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ABSTRACT

The purpose of the present study was to investigate whether the inclusion of visual tracking exercise in a remedial reading program would result in significant higher reading achievement scores when compared to a conventional remedial reading program. Seventy-five sixth-grade students, reading a year or more below grade level and potential, made up the 16 groups under investigation. Eight groups, chosen randomly, composed the experimental group which received practice in the "Visual Tracking" and "Word Tracking" workbooks of the Michigan Tracking Program, for 10 minutes at the beginning of each 40-minute reading period. The control group received conventional reading remediation for the entire 40 minutes. The groups were taught by eight remedial reading teachers, each having under her tutelage one experimental group and one control group. The teachers met both groups three times a week for three months. An analysis of test scores on standardized reading tests showed no significant differences between the control and experimental groups, and no statistically significant difference between boys and girls in the experimental group. It was concluded that the use of the visual and word tracking exercises was not warranted. (Tables of data and references are included.)

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THE EFFECT OF THE MICHIGAN TRACKING PROGRAM

ON GAINS IN READING

A THESIS

SUBMITTED TO THE FACULTY

OF THE GRADUATE SCHOOL OF EDUCATION

OF

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ABSTRACT

The main purpose of the present study was to investigate whether the inclusion of visual tracking exercises in a remedial reading program would result in significantly higher reading achievement scores compared to a conventional remedial reading program.

Seventy-five sixth-grade students, reading a year or more below grade level and potential, made up the 16 groups under investigation. Eight groups, chosen randomly, comprised the experimental group which received practice in the Visual Tracking and Word Tracking workbooks of the Michigan Tracking Program for 10 minutes at the beginning of each 40-minute reading period. The control group received conventional reading remediation for the entire 40 minutes. The groups were taught by eight remedial reading teachers, each having under her tutelage one experimental group and one control group. The teachers met both groups three times a week for three months.

An analysis of the pretest and posttest score differences of the Vocabulary, Comprehension, and Speed and Accuracy subtests of the Gates-MacGinitie Reading Tests, Survey D, showed that there were no statistically significant differences between the experimental and control groups.

When the difference scores were analyzed to see whether students with verbal or nonverbal IQ measures above or below 90 were affected differently by this type of training, it was found that there were no statistically significant differences between the experimental and control groups in Vocabulary or Comprehension. In Speed and Accuracy, students in the experimental groups with verbal IQ scores of 90 and below had significantly higher scores at the .01 level.

It was also found that there was no statistically significant difference between boys and girls who received visual tracking training in the experimental group.

On the basis of the statistical evidence for the population in this study, it was concluded that use of the visual and word tracking exercises of the Michigan Tracking Program was not warranted as it did not affect an increase in reading achievement over conventional remediation.

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CHAPTER I

THE PROBLEM

In his search for materials to use in remedial instruction for the retarded reader, the reading specialist must be discriminating in his choice as to those materials that will help his students most in the limited time generally allotted to remediation.

Visual tracking exercises are used in some reading centers that claim success for their overall programs. Zweig (1969), in a description of the Reading Guidance Center at Huntington Beach, California, lists the use of the Visual Tracking exercises by Smith as one of the nine activities for the teacher-taught lesson. He reports significant results with a high percentage of students attending the reading laboratory. However, since there are many activities to which the students are exposed, it is difficult to ascertain just what contribution is made by visual tracking.

Frostig (1968) reports that eye-tracking exercises are included in the program at The Marianne Frostig Center of Educational Therapy partly because of her agreement with Prechtl (1962) that it is common sense that erratic

eye movements retard reading, and partly because eye-tracking exercises are not harmful and should not be discarded unless their efficacy is disproved. Ayres (1968) also believes that it is appropriate to involve the eyes in some specific horizontal tracking exercises.

Statement of the Problem

Visual exercises, such as those espoused by the Michigan Tracking Program, are used in some remedial reading programs in the hope that they will result in improved reading scores. It is the purpose of this study to investigate whether such a training program does benefit retarded readers by ascertaining the following:

1. Will retarded readers who are given practice in visual tracking make greater gains in reading than those who are exposed to conventional reading materials only?

2. Would high or low verbal and nonverbal IQ scores be a factor in visual tracking training?

3. Would visual tracking exercises affect boys and girls differently resulting in reading gains favoring one sex over another?

Hypotheses

1. There is no significant difference in mean difference raw scores of the Gates-MacGinitie Reading Tests, Survey D, between sixth-grade remedial reading students

who receive practice in the Michigan Tracking Program and those who receive conventional remediation.

2. There is no significant difference in mean difference raw scores between sixth-grade students in the experimental and control groups who have verbal and nonverbal IQ's of 90 and below or 91 and above.

3. There is no significant difference in mean difference raw scores between sixth-grade boys and girls in the experimental group.

Definition of Terms

The definition of terms which follow pertain to this particular study rather than in the general sense.

Visual tracking. Visual tracking is a term given to a type of exercise in the Michigan Tracking Program authored by Geake and Smith (1962) designed to improve directional control and to correct errors such as additions, substitutions, reversals, hesitations, and omissions. It requires close attention in finding and striking out printed symbols on a page in a prescribed order suggested by a sample above each exercise.

Conventional reading materials. This term refers to materials generally used in the remedial reading situation to improve the skills of phonics, word recognition, and comprehension. Materials designed to give practice in phonics would consist of workbook exercises, charts,

overhead projector, word games, etc. Comprehension exercises would be provided in books such as McCall-Crabbs, Barnell-Loft, New Practice Readers, and Gates Peardon. Opportunities for word recognition improvement would be provided by tachistoscope practice on sight words, the use of the Language Master, and word games. The availability of high-interest, low-reading-level books for free reading would also be typical of the conventional remedial reading milieu.

Retarded readers. Reference to retarded readers is to students in the Reading Improvement Program whose instructional reading levels are one or more years below grade level when their reading potential, determined by their IQ scores, is taken into account. Candidates for the program are recommended by the classroom teachers. The remedial reading teacher servicing the school ascertains the child's reading level and potential.

Importance of the Study

Reading specialists are constantly looking for materials that will produce the greatest growth in reading in the shortest time. The Visual Tracking Program is being used more and more in remedial programs in the hope that it will result in greater gains in reading than use of conventional reading materials only. It is important that the block of time the remedial reading teacher spends

with his pupils be utilized in the most propitious manner. The importance of this study, then, is to determine whether visual tracking makes a positive contribution to reading achievement.

Limitations of the Study

This study was limited by the number of sixth-grade students enrolled in the Reading Improvement Program of Woodbridge Township, New Jersey, during the school year 1971-72. Also, the time devoted to this study spanned only three months of a nine-month program. The months of November and December were interlaced with many school holidays. Absences due to illness and inclement weather took their toll in January.

Overview of the Study

The remainder of this paper will cover in detail facets of the problems presented above. A review of the literature is found in Chapter II. A description of the population of the study, the training program, and the statistical design of the data are detailed in Chapter III. Chapter IV presents a discussion of the data and a comparison of results with studies cited in the review of the literature. The summary, conclusions, and suggestions for further research are contained in Chapter V.

CHAPTER II

REVIEW OF THE LITERATURE

There is hardly an aura of unanimity in the reading literature concerning the relationship between visual perceptual skills and reading. Some educators who believe there is a positive relationship are committed to perceptual training, yet others are skeptical of its value. It would seem appropriate to discuss various facets of visual perception as a background for the studies done in this area. It is the purpose of this chapter to:

1. Present some definitions of visual perception.

2. Discuss visual acuity in relation to visual perception and reading achievement.

3. Give a brief history of early perception studies.

4. Present some early and current theories of reading disorders related to visual perception.

5. Describe various programs which purport to improve visual perception.

6. Review studies related to visual perception and reading.

7. Review studies showing the effect of visual perceptual training on reading.

Definitions of Visual Perception

Inherent in most definitions of visual perception is the premise that cognitive functioning is involved. Vernon (1952) explains that the sense organs transmit nerve impulses to the central nervous system. Essential to the perceptual process, however, is the identification and understanding of meaning of the sensory impressions after they have reached the receptor areas of the cortex. She believes that naming is fundamental to the development of perception so that an object can be related to the conceptual category to which it belongs. Vernon also feels that perception develops slowly with age and is gradually built up in the light of experience.

