

A FOLLOW-UP STUDY OF CHILDREN
WITH LEARNING DISABILITIES

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PREFACE

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CHAPTER I

INTRODUCTION

Public schools are faced with the problem of providing educational programs for all children. To do this task school curricula are usually organized in a developmental sequence. Most children begin their schooling in kindergarten or the first grade and progress from one level to the next until their formal education is terminated.

Because human beings vary greatly in mental and physical capacities, many children do not progress uniformly through the normal curricular sequences. When a child experiences difficulty in learning, the members of the school staff are responsible for initiating action to: 1. observe the behavioral symptoms which are related to his difficulty; 2. investigate possible contributing factors; 3. make recommendations for correcting, ameliorating, or compensating for poor performance.

Sometimes the cause of the learning problem may be obvious as in blindness, severe mental retardation, emotional disturbance, deafness, or other health impairments. These handicapped children have long been recognized, and special schools and classes have been established for their education (Robinson and Robinson, 1965). In other cases the cause of the problem is not so obvious. There are children with major learning problems who are neither mentally retarded, blind, deaf, emotionally disturbed, nor characterized by demonstrable brain damage

(Chalfant and Scheffelin, 1969). In recent years it has been hypothesized that these children have learning problems related to what has been called minimal brain dysfunction. Unfortunately the traditional categories of special education programs do not appear to meet the needs of these children. This new area of concern is complicated by differing terminologies and conflicting opinions among professional workers in the related disciplines of medicine, psychology, and education (Johnson and Myklebust, 1967).

A review of the literature provides examples of the different terms presently employed for the population under study. Among these are labels such as "learning disabilities," "psychoneurological learning disorders," "brain injured," and "minimal cerebral dysfunction." It is apparent that without competent screening programs and diagnostic services it is difficult to distinguish between children who have minimal brain dysfunction, sensory deprivation, cultural deprivation, delayed development resulting from mental retardation, or who are affected in other ways. Unless proper differentiations in classification are made, a child may be placed in an educational program which may not be appropriate to his needs.

Background of Study

In 1967-68 Bauman undertook an extensive study of the effects of an educational program on the test performance of children diagnosed as having psychoneurological learning disabilities (Baumann, 1969). In the broadest sense the objectives of the investigation were to determine a systematic method of identifying these children, to develop a suitable educational program for them, and to assess the effects of the program

upon particular aspects of behavior. The outcomes suggested that certain increases in basic skills underlying intellectual functioning were attained through the remediation employed in the research.

In February, 1970, a second project, labeled Perceptual Training, was developed for children suspected of minimal brain damage and was undertaken at the Payne County Guidance Clinic. The major objective of the guidance clinic program was to assist the children to learn more effectively in the program in the public schools. The remediation involved in large measure special attention to the development of the areas of gross motor functioning, eye-hand coordination, and language skills. The training program was supervised and conducted by Marjorie Shaw, clinic director, assisted by the staff of the Payne County Guidance Clinic, a small group of graduate students from Oklahoma State University, and several nonprofessional workers from the community.

Purpose of the Investigation

No provision was made for a systematic evaluation of the outcome of the 1970 project at the time it was planned. This limitation was imposed because funds were not available to do the follow-up. The author of this study worked as a volunteer in the project and obtained permission from the director to take steps to evaluate the total effort.

The major thrust of this study was to provide a systematic follow-up of the effects of the perceptual training program, along with the experiences encountered at home and in the school, upon the child's cognitive, psycholinguistic, and academic behaviors. These behavioral changes were assessed by certain standardized testing instruments presently available, and by reports for each child from the school.

Problems Investigated

Certain aspects of the evaluation procedure were designed to answer questions which were posed as null hypotheses. Other aspects of the evaluation were based upon limited data obtained from school files, which were tallied and reported. The null hypotheses to be tested may be stated specifically as follows:

1. There are no statistically significant differences for each child between pre- and post-test data on the Verbal, Performance, and Full Scales of the Wechsler Intelligence Scale for Children (WISC).
2. There are no statistically significant differences between the pre- and post-test data for each child, based upon the composite score of the Illinois Test of Psycholinguistic Abilities (ITPA).
3. There are no statistically significant differences between the means of the pre-test and post-test data for the group as a whole based upon:
 - A. the data from the three major scales of the WISC, and
 - B. the composite scale scores of the ITPA.

The investigator also obtained a subjective measure of each child's progress. Each subject's teacher was asked her opinion of that child's progress during the school year 1970-71.

Analysis of Outcomes

The analysis of the data consisted of the following steps:

1. In order to estimate the amount of change for an individual, the standard error of measurement of the three major scales of

the WISC and of the composite scale of the ITPA were computed, and the standard error of measurement of the difference between the pre- and post-test scores assessed for each individual; the standard error of measurement of the difference was multiplied by the value at the .15 level of confidence (Davis, 1964).

2. The differences between the means for the pre- and post-tests were assessed by the t-test for matched groups.

The method of statistical treatment selected for measuring change is appropriate to the procedure employed (Davis, 1964). The results of the teachers' statements are described in greater detail in Chapter IV.

Limitations of the Study

Perhaps a limitation of the investigation is the absence of an external control group against which to assess the magnitude of change which has occurred. The investigation has been designed, however, so that each subject may serve as his own control. An additional limitation is the small number of cases available for analysis.

CHAPTER II

REVIEW OF THE LITERATURE

This review of the literature includes the following areas: a survey of the terminology used to classify children who experience difficulty in learning; the scope of learning disabilities; a survey of behavioral criteria useful for identifying children who experience difficulty in learning; proposed etiological theories; methods of treatment of children who exhibit learning difficulties; and summary.

A Problem in Terminology

Children who experience difficulty in learning have always existed. However, in the past two decades a particular type of condition has become generally recognized (Tarnopol, 1969, p. 5). This new area of concern is confused by a proliferation of labels, but all share three common elements: 1. The child so classified is of average to above-average intelligence. 2. He exhibits difficulty in learning which is much greater than that predicted by his general level of intellectual functioning. 3. His learning difficulty is not clearly attributable to a definite cause such as deafness or cerebral palsy.

Among the welter of labels that have been used to describe such children are the following: attention disorders; brain-injured (Strauss and Lehtinen, 1947); central nervous system developmental lag (Bender, 1956); central nervous system deviation; central nervous system dysfunc-

tion; central nervous system maturational lag (Bender, 1956); cerebral dysfunction (Laufer, 1962); clumsy child syndrome (Walton, Ellis, and Court, 1962); conceptually handicapped; dysmaturational; educationally handicapped (California Administrative Code); exceptional; exogenous (Strauss and Lehtinen, 1947); functionally impaired; hyperexcitability syndrome (Prechtel and Stemmer, 1962); hyperkinetic behavior syndrome (Denoff, Laufer, and Holden, 1959); learning disabilities; minimal brain damage (Clemmens, 1961); minimal brain injury (Strauss and Lehtinen, 1947); minimal cerebral damage (Knoblock and Pasamanick, 1959); minimal cerebral dysfunction (Clements and Peters, 1962; MacKeith and Bax, 1963; Clements, 1966); minimal cerebral injury (Gesell and Amatruda, 1947); minor brain damage (Strauss and Lehtinen, 1947); neurological handicap; neurophrenia (Doll, 1960); neurosensory disorder; organic brain damage (Bradley, 1957); organic brain dysfunction (Burks, 1957); organic drivenness; perceptual cripple (Silver, 1951); perceptually handicapped; perceptual-motor impairment; psychoneurological learning disability (Myklebust and Boshes, 1960).

The plethora of terms reminds one of the blind men and the elephant. The classifications are as different as the orientation of the observer.

The Blind Men and the Elephant

It was six men of Hindostan
 To learning much inclined
 Who went to see the elephant
 (Though all of them were blind)
 That each by observation
 Might satisfy his mind.

The first approached the Elephant
 And happening to fall
 Against his broad and sturdy side
 At once began to bawl

"Bless me, it seems the Elephant
Is very like a wall."

The other verses condensed are:

The second, feeling his tusk
Thought he is like a spear

The third, happening to take the trunk
Thought the Elephant is like a snake

The fourth, felt about the knee
Thought, "He is very like a tree"

The fifth, chanced to touch the ear
And thought the Elephant is like a fan

The sixth, seizing on the swinging tail
Cried the Elephant is like a rope

The last verse goes as follows:

And so these men of Hindostan
Disputed loud and long
Each in his own opinion
Exceedingly stiff and strong
Though each was partly in the right
And all were in the wrong.

Saxe (1892)

One can apply this parable to any number of complex phenomena. In discussing the concept "perceptually handicapped," Blum (1968) describes this tendency as follows:

In order to manage concepts that are complex, they are often reduced to simple parts that are not entirely accurate and can often be misleading. The phenomena presented in this paper are certain behaviors from tests and from other observations which are classified as perceptual handicaps that bear a relationship to problems in learning. Learning disabilities is the larger whole of which perceptual handicaps are a part. Like the blind men the tendency exists to describe a complex whole in terms of a part that is not entirely accurately perceived, or in terms of fragmenting parts, emphasizing one part in isolation from others. Unfortunately, the many professional disciplines who have had an interest in learning disabilities have tended to act as blind men focusing on those parts of the whole containing their bias and offering explanations that may be simple and biased as well (p. 5).

Looking at the same child, the educator might see a "learning disability"; the speech therapist, a "communication disorder"; the psychologist, a "behavior problem"; the physician, a "brain damage problem"; and the psychiatrist, an "emotional problem" (Baldwin and Kenny, 1966).

No attempt will be made here to define all the preceding labels, but certain of the more popular ones will now be discussed briefly.

1. Task Force One of the National Project on Minimal Brain Dysfunction in Children considered questions of identification and terminology (Clements, 1966). This committee was composed of two psychologist-educators, nine physicians, and an agency executive. They listed thirty-seven different terms used to designate the learning disabilities resulting from a presumed neurological deficit in children of substantially normal intelligence. The terms were found to be of two types: those designating organic aspects of the problem such as "organic brain damage" and "minimal cerebral palsy," and a group which were related to behavioral characteristics, such as "hyperkinetic behavior syndrome," and "learning disabilities." This primarily medical committee adopted the term "minimal brain dysfunction" as best representing the disorder.

