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A post-hoc analysis of factors contributing to the preponderance of males in learning disabilities

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A POST-HOC ANALYSIS OF FACTORS CONTRIBUTING TO THE PREPONDERANCE OF MALES IN LEARNING DISABILITIES

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ABSTRACT

The present study assessed the efficacy of specific classes of variables (Intrapersonal, Interpersonal, Extrapersonal) for the explanation of the preponderance of males in learning disabilities placements (LD). Factors were selected which represented a cross-section of variable classes and included behavioral, genetic, and physiological factors. A large number of variables were included to facilitate a relationship between the present study and the many mutually exclusive theories of LD. A significant purpose of the present study was to examine the applicability of specific theories of LD to an actual population.

An examination was made of the case histories of a complete population of LD students (45 males and 35 females). Case data from a matched sample of regular education (RE) students was gathered for a control group comparison. Through the use of Discriminant Analysis, an intercorrelated grouping of variables was found which best predicted LD placement for each sex. A separate grouping was produced which accurately discriminated between Learning Disabilities (LD) and Regular Education (RE) subgroups.

Of the 18 variables necessary for discriminating males and females within the LD group, 12 had high values associated with "maleness" and 6 had high values associated with "femaleness". Among the high-value predictors associated with "maleness" were

ITBS Composite score, age, number of siblings, medical trauma or injury, and evidence of speech and language problems. The high-value predictors associated with "femaleness" were ITBS Reading and ITBS Language scores, hospitalization at birth, a reconstituted family structure, postnatal problems, and visual problems. Of the 19 variables necessary for discriminating LD from RE subjects, 14 had high values associated with LD and 5 had high values associated with RE. Among the high-value predictors associated with LD were ITBS Math scores, a difficult delivery at birth, medical trauma or injury, a one-year retention in school, a single-parent family, prenatal drugs or smoking, postnatal problems, and number of siblings. The high-value predictors associated with RE with ITBS Language, Writing, and Vocabulary scores; a second retention in school, and the presence of a previous referral to a Child Study Team.

The major conclusions were as follows:

1) The efficacy of pre-existing data was demonstrated, especially for demographics, medical history, family history, and group achievement data. This finding has profound implications for the early identification of learning disabilities.

2) Males and females within LD are similar in that both have "masculine" characteristics. The high risk female is therefore more different from females in general than the high risk male is from males in general. This may be the true difference between males and females within an LD population.

3) Since similar effects occur in males and females who are "at risk", bias in placements may explain the preponderance of males in learning disabilities placements.

4) Males may be more generally vulnerable (and thereby more likely to develop a learning disability) and females may be vulnerable only to specific factors. Thus fewer females develop a disability.

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CHAPTER 1

INTRODUCTION

Even a glance at Special Education research will expose the marked disparity in the number of boys versus the number of girls receiving special services. In emotional disabilities programs (Kaplan, 1971; Fink, 1970), in mentally retarded programs (Mercer, 1973; Farber, 1968), in learning disabilities programs (Johnson & Greenbaum, 1980; Naiden, 1976; Heaton-Ward, 1975; Money, 1966), in virtually all diagnostic categories (Gershman, 1975; Mumpower, 1970), the ratio ranges from a simple majority to as much as 10 to 1. Not surprisingly, boys outnumber girls in referrals to psychological services as well, especially for behavior problems (Garrido, 1978; Leitz, 1977) and serious mental problems (Bower, 1960; Clancy & Smitter, 1953). This trend is by no means a recent phenomenon, having been noted as early as 1928 (Nicholson, 1967; Robbins, 1967; Peck, 1935; Hildreth, 1928). Explanations for the preponderance of males receiving special education services can be viewed from three perspectives: intrapersonal, interpersonal, and extrapersonal.

Intrapersonal

The Intrapersonal dimension involves facets of the so-called "Nature-Nurture" controversy. On the one hand are theories for

sex-linked genetic traits, which argue that males are biologically predisposed to developing learning disabilities, Dyslexia, mental retardation, etc. (Gomberg & Franks, 1979; Farber, 1968). Other geneticists believe that the evidence points to male physical inferiority in general (Seaver, 1972), citing evidence of higher infant mortality rates (Gruenberg, 1964). On the other hand, a larger body of evidence exists for a developmental lag in males. Boys mature more slowly and, therefore, are more vulnerable to the stresses in their environment, including schooling (Lynn, 1979).

Interpersonal

The Interpersonal dimension is the purview of the social scientist. This body of theory accounts for the preponderance of males in special programs with factors such as teacher bias in grading (Arnold, 1968) and teacher ratings of behavioral and academic problems (Miller, 1972; Slobodin & Campbell, 1967). Much emphasis is also placed on differing role expectations for each sex (Warder, 1978; Larson, 1975; Walker, 1962; Bush, 1954), and a lack of role models for boys in the feminine world of the schools (Gove & Herb, 1974).

Extrapersonal

The Extrapersonal school of thought attributes the sex ratio in special education to cultural and social expectations, especially

as they influence intelligence (Hubbard & Lowe, 1979; Samuda, 1975; Sigel, 1964). The major arguments can be summarized as follows. It may be that males are expected to fulfill a wider variety of role functions than women. The greater aggressiveness of males offers more opportunities for their adjustment to be evaluated (Beilin & Werner, 1957). A greater degree of variability may be tolerated among females because they are not expected to achieve, while males experience more pressure to conform to a restricted class of behaviors. Teachers may also tolerate a wider range of behavior for girls. Therefore, more males will be referred for school problems and more males will be placed in special programs. Of all the extrapersonal variables, socioeconomic status (SES) has most consistently been associated with placement in Special Education (Gershman, 1975).

Statement of the Problem

The impetus for the present study developed from a desire to test the validity of specific categories of explanation (Intrapersonal, Interpersonal, Extrapersonal variables) for the preponderance of males in learning disabilities placements (LD). In order to do so, it was necessary to examine differences between males and females within an LD population across these categories. Such an examination leads to inferences as to the causes of the general phenomenon for males. As will be seen, the categories of

explanation are based on theories which present themselves as mutually exclusive alternatives. To evaluate the strength as well as the independence of each, it was necessary to select variables which constituted a reasonable representation of theoretical alternatives. The general problem of explanation had to be explored on behavioral, genetic, and physiological fronts simultaneously (Owen, 1978; Yule & Rutter, 1976). Furthermore, to facilitate a practical application of any results, only non-generated factors were included in the study. Therefore, the main question for the current investigation was: By examining case histories of upper elementary students placed in learning disabilities programs, what intercorrelated grouping of pre-existing variables best accounts for the observed sex differences in placements?

The second major emphasis of the current study was to compare the background data of the LD population to the background data of a matched sample of regular education placement (RE) students. In order to fully evaluate any differences within an LD group, it was deemed necessary to establish a reference group. Only through comparison to some kind of norm could the meaning of differences within an LD population be appreciated. The present study attempted to demonstrate clear differences both within and between placement groups.

Objectives of the Study

The general objective of the current study was to use a correlational approach to conduct a preliminary survey of hypotheses regarding the preponderance of males in learning disabilities placements. The most plausible hypotheses could then be referred for more intensive study, especially regarding their generalizability to other diagnostic categories within special education.

The first specific objective was to discover an intercorrelated group of attribute variables which would best account for the observed sex differences within the LD placement group, and thereby allow inferences as to the causes of the disproportionality. The resulting variable cluster could be thought of as a decision rule for classifying individuals as prospective LD placements. The study also examined differences between the two placement groups, with sex then treated as one of the factors in the analysis as opposed to comparing two groups already separated by sex (Objective 1).

Significance of the Study

The present study is an attempt to associate referrals and placements in learning disabilities programs with specific, quantifiable factors. It is one of a relative few which examines sex differences within a special education population, and the only

one to concurrently compare sex differences across placement categories.

The study will also serve a heuristic purpose for future research into explanations for the sex ratio in special education. It attempts to pinpoint areas for investigation by demonstrating specific associations to precursors (Satz, Taylor, Friel & Fletcher, 1978) by sex.

Lastly, the study endeavors to demonstrate the usefulness of pre-existing data, as opposed to newly generated data. That is, rather than administering batteries of tests and/or physical examinations (all necessitating time-consuming contact with individual children, parents, teachers, etc.), the present study seeks to encourage the utilization of data gathered routinely by schools, easily accessible and relatively non-threatening to the individuals concerned.

Hypotheses

Hypothesis I (H_0I): No nonchance set of intercorrelated factors exists which accounts for the observed disproportionality by sex within learning disabilities placements (H_0I: Discriminant Function $D_1(X) = 0$).

Hypothesis II (H_0II): No nonchance set of intercorrelated factors exists which best describes the observed differences between placement groups by sex (H_0II: $D_2(X) = 0$).

Limitations of the Study

Questions of teacher bias in referrals were not dealt with in this study, as it would have required a much more extensive investigation. It is likely, however, that teacher expectations differ for boys and girls, as is evidenced by Levy (1972) and others (See appendix C). Furthermore, no examination was made of actual teacher behavior in classrooms, although there is data to support a hypothesis that girls would receive more approval than boys (Meyer & Thompson, 1963) and that boys would receive more prohibitory control (Jackson & Lahaderne, 1971). These influences may also prove to be associated with referral and placement in special programs, but the present study will only examine factors identified by case histories.

Similarly, the biases and expectations of psychologists, social workers, and other special services personnel were not examined, although it could be argued that some influence could be established. Also, cultural influences will not be specifically examined, since all of the referrals originated with White, female teachers and since all subjects were White.

In order to complete this study within reasonable time limits, the sample was restricted to learning disabilities rather than to all of special education. It must be acknowledged that the population of learning disabled students may represent a biased sample, not

only due to the cumulative biases of the personnel involved, but also due to program size restrictions on the number of students who can be served by a teacher.

Also, no attempt was made to differentiate subgroupings within the LD population, although there is evidence to indicate that such a determination could be made (see Chapter 2 - Review of Literature). Limitations of sample size, especially in light of the large number of variables under consideration, led to the decision to leave the sample intact.

Definition of Terms

Learning Disabilities - Operationally defined by PL 94-142 and by commonly accepted practice within the local Area Education Agency; includes language and academic learning disorders, perceptual handicaps, minimal brain dysfunction, dyslexia, and aphasia. It does not include children whose learning problems are primarily the result of physical, emotional, or environmental factors.

Dyslexia - Impaired ability to read or to understand what is read silently or orally, and commonly associated with brain dysfunction (Meier, 1976).

Special Education Programs - Also called special programs, includes all categories of self-contained or Resource programming for specific disabilities, including but not restricted to Emotional

Disability Programs, Learning Disability Programs, and Mental Disability (Retarded) Programs.

Child Study Teams - Those support services personnel who assess and evaluate referrals from schools or parents, and including School Psychologists, Educational Strategists, Educational Consultants, Social Workers, Audiologists, and Speech/Language Clinicians.