Bruner (1957) seems to concur with Vernon's view of the importance of categorization. He believes visual perception is a process of discrimination--deciding how one thing is the same or different from another, with this information being sorted into categories. Placing it into categories implies giving it an identity. He feels that categorizing is often a silent or unconscious process.

Dechant (1970) states:

> Perception refers to the interpretation of everything that is sensed and that at a complex level, sensation is clothed with the perceiver's wealth of past experience and values. The percept reflects biological and environmental characteristics of the perceiver [p. 26].

Buswell (1957) states it succinctly, "Perception

is meaningful recognition [p. 101]."

Most definitions of visual perception would seem to agree that the perceptual process goes beyond what the eyes see in a merely physical sense and that the brain must process incoming sensory data to give it meaning, with the implication that this processing is affected by past experience.

Visual Acuity in Relation to Visual Perception and Reading Achievement

The term visual perception involves the central nervous system and should be distinguished from visual acuity which refers to sharpness of image and freedom of refractive errors. Grow (1955), an ophthalmologist, states that eye problems are seldom the cause of reading difficulty. Only when visual acuity is reduced 50% or more will the child have trouble interpreting symbols because of poor sight. He believes the effect of moderate refractive errors is generally exaggerated and does not feel that the poor reader is primarily an ophthalmological problem. Even muscle imbalance has little effect on reading ability since vision in one eye is adequate for reading and the image in the nonfixing eye is suppressed. He also rules out depth perception and variation in image size as seen by the two eyes as contributing causes. As Jampolsy (1955) so aptly puts it,

> Children with 20/400 vision may learn to read if they possess a 20/20 brain. But 20/20 vision in the presence of a 20/400 brain may lead to obvious problems. Cerebral astigmatism appears to be a more important cause of reading disability than the ocular variety [p. 88].

Robinson (1968) describes a very detailed study which attempted to identify visual factors important to reading achievement. The subjects were 100 children at each elementary grade level. The characteristics examined were:

1. Visual acuity at far and reading distances
2. Hyperopia
3. Myopia and astigmatism
4. Depth at far and near distances
5. Fusion at far and near distances
6. Accommodation, including range, amplitude, and relationship to convergence
7. Suppression.

The finding was that the relationships among the seven vision factors and reading were insignificant.

While aniseikonia was not one of the factors investigated in the above report, Rosenbloom (1968) describes a study to determine whether there is a significant difference in the incidence and severity of this condition between groups of good and poor readers in the elementary grades. Aniseikonia is a condition in which the ocular images of the two eyes are unequal in size and/or shape.

The subjects consisted of 40 retarded readers in grades 4 through 8 and 40 successful readers with equivalent IQ scores. The results showed that aniseikonia could not be regarded as a major inhibiting factor to reading achievement.

It would seem, then, that printed material will not have meaning to a viewer merely because he sees it clearly. "Meaning is dependent on experience, culture, emotional state of the reader, and the reader's ability to reconstruct his experiences [Dechant, 1970, p. 26]."

Brief History of Early Studies of Word Perception

Studies of eye movements and tachistoscopic experiments have contributed to our knowledge of the reading process. While it is commonly known today that the eyes do not move across the page in a continuous sweep, it was a French oculist, Javal, who in 1879 first called attention to the fact that the eyes move by a succession of quick short movements along a line of reading and return in a quick movement to the left. These movements are called "saccadic" eye movements from Javal's description of how the eyes moved "'par saccades' (in jerks) [Anderson & Dearborn, 1952, p. 102]." It is during the fixation pauses that the reader sees several letters simultaneously, rather than recognizes each letter separately. Professor

Cattell in 1886 concluded that we read in word-wholes since it took no longer to name a whole word than it did a single letter (Huey, 1908). Further evidence of word shape as a cue was given by Erdmann and Dodge in 1898 when they found that a word could be read at a distance at which individual letters could not be seen.

Word shapes did not influence the results of Zeitler's study in 1900 (Anderson & Dearborn, 1952) when he concluded that capital letters and letters that extended above and below the line dominated the perception of the word since they were reported correctly even though the word itself was misread. He called these "dominant letters." Goldscheider and Müller in 1893 also felt it was not probable that word shape was used as a cue (Huey, 1908). They found that recognition would still occur even when certain letters were omitted or, when present, would be disregarded. The letters which seemed to be used in determining the recognition of a word were named "determining letters" and the others were called "indifferent letters." Almost always the first letter was a determining one and did not necessarily have to be a consonant. The letters that projected above or below the line came next in providing a cue. Messmer, too, in 1904 found that children read less by word shapes than by certain details which catch the eye and that a large personal element

entered into their word recognition. Messmer also agreed with Zeitler's idea of "dominant letters." In addition, he found that ascenders yielded better cues than descenders and that the upper segments of words were easier to read than the lower (Anderson & Dearborn, 1952).

The foregoing is not to say that the value of word shapes or patterns is to be disregarded. Anderson and Dearborn (1952) point out that the pattern of a word may be useful when the word is very familiar, but perception of unfamiliar words requires greater attention to details. The beginning reader is more apt to identify words with dominant letters; recognition by pattern coming later through much practice. According to Huey (1908),

> The more unfamiliar the sequence of letters may be, the more the perception of the word proceeds by letters. With increase of familiarity, fewer and fewer clews suffice to touch off the recognition of a word or phrase, the tendency being toward reading in word wholes [p. 67].

While the above views seemed to put reading by wholes in an intelligent persepctive, the whole-word method of reading became very popular after the impetus of the studies by Cattell which were later confirmed by Erdmann and Dodge. The whole-word method got an even greater foothold with the popularity of the Gestalt psychologists who claimed that children perceive complex things in somewhat the same manner as adults (Diak, 1960). Hebb (1949) opposes the Gestalt argument (as does Diak)

that one perceives a figure as a distinctive whole without the need of a learning process. He reports on the monograph Senden wrote in 1932 describing the vision of the congenitally blind who were given sight by surgery. It was found that these people did not see objects as a whole for a long time and found it necessary to verify details of a figure over and over again in order to learn its shape. Even then they failed to recognize it if it were put in a new setting. For instance, they might recognize an object on the table, but not if it were suspended on a thread. This lead Hebb to conclude that perception requires a long, slow learning period with separate attention given to each part of a figure, gradually arriving at an identification of the whole. He called it "serial apprehension" as opposed to "simultaneous."

Vernon (1957) feels that the early word perception studies were carried out on adults and are studies of visual perception at the highest level. It would not be correct to think that the same type of recognition takes place with beginning readers. Adults may not be conscious of letters while they are reading because they have a great deal of experience with the printed word.

Some Early and Current Theories of Reading Disorders Related to Visual Perception

The possibility of localized cerebral disfunction is often cited as a cause of deficiencies associated with

reading disability. Verbal abilities are impaired by lesions of the dominant hemisphere which is the left one for a majority of right-handed children and for about one-half of the left-handed. Early descriptions of reading disorders and the origin of congenital word-blindness are reviewed by Doehring (1968) beginning with the late nineteenth-century observation by an English school physician, James Kerr, that some children who had severe reading problems seemed to have no other intellectual deficits. Shortly afterward, W. Pringle Morgan described a case of "congenital word-blindness" in a 14-year-old boy of normal intelligence. James Hinshelwood, a Glasgow ophthalmologist, in 1917, thought that congenital word-blindness resulted from a cortical defect which he assumed to be congenital because there was no history of any acquired cortical lesion.

It was the belief of Orton (1937), an American neurologist, that there are multiple causes for a delay in learning to read. In some cases, however, he found that such a delay was out of harmony with a child's general physical, mental, or emotional development and was characterized by confusion of oppositely oriented letters, a tendency to change the order of direction of reading, and a failure to recognize a printed word even after it has been seen many times. He labeled this condition

strephosymbolia--meaning "twisted symbols." He felt there was a strong probability that incoming visual stimuli are registered or recorded in both hemispheres of the brain. In the normal reader, these records or engrams remain strong in the dominant hemisphere and are elided or erased in the nondominant hemisphere. In the strephosymbolic reader, the engrams in the nondominant hemisphere have not been completely elided and cause confusion in recognition and recall. He noted the spontaneous ability in delayed readers for mirror reading and mirror writing which he attributed to the existence in the nondominant hemisphere of engrams of the opposite orientation from those in the dominant hemisphere. The treatment he recommended for these disabled readers consisted of a heavy emphasis on phonics presented in small units and simultaneous tracing of letters causing difficulty to fix the association of the sound and properly oriented letter form.

