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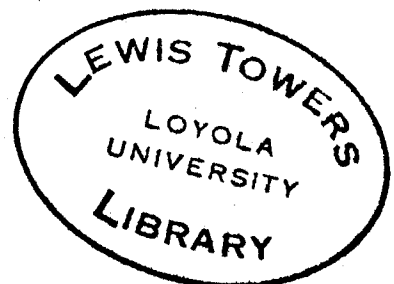
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The Effect of Neurological Training
on
Reading Retardation

By
Mary Julia Masterman

A Thesis Submitted to the Faculty of the Graduate School
of Loyola University in Partial Fulfillment of
the Requirements for the Degree of
Master of Arts

1966



CHAPTER I

INTRODUCTION

"To be totally human, man must be able to use language." (7) Centuries ago, we could have interpreted this to mean the ability to understand the spoken word; but in these modern and more complex times, we must also include the ability to understand the written word - the ability to read. And yet countless thousands of people in this advanced country cannot read.

Many cannot read because instruction has not been available. Fortunately, our country's leaders are focusing some attention on this deprivation and are providing more adequate legislation to solve this problem. Others cannot read because they lack adequate intelligence. Now, with more refined psychological tests, mental retardation, once considered the cause of all reading problems, can be spotted with a fair degree of accuracy and special attention can be given to those who fall within this group. Care has also been taken to spot children with problems of hearing and vision. Educators are discovering these difficulties early and are devising improved school programs and specialized training to help these children. But then there is the "hard core" group - the children who, for no apparent reason,

cannot read. What can be done for them?

It is this final group that has perplexed educators, psychologists and parents for years. Innumerable causes and equally as many solutions have been posited but none has been a panacea. Educators, believing that if children cannot read they have not been properly taught, have sought to derive new methods. For the past 50 years, controversy has persisted between the two major word-attack methods - phonics, the traditional tool of the teacher and word-sight, the Gestalt concept. An attempt has been made to combine these two methods and to develop new approaches, but a hard core of students remain unaided.

Psychologists have attempted to employ their skills in attacking this problem. Some have concentrated on the need for maturity and have devised tests to determine the child's readiness to read. Others consider poor reading an affective (emotional) response to language itself. Gardner and Sperry (16) relate reading difficulties to a lack of ego strength. This group stresses the emotional climate of the class room and looks to counseling and psychotherapy for a remedy.

The growing awareness that neither the educational nor the psychological approach is the complete answer has

led many to look further. In 1952, Dr. Carl Delacato, who is now director of the Developmental Reading Program at Chestnut Hill Academy and director of the Institute for Language Disabilities, a division of the Institute for the Achievement of Human Potential in Philadelphia, felt that the methods used were too peripheral in nature. He began to scrutinize the poor readers themselves in an attempt to find a common denominator which could be related to their poor reading. The likeness which he found appeared in the neurological realm. In at least 70% of the reading problems studied, a degree of neurological immaturity was evidenced. (6)

Once Delacato arrived at the realization that the problem was in the nervous system, it seemed only logical to find a means to treat this nervous system. For several years, Delacato engaged in intensive study and worked closely with doctors treating brain damaged children who also manifested difficulty, although grossly more severe, in the neurological realm. With this experience, Delacato was able to crystalize his theory. He formulated a series of exercises to be used to encourage the necessary neurological development in the poor reader. To date, this unique and refreshing approach to treating reading problems has met with outstanding results.

The purpose of this study will be to assess the value of these exercises by using them in a controlled situation on children who have been previously diagnosed as reading problems. An attempt will be made to evaluate this type of training as a means of treating the average retarded reader in the class room situation.

In the following chapter, the literature relating to this approach to reading problems will be reviewed.