Task Force One based its terminology on the following premises:

A. Brain dysfunction can manifest itself in varying degrees of severity and can involve any or all of the more specific areas, e. g., motor, sensory, or intellectual. This dysfunctioning can compromise the affected child in learning and behavior.

B. The term minimal brain dysfunction will be reserved for the child whose symptomatology appears in one or more of the specific areas of brain function, but in mild, or subclinical form, without reducing overall intellectual functioning to the subnormal ranges. (Note: The evaluation of the intellectual functioning of the "culturally disadvantaged" child, though perhaps related, represents an equally complex, but different problem.) (Clements, 1966, p. 17).

2. Another popular term is "educationally handicapped," devised for use in California, which established by law the first public school program for these children. Educationally handicapped children have been defined as minors "not physically handicapped or mentally retarded, whose learning problems are associated with a behavioral disorder or a neurological handicap or a combination thereof, and who exhibit a significant discrepancy between ability and achievement" (California Administrative Code, Article 27 of Title 5, Section 221a).

3. Myklebust and Johnson (1967) define their preferred term as follows:

In those having a psychoneurological learning disability it is the fact of adequate motor ability, average to high intelligence, adequate hearing and vision, and adequate emotional adjustment together with a deficiency in learning that constitutes the basis for homogeneity (p. 14).

In the present study, the terms learning disability, minimal cerebral dysfunction, assumed neurological impairment, and other similar designations will be used interchangeably to refer to children who, despite average intelligence, fail to learn appropriately, with no readily apparent reason. The terms may be interchanged because there is no positive test that can diagnose minimal brain damage; it must be assumed on the basis of "soft signs" (Cole, 1965).

While brain damage or "minimal brain dysfunction" may be suspected, it is not the place of education to so label a child. Only medical authorities, following examination, can make this diagnosis. Some medical authorities--Dr. Edwin Cole, neurologist and neuropsychiatrist, for one--do not recognize the condition of "minimal" brain damage. They only recognize outright brain damage, as detected through medical examination (Slingerland, 1969).

Scope of Learning Disabilities

It is estimated by the California State Department of Education that educationally handicapped (EH) children will ultimately constitute about four to five percent of the total school population (Tarnopol, 1969). State funding assistance has been made available to local school districts which introduce programs for EH children up to two percent of the school population. Some school districts have exceeded the two percent limitation on state funding and are financing the extended programs with local monies (Tarnopol, 1969).

Doctors Frances Ilg and Louise Bates Ames of the Gesell Institute of Child Development at Yale University made the following statement:

Within the next few years we hope that many public schools will recognize the fact that possibly as many (in our estimation) as one-third of the students are perceptually handicapped to some degree or other, and can and should be given help and training, with the school situation. Third grade is too late. By that time a child who is perceptually handicapped can be messed up good and plenty (Pittsburgh Post-Gazette, May 24, 1967, p. 11).

It can be seen that estimates vary greatly regarding the percentage of the population which may be affected. Some workers feel that some brain damage is almost universal. Robinson and Robinson (1965) state that in view of the dozens of opportunities for minor damage to the functioning brain both before and after birth, it seems likely that most of us at one time or another sustain brain damage which is so minor as to pass unnoticed.

A Survey of Behavioral Criteria Useful for Identifying
Children Who Experience Difficulty in Learning

Effective educational planning for children with learning difficulties depends upon accurate diagnosis. Prerequisite to accurate diagnosis is the establishment of valid criteria for identifying these children. These criteria should include symptoms commonly manifested by such children. However, a search for common symptoms indicative of neurological impairment reveals an overwhelming variety. It would appear that a practical description of symptoms displayed by these children is difficult, if not impossible (Wortis, 1956; Clements, et al., 1964; Michal-Smith and Morgenstern, 1965).

Some of the reasons for the confusion over symptoms are that this area of interest is relatively recent, is still in the developing state, and conflicting research outcomes exist. Also, investigators from different disciplines tend to view the same phenomenon from their own orientation and use their own terminology to describe it. Nevertheless, many authors have attempted to identify core characteristics manifested by most children with learning disabilities (Gesell and Amatruda, 1947; Strauss and Lehtinen, 1947; Doll, 1953; Hanvik, et al., 1953; Carmichael, 1954; Goldstein, 1954; Bender, 1956; Bradley, 1955; Eisenberg, 1957; Laufer, et al., 1957; Thelander, et al., 1958; Levy, 1959; Burks, 1960; Denhoff, 1961; Clements, 1966). Every affected child is in some way different from every other, but certain threads run through the pattern and can be defined.

The most prevalent observation is that almost all of these children exhibit difficulties in learning. This is, of course, one of the characteristics that define the category of learning disability. Arithmetic

and language areas are those most frequently affected.

... Together with deficits in the learning of arithmetic, the deficiencies in acquiring spoken, read, and written language constitute the primary areas under the category of disabilities in verbal learning. Under the nonverbal are found disturbances in learning to tell time, directions (east and west), body orientation (right and left), meaning of facial expressions (happiness and anger), meaning of the behavior of others (learning to play games such as "cowboy"), music and rhythm, and meaning as conveyed in art (Myklebust and Johnson, 1967, p. 17).

Hyperactivity, the characteristic most frequently cited by different authors, basically refers to an excess of energy or a lack of functional controls. Children with the hyperkinetic syndrome are usually brought to the physician as behavior problems. Their symptoms of hyperactivity, distractibility, short attention span, emotional lability, cyclic behavior, poor impulse control, low frustration tolerance, overreactivity to excitement, temper outbursts and clumsiness make them difficult to live with or even to tolerate in the doctor's office (Gofman, 1969). Relatives and neighbors often make the parents feel as though they are to blame for the child's behavior, which makes them feel failure as parents. It is easy for them to become resentful of the child, which results in poor parent-child relationships. When this type of child enters school, he often disrupts the classroom, adding to the parents' resentment and anxiety. These parents need sympathetic help rather than the criticism which is often forthcoming from professionals (Gofman, 1969).

Perceptual, perceptual-motor, and conceptual difficulties form another area of skills that are often affected by presumed neurological impairment. These difficulties may be described as inadequate integrative functions:

Perceptual functioning may also be impaired, that is, the integrative function which enables the child to distinguish and interpret the meaning of sensory stimuli is faulty. Perceptual disturbances may also be seen in one or more of the sensory routes which distorts what is seen, heard, or touched. In general, perceptual problems refer to disturbed perceptions of form, shape, and depth (Michal-Smith and Morgenstern, 1965, p. 186).

Motor function disorders are often found in the child with a learning disability. Both gross and fine muscle movements may be impaired. A delay in the appearance of gross muscle behaviors such as skipping and hopping, and fine muscle acts such as pencil and paper tasks may indicate neurological dysfunction or even damage. Motor efficiency and learning have been discussed by Periere, Itard, Seguin, Piaget, and Montessori (Barsch, 1966).

Difficulties in speech or language development are manifested by a large number of neurologically impaired children (Cruickshank, 1967). "A significant number of children who have had a history of delayed speech development also have had difficulty in academic language skills" (Gofman, Flower, et al., 1965).

Lability of affect has been referred to as "...an emotional instability in which the child overreacts to minimal stimuli either by an inordinately intense or mobile response" by S. R. Rappaport (1964). Descriptive studies of neurologically impaired individuals suggest that this is a common factor (Strauss and Lehtinen, 1947; Klebanoff, et al., 1954).

Equivocal neurological signs, or "soft" neurological signs, include, among others, awkwardness, mixed laterality, confused laterality, strabismus, speech defects, short attention span, and hyperactivity (Clements and Peters, 1962). In this section have been described several of the more common behavioral characteristics of children with

learning disabilities. A child may manifest one or many of these behaviors in differing degrees of severity.

Proposed Etiologic Theories

Among the proposed causes of learning disabilities or minimal cerebral dysfunction are:

1. Illness or difficulty of the mother during pregnancy, including spotting, bleeding, or toxemia.
2. Birth history of prematurity, prolonged or precipitous labor or unusual delivery, or perinatal anoxia.
3. Illness or accidents that could cause central nervous system insult or injury (central nervous system infections, severe dehydration in infancy).
4. Overloading of the brain with intra- and interneurosensory functions (Johnson and Myklebust, 1967). One illustration of this could be the child who rejects auditory in favor of visual information. He looks away so as not to see the face of the speaker because he comprehends better; he may dis-integrate when trying to imitate speech by watching himself and the speaker in a mirror.
5. General debility due to malnourishment or chronic illness.
6. Genetic or congenital reading disabilities (Eisenberg, 1966).
7. Eisenberg (1966) has suggested a classification of the sources of reading retardation which should be the same for learning disabilities. Among his sources are four sociophysical causes: defects in teaching; deficiencies in educational stimulation during the first six years of life; lack of environmental motivators; lack of motivation due to emotional factors.

8. Doman and Delacato categorize non-normalcies which cause learning inadequacies as: brain injury (including neural underdevelopment, nondevelopment, or atrophy due to inadequate environmental stimulation or pretermitted development stages); psychoses; familial genetic deficiency. These authors contend that brain injury without psychotic involvement or genetic impairment is the most prevalent of the three non-normalcies (Kershner and Bauer, 1966).

9. Kephart is concerned more with manifest educational difficulties than with etiology. He identifies four causes of learning inadequacies as: low genetic endowment; inadequate environment; organic damage; emotional disturbance (Kershner and Bauer, 1966).

10. Silver (1971) proposes a neurohumoral theory to explain the origin of the neurological learning disability syndrome. He feels there is an inherited, physiological basis involving norepinephrine. His theory offers an explanation for the paradoxical effect of Ritalin and the amphetamines on hyperactive children. Instead of further stimulating hyperactive children, Ritalin (and other similar medications) often help them focus their attention, and have a calming effect. Silver feels this occurs because the medication increases the amount of available norepinephrine in the child's brain.

