CORRELATES OF ACHIEVEMENT IN LEARNING DISABLED CHILDREN

A Dissertation

Presented to

the Faculty of the Department of Psychology

University of Houston

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

By

Charlsa Trammell Lowell

August, 1974

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ABSTRACT

This study was designed as a preliminary investigation seeking to discover some of the correlates of scholastic achievements in learning disabled children and to determine the effects of educational therapy as it is practiced in this region.

The investigation was made ex post facto employing data developed by psychologists and psychiatrists who had performed the psychological appraisals and by school personnel who routinely administered the SRA Achievement Series to the fourth, fifth, and seventh grades in September and/or October each year.

A multiple regression program was used to determine which combination of variables best accounted for criterion variance when remediation was given and when it was not administered. The individual hypotheses were tested by correlational analysis by first computing the achievement test scores for each student and then correcting for age variance at the time of achievement testing.

Analysis indicated that the experimental and control groups were not significantly different except with regard to age at time of testing. (The experimental group averaged being 8.6 months older than the control group.) This factor

was therefore controlled statistically to remove this source of variance.

The first hypothesis stated that experimental children would excel their learning disabled peers who had not received educational therapy in all criterion areas--language arts, arithmetic, and reading. This proved to be true only with regard to language arts scores. Arithmetic and reading scores were not significantly different for the two groups.

An expectation that all girls would exceed boys in academic achievements, and that those attending remedial classes would require shorter periods of remediation, was not confirmed by these data. With age controlled, the data indicated no significant differences between males and females.

A third hypothesis anticipated that children who were placed in remediation when younger would require shorter periods of remediation. The data indicated, however, that the converse was true for the subjects of this study. A corollary expectation that the younger children would later prove to have higher achievement scores was not supported either. The younger children did relatively less well on arithmetic and did not differ significantly on language arts and reading from those whose remedial period had started at later ages.

The expectation that children who required shorter periods of remediation would later have better achievement scores proved to be accurate in this case for language arts and

arithmetic. Reading scores tended in the same direction but did not reach the .05 level of confidence. The proposition that a child's academic abilities would accelerate as the period between the end of remediation and SRA testing increased was not supported by the data.

It was anticipated that VIQ scores were significantly related to the achievement criteria for both groups. This proved correct with the single exception of an insignicant correlation between VIQ and reading achievement for the control group.

For the remedial group, PIQ scores were significantly related to all criterion measures. For the control group, PIQ was not significantly related to any criteria. The expectation that VIQ would evidence a stronger degree of relationship to the criteria than PIQ was met only for the experimental group for language arts and for the control group for language arts and arithmetic. In all other instances, PIQ showed a stronger degree of relationship with the criteria.

The proposal that FSIQ scores would be related to achievement scores was met in every instance but one. There was not a significant degree of correlation between FSIQ and reading achievement scores for the control group.

Multiple regression equations for the remedial group revealed age at SRA testing, FSIQ, and length of remedial period to account for a significant amount of the variance

of language arts scores. A combination of age at time of SRA testing, PIQ, length of remedial period, VIQ, and FSIQ was most potent in accounting for variance of arithmetic scores for the experimental group. For reading scores for this group, only PIQ proved to be a significant function.

For the control group, multiple regression equations showed VIQ as the only variable with a significant function in language arts score variance. For arithmetic scores for this group, a combination of age at SRA, VIQ, and time between diagnosis and SRA testing proved to account for a significant proportion of the variance in this criterion. For reading scores of the control group, no individual predictor variables had a significant beta weight, but a combination of age at SRA, PIQ, and FSIQ accounted for a significant amount of the variance in this criterion area.

Given the totality of expectations set forth in the hypotheses for this study, results were largely negative. Many of the findings made for small, select groups of children did not hold true for this sample drawn from the broad-based population attending public schools. It seems now imperative for psychologists and educators to re-examine more closely some of the assumptions based on popular beliefs which have failed to find support in this study.

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CHAPTER I

INTRODUCTION

This project was undertaken as a preliminary study seeking to discover certain correlates of school achievement in learning disabled children and to determine the effects of educational therapy, as it is practiced in this region, on later academic achievement. It was conceived as an aid to the educators and psychologists who must decide which children, if any, should be referred for remediation of learning disabilities.

Information Needed

The school psychologist who seeks the best means of arranging delivery of remedial education to these children under the usual school program is faced with very difficult choices. They can remain in the regular classroom and receive whatever additional assistance an already busy teacher can provide, can be assigned to self-contained classrooms, or can attend remedial classrooms for most of the day but participate in regular classrooms for those subjects not affected by their particular disorders. Investigators such

as Dubnoff (1966), Frostig (1968), and Gonik and Ayers (1966) have shown that private schools can improve materially the functioning on these children while others (Kephart, 1967; Myklebust, 1968; Lowell, 1973) have shown that remedial education frequently alleviates some of the maladaptive emotional reactions that almost invariably develop as a result of the child's negative learning experiences (Harris, 1961; de Hirsch, Jansky, & Langford, 1966). On the contrary, there is much sentiment to the effect that attendance at special classes labels a child and destroys his confidence and self-esteem, thus reducing his learning potential (Christopolos & Renz, 1969; Mercer, 1972). Some school authorities have described special classes as creating "cultural deprivation" for the child because of a supposed reduction in exposure to concepts and materials employed in the regular classroom. If remediation does not reduce materially the learning handicap, these negative side-effects should be avoided--if they exist. The reverse possibility should also be considered. Remedial classes may reduce emotional disturbances or tension related to learning disabilities without significantly improving academic achievement. If so, research is indicated to determine which side-effects of remedial classrooms are associated with these improvements in emotional functioning so they may be provided more directly.

Research Needed

In order to reach the most valid decision for a given

child, psychologists, educators, and parents need to know the probability that remediation will make a significant improvement in the child's school achievements and under what circumstances this change will occur. As indicated earlier, studies have shown that children do make significant improvements in private school settings, but these children are a very limited sub-sample of the population of students with learning disorders and private school settings ordinarily provide extensive controls over a child's environment which do not exist in public school settings. There is no dearth of pre- and post- studies showing that children in special classes have improved significantly in their scores on tests of "auditory reception", "figure-ground discrimination", etc. However, a review of the literature for the period 1966-1971 failed to reveal any comparative studies of academic achievement in these children and a matched control group in public schools subsequent to such periods of educational therapy.

Limitations

Because of the possible diversity of types of remedial programs, ability and personality factors of teachers, differences in referral processes, and characteristics of sample, these findings may be applicable uniquely to the school district in which this study was made. This is a survey, the first step in basic research to determine what appears to be objective reality to note functional re-

lationships. It is not within the scope of this effort to seek all possible functional relationships, to determine which of these also are causal relationships and, through this information, to build improved systems of remediation. It is hoped, however, that this first step will add materially to the accuracy of the decision process under current remedial techniques as well as to suggest fruitful lines of investigation to later researchers.

CHAPTER II

BACKGROUND

Educators have long known there were children of apparently adequate intelligence who could not or would not keep pace with their peers in the classroom, and parents have noted with dismay the son who was "bright as a dollar" but "tripped over dust" and "couldn't hit the floor with his hat." Prior to the past few decades, parents and teachers of these children often described them as lazy or careless or "just not trying." Certainly emotional factors enter into a child's capacity to learn at any given time, but it is equally possible that some of these emotional states may be the result of the child's inability to learn rather than the cause of it, i.e. a destructive sense of failure that many of them develop through pressures to perform complicates the disability by causing loss of motivation and emotional disturbance (Bryant, 1972; Gates, 1941; Natchez, 1959). The children we now categorize as learning disabled are the four or five children out of every thirty in a typical classroom who find demands of the curriculum truly un-

attainable or to be met only at the expense of far greater effort than is required of their normal peers (de Hirsch, 1962; Gallagher, J. R., 1960; Kephart, 1967).

Characteristics

Children with learning disabilities have been described as a "group of children who are not deaf but could not hear, not blind but could not see, not mentally retarded but could not learn (Kirk, 1966, p.26)." Scientists who have worked with these children have painted varied pictures depending upon their subjects and their interests. For example, these children may be characterized by the familiar Strauss Syndrome of hyperactivity, distractability, rigidity, perseveration, short attention span, and emotional lability (Strauss & Lehtinen, 1947), or they may be hypokinetic, cooperative, and even-tempered (Denhoff & Novack, 1967). They may also display a lack of fine motor control, non-specific awkwardness, difficulty in gestalt function and generalized inadequacy of perceptual motor function (Drake, 1966). Often incoming information seems to be disrupted so that it does not hold together, or outgoing responses may be disorganized or erroneous (Kephart, 1967).

Historic Attitudes

Two terms employed for these children were brain injured or brain damaged since many of them exhibited the behavior syndrome apparent in many children with exogenous brain damage studied by Strauss and Lehtinen (1947), as described above. On neurological examination a number of these chil-

children were found to show evidence of cerebral lesions, abnormal electroencephalogram readings or to have had a history of disease such as encephalitis or meningitis or of accidents such as lead poisoning or partial asphyxiation which frequently result in cerebral insult.