CHAPTER II

REVIEW OF RELATED LITERATURE

Since the early writings of man, a tendency to relate the nervous system to the language function can be seen. The relationship, however, was never clearly defined and therefore for many years attention shifted from this wholistic approach to concentration on one aspect alone, on handedness. Handedness gradually became the major criterion for denoting cerebral dominance and was seen as having the most direct effect upon speech and reading. (4)

Perhaps the first to see a clear connection between reading disability and a more total neurological dysfunction was Dr. Samuel Ortin, a neurologist whose writings greatly influenced Delacato. (30) Ortin saw a close parallelism between the symptoms of adults who had suffered a loss in language as a result of brain injury and those of children during the development of the language faculty. This suggested the possibility that the same psychological process was being seen in both instances. Ortin was cognizant of the fact that one hemisphere of the brain was dominant and as he became aware that adult losses occurred mainly when damage was done to this master hemisphere, he began to focus his attention on this unilateral brain control.

In his writings, Ortin described three levels of the cortex: the first, the area striata, which dealt with external awareness; the second, which served as a storehouse for visual impressions; and the third, the association level. On the first two levels both sides of the brain were used simultaneously. On the third level, however, only one side, the dominant side, was used although both were irradiated equally. The record left behind on the sub-dominant side, the engren, was the mirror image of that on the dominant side. Therefore, if neither side became dominant or if dominance fluctuated, a condition of word blindness, or as Ortin called it, strephosymbolia (twisted symbols) occurred as mirrored words and letters were seen intermittently. (31) In brief, this was Ortin's explanation for many poor readers.

Although some of Ortin's beliefs, such as the fact that the visual patterns were stored in the brain, were not tenable, his rationale enjoyed considerable following through the 1930's. Unfortunately, however, co-operation between neurology and education was not possible at that time. Gradually, his theory fell prey to educators who, ignorant of the neurological causes, attempted to treat the symptoms with a purely phonetic approach. As the treatment met with only limited success, followers became dissatisfied and the entire theory fell into disuse, postponing progress along these

lines for many years.

Research again took a more narrow view. Eyedness fought for the prominent spot which handedness had held. Among those who attempted to find a visual relationship to cortical hemispheric dominance were the Berners (2). They examined children with normal intelligence who had experienced difficulty in reading and noted a high incidence of reversals and of poor visual images. This they attributed, in some way, to crossed eye-hand dominance and felt that the solution was the ophthalmologists' job.

Fink (13) and Johnson (23) also worked towards finding a consistent link between vision and reading difficulty. They could not agree, however, on the meaning of "ocular dominance" and therefore could not assist in each other's efforts. Fink continued to describe the dominant eye as the sighting eye while Johnson referred to the controlling eye or the eye which controls in binocular vision.

Since the eyeballs do not in themselves constitute a pair of separate structures, as the two hands, the problem of ocular dominance naturally became complicated. Some, concentrating on the fact that neither eye moves alone and that both respond from innervations from either cerebral hemisphere, doubted that a connection between eyedness and

brainedness existed. Wall, previously trapped by these findings, gradually saw a relationship and although he could not readily define it, commented that "all rules were off", and that "we should be prepared to find whatever we find." (36)

At last, this free, less rigid approach took hold. Many began to see that neither eyedness nor handedness were important exclusively. Strongly influenced by Gesell's and his followers' developmental rationale, a more dynamic and wholistic school of thought arose. Harris (19), Herman (20), and others in viewing reading problems saw not only a high incidence of mixed eye-hand dominance, but defective right-left orientation and faulty motor control as well. Eames (10), Rabinovitch (33), Kawi and Pasamanick (24) noted the frequent presence of pre- and para-natal complications in the histories of reading problems, strongly suggesting developmental abnormalities in the central nervous system. Dr. Temple Fay's (12) neurological studies shed even more light on the relationship between neurological development and reading difficulties. Soon many were led to a more wholistic, brain-centered approach and to the belief that "not the eyes but the brain sees". (20)

Neurological malfunctioning has now become an accepted major cause of reading difficulty by many. Rabinovitch (33) and others consider disability caused by "disturbed patterns

of neurological organization" primary reading retardation, distinct from those resulting from secondary causes such as emotional blocking, anxiety and poor instruction or from frank brain damage.

