods developed to record the eye movements made by human subjects while reading.

The direct observation methods were those by which eye movements were directly observed without the aid of intermediate recording devices. The problem investigated under the direct observation approach concentrated on general, qualitative classification of larger and slower eye movements. According to Taylor,[3] these were the three major direct observation methods:

1. A mirror was placed either beside or above the reading

---

[1]Leonard Carmichael and Walter F. Dearborn, Reading and Visual Fatigue, Boston: Houghton Mifflin Company, 1947.

[2]Earl A. Taylor, Controlled Reading, Chicago: University of Chicago Press, 1937.

[3]Stanford E. Taylor, Eye-Movement Photography With the Reading Eye, Huntington, New York: Educational Developmental Laboratories, Inc., 1960, pp. 4.

material so that the observer could count the eye movement by watching the subject's eye.

2. Telescopes, microscope, and magnifying lenses and other means to magnify the eye were used so that the observer could more clearly see and objectively count eye movements.

3. A small peephole was cut into the middle of the copy to be read. The observer placed his own eye close to the peephole, and peering through, counted the eye movements made by the subjects.

According to Carmichael and Dearborn,[4] the main disadvantage of direct methods of observing eye movements such as those just considered was that no permanent record of the actual movements themselves was available for measurement or study when the observation was completed. Further, such a procedure failed to obtain quantification or measurement of the constituent movements of the reading pattern or other eye behavior.

Due to the disadvantages, indirect methods of observation were therefore developed involving techniques or apparatus which had the intermediary function of making eye movement records which could later be measured, interpreted, and analyzed by the researcher. The second stage of eye movement methods were based on mechanical and electrical approaches. Several mechanical methods had been developed. These latter methods will be discussed first.

A number of studies stressing mechanical methods were conducted in the early nineteen centuries. Early recordings of vertical eye lid movements were made by Ohm.[5] He placed levers against the side of the eyeball or fastened them directly to the eyelid with adhesive tape. As

---

[4]Carmichael and Dearborn, op. cit., pp. 146-153.

[5]J. Ohm, "Zur graphischen Registrierung des Augenzittenns der Bergleute und der Lidbewegungen," Zeitschr, f. Augenheilk, 32:4-8, 1914.

the eye rotated, the movements were amplified through additional levers, and the movements were recorded on a Kymograph.*

Buy[6] conducted another study where he laid pneumatic capsules over the eyelid or against the eyeball. The movement of the eye compressed the capsule which activated a tambour and this in turn activated the Kymograph's recording stylus.

Lamare,[7] who collaborated with Javal, devised a method by which eye movements could be "heard" instead of "seen." In this study, a tambour with a protruding stem was held against one eyeball. Two rubber tubes running from the tambour were inserted into the ears of the experimenter. The changes in air pressure were audible, allowing the experimenter to listen to and count the movements.

Several experimental studies by Arhens,[8] Delabarre,[9] and Huey,[10] attempted to use different kinds of materials in the form-fitting cups that were placed on the cornea of the eye. These form-fitted cups were made of ivory, aluminum, rubber, carnelian marble or steel ball. Attached to the cups were levers or threads which activated a recording

---

*A Kymograph is a revolving drum to which is usually attached smoked paper upon which a stylus may leave a tracing.

[6]E. Buy, "Uber die Nystagnographie beim Menschen," Internat. Zentralbl. f. Ohrenhk., 9:57-65, 1910.

[7]A. Lamare, "Des Mouvenments des Yeux dans la Lecture," Bull. Mem. Soc. Franc. D'Ophtal., 10:354-364, 1892.

[8]A. Ahrens,"Untersuchungen über die Bewegung der Augen biem Schreiben,"Rostock, 1891.

[9]E. B. Delabarre, "A Method of Recording Eye-Movements," American Journal of Psychology, 9:572-4, 1898.

[10]E. B. Huey, "Preliminary Experiments in the Physiology and Psychology of Reading," American Journal of Psychology, 9:575-586,1898.

stylus when the eye moved. A later study by two experimenters, Marx and Trendelenburg,[11] included placing a mirror on the cup which reflected a beam of light onto a screen where the movements could be observed.

The disadvantage in using the mechanical methods was that it employed attachments to or pressures against the eye which caused discomfort to the subject. Also, eye movement record was limited because the kymographic record was limited to the length of time it took the drum to revolve. Finally, there was a lack of sensitivity in recording eye movement. During the time that research studies were being conducted in mechanical methods, a few studies using electrical methods were performed with some success. According to Taylor:

> The electrode method was found to be superior to previously mentioned techniques using direct observation and mechanical methods in that subject's eyes were unencumbered and his head was relatively free.[12]

As the work progressed, it became evident that the most objective and successful method of studying eye movement in reading was that of photography. Carmichael and Dearborn[13] explained that the general group of photographic methods could be distinguished according to the manner in which the photographic equipment was used. There were three photographic approaches: (1) kinetoscopic method, (2) mirror reflection method, and (3) cornea-reflection method.