In many instances, however, careful medical examinations failed to reveal brain damage but the child's behavior supported a diagnosis of brain dysfunction (Richardson, 1966). One possible reason for this may lie in the fact that focal damage to a young brain does not cause specific disabilities as it does in an adult but tends to have a more pervasive effect on the higher mental functions (Kessler, 1970). Ross (1959) has suggested that a lesion in any part of the brain would disrupt differentiation and integration to a greater or lesser degree and in different combinations, depending on the type, site and extent of the defect and the developmental state of the child at the time of an injury. Disturbances in these processes would then be diagnostic of cerebral pathology. A problem arises, however, in the fact that some children with known brain damage do not show these deficits while many more children without known damage do so, particularly the endogenous mentally retarded (Benton, 1962).

One possible cause for this dilemma has been suggested by Birch and Diller (1959). They hypothesize that the reason it often is difficult to detect brain damage is that cerebral damage results in two different kinds of changes in

behavior which they describe as subtractive and additive. The subtractive change would result from a lesion which causes a loss of or deficiency in one or more behavioral functions without producing any active interference such as convulsions, spasticity, perseveration, or perceptual distortions. They reason that a lesion causing additive behavioral consequences, however, would produce problems for an individual by adding new physiological dimensions to cerebral functioning causing behavioral disturbances over and above whatever subtractive effects might also be occurring. Children with lesions of this type would then display signs of organicity which lead to the label brain-injured, while those having lesions of the subtractive type (more likely to be those who incurred brain damage in pre- or perinatal periods) may be the non-organic mentally retarded and non-organic learning disabled children.

Since a child's inability to learn normally suggested subtle disturbances of the central nervous system, new diagnostic labels such as minimal cerebral dysfunction and minimal brain injury came into use. These were based on the conviction that the great majority of these children, if not all of them, would ultimately be identified as having some type of neurological insult when diagnostic instrumentation was sufficiently advanced (Cruickshank, 1961; Graham & Berman, 1961).

Forces for change. Dissatisfaction with terminology suggesting that the etiology of learning disabilities was

cerebral damage evidenced in Strauss Syndrome behavior patterns increased. This concept was demonstrably inaccurate because brain damage may vary greatly with respect to etiology, extent, locus, type of lesion, etc., and the syndrome of dysfunction that result (Silver, 1970; Drake, 1966). In addition, some children with known brain damage have no learning deficits (Benton, 1962). The concept of minimal brain injury was also inadequate. Although learning disabled children all fail to respond appropriately or in the usual way to certain common environmental stimuli and reinforcers (dependent upon the individual's particular dysfunction), or display some disruption in the ability to form concepts and percepts according to classical theory (Trubey, 1968), the etiology of their learning disorders may be quite varied. A brief but highly traumatic period in a child's life may disrupt his behavior so markedly that he is unable to learn because of his uncontrolled behavior, or a less traumatic but very prolonged emotional disturbance can cause continued emotional stress with a resulting adaptation to stress following Selye's (1956) general adaptation syndrome. As a consequence, there is an interference with functional relationships within the central nervous system producing an effect very similar to brain injury (Kephart, 1967). In addition, children with a developmental lag in the perceptual motor area (Koppitz, 1964) and children in a highly inadequate physical or social environment (Frostig, 1966) may also

develop learning disabilities due to lack of adequate experience or because of experience acquired out of its proper sequence (Kephart, 1967).

Until increasedunderstanding of the nervous system clarifies these issues, it seems desirable to avoid use of a label which indicates an understanding of etiology or pathogenisis (Silver, 1970). Labels such as learning disability or learning disorder are therefore growing in popularity, and although they are no more functionally useful than the terms brain damage or minimal cerebral dysfunction they help to avoid an educator's feeling of hopelessness and parents' distress at the stigma of this label (Hewett, 1968).

Current Status

Nomenclature for these children is still nearly as varied as its user despite the decline in usage of terminology suggesting cerebral damage. A recent study was conducted by McDonald (1968) on the classification of children with learning disabilities. Of thirty-five professional workers in this field who replied to his questionnaire, twenty-two used labels such as brain injured, developmental imbalance, educationally handicapped, interjacent children, language disorders, minimal brain dysfunction, psycholinguistic disabilities, psychoneurological disorders, etc. Many of these terms were used as exact synonyms for the term learning disorders.

Definitions by Professional Organizations

The following definition emerged when the Council for

Exceptional Children, feeling the need for a Learning Disabilities Division, held a formulation meeting in St. Louis in April 1967: "A child with learning disabilities is one with adequate mental abilities, sensory processes, and emotional stability, who has a limited number of specific deficits in perceptive, integrative, or expressive processes which severely impair learning efficiency. This includes children who have a central nervous system dysfunction which is expressed primarily in impaired learning efficiency."

Another definition, similar in scope but placing emphasis on the basic nature of the language process, was adopted in January 1968 by the National Advisory Committee on Handicapped Children. This definition has been incorporated into federal legislation: "Children with special learning disabilities exhibit a disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written language. These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling, or arithmetic. They include conditions which have been referred to as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, developmental aphasia, and so on. They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance, or environmental disadvantage (Bryant, 1972)."

Study Population Defined

As Rabinovitch noted (1949) the term learning disability does not refer to a clinical entity distinct in itself

but rather to a symptom or symptoms reflecting disorder in one or more of the many processes involved in academic learning. For the purposes of this study, the sample of children in question will be categorized by the following definition: Children with learning disabilities are those who have a limited number of specific deficits in perceptive, integrative, or expressive processes which severely impair learning efficiency. These deficits will be displayed as disorders in symbolic language functions of thinking, talking, reading, writing, spelling, or arithmetic. They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance, or to environmental disadvantage.

By specifying the behavioral effects of a disability and omitting its etiology, this definition avoids polemical issues yet still describes the population under consideration.

CHAPTER III

CHOICE OF CORRELATES

Numerous Possible Predictor Variables

Even a brief consideration of the characteristics of children with learning disorders suggested an extended array of factors which may be associated with their scholastic achievements: sex, race, age when remediation is begun (if at all), length of remediation, period elapsed between remediation and achievement testing, overall intelligence, most intact channel for learning, etiology and extent of the disorder and the child's age at onset, family situation, cultural effects, health, learning style, sensory acuity, behavioral characteristics, type of remediation, teacher qualities, and so on. The choice of correlates for this study was necessarily limited to material available within the records of a specific school district in order to circumscribe the study within manageable limits of time and effort. However, the district had accumulated the data most readily available to psychologists who must make decisions with regard to remediation of learning disorders and to educators who

must determine when to initiate and terminate educational therapy.

Correlates Chosen

The following factors were selected as predictor variables to be examined by this study: sex, age at initiation of therapy, length of remedial period, period elapsed between remediation and achievement testing, overall intelligence and most intact channels for learning as reflected by the Verbal, Performance, and Full-scale Intelligence Quotients of the Wechsler Intelligence Scale for Children (WISC).

Rationale for Selection of Predictor Variables

Sex. Sex differences have received a great deal of attention in studies of academic performance because learning problems are far more common in boys than in girls (Schiffman & Clemens, 1967). A frequent reason given has been that child-rearing practices and social pressures centering around the role of the male child as a potential primary source of economic support for the family creates emotional stress which then leads to learning difficulties (Egeland, DiNello, & Carr, 1970). Boys may not find primary grade activities compatible with their understanding of the male role (Kagan, 1964). It is possible, however, that physiological and maturational factors may play an important role since the human male matures at a slower rate than the female (Betts, 1936). Direct measurement of maturational rates of the central nervous system are lacking, but in the bony skeleton the secondary centers of ossification appear consistently later in boys, the average difference being 20 months

(Bentzen, 1963). The learning problems and behavioral disorders noted more frequently among boys may be reactions to demands of a society which has neglected to provide for this biological age differential.

Other variables also may be influencing the outcome of research on sex differences. Differences in actual achievement may be due to more favorable classification practices for girls, or the matriarchal elementary school may influence attitudes and interests in such a way as to contribute to achievement differences between the sexes (Hutton, 1970). Girls also tend to be more tractable in the classroom, thereby incurring the greater approval of both male and female teachers (Paxson, 1968), as well as giving themselves more opportunity for the educational stimuli to be received, the essential first step in the learning process. Because they are better liked than boys as well as having a developmental advantage, girls may develop a better self-concept. Studies have shown that in both elementary and junior high schools students with low self-esteem tended to have lower grades than did their classmates with high self-esteem (Reeder, 1955; Lowther, 1963).

Whatever the sources of differences, studies have shown that girls score higher than boys on various tests (Carroll, 1948; Hall, 1963) and are superior to boys in their early school years when comparisons are made on achievement (Carter, 1956; Walker, 1965). Balow (1963) found that first

grade girls had achieved greater reading readiness than boys, a natural outcome of the marked developmental advantage enjoyed by girls (Bryant, 1962; Tanner, 1961).