Regular Education Class - Defined as non-special education placement, exclusive of those students with diagnostic labels or receiving Resource educational programming.

Sex - Sex of the subject.

Grade - Current academic grade level or placement.

Placement - Designated as LD (Learning Disabilities Program) or RE (Regular Educational Placement).

School - A coding for each attendance center included in the sample.

Age at Referral - The chronological age at which the LD subjects were referred for the evaluation which resulted in placement.

Grade at Referral - The grade from which the LD subjects were referred for the evaluation which resulted in placement.

Grade at Placement - The grade level of the initial LD placement.

Socioeconomic Status (SES) - Classified as I, II, III, or IV (high to low), according to the U. S. Department of Labor Statistics, as outlined by Touliatos and Lindholm (1976) and Lindholm and Touliatos (1977).

Behavior Problems - Operationally defined by reports by special services personnel and by teacher ratings, including acting out behaviors, frequent disobedience, non-cooperation in the classroom, out-of-seat behavior, impulsivity, inappropriate aggression, and a general lack of self-control; categorized by the Behavior Problem Checklist as Conduct Disorder (Werry & Quay, 1971).

Emotional Maladjustment - Defined by evidence in clinical records and by teacher ratings of classroom behavior which included anxiety, depression, and accompanying difficulty in functioning; categorized by the Behavior Problem Checklist as Personality Problem (Werry & Quay, 1971).

Personality Problems - Defined by evidence in clinical records and teacher ratings of daydreaming, withdrawal, passivity or lethargy, and short attention span; categorized by the Behavior Problem Checklist as Inadequacy-Immaturity (Werry & Quay, 1971).

Academic Problems - Defined by special services reports and teacher ratings, including incidence of difficulties in completing school work, low frustration tolerance, and poor academic performance in the absence of other symptoms.

Achievement Estimate - Defined as scores on the Iowa Test of Basic Skills (ITBS) for the year of placement, and consisting of Vocabulary (V), Reading (R), Total Language (L), Total Math (M), Total Writing (W), and a Composite Score (C).

Ability Estimate - Defined as scores on the Wechsler Intelligence Scale for Children-Revised (WISC-R), including the Verbal Scale Score (VS), the Performance Scale Score (PS), and the Full Scale Score (FS), for all LD subjects at the time of placement.

Length of Retention - The number of years the student was retained. Partial retentions were counted as a whole year.

Family Constellation at Placement Referral - Whether the family consisted of natural parents, adoptive parents, stepparents, or a single parent.

Parental Marital Status at Placement Referral - Whether the parents were married, divorced, separated, or deceased at the time of the placement referral.

Number of Older Brothers - Number of older male siblings at the time of placement referral.

Number of Older Sisters - Number of older female siblings at the time of placement referral.

Number of Younger Brothers - Number of younger male siblings at the time of placement referral.

Number of Younger Sisters - Number of younger female siblings at the time of placement referral.

Medical History - Presence in the case histories of vision or hearing problems, high fevers before age 5, accidents before age 5, surgery before age 5 or after age 5, treatment for allergies, and any other medically significant events as noted in reports.

Previous Referral - A previous referral for special services intervention and/or evaluation, or a referral to a mental health professional, or a referral to a specialized diagnostic center.

Grade of Previous Referral - Grade at which a referral to the Child Study Team had been made prior to the referral which resulted in placement. This includes referrals for speech and language services, Educational Consultant/Strategist services, a psychological evaluation, referral to one of several specialized diagnostic centers, and referrals to medical personnel.

Nature of Previous Referral - Defined by areas of expertise of the professionals consulted, including medical problems, neurological signs, psychological evaluation, remedial reading, etc.

Medications Before Placement - The use of medications for allergies, hyperactivity, etc., exclusive of antibiotics for infections, colds, etc.

Pregnancy and Birth Complications - Defined by difficulties during pregnancy as reported by the hospital, including: nausea, bleeding, etc.; a difficult delivery or premature birth; hospitalization of the baby at birth; prenatal, perinatal, or postnatal

insults; an event of sufficient concern to be noted in medical records.

Developmental Delays - Evidence in case histories of delays in language development, walking or crawling, etc.

Number of Schools Attended - For each subject, the number of attendance centers entered since beginning the public school sequence.

CHAPTER 2

REVIEW OF LITERATURE

Since there has been a consistently high incidence of reading problems in males, it is not surprising to find programs for learning disabilities dominated by males (Johnson & Greenbaum, 1980). There are many theories which purport to explain learning disabilities, but few which deal specifically with the male-female ratio. This chapter will outline several major theoretical frameworks which seek to account for the observed frequency of males, and will also examine specific variables which have been associated with higher rates of placement for males.[1] The discussion will progress from general theories of explanation for sex differences in learning disabilities to specific multifactorial research. It concludes with an examination of the influence of sex as a predictor variable.

The authors cited in the upcoming review coalesced categories for learning problems, including Learning Disability (LD), Minimal Brain Dysfunction (MBD), Dyslexia, and Reading Disability. Within the sections that follow, these categories cannot be compared

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[1]The writer is indebted to the work of John H. Meier (1976, 1978), who outlined a major portion of the research on factors associated with reading disabilities. The reader is urged to consult these references for a more detailed and somewhat more inclusive discussion of theory and research.

directly, although the descriptions of actual problem reading behavior are quite similar across definitions. Therefore, the common references to reading problems serve to equate the terms for the purposes of the present discussion. Specific differences will not be dealt with in this review.

Intrapersonal Variables

Specific Inheritability

Rossi (1972), Hermann (1959), and Hallgren (1950), among others, have developed evidence for a sex-linked genetic trait for LD and Dyslexia. The trait has even been given a name - dysdiadochokinesis - but it by no means accounts for all learning problems. Even Rossi (1972) admitted that some difficulties could be the result of a lack of skills, a fear of failure, or emotional factors. Less well-supported opinions include genetically-based differences in emotional constitution and intellectuality (Layton, 1979). Or, it could be that the sexes differ in their reactions to stress (Dohrenwend & Dohrenwend, 1969).

The genetic argument is by no means conclusive. In fact, an examination of the evidence in detail shows no clear familial pattern of inheritance. That is, even though progeny may indeed develop reading or learning problems, the specific nature of the difficulty follows no clear pattern (Lynn, 1979).

In the Hallgren study (1950), for example, 103 out of 116 cases of reading disability had evidence of a similar disability in relatives. However, the nature of the disability (auditory perception, visual perception, reversals, etc.) was inconsistent within family groupings. More recent research (Finucci, 1978; Schulman & Leviton, 1978) accepts the heterogeneity within dyslexia, while at the same time supporting the existence of familial clusters of lower reading and spelling abilities.

Dyslexia in general tends to "run in families", but lack of consistency in the specific nature of the disorder among family members argues against a specific genetic trait. It may be that the sex-linked trait reveals itself differentially, but without evidence of "purities" in inheritance, it is safest to conclude that any sex-linked dominant trait operates indirectly at best (Hoyenga & Hoyenga, 1979).

Global Inferiority

A more plausible case can be made for a global genetic inferiority. Males have a higher rate of infant mortality, a larger head-size (making them more injury prone), and a greater vulnerability to environmental effects (Gruenberg, 1964; Bortner, 1979). These findings are supported by Kawi and Pasamanick (1959), who also discovered a greater frequency of pregnancy complications and premature births for males. Such a biological inferiority would

cause males to be more vulnerable to stress (Gove & Herb, 1974), leading to "poor learning receptivity" (Mayron, 1978, p. 32), and specifically to difficulties in reading.

A much clearer connection between reading problems (or learning disabilities) and causative factors must be made, however, in order for a theory to be practical. Such connections come from data on developmental differences which show that boys and girls develop skills at differing rates, rather than developing skills unique to one's gender (Meier, 1978). Differing rates, however, can be viewed as a manifestation of genetic inferiority (and thereby specific to gender after all). Nevertheless, the theory is typically presented as a genuine alternative. It is still possible that some specific forms of disability are indeed more prevalent in males. Lastly, a connection between learning disabilities and causative factors comes from theories that children may develop skills at differing rates and skills unique to gender (Hoyenga & Hoyenga, 1979). Specifically, the global inferiority of males would tend to manifest itself in specific disabilities (or structural defects), the nature of which would be determined by sex differences in the neurophysiological hierarchy.

Maturational/Developmental Lag Theory

Smith (1972) cited evidence for a true developmental lag in males based on prenatal differences and differences in rates of

physiological development (bone age, dental age, development of reproductive system); girls have an 18-month advantage by age 9 (Feiring & Lewis, 1979; Wheatley, 1977; Michael-Smith, Morgenstern & Karp, 1970). As for school readiness, boys lag behind girls in speech and language development, reading, and social maturity (Bentzen, 1966). Girls are also more verbal at an early age and do better in school as a result (Gallagher & Aschner, 1963; Gesell, 1940; Terman, 1929), even though boys eventually "catch up" and surpass their counterparts (Gallagher & Aschner, 1963).

Research by Bentzen (1966), Anthony (1970), and Wheatley (1977) argued more specifically for a causal link between developmental lag and reading problems or LD in males. E. J. Anthony (1970) provides an excellent summary when he writes:

> During the first grade, the boy is referred eleven times as often as a girl for social and emotional immaturity, a syndrome characterized by a high rate of absenteeism, fatigability, inability to attend and concentrate, shyness, poor motivation for work, underweight, inability to follow directions, slow learning, infantile speech patterns, and problems in visual-motor and visual-perception areas. (pp. 722-23).

Thus, it may be concluded that White American males are slightly behind females in all aspects of development, including language (McCarthy, 1953), resulting in difficulties in reading. The developmental lag may be a uniform event. It may also be that the lag is due to specific deficits (Meier, 1978). However, it is

usually presented as a difference in rate of development (Satz & Ross, 1973), thereby assuming that boys have the potential to advance in ability, albeit requiring a longer period of time.

Brain Functioning and Differences in Intelligence

One other significant argument must be mentioned. Restak (1979) concluded that "many behavioral differences between men and women are based on differences in brain functioning that are biologically inherent and unlikely to be modified by cultural factors alone" (p. 233). There was already support for the idea of differences in cerebral dominance as they related to LD (Critchley, 1970; Rossi, 1970), and Restak carries this theory to its logical conclusion.

However, a strong case could be made for environmental influences playing a significant role in the manifestation of sex differences within the educational setting (Wheatley, 1977). Perhaps these two ideas can be accommodated by proposing that there is a "greater vulnerability and exposure of males to environmental influences and the reciprocal lack of equivalent environmental stimulation which leads by default to a larger genetic component of intelligence for females" (Seaver, 1972, p. 2). Equivalent environments will have a greater effect on boys' intelligence than on girls' intelligence (Gomberg & Franks, 1979; Sherman, 1978;

Witkins, 1969), especially with regards to maternal child-rearing (Clancy & Smitter, 1953) and father-absence (Lamb, 1976).