A certain proportion of reading disorders are believed by Kawi and Pasamanick (1959) to be due to pregnancy complications. In a study of 372 white male children with reading disorders compared to a control group of 372 normal readers, they found that there was a higher prevalence of premature births and abnormalities of the prenatal and paranatal periods among children with lower reading quotients. They point out that the reading

clinician should be aware of minimal cerebral injury as a possible factor in some cases of disabled readers.

Smith and Carrigan (1959) conclude, from a study comparing 526 children in grades 3 through 9 whose reading scores were below the twentieth percentile with 32 superior readers, that severe reading disability which resists correction may be a functional rather than a structural problem. They contend that certain types of nonreaders suffer from a disturbance of synaptic transmission affected by the production of the chemical substances acetylcholine and cholinesterase controlled by endocrine functioning.

A Review of Some Current Training Programs which Purport to Improve Visual Perception

The Frostig, Delacato, and various perceptual-motor programs are prominent in the area of perceptual training with the purpose of improving the reading performance of disabled readers. Chronologically, Delacato (1959) precedes the others. He believed that only by organizing the individual at his most efficient level (that of unilaterality) could a solution to his basic language difficulty be initiated. He was very preoccupied with the importance of establishing a dominant hemisphere and advocated a program centered around neurological organization and laterality. His program was to be adhered to from four to six weeks in order to establish a

one-sided individual. This training was ideally to precede remedial reading and encompassed the following features.

1. The dominant hand is made the skilled and most used hand; if necessary, the sub-dominant hand is put in a sling to immobilize it. Two-handed sports are discouraged.

2. The child is physically conditioned to be single footed and is encouraged to lead off with the dominant foot in all games and activities.

3. The dominant eye is strengthened by occluding the sub-dominant eye.

4. Singing or listening to music is curtailed so that the sub-dominant hemisphere is as inactive as possible.

5. The child is correctly posturalized during sleep so that the arm and leg on the side the child is facing are flexed, while the other arm and leg are extended.

6. Fluid intake is restricted, as is salt and sugar which retain fluid in the body.

Delacato's theory of faulty neurological organization has been challanged by Robbins and O'Donnel whose studies will be discussed in the next section.

Many people in the optometry field have become

interested in perceptual motor skills, especially in oculomotor skills as it pertains to visual efficiency. Most of their work is closely allied to the philosophy of A. M. Skeffington, an optometrist. He organized the Optometric Extension Program where interested optometrists take advanced study and train to work with children having "developmental vision problems" (Krippner, 1968). Getman and Kane (1964) believe that inability to read stems from a lack of basic perceptual skills and feel that the child should reach a certain level of developmental achievement before he is ready for first grade. In The Physiology of Readiness Getman and Kane (1964) expound the virtues of the following tasks which they deem appropriate to the school situation.

1. General movement patterns: jumpboard, walking beam, trampoline, running, and throwing games.

2. Special movement patterns for manipulative and eye-hand skills: cutting with scissors, working with hammer and nails, pegboards, tracing shapes, etc.

3. Eye movement patterns to encourage ocular motility.

In addition to the gross motor skills, Getman's program also encompasses visual memory training. This is done by flashing a shape on the tachistoscope projector and having the child trace it in the air (kinesthetic).

The shape is encircled by the child on a worksheet (matching) and is then traced on the worksheet (tactile). Finally, the child is asked to make one like it (visual memory). All work is done with geometric shapes.

Some reading studies (reviewed below) incorporate both the Getman and Kephart techniques. Though Kephart himself is a psychologist, he has worked closely with a number of optometrists and uses visual training procedures with disabled readers. He believes that children become slow learners because they come to school lacking in perceptual-motor skills which he feels will not be acquired necessarily through maturation or the function of innate responses (Kephart, 1960). In his view, when perceptual-motor deficiencies are detected in children, special training should be given. He believes in the hierarchy of educational tasks; that the child must become adept in the earlier ordered tasks before he can be successful in the small perceptual tasks that are required of reading. Kephart's program seems to be quite similar to Getman's in the area of physical activities and tracing of geometric forms. However, his program goes beyond the mastery of geometric shapes to the tracing of letters and words from a template.

Other visual training programs include the Lyons and Lyons method which stresses visual memory and the

reduction of subvocalization; the Armstead and Armstead method which uses tachistoscope training; and the Murroughs method which works on the "principle of multiple causation" (Lambeth, 1966).

Ophthalmologists are generally critical of the visual training programs espoused by the optometrists; the implication being that they desire to enhance their reputation with the lay public and pad their practice. Goldberg (1959), an ophthalmologist, claims that visual training may provide extra motivation, but does not correct an ocular defect or muscle weakness. An educator, Howards (1969) is more vehemently critical of the techniques and methods of people from the optometry field:

> That professionals should pay heed to men trained in the grinding of lenses and the giving of minimal visual tests is another indication of what happens when a vacuum is created; fools and opportunists rush in. . . . This "Mickey Mouse" cult has set us all back, especially the youth and their parents, who are legitimately concerned and are suffering as a result of these false prophets (take that word any way you wish) [pp. 12-13].

The philosophy behind the Frostig (1968) program seems to be much more sophisticated than the previously described visual-motor methods and delves into aspects of brain functioning rather than visual efficiency and ocular motility. Although the Frostig program does not include physical activities, Frostig does feel that there is an interaction between motor and perceptual abilities.

However, she does not believe that reading should be delayed until the child's motor abilities have improved, but that sensory motor training can be integrated with a beginning or remedial reading program, if indicated. She advocates teaching to the child's best modality while using specific training to develop lagging skills. The Marianne Frostig Developmental Test of Visual Perception evaluates five visual perceptual abilities that are involved in the process of discrimination. They are given below with a brief explanation of the behavior of children who are deficient in them (Frostig, 1968).

1. Eye-hand coordination. The child may have trouble coordinating his vision with the movement of his body. He may have difficulty with ordinary childhood tasks such as dressing himself and participating in games. In learning to read, he may have difficulty making the coordinated eye movements necessary in reading.

2. Figure-ground perception. Children with this deficit tend to skip words and lines, substitute words, and have difficulty locating specific information in reference books. A child with this disability cannot focus on the words in the correct order because his attention jumps from stimulus to stimulus. He may get stuck on a certain word because he cannot separate himself from the stimulus at will.

3. Constancy of perception. A child with this difficulty has trouble in differentiating among similar letters, as r-n-h or v-w, and with words of similar configuration, as hay and boy. He might recognize a word in one script, but not in another; or in one plane and not in another (blackboard vs. book). He might have trouble when he progresses to a new reader because he has difficulty transferring from one context to another and may have forgotten what he seemed to know well.

4. Position in space. This difficulty manifests itself in reversals of letters and words and in left-right discrimination.

5. Perception of spatial relationships. This refers to the ability to see the "pattern" of a word. The child may scramble the letters in a word (as differentiated from reversing), such as writing hsisp for ships. He might tend to have trouble reading maps, graphs, diagrams, and telling time.

Remedial techniques for the deficit areas outlined above are given in the Teacher's Guide and worksheets of the Frostig Program for the Development of Visual Perception.

Many of the above training programs are geared to the correction of associated deficiencies of reading, such as directional confusion, disturbances of visual-motor

functioning, inconsistency of eye-hand dominance, and delayed maturation of perceptual abilities. While some of these nonreading deficits may show a correlation with reading disability, it does not necessarily follow that they are the cause of such disability. Crosby and Liston (1968) believe that they may be an effect of the same neurological process that caused the reading disability itself.

The Relationship between Visual Perception and Reading

The relationship between visual perception and reading disability was investigated by Gates (1926) in a study of 310 children in grades 1 through 4. After administering visual perception tests using geometric figures, digits, and words, he found that only the tests employing words had substantial correlation with reading and spelling. Good readers, as well as poor readers, were in the lowest group in the nonverbal perception tests (although there were more poor readers). This led Gates to believe that perception is specialized and that a person who scores high on nonverbal items will not necessarily perceive words well; that verbal perception is a special kind of perception and in the majority of cases it cannot be predicted accurately from other types of perception. He concluded that very low levels of perceptive abilities are

probably sufficient for reading and, above this, additional perceptual aptitude had little effect on reading achievement.

