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Factors contributing to the preponderance of males in learning disabilities: A follow-up study

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FACTORS CONTRIBUTING TO THE PREPONDERANCE OF MALES IN LEARNING DISABILITIES: A FOLLOW-UP STUDY

An Abstract of a Thesis

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ABSTRACT

The present study was designed to assess the utility of specific variables for differentiating LD males and LD females and LD students from RE students. Variables were selected based on previous research findings indicating their utility for differentiating the relevant samples and the availability of pertinent data in existing files.

Data regarding the 21 pre-selected variables were obtained for all LD students (50 males and 30 females) and a control group of RE students matched with them by sex, grade, and age. Discriminant Analysis procedures were used to determine the intercorrelated grouping of variables which best differentiated sex within LD placement, LD placement from RE placement, and LD placement from RE placement for each sex.

Results of the current study clearly indicate a preponderance of males within the LD sample. This finding, while consistent with male/female ratios generally reported in the literature, contradicts those of the study that served as an impetus for the present invesigation, suggesting that the prior sample may not have been representative of the usual LD population. Factors not accounted for in the current study, teacher practices, teacher expectations, and referral and placement biases, may contribute to the usually found disproportion.

Of the 16 variables contributing to the discrimination of males and females within the LD group, nine were associated with

"maleness" and seven with "femaleness". Those associated with maleness included SCAT Quantitative, SCAT Total, WISC-R Verbal IQ, STEP Math Computation, STEP Math Concepts, retention, SCAT Verbal, STEP Writing, and STEP Reading. Speech referral; both parents working; reading standard score; one or no natural parents residing in the home; divorced, separated, or divorced and remarried parents; STEP Vocabulary; and health problem/injury were associated with femaleness.

Of the 14 variables contributing to the discrimination of LD and RE, five were associated with LD and nine with RE. The variables associated with LD were speech referral; health problem/injury; divorced, separated, or divorced and remarried parents; retention; and one or no natural parents living in the home. All achievement measures were associated with RE, as well as both parents working.

The results of analyses by sex suggest that females who receive LD services differ more from RE females than LD males from RE males. Overall males and females in LD are highly similar, with the female manifesting more symptoms of stress and health impairment.

The major conclusions of this study were as follows:

1. The efficacy of pre-existing data to predict need for LD placement as suggested by Piwowarski (1981) was again demonstrated.

2. Inclusion of medical, familial, and group achievement and ability data may produce more effective and efficient early identification batteries than batteries relying solely on newly generated test results.

3. Males and females within LD possess similar characteristics--early health problems/injury, familial stress, low ability and achievement scores, retention, and speech referral.

4. The high risk female is more deviant from RE females than the high risk male is from RE males.

5. An interactionary explanation, with its emphasis on male vulnerability, male slower rate of maturation, societal expectations, and possible biases in the referral and placement process probably best accounts for the preponderance of males in the current study.

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CHAPTER 1

INTRODUCTION

Recent national surveys reveal there is a preponderance of males in the special education population (U. S. General Accounting Office, 1981). The overrepresentation of males is not a new trend, but was evident as early as 1928 (Hildreth, 1928; Nicholson, 1967; Peck, 1935; Robbins, 1967). The Office of Civil Rights Fall 1978 Elementary and Secondary Civil Rights Survey reported that while the proportion of males to females ages 3-21 enrolled in schools was 51% male to 49% female, the ratio of males to females in special education was more discrepant (U. S. General Accounting Office, 1981). The ratios by handicapping condition were as follows: educable mentally retarded, 1.46:1; trainable mentally retarded, 1.32:1; emotionally disturbed, 3.15:1; learning disabled, 2.55:1; and speech impaired, 1.65:1. Clearly, there is a higher incidence of males in all categories, with the greatest disparity found in the emotionally disturbed and learning disabled populations. This study was limited by choice to considering only the learning disabled population.

Although the literature reveals many theories and a great deal of research concerning the causes of learning disabilities, little research has dealt specifically with the male-female ratio and factors differentiating these groups. Until recently researchers have often failed to report the sex of subjects in their studies,

let alone examine data for sex differences (Keogh, Major, Omori, Gandara, & Reid, 1980). An examination of 408 research studies in learning disabilities from 1970-1980 revealed that sex has not been considered an important variable in learning disability research; only two of the 408 studies were conducted on all female samples, while 69 included males only, and 215 included both males and females (Keogh et al., 1980). These authors noted that where both sexes were included in the samples, males generally constituted the overwhelming majority. Sex of subjects was not reported in 30% of the studies included in this research. Generalizations based on research including only males, or only females, or having an overwhelming majority of males run the risk of being erroneous as interactions of sex of child and the nature of the learning disability, interventions and other characteristics have not been accounted for.

Historically research on sex differences has examined sex differences by single variables. Recently, however, the trend has changed. Researchers are increasingly becoming aware of the multicausal nature of learning problems (Lambert & Sandoval, 1980; Scholom & Schiff, 1980). As Meier (1978) stated, "it has become increasingly clear that simplistic approaches to describing, diagnosing, and treating dyslexia are inadequate" (p. 99). Meier advocated the use of modern statistical techniques designed to

examine multiple variables simultaneously to delineate what factors contribute to learning difficulties. These same techniques can be used to examine sex differences in special education populations.

Statement of the Problem

The present study addressed two major questions. First, the study sought to determine which factors differentiate male learning disabled students from female learning disabled students. The second question concerned which factors differentiate students in learning disability classes from students in regular education classes.

Questions to be Answered

1. Does the ratio of males to females in this sample support the ratio cited in the U. S. General Accounting Office report?

2. Do clusters of variables, from the pre-selected variables, exist which differentiate male learning disabled students from female learning disabled students?

3. Do variable clusters, from the pre-selected variables, exist which differentiate learning disabled students from regular education students?

Significance of the Study

The present study sought to determine whether the factors identified by Piwowarski (1981) as differentiating males and females in learning disabilities would be supported within another

learning disabled sample. Replication of previous findings could suggest potential variables for future research on sex differences in special education.

The study also sought to identify clusters of variables which would differentiate learning disabled students from regular education students. The identification of such variables could provide a tool for the early identification of learning disabilities based on pre-existing file data. This, in turn, could facilitate early intervention and reduce the need for generating new data for diagnostic and placement purposes.

Limitations

This study was based on factors in case histories and did not include explanations related to teacher bias, teacher expectations, teacher behaviors, or biases of other child study team members. The study was limited to fourth, fifth, and sixth grade students who had been identified as learning disabled in one school district.

Definition of Terms

Ability Estimate--Defined as scores on the School and College Ability Test (SCAT) given to all subjects in grade three, including SCAT Verbal (SCAT-V), SCAT Quantitative (SCAT-Q), and SCAT Total (SCAT-T).

Achievement Estimate--Defined as scores on the Sequential Test of Educational Progress (STEP) given to all subjects in grade three,

and consisting of STEP Reading, STEP Vocabulary, STEP Writing, STEP Basic Mathematics Concepts, and STEP Mathematics Computation.

Current Family Constellation--Whether the child resided with both natural parents or one or no natural parents. Adoptive parents, stepparents, or a single parent were included in the second categorization.

Current Parental Marital Status--Whether the parents were married or divorced, separated, or divorced and remarried at the time of data collection.

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

Health Problem/Injury--Defined as the presence of one or more of the following conditions in case histories: vision problems, surgery before age five, surgery after age five, hospitalization for more than two weeks before age five, high fever, medication other than allergy, mother's use of drugs during the pregnancy, mother smoking during the pregnancy, difficult delivery, post-natal problems, and developmental delays.

Learning Disability--"Operationally defined by PL 94-142 and by commonly accepted practice within the local Area Education Agency; includes language and academic 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" (Piwowarski, 1981, p.8).

Reading Standard Score--A standard score with a mean of 50 and a standard deviation of 10, calculated by computing the discrepancy between actual grade placement at time of test administration and the total reading score from the Woodcock Reading Mastery Test or the reading cluster score from the Woodcock-Johnson Psychoeducational Battery.

Regular Education Class--"Non-special education placement, exclusive of those students with diagnostic labels or receiving Resource educational programming" (Piwowarski, 1981, p. 9).

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" (Piwowarski, 1981, p. 9).

Verbal Ability Estimate--Defined as the verbal scaled score of the Wechsler Intelligence Scale for Children-Revised (WISC-R).