The technique known as the Kinetoscopic or "movie" photography used some small object on the eye or cornia, and then still pictures were

---

[11]E. Marx and W. Trendelenburg, "Uber die Genauigkeit der Einstellung des Auges Beim Fixieren," Zeischr. f. Sinnesphysiol. 45:87-102, 1911.

[12]Taylor, op. cit., p. 5.

[13]Carmichael and Dearborn, op. cit., pp. 160-168.

taken of a particular structure of the eye. Mirrors were also used with the Kinetoscope so as to pick up light reflected from the eye. The first photograph of eye movements was believed to have been made by Dodge in November 1899 on a five-inch by seven-inch falling plate.[14] His photographic technique was essentially a kinetoscopic record of particular structures of the eye. Later studies by Judd et al.,[15] involved the placement of small pieces or flakes of Chinese white pigment on the cornea of the eye. The subject was held stationary in a specially built chair with firm head and back supports. In front of the subject was a rigid crossbar to furnish a firm rest for the upper teeth. This simple control made possible the discrimination of head movements as distinct from true eye movement. Also it was possible to photograph the full face of the subject by a motion picture camera. The motion pictures were enlarged through projection, and the movement of the "eye-spot" plotted off to indicate the movement of the eye.

It was typical of kinetoscopic methods that, whether the photographing was direct or indirect, a record was still made of some relatively gross feature of the eye or of some "eyepiece" such as a bead or flake. The more involved the print, the more difficult the interpretation and quantification of the record. In the interest of refining the record, mirror reflection methods were developed which recorded simply a

---

[14]Raymond Dodge and T. S. Cline, "The Angle Velocity of Eye Movement," Psychological Review, 8:145-157, 1901.

[15]C. H. Judd, C. N. McAllister, and W. M. Steele, "General Introduction to a Series of Studies of Eye Movements by Means of Kinetoscopic Photographs," Psychological Monographs, 7:1-16, 1905.

beam of light reflected from mirrors placed on or over the eye.[16]

The mirror reflection methods also known as photokymography, was a technique used in recording phenomena of a variety of voluntary movement such as eyelid reflexes, knee jerks, muscle tonus, pulse, etc. Dodge helped pioneer the development of a standard apparatus utilizing the methods of mirror reflection. A mirror was mounted into a spectacle frame so that it could be held against a closed eyelid. A beam of light was reflected from the mirror and recorded onto the photographic film.[17]

The major disadvantage of the mirror reflection method was that it required that some of the apparatus be in contact with the eye of the subject. If the subject did not become accustomed to the contact, or if the mirror caused pain or inconvenience, it could influence the results secured by its use. Furthermore, the mirror reflection method did not involve the use of two eyes in reading as they would normally be. Finally the mirror reflection method could not accurately reflect all of the eye movements. As a result of such disadvantages, some rearrangement of the camera and optical system were made through further research. These changes have resulted in the development of the now common and valuable corneal reflection methods.

The so-called corneal reflection method was and is by far the most widely used photographic method because of its reliability and convenience. In this procedure a beam of light is reflected directly from the natural mirror of the cornea into a camera and onto sensitive plates

---

[16]Raymond Dodge, "A Mirror-Recorder for Photographing the Compensatory Movements of Closed Eyes," Journal of Experimental Psychology, 4:165-74, 1921.

[17]Ibid.

of film.[18]

From 1907 to 1931, a number of corneal reflection cameras were built at various universities and reading centers. Most of these cameras were quite elaborate and tremendous in size. Taylor[19] provided the following description of these corneal reflection cameras:

1. Wesleyan University Camera, Designed by Dr. Raymond Dodge, 1899-1901. Known as the "falling-plate" or Dodge-Cline camera, this was the first camera to use the corneal reflection method.

2. University of Wisconsin Camera, designed by Dr. Walter F. Dearborn, 1905-1907. This improved camera used a three-inch film about three feet long, propelled by a roller friction drive.

3. University of Chicago Camera, designed by Dr. Clarence T. Gray, 1910-1911, and improved and modified by Dr. Guy T. Buswell. This camera provided for binocular photography as well as photographing a third bead to distinguish head movements and was the first camera to use motion picture film.

4. Stanford University Camera, designed by Dr. Raymond Dodge, but remodeled by Dr. Walter R. Miles in 1922. This camera used a length of panchromatic film instead of the falling plate principle and recorded both horizontal and vertical movements.

5. University of Minnesota Camera, built under the direction of Dr. Miles A. Tinker in 1930. This is one of the most elaborate of the large cameras which have been constructed. It was about ten feet long and five feet high.