Kendall (1948), in investigating the question of whether difficulty in learning to read was associated with low scores in a test of visual-motor memory or with a tendency to reverse designs, found that there were no significant relationships.

Goldmark (1964), in a study of 83 children in the second grade, found that correlations of perceptual tests with word recognition were low while the correlation with categorization was .614.

While the foregoing show low correlations between visual perceptual skills and reading, Goins (1958) found predictive validity of visual perception tasks with the reading achievement of first graders. The four highest tasks had correlations ranging from .38 to .52. The perceptual task of pattern copying had the highest correlation with reading (.52), followed by reversals (.50), figures (.39), and picture squares (.38).

Visual discrimination was found to be a better predictor of reading success than intelligence or auditory discrimination in the first and second grades (Kerfoot, 1964). An interesting finding here was that a large amount of unaccounted for variance in dependent variables

indicates that visual and auditory skills are only part of the equipment necessary for reading and spelling success.

Koppitz, Mardis, and Stephens (1961) found that scores on the Bender-Gestalt test given on entering school showed a correlation of .60 with reading achievement at the end of the first grade.

Bruininks (1969), in a study with first graders, found good readers significantly superior to poor readers in visual perceptual skills. However, in a study with third graders, he concluded that relationships between perceptual skills and reading performance were low to moderate and that intelligence scores produced a higher correlation. We see here an emerging picture of the importance of age and experience in connection with visual perceptual skills. The correlation between reading and perceptual skills appears to decrease with age while the correlations between reading and intelligence increases with age.

Schellenberg (1962) found that the Frostig Developmental Test of Visual Perception did not appear to differentiate adequate and retarded readers in the third grade, nor did Bender figures drawn by pupils.

Bryan (1964) found a higher relationship between the Frostig Developmental Test of Visual Perception and reading in grades 1 and 2, but in grade 3 intelligence

was more closely related. Frostig and Horne point out that their test cannot be predictive at higher grades. They found that the correlation between visual perception and reading is medium high at the first grade but diminishes to very slight at the third grade.

It would appear that the more recent studies acknowledge that a positive relationship exists between reading and visual perceptual skills at the first grade level and to a lesser extent at higher levels. Yet this observation is not unanimous. Feldman (1961), in a study involving 95 children at each grade level from kindergarten through grade 5, found a prolonged relation between reading and visual perception scores. She comments that continued instruction in visual perception skills might be useful in the upper grades. Her use of the word "continued" implies that visual perceptual training is an accepted treatment for children with reading difficulties in the lower grades. But this assumption is by no means universal. The effect of perceptual training on learning to read is still open to argument as the following studies will show.

The Effect of Visual Perceptual Training on Reading

Many studies of perceptual training involve instruction in the techniques described earlier, such as

those by Frostig, Kephart, Getman, and Delacato, or a combination of these.

Rosen (1966) wanted to explore the effects of the Frostig Program for the Development of Visual Perception on reading achievement toward the end of the first grade. His subjects included 305 pupils in 12 experimental classes and 332 pupils in 13 control classes. The training period lasted 29 days during which the experimental classes received 30 minutes a day of visual perceptual training with worksheets from the basic 100-page workbook and supplementary worksheets and games from the Frostig Teacher's Manual. The control classes received 15 minutes more of regular reading instruction. The experimental group received 15 minutes less reading time. Results indicated that the training of certain visual perceptual capabilities did not result in significant improvement in reading scores, although there was improvement in the perceptual capabilities. The control groups excelled the experimental groups in comprehension.

In a study by Cohen (1966-67), 155 children who were deficient in visual perceptual skills had 29 daily training sessions based on the Teacher's Guide to the Frostig Program. After 10 weeks, the results showed that t ere was no significant relationship between training in visual perception and gains in reading achievement. Such

training did affect positive gains on a test of ability to copy geometric figures.

Jacobs, Wirthlin, and Miller (1968) concluded from an initial study, and a replication of that study the following year, that pupils who take the Frostig Program seem to have no particular advantage as far as future reading is concerned, but achieve higher scores than the controls on a visual-perception test.

Arciszewski (1968) also reported on a study which used visual perceptual training based on Frostig materials. The subjects were 215 children divided into three groups. The experimental group received perceptual training 30 minutes a day four times a week for 22 weeks. He concluded that despite the expenditure of money, time, and energy, first-grade children who received perceptual training did not significantly improve their reading achievement or visual perception in comparison to students who received training in supplementary phonics or basal reading.

McBeath (1966) conducted a study to test the effectiveness of a training program on reading readiness for 117 kindergarten children below the twenty-fifth percentile on the Frostig tests of visual perception. Of four groups, one was assigned to 15 minutes a day of training as prescribed by Kephart emphasizing physical

coordination activities, such as the use of the balance beam and balance board; a second received 15 minutes a day of the Frostig Program for the Development of Visual Perception; a third group alternated both methods; and the fourth had no special treatment. After 64 days, none of the three experimental groups did better than the group which received no special training.

The studies reviewed above would seem to indicate that the Frostig program of visual perceptual training has not been effective in improving reading.

Studies that employed physical coordination and eye-hand coordination have also been undertaken. LaPray and Ross (1967) conducted a study of four groups of first graders in the bottom quartile of reading achievement. Group 1 received training in tasks suggested by Getman and Kephart, such as matching simple shapes, completing incomplete drawings of geometric designs, walking a balance beam, etc. Group 2 had extra work with reading materials. Group 3 learned songs and listened to stories to test the Hawthorne effect. Group 4 received no instruction and was tested at the end to determine the effects of maturation. Results were that: (1) the group that had special classroom reading did better in reading achievement than the visual training group or the two control groups, (2) time helped all children, and (3) the visual

training group drew better posttest Benders. The study concluded that perceptual skills can be trained, but is of little use to the child in reading if it only helps him draw better Benders.

Roach (1967) measured the effects of perceptual-motor training on a group of 40 slow learners in the upper primary and middle grades. Using techniques which were modifications of ideas by Kephart, he divided his subjects into small groups of six to eight children who received 30 minutes of intensive perceptual motor training each day for eight weeks of a summer reading program. The control group of 40 children was given 30 minutes of free play recess. Results in reading achievement for the perceptual-motor group failed to reach a level of statistical significance.

Delacato's theory of the relationship between neurological organization and reading was challenged by Robbins (1966) who conducted a study involving a second-grade class from each of three schools of the Chicago Roman Catholic Archdiocese. One class served as a control group and received no treatment. The second class was guided through cross pattern creeping and walking, avoidance of music, the use of appropriate sleep posture and sidedness, and color filtration activities to encourage use of the dominant eye. The third class was encouraged

to participate in musical activities and games which, according to the Delacato theory, stimulates the non-dominant side of the brain. The results of the study did not support the theory of the relationship between neurological organization and reading achievement. Robbins concludes that because of this the entire theory is suspect.

The Robbins study attracted the attention of Glass who investigated the 15 published studies cited by Delacato as evidence supporting his system of therapy (Glass & Robbins, 1967). Glass questioned the methodology and techniques of research used in the studies and criticizes faults in their design and analysis, claiming that variables were manipulated, control groups were not used, and that matched groups were used where randomization was feasible. Glass is careful to state that his investigation of the 15 studies does not test the effectiveness of Delacato's theory but brings to light the disregard of fundamental principles of experimental design in the studies that purported to be evidence of the effect of therapy to improve neurological organization.

While Robbins' study did not support the Delacato treatment for reading improvement for children in a normal classroom, O'Donnell (1969) sampled disabled readers with crossed or uncertain lateral dominance. A three-group

treatment was divided into Delacato training (cross-pattern creeping, cross-pattern walking, visual pursuit activity, and filtered reading); limited Delacato training (visual pursuit activity, filtered reading, and physical education games and exercises); and the control group (physical education, games, exercises, sports, and folk dancing). The results showed no significant differences among the treatment and control groups on reading achievement. Also, there were no differences on tests of motor integration and lateral dominance.

Balow (1971) concludes from a search of the literature that

> . . . no experimental study conforming to accepted tenets of research design has been found that demonstrates special effectiveness for any of the physical, motor, or perceptual programs claimed to be useful in the prevention or correction of reading or other learning disabilities [p. 523].