The preceding list of etiologic theories is not comprehensive, but includes many of the more well-known theories. The following section will discuss several different treatment approaches, and evidence of their efficacy.

Treatment Approaches

Of the various educational or medical approaches to aid children with learning disabilities, the approach emphasizing motor development has probably received most emphasis. Psychomotor development is basic to the educational programs of three major schools of thought: Kephart's group at Purdue University, Doman and Delacato at Philadelphia, and the Bellevue group, influenced strongly by the Schilder-Bender-Freidus tradition. All three schools stress the need for systematic training in motor development. Doman and Delacato (1960) and Kephart (1963) feel that the neurologically handicapped "...need to be taken back and brought up through the different stages of motor development to establish the complex motor movements involving balance, coordination, and movement; otherwise the child is likely to develop splinter skills" (Dunn, 1967, p. 123). The psychomotor adherents stress development of laterality, body image, and the coordination of patterns of movement needed for more complex acts (Schilder, 1935; Bender, 1956; Freidus, undated). Unfortunately, there is a lack of well-designed and controlled studies concerning the effectiveness of psychomotor training approaches for children with learning disabilities. A controlled study by Robbins (1966) with normal children failed to demonstrate that creeping and crawling exercises improved school performance after three months. However, exact controls were not established, these subjects were classified as normal, and a three-month test may be inadequate. A similar study was done in the Wasco Union School District of California (Foster, 1965). Three matched groups of fourth and fifth grade boys having mixed dominance were selected. Training programs as outlined by Doman-Delacato were carried out thirty minutes a day for a period of

five months. Analysis of the data showed no significant differences in the post-test scores of reading achievement or intelligence between the two experimental groups and the control group. Studies which have evaluated Delacato training procedures generally point to improvement in skills directly related to training procedures, such as crawling, but not in skills that are presumed to be more distantly related (Blum, 1968).

Concerning the widely-publicized Doman-Delacato method, the American Academy of Pediatrics and the American Academy of Neurology issued a joint position statement urging careful assessment of its claims:

To our knowledge, no controlled studies are available to support the greater value claimed for the program as compared with conventional treatment of the neurologically handicapped child. Without such studies, a medically acceptable evaluation is not thought possible (1968, p. 368).

Following the issuance of this statement, Kershner (1968) reported a study which supported several of the Doman-Delacato hypotheses. The subjects he used were retarded, however, so the results cannot be directly extrapolated to subjects with normal intelligence.

Lehtinen developed a second major educational approach, concerned with the development of concept formation. He gives recommended techniques for training, including instruction in various school subjects (Strauss and Lehtinen, 1947). No information is available concerning the effectiveness of his approach under well-controlled conditions.

A third approach involves emphasis upon training in perceptual development. Kephart (1960) proposes his construct of perceptual-motor match which involves matching perceptual data with motor activity through training. His recommended exercises call for integration of

visual and auditory information with the tactual system. Marianne Frostig (1961) uses this approach, emphasizing visual perception development through paper and pencil exercises. No controlled studies are cited to support these methods.

Johnson and Myklebust (1967) describe a speech and language remedial approach, but unfortunately no controlled studies are cited to support their method.

A fifth approach is a teaching method developed by Haring and Phillips (1962) and elaborated by Hewett (1967), referred to as the engineered classroom. This approach to teaching educationally handicapped children is based upon the behavior modification model. In this model, children are not viewed as being blocked in their learning by emotional conflicts, neurological impairment or other basic causes. Rather, the child's level of academic and social functioning are observed and his behavior is modified to correspond with accepted academic and social standards by assigning carefully graded tasks within the child's ability level in a classroom which provides both structure and rewards in accordance with the well-known principles of operant conditioning developed by Skinner. However, at present, there is no research data comparing this teaching method with others (Tarnopol, 1969).

A sixth approach that has been used is drug therapy, widely used with children who exhibit learning difficulties including hyperactivity:

Some children with the hyperkinetic syndrome show dramatic improvement on special medication, particularly that which appears to enable them to screen out multiple stimuli and attend to one. In our experience, the first drugs of choice are the amphetamines, the second Ritalin, with the dosage tailored to the requirements of the individual child (Gofman, 1969, p. 127).

A study reported by Knights and Hinton (1969, p. 272) illustrates

the effects of Ritalin, mentioned above:

As part of the comprehensive study of these patients, 40 took part in a double-blind study of methylphenidate (Ritalin). This drug is one of the direct stimulants of the central nervous system and its intensity falls between caffeine and the amphetamines as a stimulant, but it lacks some of the adrenergic side effects of these drugs. These stimulants are paradoxical in their effect on children as they are associated with the increased attention span, less distractibility, and less impulsivity. In clinical reports, Ritalin, in dosages of from ten to sixty milligrams per day, is considered the most effective stimulant in the treatment of children who are hyperactive or distractible.... The 40 children included in the study... were a heterogeneous group selected because of the diagnosis of Minimal Brain Damage, and not for any particular trait, such as hyperactivity. After six weeks of Ritalin medication there was a statistically significant improvement in the drug group over the placebo control group on the WISC performance IQ, especially on the Coding and Picture Completion subtests. In addition, there was a significant improvement in motor coordination on two tests of tremor. The children were rated both by parents and teachers on a standardized scale, and there was a significant improvement in the behavior of the children on Ritalin. There was a strong placebo effect in the study, but there is no doubt that the Ritalin was helpful in modifying the behavior of two-thirds of the children.

A seventh remedial approach can be termed eclectic. Several examples of this approach will be given now. A diagnostic treatment center for learning disabilities and emotional problems was developed to serve six school systems in Kentucky under provisions of Title III of the Elementary-Secondary Education Act of 1965. Evaluation by the multi-disciplinary staff covered behavior, family background, health, intellectual, perceptual motor, emotional, and educational functioning. Treatment plans, developed by the team which subsequently met with the school personnel, involved the child in play and educational or behavioral therapy on an individual or group basis. Treatment also altered the child's environment by providing family therapy and parent counseling, mothers' groups, school or parent conferences, or staff consultant to

work with school personnel. Consensual judgment of change (by parents, school personnel, and staff) in school work, and in educational and behavioral functioning indicated mild improvement in 60.9 percent of the 350 cases. Marked improvement was judged in 16.2 percent, with girls showing more improvement (p less than .01). Of the total sample, 22.6 percent were judged to be the same as before treatment, and only .3 percent were judged worse. Age was not significant. Three cardinal principles emerged from this effort, according to the summary and evaluation (Office of Education, ED 036 921, 1969):

1. The most effective intervention is derived from the efforts of a closely integrated inter-disciplinary team functioning as a unit.
2. The child was best helped when Regional Educational Diagnostic Treatment Center (REDTC) personnel worked closely with the school staff to assist them in solving the problem.
3. There is no one answer to any problem and there are many different avenues of approach that will bring about change.

This effort is lacking a control group, as is true of many programs to assist such children. It is possible the same improvements would have occurred without "treatment."

A second eclectic example is the Perceptual Development Program of the Oakland Schools, Michigan, for children with learning problems (Lukens, 1969). Children in public school are eligible to enter the program if they are between six and ten years of age. They may remain in it as long as they need the program and are progressing satisfactorily. The overall goal is to develop the child's skills for his return to regular elementary classroom within a reasonable period of time. It is essential to have parent cooperation and understanding. A multidisciplinary diagnosis and approach is used, involving cooperation between

teachers, parents, social workers, psychologists, and medical specialists, as well as administrators. In 1961 the pilot study involved four classes, which grew into a program of 23 classes containing nearly 250 children in 1968. The program has continued to expand, with approximately 55 classes in 1971 (personal communication from Lukens). Some of the children return to regular classrooms after one year in the special class, and a few children stay four years. A follow-up study indicates that 90 to 95 percent of those returning are doing average classroom work--a few are doing better--a few have not succeeded (Lukens, 1969). A personal communication with Lukens disclosed that the Oakland program has not done rigorous research using control groups, but the program has continued to be expanded, financed partly with local millage, because the community feels it is working. This is a pragmatic or empirical approach, rather than experimental. Regarding the use of medication, Lukens estimates that one-third of the children in the Perceptual Development Program (PDP) are on medication at some time during their enrollment in the program. As in many of the approaches, a control group is lacking.

A third study by Knights and Hinton (1969) has been mentioned in the discussion on drug therapy. However, medication was only a part of an eclectic remedial program that also included counseling the parents and communication with the school. The authors conclude:

In summary, the principal findings are that the term Minimal Brain Damage does indicate psychological deficits which are related to academic progress and that the common problem is in language--reading, spelling, and writing. In the present study, the diagnosis of MBD probably included children without brain dysfunction who had learning problems based on school-adjustment problems. The pattern of abilities and deficits must be assessed for each child, since the group was not homogeneous and since the deficits related to a particular symptom were varied. Counseling the parents,

communication with the school, and medication of the child were effective in assisting two-thirds of the group [of 40 children] in the sense that they did not fail or need special educational assistance. In the parents' and teachers' estimation, Ritalin was associated with a greater behavior improvement than was the placebo. This improvement was also reflected on several performance tests. In the test battery, the tests of motor coordination were most helpful in the diagnosis and treatment planning of the MBD child (Knights and Hinton, 1969, p.273).

A fourth eclectic study was carried out by Baumann (1969) and serves as the foundation for the present study. Baumann used 48 pupils in public school grades one to three in an attempt to assess the effect of an educational program on certain dependent variables such as scores on the subtests of the WISC. The major independent variable was participation versus nonparticipation in the educational training program developed for evaluation in Baumann's study. The study concludes:

...the results of this investigation suggest that certain increases in basic skills underlying intellectual functioning can be attained through educational remediation. A number of significant findings suggest the efficacy of the educational approach designed for use in this study. Thus, it would appear that, on the basis of these data, there would be some utility in using this approach with primary age children with similar needs (p. 194).