Not until 1932 was a small, semiportable camera invented. This was called the Ophthalmograph and was offered commercially by the American Optical Company. The Ophthalmograph was designed by James Y. Taylor, Carl C. Taylor and Earl A. Taylor and was available until about 1939.[20]

---

[18]Carmichael and Dearborn, Loc. cit.

[19]Taylor, op. cit., pp. 6-9

[20]Ibid.

Beginning in the 1960's, a new eye movement camera called the Reading Eye was devised by Earl A. Taylor's son, Stanford Taylor. It is presently sold by the Educational Developmental Laboratories of Huntington, New York. The present method of photographing the eyes involves the focusing of a small beam of light on the cornea of the reader's eye. The reflection of the light is focused by means of a lens system onto moving film. The reading is done from cards with 100-words selections, ranging in difficulty from first grade through adult levels of difficulty. As the subject begins to read, a small motor sets the film into motion at the rate of one inch every 2-1/2 seconds. The exposed film is rolled into a magazine from which the film can be removed and immediately developed.[21]

The graphs obtained during the reading by the subject provide information on (1) rate of reading, (2) number of fixations and regressions per 100 words, (3) average span of recognition, and (4) average duration of the fixations. Also the graph may show (5) rhythm of the movement habit, (6) general efficiency, (7) binocular coordination, or inefficient and wasteful movements which the reader may have habituated.

All of the data which includes fixations, regressions, span of recognition, duration of fixation, and rate are compared with national norms researched by Taylor, Frackenpohl and Pettee.[22] In this way a performance profile is created. This information also serves as a basis for calculating the reader's equivalent grade level performance.

---

[21]William Kottmeyer, Teacher's Guide for Remedial Reading, St. Louis: Webster Publishing Company, 1959, pp. 70-73.

[22]Stanford E. Taylor, Helen Frackenpohl, and James L. Pettee, Grade Level Norms for the Components of the Fundamental Reading Skill, EDL Research and Information Bulletin No. 3. Huntington, New York: Educational Developmental Laboratories, 1960.

APPENDIX D

Stockton Unified School District

ADMINISTRATION CENTER – 701 N. MADISON STREET
TELEPHONE 466-3911
STOCKTON, CALIFORNIA 95202

Board of Education
HARRY W. HEDBURG, JR.
President
FERNANDO MORENO
Vice President
MRS. JAMES HAND
Member
EARL TAYLOR, M.D.
Member
MRS. ENNIS C. WOODRUFF
Member

Superintendent of Schools
J. ROLAND INGRAHAM, JR.
Deputy Superintendent
GORDON L. CHAMBERLIN
Business
Assistant Superintendents
JEFF B. WEST
Elementary Education
LEONARDO C. PACHECO
Secondary Education

January 29, 1971

To: Don Evans, Coordinator, Special Education
From: Jeff West, Assistant Superintendent
Elementary Education

Re: Making Data Available to Jeffrey Lee

Mr. Jeffrey Lee, a part-time employee of the Stockton Unified School District, is interested in collecting data concerning disabilities of children in the learning disabilities groups in grades one through six. These data will be used by him in a dissertation at the University of the Pacific. Mr. Lee should be given access to the cum folders and case studies on all the children in this program in the elementary grades. I would appreciate it if you would cooperate with him in every way.

rfv

UNIVERSITY OF THE PACIFIC

SCHOOL OF EDUCATION Stockton, California Founded 1851
95204

DEPARTMENT OF EDUCATIONAL
AND COUNSELING PSYCHOLOGY

8 February 1971

Elementary School Principal
Stockton Unified School District
Stockton, California

Dear Sir:

Mr. Jeffrey C. Lee is a doctoral candidate enrolled in the Department of Educational and Counseling Psychology at the University of the Pacific. He is under the advisement of Dr. Heath W. Lowry, Director of the Laura Ann Sisk Memorial Reading Clinic at the university. Mr. Lee is presently working on a dissertation topic concerning various treatment approaches to improving the reading efficiency of learning disability students. This study is in partial fulfillment of the requirements for the Doctor of Education Degree.

The experimental study proposed by Mr. Lee would require the participation of students who have been legally admitted into the Stockton Unified School District's Learning Disability Program. Currently, little scientific research is being conducted concerning treatment procedures for learning disability students. Furthermore, it is our belief that such a study would be instrumental in providing insight and a better understanding of the needs of these learning disability students.

We would appreciate your cooperation in assisting Mr. Lee in the gathering of his data.