Interpersonal Variables

Perceptual Bias

Teacher perceptions and biases are seen as plausible contributors to disparities in referral for academic and behavior problems (Arnold, 1968; Miller, 1972). It must be recognized that any teacher bias may be due to the diagnostic labels already attached to some students. Foster, Ysseldyke, and Reese (1975) found that even teacher trainees hold negative stereotypical expectations of children labelled emotionally disturbed. Purgess (1979) found that labels and pupil behavior affected teachers' expectations of academic success, ratings of present academic achievement, and ratings of likelihood of retention. The consideration of a label bias could explain the preponderance of males in special programs.

Referral, Assessment, and Decision Biases

But how do students receive these labels in the first place? Both labels and expectations can be considered products of teacher perceptions. These perceptions persist, logically, because the teachers tend to fulfill their prophecies and thus to confirm their beliefs (Larsen, 1975; Salvia, Clark & Ysseldyke, 1973). In other words, pupils perceived as "poor" tend to be rated as poor. Or,

the pupils themselves become convinced and comform to the label expectations (Adelman, Taylor, Fuller & Nelson, 1979; Davidson & Lang, 1960).

Teachers may also expect more problems from boys simply because boys are perceived as being more curious. Thus, at least one self-fulfilling prophecy may be taking place (Walker, 1962). Teacher behavior does seem to differ for boys and girls, which may influence the children's behavior and teacher expectations reciprocally. Girls tend to get more approval (Meyer & Thompson, 1963), while boys tend to be the recipients of more control (Jackson & Lahaderne, 1971). Teacher expectations have been shown to differ by the sex of the teacher and by the sex of the student (Larson, 1975; Doyle, Hancock & Kifer, 1972; Palardy, 1969; Datta, Schaefer & Davis, 1968; Arnold, 1968).

Boys who fidget more in earlier grades are freer in their approach to learning later (Bruner, 1966), and the one common element between high-achieving and highly creative boys and girls is that neither adopts traditional sex-roles (Torrance, 1959). Thus, traditional socialization patterns not only produce more school problems for boys, but they may also stifle learning achievement for both sexes (Kagan & Moss, 1962).

Finally, boys may suffer from a lack of role models in a feminine world, especially when the father is absent or uninvolved with the child and the mother is overinvolved (Lamb, 1976; Gove &

Herb, 1974; Maccoby & Jacklin, 1974). Furthermore, since parents encourage boys to solve their own problems rather than to seek assistance (Rosaldo & Lamphere, 1974), it can be expected that boys will be encouraged to become more curious (Mendel, 1965; Smock, 1961) and more aggressive (Duke, 1978; Devine & Tomlinson, 1976; Feshbach & Feshbach, 1973; Kagan, 1964; Masland, Sarason & Gladwin, 1958). Coupled with the bias inherent in teacher perceptions and differential role expectations, it is easy to see why more boys may end up in special programs.

Extrapersonal Variables

Sociological Influences

A third school of thought attributes the preponderance of males in special education to cultural and social expectations, especially as they influence intelligence (Hubbard & Lowe, 1979; Samuda, 1975; Sigel, 1964). Society tolerates greater intellectual subnormality in girls and women, and thus males experience more stress due to higher social expectations (Gove & Herb, 1974). Our culture tolerates a wider range of appropriate behavior for preadolescent girls, with a correspondingly restrictive range for boys (Gove & Herb, 1974).

Role Expectations

Since males may be unable to meet cultural expectations due to a developmental lag, genetic inferiority, or genetic defect, more

males experience problems in schools. These school problems tend to manifest themselves behaviorally, due to male socialization toward aggression, even though the actual difficulty may be academic. Boys are referred more often for behavior problems (Lindholm & Touliatos, 1977; Grieger & Richards, 1976; Miller, 1972). Girls, well-socialized in the appropriate school behaviors, are rarely identified as having behavior problems. When they are, the problems are either more severe (Beilin, 1970; Singer & Osborn, 1970) or a fewer number of problems are required before referral (Peck, 1935).

More specifically, Miller (1972) and Levy (1972) believe that males have more problems in schools because of the incongruency between expectations of boys and school setting. Boys are encouraged to be active and aggressive, yet schools demand passive or compliant behavior. Indeed, teachers prefer the more compliant behavior of girls (Beilin, 1970; Feshbach, 1969). Said another way, classrooms are more suited to the way girls are trained to think (Restak, 1979). Perhaps it would be more fair to say that educators have not yet adapted to more slowly developing males (Wheatley, 1977).

In any case, it has been established that in classrooms, girls receive less attention than boys (Emery, 1973) and that the attention they do receive tend to be in the form of approval, whereas boys tend to receive more disapproval (Meyer & Thompson, 1956, 1963). Thus, it is possible that the disparity among

placements in special programs could be attributed to a mismatch between boys and the school environment.

Socioeconomic Status

Of all extrapersonal variables, socioeconomic status (SES) has most consistently been associated with placement in special education (Gershman, 1975). Students from lower SES tend to have lower reading and arithmetic scores when they start school (Kealey & McLeod, 1976). A higher proportion of disruptive students are from lower SES (Garrido, 1978). Low SES has been associated with greater incidence of psychopathology, especially personality disorder (Dohrenwend & Dohrenwend, 1969). More significantly, the educational aspirations of boys seem more closely linked to SES than those of girls (Marini & Greenberg, 1978).

Family Milieu

Lastly, one potent influence on aspirations and educational success in general is the family milieu. There is evidence which purports to show that reading problems tend to "run in families". Twenty to thirty percent of the parents of children with reading problems had experienced severe difficulties themselves in learning to read (Erickson, 1978). Similar findings are cited as proof of the existence of genetic factors (Wallace & McLaughlin, 1975). However, no adoption study of reading development has yet been

conducted (Myklebust, 1978), and the familial patterns could simply be the result of parental modeling (Benton & Pearl, 1978).

Conclusions

As seen in the preceding brief review, it can be concluded that more males experience problems in school. This is further confirmed by reported rates of referral (Hyde, 1975; Robbins, Mercer & Meyers, 1967). In fact, there appears to be no diagnostic category for which boys stand less than a 50 percent change of referral (Gregory, 1977). Since up to 60 percent of all referrals result in placement in special education programs (Tomlinson, 1973), we would expect more males in all special programs.

Associated Disorders Theory

Considering the various competing theories to explain the preponderance of males in learning disabilities, it soon became evident that all of them were correct for a portion of the affected population (Gruenberg, 1964). Therefore, it seemed more logical to propose that reading disabilities do not exist without an accompanying impairment in non-reading skills (Doehring, 1968). Doehring's view is supported by Meier (1978) and others (Goldberg & Schiffman, 1972), lending credence to a theory of global inferiority mainfested via diffuse mechanisms, rather than specific deficits, differential rates of growths, etc.

A diffuse mechanism allows for individual differences within the affected population, and easily permits the simultaneous consideration of such diverse conceptions as genetic transmissions, maturational lag, neurological dysfunction, and cerebral dominance. Research, therefore, began to concentrate on the identification of subgroupings within learning disabilities, the subsequent analysis of which produced more particular associations among factors. At this point, analyses by sex (should they exist) would yield more definitive explanations for the observed sex ratios within LD.

Early Multifactorial Research

A small group of investigators, some as early as 1935 (Castner, 1935), began to collect evidence linking specific quantifiable factors to the presence or absence of a diagnosis of Learning Disabilities. As support developed for variables from mutally exclusive theoretical camps, efforts branched out to include improving the definition, identification, and prediction of LD, as well as the establishment of subgroupings.

Early work involved a relatively small number of variables in attempting to discover a prediction formula for placement. Initial attempts seeking to utilize screening test batteries met with mixed results, and had questionable reliabilities (Goldberg & Schiffman, 1972). Some investigators, like Nicholson (1967) and Rice (1963), preferred to look at reasons for referral, individual intelligence tests, and grade levels as independent variables.

Reasons for referral were classified similarly in both studies, with common categories including Academic or Intellectual Difficulties, Emotional Reactions, Moral Problems, and Physical Problems. Nicholson, however, also used Class Placement, Family and Home Problems, and Behavior Problems. Rice used Motivational Inadequacy and Social Maladjustment. Nicholson found males in LD programs to have been more often referred for Behavior Problems and Academic Difficulties. Rice found associations for Intellectual, Moral, and Social Problems, but made no differentiation by sex.

Other studies, typified by Clements and Peters (1962) considered Medical History, a Psychological Evaluation, an EEG, and a specialized neurological exam. The presence of so-called "soft signs", a higher incidence of trauma or insult in the medical history, and some anomalies in EEG, were associated with diagnoses of Minimal Brain Dysfunction (MBD).

The dichotomy between descriptive variables and psychoneurological variables reflects the two major lines of research through the 1960's (Hochschild, 1973). Each involved a search for a "formula" to explain and predict learning problems, MBD, and LD, characterized in common by reading difficulties.

Critchley (1970) abandoned the notion of a "formula" and sought instead an associative relationship to a "constellation" of factors. He expanded the categories of variables to be considered,

moving into Cerebral Dominance, Speech Defects, Motor Disorders, and problems in Gestalt cognition (such as letter reversals). He also considered Socioeconomic Status, Birth Order, and Medical History. His conclusion was that Dyslexia was associated with mixed, inadequate, or inconsistent cerebral dominance, speech defects, motor disorders, and Gestalt problems. He also assumed a superadded emotion disorder, to account for the incidence of behavior problems in children with learning difficulties. Mainly he concluded that no single clinical feature was sufficient for prediction, and generally supported a theory of maturational lag to explain LD.

Kenny and Clemmens (1971) followed suit by including a cross-section of variables from several spheres: Behavior Problems, Learning Problems, Developmental Problems, Source of Referral, and Family Stability. Their findings also supported a theory of developmental lag, although only "soft signs" showed any marked association with LD. Their recommendation was to abandon extensive medical exams and concentrate on symptomology (hyperactivity, distractibility, short attention span, etc.).

Still, there were efforts to maintain a separate empirical foundation for more purely neurological factors. Hartlage (1973), for example, concluded that the Ravens Progressive Matrices and a neurological exam were best for identifying learning disabled children. His line of research culminated in a series of

"expectancies" or norms for given ages against which pediatricians could compare children, and thereby diagnose LD (Hartlage, 1973a, 1973b).

Thus, the state of the art developed into competing sets of variables which, although crossing theoretical boundaries, continued to promote an exclusivity in explaining and predicting the incidence of learning disabilities. All of these studies utilized intact groups of previously identified children, in an attempt to discern those unique variables which separated children with learning problems from their peers. Again, almost all of these studies concentrated their attention on groups of males.