The parents of the children in the experimental group were advised that their children would be accepted for training only if the parents would attend group sessions designed to outline plans for continuing treatment in the home. The parents then participated in meetings every two weeks, at which times they discussed procedures for home management, filled out parent self-reports, reported their successes and failures with various home procedures, and set up individual consultations as needed. Conversely, the parents of the 19 control children were not contacted, and had no participation in a parent group. Therefore, any beneficial changes that the experimental group showed may have resulted

from a combination of the formal training exercises in a clinic setting as well as changed parental attitudes and home management.

A limitation of the study is that the director of the experiment served in multiple roles, in the capacities of group leader for the parent meetings, teacher for some of the children's training sessions, and as the tester for much of the individual testing. Baumann herself describes this, and comments: "This represents a degree of involvement that approaches a vested interest in the outcome of the study.... In the future studies, adequate staffing for independent evaluation and possibly some version of the double-blind technique are recommended" (Baumann, 1969, p. 163). The Baumann study is termed "eclectic" because it involved a combination of parental counseling in groups, individual conferences with parents, cooperation of public school teachers, and small-group educational play therapy in a guidance clinic setting with volunteer workers. This study has been discussed in some detail because it was the basis for the present descriptive study.

Summary

A search was made of the literature for information relevant to this study. This review focused upon the following areas: a survey of the terminology used to classify children who experience difficulty in learning; the scope of learning disabilities; a survey of behavioral criteria useful for identifying children who experience difficulty in learning; proposed etiological theories; treatment approaches and results of treatment; summary.

The terminology was described as confused and varied, attributable primarily to the different disciplines concerned with learning disabili-

ties and the relatively recent growth of interest in this area. There are differing estimates of the scope of the problem, with estimates of minimal brain damage ranging from one percent to "most" of the population.

Well-controlled experiments concerned with treatment of children with learning disabilities were described as difficult to find. Many published studies support the theory that a child with a learning difficulty of presumed neurological dysfunction is best helped by a combination, or eclectic approach. This consists of interdisciplinary cooperation and communication between medical specialists, educators, administrators, psychologists, social workers, and parents (Brueckner and Bond, 1955; Baumann, 1969; Gofman, 1969; Knights and Hinton, 1969; Lukens, 1969; Office of Education, 1969).

CHAPTER III

DESIGN AND METHODOLOGY

The design and methodology followed in this study were developed after the subjects had completed their perceptual training at the Payne County Guidance Clinic. The investigator served as one of the volunteers working with the children. This volunteer participation was the investigator's introduction to children suspected of having a learning disability. The present descriptive follow-up study is a result of the investigator's desire to determine how the children who completed a perceptual training (PT) program were developing approximately one and one-half years after initial identification by their teachers. Consequently, the subjects and the initial evaluative procedure were not chosen by the investigator, since they were part of a program already operating when the investigator became involved with it. As often happens when cooperating with public service institutions, the results of this study may be confounded by such variables as administrative regulations, and especially by a concern for the well-being of the subjects involved.

Subjects

The subjects in the present study were 16 pupils from schools in Stillwater, Oklahoma. The population from which they were selected consisted of public school children, grades K-1. Their ages at the time of initial identification ranged from five to seven years old.

Sixteen subjects were available for follow-up for this study; ten were boys and six were girls. The fact that more boys than girls exhibit learning difficulties is an intriguing but unexplained one, discussed in the literature (Gofman, 1969; Knights and Hinton, 1969). Because of the small number of subjects available, differences due to sex were not considered in this study.

Information regarding the subjects may be summarized as follows:

Number of female subjects: 6

Age range at time of pre-testing by public schools or Guidance Clinic:

5 years, 4 months--6 years, 10 months

Age range at time of post-testing, arranged for by the investigator:

6 years, 6 months--8 years, 0 months

Number of male subjects: 10

Age range at time of pre-testing by public schools or Guidance Clinic:

5 years, 2 months--7 years, 5 months

Age range at time of post-testing, arranged for by the investigator:

6 years, 4 months--8 years, 5 months

Description of Diagnostic and Evaluative Instruments

Four instruments or procedures were used in the program to diagnose and evaluate the children with suspected learning disabilities. They were:

1. Checklist for symptoms of the Perceptually Handicapped Child (Appendix A)
2. Wechsler Intelligence Scale for Children, or WISC, by Wechsler (1949)

3. The Revised Illinois Test of Psycholinguistic Ability, or ITPA, (Kirk and McCarthy, 1968) (see Appendix B)
4. A pediatric-neurological examination by a physician (Appendix C)

The checklist was taken from Clements and Peters (1962) and is self-explanatory. If a child was checked on several items that suggested a perceptual handicap, he was then tested on the WISC by a qualified examiner either at the public school or the Payne County Guidance Clinic.

The WISC is one of the two most widely utilized individual intelligence tests in this country, and seemed to be more satisfactory than the Stanford-Binet Intelligence Scale (Terman and Merrill, 1916, 1937, 1960) because items on the WISC have been grouped into subtests according to certain assumed underlying psychological functions. The resultant scales yield weighted scores that allow intra-individual comparisons between skills. The WISC also yields separate verbal and performance IQ's, so that the relationship of a given individual's verbal score to his performance score can be studied, and may lend insight into the psychological make-up of the individual (Repaport, et al., 1968). The WISC is based on Wechsler's global concept of intelligence, which is briefly described by Wechsler as follows:

...intelligence is part of a larger whole, namely, personality itself. The theory underlying the WISC is that intelligence cannot be separated from the rest of the personality, and a deliberate attempt has been made to take into account the other factors which contribute to the total effective intelligence of the individual (WISC manual, p. 5).

The administration of the WISC served two main purposes: it gave an estimate of the child's overall intellectual functioning at the time of the test; and it pointed out possible strengths and weaknesses on the various subtests, such as arithmetic, block design, etc. A child was considered within or above the "average" IQ range, and hence a candidate

for the perceptual training, if his Verbal IQ, Performance IQ, or Full Scale WISC IQ was 90 or above (personal communication with Janice Farr, Child Development Worker for the Payne County Guidance Clinic).

If a child tested within or above the average range as defined above, he was given the Revised ITPA, administered by a qualified examiner in the public school or at the guidance clinic. This instrument is in wide use as an individual diagnostic device to measure various activities thought to be involved in language development.

The Revised Edition, as well as the original ITPA, was conceived as a diagnostic rather than a classificatory tool. Its object is to delineate specific abilities and disabilities in children in order that remediation may be undertaken when needed. Thus the ITPA provides (a) a framework within which tests of discrete and educationally significant abilities have been generated; (b) a base for the development of instructional programs for children. With this dual purpose the diagnostic/teaching model serves not only as a model for evaluating learning problems but also as a model for selecting and programming remedial procedures. The ITPA bears the same relation to the field of communication and learning disorders that diagnostic reading tests bear to the field of reading. (Kirk, McCarthy, and Kirk, 1968, p. 5).

The ITPA is based on the communication model of Osgood (1957), which postulates three dimensions of cognitive abilities:

1. Channels of communication, such as auditory-vocal and visual-motor
2. Psycholinguistic processes
 - A. the receptive process
 - B. the expressive process
 - C. an organizing process, or central mediating process
3. Levels of organization
 - A. the representational level, which requires utilizing symbols
 - B. the automatic level, involving the individual's habits of functioning, such as speed of rote learning

The ITPA yields twelve subtest scores, as well as a composite psycholinguistic age. A description of each subtest is given in Appendix B. One advantage of the ITPA is that the test scores can be converted into scaled scores (SS), which take into account both the group means and variances. The SS make it possible to compare the child's performance from subtest to subtest, or, as was done in the present study, from pre- to post-test. Wide discrepancies among the twelve postulated abilities measured by the subtests are felt to help identify the child with a learning disability and to help delineate the areas requiring remediation (Kirk, et al., 1968). Information about the development of, and normative data for the ITPA are to be found in The Development and Psychometric Characteristics of the Revised Illinois Test of Psycholinguistic Abilities (Paraskevopoulos and Kirk, 1969).

The fourth evaluative procedure was a pediatric-neurological examination. The physical portion of this individual examination by a physician was designed to detect any obvious medical problems that might adversely affect the child's learning or development, such as loss of hearing. If any such problems were detected, they were reported to the guidance clinic staff, who had the responsibility of informing the parents or school teacher of the child's difficulty. The neurological portion of the medical examination was designed to detect equivocal or "soft" neurological signs. A copy of the neurological items tested or observed is found in Appendix C. Among the most often noted signs in children with learning difficulties are transient strabismus, poor hand-eye coordination, mixed laterality, confused laterality, speech impairment or a history of slow speech development or irregularity, developmental discrepancies and general clumsiness (Clements, 1966). The in-

investigator assisted one of the physicians with two neurological examinations to become more familiar with the items tested.

Description of the Guidance Clinic Training

The child's parents were contacted by the child's public school teacher, who informed them that their child was a candidate for one of the perceptual training classes, which were held at the Payne County Guidance Clinic before or after school hours. The subjects who attended afternoon kindergarten attended a morning perceptual training (PT) class. The children involved in the present study were enrolled in one of the three PT classes which met from February 24, 1970, to May 8, 1970. The classes were held three days per week, for one hour each day, for a total of approximately thirty hours. The teachers for the PT sessions were guidance clinic staff members, graduate students from Oklahoma State University, and adult members of the community. The children worked or played (depending on the task and the child's perception of it) in a ratio that varied from one child per adult to three children per adult.