He also feels that it cannot be assumed that motor and perceptual skills weaknesses are the causes of learning disabilities. It is likely that they are "simply concomitants without causal relevance [p. 523]." Nevertheless, Balow feels that motor-perceptual programs are not entirely without merit as possible additions to the curriculum for children who have skills deficiencies. In the case of boys who find it difficult to sit still, motor activity is a welcome outlet, especially if it brings some recognition of success to someone who has been failing in

academic subjects. Such training might also encourage habits and skills of attention and following directions. Balow emphasizes that if such training is not a replacement for direct teaching of basic school skills, but is recognized as an addition to the curriculum, it might be useful in teaching general behavioral skills necessary for school success. In this light, he concludes,

> . . . visual perceptual and cognitive motor activities can be advocated despite the absence of experimental evidence supporting their use as the treatment of choice for correction or prevention of serious disabilities in reading or other basic school skills [p. 524].

There has been a tendency to distinguish between visual perceptual training based on visual motor exercises and training involving letters and words. Durrell (1958) believes that reading instruction itself improves perception. Vernon (1959) doubts that learning to discriminate meaningless shapes will have much effect on learning to recognize letters and words. This view is borne out by the Muehl (1960) study with first graders in which the results on the reading test favored the group that had practiced discriminating words rather than geometric forms. The implication for teaching was that visual discrimination training from the very beginning should be with word and letter stimuli. Having the child match animal pictures, geometric forms, or any nonverbal material did not appear to transfer to word discrimination.

Barrett (1965), after reviewing prediction studies, came to the conclusion that visual discrimination of letters and words had a somewhat higher predictive relationship with first-grade reading achievement than did visual discrimination of geometric designs and figures, although several tasks requiring the discrimination of designs and pictures (especially pattern copying) warrant further study.

Gagon (1966) also feels that the child might profit more to have visual discrimination exercises on the letter and word forms rather than being taught on geometric forms with the expectation of transfer taking place.

Concurring with the idea of using visual-verbal symbols, Kaufman (1969) states,

> If a deficiency in perception is to be remedied, the validity of the remedial procedure must be demonstrated. Considerable published material and many procedures have been offered for improving perception. The validity of these materials and procedures often has never been demonstrated.
>
> The occurrence of a perceptual deficit concurrently with an academic deficiency need not mean that remediation of the perceptual deficit will contribute to improvement in the academic area, for one deficit may not be the cause of the other. Even if a cause-effect relation exists, it may be more helpful to train pupils directly on the perceptual skill within the academic area, such as the identification of syllables within words, than to train them on a related skill using geometric forms, for example [p. 125].

A search of the literature has revealed no specific studies on the Michigan Tracking Program except for

two small studies offered in the manual accompanying the workbooks. In the first study, called the Greenfield Village Study, 23 children in grade 3, 25 children in grade 4, and 25 children in grade 5 were divided into equivalent groups on the basis of the Gates Reading Survey scores. The children in the experimental group in each grade were given the entire set of Visual Tracking exercises over a three- to four-month period in addition to regular classroom teaching of reading. The control groups were given "related reading activities." At the end of the training period, the 12 children in the third-grade experimental group were favored by a significant change in Comprehension over the 11 children in the control group at the .01 level. There were no significant changes between the fourth-grade experimental and control groups. In the fifth grade, the 13 children in the experimental group showed an advantage over the 12 children in the control group, significant at the .05 level.

The second study cited in the Manual for the Michigan Tracking Program was done by MacIver and Geake (1965) to test the effect of perceptual training on the oral reading of 27 fourth-grade children. The training consisted of completing the 160 exercises in the Visual Tracking workbook. Two other classes of fourth-grade children formed a control group of 52 pupils who received

no perceptual training. All pupils were pre- and post-tested with Gray's Oral Reading Paragraphs. The results showed that the experimental group made a total gain of 1.2 grades significant beyond the .01 level. The control group gain of .6 was not statistically significant. The authors of the study concluded that the use of Visual Tracking resulted in improvement of oral reading.

Despite the dearth of research data on the Michigan Tracking Program, many remedial reading teachers are using the Visual Tracking and Word Tracking workbooks in the hopes that the tracking practice will affect a positive change in reading achievement. The rationale behind the present study is that the tracking exercises involve the use of verbal symbols which provide a more logical basis for visual perceptual training in relation to reading than the Frostig, Delacato, and sensory-motor programs. Robinson (1971) points out that it is still not clear whether visual perceptual deficiency is due to lack of experience, to inattention, to some neurological deficit, to immaturity, or to some unidentified factor. If, indeed, inattention is a possible or partial cause of visual perceptual deficiency, the motivation provided by the timed and graph-recorded tracking exercises might tend to encourage the student to focus on the visual stimuli, thereby reducing inattentiveness. Whether the type of

visual-verbal exercises and the concentrated effort demanded by being timed in the performance of Michigan tracking material will carry over into reading achievement will be explored in this study.

CHAPTER III

PROCEDURE

The essential problem to be pursued in this study is the attempt to determine whether a three-month training period in the Michigan Tracking Program would benefit students in a remedial reading program, such benefit being measured by a significant mean difference between pretest and posttest reading scores of the experimental and control groups.

The Population

Subjects. Sixteen remedial reading groups, comprised of 87 sixth-grade students in the Reading Improvement Program in Woodbridge Township, New Jersey, during the school year 1971-72, were available for this study. The experimental groups were chosen randomly by means of a table of random numbers (Kendall & Smith, 1938) with the group as the unit of randomization. Of the original 87 students, three returned to regular classroom instruction, one moved out of the area, and eight were absent on the posttest date. This reduced the population of the study to 75, with 23 boys and 15 girls in the experimental group and 30 boys and 7 girls in the control group.

Teachers. There were eight remedial reading teachers who participated in the study. Four held Master's Degrees in Education (Reading Specialization), one had a Master's Degree in Education (Learning Disability), and three were taking graduate courses in Reading Specialization toward their Master's Degrees. All had prior experience teaching on an elementary school level.

Description of Training Instrument and Procedures

Training instrument. For the purpose of this study with sixth-grade students, the Visual Tracking and Word Tracking workbooks of the Michigan Tracking Program were used. The Program was devised by R. R. Geake and D. E. P. Smith as a by-product of a University of Michigan research program on perceptual skills in reading. The authors believe that many errors in reading are accounted for by erratic eye movements just prior to the error and that eye control is most difficult when the word has a similar letter or word shape nearby, especially in the line above or below. In the Manual for Visual Tracking, the authors state,

> It would seem that the faster a letter or word is discriminated, the less should be the tendency for eye movement errors to occur. If this is the case, instructional procedures should improve discrimination and, if possible, directional control [p. 1].

They feel that visual tracking exercises should be of

benefit to students who exhibit errors of reversals, inversion, omissions, substitutions, and additions. The following is a description of both workbooks.

The task in the Visual Tracking workbook is so arranged that detection of each letter requires discrimination of that letter from similar letters nearby. Letter size, letter spacing, and line spacing in the early paragraphs are large, but are gradually decreased to medium, then to small, in nine steps. The exercises consist of letters of the alphabet grouped to form nonsense words which simulate a paragraph of English writing (Appendix E). The student's task is to strike out the letters of the alphabet in correct progression from "a" to "z" without regressing to a "word" once it has been passed. An example follows (Geake & Smith, 1962, p. 1):

Fgn ɑcog aɒof hdmi nush pow
tryp dif nurɋ shɑd. Mo jins
pɇm ruk. Rolb snb oɟn lijs
buw roɡ sar, etc.

Exercises in the Word Tracking workbook have sentences which are used as guides for striking out words embedded with other words of similar appearance (see Appendix D). An example from this workbook follows (Smith, 1967, p. 6):

Some boys play ball.

Son Seme Same Soar
bays pays toys boys
pay pray play stay
tall fall doll ball

Training procedures. Each of the eight teachers who was involved in the study had under her tutelage one experimental group and one control group. She was to conduct the same type of remedial reading program for both groups except that the experimental group was to receive 10 minutes of training in the Michigan Tracking Program at the beginning of each 40-minute reading period while the control group was to receive conventional remediation for the entire 40 minutes. The teachers met with their groups three times a week for three months. Since ther is more practice material in the Visual Tracking workbook, two months were devoted to training in that book. The third month was devoted to doing the exercises in the Word Tracking workbook.