Recent Research - Global Definitions

By the mid-1970's, large-scale efforts were being devoted to discovering the definitive constellation or formula which would satisfy all requirements for all placements in Learning Disabilities. Taylor, Brown, and Michael (1976), among others, argued for the simultaneous consideration of multiple categories of variables to explain "aptitude". They used a lengthy battery of cognitive assessments, personality tests, interest inventories, and demographic variables, concluding with a statement as to what few variables did not associate with aptitude. Such an amorphous conglomerate of variables had marginal utility, as every child with difficulties in learning could be identified but no useful

patterns were evident. Thus no useful statements regarding the nature of the disability or its treatment could be made.

Gillespie and Fink (1974) produced a significant shift in this body of multifactorial quantitative research by rediscovering the relative lack of homogeneity within placement groups. In other words, while much effort was being devoted to defining a broad, inclusive set of variables which would best predict LD, the task was being made more difficult by the wide variety of characteristics among those diagnosed as LD (Smith, 1974; Reynolds & Balow, 1972). It was suggested, therefore, that the entire problem be simplified by assuming multi-dimensional classifications within Learning Disabilities. Research was now directed at identifying and predicting for any subgroup within the general class of learning problems. Once more, strength was given to Gruenberg's observation that all theories of LD are correct for some portion of the affected population (Gruenberg, 1964).

Recent Research - Circumscribed Theories

Benton and Pearl (1978), in an extensive bibliographic review, concluded that only the most general explanations would be suitable, since there was too much overlap among subgroups. This was particularly evident for factors such as neurological impairment, maladjusted personality, specific language disorder, and familial learning problems. This argument lost out to efforts to discern clusters of variables for specific disabilities.

For example, Layton (1979) summarized those variables identified by research as related to success in beginning reading as follows: general intelligence, vision-related tasks, auditory-related tasks, motor development, perseverence to tasks, physical health and maturity, comprehension and application of oral language, ethnic group and social class, emotional and social adjustment, intellectual curiosity, and sex. Obviously, although these variables could support several different theories, such a large number of factors makes it difficult to define a subgrouping which contains homogeneous subjects. Layton solved the problem by proposing a duoclassification for reading disabilities, differentiating between specific, congenital syndromes (Dyslexia, Dysgraphia, Dyscaculia, Agnosia, Right-Left Disorientation, etc.) which he labelled Primary Reading Disability, and those acquired disabilities with no specific syndrome, which he called Secondary Reading Disability.

Layton's bi-level system appears to be the most practical approach yet proposed, barring more definitive discoveries as to the etiology of learning disabilities. At the very least, the evidence argues overwhelmingly for the simultaneous study of numerous aspects of developmental patterns, including behavioral, genetic, and physiological variables.

Gender as Predictor

One common characteristic of almost all previous multifactorial research was the relative lack of consideration of the influence of

sex as a variable. Many studies restricted their samples to males, partly due to the scarcity of females necessary for an adequate representation (Doehring, 1968) and partly due to the relative ease of making predictions for males (Chronister, 1964). That is, not only were target populations significantly dominated by males, but the selected variables actually seemed to function better as predictors for males. Thus, efforts to predict LD placement reflected the sex bias inherent in the affected population.

One study by Hyde (1975) which did consider sex as a significant variable concentrated on a predominantly Black school system. Findings included a higher referral rate for males and females in primary grades (1-3) for academic concerns, and a higher rate of referral for females in intermediary grades (4-6) for emotional problems.

A broader study by Touliatos and Lindholm (1976) examined a population of White and Hispanic children, comparing them by sex, grade, socioeconomic class (SES), and educational placement. As classified by the Behavior Problem Checklist, females in regular classes were found to have the fewest behavior problems; males of higher SES in regular classes were found to have the fewest personality disorder symptoms. In higher grades (4-6), children of lower SES in regular classes had significantly more socialized delinquency symptoms. There were no significant relationships by ethnic origins.

Although these findings indicate that there were more symptoms of behavior problems and personality disorder in special education classes, no clear associations were investigated between these findings and other descriptive variables (demographics, family stability, etc.). What was needed was a definitive investigation considering a multiplicity of factors which could differentiate the population by sex.

An excellent series of longitudinal studies was conducted by Satz and various associates, beginning with a one-year follow-up study of 474 kindergarten boys (Satz & Ross, 1973). Predictor variables included age, handedness, socioeconomic status (SES), teacher ratings, an extensive battery of tests, and day of testing. Using Discriminant Analysis, a technique borrowed from Marketing Research (Morrison, 1974), a linear combination of variables was sought which best separated a High Risk group from a Low Risk group. Among the instruments used, the Finger Localization tests were a particularly potent predictor, being successful in 71.1 percent of the total cases. This was increased to 80 percent by the addition of SES, Dichotic Listening Test, and the Peabody Picture Vocabulary Test (PPVT), respectively. Since the effect of SES could have been confounded by the inclusion of teacher-ratings as predictor variables, Satz and Ross recommended the inclusion of other variables to ensure a more unbiased prediction. They also acknowledged that future studies should include both sexes in the sample.

Satz and associates conducted two-year, three-year, and four-year follow-up studies of the same 474 boys, and again found finger agnosia to be predictive of reading problems, especially for the younger children (Satz & Friel, 1974; Satz, Friel & Rudegeair, 1974a, 1974b). Finally, a six-year follow-up study and a cross-validation study with a entirely new sample was conducted. The entire series concluded with a new sample of Black and White boys and girls, followed through kindergarten (Satz, Taylor, Friel & Fletcher, 1978). The same set of predictor variables was used throughout, including SES and day of testing. Their final results determined that the best predictors were the Finger Localization Tests, the PPVT, and the Beery Developmental Test of Visual-Motor Integration (Beery). Sex did not appear in the analysis as a potent variable, nor was there any specific attempt to predict placement probabilities by sex.

This most recent study by Satz et. al. then separated the variables into a Language Battery and a Non-Language Battery, in an attempt to develop an abbreviated set of predictors. Within each grouping SES became the best single predictor of reading level, regardless of sex. A comparable result by Lynn (1979) determined that there seemed to be an inverse relationship between SES and LD placement. This finding suggests using controls for SES in future studies, especially if any differences by sex are to be discovered.

Additional Variables of Significance

Naidoo (1972), in a well-financed and extensive study for the ICAA Word Blind Centre for Dyslexic Children in London, studied 196 boys who were previously diagnosed as Dyslexic by the Centre. The variables she studied included whether the mothers were working, developmental history (including illness, accidents, and high temperatures), the presence of asthma, and the number of schools attended. She found that fewer reading retardates were eldest children, that the presence of neurological anomalies was important, and that there were no clear-cut subtypes within the general classification. Surprising, there was not a greater frequency of behavior problems, early illness, or birth hazards for the Dyslexics, nor was birth order significant. Perhaps the fact that the sample was composed of English school children produced results which conflict somewhat with those from studies of American children.

Naidoo concluded by establishing two artificial dimensions within Dyslexia. The first was identified by a family history of reading or spelling difficulties, but had to be divided according to the presence of language and speech delays or the presence of atypical laterality. The second subgroup was identified by neurological dysfunction in the absence of family history. Like Layton's duoclassification system (Layton, 1979), these categories function

only on the most general levels, yet contribute significantly to the understanding of the disorder.

Other researchers have made use of sets of variables similar to those of Naidoo, with only slight changes or additions. As noted by Meier (1978), these variables have included nutrition, morbidity risk indicators, vision and hearing problems, abuse and neglect, infact cognition, receptive and expressive language, social adaptation, maturity, and achievement. Hartlage (1973b) recommended taking note of school failure and retention. Becker and Snider (1979) used grade of initial referral. Greer and Whitley (1971) used number of siblings. Pregnancy and birth complications were mentioned as important (Colletti, 1979), but in addition, perinatal events also are considered significant (Kawi & Pasaminick, 1959; Stauffer, Abrams & Pikulski, 1978). Familial variables should include divorces and separations (Duke, 1976; Clancy & Smitter, 1953). The nature of any referral problem should also be considered in detail (Garrido, 1978; Devine & Tomlinson, 1976; Grieger & Richards, 1976; Werry & Quay, 1971; Quay, Sprague, Shulman & Miller, 1966).

While many studies achieved significant results using these variables, few analyzed their data to identify predictors by sex. As had been noted earlier, this is a serious shortcoming, and stresses the importance of such an analysis for the development of inferences regarding the reasons for the observed sex-ratio within LD.

An Alternative Approach

In his dissertation for Rutgers-The State University, Robert I. Price (1975) approached the entire question of sex ratios from a unique perspective: He surveyed female teachers, male teachers, administrators, and special services personnel to determine their opinions as to why special education placements were dominated by males. They were asked to select from a long list of possibilities those 10 reasons which they believed were responsible for the phenomenon. They were then asked to rank-order their selection.

The six reasons (as phrased by Price) chosen most often by the total group were:

1) Our society exerts more pressure on boys than on girls to succeed and be competitive.

2) Boys mature more slowly emotionally and socially and are more easily frustrated.

3) Boys are physically less mature and have more perceptual problems.

4) Boys are encouraged to be more aggressive and then are placed in a school setting which punishes this behavior.

5) Boys are encouraged to suppress their fear, anxiety, and injuries.

6) Boys are required to start reading when they are not as ready as girls.

When Price analyzed a series of referrals by age at placement, grade at placement, achievement level at placement, IQ, father's occupations, and reasons for referral, he found that more males were chosen for special education in general when the decision was based less on IQ or physical handicap.

The significance of Price's results is two-fold. For the first time, evidence was presented of the beliefs and attitudes of those professional educators who initiate referrals and recommendations for placement in special programs. There was evidence of a consistent belief in the vulnerability and susceptibility of males. In the examination of actual practice, the result of these beliefs, Price discovered that the sex ratio became more equal as placement specialists relied more on IQ or actual physical handicap. It would be fair to infer that the preponderance of males in special education may be due to factors further removed from any actual disability. More significantly, the preponderance may be due to factors further removed from the current assessment techniques used to make placement evaluations.

Thus, Price's results support the empirical data on incidence rates by sex. However, there is yet to be research to follow up on this distinctive approach. Since there is now evidence of attitudes of special services personnel, analyses should be conducted to determine whether the opinions actually have an empirical basis in fact. Where it might be difficult to quantify the variables involved,

a qualitative approach may serve to produce more coherent results. Examining the six most frequent opinions cited earlier, all but the first could be investigated using quantitative variables. Only the first, that society exerts more pressure on boys to succeed and be competitive, might more easily lend itself to a qualitative design.

Discriminant Analysis

The primary analyses in this study were conducted using Discriminant Analysis (Fisher, 1936; Stoller, 1954). According to Lachenbruch (1975), by analyzing a number of observations for two distinct groups, a mathematical interrelationship is developed into a function which assigns unknown observations to each group with a minimum rate of error. It is not a procedure for testing between group differences per se, since the result is a single function. The function allows a decision process which can be described thusly: a subject will be more like Group A if D (X) < some number, more like Group B if D (X) > some number. The function operates on a minimax rule, which minimizes the maximum probability of misclassification.