Age. If remedial attention was warranted, when should it be commenced? "Start early" has been the watchword and many psychologists and educators have agreed upon the urgency of early diagnosis and treatment (Gallagher, J. L., 1966; Webb & Pate, 1970; Zedler, 1970). Waiting may allow a child to acquire learning from a later developmental stage without an adequate foundation in the early stages (Kephart, 1960), or to develop harmful learning behaviors which must be painfully unlearned before efficient methods can be acquired (Bangs, 1968). The most propitious time, physiologically, for certain types of learning may be missed (Ilg & Ames, 1964). In addition, adverse emotional reactions to reading failure appear very early in the elementary grades (Harris, 1961; Rabinovitch, 1954) and create increasingly complex problems.

Samuel Kirk (1958) has shown that early treatment was helpful to "familial" or endogenous retardates but not to equally capable exogenous retardates, at least when instruction was on a group basis. Washburn (1941) has found that certain children progressed faster if reading training was begun later, and the Spache (1966) study indicated that an extended readiness program had beneficial effects on later reading achievement in spite of the delay in introducing formal reading. Most psychologists lauding an early start have worked with children on an individual basis, in small pri-

vate schools, or only within the first few grades of public schools. Would their findings hold for children who were given remedial instruction in public schools and at a variety of age levels?

Permanence of Remediation. Would the value of remediation tend to increase or decrease as time passes after the formal remediation ceased? Therapists have noted that there is sometimes a "snowball" effect with a child applying his new-learned skills or coping mechanisms to a variety of learning situations, being reinforced by his increasing capacity to succeed, and becoming increasingly more proficient. However, in the related area of attemptimg compensation for cultural deficiencies this effect often has not occurred. Perhaps this increasing momentum has been restricted to certain fortunate children and not to the broad-based population to be found in the public schools.

Intellectual Capacity. Alfred Binet, the pioneer of intelligence testing as it exists in the western world used teachers' rating of children's scholastic achievements as his criteria, and his work was originated in an effort to predict children's ability to succeed in school. Many present day educators feel that this may be the primary value of intelligence testing today (Garcia, 1972; McClelland, 1973).

The WISC Full Scale Intelligence Quotient (FSIQ) was chosen as a correlate of achievement, or predictor variable,

because a number of studies have shown that global intelligence ratings are related to classroom achievement. In comparing scores of first grade boys on the WISC, Bender Visual Motor Gestalt Test (BVMT) and Illinois Test of Psycholinguistic Abilities (ITPA) with an achievement test measure, Egeland (1966) found that the global intellectual measure best predicted academic performance although inclusion of certain ITPA subtests did improve the prediction. Garner (1961) and Loughlin (1956) found mental age derived from full scale [illegible] with academic performance measures [illegible] mental age. In an analysis of the effects of mental [illegible] and socio-economic levels on reading achievement in [illegible] grade children, socio-economic status [illegible] was found [illegible] closely related to academic performance than was [illegible] mental age, but the highest correlations were [illegible] mental age and academic performance (Vilscek, 1965).

Given different combinations of variables, however, global measures of intellectual capacity such as the WISC [illegible] have been reported as less satisfactory. De Hirsch, Jansky, and Langford (1966) found their students' FSIQ scores to be positively related to reading achievement at the second grade level, but this was less effective than such indicators as verbal fluency and certain perceptual motor skills.

Verbal and Visual-Motor Channels. Are the areas of [illegible] on the Verbal Scale of the WISC more or [illegible] to child's school achievement than those of

the Performance Scale? Both educational and other environmental stimuli impinging upon a child have a large verbal component. Walker's (1965) study found that the Verbal Intelligence Quotient (VIQ) of the WISC served better as a predictor of achievement test scores than did sex, chronological age, socio-economic status, or maturity ratings. A study by Egeland et al (1970) noted that the verbal subtests Information, Arithmetic and Digit Span had significant correlations with both reading and arithmetic achievement scores of normal children at first and third grade levels while performance scale subtests did not. However, Harrington and Durrell (1955) found visual determinants to be far more crucial in the reading process than are auditory ones. Reading requires both visual discrimination and integrative capacities and these qualities are also required for the performance items of the WISC (Coins, 1958; Potter, 1949).

Correlates Excluded

Other data which may be pertinent and are often available for the decision process in determining whether to arrange remedial education for a child were excluded for the following reasons.

Race. This may be a most important variable and deserves inclusion. However, in this district there was only one Negro child in special education classes. He was deaf. There were many Mexican-American or Chicano children in learning disabilities classes but these children were excluded because of the complicating factors associated with bi-

lingualism.

Strauss Syndrome. The presence of symptoms of hyperkinesis, distractability, short attention span and labile affect were sometimes noted on the referral or report in a given child's folder in this district. On many occasions, however, no comment was made about the presence or absence of these behaviors, but it was judged unsafe to assume that they therefore did not exist since the referring agent might have omitted these data.

Behavioral Tendencies. Behaviors such as extreme aggressiveness, withdrawal, presence or absence of motivation to learn, etc., were not routinely noted for all children and, as discussed above, failure to mention a negative behavior did not necessarily mean that its positive antithesis was present.

Brain Injury. This variable was omitted because of diagnostic confusion and lack of reliable diagnosis. (See Chapter II.) Were this not the case, however, this variable would have been omitted after the physicians' reports were scrutinized. (All children admitted to the remedial programs were required to have neurological examinations.) For example, some physicians required EEG readings and others did not. Some considered the presence of 14 and 6 spikes as indicative of brain dysfunction and others did not. Some regarded minor abnormalities of the EEG as diagnostic while others believed that a large proportion of normal children

have such readings and they required more definitive findings. With regard to one particular child, two specialists disagreed. The examining physician diagnosed him as emotionally disturbed, not brain-injured, and referred him to a psychiatrist who then diagnosed the child's difficulty as brain injury and not emotional disturbance. A wide range of standards was in effect and in at least some cases a child's neurological standing depended upon the physician's orientation. In addition, for children diagnosed as "not brain injured" the possibility that their lack of positive symptoms may have been due to subtractive effects of brain damage or to an early cerebral insult resulting in diffuse, non-specific disabilities created the suspicion that a decision would be based on ignorance of the reasons for their learning problems rather than positive knowledge about the integrity of their brains (Ross, 1968).

The designation of some children as being definitely brain injured and others as being definitely not brain injured would have been of very doubtful validity, while their description as children with learning disabilities characterized by a discrepancy between apparent capacity for performance and actual level of functioning (Bateman, 1964) could be confirmed by direct observation and measurement.

Choice of Achievement Measures

Within this district both teacher-developed subject grades and Science Research Associates (SRA) Tests results

were available as criteria of a child's scholastic achievements. Scores on standardized achievement tests often have been used as indicators of academic performance (de Hirsch et al, 1966; Egeland et al, 1966; Koppitz, Sullivan, Blyth, & Shelton, 1959). They have the disadvantage of being a one-occasion sample of an individual's achievements while teachers' grades are built upon many samples and are not unduly influenced by illness or emotional disturbance upon a given test date. However, standardized tests present equally difficult problems to all children while subject difficulty in the classroom may vary substantially from teacher to teacher. They also tend to control for any teacher-bias which may be present in grading. Since these data could be obtained inexpensively because of the district's routine testing program, SRA test results were chosen as the criteria of a child's academic achievement in language, mathematics and reading for this study. The SRA Language Arts Test consisted of separate scores for Capitalization and Punctuation, Grammatical Usage, Spelling, and Total Language Score. The Arithmetic Test consisted of a separate score for each of the areas described as Reasoning, Concepts, Computation, and Total Arithmetic. The Reading section of the SRA tests consisted of Comprehension, Vocabulary, and Total Reading Score. In each criterion area, the total score was chosen because a total score is more stable than any of its components.

Hypotheses

On the basis of previous research cited above and/or theoretical conceptualizations, a number of hypotheses were made with regard to the correlates of achievement.

Hypothesis 1. Children with learning disabilities who attend remedial classes provided by this school district subsequently show a higher level of academic achievement in regular classes than do children with similarly diagnosed handicaps who do not receive this remediation.

Hypothesis 2. Female students require a shorter period of remediation and show a higher level of school achievement than male students. Among children not receiving remediation, females will have higher SRA scores than boys.

Hypothesis 3. Children who are younger when remedial education is commenced require a shorter period of remediation than older children, and subsequently obtain higher achievement scores.

Hypothesis 4. As the period between the end of remediation and achievement testing lengthens, a child's capacity for academic achievement accelerates. Therefore, the length of the period after remediation is positively correlated with the level of achievement.

Hypothesis 5. Length of remedial period is positively related to a child's age at beginning remediation and negatively correlated with the subsequent level of achievement.

Hypothesis 6. The WISC Verbal Intelligence Quotient (VIQ) is positively related to achievement level in learning

disabled children.

Hypothesis 7. The WISC Performance Scale Intelligence Quotient (PIQ) is positively related to the academic achievement level of learning disabled children but to a lesser degree than the VIQ.