Sincerely,

W. Preston Gleason
Dept. Chairman

WPG/sem

February 16, 1971

Jeff,

Duplicate letters, such as the attached one to Dr. Clark, also went to the following elementary school principals:

Lester Carson,	Montezuma School
Edgar Bryant	Fillmore School
Lorne H. Patterson	August School
Edwin Tiede	Harrison School
George McCormick	Hazelton School
John Spooner	Tyler School
Verner Story	Madison School
Robert Scott	El Dorado School

gr

February 16, 1971

Dr. Charles Clark
Principal, Woodrow Wilson School
Stockton Unified School District
Stockton, California 95202

Dear Charles;

Mr. Jeffrey Lee will be contacting you concerning a study to approaches to reading problems with elementary children who have learning disabilities. I have reviewed this project with Mr. Lee and I think it would help some elementary school children as well as to providing more research to the Educationally Handicapped Program.

There appears to be a minimum amount of time that would involve the local school and I think it is a section of research that needs attention. I support Mr. Lee's efforts and I hope that you will see reason to do likewise.

Sincerely,

Don F. Evans
Coordinator, Special Education

DFE:gr

c.c. - Jeffrey Lee

BIBLIOGRAPHY

BIBLIOGRAPHY

Ahrens, A. Untersuchungen uber die Bewegung der Augen biem Schreiben, Rostock, 1891.

Aiken, Catherine. Method of Mind Training. New York: Harper and Brothers Publishers, 1896.

Ashlock, Patrick and Alberta Stephen. Educational Therapy in the Elementary School. Springfield: Charles C. Thomas, 1966.

Barry, Hortense. "The Young Aphasic Child: Evaluation and Training," Volta Review, Washington, D.C., 1961.

Barsch, Ray H. "Counseling the Parent of the Brain-Damage Child," Journal of Rehabilitation, Vol. XXVII, No. 3, (May-June, 1961).

Bateman, Barbara. "Learning Disabilities-Yesterday, Today, and Tomorrow," Exceptional Children, 31 (December, 1964).

Bear, Robert M. "The Dartmouth Program for Diagnostic and Remedial Reading with Special Reference to Visual Factors," Educational Record, XX, Supplement No. 12, January, 1939.

Beery, Keith E., and Norman A. Buktenica. Developmental Test of Visual-Motor Integration (Administration and Scoring Manual). Follett Publishing Company, Chicago, Illinois, 1967.

Behrmann, Polly. "Activities for Developing Visual-Perception," Academic Therapy Publication. San Rafael, California, 1970.

Bender, Loretta. "Specific Reading Disability as a Maturational Lag," Bulletin of the Orton Society, Vol. XIII, 1963.

Bennett, Chester Clarke. An Inquiry Into the Genesis of Poor Reading. New York: Teachers College, Columbia University, 1938.

Berner, George E. "When is it Safe to Use the Eyes for Reading?" Twenty-Ninth Annual Schoolmen's Week Proceedings: Education in a Nation at War. University of Pennsylvania, June 26, 1942.

Betts, Emmett A. The Prevention and Correction of Reading Difficulties. Evanston, Illinois: Row, Peterson and Company, 1936.

Bond, Guy and Eva Bond. Developmental Reading in High School. New York: McMillian Company, 1941.

_____ and Miles Tinker, Reading Difficulties. New York: Appleton-

Century-Crofts, 1967.

_____ and _____. Reading Difficulties, Their Diagnosis and Correction. New York: Appleton-Century Crofts, Inc., 1957.

Bormuth, John R. and Cleatus C. Aker. "Is the Tachistoscope a Worthwhile Teaching Tool?" Reading Teacher, 14, January, 1961.

Brown, C. B. "Teaching Spelling with a Tachistoscope," English Journal, 40, 1950.

Brown, J. I. "Vocabulary Via Tachistoscope: A Visual Approach to Improved Reading Ability," Educational Screen, 30, 1951.

Bryant, N. Dale. "Some Principles of Remedial Instruction for Dyslexia," Reading Teacher, 18:7 (April, 1965).

Buswell, Guy T. Fundamental Reading Habits: A Study of Their Development, Supplementary Educational Monographs, No. 21. Chicago: University of Chicago Press, 1922.

_____. Remedial Reading at the College and Adult Levels: An Experimental Study, Supplementary Educational Monographs No. 50. Chicago: Department of Education, University of Chicago, 1939.

Buy, E. "Uber die Nystagnographie beim Menschen," Internat. Zentralbl. f. Ohrenhk., 9:57-65, 1910.

California Administrative Code, Title 5, Provisions Pertaining to Programs for Educationally Handicapped Minors, Section 3230. Sacramento: California State Department of Education, November, 1969.

California Administrative Code, Section 2, Article 27, Subchapter 1, of Chapter 1 Title V.

Campbell, Donald T. "Factors Relevant to the Validity of Experimentals in Social Settings," Psychological Bulletin LIV (July, 1957).

_____ and Julian C. Stanley. Experimental and Quasi-Experimental Designs for Research. Chicago: Rand McNally and Company, 1963.

Carmichael, Leonard, and Walter F. Dearborn. Reading and Visual Fatigue. Boston: Houghton Mifflin Company, 1947.