The function first chooses that variable which maximizes the between-group differences, then chooses a variable which separates the groups where they are closer together, and so on. Variables added at each step may cause earlier variables to be rejected, as they will fall below a critical value for "potency". They will

no longer contribute significantly to the discriminating function. The resulting function consists of those variables necessary and sufficient to produce the minimum error in the prediction of group membership. This procedure is similar to Step-Up Regression.

Discriminant Analysis assumes a linear relationship between the independent variables (Morrison, 1969), and has four basic assumptions (Lachenbruch, 1975):

1. f_1 (X) and f_2 (S) are multivariate normal.
2. The covariance matrix in Π_1 is the same as the covariance matrix in Π_2.
3. The population means μ_1 and μ_2 are known and the covariance matrix Σ is known, where Π_i = population i; μ_i = k x 1 mean vector in Π_i; Σ_i = k x k covariance matrix in Π_i; p_i = a priori probability that an observation comes from Π_i; k = number of variables; X = k x 1 vector observation; f_i (X) = density function of X in Π_i.
4. The a priori probabilities p_1 and p_2 are known (or equal).

In using Discriminant Analysis, accommodations must be made for missing data. Chan and Dunn (1972, 1974) recommended specific methods for handling missing data, depending on the number of variates. For a large number of variates, substituting variables for the missing data was found most efficacious in predicting group membership. Unequal sample sizes seemed to have little effect on the mean substitution method (Little, 1978; Chan, Gilman, Aono & Dunn, 1976).

Summary

There are several major theoretical frameworks which seek to account for the predominance of males in learning disabilities. All depend on particular variable sets to support specific contentions; these variables rarely cross theoretical boundaries. The major frameworks can be said to depend on subsets of Intrapersonal, Interpersonal, or Extrapersonal variables.

The modern trend has been to combine variable subsets in order to improve the accuracy of prediction. At first glance, such combinations would seem to add to the confusion by providing concurrent support to opposing theories. However, it has come to be recognized that no one theory is sufficient in and of itself to account for all of the variability within learning disabilities. More to the point, mutually exclusive theories can be used to explain the same observed phenomena. Therefore, it is logical (even compulsory) to include many kinds of variables (not merely those supporting one major framework) in studies designed to aid inferences as to the etiology and process of learning disabilities. This is necessary not only for accuracy in the statistical sense, but also for accuracy in the sense of completeness. It is highly likely that a complex network of interactions among several types of variables is responsible for learning problems, rather than a select few variable subsets.

The preceding review of literature in the field of learning disabilities was provided both as a general background for the current study and as a reference guide for research pursuant to the analyses. In the Methodology section which follows, the reader should bear in mind that only a select cross-section of all possible variables was utilized. The present study depended on pre-existing data on variables classified as Intrapersonal and Extrapersonal. Since no direct assessments were conducted, no Interpersonal variables were included.

CHAPTER 3

METHODOLOGY

Procedures

The present study constitutes a static group comparison within an Ex Post Facto design (Gage, 1963), utilizing subjects in matched pairs. The intent of this quasi-experimental approach is to formulate a prediction equation for a specific effect by grouping subjects according to those pre-effect attributes which are found to be in common.

After securing the proper administrative clearances, an examination was made of confidential case records and cumulative files for all pupils placed in programs for learning disabilities. Information gleaned included Demographics and Personal Data, School Data (including previous referrals and the results of any formal assessments), Familial Data, Medical History, and Pregnancy and Birth Complications.

Sample

The total sample was restricted to the Upper Elementary or Intermediate grades to facilitate the gathering of data, as a partial control for age, and to make use of "stabilized" variables (Touliatos & Lindholm, 1976). Richey and McKinney (1978) argued

similarly in their study of the classroom behavior of LD boys. The total sample was drawn from a relatively small homogeneous school district; sample characteristics may reflect this homogeneity.

Learning Disabled (LD) Sample

The LD sample was drawn from seven public elementary schools located within one urban school district. All students placed in Learning Disabilities Programs in the seven schools were included regardless of the level of severity or nature of the disability. Fifty-nine males and 42 females were selected, representing placements for the 4th, 5th, and 6th grade levels only. Ten subjects were eliminated because of imcomplete demographic data (8 males, 2 females), 9 were eliminated due to a primary or secondary diagnosis or emotional disability (5 males, 4 females), and 2 were eliminated because of a primary diagnosis of mental disability (1 male, 1 female). The final LD sample consisted of 45 males (56.25%) and 35 females (43.75%).

The LD sample was not drawn randomly. However, Bock (1975) asserts that when one of the independent variables is used as a control (when one population represents a norm), it is best to sample in proportions and not randomly. In essence, the use of all members of an intact group (in this case, the LD subjects) constitutes a norm, and thus is a sample in proportions. The use of an intact group carries with it the effects of decision

biases, referral biases, assessment biases, perception biases, and selection biases, which are unmeasured in the present study.

Regular Education (RE) Sample

White student registration cards were a resource for both samples of students, they were particularly useful for selecting the matching RE sample. Cards were pulled for those students who matched the LD sample on sex, grade, and socioeconomic status. A subset was selected of those students who most closely matched the LD sample on date of birth. In no case was a subject selected who differed more than six months in age. From this final group, a random selection was made for inclusion in the study sample. At that point, confidential case records and cumulative records were examined for these regular education students.

Data Coding

The data was coded on IBM coding sheets, for keypunching and computer analysis. The Discriminant Analysis program of the Statistical Package for the Social Sciences (SPSS) was utilized for this study. Certain variables were eliminated from each Discriminant Analysis for specific reasons. For the development of Function One, Current Educational Placement was eliminated since it obviously was common to all LD subjects used in the analysis, and therefore of no value as a predictor. For the

development of Function Two, those variables were eliminated which were specific to the LD group and for which there was no comparable data available for the RE group. The variables eliminated were: Current Educational Placement, Age at Referral, Grade at Referral, Grade at Placement, Reasons for Referral, Length of Placement, and all WISC-R scores.

In coding data for the LD group, it was discovered that certain case histories contained no specific information regarding WISC-R test scores or other necessary factors. In order to include these subjects in the study, some data had to be generated artificially.

CHAPTER 4

RESULTS

Discriminant Analyses

Hypothesis I (H_0I) stated that no set of variables existed which successfully discriminated between males and females within the LD group. H_0I was tested via Discriminant Analysis on the LD sample only, with Sex as the dependent variable. The existence of a Discriminant Function which correctly classifies subjects significantly better than chance (Morrison, 1969) is cause for rejection of H_0I. The Canonical Discriminant Function obtained for this test was composed of 18 variables after employing the variable-addition feature. One hundred percent of the variance within the LD group is accounted for by these 18 variables. They are presented in Table 1, with the variables ranked according to the absolute value of the canonical coefficient and with the sign of the coefficient retained. The rate of successful classification into Group 1 (males) was 86.7 percent and for Group 2 (females) was 88.6 percent. The overall rate of success was 87.5 percent. According to Morrison (1969), the function exceeds the expectations of a proportional chance criterion, and H_0I is rejected.

Hypothesis II (H_0II) stated that no set of variables existed which successfully discriminated between the LD group and the RE group. H_1II was tested via Discriminant Analysis on the total

Table 1

Canonical Discriminant Function One - Within LD Group

Variables	Standardized coefficient[a]
ITBS Composite	.936
Age	.890
Hospitalized more than 2 wks	-.774
ITBS Reading	-.712
Divorced and Remarried	-.684
ITBS Language	-.682
Number of Younger Sisters	.672
Surgery before Age 5	.665
Number of Older Sisters	.521
Both Parents Working	.506
Single Parents	.478
Postnatal Problems	-.466
WISC-R Verbal Score	.443
Current Grade	.385
Previous Speech/Lang. Referral	.378
Difficult Delivery	.354
Number of Younger Brothers	.249
Vision Problems	-.231

Note. Refer to appendix A for a complete listing of all 48 independent variables.

[a]Positive coefficients represent associations with maleness, and negative coefficients represent associations with femaleness.

sample, with Sex considered as a predictor. The existence of a Discriminant Function which correctly classifies subjects signi-nificantly better than chance is cause for rejection of H_0II. The Canonical Discriminant Function obtained for this test was composed of 19 variables after employing the variable-addition feature. One hundred percent of the variance in the total sample is accounted for by these 19 variables. They are presented in Table 2, with the variables ranked according to the absolute

Table 2

Canonical Discriminant Function Two - RE vs LD

Variable	Standardized coefficient[a]
ITBS Math	.624
ITBS Writing	-.515
ITBS Language	-.475
ITBS Vocabulary	-.445
Grade of Second Retention	-.397
Difficult Delivery	.346
Surgery before Age 5	.325
Grade of First Retention	.315
Single Parent Family	.214
Grade of Previous Referral	-.209
High Fever before Age 5	.204
Prenatal Drugs, smoking, etc.	.204
Surgery after age 5	.189
Number of Younger Sisters	.187
Number of Older Brothers	.176
Previous Speech/Lang. Referral	.136
Other Medications	.132
Postnatal Problems	.123
Number of Younger Brothers	.118

Note. Refer to appendix A for a complete listing of all 48 independent variables.

[a]Positive coefficients represent associations with LD placement, and negative coefficients represent associations with RE placement.

value of the canonical coefficient and with the sign of the coefficient retained. The rate of successful classification into Group 1 (RE) was 88.8 percent, and for Group 2 (LD) it was 91.3 percent. The overall rate of success was 90 percent. According to Morrison (1969), the function exceeds the expectations of a proportional chance criterion, and H_0II is rejected.

Heuristic Analyses

As a check on previous research, several comparisons were made for their heuristic value. Within the LD group, an examination was made of SES, reasons for referral, observed frequencies of grade at placement, ITBS Composite scores, WISC-R scores, and the correlation between WISC-R scores and ITBS Composite scores to determine whether significant differences existed by sex. In addition, ITBS Composite scores were compared within the RE group and the ITBS Composite scores were compared between placement groups.

In comparisons involving multiple *t*-tests, the reasonable approach is to exponentially increment the alpha coefficient for each test subsequent to the first. This was not done for the heuristic analyses in the present study because the results were not used for the major analyses. In order to examine certain variables which related closely to previous research, an assumption was made of independence among the variables. This is comparable to having conducted several narrower studies simultaneously, each using a more limited number of variables. Statistically, this would have required independent samples for each variable (or at least for each investigation). Therefore, the following results were sought for their heuristic value only, and should be interpreted as indicative rather than definitive. For larger samples, a factorial design utilizing a variety of the *F*-test (depending upon the independence of the variables included) would be better suited to

examinations of mean differences. These tests could be followed up with a posteriori *t*-tests or the methods of Scheffé, Tukey, Newman-Kuels, etc.