Hypothesis 8. The WISC Full Scale Intelligence Quotient (FSIQ) is positively correlated with the child's academic achievement level.

CHAPTER IV

METHODS AND PROCEDURES

Subjects

Children chosen as subjects for this study were students of a school system that was among the first in this area to offer special education for children with learning disabilities. It has constantly expanded the number of remedial classrooms as children's needs became more apparent so that there has been little or no waiting period for admission after diagnosis and approval of the placement committee. Each child's program was individually tailored to remediate those deficits noted in the referral and psychological appraisal, and then adjusted in accordance with the needs and abilities displayed as remediation progressed. The child was placed in a special class for those functions requiring therapeutic intervention and in a regularly constituted class for those subjects at which he was successful. The school district maintained between 35 and 40 schools and was centered primarily in a small city dominated by heavy industries. The majority of its citizens were

Caucasian with a minority of Mexican-Americans or Chicanos, and with most families in the lower to middle socio-economic range.

Experimental Subjects. The experimental group of subjects consisted of all children who had been in remedial education classes and who met the following specifications:

1. Referral for psychological evaluation by a regular classroom teacher who noted severe academic deficiencies in the child's daily performances.

2. Psychological appraisal including administration of the WISC, resulting in a diagnosis of (a) cerebral dysfunction; (b) learning disorders extensive enough to disrupt the child's capacity to cope with the academic demands of the regular classroom, displayed as disorders of thinking, talking, reading, writing, spelling, or arithmetic; and (c) apparently adequate intelligence in areas not affected by the learning disabilities, with a FSIQ of 75 or more.

3. Apparently good health with no uncorrected deficits of visual or auditory acuity.

4. Return to regular classes on a full-time basis after a period of remediation. Some of these returns were initiated at the insistence of parents but the majority were upon the recommendations of special education teachers.

5. After remediation and while enrolled in regular classes were administered the SRA Achievement Series Multilevel Edition, Green Level or Blue Level, Forms C and D, pub-

lished by Science Research Associates, 259 East Erie Street, Chicago, Illinois, 60611.

Only Total Language Arts, Total Arithmetic and Total Reading scores were used. These tests were administered as part of the district's regular autumn testing program for fourth, fifth, and seventh grade classes. Although 131 students met the first four qualifications, only 40 were found who also met the fifth.

Control Subjects. For the group of control subjects a sample of 253 children was chosen by selecting letters of the alphabet at random and accepting as subjects all children in this school district whose records were filed under those letters and who met the first three qualifications established for the experimental group but who did not receive remedial attention. Of this group 59 were located who had remained in the district and had been administered the SRA tests as specified under item 5 above. Descriptive statistics for all subjects have been placed in Table 1.

Group Differences. Control and experimental subjects were therefore alike on the above dimensions but may have differed on others. Parents willingness to arrange for neurological examinations and/or to allow their children to participate in remedial classes may have represented factors creating significant differences between experimental and control subjects. (School subsidization of examinations fees was available where needed.) Whether a failure to cooperate connoted

TABLE 1

COMPARATIVE DATA ON EXPERIMENTAL AND CONTROL GROUPS

	EXPERIMENTAL CROUP		CONTROL GROUP	
	Males	Females	Males	Females
Number	28	12	45	14
*Age at diagnosis or beginning remed.	110.8	122.4	110.4	91.7
*Age at SRA testing	155.5	166.5	148.4	152.0
*Length of remed.	18.0	14.9		
*Length of period remed. to SRA	22.6	23.5		
*Length of period diagnosis to SRA	44.7	41.1	40.2	53.1
*Remediation ended:				
Parent decision	5	2		
Teacher decision	23	10		
WISC VIQ	93.8	95.9	95.6	91.5
WISC PIQ	92.9	99.3	94.9	89.4
WISC FSIQ	92.5	97.6	94.7	89.6
*SRA Total Language	62.8	80.7	59.6	55.0
*SRA Total Arithmetic	64.7	72.8	64.7	60.1
*SRA Total Reading	65.9	73.3	64.7	59.1

*Numbers refer to months.

Data presented are mean scores for each subgroup.

disinterest in their child's education, reluctance to admit a deficiency in their child, a lack of confidence in the efficacy of speical education, or a preference for private treatment is not known. Koppitz (1971) observed that parent consent to the placement of a child in learning disabilities classes was an important factor in the child's academic success. Experimental children, therefore, may have had some advantage.

The groups may also have varied on the basis of socio-economic status, cultural background, family constellation, degree or pattern of learning deficiency, behavioral characteristics, or motivational factors. Social data was examined for approximately one-third of each group and failed to indicate significant differences in family structure or stability or parent-child relationships. As stated elsewhere, however, reliability of such data was doubtful. Because of these possible differences between control and experimental groups other differences of interest in this study may have occurred due to these unknown and uncontrolled factors.

Attrition. The attrition suffered by these groups was primarily due to two factors: (1) family mobility, and (2) the finding that apparently equivalent scores on SRA Achievement Test Series 1-2 and 2-4 Form D, on the one hand, and the Blue and Green Level Series on the other were not actually equivalent. That is, a Grade Equivalent (GE) score of 5.3 on the 2-4 Form D test was not equivalent to a GE score of 5.3 on the Blue Level. (Communication with an SRA official at the

Chicago office provided the foregoing information along with data showing that apparently equivalent scores on the Blue and Green Level Series did indeed represent equal levels of ability.) It was therefore necessary to eliminate those subjects who had received the 1-2 Form D or the 2-4 Form D tests and use only those who had been administered the Blue and Green Level Series.

Procedures

Since this was an ex post facto study, no actual procedures were applied. The data points employed were developed by psychologists and psychiatrists who had performed the psychological appraisals and by school personnel who routinely administered the SRA Achievement Series to the fourth, fifth, and seventh grades in September and/or October each year.

Data Collection

Predictor Variables. Files maintained in the Special Education Administration Office were entered to locate subjects for the experimental and control groups who met the qualifications established above and expressed in the definition in Chapter II. That is, they had learning disabilities not due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance, or to environmental disadvantage. The following data were then retrieved for each subject: the child's name, birthday, age on appraisal or entry into remedial classes, age on re-entry into regular

classes on a full-time basis (for the experimental group), length of remedial period, reason for return to regular classes (parent or teacher decision), VIQ, PIQ, and FSIQ scores.

Achievement Scores. To obtain the SRA scores, each individual school was visited. A letter of introduction from the superintendent of this district was presented to each principal and the purpose of this study and data required from the school were described. Principals were assured that both children and schools would remain anonymous. Some principals recognized the superintendent's handwriting but others telephoned to verify the letter. When a principal was convinced the study was approved, he then called in the school secretary, if it was an elementary school, and the search began. School enrollment cards were furnished to compare with the original list of 131 experimental and 253 control subjects. A list of children with the same names and birthdates was developed and the files of these children were sent to the principal's office. SRA scores and dates of testing were then obtained. In some schools these files were maintained in the school's central office thus eliminating the need for disturbing classroom teachers.

For secondary schools the search was further complicated by the fact that each grade level was assigned a counselor who kept record files for that grade. After obtaining a list of matching names and birthdates from the school's enrollment

records, it was necessary to wait until each counselor was free, explain again the nature of this study, and obtain the necessary data.

Preparation for Analysis

Because many children were not at their appropriate grade levels in the regular classrooms, it was not possible to use percentile ranks available from the SRA tests since percentile ranks refer to a child's ability relative to other students in his grade rather than to his age peers. It would be necessary therefore to partial out the effects of age and evaluate a child's academic achievements in relation to the grade equivalent (GE) he had attained rather than his percentile rank. In preparation for this, all ages, periods of time, and grade levels were converted to months. That is, a GE of 5.3 was converted to 63 months or an age of 6 years 6 months was converted to 78 months.

Data were prepared for the computer using actual numbers where these existed and translating nominal data such as sex or group memberships into a binomial system of 1 for one group or sex and 2 for the other. Each subject was given an identifying code number and names were eliminated. The following data points were coded on optical scan sheets for each subject:

1. Individual code number.
2. Group membership--experimental coded 1; control coded 2.

3. Sex--males coded 1; females 2.

4. Age at diagnosis or entry into remedial classes--coded in months.

5. Age at achievement testing--coded in months.

6. Length of remediation for experimental subjects coded in number of months actually in remedial classrooms. Three school years would be coded as 27 months.

7. Period elapsed between end of remediation and achievement testing for experimental group--coded in total months elapsed.

8. Period elapsed between diagnosis and achievement testing, for all subjects--coded in months.

9. VIQ score.

10. PIQ score.

11. FSIQ score.

12. SRA Total Language Arts score--coded in total months.

Total Arithmetic score--coded in total months.

14. SRA Total Reading score--coded in total months.

15. Reason for returning to regular classroom on a full-time basis for experimental group--coded 1 for teacher decision, 2 for parent decision.