Although many have seen a connection between neurological organization and poor reading, Delacato, who has been writing on this subject since 1952, was one of the first to offer a solution. He has devised exercises which have been designed to help a child achieve neurological organization and with these has had considerable success. But like many who have been somewhat ahead of their contemporaries, he has met with constant criticism. Money (28) labels him a "faddist" and Zangwell (37), still concentrating on handedness, attempts to disprove his concept of cerebral dominance, believing that dominance is persistent and not affected by manual training. Others think that, scientifically speaking, his methods of treatment are premature. (28)

Undaunted, Delacato has continued to utilize his methods, and although his results have been amazing, he does not feel that he has discovered a miraculous cure for reading retardation. He admits that he cannot adequately explain all that is happening and welcomes psychologists, neurologists and educators to question his theory and urges them to continue to investigate.

In the following chapter, a summary of Delacato's theory is presented. A more complete description can be found in his two books, The Treatment and Prevention of Reading Problems, published in 1957 and The Diagnosis and Treatment of Speech and Reading Problems, published in 1963.

CHAPTER III

SUMMARY OF DELACATO'S THEORY

Dr. Carl Delacato attacks reading problems with a neuro-psychological approach similar to that used in treating the brain-damaged child. He considers reading retardation merely a symptom of the more basic problem of faulty neurological development and places the retarded reader somewhere on a continuum stretching from the normal, well-organized child to those with varying degrees of frank brain damage. He abandons previously accepted methods of treatment and focuses attention on ways to help the child achieve what he calls neurological organization.

This neurological organization, as described by Delacato, is that "physiological optimum condition" necessary before a child can utilize his maximum reading ability. It is the result of a smooth, uninterrupted ontogenetic development which, in the normal child, begins in the early months of gestation and progresses vertically through the spinal cord, the medulla, the pons and the midbrain until it reaches the level of the cortex. Here the progression becomes lateral and in this final stage of development, one of the hemispheres of the brain, which mirror each other physically, achieves dominance. These stages, according to Delacato, have an

interdependent relationship and therefore, in order to achieve that physiological optimum condition, all lower levels must be successfully completed.

Delacato clearly defines each stage of development and identifies the activities expected at each level of brain functioning. He sees this development recapitulating the phylogenetic levels of animal life and describes it in that light.

In the beginning, Delacato views the child's activities as reflexive. Like the vertebrates, he is operating at the level of the medulla. As his development continues, his activities progress to the level of the pons, where, in the homolateral fashion of the amphibian, he can pull himself across the floor. The tonic neck reflex, used functionally for propulsion, is apparent as are the beginnings of visual and auditory reception.

At about six months of age, maturation progresses to the level of the mid-brain. In Delacato's words, the child becomes "truly a land animal". For the first time, he is able to use functions from both sides of the body in concert. He can creep in a cross-pattern (using the right knee with the left hand and the left knee with the right hand) with great smoothness and serialization. He progresses from

biocular to binocular vision and with this new achievement begins to view his world in three dimensions.

The child begins to move from this mid-brain level to early cortical functioning at about one year of age. Delacato notes that development begins to slow down and is no longer as explosive. During this stage, the child begins to use his arms and legs independently and achieves the ability to walk. Before this stage is completed, he can walk in a cross-pattern, has three dimensional hearing and vision and begins to develop speech. He can oppose his finger and thumb dexterously (proving cortical opposition) and can supinate and pronate his forearm and hand. Delacato now sees the child slightly ahead of the primate.

The child remains at this level of cortical functioning for several years. Then, between five and eight years of age, the child gradually moves on to the final stage, which Delacato refers to as man's unique contribution to the schema. At this stage, one of the two hemispheres of the brain, which have been operating simultaneously, begins to gain dominance. This usually begins with handedness. As the choice of hand becomes more consistent, the chosen hand becomes more skilled. The eye closest to the chosen hand, the most convenient eye, is used most and gradually becomes the predominant or stronger

eye. As this development continues, the cortical hemisphere opposite this chosen hand takes over the control of these skilled activities and becomes the dominant one. The other, although it receives the same innervations, is forced into a more subservient role and becomes the seat of tonality. And thus neurological organization is complete.