CHAPTER 2

REVIEW OF LITERATURE

This chapter will outline the major theoretical orientations which attempt to account for the disproportionate representation of males in learning disabilities and will also discuss recent research findings on sex differences in learning disabilities. The discussion will progress from general theories, including biological, socio-cultural, and interactionist explanations for sex differences in learning disabilities, to recent research findings on sex differences in learning disabilities, and will conclude with a discussion of multivariate research on the learning disabled population.

Biological Explanations

The biological perspective explains sex differences as due to physiological, genetic, and maturational factors. Five theoretical positions dominate the perspective. One approach theorizes that males are biologically predisposed to the development of learning difficulties due to sex-linked genetic traits (Eme, 1979; Farber, 1968; Gomberg & Franks, 1976). Another argument concerns the proposed general physical inferiority or vulnerability of males (Farnham-Diggory, 1978; Gruenberg, 1964; Seaver, 1972). The third theory is based on evidence regarding differences in male and female rates of maturation. The maturation of males is slower than females', yet the same abilities are often expected of equal

age children (Lynn, 1979). The fourth theory attributes sex differences to prenatal, pubertal, and cyclic hormones (Burnstein, Bank, & Jarvick, 1980). A fifth line of investigation proposes that innate differences in neurological organization and hemispheric lateralization account for sex differences in learning difficulties (Burnstein et al., 1980).

Specific Inheritability

The first report on the familial occurrence of "congenital word-blindness" was published in 1905 by Thomas as cited by Hallgren (1950). Since that time research, including twin studies, family studies, and single-family and multiple-pedigree studies, has attempted to validate the proposed genetic origin of learning disabilities (Finucci, 1978). While research has supported the concept of a heritable basis for learning disabilities, there is a lack of consensus regarding a particular mode of inheritance. In the most extensive genetic analysis conducted, Hallgren (1950) concluded that reading disability is not sex-linked, but follows a monohybrid dominant mode of inheritance, a mode of inheritance that is not sex-linked and displaces the corresponding allele in the chain of inheritance. He further concluded that both sexes are probably affected in equal numbers, but the reading retardation in girls is less severe and less noticeable.

Later Hermann's (1959) twin studies also provided evidence for genetic influence as all 12 monozygotic pairs in his sample

were concordant for dyslexia, while only 11 of 33 dyzygotic pairs were concordant. Bakwin (1973) found 84% concordance for monozygotic pairs and 29% for dyzygotic pairs lending further support to the genetic argument.

Other genetic models for the inheritance of reading disability have been proposed including the following: autosomal dominant with partial sex limitation (Zahalkova, Vrzal, & Kloboukova, 1972); sex-linked recessive (Symmes & Rapoport, 1972); and sex-influenced, dominant in males, recessive in females (Finucci, 1974). In a more recent study Finucci, Guthrie, Childs, Abbey, and Childs (1976) concluded that reading disability is genetically heterogenous. Lewitter, DeFries, and Elston (1980) conducted research on four sets of data to further investigate the heterogeneous nature of reading disabilities. Subjects included 198 reading disabled males and 60 reading disabled females between 7½ to 12 years of age and a set of control subjects matched by age, sex, grade, school, home neighborhood, and where possible father's occupational level. Genetic segregation analyses were performed on the following data sets: all families, families with male probands, families with female probands, families with severely affected probands, and on all children. Five hypotheses of the transmission of reading disabilities were tested--dominant, recessive, two distributions, Mendelian incomplete dominance, and environmental. According to the authors, the results can be interpreted in two ways, either reading disability is a

genetically heterogeneous disorder or a more complicated model is needed for examining the genetic influence. The results do suggest however, that a recessive gene is the major cause of reading disabilities in girls, though not the only cause. This explanation accounted for only a small proportion of cases in males. The authors concluded that this finding alone may explain the overrepresentation of males in learning disabilities. Analysis of the children's data alone supported both environmental and genetic determination of reading disabilities. Finucci (1978) also argued that genetic factors account for only some forms of learning disabilities. He felt the etiology of learning disabilities is analogous to that of mental retardation in that some forms are genetic in origin, some are the result of environmental factors, and others are due to a combination of genetic and environmental factors.

Rossi (1970, 1972) advocated another view of the genetic argument of learning disabilities. He proposed that for the majority of the emotionally disturbed, behavior disordered, and learning disabled children, the learning impairment is related to a deficiency of gamma-amino-butyric acid (GABA) during pre-puberty. According to Rossi, GABA deficiency results in impairment of protein synthesis at the level of DNA transcription and affects synaptic neurochemical transmission. Rossi (1972) proposed that the sex differential in learning disabilities is due to the fact that GABA deficiency is genetically endowed and that females are "genetically better

constructed and have a more efficient chemical system" (p. 491-492). Rossi further suggested that girls are neurochemically and neurophysiologically mature for kindergarten at age 2½.

Although the familial nature of dyslexia is well supported in the literature, there is currently no agreed upon mode of genetic transmission. Lewitter et al. (1980) planned to continue genetic analysis via pedigree studies in search of an answer. An area of genetic study still open to investigation is that of adoption studies. This approach, advocated by DeFries, Vandenberg, and McClearn (1976), may lend further credence to the genetic argument.

Global Inferiority/Vulnerability

Related to the genetic argument is the proposed theory of global male inferiority and vulnerability. According to Eme (1979) males may be "more vulnerable, not only to biological stress, but to psychological stress as well" (p. 577). Evidence of the biological vulnerability of males is supported in the following statistics. There are 120 males conceived for every 100 females, yet there are only 106 live male births for every 100 females (Sherman, 1978). While there are more males conceived, there are also more males spontaneously aborted, miscarried, and stillborn (Singer, Westphal, & Niswander, 1968). Kawi and Pasamanick (1958) found a greater frequency of pregnancy complications and premature births among males also. Bentzen (1963) stated that 73% of all stillborn

fetuses before the fourth month are male. Males also tend to have larger head size making them prone to brain injury while passing through the birth canal. Singer, Westphal, and Niswander (1968) found male infants more vulnerable before birth, at birth, and during the early years of life. Throughout the life span, males also die at a faster rate than females (Sherman, 1978), with more male deaths occurring during each decade of life (Hamburg & Lund, 1966). Hamburg and Lund (1966) proposed that the more complex nature of the differentiation of the male genital tract and certain male circuits in the brain may also contribute to male vulnerability. They further speculated that due to the fact that males possess one X and one Y chromosome, they may be more susceptible to noninfectious disease and have reduced immunological effectiveness. The incidence of males not only outnumbers that of females in learning disabilities, but in the following conditions as well: physical abnormalities, mental retardation, speech disorders, behavior disturbance, neurological disturbance, visual and auditory difficulty, infantile autism, childhood schizophrenia, heart disease, cancer, cirrhosis of the liver, influenza, and pneumonia. Hoyenga and Hoyenga (1979) reported that males may also be more susceptible to social stress as demonstrated by their more adverse reaction to overcrowding.

Meier's (1978) assertion that "reading and learning abilities are mediated by the most recently developed human cortical structures and functions," which themselves, "are most vulnerable to practically

any physical or psychological insult" (p. 89), also coincides with the view of biological inferiority. If the male is genetically more vulnerable to physical and psychological stress as the literature overwhelmingly suggests, and reading and learning are mediated by structures so defined, a preponderance of males with learning and reading difficulties would be expected.

Rate of Maturation

"There is a male preponderance in all disorders that involve a specific delay in development (i.e., speech and language delay, nocturnal enuresis, and clumsy child syndrome)" (Eme, 1979, p. 579). Abrams defined learning disabilities as a similar syndrome, reflecting a delayed or irregular pattern of maturation (Silver, 1971). At birth males lag four to six weeks in neurological and physical development (Morgan, 1979). Kagan (1972) cited evidence of this in two areas. The female's central nervous system is further developed at birth as evidenced by growth of the myelin sheath around axons, and the development of muscle and bone tissue in the female is also further advanced at birth. Both the cortical structures underlying speech, and speech itself develop earlier in females. Their speech has been described as being more comprehensive, more accurate, and more complex than males' of equivalent age (Morgan, 1979). Overall, the male matures at a slower rate and requires three to five years more than the female to reach full physiological and mental maturity (Garai & Scheinfeld, 1968).