CHAPTER V

ANALYSIS AND RESULTS

Statistical Procedures

A multiple regression program was used to determine which combination of variables best predicted SRA achievement scores for these children with learning disabilities (1) when remediation was given and (2) when it was not. The program selected the variables which contributed most to the criterion variance in turn and added them one at a time beginning with the variable for which the beta weight was most significant. Variables were added until they no longer made a significant contribution ($p < .05$) to the final multiple regression.

The individual hypotheses were tested by correlational analysis by first computing the achievement scores for each student corrected for age variance at the time of achievement testing. For Hypotheses 1 and 2 these corrected achievement scores were then correlated with group membership score vectors where membership in a group was scored 1 and non-membership was scored 2. This procedure produced a

correlation coefficient which traditionally has been called a point-biserial coefficient. The multiple regression program used also produced the zero order correlation coefficients and required analysis.

Results

The correlation coefficients indicated that the groups were not significantly different with regard to the independent variables shared by both except with respect to age. The remedial group was 8.3 months older at time of diagnosis, a difference significant at the .02 level of probability, and maintained approximately this advantage (8.6 months) at the time of achievement testing, a difference significant at the .002 level of confidence. (See Table 2.) Girls were older on the mean than boys at the time of achievement testing ($p < .02$). Girls in the remedial group and boys in the control group tended to be older at the time of diagnosis but these differences did not reach the .05 level of significance.

Within the group having had remedial education for their learning disabilities, those children who were returned to mainstream education on a full-time basis at the recommendation of their teachers were younger than those who were returned by parental decision only ($p < .01$) and showed a tendency to receive lower Total Language achievement scores ($p < .08$). Reason for return to regular classrooms was not related to the other predictor variables of sex, age at SRA

TABLE 2

RELATIONSHIP OF GROUP MEMBERSHIP

TO PREDICTOR AND CRITERION VARIABLES

Combined Groups	Sex	Age at Diag.	Period Diag/SRA	Age at SRA	VIQ	PIQ	FSIQ	SRA Lang.	SRA Arith.	SRA Reading
Original Statistics	-07	-21*	-01	-28**	01	-05	-02	-22*	-12	-04
With Age at SRA Statistically Controlled	-07	-21*	-01	00	01	-05	-02	-18*	-03	-002

The decimal points in this table have been omitted for the sake of clarity and composition.

*$p < .05$, $r = .20$ **$p < .10$, $r = .25$

Negative correlations indicate that the experimental group's mean score was larger.

testing, intelligence scores, or to achievement test scores. However, there was a tendency ($r = .27$) for the children returned by parental decision to have a shorter period of assistance than children returned by teacher decision.

In presenting the remaining data developed by this study, findings pertinent to the listed hypotheses will be stated first. Multiple regression equations indicating which combinations of correlates most adequately account for criterion variance will be presented last.

Hypothesis 1. This proposal stated that learning disabled children who received educational therapy would show superior achievement scores on the SRA tests after return to regular classes when compared with other children with learning disorders who did not receive such remediation. Data indicated that the experimental group did obtain significantly better SRA Language Arts scores ($p < .03$) but had no advantage in Arithmetic ($p > .40$) or in Reading ($p > .49$). See Table 3.

Hypothesis 2. The expectation was that female students will require a shorter period of remediation and show a higher level of school achievement than male students, for the remedial group, and that the females of the control group will show higher achievement scores than their male peers. This supposition received very weak support from the data. (See Table 4.) The correlation between length of remediation and sex was negative ($r = -.15$), indicating that girls

TABLE 3

RELATIONSHIP OF REASON FOR RETURN TO REGULAR CLASSES

WITH PREDICTOR AND CRITERION VARIABLES

Remedial Group	Sex	Age at Diag.	Length Remed.	Age at SRA	VIQ	PIQ	FSIQ	SRA Lang.	SRA Arith.	SRA Reading
Original Statistics	-08	37*	-27	06	-07	-07	-08	06	-01	-22

The decimal points have been omitted from this table for the sake of clarity and composition.

Negative correlations indicate that the mean score of the children returned on the recommendation of special education teachers was higher than that of the children returned by parent decision.

$p < .05$

TABLE 4

CORRELATIONS OF SEX

WITH PREDICTOR AND CRITERION VARIABLES

Group	Length Remed.	Reason Return	Age at Diag.	Age at SRA	VIQ	PIQ	FSIQ	SRA Lang.	SRA Arith.	SRA Reading
Experimental (Remed.)	-15	08	27	30*	07	22	18	37*	27	06
Control (No Remed.)			-21	10	-13	-20	-18	-10	-14	-11
Combined Groups			01	18*	-04	-01	-02	10[a]	-02[a]	-06[a]

The decimal points in this table have been omitted for the sake of clarity and composition.

[a] Corrected for age at SRA testing.

* $p < .05$

attended remedial classes for shorter periods than did boys and were more often recommended for return to regular classes by their teachers ($r = .08$), but these correlations were well within the range of chance variations. Girls did show superior language scores after remediation ($r = .37$), a difference significant beyond the .01 level before correction for age at SRA testing. This superiority was in part age-related. When variance due to age at SRA was deducted, an F-ratio of 5.51 indicated that girls still had better language arts scores, but this was not significant at the .05 level (see Table 5). Arithmetic and reading scores showed no important differences between males and females.

Among girls of the control group there was no evidence of superior academic achievement over that of boys as measured by the SRA tests, either before or after correction for age at SRA testing. Females of the experimental group had somewhat higher WISC scores than the males, while the control group females had slightly lower WISC scores than the males, but in neither group did these differences approach statistical significance.

Hypothesis 3. The proposition was that children who were younger at the beginning of remediation would require a shorter period of remediation and would obtain higher scores on the achievement tests. Remediation, however, was significantly longer for the younger children ($r = -.35$, $p < .01$) as shown in Table 6. Younger children did less well on

TABLE 5

F-RATIOS FOR EXPERIMENTAL AND CONTROL GROUPS
WITH CRITERIA AS DEPENDENT VARIABLES
(Given that variance due to age at SRA has been determined)

	LANGUAGE			ARITHMETIC			READING		
Source of Variation	F-Value	df	$F_{.05}$	F-Value	df	$F_{.05}$	F-Value	df	$F_{.05}$
Experimental Group:									
Sex	5.51	1,38	4.17	1.41	1,38	4.17	.04	1,38	4.17
Age at Diagnosis	1.49	1,38	4.17	6.17	1,38	4.17	.69	1,38	4.17
Length of Remed.	4.29	1,38	4.17	7.65*	1,38	4.17	2.83	1,38	4.17
Period: Diag./SRA	1.49	1,38	4.17	6.17	1,38	4.17	.69	1,38	4.17
VIQ	12.31*	1,38	4.17	10.87*	1,38	4.17	7.16	1,38	4.17
PIQ	8.61*	1,38	4.17	22.78*	1,38	4.17	14.68*	1,38	4.17
FSIQ	14.24*	1,38	4.17	21.83*	1,38	4.17	14.19*	1,38	4.17
Control Group:									
Age at Diagnosis	.76	1,57	4.08	6.58	1,57	4.08	1.40	1,57	4.08
Period: Diag./SRA	.76	1,57	4.08	6.58	1,57	4.08	1.40	1,57	4.08
VIQ	15.82*	1,57	4.08	7.65*	1,57	4.08	1.13	1,57	4.08
PIQ	3.54	1,57	4.08	2.07	1,57	4.08	2.37	1,57	4.08
FSIQ	13.49*	1,57	4.08	6.84	1,57	4.08	.00	1,57	4.08

Predictor variables not contributing significantly to at least one of the criteria have been omitted.

*$p < .01$

arithmetic ($F = 6.17$, $p < .05$) and did not differ on language arts and reading from the children who were older when placed in remediation, after variance due to age at time of SRA testing was deducted (see Table 5).

Hypothesis 4. The hypothesis was that length of remedial period would be positively related to the children's ages at diagnosis and negatively related to SRA test scores. The first part of this proposal must be rejected. The correlation of -.35 shows that the younger children required significantly longer ($p < .01$) periods of remediation. The second part of the hypothesis received partial support. Correlation coefficients of -.30 and -.34 indicated that children who had been in remedial classes for shorter periods of time received significantly better language and arithmetic scores ($p < .05$), while a correlation of $r = -.25$ did not reach the .05 level of confidence but indicated that reading achievement was also in that direction, as shown in Table 6.

Hypothesis 5. The proposition that a child's capacity for achievement would accelerate as the period between the end of remediation and SRA testing increased found no support in the data presented. The coefficients between duration of this period and the criterion variables approached zero. (See Table 6.)