At the beginning of each reading session, all members of the experimental group would start striking out the prescribed letter or word at the teacher's signal. They were timed by the teacher who exposed a card every five seconds indicating the time that had elapsed in minutes and seconds. As they finished, the students would record their respective times on progress charts which were provided for their reward value.

Selection of Tests

The Gates-MacGinitie Reading Tests, Survey D, Forms 1 and 2 (Gates & MacGinitie, 1965a) are intended

for use in grades 4 through 6 and were selected as the instrument with which to measure pretest and posttest scores (see Appendix B). The test consists of three parts: Speed and Accuracy, Vocabulary, and Comprehension. The Speed and Accuracy test contains 36 short paragraphs of relatively uniform difficulty. The number of paragraphs the student completes in five minutes provides a measure of how rapidly he reads. The 15-minute Vocabulary Test contains 50 items starting with easy words and gradually becoming more difficult. The 25-minute Comprehension Test contains 21 passages with a total of 52 blanks. The first passages are simply written, but the later ones become progressively more difficult.

The selection of items for the Gates-MacGinitie Reading Tests, Survey D (Gates & MacGinitie, 1965b) was done on a basis of a nationwide tryout that involved 800 pupils in each of the grade levels. The pupils' responses to each of the items were tabulated and difficulty and discrimination indices were computed for each item. On the basis of item analysis, only the most effective items were retained for use in the final forms of the test.

Norms were then developed by administering the tests to a new nationwide sample of 38 communities selected on a basis of size, geographical location, average educational level, and average family income.

Alternate-form and split-half reliabilities were reported as follows: Vocabulary .85, .89; Comprehension .87, .95; Speed and Accuracy (Number Attempted) .72; Speed and Accuracy (Number Corre t) .78. The split-half reliability coefficients of the Speed and Accuracy tests were not given as it was felt that they are meaningless for highly speeded tests.

Administration of Tests

In order to compare the mean differences between the experimental and control groups observed in this study, pretests and posttests of the Gates-MacGinitie Reading Tests, Survey D, Forms 1 and 2, were administered. The pretest was given during the last week of October 1971. The posttest was administered during the first week of February 1972 after the completion of the three-month training period. To obviate the possibility of a difference in difficulty between Forms 1 and 2 of the Gates-MacGinitie Reading Tests, Survey D, one-half of the children (randomly chosen) in the experimental groups and one-half of the children (randomly chosen) in the control groups were given Form 1 of the test. The remaining half in the experimental and control groups were given Form 2. At the time of the posttest, each child received the alternate form of the test that was first administered. Each cooperating teacher administered the pretests to her

own experimental and control groups. To prevent bias in posttesting, the investigator administered the posttests. The pretests and posttests were scored by the investigator.

Analysis of Data

Experimental design. The experimental design of this study follows the Pretest-Posttest Control Group Design as presented by Campbell and Stanley (1963, p. 13) in which equivalent groups, as achieved by randomization, are employed. The design takes the following form:

$$R\ O_1\ X\ O_2$$

$$R\ O_3\ \quad O_4$$

In this design the upper line represents the experimental group and the lower line, the control group, with R standing for randomization. The first 0 in each line represents the pretest; the second 0, the posttest. The treatment to which the experimental group is exposed is represented by X.

Statistical analysis. The means of the difference scores, created by subtracting the individual's pretest raw scores from his posttest raw scores in Vocabulary, Comprehension, and Speed and Accuracy, were subjected to a *z* test to determine whether statistically significant differences were obtained between the means of the treatment and control groups. The difference scores for the two classes of IQ scorers were subjected to a *t* test

analysis, as were the difference scores for boys and girls in the experimental group.

An IQ test was not administered by the investigator since scores were available from the Lorge-Thorndike Intelligence Tests which were given to all sixth-grade students in Woodbridge Township in November, 1971.

CHAPTER IV

FINDINGS AND DISCUSSION

This chapter presents an analysis of the data pursuant to ascertaining whether sixth-grade remedial reading students who received a three-month period of training in the Michigan Tracking Program benefited to a greater degree in reading achievement than students who had instruction in conventional remedial reading only. The data were also analyzed to find out whether boys and girls were affected differently by this type of training and whether there were differences in achievement by students who scored low or high on verbal and nonverbal IQ tests. It was hypothesized that there would be no significant differences in any area of this investigation. The raw score differences between the pretest and posttest scores of the Vocabulary, Comprehension, and Speed and Accuracy portions of the Gates-MacGinitie Reading Test, Survey D, can be found in Appendix A.

Experimental and Control Group Score Differences

There were no statistically significant results between the means of the pretest and posttest raw score

differences of the experimental (Michigan Tracking) and control (conventional remediation) groups in any of the three areas of the Gates-MacGinitie Reading Test, Survey D, as determined by a z test analysis. In Vocabulary, the mean score differences was .71 for the experimental group compared to 1.78 for the control group. In Comprehension, the experimental group achieved a mean score difference of 2.18 compared to the control group's mean of 2.11. The mean score differences in Speed and Accuracy were 3.07 for the experimental group and 2.24 for the control group. A comparison of these figures and their standard deviations are shown in Table 1.

The Factor of Verbal and Nonverbal IQ Scores

Verbal IQ scores of 90 and below. There were no significant differences in Vocabulary and Comprehension between the experimental and control groups by students whose verbal IQ scores were 90 and below as determined by a t test analysis. The mean score difference in Vocabulary was -1.78 for the experimental group and .84 for the control group. In Comprehension, the experimental group mean was 1.12 while that of the control group was 3.26. In Speed and Accuracy, however, the experimental group had the advantage with a mean score difference of 4.19 compared with 1.42 of the control group. This was significant at the .01 level as shown in Table 2.

TABLE 1

READING ACHIEVEMENT RAW SCORE DIFFERENCES OF EXPERIMENTAL AND CONTROL GROUPS

Gates-MacGinitie Reading Test, Survey D	Experimental			Control			z	Signif.
	N	Mean	S.D.	N	Mean	S.D.		
Vocabulary	38	.71	4.90	37	1.78	4.79	-.96	N.S.
Comprehension	38	2.18	5.45	37	2.11	5 69	.05	N.S.
Speed and Accuracy	38	3.07	3.16	37	2.24	3.46	1.05	N.S.

TABLE 2

READING ACHIEVEMENT RAW SCORE DIFFERENCES OF STUDENTS WITH VERBAL IQ SCORES OF 90 AND BELOW

Gates-MacGinitie Reading Test, Survey D	Experimental			Control			t	Signif.
	N	Mean	S.D.	N	Mean	S.D.		
Vocabulary	16	-1.78	5.09	19	.84	5.10	-1.52	N.S.
Comprehension	16	1.12	4.95	19	3.26	4.80	-1.45	N.S.
Speed and Accuracy	16	4.19	2.23	19	1.42	2.55	3.38*	S.

*Significant at the .01 level.

Verbal IQ scores of 91 and above. For students with verbal IQ scores of 91 and over, a t test analysis of mean score differences shows no statistical significance in any reading area. The experimental group mean for Vocabulary was 1.50 to the control group mean of 2.47. In Comprehension, the experimental group mean was 3.15 to that of the control group of .88. In Speed and Accuracy, the experimental group earned a mean of 2.25 while the control group mean was 3.71. Pertinent data for the verbal IQ scorers of 91 and above are shown in Table 3.

Nonverbal IQ scores of 90 and below. No statistically significant differences were found between the experimental and control groups of students who had nonverbal IQ scores of 90 and below as determined by the t test. The experimental group had a mean score difference of .64 in Vocabulary while the mean of the control group was zero. In Comprehension, the experimental group mean was 3.55 compared to 2.61 for the control group. In Speed and Accuracy, the experimental group achieved a mean of 4.36 to that of 2.38 for the control group. These data can be observed in Table 4.

Nonverbal IQ scores of 91 and above. No statistically significant differences were found between the experimental and control groups of students who had nonverbal IQ scores of 91 and above as analyzed by the t test.