Center, Stella S. "The Significance of the Reading Clinic," The English Journal, XXVII, May, 1938.

Cerame, C. "Your Child's Vision Can be Improved," Woman's Day, April, 1966.

Chalfant, James C., and Margaret A. Scheffelin. Central Processing Dysfunctions in Children: A Review of Research. National Institute of Neurological Diseases and Stroke Monography No. 9. U. S. Department

of Health, Education, and Welfare, Bethesda, Maryland, 1969.

Cole, Luella W. Elementary School Subjects. New York: Rinehart and Company, Inc., 1946.

Contemporary Issues in Elementary Education. Washington, D.C.: The Educational Policies Commission of the National Education Association, 1960.

Crowley, Regis F. "Teaching the Slow Learner," Today's Education, 58: 48-49, January, 1969.

Cruickshank, William M., F. A. Bentzer, F. H. Ratzeburg and T. A. Tannhauser. "Teaching Methods for Brain-Injured and Hyperactive Children." Syracuse, New York: Syracuse University Press, 1961.

Dahlberg, Charles C., Florence G. Roswell, and Jeanne Chall. "Psychotherapeutic Principles as Applied to Remedial Reading," Elementary School Journal, 53 December, 1952.

Dearborn, Walter F. The Psychology of Reading. Columbia University Contribution to Philosophy, Psychology, and Education, Vol. XIV, No. 1. New York: Columbia University Press, 1906.

_____, and Vincent S. Wilking. "Improving the Reading of College Freshmen," School Review, XLIX, November, 1941.

Dechant, Emerald. Diagnosis and Remediation of Reading Disability. New York: Parker Publishing Company, Inc., 1968.

_____. Improving the Teaching of Reading. Englewood Cliffs, N.J., Prentice Hall, Inc., 1964.

DeHirsch, Katrina, Jeannett Jansky, and William Langford. Predicting Reading Failure. New York: Harper and Row, 1966.

Delabarre, E. G. "A Method of Recording Eye-Movements," American Journal of Psychology, 9:(1898).

Delacato, Carl H. The Diagnosis and Treatment of Speech and Reading Problems. Springfield, Illinois, Charles C. Thomas, 1963.

D'Evelyn, Katherine. Meeting Children's Emotional Needs. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1959.

Dodge, Raymond. "A Mirror-Recorder for Photographing the Compensatory Movements of Closed Eyes," Journal of Experimental Psychology, 4: (1921).

_____, and T. S. Cline. "The Angle Velocity of Eye Movement," Psychological Review, 8: (1901).

Dolch, Edward W. Remedial Reading. Champaign, Illinois, Garrard Publishing Company, 1953.

Duker, Sam. "Listening and Reading," Elementary School Journal, 65, March, 1965.

Durost, Walter N. (editor). Metropolitan Achievement Test (Primary II: Battery for Grade 2). New York: Harcourt, Brace & World, Inc. 1959.

Durrell, Donald D. Improvement of Basic Reading Abilities. Yonker-On-Hudson, New York: World Book Company, 1940.

_____. Improving Reading Instruction. New York: World Book Company, 1956.

Eames, T. H. "A Comparison of the Ocular Characteristics of Unselected and Reading Disability Groups," Journal of Educational Research, 24: (March, 1932).

Edgington, Ruth. Helping Children with Reading Disability. Chicago, Illinois: Developmental Learning Materials, 1962.

Eisenberg, Leon. "Epidemiology of Reading Retardation," The Disabled Reader, ed. John Money and Gilbert Schiffman. Baltimore: John Hopkins Press, 1966.

Eurich, Alvin C. "The Reliability and Validity of Photographic Eye-Movement Records," Journal of Experimental Psychology, 24: (1933).

Evans, Donald F. Resource Guide for the Educationally Handicapped Program, Curriculum Bulletin No. 228, Stockton: Unified School District, 1970.

Fernald, Grace M. Remedial Techniques in Basic School Subjects. New York: McGraw-Hill, Inc., 1943.

Foltz, Charles I. The World of Teaching Machines. Teaching Research and Technology Division Electronic Teaching Laboratories, Washington, D.C.: 1961.

Frackenpohl, Helen. Motility Training, Research and Information Bulletin No. 7, Huntington, New York: Educational Developmental Laboratories, 1965.

Frandsen, Arden. "An Eye-Movement Study of Objective Examination Question," General Psychological Monographs, 16: (1934).

Freeman, R. D. "Controversy Over Patterning as a Treatment for Brain Damage in Children," Journal of the American Medical Association, 202, October 30, 1967.

Frierson, Edward C., and Walter B. Barbe. Educating Children with Learning Disabilities: Selected Reading. New York: Appleton-Century Crofts, 1967.

Fries, Charles C. Linguistics and Reading. New York: Holt, Rinehart and Winston, 1962.