Hypothesis 6. This hypothesis was that VIQ scores are positively correlated with achievement test scores, and was supported in every instance except one. F-ratios of

TABLE 6

CORRELATIONS OF PREDICTOR VARIABLES TO CRITERIA;

INTER-CORRELATIONS OF PREDICTOR VARIABLES

FOR EXPERIMENTAL GROUP

	Sex	Age at Diag.	Length of Remed.	Period Rem./ SRA	Period Diag./ SRA	Age at SRA	VIQ	PIQ	FSIQ	SRA Lang.	SRA Arith.	SRA Reading
Sex	---	27	-15	02	-10	30	07	22	18	37	06	-11
Age at Diag.		---	-35	-57	-78	49	04	18	12	22	47	16
Length/Rem.			---	-28	52	16	-03	-14	-09	-30	-34	-25
Period Rem./SRA				---	67	03	-32	-11	-25	05	-06	08
Period Diag./SRA					---	15	-30	-20	-28	-17	-31	-12
Age at SRA						---	-35	-00	-20	10	32	09
VIQ							---	52	88	43	31	34
PIQ								---	86	43	58	53
FSIQ									---	49	50	50
SRA Language										---	74	53
SRA Arithmetic											---	65
SRA Reading					N = 40							---

Decimal points have been omitted for the sake of clarity and composition.

$p < .05$, $r = .30$; $p < .01$, $r = .39$

12.31 and 10.87 indicate a relationship with language arts scores and arithmetic scores, respectively, significant at the .01 level of confidence. An F-ratio of 7.16 shows a relationship with reading scores significant at the .05 level. (Variance due to age at SRA had been deducted.) The above figures applied to the experimental group. The combined groups also showed significant correlations of VIQ with achievement scores. Table 8 shows correlations of .48 and .39, significant beyond the .005 level, with language arts and arithmetic scores, and of .24 ($p < .01$) with the reading criterion. In the control group, VIQ scores were again related to the language and arithmetic criteria ($r = .44$ and $r = .26$, respectively) at the .01 level of confidence. The relationship with the reading test, however, approached the level of chance. F-ratios concurred. (See Tables 5 and 7.)

Hypothesis 7. This statement anticipated that PIQ scores would be significantly related to the criterion variables, SRA achievement tests in language arts, arithmetic, and reading. This supposition was supported for the experimental group and for the combined groups, but not for the control group alone. (See Tables 5 and 8.) For the children of the remedial group, PIQ scores were related to language arts scores at the .01 level of confidence ($F = 8.61$), and to arithmetic and reading scores at the .001 level ($F = 22.78$ and 14.68, respectively). Data for the combined groups, in Table 8, showed PIQ scores related to language

TABLE 7

CORRELATIONS OF PREDICTOR VARIABLES TO CRITERIA;

INTER-CORRELATIONS OF PREDICTOR VARIABLES

FOR CONTROL GROUP

	Sex	Period Diag/SRA	Age at Diag.	Age at SRA	VIQ	PIQ	FSIQ	SRA Lang.	SRA Arith.	SRA Reading
Sex	---	-32*	-22	10	-13	-20	-18	-10	-14	-11
Period Diag/SRA		---	-61*	-40*	-21	-30*	-30*	-07	-15	-08
Age at Diag.			---	48*	05	08	08	43*	20	20
Age at SRA				---	-18	-23	-24	10	33*	15
VIQ					---	43*	88**	44*	26	11
PIQ						---	80**	21	09	-23
FSIQ							---	40*	22	-04
SRA Language								---	73**	46*
SRA Arithmetic									---	29*
SRA Reading										---

N = 59

Decimal points have been eliminated for the sake of clarity and composition.

$p < .05$, $r = .25$

$p < .01$, $r = .32$

arts and arithmetic at the .005 level of significance (r = 48, r = 39, respectively) and to reading at the .01 level (r = 24). For the control group alone, however, PIQ scores were not related to achievement scores on these SRA tests (see Table 5). The proposal that PIQ would show a lesser degree of relationship to the criterion variables than VIQ was true only for the experimental group for language arts and for the control group for language arts and arithmetic. (See Table 5.) For the combined group VIQ and PIQ each showed a correlation of .43 with language. (See Table 8.) In all other instances, PIQ showed a stronger degree of relationship with the criteria.

Hypothesis 8. The proposal that FSIQ scores would be related to achievement test scores was met in every instance but one. FSIQ showed no correlation with reading scores for the control group (F = .004). Table 5 shows F-ratios significant at the .001 level for the relationship between FSIQ and the language arts, arithmetic, and reading criteria for the experimental group. For the control group, the relationship between FSIQ and language arts is significant at the .001 level (F = 13.49) and between FSIQ and arithmetic at the .05 level (F = 6.84). For the combined groups, the correlation between FSIQ and the achievement criteria is significant at the .01 level of confidence. Table 8 shows r = .49, r = .50, and r = .50, respectively.

Multiple Regression Equations: Remedial Group

Language Arts Scores. Table 5 shows F-ratios of those

TABLE 8

CORRELATIONS OF PREDICTOR VARIABLES TO CRITERIA;

INTER-CORRELATIONS OF PREDICTOR VARIABLES

CORRECTED FOR AGE AT SRA TESTING

	Group	Sex	Age at Diag.	Period Diag./SRA	VIQ	PIQ	FSIQ	SRA Lang.	SRA Arith.	SRA Reading
Group	---	-07	.-21	-01	01	-05	-02	-18	-03	00
Sex		---	01	14	-04	-01	-02	09	-02	-06
Age at Diag.			---	-67	04	13	10	16	35	14
Period Diag./SRA				---	-25	-26	-29	-16	-35	-15
VIQ					---	47	88	48	39	24
PIQ						---	83	34	37	12
FSIQ							---	48	45	22
SRA Lang.								---	73	49
SRA Arith.									---	44
SRA Reading										---

N = 99

Decimal points have been eliminated for the sake of clarity and composition.

$p < .05$, $r = .20$

$p < .01$, $r = .25$

independent variables which contribute significantly to at least one of the criterion variables--SRA Language Arts, Arithmetic, and/or Reading scores. Multiple Regression Analysis Tables for all three criteria were placed in Appendix A. With regard to language arts scores as criterion, multiple regression showed that when age of students at time of SRA testing was used by itself, an insignificant amount of the variance was accounted for. When FSIQ was added to the equation, the combination of age at SRA and FSIQ accounted for .29 of the variance. While age at SRA was still insignificant, FSIQ was significant beyond the .05 level. Therefore, with age controlled FSIQ was still a significant function in determining language arts scores. When the variable, length of remedial period, was added to the above equation, an additional .07 of the variance was accounted for. (It should be noted that time was a negative influence.) When additional predictor variables were added to this equation their functions were insignificant.

Arithmetic Scores: Intellectual functions tapped by both the WISC Verbal and Performance Scales were more closely related to SRA Arithmetic scores than to language arts or reading scores. Age at time of SRA testing was an important factor contributing .10 of the variance of arithmetic scores. Adding the variable PIQ increased the variance accounted for to .44. Both functions were significant beyond the .05 level. Adding the variable, length of remedial period, (again a negative influence) accounted for an additional .10 of the vari-

ance. With age, length of time in remediation, and PIQ controlled, the effect of abilities tapped by VIQ still proved to be a significant function and added .05 to the variance accounted for at this point. When FSIQ was added next its function was negative but significant at the .05 level and added an additional .05 to the variance accounted for. When other predictor variables were added to the equation, their functions were insignificant.

Reading Scores. When age at SRA testing for remedial students was entered as the first variable of a multiple regression equation, its function was not significant. When PIQ was added to the equation, the combination of age at SRA and PIQ accounted for .29 of the variance, and while age at SRA was still not an important factor, PIQ was significant beyond the .05 level of confidence. When other predictor variables were added beyond this point, their functions proved to be insignificant in determining reading scores.

Multiple Regression Equations: Control Group

Language Arts Scores. When age of control students at SRA testing was used by itself in a regression equation for predicting language arts scores, its function was not significant. When VIQ was added as a predictor variable, age at SRA was still not significant. The combination, however, accounted for .23 of the variance and VIQ was a significant function at the .05 level. Addition of other predictor variables beyond this point did not make a material contribution to the variance accounted for in this criterion variable.

Arithmetic Scores. In order to control for age of control students at time of SAR testing, this variable was entered first into a multiple regression equation and proved to be a significant function (.05 level of confidence) accounting for .11 of the variance. Addition of VIQ, the variable having the largest Beta weight, accounted for an additional .11 of the variance and was also significant at the .05 level. When the time between diagnosis and SRA testing was introduced to the combination, its function was negative but accounted for .06 of the variance of the combination of age at SRA, VIQ, and time between diagnosis and SRA. Addition of other predictor variables beyond this point did not prove significant in determining arithmetic scores.

Reading Scores. When age of students at SRA testing was used by itself, an insignificant amount of the variance was accounted for. Addition of PIQ, the predictor variable having the largest Beta weight, did not materially add to the variance accounted for. However, when age at SRA, PIQ, and FSIQ were controlled, the criterion variance accounted for rose to .12 with the functions of PIQ and FSIQ significant at the .05 level of probability. However, the function of PIQ was negative. With age at SRA, PIQ, and FSIQ controlled, the criterion variance accounted for by the other predictor variables was not significant.

CHAPTER VI

CONCLUSIONS

Purpose

This study was envisioned as a preliminary survey to determine whether learning disabled children who receive educational therapy subsequently show a higher level of academic achievement than their handicapped peers who do not; identify some of the correlates of achievement for such children; and note which combinations of correlates most adequately account for criterion variance.