Anthony (1970) noted that by the age of six, girls are a year ahead of boys and,

> during the first grade, the boy is referred eleven times as often as the 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 the visual motor and visual-perception areas. (p. 722-723)

Sapir (1966) examined the developmental patterns of kindergarten males and females and found female precocity for perceptual motor skills at age 4½ which persisted until age five. Males lacked perceptual-motor readiness, which is a prerequisite to reading. The differential rates of maturation of both linguistic and perceptual-motor skills may account for the preponderance of males with early learning and reading problems.

The slower maturation of the male nervous system (Yarhraes & Prestwich, 1976) may affect the onset of speech (Terman & Tyler, 1954) and other skills essential to academic success. Reading retardation is not only more common in males, but also is often found with overt neurological disorder and delays in speech and language development (Yule & Rutter, 1976).

Hormonal Influences

The hormonal explanation of sex differences in learning disabilities is a component of two other explanations, differential rates of maturation and an explanation based on differences in

cerebral lateralization. In concordance with the first explanation, differences in male-female maturational rates are related to the effects of hormones during both the prenatal and pubertal stages of development. The differential effect of prenatal hormones may inhibit male development from shortly after conception. Masland, Sarason, and Gladwin (1958) theorized that the observed vulnerability of males may be due to prenatal hormonal factors. Durden-Smith (1980) hypothesized that H-Y antigen produced by the male may sensitize the female body against the male fetus, producing immunologic incompatibility between the male fetus and his mother.

Burnstein et al. (1980) contended that sex hormones also probably affect the organization and functioning of the brain and thereby determine sex differences in cognitive functioning. Sex hormones, including estrogen and testosterone, may affect verbal ability. Broverman, Klaiber, Kobayashi, and Vogel (1968) contended that there is an optimal ratio of estrogen to testosterone and that too much or too little estrogen may inhibit male verbal fluency. It has already been observed that speech difficulties are highly correlated with learning disabilities (Yule & Rutter, 1976).

McGuiness and Pribram (1979) stated that hormonal differences in the arousal systems of males and females account for differences in hemispheric specialization, predisposing females to greater flexibility in hemispheric functioning. Further implications of this finding will be discussed in the following section.

Hemispheric Specialization/Neurological Organization

Satz, Friel, and Rudegeair (1974a) theorized that developmental dyslexia is due to a lag in the maturation of the cerebral cortex. They postulated that the lag, occurring primarily in the left hemisphere, affects the acquisition of skills that are in primary ascendancy during the pre-school years and are essential to early reading.

Hier (1979) and Edwards (1982) suggested that sex differences in hemispheric specialization for spatial and verbal processing underlie the likelihood of a male being diagnosed dyslexic. Research indicates that males have greater right hemisphere specialization for spatial processing and greater left hemisphere specialization for verbal processing than do females (Burnstein et al., 1980; Edwards, 1982; Hier, 1979). Hier contended that increased hemispheric specialization in males may contribute to their risk of being dyslexic via two mechanisms. First, increased hemispheric specialization may decrease the male's overall verbal ability, or secondly, it may decrease the male's ability to compensate for left hemispheric injury.

The female's brain shows greater plasticity (Edwards, 1982; Restak, 1979), therefore damage to the left hemisphere results in less impairment. Studies on the differential effects of brain lesions support this finding (Inglis & Lawson, 1981; McGlone, 1977, 1978). These researchers found that only males showed a significant lateralized effect due to brain damage. Following damage to the left

hemisphere, males experienced impairment of verbal skills and following right hemisphere damage, males experienced perceptual-motor impairment. Brain damaged females displayed greater bilateral representation of both verbal and perceptual-motor skills. Their cognitive impairment was less severe and less specific. McGlone (1978) stated that the rate of neural, physical, and/or sexual maturation may be related to hemispheric specialization both before and after puberty.

Witelson's (1976) research also supported the notion of greater hemispheric specialization in males. Results of tests involving tactual perception and spatial processing indicated that males establish right hemispheric dominance by the age of six, while hemispheric dominance is not established until past the age of 14 in females. Witelson contended that the same neural structures in males and females serve different functions. Their brains may be differentially organized for those processes involved in reading and the greater hemispheric specialization in males may be related to sex chromosomes and/or testosterone level.

Socio-cultural Explanations

The socio-cultural perspective includes explanations due to differences in expectations and roles assigned to the sexes within the educational setting and larger culture. Teacher-bias in grading (Arnold, 1968), teacher rating of behavior and academic problems (Miller, 1972; Slobodian & Campbell, 1967), teacher interactions

(Emergy, 1973; Fagot, 1981; McNeil, 1964), role expectations for each sex (Beilin, 1959; Bush, 1954; Larsen, 1975; Walker, 1962; Warder, 1978), and the lack of male role models for boys in schools (Gove & Herb, 1974) are educationally-related variables theorists have proposed to account for the overrepresentation of males in special education. Sex-role expectations of the dominant culture are also relevant to this argument. Cross cultural studies indicate that academic performance and sex role expectations vary by culture (Johnson, 1976; Lehr, 1982; Preston, 1979).

Feminized Nature of the School Environment

The academic problems of boys during the elementary school years have been attributed to the feminized nature of the school environment (Brophy & Good, 1973; Gove & Herb, 1974; Vroegh, 1976). In our society, most teachers in the early grades are women (Gibson & Levin, 1975) who reinforce obedience, docility, and dependence; all of which are traditional female sex-role characteristics (Levy, 1972).

Gove and Herb (1974) proposed that the slower intellectual and physical development of the male along with difficulty in establishing a male identity in the feminine school environment were responsible for the preponderance of males with learning problems. Fagot (1981) found that teachers tend to reinforce both males and females for feminine-preferred behaviors. She also found greater overlap for behaviors rated by teachers as important to school success and

preferred by girls than for behaviors important to school success and preferred by boys. Fagot contended that the demands of the school produce conflict for the male who experiences mixed messages regarding sex-appropriate behavior, while females do not experience this conflict.

Sex of Teacher

It has been proposed that the lack of male teachers adversely effects male achievement (Grambs & Waetjen, 1966). Lahadrene (1976), in a comprehensive review of research on male and female elementary school teachers, concluded that male teachers did not differ significantly from female teachers in their perceptions or treatment of students. A similar review by Good and Brophy (1977) supported the finding that male teachers do not interact differently with male and female students than do female teachers. However, recent research indicated that male teachers may have a positive effect on the attitudes of boys toward reading (Shapiro, 1980). Shapiro found that while girls have more positive attitudes than boys toward reading overall, children taught by males have better attitudes than children taught by female teachers. This study was conducted on 141 second grade students from eight classes, four male teachers were matched with four female teachers on the basis of teaching experience, heterogeneous placement of children in their classes and similarity of their reading programs. Shapiro speculated that male teachers serve as appropriate sex-role models for boys

learning to read, reducing male dissonance in an otherwise feminine environment. Halperin (1977), in a study conducted three years earlier, had formulated a similar contention. Halperin's study investigated the achievement-oriented behaviors of first and fourth grade students under either a neutral or an achievement-emphasis condition with either a male or a female experimenter. She found that of first graders who were encouraged to achieve, males responded more positively with male experimenters and females with female experimenters, while fourth graders were not influenced by experimenter sex. She speculated that appropriate sex behavior modeling is an important variable related to achievement for young children.

Teacher Expectations/Practices

Teacher expectations and practices may contribute to the preponderance of males referred for academic and behavior problems. Miller (1972) found teachers rated boys as less well motivated and having more academic disabilities. Arnold (1968) found that teachers assigned higher grades to girls than boys. Teacher ratings and grading may reflect teacher bias, which itself could affect the referral and placement of males. Doyle, Hancock, and Kifer (1972) proposed that teacher expectations may affect the performance of pupils and that teacher expectations are influenced by the sex of the pupil. They found that first grade teachers' estimates of IQ for male and female students differed significantly as a function of sex. In other words, teachers tended more often to underestimate

male IQs and overestimate female IQs. A two by two factorial design was employed to examine whether teacher perceptions also were related to pupil achievement. While the probability level was not significant, the results were in the direction predicted. The authors contended that a sex effect would emerge if larger groups were used.

Palardy (1969), in an investigation of the effect of teachers' beliefs on pupils' achievement, found the reading scores of boys whose teachers reportedly believed that first grade boys experience less success in reading were lower than the scores of boys taught by teachers who did not report this belief. Purgess (1979) found that teacher expectancy for success, ratings of likelihood of retention, and ratings of present achievement were affected by label and pupil behavior. Preconceived stereotypes held by teachers may result in self-fulfilling prophecies (Salvia, Clark, & Ysseldyke, 1973).