There were no significant differences in the frequencies of reasons for referral between males and females within the LD group. Similarly, there were no significant differences in socioeconomic status, grade at placement, ITBS Composite scores within the LD group or the RE group, and WISC-R scores within the LD group. Finally, there was no significant correlation between WISC-R scores and ITBS Composite scores for females within the LD group.

Some variables were tested which did yield statistically significant results. When ITBS Composite scores for LD males were compared with ITBS Composite scores for RE males, the resulting *t* of 7.52 was significant at the .01 level. When ITBS Composite scores for LD females were compared with ITBS Composite scores for RE females, the resulting *t* of 7.09 was significant at the .01 level. A significant positive correlation ($r = .31$, $p < .05$) was found between WISC-R Verbal scores and ITBS Composite scores for the LD males. Also, a significant positive correlation ($r = .34$, $p < .05$) was found between WISC-R Full Scale scores and ITBS Composite scores for the LD males.

CHAPTER 5

DISCUSSION, CONCLUSIONS, SUMMARY

Discussion

Since the present study contained a large number of variables and since the number of subjects was relatively small, it is reasonable to regard the results of the analyses with caution. Spurious relationships may have occurred within the heuristic analyses due to chance, or significant effects may have been suppressed by the abundant variable interactions. With regard to the discriminant analyses, however, the high percentage of accuracy in the prediction of group membership permits reasonable confidence in the potency of the variables involved. The resultant canonical discriminant functions provide a rank order by potency of those variables which are both necessary and sufficient for the most accurate prediction. The linear nature of the function requires that all variables contributing to the function be considered collectively when formulating implications.

Sex Proportionality

While not a major finding, one of the most interesting and unanticipated results of the current study was the lack of an overwhelmingly disproportionate number of males within the LD sample. It appears that the school district sampled contains none of the

factors contributing to a preponderance of males so typical of previous research (Mumpower, 1970). Conversely, it may be that the females within the sampled school district are significantly more likely to develop learning problems than females in general (judging from the relative lack of representation in previous research). In other words, the female population within the sampled school district may be significantly more "at risk" for developing a learning disability than the population of females at large. Since the likelihood of such a phenomenon is highly speculative, we must turn to a more reasonable explanation.

Previous literature has been almost exclusively restricted to males, due to the lack of availability of females with special problems (Doehring, 1968) and due to the relative ease of making predictions for males (Chronister, 1964). Since the present study contained a near-equal balance of males and females, it is possible to conclude that the significant findings in previous research comparing males in regular education (RE) to males in special education may also be equally applicable to females (Bentzen, 1966; Wheatley, 1977). Studying only males with learning problems may yield results which seem significant in isolation but which in actuality apply generally to females or even to students in other educational placements. If this is indeed the case, a strong argument can be made for the operation of bias in the creation of a preponderance of males in learning disabilities placements.

In other words, females may be similarly "at risk", yet are less frequently referred for special problems. Perhaps it is because society does tolerate greater intellectual subnormality in females (Gove & Herb, 1974). The use of both sexes in future comparisons across multiple educational placements would seem to be mandated by the results of the present study, as would the use of a control group of regular education (RE) students. Ideally, each placement group should be sampled simultaneously and followed longitudinally. Such research could then establish more reliable predictors for males and females within a broad range of placement categories.

As an aside, it should be explained that no male/female Discriminant Analysis was attempted within the regular education (RE) placement group for a specific reason. The LD sample can be seen as proportional, since it included all usable LD subjects. The RE sample cannot be taken as proportional, since no examination was made of its representativeness. Any associations by sex could easily have been spurious, and the generalizability of any results would have been tenuous at best.

Discriminant Analysis - Function One

Male cluster. Of the 18 variables included in the first Discriminant Function, 12 had high values associated with "maleness" The two highest values among the "male" variables were the ITBS Composite Score and Age, indicating that the males tended to be older and tended to perform better overall on this group test of achievement

than the females with learning problems. Males in the LD group also tended to have both older and younger sisters, to have had surgery fairly early in life (usually a myringotomy, the insertion of tubes in the ears), and to have experienced a degree of "parent absence" (both parents working or single-parent homes). The inclusion of WISC-R Verbal scores was not expected based on past research into the verbal superiority of females (Bentzen, 1966; Gallagher & Aschner, 1963). It has been well established that males do less well on verbal tasks than females. Gallagher and Aschner (1963) evidenced that males eventually "catch up" and surpass females, however. Perhaps the males in the present study had done so. Since age figured significantly in the analysis, this latter conclusion seems justified. On the other hand, perhaps the WISC-R Verbal Scale is more truly representative of verbal reasoning rather than verbal usage, and perhaps males excel in this area.

The remaining "male" variables are of relatively low potency, but remain necessary for an accurate prediction. Males in the LD group who possessed the previous characteristics also tended to be in the upper grade levels, to have had a previous Speech and Language referral, to have had a difficult birth, and to have younger brothers. Perhaps the presence of siblings represents a selection phenomenon, in that the boys tend to stand out in comparison (especially to their sisters) and thus are more likely to have their

learning problems recognized. Since almost all of the subjects in the current study were referred by classroom teachers, however, this explanation appears to be unfounded. It is possible that the sibling variables represent a spurious relationship, except that their coefficients are relatively large. Therefore, the presence of both older and younger siblings is particularly hazardous for males.

The presence of a "parent absence" factor bears further investigation, as does the presence of a severe physical trauma (surgery, difficulties in birth) in the developmental history. Such factors seem to place the male "at risk" for LD placement. Future research should concentrate on determining whether these phenomena are present to the same extent in males placed in other special programs or in males in general.

Female cluster. Of the six variables forming a "female cluster" or profile, those with the highest values indicate that female LD students are more likely to have been hospitalized early in life (usually for premature birth or illness). At first glance, this seems surprising, considering the evidence for biological frailty in males and a corresponding superior health in females (Gruenberg, 1974; Seaver, 1972) and the higher incidence of premature births for males (Kawi & Pasamanick, 1959). Therefore, it is more likely indicative of the significance of this particular variable for the prediction of LD in females when combined with the other five factors. In

other words, so few females in the general population are hospitalized shortly after birth (as compared to males) that the presence of this factor in the medical history becomes a potent predictor of LD placement in conjunction with other factors.

Heuristically, however, we can separate the hospitalization variable from the cluster and examine its implications independently. Considering the near-equal representation of males and females within the LD sample used for the present study, the potency of the hospitalization factor in the prediction for females could be strong evidence in support of the contentions of Beilin (1970) and Singer and Osborn (1970), who found that learning problems had to be more severe for females before a referral would occur. In other words, some sort of bias against females may be operative. On the other hand, since biological deficits are so pervasive among males in general, perhaps males in LD populations are better able to compensate for their defects. Since any aberration would be correspondingly rare in females, females in LD populations may not be as adept at compensation. Thirdly, it simply could be that females are more susceptible to the deleterious effects of early hospitalization than are males.

More easily explained is the inclusion of ITBS Reading and Language scores in the cluster for females. Gallagher and Aschner (1963), Gesell (1940), and others have acknowledged the verbal superiority of females at an early age, as was noted previously. Therefore, even LD females maintain their verbal superiority over

males. However, the precise nature of this verbal superiority must be explored, in light of the previous discussion of the male cluster.

The presence of a variable for Parents Divorced and Remarried argues for a stronger impact of reconstituted families on young girls. It follows that females may be susceptible to specific phenomena, while males are more generally vulnerable. Future researchers might do well to consider family constellation in subsequent inquiries of characteristics of special education students.

The final factors associated with female LD subjects (Postnatal Problems and Vision Problems) can be evaluated in much the same way as the presence of the hospitalization factor. As with their predecessor, these latter two factors most likely derive their significance from the relative infrequency of occurrence among females in general. A girl who experiences postnatal problems (a pseudonym for developmental delays), vision problems, or who is hospitalized shortly after birth can be said to be "at risk" should her parents divorce and remarry. These factors may not predict as well for males, even though research shows that they occur more frequently in males, because many males with developmental delays (for example) are never placed in anything other than regular educational programs.

Relationship to variable sets. In scanning the complete list of 18 variables included in Function One, Intrapersonal variables easily dominate. However, within the variable clusters for each sex, an interesting pattern emerges. For males, six of the factors were Intrapersonal variables and six were Extrapersonal. For females, five were Intrapersonal and only one was Extrapersonal. Clearly this difference supports previously stated speculations that males are more generally vulnerable than females and that the high risk female is probably more vulnerable to specific phenomena. Since males and females were fairly equally represented in the LD population used for the present study, it may be concluded that males and females in LD share a common risk probability, but due to different factors. Additionally, males and females in the LD placements were similar in terms of the "masculine" nature of the variables of significance. In other words, males and females within LD are influenced by the same general class of variables, yet differing in the number and nature of specific factors. Since males and females are similarly "masculine", the high risk female is therefore more different from females in general than the high risk male is from males in general. This may be the true difference between males and females within an LD population. Males in LD placements are probably more vulnerable to Extrapersonal influences, and environmental stress in general (Bortner, 1979), while females in LD placements may actually be more pathological than their female counterparts (Beilin, 1970; Singer & Osborn, 1970).

At the very least, the results of the first Discriminant Analysis exhort investigators to consider multiple categories of variables (behavioral, genetic, physiological) simultaneously. With the addition of such Interpersonal variables as perceptual bias (Arnold, 1968; Miller, 1972) and decision biases (Jackson & Lahaderne, 1971; Larson, 1975; Meyer & Thompson, 1963), a more complete picture to date of the etiology of Learning Disabilities would follow. More importantly, future research should endeavor to secure an even representation of males and females, or at the very least a sample which is both proportional and representative. In areas where too few female subjects exist to constitute an adequate sample, consideration should be given to combining subjects over consecutive years. This procedure poses additional problems, since males would have to be sampled whereas all female subjects would be included. However, the value of including a comparison group of females would outweigh any methodological complications.

Discriminant Analysis - Function Two

LD cluster. The second Discriminant Function consisted of 19 variables; 14 had high values associated with the LD group. The highest value among the "LD" variables was the ITBS Math score, which makes perfect sense when compared to the strongest predictors of RE placement. Since LD students typically do poorly on writing, language, and verbal tasks, it is the ITBS Math score

which has the greatest potential to be the highest score within the battery. A difficult delivery at birth was also a strong predictor of LD placement, but the significance of this variable must be evaluated in the context of the complete Discriminant Function. A difficult delivery is only significant when the other variables are also present in the case history. It is appropriate, therefore, to speak of an LD profile, which would include an ITBS Math score higher than other subtest scores, a difficult delivery at birth, surgery early in life, a retention of one grade level, and a single-parent family.