Discussion

Given the above set of goals and the results of this study, the discussion will examine the extent to which they support the original predictions and what possible lines of investigation they may indicate for the future. The first prediction, that remediation would increase the learning disabled child's academic achievement over that of his handicapped peers who did not receive educational intervention for their learning problems was verified only with regard to

language scores. However, the pessimistic view that remedial classes amount to cultural deprivation received no support whatever and was clearly negated with respect to the language arts.

Administrators of this program were interviewed for reactions to the above findings and could offer no objective evidence bearing on them. One possibility investigated was that psychological reports returned to the teachers of control children contained education program plans or suggestions for remediation which were implemented in the regular classroom. One official responded that this practice is now in vogue but was not used during the period covered by this study. One suggestion offered was that behaviors of experimental children may have been more disorganizaed and more threatening to the stability of their regular classrooms, resulting in increased pressure from school personnel to secure the parents' consent for placement in special classes. In addition, negative behaviors of remedial children may have been more extensive and disruptive in the home situation resulting in an increased willingness on the parts of parents and their surrogates, physicians and psychologists in private practice, to press the school to accept their children

into established remedial classrooms or to open new classes promptly rather than simply building waiting lists.

Another possible explanation for the failure of remediation to result in higher achievements in arithmetic and reading for the experimental group is that identifying a control child to his parents and teachers may have changed his situation in some critical fashion. In a neighboring, very large school district that maintains long waiting lists for remedial classes, school psychologists have commented favorably on the "Waiting List Technique" as a means of therapeutic intervention because their labeled children seemed to make major improvements in learning and behavior when merely put on a waiting list for remedial classes. The assumption had been that parents and teachers revised their views of the child from "problem child" to "child with a problem" who needed their help and understanding--and then acted on this new impression, resulting in a decrease in pressure and frustration for the student and increase in individual help within the regular classroom and from interested parents at home. Koppitz (1971) spoke of a similar phenomenon among children placed in remedial classes. They showed a large initial gain in academic achievements, never subsequently matched. She hypothesized that this might really represent prior learning which they had not been free to use until remedial classes eased the pressure and sense of failure under which they had been operating. However, a counter-

impression comes from experiences at the Demonstration Center for Language-Handicapped Children (Miller, 1973; Hale, 1973). It was found there that learning disabled children who were identified as such to their regular teachers (without any suggestions of techniques or materials for remediation being provided to the teacher) subsequently showed less achievement than other learning disabled children in the same classrooms who had been identified by the examiners but were not revealed to their teachers as being handicapped.

Still other possibilities exist and may warrant investigation. The home environments of the groups may have been very different, to the advantage of the non-remedial group. An informal survey of the social histories of these subjects suggested that there was not a great disparity in the family situations of these children with respect to open strife or dissolution of the family units, but as noted earlier these data were incomplete, often contradictory, and not subject to objective verification.

The groups may have varied in crucial ways not immediately apparent to examiners giving the psychological appraisals or to the author in perusing the children's files. For example, de Hirsch et al (1966) noted that emotionally immature children and those who had been born prematurely were in the high risk category for reading disorders at second grade level. Hertzig (1971) found that children from families where learning and competence were encouraged showed marked increase in intelligence scores over time

while peers who had equivalent IQ scores at time of first testing but who were encouraged in dependency by their families and/or not taught to be task-oriented showed little or no improvement.

A study by Rugel (1974) proposed that scores on the sequential tests of the WISC---Digit Span, Coding, and Picture Arrangement--may hold the key to identification of problem readers. This may be true for individuals, but is probably not the cause for the failure of the experimental group to excel over the control group after remediation. The mean Coding scaled score for the experimental group was 9.09 and for the control group was 9.10. The mean Digit Span scaled score for the remedial group was 7.80 and for the control group was 8.08.

Given the view that remediation should result in higher achievement scores when correct pre-conditions prevail, a number of other tentative explanations for the failure of this survey to support this expectation in all three criterion areas also exist. (1) Regular teachers in this district may have been superior to remedial teachers. (2) The remedial program may have been better prepared to deal with linguistic problems or to teach language arts. (3) A screening program is needed to identify children at an earlier age. These subjects may have been past the optimum time for intervention with regard to reading and arithmetic skills. Further investigation controlling for such factors as those dis-

cussed above is clearly in order.

For the alternate point of view that removal from the mainstream reduces a child's academic potential through reduced self-confidence, poor self-image, impoverished content in the curriculum of the special classroom, etc., this study provides no comfort. The experimental group was clearly superior on the language dimension and was equally capable in arithmetic and reading. Participation in remedial classes may have had some effect on a child's emotions, however, without a reduction in his academic efficiency.

The idea occasionally advanced that a child will eventually "out-grow" the disorder as maturational lag disappears, without remediation, obtained some support from the fact that the length of the time period between diagnosis or entry into a remedial program and SRA testing was positively associated with arithmetic achievements even after variance due to age at SRA testing had been deducted. F-ratios of 6.17 and 6.58 show that this was true at the .05 level of confidence for the experimental and control groups, respectively. (See Table 5.) The idea, however, loses more than it gains because there was no relative difference between the younger and older children in the areas of language arts and reading achievement.

Correlates Examined

Sex. Females of the experimental group excelled only in language (due to an age advantage at SRA testing time) and re-

quired as long as males for remediation, while females of the control group were in no way superior to males. Although there was little support for the hypothesis of female developmental or behavioral advantage, the reason may lie, at least partially, in the fact that significantly fewer girls (26%) than boys were diagnosed as learning disabled. This discrepancy may occur because some girls of the same age, intellectual ability, and degree of dysfunction as boys with diagnosed deficiencies were able to cope with grade requirements because of their developmental advantages and so were not referred for appraisal. Those girls who were diagnosed as learning disabled, therefore, were more deviant from the female mean than handicapped boys were from the male mean, so that they no longer had an advantage.

Age. While the proposition that learning disorders may be better remedied in younger children and in less time received no support here, the result may have been due to the method of referral in this school district at the time of this study. Children who were referred were those most unable to keep pace with their classmates, so that those who were failing at first grade may have been more seriously involved than children who were able to struggle to keep pace but fall somewhat farther behind each year until failure finally became inevitable at third or fourth grade. This theory does not accord with intelligence scores obtained for subjects in this study (which were essentially at chance levels

of difference), but may be related to level of maturity, prematurity at birth, or task-orientation attitudes as discussed above. A system of pre-school screening to identify potential learning problems before frustration and failure take their tolls and to take steps to alleviate these problems for all children, whether mildly or severely involved, is currently underway in much of this district and may subsequently prove than an early start is the winning technique.

Length of Remediation. The need for longer periods of remediation for younger children may be associated with more learning dysfunction but may also reflect teacher bias. Are different standards of functional achievement set for those who return to regular classes at different ages? If so, then the periods for which younger children are kept in remediation may need to be re-examined in view of the finding that children who have been in remediation for shorter periods of time show better scholastic achievement later.

Acceleration of Achievement. The finding that achievement scores of children who have recently left remedial classes did not differ from that of children who have completed remediation much earlier does not support the view that a child would be able to build progressively on his improved learning strengths or coping mechanisms after return to regular classes. However, it also does not lend credence to the theory that regular classes provide a significantly richer curriculum than do remedial classes and so

improve the functioning of mainstream disabled children over that of learning disabled children in special education classes. On its surface, this finding also does not show any tendency for a child to lose his new-learned skills or techniques over time. A number of things may be going on simultaneously. For example, improvement of a child's learning disorder, achieved in the special classroom, may be dissipated after return to mainstream classes but the richer curriculum of regular classes may then act upon him to maintain his scholastic standing without apparent change. An analysis should consider what interactions are occurring.

Intelligence Scores. The finding that the WISC FSIQ, a global intelligence score, was highly correlated with achievement scores (except for the control group for reading), was in the direction postulated. The fact that correlations were much higher between the FSIQ and language and arithmetice skills ($r = .34$ to $r = .48$) than reading scores ($r = .12$ to $r = .24$) is in line with the finding of de Hirsch et al (1966) that WISC scores were significant correlates of reading ability but that a number of specific skills were more diagnostic of future reading success.

Modality. For the combined groups, the prediction that verbal skills, or more efficient processing of input through the auditory channel, was more highly correlated with academic achievements than an equal degree of integrity in the visual motor channels (as these are exemplified by scores on

the WISC Verbal and Performance Scales) was correct. When the experimental and control scores are examined individually, however, much of this superiority of the VIQ as a predictor of achievement disappears. The VIQ was a significantly better predictor of language arts scores for both groups and for arithmetic for the control group, but PIQ was markedly better for arithmetic and reading for the remedial children and minimally better for reading for the control students. The Walker (1965) and Egeland et al (1970) studies which found VIQ or verbal subtests better predictors of achievement dealt with normal children. Learning disabilities may create complex interactions within a modality or in the integrative functioning between modalities which are substantially different than those of more normal subjects.