Frostig, Marianne. "Visual Modality and Reading," in Helen K. Smith (ed.) Perception and Reading. International Reading Association. Newark, Delaware: 12:4, 1968.

_____, and D. Horne. The Frostig Program for the Development of Visual Perception. Chicago: Follett, 1964.

Garrett, Henry E. Statistics in Psychology and Education. New York: Longmans, Green and Company, 1958.

Gates, Arthur I. "Diagnosis and Treatment of Extreme Cases of Reading Disability," The Teaching of Reading: A Second Report, the Thirty-sixth Yearbook of the National Society for the Study of Education. Bloomington, Illinois: Public School Publishing Company, 1937.

_____. "Teaching Reading Tomorrow." Paper presented at the Third General Session, International Reading Association, Kansas City, Missouri, May 2, 1962.

_____. The Improvement of Reading. New York: MacMillan Company, 1927.

_____. "The Role of Personality in Reading Disability," Journal of Genetic Psychology, 57:77, January, 1941.

Getman, G. N. "The Visuomotor Complex in the Acquisition of Learning Skills: In Jerome Hellmuth, Learning Disorders Vol. I. Seattle: Special Child Publication, 1965.

Gillingham, Ann, and Bessie Stillman. "Remedial Training for Children with Specific Disability in Reading, Spelling, and Penmanship," Cambridge, Massachusetts: Educators Publishing Service, 1960.

Goins, Jean T. "Visual Perceptual Abilities and Early Reading Progress," Supplementary Educational Monographs, No. 87, Chicago: University of Chicago Press, 1958.

Goldberg, Herman K., and William Arnott. "Ocular Motility in Learning Disabilities," Journal of Learning Disabilities, 3:40-42, March, 1970.

Gould, Lawrence N., et. al. "Vision Motor Perception Program in the Brentwood Public Schools," In J. Allen Figurel (ed.), Improvement of Reading Through Classroom Practice, International Reading Association Conference Proceeding Volume 9. Newark, Delaware: International Reading Association, 1964.

Gray, William S. "Reading," Encyclopedia of Educational Research, edited by Walter S. Monroe. New York: Macmillan Company, 1941.

Harris, Albert J. How to Increase Reading Ability (4th edition). New York: David McKay Company, Inc., 1961.

Hildreth, Gertrude. "Some Principles of Learning Applied to Reading," Education, 74 (May, 1954).

Hinshelwood, James. Congenital Word Blindness. London: H. K. Lewis, 1917.

Huey, E. B. "Preliminary Experiments in the Physiology and Psychology of Reading," American Journal of Psychology, 9: (1898).

Johnson, Doris J. Educational Principles for Children with Learning Disabilities, in Donald D. Hammill and Nettie R. Barrel (editors) Educational Perspectives in Learning Disabilities. New York: John Wiley and Son, Inc., 1971.

_____, and Helmer R. Myklebust. Learning Disabilities: Educational Principles and Practices. New York: Grune and Stratton, 1967.

_____. "Treatment Approaches to Dyslexia," International Reading Association Conference Proceedings, Vol. 13, Part III, 1969.

Judd, C. H., C. N. McAllister, and W. M. Steele. "General Introduction to a Series of Studies of Eye Movements by Means of Kinetoscopic Photographs," Psychological Monographs, 7: (1905).

Kaluger, George, and Clifford J. Kolson. Reading and Learning Disabilities. Columbus, Ohio: Charles E. Merrill Publishing Co., 1969.

Kephart, Newell C. "Learning Disability: An Educational Adventure," Kappa Delta Pi, West Lafayette, Indiana, 1968.

_____. The Slow Learner in the Classroom. Columbus: Ohio: Charles E. Merrill Books, Inc., 1961.

_____. "Visual Behavior of the Retarded Child," Monograph of the American Journal of Optometry, 35: (1958).

Kirk, Samuel A. Educating Exceptional Children, (2nd edition). Boston: Houghton Mifflin Company, 1972.

_____. Teaching Reading to Slow-Learning Children. Boston: Houghton-Mifflin Co., 1940.

Kottmeyer, William. Teacher's Guide for Remedial Reading. St. Louis, Montana: Webster Publishing Company, 1959.

Kress, Roy A. "When is Remedial Reading Remedial?" Education 80:540, May, 1960.

Ladd, Margaret Rhodes. The Relation of Social Economic and Personal Characteristics to Reading Ability. New York: Columbia University Contribution to Education, No. 582, 1933.

Lamare, A. "Des Mouvenments des Yeux dans la Lecture," Bull. Mem. Soc. Franc. D'Ophtal., 10: (1892).

Lanning, Frank, and Russell Robbins. "The Slow Learner," The Instructor, 77:183, October, 1967.

Laws and Regulations Relating to Education and Health Services for Exceptional Children in California, Section 6750. Sacramento: California State Department of Education, 1969.