TABLE 3

READING ACHIEVEMENT RAW SCORE DIFFERENCES OF STUDENTS WITH VERBAL IQ SCORES OF 91 AND ABOVE

Gates-MacGinitie Reading Test, Survey D	Experimental			Control			t	Signif.
	N	Mean	S.D.	N	Mean	S.D.		
Vocabulary	20	1.50	5.39	17	2.47	4.36	- .59	N.S.
Comprehension	20	3.15	5.57	17	.88	6.55	1.14	N.S.
Speed and Accuracy	20	2.25	3.67	17	3.71	4.00	-1.16	N.S.

TABLE 4

READING ACHIEVEMENT RAW SCORE DIFFERENCES OF STUDENTS WITH NONVERBAL IQ SCORES OF 90 AND BELOW

Gates-MacGinitie Reading Test, Survey D	Experimental			Control			t	Signif.
	N	Mean	S.D.	N	Mean	S.D.		
Vocabulary	11	.64	4.00	13	0	4.09	.39	N.S.
Comprehension	11	3.55	3.78	13	2.61	5.16	.50	N.S.
Speed and Accuracy	11	4.36	3.36	13	2.38	3.18	1.48	N.S.

The experimental mean score differences in Vocabulary was .96; the control mean was 2.52. The Comprehension mean was 1.44 for the experimental group and 1.88 for the control group. The mean score differences in Speed and Accuracy were 2.56 for the experimental group and 2.08 for the control group. These figures are shown in Table 5.

Sex Differences in Visual Tracking Practices

There were no statistically significant results between the mean score differences of boys and girls in the experimental groups as determined by the t test. The boys obtained a mean difference of 1.39 in Vocabulary compared to -.33 for the girls. In Comprehension, the boys' mean score difference was 2.43 while the girls' was 1.80. In Speed and Accuracy, the boys earned a mean of 3.48 compared to 2.33 for the girls. These figures and their standard deviations can be found in Table 6.

Discussion

The current study found that training in the Michigan tracking materials did not make a significant difference in reading achievement in 17 out of 18 areas of this investigation. The one statistically significant analysis was in Speed and Accuracy where students with verbal IQs of 90 and below in the experimental group earned a mean score difference of 4.19 to that of the

TABLE 5

READING ACHIEVEMENT RAW SCORE DIFFERENCES OF STUDENTS WITH NONVERBAL IQ SCORES OF 91 AND ABOVE

Gates-MacGinitie Reading Test, Survey D	Experimental			Control			t	Signif.
	N	Mean	S.D.	N	Mean	S.D.		
Vocabulary	25	.96	5.41	23	2.52	4.94	-1.04	N.S.
Comprehension	25	1.44	5.76	23	1.88	5.81	- .26	N.S.
Speed and Accuracy	25	2.56	3.13	23	2.08	3.70	.49	N.S.

TABLE 6

READING ACHIEVEMENT RAW SCORE DIFFERENCES OF BOYS AND GIRLS RECEIVING TRAINING IN THE MICHIGAN TRACKING PROGRAM

Gates-MacGinitie Reading Test, Survey D	Boys			Girls			t	Signif.
	N	Mean	S.D.	N	Mean	S.D.		
Vocabulary	23	1.39	5.18	15	-.33	4.43	1.07	N.S.
Comprehension	23	2.43	5.78	15	1.80	5.07	.34	N.S.
Speed and Accuracy	23	3.48	3.30	15	2.33	3.04	1.08	N.S.

control group mean of 1.42, significant at the .01 level. A possible explanation of this result might lie in the type of selections which comprise the Speed and Accuracy portion of the Gates-MacGinitie Reading Test. They consist of simple paragraphs which do not increase in difficulty and for which factual questions are asked. All items are on an approximately equal reading level to measure speed rather than power. Reference to Table 2 shows that the control group mean was higher than that of the experimental group in Comprehension where the selections become more difficult and the questions more inferential. A similar advantage for the control group prevails in Vocabulary. Although the means of the two groups in Comprehension and Vocabulary are not statistically significant, they approach significance more closely than any other area in the study. While the training in the tracking materials may have stimulated the students in the experimental group with verbal IQs of 90 and under to work faster on easy material, it deprived them of the opportunity of working on comprehension and vocabulary building exercises for 10 minutes of each remedial reading session. There seems to be a discernible trend of low verbal IQ scorers to benefit by tracking if one wishes to emphasize Speed and Accuracy. If Comprehension and Vocabulary are the areas of emphasis, this verbal low IQ group

would possibly benefit more by devoting the entire 40-minute block of time to conventional materials.

With the verbal IQ group of 91 and above, the experimental group had a moderate advantage in Comprehension though not statistically significant (see Table 3). It would appear that low and high verbal IQ scorers react differently to tracking as reflected in Comprehension scores, with the higher verbal IQ scorers gaining somewhat by tracking and the lower IQ scorers losing.

The experimental group of nonverbal IQ scorers of 90 and below had a slight lead in Vocabulary and Comprehension and a moderate lead in Speed and Accuracy over the control group but none was statistically significant (see Table 4).

No discernible trend seems to be apparent between the experimental and control group of students with nonverbal IQs of 91 and above (see Table 5).

While there is no statistical difference between boys and girls in the experimental group, the boys' means exceeded that of the girls' by a small measure in Comprehension and a moderate one in Vocabulary and Speed and Accuracy (see Table 6).

Comparison with Similar Studies

Although the present study involving the Michigan Tracking Program can be classed as a visual training

program, it is difficult to compare it with other "visual training" studies in that the term is loosely applied to studies which might consist of visual-motility training, visual-motor training, or visual training with geometric shapes. Many of the studies found in the literature deal with training in the Frostig materials (which are applicable to the lower grades; the sensory-motor programs, such as the Getman-Kephart type; or the Delacato treatment, all of which do not deal with verbal symbols.

The investigator was unable to find any studies using the Michigan Tracking Program in the literature. Upon a written request sent to the authors for studies done on training in the tracking program, a Manual for the Michigan Tracking Program was sent which contained two studies. They did not appear to be independent. The first of these, the Greenfield Village Study (no date given), found that 12 children in grade 3 and 13 children in grade 5 made a significant gain in Comprehension over a control group of 11 children in grade 3 and 12 children in grade 5. There was no significant difference in the Comprehension scores of the groups in grade 4. The present study, involving 38 sixth-grade students in the experimental group and 37 sixth-grade students in the control group, shows no statistically significant difference in Comprehension.

In the second study (MacIver & Geake, 1965), an experimental group of fourth-grade children made a significant gain in Oral Reading over the control group whose gain did not reach statistical significance. Since the present study did not encompass Oral Reading, a comparison cannot be made in this area.

Comments by Teachers

The teachers involved in the study reported that the sixth-grade students were enthusiastic about the workbooks. They were pleased at this reaction since this age group did not generally respond positively to remedial reading materials. Some reported that the initial enthusiasm began to wear thin toward the end of the experimental period. There were scattered cases of perceptually deficient children who were frustrated by the task and for whom, it would seem, this type of training was especially intended. A few showed improvement and began to enjoy doing the exercises, but some remained frustrated during the entire three-month period.

CHAPTER V

SUMMARY AND CONCLUSIONS

A summary of the present study is given in this chapter along with conclusions regarding the hypotheses. Suggestions for further research are also discussed.

Summary

The purpose of this study was to investigate the effect of including visual tracking exercises in the remediation program for sixth-grade retarded readers. There was a total of 16 groups in the study. Each of eight remedial reading teachers taught an experimental group which received a 10-minute training session at the beginning of each 40-minute reading period and a control group which received only conventional reading remediation for the entire 40 minutes. The exercises in the Visual Tracking and Word Tracking workbooks of the Michigan Tracking Program were the training materials used for the experimental group. The teachers met both groups three times a week for three months--November, December, and January of the 1971-72 school year.

Seventy-five sixth-grade students, reading a year or more below grade level and potential, were the subjects

of the study. The 16 groups, each comprised of five or six students, were assigned to experimental or control treatment using a system of random numbers, with the group as the unit of randomization.

The main question that was investigated was whether the inclusion of the Michigan Tracking Program in a remedial reading curriculum would affect a difference in reading achievement between students who were given this training, known as the experimental group, and the students who were given conventional instruction, designated as the control group. The second question that was pursued was whether low or high verbal and nonverbal IQ scores were a factor in this type of perceptual training. Thirdly, the study sought to discover whether gains of those receiving this special training could be attributable to sex difference.