When Delacato compares the neurological maturation of the retarded reader with this schema of normal development, discrepancies are evidenced usually beginning at the level of the mid-brain. Frequently these children cannot creep in a cross pattern fashion, cannot accurately supinate and pronate their forearm and hand, have not achieved cortical opposition or prefer to use the hand opposite the preferred eye. Some are poor spellers as well as readers, frequently twist letters and words or stutter except when singing (when the tonal side is able to be dominant without competition).

These interruptions in growth, according to Delacato, keep the child stranded on lower levels and hamper his communication and mobility analogous to the way trauma to these areas hamper the brain-damaged child. Although he has considered the possibility of brain injury, neurological evaluations consistently place the retarded reader within the normal range. Therefore, he concludes that the child's prob-

lems are functional rather than traumatic in etiology and he posits a tendency to hurry a child through the stages of development, to encourage him to walk before he is ready, to restrict normal development with tight clothing and over-use of the playpen as some of the possible causes.

Nevertheless, even though the causes appear to be different, Delacato continues to see many similarities between the retarded reader and the brain damaged and employs like methods to meliorate the difficulty. He bases his treatment on the belief that the brain has not received the proper stimulation and attempts to duplicate the stimulations the brain should have received at each incomplete level. Exercises are designed to impose "patterns of activity" on the brain and thereby, to encourage further growth. Although areas of difficulty may differ from child to child, for the child who manifests problems in reading, schemes to encourage use of the eye corresponding to the preferred hand, sessions of creeping and walking in an exaggerated cross pattern, and deletion of music are usually prescribed.

In the following chapter, an experiment using Delacato's methods of treatment will be described.

CHAPTER IV

PROCEDURE

The purpose of this experiment was to test the effect of neurological training on reading retardation. Dr. Carl Delacato's methods of treatment were used. Although similar experiments have been performed with small groups, in order to get more reliable results and to explore the possibility of utilizing these exercises in the average classroom, a large number of children were used. The null hypothesis that neurological training will have no effect on reading retardation was posited.

The Catholic Charities Archdiocesan Reading Service co-operated with this study by offering the use of two summer reading centers, St. Alphonsus and St. Bartholomew. These two centers were chosen because they serviced children from relatively stable and homogeneous areas in the middle socioeconomic class and hopefully would be free from extreme biases. All of the children attending these centers had been diagnosed as reading problems by their teachers and had been interviewed individually at the Catholic Charities' offices to determine class placement. There were 152 children enrolled at St. Alphonsus and 270 at St. Bartholomew.

Dr. Paul Dunne, a pediatrician and Dr. Robert Tentler, a neurologist, helped to set up the experiment and determined which neurological tests and exercises would be used. Both were familiar with Dr. Delacato's theory and had successfully used his methods. They conferred with Dr. Delacato for approval before the experiment began. They generously offered their time to demonstrate the tests and exercises and to train the teachers involved.

For statistical purposes a design including an experimental and a control group was chosen. Fortunately, each of the teachers, seven at St. Alphonsus and twelve at St. Bartholomew, were assigned two morning classes of children with similar age and reading ability. This afforded a convenient division. All of the children attending the first period sessions, therefore, were arbitrarily assigned to the experimental group and those in the second period, the control. All of the 422 children enrolled were included in the experiment although it was known that many would be excluded before a statistical comparison could be made.

Before classes began, the Gray's Oral Reading Paragraphs Test was given to each child by psychologists who had been trained to give identical instructions. This test was chosen because there is little or no residual effect in

retesting. Care was taken to have each psychologist test a reasonably equal number of children from the experimental and the control group. To insure uniformity, the writer reviewed the scoring of each test.