A typical hour of PT will be described, to illustrate the type of activities that were available to the children. When a youngster arrived at the clinic for perceptual training, he was greeted by the Child Development Worker (CDW) and the volunteers. He was then told by the CDW where he would play first, and the name of the adult and any other children who might be in his group. Perhaps the first twenty minutes would be spent working in the area of language development, one of the three areas of training. Language development was usually staffed by a graduate student specializing in speech therapy. The therapist and

children in the group would converse casually sometimes, describing events at home or at school. At other times the situation would be more structured, in an attempt to aid the child in his speech development. An example of a structured speech task would be for the child to hold an object, and try to describe as many characteristics as he could about it. The therapist might then mention other descriptive words which the child omitted in an attempt to enrich his vocabulary. When the twenty minutes allotted for language were over, the CDW would direct the child to a second area, for example, gross motor development. Training in this area was usually done by graduate students from the Physical Education Department of Oklahoma State University, and included such activities as bean bag tossing, ball catching and throwing, balance beam walking, hopping, skipping, etc. For the last third of the hour, he would attend the eye-hand development area, which included such things as puzzles, crayons, Lotto, and the game of Cootie. At each area, the adult worked with and observed the child and was to try to assist him in improving his skill, while at the same time helping him feel successful. The teachers were encouraged to make notes on the progress of the children, which were kept in each child's personal file. Informal meetings were held weekly for the teachers to meet to discuss the progress of the children and ideas for helping them improve their physical or interpersonal skills.

Some of the elements the investigator observed in the PT sessions that might influence the children's behavior were:

1. Attention of an interested adult.
2. Encouragement by the teacher for the child to do a task, or to improve his attempt at a task.
3. Recognition by the teacher for genuine effort on the part of

the child.

4. Practice with materials that the child might not have access to elsewhere.
5. Participation in a regularly-scheduled event, with a variety of activities geared to the ability and interest of the child.
6. Interaction with several adults and children.

The parents of the children enrolled in the perceptual training class were invited to two evening meetings during the ten weeks of PT. At one of the meetings a film on learning disabilities was shown. A conference was scheduled with the parents of each child, at which time the child's development was discussed, and his WISC and ITPA scores were interpreted to the parents by a guidance staff worker. If parents wished another conference, this was provided through the guidance clinic.

In general, the parents, guidance center staff, and volunteers seemed to feel that the children were making satisfactory improvement in the areas of impulse control, school and home adjustment, interpersonal relationships, and overall adjustment. It should be remembered that approximately five months had elapsed since the public school teachers had checked the behaviors on the checklist, and during that time the children had been growing in experience at school and growing physically. This study was undertaken to provide some objective evidence of their development.

A second training program was held from June 16 to July 31, 1970, in which three of the subjects participated. The PT classes again met for three, one-hour sessions each week, for a total of twenty hours. However, no valid comparisons can be made between the thirteen children who participated in one PT class, and the three who participated in both classes, because the children were not equated for individual dif-

ferences, i.e., the groups were not matched.

Procedure

To provide a systematic follow-up of the effects of the Stillwater Guidance Clinic perceptual training program, the investigator took the following steps: A survey was made ten months after the perceptual training had ended, to determine how many children were available for the follow-up study. Sixteen children were residing close enough to Stillwater to permit retesting, and parental permission was obtained for their retesting.

These sixteen children were retested on the WISC by the investigator at the Guidance Clinic, unless they had already been reevaluated by the public schools or the Guidance Clinic staff. The Guidance Clinic staff reevaluated four of the subjects on the WISC, the Stillwater Public Schools reevaluated two subjects, and the investigator personally retested twelve of the subjects. The times which elapsed between the original pre-testing (done by the Guidance Clinic or the public school), and the post-testing on the WISC and ITPA ranged from 11 to 17 months. The author of this study collected the data for both the WISC and ITPA from the guidance center and public school system, and shared her test data with both those sources.

The ITPA was readministered to only 15 subjects, since one child had not originally been given the ITPA. The public school system retested six of these children; the author of this study hired a qualified speech therapist to retest five subjects; and the guidance clinic speech therapist retested the remaining four subjects on the ITPA.

The author of this study compared the children's pre- and post-test

scores, and interpreted these data to the parents of each child she had tested on the WISC or the ITPA. The interpretations to the parents were usually given to the subject's mother, and took place either at the Guidance Clinic or over the telephone. At these meetings, the subject's parent or parents often talked at length about their child's current behaviors, and these had generally improved from the time of pre-test a year earlier, according to the parents.

After the discussions with the subjects' parents, the author tabulated each subject's total score and subtest score for the WISC and ITPA, both for pre- and post-tests (see Appendices D and E). These data were then examined for the differences explained in Chapter One, page 4, pertaining to significant changes for each child's score on either test, and the means of the group on either test.

In addition to discussions with at least one parent of each subject, the investigator conferred with each child's public school teacher regarding his current and past behavior for the school year with that teacher.

CHAPTER IV

RESULTS OF THE STUDY

Measurement of Change for Each Subject

The results of the study are presented in Tables I, II, III and IV. In general, the results show that most of the subjects' test scores increased upon retest, but usually the post-test results were not statistically significantly higher. The data presented on each table will be discussed.

Table I compares the Wechsler full-scale IQ values at pre-test with the post-test values, and the difference is tabulated under the column entitled "Difference obtained." This difference is compared with the difference needed for statistical significance, which is derived from the procedure described by Davis (1964). As can be seen from Table I, four subjects scored significantly higher upon retest, and one subject's full-scale WISC IQ decreased significantly. These results seem to indicate that 11 subjects made no change in spite of the efforts of the guidance clinic, home, and school. There is, however, an upward trend of the scores, with 11 of the 16 subjects scoring higher on retest. Although not significant statistically, these findings are encouraging. The subject showing the significant decrease in IQ had home and emotional problems which interfered with his performance, and he is currently undergoing treatment for his emotional difficulties.

TABLE I
 COMPARISONS OF OBTAINED DIFFERENCES BETWEEN
 WECHSLER FULL SCALE IQ VALUES

Subject	Age at test time*	Pre- test IQ	Post- test IQ	Difference obtained	Difference needed for statistical significance	Significant at .15 level
#1	6-2 7-1	99	107	8	8.65	--
#2	5-6 6-9	91**	83	8	7.24	yes
#3	6-6 7-9	87**	96	9	7.47	yes
#4	6-6 7-11	91	100	9	8.65	yes
#5	7-5 8-5	102	104	2	8.65	--
#6	5-5 6-7	103	104	1	8.65	--
#7	6-10 8-0	99	94	5	8.65	--
#8	6-3 7-9	95	100	5	8.65	--
#9	6-4 7-5	106	113	7	8.65	--
#10	5-11 7-4	114**	109	5	7.22	--
#11	5-6 6-6	95**	102	7	7.24	--
#12	5-11 7-4	107	101	6	8.65	--
#13	6-3 7-2	85	84	1	8.65	--
#14	5-7 6-6	88**	96*	8	5.77	yes
#15	5-4 6-6	114**	130	16	7.24	yes
#16	5-2 6-4	89**	93	4	7.39	--

* Age is given in years and months, eg., 6-2 means 6 years, 2 months.

** IQ's starred are WPPSIs; all others are WISCs.

Table II compares Wechsler Verbal IQ values at pre-test with post-test values, and the difference is tabulated under the column, "Difference obtained." The procedure followed to obtain the difference needed for statistical significance is the same procedure used in Table I. As can be seen from Table II, two subjects showed statistically significant upward changes in their Verbal IQ, while two showed changes downward. Subject 2 was noted in the discussion above to have serious emotional and home complications. His lower Verbal retest IQ is responsible for the drop in his Full-Scale IQ. Subject 14 made a 12-point gain in WISC Verbal IQ, a gain which may be related to his ITPA score, to be discussed later. Subject 15 made a 19-point gain in verbal IQ. Subject 15 can be seen to have the highest post-test full-scale IQ for any subject in this study. His home situation appears to be secure, and the teacher reports that he was an excellent student the past year. The reason for his referral to the learning disabilities training initially was due to poor fine muscle coordination, including writing, which he seems to have overcome. In addition to the statistically significant IQ changes mentioned above, 11 of the 16 subjects showed increases in their Wechsler Verbal IQ score, as opposed to only five subjects whose verbal IQ's declined. As mentioned earlier, although this is not a significant statistical finding, it does lend support to the assumption that the majority of the subjects are showing gradual improvement.

Table III shows the comparison of Pre-test and Post-test Wechsler Performance IQ values. The standard error of measurement (SE_m) is largest for the performance Scale, hence, a greater difference is necessary for a statistically significant change in scores to occur. Only

TABLE II
 COMPARISONS OF OBTAINED DIFFERENCES BETWEEN
 WECHSLER VERBAL IQ VALUES

Subject*	Pre-test Verbal IQ	Post-test Verbal IQ	Difference obtained	Difference needed for statistical significance	Difference signifi- cant at .15 level
1	92	101	9	10.57	--
2	100	81	19	8.93	yes
3	101	97	4	9.17	--
4	91	94	3	10.57	--
5	91	99	8	10.57	--
6	91	96	5	10.57	--
7	85	77	8	10.57	--
8	92	95	3	10.57	--
9	104	110	6	10.57	--
10	112	101	11	8.93	yes
11	91	96	5	8.93	--
12	101	97	4	10.57	--
13	75	81	6	10.57	--
14	75	87	12	7.23	yes
15	115	134	19	8.93	yes
16	85	90	5	9.10	--

* The subjects' ages and type of Wechsler test (WISC or WPPSI) can be found in Table I; they are listed in the same order on Tables I, II, and III.

two subjects showed a statistically significant change in Wechsler Performance IQ, both in an upward direction. Subject 3 increased his performance IQ by 22 points over his score 15 months earlier. His improved performance may be a result of his improved physical health. At the time of the first intelligence test, Subject 3 had had repeated throat infections and was on frequent medication, according to his mother. Subject 3 was also shy and afraid of children his own age, according to the physician's neurological report. However, 15 months later, at the time of the post-test, the subject had enjoyed good health for almost a year, and was doing satisfactorily in school, according to his teacher. He had also had a tonsillectomy about a year before the post-test. He related well to other children, according to the mother. His improved physical health and social behavior are thought to be partly responsible for his 22-point performance increase. Subject 4 showed a 15-point performance IQ increase over his pre-test performance. This subject has also enjoyed improved health, having undergone treatment for asthma since the time of pre-test. Subject 4's teacher reports the subject "blossomed" the past year at school.