Conclusions Regarding Hypotheses

It was hypothesized that:

1. There is no significant difference in reading achievement between sixth-grade remedial reading students who receive practice in the Michigan Tracking materials and those who receive conventional remediation.

2. There is no significant difference in reading achievement due to visual tracking among sixth-grade remedial students with verbal and nonverbal IQ scores of

90 and below or 91 and above.

3. There is no significant difference in reading achievement between boys and girls due to visual tracking among sixth-grade remedial reading students.

On the basis of the statistical evidence for the population in this study, provided by analyzing the pre-test and posttest score differences of the Gates-MacGinitie Reading Test, Survey D, the three hypotheses listed above were accepted. There was one area that did reach a level of statistical significance at .01--the Speed and Accuracy portion of the test by students with verbal IQ scores of 90 and below. Since the same group did not achieve signif-icant differences in Vocabulary and Comprehension, which comprised two-thirds of the test, Hypothesis 2 was accepted. All other areas of the study produced no sta-tistically significant differences.

Suggestions for Further Research

Further study on the effect of the Michigan Track-ing Program on gains in Reading is suggested using a larger number of subjects and a longer training period. The following trends were discernible which might possibly yield more conclusive results in a larger study.

1. Students with IQs of 91 and above in the exper-imental group have a moderately higher mean in Comprehen-sion than those in the control group, while students with

IQs of 90 and below in the experimental group have moderately lower mean scores in Comprehension. Can the low verbal IQ scorers afford to lose reading instruction time to visual tracking? Would higher verbal IQ scorers benefit by visual tracking whereas lower IQ scorers would not?

2. The boys in the experimental group have a slightly higher mean difference than the girls in Comprehension and a moderately high difference in Vocabulary and Speed and Accuracy. Would a larger sample of boys and girls show that boys benefit to a greater degree from tracking exercises than girls?

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APPENDIX A

PRETEST AND POSTTEST READING ACHIEVEMENT RAW SCORES FOR REMEDIAL STUDENTS TRAINED IN THE MICHIGAN TRACKING PROGRAM AND STUDENTS TAUGHT BY CONVENTIONAL PROCEDURES

TABLE A1

VOCABULARY

Michigan Tracking (Experimental)				Conventional (Control)			
Student number	Pre-test	Post-test	d	Pre-test	Post-test	d	Student number
38	30	28	-2	22	19	-3	1
39	27	31	4	27	31	4	2
40	34	39	5	24	14	-10	3
41	29	36	7	30	32	2	4
42	30	29	-1	25	25	0	5
43	29	24	-5	17	19	2	6
44	29	32	3	26	21	-5	7
45	17	19	2	26	29	3	8
46	23	31	8	32	33	1	9
47	29	17	-12	23	19	-4	10
48	10	13	3	20	18	-2	11
49	19	14	-5	23	27	4	12
50	24	17	-7	23	28	5	13
51	26	20	-6	27	27	0	14
52	28	24	-4	12	14	-2	15
53	34	39	5	13	20	7	16
54	25	16	-9	15	21	6	17
55	31	30	-1	18	26	8	18
56	34	39	5	21	25	4	19
57	29	26	-3	25	21	-4	20
58	17	18	1	16	27	11	21
59	18	17	-1	25	19	-6	22
60	19	26	7	26	23	-3	23
61	18	20	2	28	25	-3	24
62	17	21	4	11	14	3	25
63	20	21	1	18	14	-4	26
64	18	26	8	25	31	6	27
65	27	29	2	16	22	6	28
66	21	23	2	34	35	1	29
67	20	25	5	24	27	3	30
68	25	23	-2	20	29	9	31
69	29	32	3	20	25	5	32
70	28	29	1	29	36	7	33
71	18	26	8	21	26	5	34
72	33	27	-6	23	31	8	35

(continued)

TABLE A1 (continued)

Michigan Tracking (Experimental)				Conventional (Control)			
Student number	Pre-test	Post-test	d	Pre-test	Post-test	d	Student number
73	19	20	1	23	23	0	36
74	16	19	3	34	36	2	37
75	23	24	1				
Σd			27			66	
Σd^2			911			944	
$\bar{d}$			.71			1.78	
s_d^2			24.10			22.95	
s_d			4.90			4.79	

TABLE A2

COMPREHENSION

Michigan Tracking (Experimental)				Conventional (Control)			
Student number	Pre-test	Post-test	d	Pre-test	Post-test	d	Student number
38	40	40	0	24	27	3	1
39	36	32	-4	27	38	11	2
40	40	38	-2	29	28	-1	3
41	39	47	8	36	27	-9	4
42	32	34	2	27	27	0	5
43	35	32	-3	23	22	-1	6
44	31	35	4	23	21	-2	7
45	27	28	1	35	36	1	8
46	31	40	9	40	44	4	9
47	29	34	5	31	26	-5	10
48	6	8	2	12	19	7	11
49	19	19	0	29	31	2	12
50	20	21	1	36	39	3	13
51	22	23	1	23	25	2	14
52	28	32	4	5	16	11	15
53	36	37	1	16	26	10	16
54	32	26	-6	32	33	1	17
55	28	36	8	20	21	1	18
56	36	36	0	18	18	0	19
57	38	32	-6	34	23	-11	20
58	21	27	6	18	27	9	21
59	28	31	3	25	33	8	22
60	14	23	9	21	20	-1	23
61	17	15	-2	34	36	2	24
62	21	31	10	13	15	2	25
63	26	31	5	21	26	5	26
64	27	29	2	26	37	11	27
65	29	35	6	14	23	9	28
66	28	22	-6	34	40	6	29
67	24	21	-3	38	37	-1	30
68	26	24	-2	32	22	-10	31
69	34	41	7	27	22	-5	32
70	26	33	7	34	35	1	33
71	16	31	15	30	40	10	34
72	27	40	13	37	38	1	35

(continued

TABLE A2 (continued)

Michigan Tracking (Experimental)				Conventional (Control)			
Student number	Pre-test	Post-test	$\underline{d}$	Pre-test	Post-test	$\underline{d}$	Student number
73	27	26	-1	27	31	4	36
74	36	29	-7	39	39	0	37
75	35	31	-4				
Σd			83			78	
Σd^2			1281			1330	
$\bar{d}$			2.18			2.11	
s_d^2			29.72			32.38	
s_d			5.45			5.69	

TABLE A3

SPEED AND ACCURACY

Michigan Tracking (Experimental)				Conventional (Control)			
Student number	Pre-test	Post-test	d	Pre-test	Post-test	d	Student number
38	18	14	-4	15	15	0	1
39	11	16	5	8	10	2	2
40	12	18	6	16	11	-5	3
41	13	14	1	16	16	0	4
42	11	13	2	8	13	5	5
43	12	15	3	9	10	1	6
44	17	16	-1	12	19	7	7
45	9	14	5	13	18	5	8
46	11	15	4	16	20	4	9
47	12	14	2	8	11	3	10
48	6	12	6	10	15	5	11
49	6	9	3	10	9	-1	12
50	11	12	1	17	14	-3	13
51	12	16	4	12	11	-1	14
52	15	19	4	6	8	2	15
53	15	23	8	11	15	4	16
54	10	14	4	13	13	0	17
55	14	15	1	8	12	4	18
56	14	14	0	10	20	10	19
57	19	17	-2	9	15	6	20
58	12	19	7	5	8	3	21
59	11	13	2	9	14	5	22
60	10	11	1	13	9	-4	23
61	9	12	3	16	12	-4	24
62	12	12	0	10	11	1	25
63	11	23	12	12	17	5	26
64	11	14	3	14	19	5	27
65	14	14	0	10	13	3	28
66	12	17	5	12	16	4	29
67	10	16	6	12	12	0	30
68	9	15	6	9	9	0	31
69	17	19	2	13	11	-2	32
70	11	11	0	18	18	0	33
71	15	14	-1	13	15	2	34
72	14	16	2	14	18	4	35

(continued)

TABLE A3 (continued)

Michigan Tracking (Experimental)				Conventional (Control)			
Student number	Pre-test	Post-test	$\underline{d}$	Pre-test	Post-test	$\underline{d}$	Student number
73	12	17	5	13	19	6	36
74	12	13	1	16	21	7	37
75	17	26	9				
Σd			115			83	
Σd^2			709			613	
$\bar{d}$			3.07			2.24	
s_d^2			9.76			11.86	
s_d			3.16			3.46	