Leinhardt, Seewald, and Engel (1979) reported that sex differences in reading performance correspond to teacher behavior. Observations of teacher interactions during reading and mathematics instruction revealed that teachers made more academic contacts with girls during reading and with boys during mathematics. More time spent was on cognitive material with girls during reading instruction and with boys during mathematics instruction. While there were no differences in initial ability for either subject, sex differences were reported for end of the year reading results.

Leinhardt et al. (1979) suggested that differences in academic performance "are learned and reinforced within the context of the larger culture" (p. 433). Possibly teachers alter their behaviors to produce results consistent with their beliefs. Alternatively, Slobodian and Campbell (1967) theorized that the difficulty males experience in learning to read may be due to their perception of their teachers' feelings about them. These mechanisms are undoubtedly interrelated and may act in conjunction, with the end result being poorer academic progress for boys.

Referral, Assessment, and Decision Bias

Teacher perceptions may influence the preponderance of males in special education. Gregory (1977) found that teachers would be more likely to refer boys than girls with identical problems. He suggested that styles of teacher-student interactions may result in the increased likelihood of teachers perceiving problems in males and referring them for special services.

Gillespie and Fink (1974) proposed that both the behavioral differences between boys and girls and the manner in which educational personnel respond to the differences may contribute to the high referral and identification of males in special education. Boys are more aggressive than girls in school (Masland, 1958). Naiden (1976), in a study of learning disability referrals, found that teachers referred boys four times as often as girls. An examination

of Metropolitan Test scores in reading revealed the ratio of boys to girls with significant deficits in reading to be 3:2, however, boys with severe reading problems were referred and placed in learning disability programs three times as often as girls with equivalent problems. Naiden suggested two factors that may bias the referral process--the behavior of boys who fail and teacher expectations for boys. According to Naiden, low achieving boys manifest their frustration in more overt ways than low achieving girls, making themselves more noticeable and perceived as discipline problems. She also reported that teachers feel girls are easier to teach because they are more eager to please than boys.

Caplan and Kinsbourne (1974) found sex differences in emotional response to academic failure. Their research indicated that males who experience academic failure are more likely to exhibit behavior problems and to receive teacher disapproval. Lietz and Gregory (1978) reported that higher referral rates tend to occur when teachers must deal with aggressive or threatening behaviors. Girls who experience academic failure are more likely to react in socially acceptable ways and not draw teacher attention (Caplan & Kinsbourne, 1974).

Phipps (1982) concluded that the perceptions of regular classroom teachers toward conduct and behavior play a major role in the identification of children served in special education programs. She termed special education a "dumping ground for boys perceived

as conduct problems" (p. 430). The Phipps study indicated that girls referred for special education are on an average 1½ years more retarded academically than boys, suggesting that teacher perceptions of the student's conduct and behavior problems also influence teacher referrals.

Ryckman (1981) suggested that girls diagnosed as learning disabled "represent a more significant deviation from the norm than do boys" when compared to the non-learning disabled population (p. 51). The findings of Bryan (1974), Bryan and Bryan (1978), and Scranton and Ryckman (1979) support the hypothesis that learning disabled girls are more deviant in terms of peer rejection. Mercer (1973) found that girls must be less intelligent than boys to be labeled and placed in special education classes. Lambert and Sandoval (1980) found that severe discrepancies between ability and achievement are almost as common in females as males, yet females are underrepresented in special education programs. The U. S. General Accounting Office (1981) report suggested "it might be that overrepresentation by sex and handicapping condition is a result of teacher/administrator bias related to perception of normal and appropriate behavior for females versus males" (p. 65). Perhaps teachers, administrators, and society as a whole are more tolerant of female deviance.

Role Expectations

Singer and Osborn (1970) suggested that "greater concern with male than female accomplishments coupled with greater tolerance

concerning ultimate vocational accomplishments" (p. 161) may influence referral and admission patterns for the mentally retarded. Similar socio-cultural expectations may function across diagnostic categories. Schlosser and Algozzine (1980) stated that boys are assigned higher status than girls in our society. They concluded that this bias results in greater concern over males who exhibit learning problems than females. The greater concern is possibly followed by greater likelihood for male referrals and placement. Research by Caplan (1977) supported the hypothesis that societal bias tends to arouse greater concern when boys experience learning problems than girls.

It has also been proposed that males' perceptions of school and reading as inapprorpriate to the male sex role may depress male achievement (Downing & Thomson, 1977; Dwyer, 1973). Sarason (1959) wrote that the male subculture does not attach value to good school performance while the female subculture does. Kagan (1964) stated that boys are encouraged to express aggression and inhibit dependency, passivity, and conformity. These sex typed characteristics counter characteristics rated by teachers as related to successful school performance (Levy, 1972).

Kagan (1964) proposed that the preponderance of males with learning difficulties is related to the male's classification of school as a feminine activity. School activities are perceived as incongruent with the male sex role and the male does not invest in

school. The sex role preferences of males appear earlier (Hartup & Zook, 1960) and are more consistent.

Interaction

The interactionist position states that both biological and socio-cultural factors are important in determining the child's behavior and academic performance (Bixler, 1980). Within the interactionist grouping there exists a continuum of positions, ranging from primary emphasis on biological factors (Edwards, 1982; Garai & Scheinfeld, 1968) to primary emphasis on socio-cultural factors (Hubbard & Lowe, 1979). Few theorists who advocate the influence of constitutional factors actually deny the influence of the environment and vice-versa. Behaviors and abilities are generally viewed as a product of development, dependent upon both environmental and biological conditions (Seward, 1980).

Attempts to isolate single factors as causes of learning disabilities (Hermann, 1959) and sex differences (Burnstein et al., 1980; Hubbard & Lowe, 1979) attributable to constitutional or environmental factors have not produced conclusive results. Many difficulties plague this type of research. Perhaps most significant is our inability to absolutely distinguish biological and environmental factors. As Stauffer, Abrams, and Pikuluski (1978) wrote, the "inheritance of potentials for development are altered after conception by prenatal, perinatal, and postnatal events" (p. 209). The presence of biological correlates does not infer

biological causation. Such an assumption overlooks the possibility that the social environment may promote biological alterations (Hubbard & Lowe, 1979).

In regard to learning disabilities Layton (1979) wrote,

> to some undiscovered degree hereditary, socioenvironmental, natal, infancy, and childhood variables in combination with related physical, emotional, linguistic, perceptual, and intellectual variables will be responsible for the success or failure children eventually realize in language arts areas. Unless educational program designers and implementors are aware of the effects of all these variables either singularly or in combination--the results of their programs may predestine some children to failure and again lend support to the unnatural superiority of some children in learning to read over others who did not learn to read. (p. 17)

Researchers interested in the overrepresentation of males in special education and other areas of concern have proposed specific variables which they feel contribute to the disparity. Gove and Herb (1974) suggested that the higher rate of mental illness among preadolescent males is due to the fact that males experience a greater difference between their ability and the expectations of others than girls and that there exists a narrower range of acceptable behaviors for young males. Thus the slower physical development of males coupled with difficulty establishing appropriate sex role behavior produces more stress for the male organism and is detrimental to his mental health. Eme (1979) advocated a similar position, stating that cultural pressures are less for girls who may be constitutionally less susceptible to the

effects of biological and psychological stress. Anthony (1970) suggested that while male vulnerability may be genetically determined, environmental circumstances in the form of stresses or trauma often precipitate disturbance. Earlier Bentzen (1963) had advocated the view that the preponderance of males experiencing learning difficulties represented a "stress response of an immature organism to the demands of a society that fails to make appropriate provisions for this biological age differential" (p. 94).

While few researchers deny the influence of both environmental and constitutional factors as causes of learning disabilities and sex differences in learning disabilities, few have examined the influence of both sets of factors simultaneously. Edwards (1982) contended that "understanding the interaction of physical and environmental factors will provide far greater insight into learning and behavior than either approach by itself" (p. 58). The following sections will include studies which examined both biological and environmental factors.

Multivariate Research

Multivariate research designs have been used to examine the causation (Doehring, 1968; Krippner & Snyder, 1976; Naidoo, 1972; Robinson, 1946) and the early identification (Bateman, 1966; Kenny & Clemments, 1971; Satz & Ross, 1973) of learning disabilities. Recently, similar approaches have been used to examine sex differences in learning disabilities. The following examination of multivariate

designs will begin with research related to causation. This will be followed by a discussion of multivariate research related to identification and conclude with a review of multivariate research on sex differences in learning disabilities.