When all changes in Wechsler Performance IQ's are considered, it can be seen from Table III that a total of 11 subjects showed some upward trend, one subject scored the same on both pre- and post-test, and four subjects' IQ scores decreased. Again, this is encouraging, although not statistically significant.

Changes in subtest scores of the WPPSI and WISC tests were not analyzed because of their low reliability (Wechsler, 1949). However, the subtest scores are listed for each of the 16 subjects in Appendix D. The reader may study the subtests and note which areas were respon-

TABLE III
 COMPARISONS OF OBTAINED DIFFERENCES BETWEEN
 WECHSLER PERFORMANCE IQ VALUES

Subject*	Pre-test Perform. IQ	Post-test Perform. IQ	Difference obtained	Difference needed for statistical significance	Difference Significant at .15 level
1	106	111	5	11.42	--
2	84	89	5	9.51	--
3	74	96	22	9.91	yes
4	92	107	15	11.42	yes
5	114	108	6	11.42	--
6	115	113	2	11.42	--
7	114	114	0	11.42	--
8	99	105	6	11.42	--
9	107	114	7	11.42	--
10	112	115	3	9.48	--
11	100	108	8	9.51	--
12	113	104	9	11.42	--
13	100	90	10	11.42	--
14	104	107	3	7.65	--
15	111	120	9	9.51	--
16	96	99	3	9.75	--

* The subjects' ages and type of Wechsler test (WISC or WPPSI) can be found in Table I; they are listed in the same order in Tables I, II and III.

sible for changes in total IQ scores.

Changes in subtests scores of the ITPA were also not analyzed because of their low reliability. However, the subtests scores are listed for 15 subjects in Appendix E for the interested reader.

Table IV compares pre- and post-test ITPA Composite scores, which are scaled scores with a mean of 36 and a standard deviation equal to six. The mean for the 1000 "average children between the ages of two and ten" in the ITPA standardization group was set equal to 36 for each age group (Kirk, McCarthy, and Kirk, 1968, p. 93-94). As can be seen from Table IV, three subjects showed statistically significant changes, all in an upward direction, in ITPA Composite scores. An upward change on the ITPA suggests an increase in psycholinguistic abilities. The formula for computing the difference needed for statistical significance remains the same as that used in Table I. The standard errors of measurement for the ITPA Composite test are given by Paraskevopoulos and Kirk (1969, p. 116). Only 15 subjects are tabulated in Table IV, since an ITPA score was not available for Subject 15 on Table I. The subjects remain in the same order, i.e., subjects 1 through 14 are the same, and the last subject on Tables I, II, III and IV is the same child.

Subject 4, showing a statistically significant increase in ITPA score (Table IV), is the only subject who also showed a statistically significant Wechsler increase. Subjects 9 and 11, who show ITPA gains significant at the .15 level of confidence, also had Wechsler post-test IQ gains of several points (7 points each on the Full-Scale IQ), but the IQ gains did not reach the level of statistical significance. Subject 4, it was mentioned above, is the child who has been treated successfully for asthma and "has blossomed" in school the past year.

TABLE IV

COMPARISONS OF OBTAINED DIFFERENCES BETWEEN
ITPA COMPOSITE SCALED SCORES

Subject	Pre-test ITPA Composite Score	Post-test ITPA Composite Score	Difference obtained	Difference needed for statistical significance	Significant at .15 level
1	37.7*	38.4	.7	4.19	--
2	31.9	35.3	3.4	4.19	--
3	36.0	36.9	.9	3.87	--
4	31.3	35.4	4.1	3.87	yes
5	34.3	35.2	.9	3.87	--
6	33.5	34.4	.9	4.19	--
7	34.9	33.7	1.2	3.87	--
8	35.1	34.0	1.1	3.87	--
9	32.0	36.0	4.0	3.87	yes
10	39.8	37.7	2.1	4.19	--
11	26.0	35.6	9.6	4.48	yes
12	38.6	40.1	1.5	4.19	--
13	29.7	32.8	3.1	3.87	--
14	30.4	34.5	4.1	4.48	--
15	37.3	38.9	1.6	3.58	--

* All scores given are Scaled Scores.

Overall, twelve subjects showed some increase in ITPA Composite scores upon post-test, and only three showed a decrease in score. While not statistically significant, this suggests that a majority of the children in the study may be showing an increase in psycholinguistic ability.

In the section describing the design of the study it was mentioned that three of the subjects participated in twenty additional hours of perceptual training in the summer of 1970. Of those three, two subjects showed statistically significant improvement upon retest. One subject improved in his ITPA performance, and the other on the Wechsler post-test. This finding suggests that the twenty additional hours of perceptual training may have been of some value to the subjects.

Measures of Change Indicated by the Means of the Groups

Steps were taken to look at the differences between the means for the pre-test and post-test data for the three scales of the WISC and the Composite scaled score of the ITPA. The results are presented in Table V.

It is evident that the mean difference based upon the composite score of the ITPA reaches a critical level of significance. The hypothesis that no difference exists between the pre- and post-test means can be rejected. The WISC data show a different picture. The Performance and Full Scale IQ's approach significance which suggests that tendencies toward change in a positive direction on these scales can be assumed.

The types of behaviors assessed by the ITPA may be more susceptible to the types of treatment utilized in the program than those measured

TABLE V.

STATISTICAL TESTS OF OBTAINED DIFFERENCES BETWEEN
 PRE- AND POST-TEST MEANS BASED UPON THE THREE
 SCALES OF THE WISC AND THE COMPOSITE
 SCALED SCORE OF THE ITPA

<u>WISC</u>	Mean Difference	DF	T value	Confidence Level
Verbal IQ	2.2	15	.94	ns
Performance IQ	3.7	15	1.80	.09
Full Scale IQ	3.2	15	1.90	.08
<u>ITPA</u>				
Composite Scale	2.0	14	2.70	.02

by the WISC. It should be recalled that both of the tests meet high standards of reliability.

Subjects Who Attended Local Innovative School

In addition to the analyses of test results mentioned earlier, it was possible to note the progress of nine children attending an innovative Stillwater school with a learning disabilities teacher. Of the nine children who attended the new elementary school for the full nine months of the school year, 1970-71, two showed statistically significant decreases in IQ. One child's Full Scale WISC IQ decreased significantly, and the other decrease was in another child's verbal IQ. On the ITPA, two of the nine children showed a statistically significant increase in ITPA Composite score. No conclusion should be drawn from these results, however, since the children were not randomly assigned to the school, nor were they matched in ability with the other children not attending the innovative school. In other words, some of the children who were felt to have more severe learning disabilities were assigned to that school.

A Consideration of Possible Contributing Factors

In searching for possible common environmental or physiological factors among the 16 subjects, the investigator collected the following data. The questions were written by the investigator:

	YES	?	NO
1. Is the family breadwinner a full-time student?	3		13
2. Is the family in "financial need," as defined by consensus of the guidance center staff and the investigator?	4	3	9

	YES	?	NO				
3. Parents divorced in child's lifetime?	4		12				
4. Does child live with only one parent?	2		14				
5. Is subject the eldest/elder child?	3		13				
6. Is subject the youngest/younger child?	6		10				
7. Does subject have unusual medical history, including allergies, asthma, chronic ailments, major surgery, prolonged hospitalization, or prematurity at birth?	8		8				
8. How many siblings does subject have?							
Number of sibs:	none	one	two	three	four	five	six
Subjects	2	3	5	3	0	0	3

The data above were gathered either from the child's records at the Payne County Guidance Clinic, or from the parent by telephone. It appears that none of the items except question 7 are positively correlated with the classification of "learning disabilities" for the children in the present study. However, on question 7 half the subjects did have a history of "unusual medical problems," as defined in that question. This may be significantly correlated with the diagnosis of learning disabilities. A similar survey would need to be made on "average" children without learning difficulties for any definitive statement concerning the relationship. Such a report was not feasible within this study. The investigator feels that 50 percent represents an unusually large percent of children with such medical histories.

Subjective Judgments of Children's Behavior by Parents and Teachers

Test results are not the only important consideration when evaluating a child's progress. What can be equally or more important is the

opinion of those close to him--his parents and teachers. They see his behavior in a variety of settings, and for a much longer time than does the examiner of an individual test. Their opinions are important in the development of the child's self-image, since at this age it is strongly influenced by the opinions of significant others in his life, such as teachers and parents.

If other people, particularly the most important people in his world, display respecting, approving, and loving attitudes toward him, he comes to view himself in a favorable light. If they are derogatory or hateful toward him, he develops a low self-concept. The child, and to a large degree, the adult, has no other measure of his own value than the recognition he receives or has received from others (Sawry and Telford, 1962, p. 312).

The investigator asked the child's parent (usually the mother) and his public school teacher the following questions in July, 1971: (to parents) "Are you satisfied with the progress your child has made since his referral to the guidance clinic in February, 1970?" To the teacher, "Are you satisfied with the progress of this child the past year in school, considering the point at which he started when he began the school year?"

The results of the telephone survey are tallied below:

	Parents' opinions	Teachers' opinions
Satisfied	12	11
Undecided	2	3
No	2	2

Many of the teachers remarked that even though a child had shown no significant change on the WISC or ITPA retest, they had seen considerable progress in the child's behavior at school. Many of the changes reported were in the direction of improved attitudes toward school, other children, reading, and motivation to learn. The two standardized

instruments used in this study do not measure such changes as these. Perhaps after more time elapses these improved attitudes will have a positive effect on the child's scores on such tests as the WISC and ITPA.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary of the Follow-up Study

Sixteen students from the Stillwater, Oklahoma, public schools were available at the time this follow-up study was made. These students were initially identified as having difficulty in school by means of a check list which their school teachers filled out. The students were administered certain standardized tests of intelligence and psycholinguistic ability; next, they participated in training classes at the Payne County Guidance Clinic; and finally, they were retested on the same instruments after 11 or more months had elapsed. The present study is based on the retesting procedure, and the interpretation of those results. Upon retest, it appeared that few of the subjects made statistically significant changes in their total WISC or ITPA Composite score. Three subjects' full-scale WISC scores went up significantly, and one child's score decreased (see Table I). Three subjects' ITPA Composite scores rose significantly, and none decreased significantly.