During the first day of class, all of the children were given a test for Laterality and Neurological Organization. The following information was secured on each child:

1. Laterality Tests

A. Eye Preference

Right Left Mixed

1. Far point

a. Binocular (telescope)

b. Monocular (board with hole)

2. Near Point

a. Binocular

3. Fusion

4. Controlling eye (telebinocular)

B. Hand Preference

1. In writing

2. In throwing a ball

3. In eating

4. In brushing teeth

5. In using scissors

C. Foot Preference

High step at least two feet high

II. Neurological Tests

Good Fair Poor

- A. Creeping
- B. Cortical opposition
- C. Supination
- D. Pronation

From these tests, it was possible to determine which hand each child preferred. Efforts were then made to make the eye corresponding to this preferred hand more dominant. Each child in the experimental group was given a pair of eye glass frames fitted with a red lens covering the eye opposite his preferred hand. Each received a piece of green filter paper which was to be placed over all reading material. Since red and green vibrate light in opposite directions, the child would see only black when looking through the covered eye and therefore, would be urged to read with the uncovered eye - the eye which should be the controlling or dominant one. All writing was to be done with a red pencil also visible with the uncovered eye only.

Since only one eye was being used most of the time, the possibility of encouraging monocular vision and of causing headaches was prevalent and had to be avoided. Efforts

were made to have the children focus on distant objects from time to time. To aid in this effort, a small ball attached to a rubber string was hung in the front of each class room. The teacher hit the ball occasionally and asked that the children follow its flight with both eyes.

Those in the experimental group were also given exercises designed to promote neurological development. They were instructed to come to school fifteen minutes before classes began and to remain fifteen minutes afterwards. During these periods they were to report to the gymnasium where they were trained to creep in a cross patterned fashion - moving the right arm in unison with the left leg and the left arm with the right leg. They were also instructed to walk to and from school in an exaggerated cross pattern. Music was to be deleted as much as possible through the six week period in order to keep the dominant (non-tonal) side of the brain in control.

Except for these described differences, the experimental group was treated exactly as the control group. Each was presented identical material and had class sessions of equal length. At the end of the six week period, all of the children were given Gray's Reading Test a second time. Whenever possible, the same psychologist did the retest.

In the following chapter, a summary of the observations noted throughout the experiment will be presented. Results of the tests will be given in Chapter VI.

CHAPTER V

OBSERVATIONS

It was interesting to note the lack of neurological organization in these children. Either mixed laterality or some indication of poor neurological organization was evidenced in 82.1% of the experimental group and 81% of the control group. This is in keeping with Delacato's findings which indicate that at least 70% of the reading disabilities in most clinics have functional disorders of neurological etiology.

Twenty-eight children failed the test for cortical opposition and were unable to oppose their thumb and index finger correctly. Results indicated that 20% of the boys and 21% of the girls preferred the foot opposite their preferred hand. Approximately 37% of the boys and 38% of the girls showed mixed eye-hand preference; and 1% of the boys and 1½% of the girls showed no hand preference at all.

Some of the children tested could creep only in a homologous fashion and learned cross patterning only with prolonged instructions. Several crept on their knees with their feet raised. One dragged his feet behind him like a

seal and others could not creep at all but knelt immobile. All of these children were able to creep correctly and smoothly before the end of the session.

During the Gray's Test, it was noted that many children repeated words and reversed letters and words frequently. These errors decreased considerably. One child repeated sounds and words excessively and gestured with his hands in a way which appeared to be akin to stuttering. His improvement after six weeks of training was outstanding. He used few hand movements, read more smoothly and improved one year and six months in reading ability. Others, although improvement was not as dramatic, showed similar changes.

In the following chapter the results of the test scores will be presented.

CHAPTER VI

RESULTS

Before a statistical comparison could be made, it was necessary to make a number of adjustments. Care was taken to eliminate those children whose major problem was not reading. Otis Quick Scoring Test scores were available on all of the children and to assure normal intelligence, all those whose scores were below 80 were excluded. During the study, it was noted that many children were not born in this country and evidenced difficulty in speaking English. Therefore, all those foreign born who had studied in this country for less than two years were dropped. Unfortunately, there was only one class for the preschool children and one for those who had completed the eighth grade. Since there were no experimental and control groups for these, neither could be used. It naturally was also necessary to eliminate all those who had not completed the course or who had not taken the retest.