Causation

Researchers began to examine multiple theories of causation of learning disabilities through the examination of multiple variables as early as 1946 in response to the "organismic hypothesis". This hypothesis suggested that reading ability is a function of the total development of the child (Smith & Carrigan, 1959). Neurological, personality, intellectual, opthalmological, and glandular functioning data collected on a clinical population of 30 children by Robinson (1946) indicated that social, visual, and emotional difficulties operate as causes of reading disability. Robinson analyzed the data by arranging the cases in descending order of severity and noting the incidence of anomalies in each area examined. Her conclusions were based on the frequency of each anomaly. Alternatively, Park (1955) concluded that a single factor, thyroid disease, underlies many cases of reading disability. His research involved the examination of the incidence of a variety of pathologies in a large group of dyslexics. The results indicated that 27% suffered from thyroid disease. These studies have a major weakness in that they did not include a control group of normal readers to compare to retarded readers.

Doehring (1968) utilized a multivariate approach in evaluating eight theories regarding the origin of reading disabilities. Data collected included test measures taken from the Wide Range Achievement Test, Wechsler-Bellevue Intelligence Scale, Trail Making Test, Halstead's Neuropsychological Test Battery, Peabody Picture Vocabulary Test, Modified Halstead-Wepman Aphasia Screening Test, Tests of Sensory-Perceptual Disturbances, Lateral Dominance Examination, Modified Minnesota Test for Differential Diagnosis of Aphasia, Speed of Visual Perception, and tests of other abilities not previously assessed including Spatial Orientation, the Thurstone Reversals Test, Word Association Test, Color Form Test, Visual Memory for Figures: Spatial, and Visual Memory for Figures: Temporal, a parent interview including birth and developmental history and family history of reading problems, and a standard neurological examination. Analyses performed included an analysis of covariance and factor analysis to examine the interrelationships among reading and other abilities tested for each group separately and a multiple regression procedure and discriminant analysis to provide more information regarding which measures best discriminated retarded readers from normal readers. Overall, the analyses indicated that retarded readers have relatively widespread visual and verbal impairment and overwhelming support was not found for any of the theories under investigation. The author found no

differences between groups for complications of pregnancy, type of delivery, general condition at birth, developmental milestone attainment, illness, diseases of childhood, general injuries, head injuries, loss of consciousness, visual or hearing problems. The reading retarded group did have higher incidences of prematurity, short or long labor, low birth weight, early feeding problems, and necessity of incubators. Differences were also noted on all aspects of educational achievement.

Naidoo (1972) conducted an extensive study for the ICAA World Blind Centre for Dyslexic Children to investigate the existence, nature, and causes of specific dyslexia. The subjects were 98 dyslexic boys and a control group consisting of 98 boys matched by age and type of school. Information collected included parent information (father's occupation, whether mother worked, mother/child separations, perinatal history, developmental history, illness, behavioral problems, and the presence of laterality patterns in parents and siblings), school information (extent of reading or spelling handicap, attendance, parental interest in progress and behavior, an estimate of the child's intelligence, and the child's score on the Bristol Social Adjustment Guide), psychological information (WISC subtest scores and Verbal, Performance, and Full Scale IQs), and additional tests (reading, spelling, auditory discrimination, articulation, sound blending, motor proficiency, right/left discrimination, laterality, and finger differentiation). Chi square

analysis of family history of reading and spelling difficulties supported the notion that reading and spelling are familial disorders ($p < .05$). Significant differences for various psychological, neurological, and developmental variables suggested multiple etiology for specific dyslexia.

Krippner and Snyder (1976) examined 12 variables to determine whether a single variable was responsible for reading disability. Subjects included 440 children seen at the Child Study Center at Kent State University. Diagnostic test data was used to determine the major cause of each child's disability. Data was obtained through the use of diagnostic tests, clinical observations, interviewing both parents and the child, and examination of medical reports, school records, and developmental histories. Variables included visual acuity, auditory acuity, brain injury, disturbed neurological organization, directionality confusion, visual skills, auditory skills, speech defects, endocrinal malfunction, social immaturity, emotional disturbance (neurotic, psychotic, and sociopathic), culturally disadvantaged, and unfavorable educational experiences. Disturbed neurological organization was ranked the most common etiological factor, followed by neurotic tendencies, unfavorable educational experiences, and poor visual skills. Neurotic tendencies, followed by poor visual skills, unfavorable educational experiences and poor auditory skills were the most frequently noted contributing factors.

Krippner and Snyder also examined sex differences in the etiology of reading disability. A chi square analysis revealed that in the case of major factors, females were more likely than males to have brain injury ($p < .01$) or poor auditory skills ($p < .01$) while males were more likely to have poor visual skills ($p < .01$) underlying reading disability. There were no significant differences for contributing factors. Krippner and Snyder concluded from their results that reading disability is multi-causal in nature, but warn that specific results should be viewed with caution as some diagnostic decisions were subjective in nature and low-income children were underrepresented in the sample.

While each of these studies examined variables to evaluate proposed theories of the causation of learning disabilities, their relative utlity and generalizability differ due to differences in design and statistical analysis. Robinson and Park based their conclusions on the incidence of presence of a variety of anomalies and did not include control groups of non-learning disabled children in their analyses. Doehring included both normal and retarded readers in his study. Use of the multiple regression and discriminant analysis procedures permitted examination of several dependent variables simultaneously and indicated along which dimensions stable differences existed for the groups. Use of the control group allows comparisons to be made which may indicate etiological factors for learning disabilities. Naidoo examined differences

separately for a number of variables and also compared expected and observed values for specific variables, while Krippner and Snyder's conclusions were based on subjective evaluations for the major contributors to each child's learning difficulty and were not based on statistical analyses. The validity of the latter findings is highly questionable due to the subjectivity involved. In general, these studies indicate that a variety of factors may be involved in the causation of learning disabilities. Causation studies involving control groups provide a stronger basis for the inferences that have been made. The examination of multiple variables simultaneously indicates which variables in combination contribute to group differences. Since theorists have generally agreed that a variety of factors contribute to learning disabilities, an approach which considers multiple factors simultaneously is the most sensible.

Identification

As early as 1935 researchers were attempting to develop methods for the early identification of learning disabilities. Castner (1935) examined case histories of 13 children in search of common factors which might predict reading disability. He found that no single factor, but rather a group of traits appeared to have predictive value. Castner's research was conducted on a small sample and no statistical analysis was performed.

De Hirsch, Jansky, and Langford as cited in Bateman (1966) attempted to develop a test battery that would identify kindergarten

age children who were at high risk. Their battery included 37 tests of perceptomotor and linguistic development. Kindergarten test scores were compared with second grade writing, reading, and spelling achievement scores for 53 children. Rank order correlations indicated that approximately one half of the predictor tests correlated significantly with second grade achievement. Most tests predicted much better for girls than boys. The authors developed a battery of 10 tests to predict high risk readers or spellers from these results.

In an attempt to evaluate the utility of individual parts of the assessment process to determine which contributed to the diagnosis and treatment of learning or behavior problems typically associated with minimal brain dysfunction, Kenny and Clemments (1971) collected data on 100 children with learning and/or behavior problems who were referred to the Central Evaluation Clinic for Children, University of Maryland Hospital for suspected minimal brain dysfunction. Data collected included reason(s) for referral, source of referral, psychological test data (intelligence, visual motor perception, and achievement), neurological evaluation, electroencephalographic findings, family stability, final diagnosis, and recommendations. A chi square analysis revealed no significant relationships among results of neurologic examinations, electroencephalogram, and final diagnosis. Examination of single factors suggested that final diagnosis appeared to be more dependent on symptomatology and

psychological findings than on neurological, medical, or electroencephalographic results. Examination of the family and stability variables suggested that adverse environmental factors were frequently found in homes of children referred for minimal brain dysfunction.