The WISC group means at the time of pre- and post-test were tested by the t-test for significant change. For the WISC Performance IQ and the Full Scale WISC, the findings were that the group means at the time of post-test were higher, approaching significance at the .09 confidence level or less (see Table V).

The group means for the ITPA Composite scores were likewise exam-

ined for change. The ITPA post-test group mean was significantly higher, at the .02 confidence level. The analysis of group change suggests that the group as a whole achieved some positive changes on both instruments at the time of post-test.

Although the two instruments administered failed to provide objective evidence of improvement for most of the subjects when considered individually, the parents and teachers told the investigator that they felt the children were progressing satisfactorily. Twelve parents and 11 teachers reported orally that they were "satisfied" with the child's progress since his referral to the guidance clinic. Many of the teachers reported changes such as improved attitudes toward school, other children, reading, and schoolwork.

Conclusions

The 16 subjects appeared to have made little significant change, when considered individually, on the WISC and ITPA retests. However, the group means did show tendencies toward improvement. These findings suggest that the group improved its performance after being identified as having a perceptual handicap, and being given perceptual training. If this assumption is correct, the group, as a whole, showed an increased ability in psycholinguistic functioning, and also an increased ability as measured by an intelligence test. The teachers of 11 of the subjects reported satisfaction with the student's progress, so it appears that something in the eighteen-month interval had a positive effect on most of the subjects. The investigator asked the teachers if they would single their student out on a checklist as being noticeably different from the other students at the time of post-test, and often they said

they would not. Unfortunately, it is impossible to definitely identify any factors which had a positive effect on the children's school behavior, since no control group existed. The investigator feels that any improvement the students have shown has multiple causes, including such factors as the increased attention shown them since they received the label "perceptually handicapped," parental counseling, and maturation during the 18 months since their identification.

Recommendations

Any future effort to identify and "treat" children who appear to warrant the label "perceptually handicapped," or seem to have a "learning disability," should include the following:

1. A separate control group, which is given no label or attention. This would help control for the effect of maturation.
2. A second control group, which is labeled as perceptually handicapped or as having a learning disability, but is otherwise untreated; this would help assess the effect of labeling.
3. All pre- and post-testing should be done by the same personnel, who would not be involved in any treatment.
4. The post-testing should use some form of the "double-blind" technique, in which the examiner is unaware whether the subjects have taken part in remedial efforts.
5. A careful analysis of the behaviors that are responsible for the child's referral. For example, some of the child's troublesome classroom behavior may actually be a healthy response to an inappropriate curriculum. Other classroom "maladjustment" may be caused by the teacher's attitudes or techniques. Of course, the difficulty may lie partly or wholly within the particular child, as would be the case of a child who truly has "minimal cerebral dysfunction."

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APPENDICES

APPENDIX A

CHECKLIST FOR SYMPTOMS OF THE PERCEPTUALLY HANDICAPPED CHILD

The Payne County Guidance Center and the Stillwater Public Schools are cooperating in an effort to identify children with a special kind of problem. These are children who often exhibit difficulties in learning, especially reading and arithmetic and who frequently exhibit behavioral differences which are a source of irritation and bewilderment to parents, teachers and playmates. At the same time these children are average or above average in measured intelligence. It is not unlikely that you have one or two of these children in your classroom at the present time and if so, they have probably puzzled and distressed you. You may have labeled this child a behavior problem, an underachiever, a slow learner, lazy, immature, undisciplined or emotionally blocked.

"Typical comments made by teachers and parents about a number of these children are:

1. He seems bright; he is quiet and obedient, but day dreams and cannot read.
2. He is high-strung and nervous; his attention is hard to hold.
3. He has frequent temper outbursts, sometimes for no apparent reason.
4. He won't concentrate for more than a few minutes at a time; he jumps from one thing to another and minds everyone's business but his own.
5. He lacks self-control; he cannot work with other children; he picks on them constantly; he is very disturbing in the classroom and worse on the playground.
6. He does not work to capacity; he is not learning to read or work with numbers, but has a good vocabulary and uses words correctly.
7. He thinks, speaks and moves so slowly and is a very poor reader; in many ways he seems very intelligent." (Clements, 1962)

The symptom picture which these children exhibit is technically called the Perceptually Handicapped Child. Although the diagnosis is

made on the basis of a thorough physical, neurological, and psychological evaluation, the teacher is invaluable in helping to identify these children for screening purposes. If these children can be identified, it has been demonstrated that with a special kind of training, many of them can function adequately in the normal classroom. The Guidance Center is in the process of establishing perceptual-motor training classes for these children on a limited basis.

As an aid in identifying these children a checklist is presented for use by the teacher. You are asked to fill out a checklist for any child in your class which you suspect of perceptual-motor dysfunction and return it to Mrs. Jungers. The Guidance Center will administer a battery of tests and the child will be seen by the pediatrician for diagnosis before he is admitted to the class for training.

Checklist for Behavioral Signs

- I. _____ Normal or above average intelligence.
- II. Specific Learning Deficits:
- _____ Cannot read at grade or age level.
- _____ Mildly stressful situation brings out dyslexic errors.
- _____ Spelling poor.
- _____ Difficulty with arithmetic.
- _____ Difficulty with abstractions and whole-part relationships.
- _____ Difficulty in mastering tasks dependent on good visual-motor coordination.
- III. Perceptual-Motor Deficits:
- _____ Printing, writing and drawing poor.
- _____ Poor and erratic performance when copying geometric figures.
- _____ Attempts to compensate for the difficulty in copying geometric figures by task-perseverance and/or innumerable and meticulous tiny strokes of the pencil.
- _____ Has difficulty in reproducing geometric designs with blocks.
- _____ Has difficulty with figure-ground discrimination.
- _____ Has difficulty with whole-part discrimination.
- IV. General Coordination Deficits:
- _____ Awkward or clumsy in fine muscle performance.
- _____ Awkward or clumsy in over-all coordination.
- V. Hyperkinesis: (less frequently Hypokinesis)
- _____ Appears to be in constant motion.

- _____ Flits from one activity or object to another.
- _____ Restless and fidgety.
- _____ Voluble, uninhibited speech in the absence of outward hyperkinesis.
- _____ Disorganized thinking in the absence of outward hyperkinesis.
- _____ Moves, thinks and talks at a reduced rate.
- _____ Seems to understand, but cannot put his thought into words.

VI. Impulsivity:

- _____ Cannot keep from touching and handling objects particularly in a strange or overstimulating environment.
- _____ Frequently speaks without checking himself.
- _____ Says insulting things.
- _____ Tells all the family secrets.
- _____ Commits striking antisocial acts such as fire setting with little provocation.

VII. Emotional Liability:

- _____ High strung
- _____ Irritable
- _____ Aggressive
- _____ Easily moved to tears
- _____ Has quick changes from high temper to easy manageability and remorse.
- _____ Panicked by what to others is a minimally stressful situation.
- _____ Sweet tempered in spite of frustrating inability to read.

VIII. _____ Short Attention Span and/or Distractibility:

- _____ Unable to concentrate for one thing for very long.
- _____ Loses interest when abstract material is being presented.

_____ Tends to become locked in a simple repetitious motor activity.

_____ Preoccupied with one verbal topic.

_____ Good attention span when interest is aroused, but marked distractibility when not so engaged.

IX. "Soft" Neurological Signs:

_____ Transient deviation of the eye which the child cannot overcome.

_____ Inability to tap on table with fingers flat, then turn hand over and do same.

_____ Poor coordination of fingers.

_____ Mixed laterality in use of hand, foot, or eye.

_____ Inability to distinguish right from left.

_____ Speech defect.

_____ Slow development of speech.

_____ General awkwardness.

Since each child has his own particular symptom cluster, it is important to remember that a given child may not have symptoms in all, or even many, of these areas.

Your help in this cooperative effort is badly needed and appreciated. It has been demonstrated that these children profit most from the coordinated efforts of educational, medical, and psychological services.

After a child has been accepted for perceptual-motor training the teacher will be informed and communication with the clinic will be maintained.

Clements, Sam D. and John E. Peters, Minimal Brain Dysfunction in the School Age Child, Archives of General Psychiatry, 6 (May, 1962).

APPENDIX B

A DESCRIPTION OF THE SUBTESTS OF THE ILLINOIS TEST OF PSYCHOLINGUISTIC ABILITIES

The 12 tests of the Illinois Test of Psycholinguistic Abilities are described below. These 12 tests are designed to isolate defects in:

- A. The three processes of communication
 1. Receptive process
 2. Organizing process
 3. Expressive process
- B. The two levels of language organization.
- C. The two channels of language input and output.

Performance on specific subtests of this battery should pinpoint specific psycholinguistic abilities and disabilities. The identification of specific deficiencies in psycholinguistic functions leads to the crucial task of remediation directed to the specific areas of defective functioning.

FUNCTIONS TESTED AT THE REPRESENTATIONAL LEVEL.

- A. The Receptive Process (Decoding). There are two tests at this level which assess the child's ability to comprehend visual and auditory symbols.

1. AUDITORY RECEPTION.

This is a test to assess the ability of a child to derive meaning from verbally presented material. Since the receptive, rather than the expressive, process is being sampled the response throughout is kept at the simple level of a "yes" or "no" or even a nod or shake of the head. The vocabulary becomes more and more difficult while the response remains at a two year level. The test contains 50 short, direct questions. Example: "Do dogs eat?" "Do wingless birds soar?"

2. VISUAL RECEPTION.

This test is a measure of the child's ability to gain meaning from visual symbols. There are 40 picture items, each consisting of a stimulus picture on one page and four

response pictures on a second page. The child is shown the stimulus picture with the directions, "See this"; then the page of response pictures is presented with the directions, "Find one here." The credited choice is the object or situation which is conceptually similar to the stimulus. The other choices include pictures with varying degrees of structural (rather than functional) similarity.