RE cluster. The regular education (RE) cluster included higher scores on the ITBS Writing, Language, and Vocabulary subtests; having been retained twice, and the presence of an early referral to the Child Study Team. As for why a second retention predicted RE placement, when the reverse might be more consistent with expectations, perhaps it was due to the nature of the population itself. Perhaps students who are retained more than one are more likely to be "slow learners" (WISC-R Full Scale IQ below 85), and thus not eligible for LD placement. Similarly, perhaps early referral to the Child Study Team results in the elimination of LD placement as an educational possibility because of a successful intervention strategy. In the present study, previous referrals tended to occur in kindergarten or first grade. It may be that later referrals are more closely

associated with LD placement. Such a hypothesis must be tested using a larger sample to establish reliability.

Relationship to variable sets. In a manner similar to that used for the first function, Discriminant Function Two can be dissected into Intrapersonal variables and Extrapersonal variables. Interestingly, the ratios obtained for each function are almost exactly the same. Intrapersonal variables also dominate Function Two. This last finding suggests the efficacy of using pre-existing data on demographics, medical history, and family history to predict eventual placement in a LD program. It must be noted, however, that the addition of group achievement test scores produces the most potent discrimination between LD and non-LD placements. Thus, a scheme for the early identification of learning problems begins to take shape. By the first or second grade, when ITBS scores first become available, a composite profile of each student could be screened for the presence of an "LD cluster". Even earlier, before the child begins school, an assessment could be made of "goodness of fit" to the LD profile. In any case, once students have been identified as "at risk", they could be compared to the male and female profiles within LD, as outlined in the discussion of Function One. These "at risk" students could then be referred to a Child Study Team for evaluation. Subjects could be followed closely by researchers to determine subsequent progress in school. A longitudinal study of children from pre-school through the elementary grades would seem to be the most thorough test of any prediction model.

Heuristic Analyses

Significant results. When the ITBS Composite scores of the LD group were compared to the ITBS Composite scores of the RE group, the resultant differences occurred as expected from the research of Doehring (1968) and Meier (1978). They postulated that reading difficulties were accompanied by deficiences in non-reading areas. We would expect a difference in composite scores across placement groups. More precise information regarding the nature or quality of this difference might be gained from a Discriminant Analysis (or a Step-Up Regression) using the ITBS subtests as the only variables.

In the only other heuristic test to succeed in reaching significance, the correlations between WISC-R scores and the ITBS Composite scores for males in the LD placement group must be regarded with suspicion. Correlation coefficients, albeit statistically significant, must be examined with respect to the percentage of the total variance accounted for by the correlation. Coefficients of .31 and .34 account for roughly 10 percent of the variance among the respective variables, and thus it would be best to regard the current correlations as minimally significant. It may be that these particular instruments are more reliable for males, but such a proposition is hardly proven by the current findings. Should it be found that the relationship is indeed a consistent one, then Chronister (1970) will receive additional support. Peripherally, the correlation coefficients for the WISC-R scores and the ITBS

Composite scores of females were so low as to posit the existence of a significant difference between the sexes in degrees of correlation for the two sets of scores.

Chance relationships. Of the eight heuristic tests in the present study, six did not reach significance. No nonchance relationships (statistically significant differences) were found between reasons for referral, socioeconomic status, grade at placement, ITBS Composite scores within each placement group, WISC-R scores within the LD group, and WISC-R correlations with ITBS Composite scores for females within the LD group. These findings fail to replicate previous research on reasons for referral (Grieger & Richards, 1976; Lindholm & Touliatos, 1977), SES (Marini & Greenburg, 1978), and grade at placement (Gove & Herb, 1974). It should be no real surprise to find that ITBS Composite scores are similar within each group, and that WISC-R scores are similar within the LD group. Both instruments were designed to eliminate sex differences in their scores. Perhaps an examination of all subtests on the ITBS as well as subtest scatter on the WISC-R would reveal more subtle differences not evidenced in this coarse analysis. It is more difficult to rationalize the lack of significant correlations between WISC-R scores and ITBS Composite scores for females, however. Since there were no differences between WISC-R scores or ITBS Composite scores within the LD group when compared by sex, we would expect that significant correlations which appear for one sex would also appear for the other. Perhaps

it is this result which best supports Chronister's thesis (1964) that predictions are easier for males. In any case, a more detailed analysis of WISC-R subtest scatter and Verbal-Performance Score differences, as compared to all subtests on the ITBS, seems warranted.

Implications

General. While it can be generally acknowledged that the relatively small sample size may have contributed to the lack of replication within the current results, the inclusion of the entire LD population in the study coupled with a near-equal representation of males and females lends credence to the supposition that the current results might present a more accurate picture of the LD population in general. Further research purporting to establish differences in reasons for referral, SES, and grade at placement (for example) would do well to consider the impact of a disproportional representation of males and females within samples. Should a disproportion exist, the researcher must rule out bias as a factor in placement before any substantive conclusions can be offered. Researchers who hope to improve on the current design would do well to consider matching their LD subjects on several of the more potent predictors found in the current analysis. The use of matched pairs would serve to focus the assessment of sex differences (for example) into even finer discriminations. Obviously, such a procedure would have to be accompanied by well-specified operational definitions for the independent variables (predictors).

Diagnosis. The more important implications relate to the possibility of predicting future LD placements without reliance upon data other than what is gathered routinely by the schools. There may be no need for individual assessments of achievement levels for diagnostic purposes. The inclusion of a group achievement score was sufficient for maximum predictability. There also may be no need for individual assessments of intelligence for diagnosis. However, individually administered evaluations may still be necessary as a prescriptive aid. Secondly, the puzzle of early identification of LD may be more easily understood in light of factors occurring early in development. Factors appearing in the first five years of life evidently have a profound influence on later success in school.

Theories of learning disabilities. One final implication must be recounted to complete the discussion of current results. There may be no "real" sex differences within LD. Layton (1979) resolved the problem of multiple conflicting theories of LD by proposing a duoclassification system within reading disabilities. Like the system proposed by Naidoo (1972), the basic differentiation hinges on the presence or absence of neurological impairment, although Naidoo's includes evidence of a family history of reading problems as well. The factors which separate LD subjects from RE subjects can be taken as indicative of neurological damage of some kind, especially variables such as Difficult

Delivery, High Fever Before Age 5, and Prenatal Drugs, etc. However, within the LD group itself (the most appropriate focus for this discussion), very few variables emerge which might have caused neurological damage. Hospitalization and Postnatal problems appear in the female cluster; Previous Speech/Language Referral and Difficult Delivery appear in the male cluster. By far, most of the remaining variables of significance have no obvious relationship of impairment in neurological systems. Rather, the potency of ITBS scores (for example) indicates a post-hoc effect - a measurement of the aftermath of impact on neurological functioning.

Perhaps there are intervening variables waiting to be discovered. More likely, and more relevant to future research, neurological factors probably become less important for defining subgroups within LD when the sex of the subject is a primary consideration. That is, while neurological symptoms may separate LD from non-LD, there may be essentially no neurological differences between males and females within LD. This conclusion has far-reaching implications for theories of genetic inferiority and maturational lag.

Once again, it may be that theories of learning disabilities apply equally to males and females. If so, it is likely that some sort of decision bias operates to produce a disproportionate number of males in learning disabilities placements, and even throughout special education. Explanations for the perceived differences in

frequencies of LD placements should be reformulated to adequately describe the process of the phenomenon for both sexes. Theories of learning disabilities (and theories of sex differences in other disabilities) should be challenged to account for the possibility that it is "masculine" characteristics that are relegated to special programs, rather than males per se. In other words, a subtle variety of sex bias may be operant within public education. Further tests of this general hypothesis should consider using the specific variables found to be potent in the current analysis. In addition, the larger Intrapersonal, Interpersonal, and Extrapersonal variable sets must be accounted for simultaneously.

Variable sets and learning disabilities theory. Each Discriminant Function was dominated by Intrapersonal variables, which best support a maturational or developmental lag theory. For LD males, the potency of such variables as age, likelihood of medical insult or injury, and speech or language problems points directly to the work of Anthony (1970), Bentzen (1966), and Wheatley (1977). They concluded the necessity for a causal link between developmental lag and reading problems in males. According to Meier (1978), the lag is due to specific deficits. However, the nature of the variables mentioned above seems more likely to be the product of a nonspecific, more indistinct handicap. The same would be true of the LD females. Some sort of global deficit seems to be operating, though differentially for each sex (Doehring, 1968; Goldberg & Schiffman, 1972; Hoyenga &

Hoyenga, 1979; Meier, 1978). For the LD females, two factors (Hospitalized for More than Two Weeks and Parents Divorced and Remarried) could be interpreted as indications of a greater vulnerability to environmental effects, contrary to the findings of Bortner (1979), Gove and Herb (1974), and Gruenberg (1964). However, more extrapersonal variables were included as predictors for males. That, plus the work of Seaver (1972) and Wheatley (1977), force two difference conclusions: either females have a more specific vulnerability, or equivalent environments have an unequal effect on boys and girls (Gomberg & Franks, 1979). Certainly, Discriminant Function Two is evidence for greater vulnerability of LD subjects in general. At the very least, the present study accounts for the wide variety of characteristics among LD populations (Smith, 1974; Reynolds & Balow, 1972). It remains for more inclusive research using many more subjects to discern the subtleties therein.

Interpersonal variables were not measured directly, but it is possible to conclude a lack of bias in referral to the LD programs sampled since there were no differences on Reasons for Referral when compared by sex (Nicholson, 1967; Touliatos & Lindholm, 1976). This is especially potent considering the proportional representation within the current sample. Research not utilizing balanced sampling may therefore be held suspect unlesss freedom from bias in placements is demonstrated. We can speculate that the near-equal representation of males and females could have been due to the

presence of more high risk females in the particular geographic area. Once again, a broader study utilizing larger samples is necessary to investigate this conjecture. Theories based on perceptual bias to account for disparities in referral to special programs (Arnold, 1968; Miller, 1972) are neither supported nore specifically rejected by the current results. The possible significance of bias as a critical variable, however, should not escape attention.

Of the Extrapersonal variables, Socioeconomic Status was not a significant factor in the present study. Perhaps the work of Gershman (1975) or Kealy and McLeod (1976) cannot be applied specifically to LD; rather, it may be that placement in special education in general is associated with SES. Family Milieu stands out as the more meaningful variable set within the extrapersonal class. Factors such as Number of Siblings, Parents Divorced and Remarried, Both Parents Working, and Single-Parent Families provide ample evidence for the significance influence of the home environment on both child development and future LD placement. Sociological assessments and a qualitative analysis of the child's interpersonal world should be included in any study desiring to be comprehensive. One specific implication worth investigating is the effect of Family Milieu on such intrapersonal variables as test scores and deportment, plus on interpersonal variables such as perceptual bias in parents and teachers. Perhaps role expectations do play a crucial role in predeterminations of LD placement

for both males and females. Finally, previous research establishing causal relationships with Extrapersonal variables for males (Hubbard & Lowe, 1979; Samuda, 1975; Sigel, 1964) probably apply to females as well, although possibly to a different degree. In other words, the same environmental effects occur in members of both sexes who are "at risk". Therefore, it is vital to operationalize Price's (1975) ten factors adequately for quantitative analysis.