Satz and various associates conducted a series of longitudinal studies to identify precursors present during the preschool years which could accurately predict reading disability. Four hundred seventy-four kindergarten boys were the subjects of the original preliminary one-year follow-up study (Satz & Friel, 1974) and several ensuing studies. Twenty-two predictor variables including age, handedness, scores on a battery of tests (i.e., Peabody Picture Vocabulary Tests, Developmental Test of Visual-Motor Integration, and Similarities), socioeconomic status, and teacher ratings of maturity, activity level, and behavior were evaluated against teacher prediction of likelihood that the child would experience learning difficulty. The criterion measure was obtained at the termination of the school year. A discriminant function analysis was performed on the predictor variables to obtain maximum differentiation between the high and low risk groups. The finger localization test proved to be the best predictor variable in terms of its discriminating power relative to the criterion measure, accounting for 71.1% of the overall correct classifications. Inclusion of socioeconomic status, dichotic

listening total recall, and the Peabody Picture Vocabulary Test score increased this to 80%. The discriminant function correctly classified 78.4% of the high risk children identified by teachers at the end of kindergarten. Results of Satz and Friel's (1974) study provided support for both the use of multifactor approaches in the early identification of learning disabilities and for Satz's explanation of learning disabilities as a lag in brain maturation (Satz & Ross, 1973).

A two-year follow-up, using a 10-item scale of reading level as assessed by the Teacher at the end of the first grade as the criterion measure, (Satz, Frield, & Rudegeair, 1974a, 1974b) yielded highly similar results. Precursors to reading competency were identified as developmental readiness in perception, cognition, language, and memory. A six-year follow-up on the original sample and two cross-validation studies on independent samples were also conducted (Satz, Taylor, Friel, & Fletcher, 1978) using similar predictor variables. Results of the study which employed an abbreviated screening battery in a heterogeneous sample, identified socioeconomic status as the most discriminating variable, followed by Alphabet Recitation, Finger Localization, and Peabody Picture Vocabulary Test scores. The triad of Finger Localization, Alphabet Recitation, and Recognition-Discrimination ranked highest in the original studies. The latter sample reflects a more heterogeneous sample in terms of race and sex, and "suggest that

cultural, linguistic, conceptual, and perceptual skills play an important role in forecasting later reading achievement" (p. 313).

The studies examining multiple variables in the identification of learning disabled children have also employed a variety of research designs and statistical analyses. Castner's research examined only a learning disabled sample and no statistical analysis was performed; De Hirsch, Jansky, and Langford examined rank order correlations; while Satz and Friel used a discriminant function analysis to develop an identification battery. The Satz and Friel study involved a larger sample and more sophisticated method for determining which tests to include in the battery. The predictive efficiency of their battery was also greater. Kenny and Clemments examined the utility of some aspects of the assessment process not included in other studies. Here, single factors were analyzed separately, instead of simultaneously. The simultaneous examination of variables has an advantage over separate analyses in that differences between groups can be detected that otherwise might not.

Sex Differences

Landsberger (1981) in an investigation of sex differences in factors related to early school achievement addressed two major questions--(1) Does the achievement and adjustment of boys decline relative to girls' between school entry and the end of third grade? (2) Does the pattern of factors positively correlated with achievement in the early school years differ for boys and girls? Landsberger

examined differences between the sexes for cognitive ability, affective factors, academic achievement, and educational advantage of home environment at the beginning and end of the first four years of school in an attempt to answer the first question. She found that males and females begin kindergarten at equal achievement levels, however, an examination of scores on five subtests of the Iowa Tests of Basic Skills--Vocabulary, Reading, Spelling, Math Concepts, and Math Problems--at the end of third grade revealed the mean scores of boys in reading and spelling to be significantly lower than girls'.

In regard to the second question, Landsberger found achievement related to different factors for boys and girls. Pearson product-moment correlation coefficients for third grade cognitive ability measures and an affective measure with the five ITBS subtests revealed that for girls, both cognitive and affective measures were correlated with achievement, while male achievement was correlated only with ability. Landsberger's research was conducted on a non-learning disabled sample and may not reflect sex differences related to achievement for the learning disabled population.

Piwowarski (1981), the model for the present investigation, examined a more extensive set of variables to determine what factors discriminated between learning disabled males and females and between a learning disabled sample and a regular education sample. He selected a pool of variables from previous research that had either been shown to have a relationship to learning disabilities or

had been suggested by the authors of previous research as needing to be included in succeeding studies. He then checked each subject's case file for the presence of the data necessary for each variable in the pool. Wherever file data existed, that variable could be included in the analysis. The final set of 50 variables was subjected to a discriminant analysis. The scaling quality of the variables measured was assumed to be interval, while in actuality it ranged from nominal to interval. The total sample size was 80, a very small sample for a 50 variable analysis.

Variables included information relating to five major categories--Personal, School, Familial, Medical, and Pregnancy and Birth Complications. Discriminant analysis was used to determine the intercorrelated group necessary for discriminating males and females in learning disabilities. Twelve variables were representative of the male LD sample: ITBS Composite score, age, number of younger sisters, surgery before age five, number of older sisters, both parents working, single parents, WISC-R Verbal score, current grade, previous speech/language referral, a difficult delivery at birth, and number of younger brothers. The six variables representing female LD students included ITBS Reading score, parents divorced and remarried, ITBS Language score, hospitalization for more than two weeks, postnatal problems, and the presence of a vision problem. Piwowarski also compared the entire LD sample to a RE sample matched by sex, age, and socioeconomic status. The high predictors

associated with LD included ITBS Mathematics' 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. High-value predictors associated with RE placement were ITBS Language, Writing and Vocabulary scores; a second retention in school; and the presence of a previous referral to a Child Study Team. Contrary to most of the literature, Piwowarski did not find a disproportionate representation of males in the LD sample he investigated.

Piwowarski's data, like Satz's battery, could provide useful criteria for the early identification of learning disabilities. Unlike Satz and Doehring, Piwowarski's approach utilized variables generated from existing file data.

Literature Review Summary

There are three major categories of explanations for the preponderance of males in learning disabilities. Variables contributing to each explanation have been identified under their relevant headings--biological, socio-cultural, and interaction. Most researchers agree that both biological and socio-cultural factors contribute to the observed sex ratio. The current study is not designed to examine competing theories, but variables from multiple theoretical standpoints, simultaneously.

Recently, multivariate designs and statistics have been used to examine multiple theories of causation, variables related to

sex-differences, and multiple factors in the early identification of the learning disabled. The discriminant analysis was utilized in the present study so variables of interest could be examined simultaneously to determine which cluster of variables differentiated learning disabled males from females and learning disabled children from regular education children.

CHAPTER 3

METHODOLOGY

This study sought to determine which of the pre-selected variables differentiate both learning disabled (LD) males from LD females and a LD sample from a regular education (RE) sample. A static group comparison within an Ex Post Facto design constituted the basic methodology. Chi square and discriminant function analyses were applied to the data.

Sample

Subjects were drawn from eight public elementary schools in the Marshalltown School District, Marshalltown, Iowa. The population of the school district is approximately 29,500 with an estimated enrollment of 5,400. According to the school system, a description of the school district would be middle to middle upper socioeconomic standing and in a rural region with small manufacturing firms for an economic base.

All students, 50 males and 30 females, in the Learning Disability Programs in grades four, five, and six were included in the LD sample. The RE sample was matched to the LD sample according to sex, grade, and age. The greatest age discrepancy for the matched pairs was 11 months, with all but three within two months.

Variable Categories

The variables included in this study were selected using two criteria: (1) previous research findings indicating their value as

predictors for differentiating the samples (Piwowarski, 1981) and (2) the availability of relevant data in existing school files. The original item pool for the present study included the variables from Piwowarski's study that contributed to the differentiation of both the LD males from the LD females and the LD students from the RE students. The final item pool for this study included 21 variables from four categories--Personal, School, Familial, and Health Problem/Injury. Two variables, sex and chronological age, were included under the Personal category. Sex was coded as a binary variable, while age was recorded in months. The three Familial variables were current marital status, both parents working, and current family constellation (number of older and younger brothers and sisters were excluded from this category due to the unavailability of this information). The Familial variables included in this study were entered as binary data.

All Medical and Pregnancy and Birth Complications variables that contributed to Piwowarski's canonical functions were included in the present study under the combined heading, Health Problem/Injury. Specifically, the Health Problem/Injury category included the presence in case histories of at least one of the following: vision problems, surgery before age five, surgery after age five, hospitalization for more than two weeks before age five, high fever, medication other than allergy, difficult delivery, postnatal problems, or developmental delays. The Health Problem/Injury category was entered as a binary variable.

The 15 variables in the School category included all variables from this category that contributed to Piwowarski's canonical functions, except for one substitution and two additions. The substitution was that Piwowarski used the ITBS, an achievement battery administered within the school district, for estimates of achievement, while the participating school district in this study routinely administers the STEP in the Spring of the third and sixth grades. Third grade STEP subtest scores were therefore used as estimates of achievement.