Therefore, all of the children used in the final study were between seven and thirteen years of age. They had completed at least one year of school and had not completed the eighth grade. All had a reasonable grasp of English and had at least normal intelligence.

Although each teacher taught two similar classes, additional care was taken to equate the two groups more perfectly. Each teacher's experimental group was paired with her control group in regards to sex, age and grade placement. Either age or grade placement was permitted to vary one year. This left 141 pairs. In each group, 30.4% were girls and 69.6% were boys.

Each child's score on the Gray's Oral Reading Paragraphs Test taken before the course began was compared to the score obtained at the end of the course. The average gain obtained by the experimental group was statistically compared to the average gain obtained by the control group to see if the difference was significant. The following results were found:

Table I

	Experimental	Control
Average reading ability before training	3.795	3.801
Average reading ability after training	4.360	4.222
Mean gain	.565	.421
Standard Deviation	.60	.61
Standard Error	.05054	.05039

Since the scores on Gray's Test are based on a 10-month year, it can be seen that the experimental group gained 5.65 months and the control 4.21 months. Thus the average gain in the experimental group was 1.44 months more than that of the control.

In order to determine the significance of these findings a t-score was obtained. Since it seemed reasonable to assume that if a difference occurred it would be in favor of the experimental group, a one-tailed test was used. Care had been taken to match the two groups as much as possible and, therefore, the difference between the gain made by each pair and the standard deviation of these differences was figured. With the standard error of these differences, .0582, a t-score of 2.46 was obtained. For a one-tailed test, a t-score of this size indicates significance near the .01 level of confidence.

Table 2

Difference between the experimental and control scores	1.444
Standard deviation of the differences (paired)	.0582
T-score (one-tailed test)	2.46

Although Stanford Reading Achievement Test scores were not available on all of the children, the teachers of St. Alphonsus gave the "L" form of the Stanford test to their students before classes began and form "M" after completion of the course. The results of these tests indicated that the experimental group gained .35 or approximately 4 months and the control group .12 or approximately $1\frac{1}{2}$ months. This indicated a difference of $2\frac{1}{2}$ months - greater difference than that shown on Gray's Test.

CHAPTER VII

CONCLUSIONS

The results described in the previous chapter indicate that those children who had received neurological training improved their reading ability 1.4 months more than those who had not received the training. A difference of this size was seen to be significant close to the 1% level of confidence and therefore, indicates that the null hypothesis, "neurological training will have no effect on reading ability", should not be upheld. The comparison of the Stanford Achievement Test results helps to reinforce this stand.

In reviewing the experiment, however, many extenuating circumstances tend to lessen the value of these findings. It is necessary to ponder whether or not exercises of any kind, if done before class, would have enhanced learning ability. Were the teachers, in an attempt to make the experiment successful, more conscientious when teaching the experimental group? Could the novelty of the glasses have been a stimulus to learning?

Since this study did not successfully answer these questions, perhaps the most valuable contribution which this experiment has made must be extracted from the observations

which were noted as the classes progressed. The unusually high percentage of children with signs of faulty neurological development, the bizarre movements evidenced in the children's attempts to creep, the types of reading errors seen and the rapid almost spontaneous improvement made by some of the children seem to cement a relationship between neurological functioning and reading problems and should encourage further research. It is hoped that, in the future, experiments including those controls overlooked in this experiment will be conducted and that more reliable results can be obtained.

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APPROVAL SHEET

The thesis submitted by Mary Julia Masterman has been read and approved by three members of the Department of Psychology.

The final copies have been examined by the director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated, and that the thesis is now given final approval with reference to content, form, and mechanical accuracy.

The thesis is therefore accepted in partial fulfillment of the requirements for the Degree of Master of Arts.

Nov. 18, 1965

Date

Vincent V. V. V.

Signature of Advisor