Conclusions

This study was not designed to measure certain intangible effects resulting from a child's having spent a portion of his school career in special classes. The remedial period may have provided a respite from the daily frustration of a regular classroom and improved immeasurably the quality of his childhood experiences. He may have learned to value himself as a person who can cope with his problems and who can prevail against powerful obstacles. He may have learned to hope, to persevere, and to be willing to try new solutions in the face of difficulty so that he is better prepared to face all the trials ahead of him both in school and

in the wider world. Or--he may have learned from the remedial experience that he is less a human being than his peers, an oddity who is out of step with their world and out of favor in their eyes. He may have learned that to be different is to be wrong.

Those things may have occurred and been of serious moment to the children involved yet not be reflected in measurable academic skills. The questions proposed for this study related to achievement, and this survey, as it stands, has cast serious doubt on the suppositions that remedial education enables a learning disabled child to outstrip his equally disabled peer, who has not received educational therapy, in all fields of academic achievement; that remediation is best when a child is younger; that disabled females will react more effectively to remediation than males; and that a child who has improved under educational therpy wil be able to consolidate his gains and improve progressively with the passing of time. It supports the belief that intelligence, as measured by the WISC, is closely related to academic achievements among children with learning disabilities as it is in their normal peers.

At this point the first step in the measurement triad has been completed, i.e. a survey to determine what appears to be objective reality. The second step should be to determine functional relationships among both the factors discussed above and others perhaps only dimly perceived, to lay the

foundation for the last step in research, experiments to seek out causal relationships.

Remedial education as presently constituted in this school district was not a complete answer to the learning problems of these children but was in some ways superior to an absence of remediation. Perhaps the most satisfactory system will prove to be retaining all children in regular classrooms to advance at their own best speed with individualized instruction available to each child when he needs it. A research project testing this hypothesis is currently underway (Miller, 1973). If special assistance is available to every one and the pace is set by each child's ability in each subject the sting of being special may be ameliorated for the learning disabled child, the pain of being dull reduced for the slower learning child, the frustration of being bored erased for the gifted child, and the anguish of being helpless removed for the dedicated teacher.

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APPENDIX A

Multiple Regression Equations

EXPERIMENTAL GROUP

MULTIPLE REGRESSION ANALYSIS OF SRA LANGUAGE ARTS SCORES

MULTIPLE R	.10	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
R SQUARE	.01	REGRESSION	1.	209.94	209.94	.42
		RESIDUAL	38.	18,948.46	498.64	

VARIABLE	BETA	F	
Age at SRA Testing	.10	.42	$F_{.05} = 4.17$

MULTIPLE R	.53	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
R SQUARE	.29	REGRESSION	2.	5,476.86	2,738.43	7.41
		RESIDUAL	37	13,681.54	369.77	

VARIABLE	BETA	F	
Age at SRA Testing	.21	2.22	
WISC FSIQ	.54	14.24	$F_{.05} = 3.32$

MULTIPLE R	.51	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
R SQUARE	.37	REGRESSION	3.	7,065.08	2,355.03	7.01
		RESIDUAL	36.	12,093.32	335.93	

VARIABLE	BETA	F	
Age at SRA Testing	.26	3.50	
WISC FSIQ	.52	14.55	
Length of Remediation	-.29	4.73	$F_{.05} = 2.86$

EXPERIMENTAL GROUP

MULTIPLE REGRESSION ANALYSIS OF SRA ARITHMETIC SCORES

MULTIPLE R	.31	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
R SQUARE	.10	REGRESSION	1.	804.65	804.65	4.28
		RESIDUAL	38.	7,146.45	188.06	

VARIABLE	BETA	F	
Age at SRA Testing	.32	4.28	$F_{.05} = 4.17$

MULTIPLE R	.67	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
R SQUARE	.44	REGRESSION	2.	3,527.87	1,763.94	14.76
		RESIDUAL	37.	4,423.23	119.55	

VARIABLE	BETA	F	
Age at SRA Testing	.32	6.83	
WISC PIQ	.59	22.78	$F_{.05} = 3.32$

MULTIPLE R	.74	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
R SQUARE	.54	REGRESSION	3.	4,304.74	1,434.91	14.17
		RESIDUAL	36.	3,646.36	101.29	

VARIABLE	BETA	F	
Age at SRA Testing	.37	10.61	
WISC PIQ	.54	22.47	
Length of Remediation	-.32	7.67	$F_{.05} = 2.86$

EXPERIMENTAL GROUP

MULTIPLE REGRESSION ANALYSIS OF SRA ARITHMETIC SCORES

MULTIPLE R	.76	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
R SQUARE	.58	REGRESSION	4.	4,606.89	1,151.72	12.05
		RESIDUAL	35.	3,344.21	95.55	

VARIABLE	BETA	F	
Age at SRA Testing	.47	14.37	
WISC PIQ	.41	9.12	
Length of Remediation	-.35	9.36	
WISC VIQ	.25	3.16	$F_{.05} = 2.64$

MULTIPLE R	.80	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
R SQUARE	.63	REGRESSION	5.	5,046.45	1,009.29	11.81
		RESIDUAL	34.	2,904.65	85.43	

VARIABLE	BETA	F	
Age at SRA Testing	.56	20.50	
WISC PIQ	3.77	6.41	
Length of Remediation	-.35	10.39	
WISC VIQ	3.91	5.84	
WISC FSIQ	-6.10	5.15	$F_{.05} = 2.49$

EXPERIMENTAL GROUP

MULTIPLE REGRESSION ANALYSIS OF SRA READING SCORES

		ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
MULTIPLE R	.09	REGRESSION	1.	155.63	155.63	.29
R SQUARE	.01	RESIDUAL	38.	20,355.47	535.67	

VARIABLE	BETA	F	
Age at SRA Testing	.09	.29	$F_{.05} = 4.17$

		ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
MULTIPLE R	.54	REGRESSION	2.	5,937.18	2,968.59	7.54
R SQUARE	.29	RESIDUAL	37.	14,573.92	393.89	

VARIABLE	BETA	F	
Age at SRA Testing	.09	.41	
WISC PIQ	.53	14.68	$F_{.05} = 3.32$

CONTROL GROUP

MULTIPLE REGRESSION ANALYSIS OF SRA LANGUAGE ARTS SCORES

		ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
MULTIPLE R	.09					
R SQUARE	.01	REGRESSION	1.	222.11	222.11	.52
		RESIDUAL	57.	24,472.60	429.34	

VARIABLE	BETA	F	
Age at SRA Testing	.09	.52	$F_{.05} = 4.08$

		ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
MULTIPLE R	.48					
R SQUARE	.23	REGRESSION	2.	5,611.91	2,805.95	8.23
		RESIDUAL	56.	19,082.80	340.76	

VARIABLE	BETA	F	
Age at SRA Testing	.18	2.22	
WISC VIQ	.47	15.82	$F_{.05} = 3.23$

CONTROL GROUP

MULTIPLE REGRESSION ANALYSIS OF SRA ARITHMETIC SCORES

MULTIPLE R	.33	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
R SQUARE	.11	REGRESSION	1.	1,359.42	1,359.42	7.11
		RESIDUAL	57.	10.900.61		

VARIABLE	BETA	F	
Age at SRA Testing	.33	7.11	$F_{.05} = 4.08$

MULTIPLE R	.47	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
R SQUARE	.22	REGRESSION	2.	2,670.05	1,335.02	7.80
		RESIDUAL	56.	9,589.99	171.25	

VARIABLE	BETA	F	
Age at SRA Testing	.39	10.62	
WISC VIQ	.33	7.65	$F_{.05} = 3.23$

MULTIPLE R	.53	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
R SQUARE	.28	REGRESSION	3.	3,478.73	1,159.58	7.26
		RESIDUAL	55.	8,781.30	159.66	

VARIABLE	BETA	F	
Age at SRA Testing	.50	15.76	
WISC VIQ	.29	6.10	
Period: Diag./SRA Testing	-.28	5.07	$F_{.05} = 2.84$

CONTROL GROUP

MULTIPLE REGRESSION ANALYSIS OF SRA READING SCORES

MULTIPLE R	.15	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
R SQUARE	.02	REGRESSION	1.	628.36	628.36	1.26
		RESIDUAL	57.	28,499.44	499.44	

VARIABLE	BETA	F	
Age at SRA Testing	.15	1.26	$F_{.05} = 4.08$

MULTIPLE R	.25	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
R SQUARE	.06	REGRESSION	2.	1,784.31	892.16	1.83
		RESIDUAL	56.	27,343.48	488.28	

VARIABLE	BETA	F	
Age at SRA Testing	.10	.55	
WISC PIQ	-.20	2.37	$F_{.05} = 3.23$

MULTIPLE R	.35	ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F
R SQUARE	.12	REGRESSION	3.	3,541.97	1,180.66	2.54
		RESIDUAL	55.	25,585.83	465.20	

VARIABLE	BETA	F	
Age at SRA Testing	.12	.84	
WISC PIQ	-.53	6.26	
WISC FSIQ	.41	3.78	$F_{.05} = 2.84$