The first variable addition to this study was that a more recent estimate of reading achievement was included for the LD students in this sample. The source for this variable was either the student's reading score from the Woodcock Reading Mastery Test or the reading cluster score from the Woodcock-Johnson Psychoeducational Battery. Scores on either of the instruments were available for only 70 subjects. Woodcock (1975) reports the correlation between scores on these instruments as .92.

The second variable addition in this study was that SCAT scores were used as estimates of ability for both the LD and RE samples. Piwowarski included ability estimates from the Wechsler Intelligence Scale for Children-Revised for the LD sample only.

The final School variables reported as three digit standard scores were WISC-R Verbal IQ, SCAT Verbal, SCAT Quantitative, SCAT Total, STEP Reading, STEP Vocabulary, STEP Writing Skills,

STEP Mathematics Basic Concepts, and STEP Mathematics Computation. The reading standard score was reported as a two digit standard score and current educational placement and current grade were single digit entries. Presence or absence of a first retention, a second retention, and a previous speech/language referral were entered in binary form. Data from the above set of 15 variables constituted the School variables used for the analyses in this study.

Permission

The Marshalltown Community School District has established a district policy for the use of school records as sources for research data. Essentially the policy provides the Superintendent of Schools with the discretionary authority to allow confidential usage of data in school files for appropriate research, useful to the district, and protective of the children and their families. Permission to follow the study's prescribed methodology was obtained from the District Superintendent. Additionally, the prescribed procedures for the ethics of research with human subjects were assiduously followed.

Procedures

After permission was granted to conduct the study, records yielding the names, birth dates, grades, and attendance centers of all LD students were made available by the school district.

The information in the records was verified by checking student registration cards at each of the eight attendance centers. The student registration cards were also used in matching RE students to the LD sample. The cards for all RE students were divided by grade, sex, and month of birth. Each LD subject was then matched to the RE child of the same sex and grade placement who had the closest birth date. After the LD sample was matched, the names of all subjects were paired with numbers which were used for identification purposes during data collection. Data for each subject was then collected using student information cards, regular education files, and special education files as appropriate.

Data Analyses

Chi square was used to analyze the ratio of males to females in the present sample. The first chi square used the equally distributed expectation of a 1:1 ratio, and the second chi square analysis used a ratio of 2.55 males to one female as cited by the U. S. General Assembly Accounting Office (1981).

The Discriminant Analysis Program of the Statistical Package for the Social Sciences (SPSS) was used to analyze data relevant to the questions regarding which variables differentiated the LD males from LD females, question 2, and the LD students from RE students, question 3. All major variables were included in the

analysis for question 2. WISC-R Verbal IQ and reading standard score were not included in the analysis for question 3.

CHAPTER 4

RESULTS

This section first presents the results for the analyses related to major questions 1, 2, and 3. Secondly, the results of the additional analyses performed for heuristic purposes follow.

Question 1

In question 1 the author asked whether the ratio of males to females in this LD sample differed from the ratio found in the U. S. General Accounting Office (1981) report. Results of the chi square analyses, presented in Table 1, indicate that the observed ratio of males to females is a non-equally represented phenomena ($p < .05$) and that the current results do not differ significantly from the ratio cited in the U. S. General Accounting Office report ($p > .05$).

Table 1

Chi Square Analyses Based on Equal Representation and the U. S. General Accounting Office Ratio

Sex	Observed	Expected f[a]	χ^2	Expected f[b]	χ^2
Male	50	40	5.0*	57.6	3.58**
Female	30	40		22.4	

[a]Expected frequency based on equal representation.

[b]Expected frequency based on U. S. General Accounting Office ratio, (2.55:1).

*$p < .05$

**$p > .05$

Question 2

In question 2 the author asked whether variable clusters from the pre-selected pool would differentiate male LD students from female LD students. The discriminant analysis was used to analyze data for the LD sample only, with sex as the dependent variable. The Canonical Discriminant Function obtained from this analysis was composed of 16 variables which accounted for 100% of the variance. The variables, presented in Table 2, are ordered according to the magnitude of the correlation. The rate of successful classification into Group 1 (male) was 71.1% and for Group 2 (female), 72%. The overall correct classification of subjects by sex was 71.43%.

Question 3

In question 3 the author asked which variables from the pre-selected pool would form the cluster that would best differentiate the LD group from the RE group. The 14 variables accounting for 100% of the variance within the total sample are presented in Table 3, with the variables ordered according to the magnitude of the correlation. The rate of successful classification into Group 1 (RE) was 72%, and for Group 2 (LD) it was 84.9%. The overall correct identification by placement group was 78.38%.

Table 2

Pooled Within-Groups Correlations Between Canonical Discriminant Functions and Discriminating Variables Within LD Group

Variables	Coefficients[a]
SCAT Quantitative	-.43314
SCAT Total	-.36388
Speech Referral	.34525
WISC-R Verbal IQ	-.27203
Both Parents Working	.27141
STEP Math Computation	-.24250
Reading Standard Score	.21645
Current Family Constellation: One or No Natural Parents	.20383
STEP Math Concepts	-.17494
Current Marital Status: Divorced, Separated, or Divorced and Remarried	.12146
Retention	-.09632
STEP Vocabulary	.09214
SCAT Verbal	-.08676
Health Problem/Injury	.08260
STEP Writing	-.07356
STEP Reading	-.00611

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

Table 3

Pooled Within-Groups Correlations Between Canonical Discriminant Functions and Discriminating Variables RE vs. LD

Variables	Coefficients[a]
STEP Writing	.83073
STEP Reading	.77990
STEP Vocabulary	.72055
SCAT Verbal	.69930
STEP Math Concepts	.66133
SCAT Total	.58731
STEP Math Computation	.50912
SCAT Quantitative	.40528
Speech Referral	-.36386
Health Problem/Injury	-.31445
Current Marital Status: Divorced, Separated, or Divorced and Remarried	-.14058
Retention	-.10040
Current Family Constellation: One or No Natural Parents	-.06849
Both Parents Working	.04887

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

Post Hoc Considerations

Additional analyses were performed to determine which variables would differentiate LD females from RE females and LD males from RE males. Again, the discriminant analysis was used to analyze data from the relevant samples. Fourteen variables accounted for 100% of the variance within the total female sample. These are presented in Table 4, with the variables ordered according to the magnitude of the correlation. The rate of successful classification into Group 1 (RE female) was 93.1%, and for Group 2 (LD female) it was 90%. The overall correct identification of females by placement was 91.53%.

Fourteen variables also accounted for 100% of the variance within the total male sample. These are presented in Table 5, with the variables ordered according to the magnitude of the correlation. The rate of successful classification into Group 1 (RE male) was 82.6%, and for Group 2 (LD male) it was 83.7%. The overall correct identification of males by placement was 83.15%.

Table 4

Pooled Within-Groups Correlations Between Canonical Discriminant Functions and Discriminating Variables
RE Female vs. LD Female

Variables	Coefficients[a]
STEP Writing	.66505
SCAT Total	.60557
SCAT Verbal	.58957
STEP Reading	.55709
STEP Vocabulary	.55340
STEP Math Concepts	.54195
SCAT Quantitative	.51846
STEP Math Computation	.45430
Speech Referral	-.40948
Health Problem/Injury	-.21254
Current Family Constellation: One or No Natural Parents	-.14132
Current Marital Status: Divorced, Separated, or Divorced and Remarried	-.12459
Retention	-.08202
Both Parents Working	.03904

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

Table 5

Pooled Within-Groups Correlations Between Canonical Discriminant Functions and Discriminating Variables RE Male vs. LD Male

Variables	Coefficients[a]
STEP Reading	.66586
STEP Writing	.66378
STEP Vocabulary	.58600
SCAT Verbal	.52370
STEP Math Concepts	.49632
SCAT Total	.35624
STEP Math Computation	.35269
Health Problem/Injury	-.26759
SCAT Quantitative	.17152
Speech Referral	-.16610
Current Marital Status: Divorced, Separated, or Divorced and Remarried	-.08823
Retention	-.07802
Current Family Constellation: One or No Natural Parents	.04498
Both Parents Working	.04405

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

CHAPTER 5

DISCUSSION, CONCLUSIONS, AND SUMMARY

The intent of this study was to determine which of the pre-selected variables would differentiate both males from females placed in Learning Disability Programs and LD students from RE students. A sequential discussion of the findings for each of the major questions and also the post hoc considerations follows.