Conclusions

It is certainly logical to conclude that the sample for the present study was not representative of the samples in previous research. Future research should be conducted statewide and regionally to ascertain the validity of the current sample. Should the sample prove to be unique, an investigation should be made to discover why so many more females were placed in LD programs than would be expected. Should the sample prove to be representative, then previous research may have utilized samples from populations biased against males.

Contrary to popular opinion, gender may be a poor predictor of LD placement. While LD students can readily be distinguished from RE students, no clear statements can be made as to how the sex of the student influences the separation of these two groups. Even the most conservation conclusion points to a marked similarity between males and females within LD, given the absence of a re-

ferral bias or other bias against males. There may be no valid reason for the observed sex ratio in any special program. On the other hand, the preponderance of males in LD placements may be due to a genuine propensity on the part of males towards developing LD. Males may be generally vulnerable and females may be affected only by specific factors, thereby producing fewer LD females. Finally, females may be the recipients of bias, making it necessary for their symptoms to be more severe before a referral could occur. This phenomenon was not evident in the current study. It can be stated, however, that the LD females were more unlike females in general than the LD males were from males in general.

On a smaller scale, familial factors should be regarded as important influences on future LD placement. Speculations arise as to the specific etiology, i.e., whether the presence of siblings makes the LD subject more noticeable, whether stress generated by divorce is an equipotent influence on both sexes, and whether any current theory can still be said to explain male-female differences within LD. Consideration should be given in the future to discerning the mechanism by which multiple influences operate as well as whether they operate differentially on males and females.

The usefulness of pre-existing data in distinguishing male and female LD subjects has been amply demonstrated by the current study. Medical history, developmental data, etc., were all important factors in prediction. But pre-existing data is insufficient for

accuracy. Group assessment data must be included, constituting at a minimum an achievement measure. However, no accurate conclusion is possible regarding the generalizability of these variables to explanations for the preponderance of males in LD programs until replicating research can be conducted to confirm the validity of the near-equal proportion of males and females in the current sample.

General support is given for a mixture of interpersonal and extrapersonal variables as the best predictors of LD placement, and for differentiating between males and females within LD. Future research should probably examine sources of influences on achievement test scores and variables which evidence a maturational lag. The current study suggests that these avenues hold the most likely promise for a comprehensive explanation for the sex ratio within LD.

Finally, consideration must be given to replicating the current design with large samples from other diagnostic categories within special education, e.g., emotionally disturbed, mentally retarded, etc. It is essential to construct a more complete picture of the differences between males and females within those categories before accurate theories of explanation for observed sex ratios can be forthcoming. Future research should include subjects matched on particular demographic variables, neurological signs, and developmental history. Specifically pursuant to research by Price (1975), operational definitions must be proposed for "society

exerts more pressure on boys than on girls . . ." (Price, 1975, p. 127) and "Boys are encouraged to suppress their fear, anxiety, and injuries" (Price, 1975, p. 127), generally described as a belief in the vulnerability and susceptibility of males.

Large samples are necessary for the large number of variates required for reliable statistical tests of subsequent hypotheses. Foreseeable problems include an interrater reliability factor across diagnostic teams and across school districts. This argues for a standarized definition for each diagnostic category. It also argues for standardization of data collection, storage and retrieval systems, and hypotheses to be tested. Such a recommendation is necessary for precision in the interpretation of future research, especially as it pertains to implications for early identification and individualized educational programming.

Summary

The present study assessed the efficacy of specific classes of variables (Intrapersonal, Interpersonal, Extrapersonal) for the explanation of the preponderance of males in learning disabilities placements (LD). Factors were selected which represented a cross-section of variable classes and included behavioral, genetic, and physiological factors. A large number of variables were included to facilitate a relationship between the present study and the many mutually exclusive theories of LD. A significant purpose of

the present study was to examine the applicability of specific theories of LD to an actual population.

An examination was made of the case histories of a complete population of LD students (45 males and 35 females). Case data from a matched sample of regular education (RE) students was gathered for a control group comparison. Through the use of Discriminant Analysis, an intercorrelated grouping of variables was found which best predicted LD placement for each sex. A separate grouping was produced which accurately discriminated between Learning Disabilities (LD) and Regular Education (RE) subgroups.

Of the 18 variables necessary for discriminating males and females within the LD group, 12 had high values associated with "maleness" and 6 had high values associated with "femaleness". Among the high-value predictors associated with "maleness" were ITBS Composite score, age, number of siblings, medical trauma or injury, and evidence of speech and language problems. The high-value predictors associated with "femaleness" were ITBS Reading and ITBS Language scores, hospitalization at birth, a reconstituted family structure, postnatal problems, and visual problems. Of the 19 variables necessary for discriminating LD from RE subjects, 14 had high values associated with LD and 5 had high values associated with RE. Among the high-value predictors associated with LD were ITBS Math scores, a difficult delivery at birth, medical trauma or

injury, a one-year retention in school, a single-parent family, prenatal drugs or smoking, postnatal problems, and number of siblings. The high-value predictors associated with RE were ITBS Language, Writing, and Vocabulary scores; a second retention in school, and the presence of a previous referral to a Child Study Team.

The major conclusions were as follows:

1) The efficacy of pre-existing data was demonstrated, especially for demographics, medical history, family history, and group achievement data. This finding has profound implications for the early identification of learning disabilities.

2) Males and females within LD are similar in that both have "masculine" characteristics. The high risk female is therefore more different from females in general than the high risk male is from males in general. This may be the true difference between males and females within an LD population.

3) Since similar effects occur in males and females who are "at risk", bias in placements may explain the preponderance of males in learning disabilities placements.

4) Males may be more generally vulnerable (and thereby more likely to develop a learning disability) and females may be vulnerable only to specific factors. Thus fewer females develop a disability.

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Appendix A

DATA CODING SCHEME

	Variable	Coding	Columns
PERSONAL	I.D. #	001 - 160	1-3
	School Code	1 - 7	4
	Sex	1 = Male, 2 = Female	5
	Age (Yrs./Mo.)	101 - 149 (last digit is decimal for months)	6-8
	Socioeconomic Class	1=Class I, 2=Class II, 3=Class III, 4=Class IV	9
SCHOOL DATA	Current Grade	4=Fourth, 5=Fifth, 6=Sixth	10
	Current Educ. Place	1=Regular Ed., 2=LD Program	11
	Age at Referral	101 - 149 (last digit is decimal for months)	12-14
	Grade at Referral	9=Kdg., 1=First,..., 6=Sixth	15
	Grade at Place.	9=Kdg., 1=First,..., 6=Sixth	16
	Reasons for Referral	0=N/A, 1=Conduct, 2=Personality, 3=Inadequacy/Immaturity, 4=Academic	17
	Length of Retention	0=N/A, 1=1 yr.,..., 6=6 yrs.	18
	Grade First Retained	0=N/A, 1=First,..., 6=Sixth	19
	Grade Second Ret.	0=N/A, 1=First,..., 6=Sixth	
	Length of Place.	0=N/A, 1=1 yr.,..., 6=6 yrs.	20
	Verbal Scale Score	60 - 130	21-23
	Performance Scale	60 - 130	24-26
	Full Scale Score	60 - 130	27-29
	Achievement: Vocabulary	05 - 90	30-31
	Reading	05 - 90	32-33
	Language	05 - 90	34-35
	Writing	05 - 90	36-37
	Mathematics	05 - 90	38-39
	Composite	05 - 90	40-41

	Grade Prev. Referral	0=N/A, 9=Kdg., 1=First,..., 6-Sixth	42
	Prev. Educational Consultant Ref.	0=N/A, 1=Referral	43
	Prev. Psychological Ref.	0=N/A, 1=Referral	44
	Prev. Sp./Lang. Ref.	0=N/A, 1=Referral	45
	Prev. Medical Ref.	0=N/A, 1=Referral	46
	Prev. Read. Ref.	0=N/A, 1=Referral	47
	Number Schs. Attend.	1=1,..., 9=9+	48
FAMILIAL	Marital Status at Placement Ref.	1=married, 2=divorced or separated, 3=divorced, remarried	49
	Both Parents Working	0=N/A, 1=Both work	50
	Family Constellation	1=Natural Parents, 2=Adopted, 3=Stepparents, 4=One parent	51
	Number Older Brothers	0=None, 1=1,..., 6=6	52
	Number Older Sisters	0=None, 1=1,..., 6=6	53
	Number Younger Brothers	0=None, 1=1,..., 6=6	54
	Number Younger Sisters	0=None, 1=1,..., 6=6	55
MEDICAL	Hearing Problems	0=N/A, 1=present	56
	Vision Problems	0=N/A, 1=present	57
	Tubes in Ears	0=N/A, 1=present	58
	Surgery before age 5	0=N/A, 1=present	59
	Surgery after age 5	0=N/A, 1=present	60

	Accident before age 5	0=N/A, 1=present	61
	Hospital for more than 2 wks, before age 5	0=N/A, 1=present	62
	High fever before age 5	0=N/A, 1=present	63
	Medication for Allergies	0=N/A, 1=present	64
	Other Medication	0=N/A, 1=present	65
PREGNANCY & BIRTH COMPLI-CATIONS (PBC)	Difficult Pregnancy	0=N/A, 1=present	66
	Prenatal Drugs, Smoking, Accident, High weight gain	0=N/A, 1=present	67
	Difficult Delivery	0=N/A, 1=present	68
	Postnatal Problems, Developmental Delays	0=N/A, 1=present	69

Appendix B

TAXONOMY OF REASONS FOR REFERRAL

Inadequate-Immature Dimension

The child in this dimension was described as:

sluggish	drowsy	passive
a daydreamer	reticent	lethargic
inattentive	dislikes school	suggestible
lazy	short attention span	withdrawn
preoccupied	has stomachaches	

Conduct Disorder Dimension

The child in this dimension was described as:

defiant	temper tantrum	disruptive
disobedient	hyperactive	aggressive
impertinent	restless	hostile
uncooperative in group	negative	swears
attention-seeking	irresponsible	show-off
boisterous	destructive	jealous
bully	profane	irritable

Personality Problem Dimension

The child in this dimension was described as:

hypersensitive	tense	anxious
easily flustered	shy	depressed
plays with younger children	fearful	nervous
self-conscious	clumsy	jittery
lacks self-confidence	aloof	inferiority

Appendix C

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Statistical Methods

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