- B. The Organizing Process (Association). At the representational level, this process is represented by the ability to relate, organize, and manipulate visual or auditory symbols in a meaningful way.

1. AUDITORY-VOCAL ASSOCIATION.

This test taps the child's ability to relate concepts presented orally. In this test the requirements of the auditory receptive process and the vocal expressive process are minimal, while the organizing process of manipulating linguistic symbols in a meaningful way is tested by verbal analogies of increasing difficulty. A sentence completion technique is used, presenting one statement followed by an incomplete analogous statement, and allowing the child to complete the second statement appropriately. There are 42 orally presented analogies, such as, "I cut with a saw; I pound with a _____." "A dog has hair; a fish has _____."

2. VISUAL-MOTOR ASSOCIATION.

The organizing process in this channel is tapped by a picture association test with which to assess the child's ability to relate concepts presented visually. The child is presented with a single stimulus picture surrounded by four optional pictures, one of which is associated with the stimulus picture. The child is asked, "What goes with this?" (pointing to the stimulus picture). "Which one of these?" (pointing to the four optional pictures).

The child is to choose the one picture which is more closely related to the stimulus picture, such as a sock belonging with a shoe, etc. This test is expanded at the upper level to provide visual analogies comparable to the auditory analogies. "If this goes with this" (pointing to each of a preliminary pair of pictures), "Then what goes with this?" (pointing to the central picture as before).

- C. The Expressive Process (Encoding). This process at the representational level involves the child's ability to use verbal or manual symbols to transmit an idea. There are two subtests, one requiring vocal and the other manual responses.

1. VERBAL EXPRESSION.

The purpose of this test is to assess the ability of the child to express his own concepts vocally. The child is shown four familiar objects, one at a time (a ball, a block, an envelope, and a button) and is asked "Tell me all about this." The score is the number of discrete, relevant and approximately factual concepts expressed.

2. MANUAL EXPRESSION.

This test taps the child's ability to express ideas manually. This ability is assessed by a gestural manipulation test. Fifteen pictures of common objects are shown to the child, one at a time, and he is asked to "Show me what we do with a _____." The child is required to pantomime the appropriate action, such as dialing a telephone or playing a guitar.

FUNCTIONS TESTED AT THE AUTOMATIC LEVEL: The following subtests measure the child's ability to perform automatic, nonsymbolic tasks. Two abilities are measured at this level. One is the phenomenon of closure (both auditory and visual), and the other is short term sequential memory (auditory and visual).

A. Closure. The following tests assess the child's ability to fill in the missing parts in an incomplete picture or verbal expression.

1. GRAMMATIC CLOSURE.

This test assesses the child's ability to make use of the redundancies of oral language in acquiring automatic habits for handling syntax and grammatic inflections. The child comes to expect or predict the grammatic form so that when part of an expression is presented, he closes the gap by supplying the missing part. The test measures the form rather than the content of the missing word, since the content is provided by the examiner. Each of the 33 verbal items consists of a complete statement followed by an incomplete statement to be finished by the child. The examiner points to the appropriate picture as he reads the given statements, for example: "Here is a dog; here are two _____."

a. AUDITORY CLOSURE. (Supplementary Test 1)

This is basically a test of the organizing process at the automatic level. It assesses the child's ability to fill in missing parts which were deleted in auditory presentation and to produce a complete word. The child is asked, "What am I talking about--bo / le? tele / one?", etc.

b. SOUND BLENDING. (Supplementary Test 2)

This test provides another means of assessing the organizing process at the automatic level in the auditory-vocal channel. The sounds of a word are spoken singly at intervals, and the child is asked to tell what the word is. Thus he has to synthesize the separate parts of the word and produce an integrated whole. This test covers a wide range of difficulty levels.

2. VISUAL CLOSURE.

This test assesses the child's ability to identify a common object from an incomplete visual presentation. There are four scenes, presented separately, each containing 14 or 15 examples of a specified object. The objects are seen in varying degrees of concealment. The child is asked to see how quickly he can point to all examples of a particular object within the time limit of 30 seconds for each scene.

B. Sequential Memory. The two following tests assess the child's ability to reproduce a sequence of auditory or visual stimuli. They are tests of short term sequential memory.

1. AUDITORY SEQUENTIAL MEMORY. This test assesses the child's ability to reproduce from memory sequences of digits increasing in length from two to eight digits.
2. VISUAL SEQUENTIAL MEMORY. This test assesses the child's ability to reproduce sequences of nonmeaningful figures from memory. The child is shown each sequence of figures and then is asked to put corresponding chips of figures in the same order. The sequences increase in length from two to eight figures.

APPENDIX C

NEUROLOGICAL EXAMINATION

I. CEREBRAL:

Speech (Intelligibility)

Articulation

Sensorium & Maturity

Right-left discrimination

On self:

On examiner (if above 7)

Knowledge of body parts

Eye, ear, hand, foot, shoulder, elbow, wrist, ankle.

Finger identification (touch, with patient's eyes closed)

II. CEREBELLAR:

Stand on one foot (5 sec by 4, 10 sec by 6)

Hop (75% by age 4, all by age 5)

Heel-to-toe (by age 5)

Rapid alternating movements

Finger-nose-finger

Finger-thumb (eyes open & closed)

Each hand

Both hands

Mirror movements

Romberg test

Swaying

Head rotation

Choreiform movements

Associated movements (any time observed)

III. CRANIAL NERVES:

Fundi:

Eyes (pupio equality, colobomas)

Extraocular movements

Nystagmus

Facial nerve

Auditory

Tongue (movements)

Palate

IV. TENDON REFLEXES:

Plantar

Others:

V. SENSORY:

Position in space

Toe position

Double simultaneous stimulation (if above 7 years)

VI. MOTOR:

Weakness

Paralysis

Muscle tone

Asymmetry

VII. GAIT:

VIII. IMPRESSION:

APPENDIX D

WPPSI and WISC PRE- and POST-TEST SCALED SCORES

Subj	Verbal					Performance				
	Infor	Compre	Arith	Simil	Vocab	Pic Comp	Pic Arr	Block	Obj Assem	Coding
1	7	5	10	13	9	11	8	12	11	12
	9	9	8	14	11	11	13	9	15	10
2	15	9	12	7	7	7		8		
	7	9	6	10	3	7	8	9	10	8
3	8	15	10	9	9	7		4		
	10	6	12	12	8	8	12	9	8	10
4	5	8	11	9	10	9	9	8	7	11
	7	7	10	11	10	11	12	9	12	11
5	6	11	7	10	9	14	12	12	11	11
	12	7	10	13	7	13	10	10	13	10
6	6	10	14	8	5	12	14	15	12	8
	10	11	9	8	9	10	12	14	13	10
7	6	6	10	10	6	10	8	16	11	15
	5	5	6	7	8	16	8	12	13	11
8	6	11	10	6	10	13	8	8	6	14
	7	13	8	9	9	8	10	9	10	17
9	7	7	12	15	12	11	8	14	12	10
	8	12	11	16	11	12	9	18	12	9
10	11	14	11	12	12	11		12		
	9	10	9	13	10	13	13	15	13	7
11	7	7	10	8	11	12		6		
	8	13	9	9	8	13	10	11	9	13
12	10	7	10	13	11	10	11	11	13	14
	8	10	9	9	11	12	10	7	12	12
13	7	3	8	7	5	15	10	11	6	8
	4	6	10	7	8	9	6	10	8	10
14	5	4	6	4	11	12		8		
	8	7	9	6	10	10		11		
15	11	11	13	11	16	8		12		
	15	8	17	19	18	13	14	6	15	16
16	10	8	6	5	9	10		5		
	7	10	7	6	12	9	14	7	10	9

APPENDIX E

ITPA SUBTEST SCALED SCORES FOR SUBJECTS, PRE- AND POST-TEST*

Subj	Representational Level						Automatic Level				supplement	
	Auditory-vocal			Visual-motor			Aud-voc		Vis-Mot		Aud. clo	Soun blen
	Aud rec	Aud ass	Verb expr	Vis rec	Vis ass	Man exp	Aud mem	Gra clo	Vis mem	Vis clo		
1	40	33	45	45	34	35	32	39	29	45	35	35
	37	39	28	40	49	39	45	36	40	31	43	38
2	33	24	26	33	29	39	31	38	29	37	43	35
	38	44	32	35	35	36	39	43	23	28	41	37
3	47	29	35	30	38	37	38	41	37	28	33	46
	38	34	36	32	36	39	38	34	47	35	39	39
4	37	31	28	26	35	26	35	40	27	28	36	46
	41	37	30	31	38	26	38	32	38	43	38	45
5	38	26	30	39	37	42	37	34	27	33	39	42
	39	38	28	38	32	43	32	34	36	32	37	41
6	28	35	28	36	32	33	31	38	44	30	31	37
	36	37	30	30	30	32	35	32	43	39	43	39
7	23	26	35	40	40	32	27	29	51	46	27	32
	21	28	36	30	42	15	28	36	51	50	38	30
8	41	25	31	38	32	45	34	32	34	39	29	32
	43	23	28	39	37	37	33	22	39	39	43	47
9	32	36	30	31	32	29	32	42	36	20	46	32
	42	36	29	47	34	33	39	43	31	26	47	49
10	31	36	36	43	39	45	35	41	37	55	43	38
	47	54	31	27	37	42	38	33	29	39	44	36
11	32	27	23	24	13	39	25	24	26	27	19	35
	40	36	34	29	32	42	33	39	34	37	31	35
12	40	38	34	41	27	38	38	44	40	46	39	35
	45	40	29	37	38	34	54	40	39	45	44	41
13	27	19	29	35	42	27	30	36	29	23	33	40
	25	29	34	38	33	37	31	36	34	31		
14	31	24	36	28	32	39	25	24	42	23	20	41
	32	23	47	44	33	43	26	30	34	33	27	57
15	38	37	38	35	37	33	36	40	41	38	35	31
	45	46	39	29	42	39	36	40	36	37	36	41

* The pre-test scaled scores are given first for each subject.

VITA 1

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