Lee, R. B. "Value of Metron-o-scope Reading," The National Elementary Principal, XVIII, February, 1939.

Litterer, Oscar F. "An Experimental Analysis of Reading Performance," Journal of Experimental Education, 1: 1932.

Marx, E., and W. Trendelenburg. "Uber die Genauigkeit der Einstellung des Auges beim Fixieren," Zeischr. f. Sinnesphysiol. 45:(1911).

McCallister, James M. Remedial and Corrective Instruction in Reading. New York: D. Appleton-Century Company, 1936.

McCarthy, James J. and Joan F. McCarthy. Learning Disabilities. Boston, Massachusetts: Allyn and Bacon, Inc., 1969.

McGinnis, Mildred, F. R. Kleffner, and R. Goldstein. "Teaching Aphasic Children" Volta Review, 1959.

MacLatchy, Josephine. "Bexley Reading Study," Educational Research Bulletin, XXV, September, 1946.

McLeod, Pierce H. Readiness for Learning: A Program for Visual and Auditory Perceptual-Motor Training, California State Series, J. B. Lippincott Company, 1965.

Mills, Robert E. "An Evaluation of Techniques for Teaching Word Recognition," Elementary School Journal, 56, January, 1956.

Money, John. Reading Disabilities. Baltimore, Maryland: The John Hopkins Press, 1962.

Monroe, Marion. Children Who Cannot Read. Chicago: University of Chicago Press, 1932.

Moore, Joseph E. "Metron-o-scope Reading: A Critical Evaluation of Mr. Lee's Study," The Peabody Reflector and Alumni News, XII, August, 1939.

Morse, William C., Richard L. Cutter and Albert H. Finks. Public School Classes for the Emotionally Handicapped: A Research Analysis. Washington: Council for Exceptional Children, 1964.

Napoli, Joseph. "Environmental Factors and Reading Ability," The Reading Teacher, (March, 1968).

National Advisory Committee on Handicapped Children: First Annual Report, Special Education for Handicapped Children, Washington, D.C.: U. S. Department of Health, Education and Welfare, Office of Education, 1968.

O'Brian, J. A. "Training in Perception as a Means of Accelerating the Silent Reading Rate," Journal of Educational Psychology, 11, 1920.

Ohm, J. "Zur graphischen Registrierung des Augenzittenns der Bergleute und der Lidbewegungen," Zeitschr, F. Augenheilk, 32: (1914).

Orton, Samuel. Reading, Writing, and Speech Problems in Children. New York: Norton, 1937.

Otto, Wayne. "A Guide to Helping Pupils with Learning Problems," The Clearing House, 40: October, 1965.

Park, George E. "Nature and/or Nurture Cause Reading Difficulties?" Archives of Pediatrics 69: November, 1952.

_____, and James D. Linden, "The Etiology of Reading Disabilities: A Historical Perspective," Journal of Learning Disabilities, 5: May, 1968.

Pollack, M. F. W., and Josephine A. Piekarz. Reading Problems and Problem Readers. New York: David McKay Co., 1963.

"Racial and Ethnic Report." Stockton, California: Stockton Unified School District, (October 21, 1970).

Rabinovitch, Ralph D. "Reading and Learning Disabilities," in Silvano Arieti (ed.), American Handbook of Psychiatry. New York: Basic Books, 1959.

Renshaw, Samuel. "The Visual Perception and Reproduction of Forms by Tachistoscopic Methods," Journal of Psychology, October, 1945.

Report on Education Research. Washington, D.C.: Capitol Publications, Inc., October 1, 1969.

Resource Guide for the Educationally Handicapped Program, Curriculum Bulletin No. 228, Stockton Unified School District, Stockton, California. Revised Edition, 1970. Don Evans, Coordinator of Special Education.

Robbins, N. A. "The Visual Aspects of Reading Problems," Nursery Outlook, 1: (1953).

Robinson, Helen M. Why Pupils Fail in Reading. Chicago: University of Chicago Press, 1946.

Sampson, Olive C. "Reading and Adjustment: A Review of the Literature," Educational Research, 8 (June, 1966).

Schubert, Delwyn G. The Doctor Eyes the Poor Reader. Springfield, Illinois: Charles C. Thomas Publishers, 1957.

Simpson, Dorothy M. Learning to Learn. Columbus, Ohio: Charles E. Merrill Publishing Company, 1968.

Sisson, Donald E. "Eye-Movement Training as a Means of Improving Reading Ability," Journal of Educational Research, XXXII, 1938.

Smith, Marguerite. "Metronoscope in Upper Grade Instruction," Texas Outlook, XXIV, March, 1940.

Smith, Robert. Teacher Diagnosis of Educational Difficulties. Columbus, Ohio: Charles E. Merrill, 1969.

Spache, George D. "Evaluation of Eye-Movement Photography in Reading Diagnosis and Reading Training," Research and Evaluation in College Reading, Ninth Yearbook of the National Reading Conference for College and Adults. Fort Worth: Texas Christian University Press, 1960.

_____. "Integrating Diagnosis with Remediation in Reading," Leo M. Schell and Paul C. Burns, Remedial Reading: An Anthology of Sources. Boston: Allyn and Bacon, Inc., 1968.

Stevens, Godfrey D., and Jack W. Birch. "A Proposal for Clarification of the Terminology Used to Describe Brain-Injury Children," Exceptional Children, 23:8 (May, 1957).

Strang, Ruth. Diagnostic Teaching of Reading. New York: McGraw-Hill Book Co., 1964.

_____. Problems in the Improvement of Reading in High School and College. Lancaster, Pennsylvania: The Science Press Printing Company, 1940.

Strauss, Alfred A., and Laura E. Lehtinen. Psychopathology and Education of the Brain-Injured Child. New York: Grune and Stratton, 1947.

Sutherland, Jean. "The Relationship Between Perceptual Span and Rate of Reading," Journal of Educational Psychology, 37, 1946.

Taylor, Earl A. Controlled Reading: A Correlation of Diagnostic Teaching and Corrective Techniques. Chicago: University of Chicago Press, 1937.

_____. Meeting the Increasing Stresses in Life. Illinois: Charles C. Thomas Publishers, 1963.

_____, and Harold A. Solan. Functional Reading and School Adjustment. New York: Reading and Study Skills Center, 1955.

Taylor, Stanford E. Eye Movements in Reading: Facts and Fallacies, EDL Research and Information Bulletin No. 18. Huntington, New York: Educational Developmental Laboratories, 1965.

_____. Eye-Movement Photography: Script to Accompany the Filmstrip. Educational Developmental Laboratories, Huntington, New York, 1962.

_____. Eye Movement Photography with the Reading Eye. Educational Developmental Laboratories, Inc. Huntington, New York: 1960.

_____, and Helen Frackenpohl. Controlled Reader, (Teacher's Guide). Educational Developmental Laboratories, Huntington, New York: 1970.

_____ and _____. EDL Tach-X, Flash-X, Tachistoscopic Techniques, (Teacher's Guide). Educational Developmental Laboratories. Huntington, New York: 1968.

_____, _____, and James L. Pettee. "A Report on Two Studies of Validity of Eye-Movement Photography As a Measure of Reading Performance," Reading in a Changing Society. International Reading Association Conference Proceedings, Volume 4, 1959.

_____, _____ and _____. Grade Level Norms for the Components of the Fundamental Reading Skills, EDL Research and Information Bulletin No. 3. Huntington, New York: Educational Developmental Laboratories, 1960.

_____, and H. Alan Roberson. The Relationship of the Oculo-Motor Efficiency of the Beginning Reader to His Success in Learning to Read. (Paper presented to the American Educational Research Association, February, 1963). Huntington, New York: Educational Developmental Laboratories, 1963.

Tinker, Miles A. "Reliability and Validity of Eye-Movement Measures of Reading," Journal of Experimental Psychology, XIX (December, 1936).

_____. "The Role of Eye-Movements in Diagnostic and Remedial Reading," School and Society, XXXIX, February, 1934.

Traxler, Arthur E. "Value of Controlled Reading: Summary of Research and Opinion," Journal of Experimental Education, II, June, 1943.

Urbancek, J. J. "The Speed-i-scope (Tachistoscope) Method for Teaching Mathematics," Visual Review, No. 50-2, Society for the Visual Education.

Van Dalen, Deobald B. Understanding Educational Research: An Introduction, Revised edition, New York: McGraw-Hill, 1966.

Wells, Gordon Keith. Pilot Study Use of the Tachistoscope in Elementary Grades. An unpublished thesis presented to the faculty of the School of Educationa, College of the Pacific, Stockton, California, June, 1956.

Wepman, Joseph M. "The Modality Concept-Including a Statement of the Perceptual and Conceptual Levels of Learning," in Helen K. Smith (ed.). Perception and Reading, International Reading Association, Newark, Delaware, 12:4, 1968.

Wilkings, Vincent S. "The Improvement of Reading Ability in College," Journal of the American Association of Collegiate Registrars, XVII, January, 1942.

Winer, B. J. Statistical Principles and Experimental Design. New York: McGraw-Hill, Inc., 1962.

Wintraub, Samuel. "What Research Say to the Reading Teacher," The Reading Teacher, 20:551-558, March, 1967.

Wiseman, Douglas. "Remedial Education: Global or Learning Disability Approach," Academic Therapy, 5:3. San Rafael, California, 1970.

Witty, Paul, and David Kopel. Reading and the Educative Process. New York: Ginn and Company, 1939.