Question 1

Results regarding question 1 indicate a preponderance of males within the LD sample. The finding is consistent with ratios generally reported in the literature. The ratio alone does not support any single explanation or combination of explanations for the preponderance of males in LD, however consideration of this finding in conjunction with the results of question 2 may suggest factors which contribute to the phenomena.

The current findings are inconsistent with those reported by Piwowarski (1981) and may reflect differences either in individual school district practices and procedures or in the populations from which the samples were drawn. The ratio of males to females found in Piwowarski's study may have reflected an unusual sample. The current sample is likely more representative of the LD population at large. It is recommended that an examination of the male-female ratios for other handicapping conditions and replication of the study on another LD sample after a three year period should be

conducted to determine whether Piwowarski's results generalize to other handicapping conditions and would be supported within the same school district for another LD sample.

Question 2

Of the 16 variables included in the first discriminant function, nine were associated with "maleness". LD males scored higher than LD females on all ability and achievement variables except STEP Vocabulary and the reading standard score. This finding is consistent with the findings of Phipps (1982) and Mercer (1973) who contend that females in special education tend to perform lower than males in special education. Since girls overall do not perform lower than boys, this finding may reflect biases at the levels of the referral and/or placement decision. Retention was also more characteristic of LD males, suggesting that teachers, parents, and other child study team members recognize boys with academic difficulties at earlier ages and/or take action to remediate their deficiencies earlier. This may reflect greater concern with male accomplishments (Caplan, 1977; Singer & Osborn, 1970).

Seven variables were associated with "femaleness". LD females were referred more often for speech evaluations than their male counterparts. This finding was unexpected as speech difficulties are more common among males (Morgan, 1979) and may indicate that speech difficulties are an especially good indicator of future learning difficulties in females. Living in homes where both

parents work; where one or both guardians are not the child's natural parents; and the parents are either divorced, separated, or divorced and remarried were also associated with femaleness. These findings may suggest that LD females are exposed to more familial stress than LD males. The correlation of health problem/injury with femaleness may reflect additional stresses on the female organism that predict her placement in learning disabilities. While health problem/injury was not a potent predictor, the association with femaleness was not expected. Research indicates that males are more prone to the variables included in the Health Problem/Injury category (Eme, 1979). Perhaps the preponderance of males in the current sample reflects the notion that males in general are more susceptible and respond less favorably to both biological and environmental stresses than females (Eme, 1979).

LD females tend to perform better on reading tests administered for placement purposes. This finding is inconsistent with all other achievement scores except STEP Vocabulary, which itself was a weak correlation. One possible explanation for this finding is that the reading tests were individually administered, while all other achievement measures were group tests. Additionally, girls may tend to perform better than boys when interacting with female examiners (Halperin, 1977). In this particular school district, reading tests administered for placement purposes were usually

administered by female resource teachers or consultants. Sex of examiners could influence the ratio of males to females in learning disabilities, as the criteria for program placement include a severe discrepancy between ability and achievement. It is interesting to note that LD males performed better on the Verbal IQ measure, which is also individually administered. However, the WISC-R is administered by school psychologists, of which the ratio of males to females is more nearly equal in the district. Information regarding sex of examiner was not collected for either the Verbal IQ or the reading standard score, but may provide useful information in subsequent research.

The variables associated with LD maleness and LD femaleness in this study, when considered individually, differ from those found in Piwowarski's (1981) study in terms of both potency and direction of association. This finding is undoubtedly due to some extent to the exclusion of some variables (number of older and younger brothers and sisters) and the modification and substitution of other variables. However, differences within the samples also seem apparent and may contribute. This, in turn, may be due to differences in the referral and decision making processes or to other factors unique to each school district. Even though inconsistencies regarding which variables are associated with LD maleness and LD femaleness appear when the two studies are compared, the current findings provide support for the use of variables,

outlined by Piwowarski, in future research. It is also important to note that the two studies are not directly comparable due to differences in statistical procedures used to obtain the canonical discriminant functions. The SPSS program was modified between the time Piwowarski analyzed his data and the current data were analyzed The impact of the modification is unknown.

Question 3

Of the 14 variables included in the second discriminant function, nine were associated with RE and five with LD. All achievement and ability estimates were associated with RE. The most potent predictors were the language-related subtests--STEP Writing, STEP Reading, STEP Vocabulary, and SCAT Verbal. The association of other subtests with RE indicates that the performance of LD students is lower than RE students across all academic areas. One other variable, both parents working, was also associated with the RE group. However, the magnitude of this correlation was weak and it may represent a spurious relationship.

Speech referral; health problem/injury; parents divorced, separated, or divorced and remarried; retention, and living in homes where one or both guardians are not the child's natural parents were associated with LD. These findings may indicate that the LD child is more prone to health-related problems and experiences more familial stress. Both biological and environmental variables

differentiate LD from RE. The findings may support the interactionist's view of LD causation.

Post Hoc Considerations

Two additional discriminant functions were performed to determine which variables differentiated RE females from LD females and RE males from LD males. A comparison of the rates of successful classification indicates that LD females differ more significantly from RE females than LD males do from RE males. This finding provides additional support for Ryckman's (1981) contention that LD females represent a more significant deviation from the norm than do LD males. In the current study the use of sex as a referent increased the rate of successful classification substantially (total LD vs. RE, 78.38%; female LD vs. female RE, 91.53%; and male LD vs. male RE, 83.15%) and indicates that LD females are more homogeneous than LD males.

Two out of three potential familial stress indicators were associated with LD females when compared to RE females, while one of the three was associated with LD males when compared to RE males. Overall the results indicate that similar variables differentiate LD females from RE females and LD males from RE males, but the variables are more potent predictors for differentiating females by placement group. It may be that females placed in learning disability programs truly fit the placement criteria, while as suggested by Phipps (1982) learning disabilities has become a dumping

ground for boys with behavior problems. This hypothesis was not formally tested in the current study and inclusion of variables originally suggested by Piwowarski, but not supported within his sample, may yield results supporting this contention in the current sample. The associations of all other variables were as expected.

The combined findings of a preponderance of males in the LD sample and a higher rate of successful classification in determining placement when sex was used as a referent suggest that males and females placed in LD differ substantially. LD females represent a more significant deviation from the female norm than LD boys do from the male norm and appear to have experienced more stresses than LD boys. The identification of LD girls may be more accurate due to the fact that developmental delays, speech referrals, and early health problems are less frequent among females and provide accurate warning signals of potential learning problems, whereas the same characteristics are more common across placement categories for males and are not as potent predictors of later academic problems in males.

The role of referral and placement bias and teacher practices and expectations, while unassessed in the current study, likely contribute to the disproportionate representation of males in the LD sample. These factors may have contributed to the lower accuracy in the prediction of males by placement and warrant further investigation in subsequent research. Inclusion of sex of the

examiner of individually administered achievement and ability tests may reveal this to be a factor which contributes to the observed ratio. Use of existing file data, including group achievement tests, resulted in the correct identification of nearly 85% of the LD sample. Individually administered achievement and ability estimates, which are currently required for placement purposes, were not included in this analysis. The results suggest that group data alone may provide sufficient ability and performance estimates for placement considerations. Overall the results, which must in the end be viewed in the gestalt, indicate that both biological and socio-cultural factors predict LD placement and the differentiation by sex. Thus the interactionist position is supported on both fronts and future research should include the simultaneous examination of variables from both orientations.

Summary

The present study was designed to assess the utility of specific variables for differentiating LD males from LD females and LD students from RE students. Variables were selected based on previous research findings indicating their utility for differentiating the relevant samples (Piwowarski, 1981) and the availability of pertinent data in existing school files.

Data regarding the 21 pre-selected variables were obtained for all LD students (50 males and 30 females) and a control group of RE students matched with them by sex, grade, and age.

Discriminant Analysis procedures were used to determine the intercorrelated grouping of variables which best differentiated sex within LD placement, LD placement from RE placement, and LD placement from RE placement for each sex.

Results of the current study clearly indicate a preponderance of males within the LD sample. This finding while consistent with male/female ratios generally reported in the literature, contradicts Piwowarski's (1981) finding and suggests that his sample may not be representative of the usual LD population. The finding of a preponderance of males in the LD sample suggests that male and female LD students differ and that research conducted on samples of only males, or only females, or an overwhelming majority of either sex, may not generalize either to the LD population at large or to other educational placements (Keogh et al., 1980). Factors not accounted for in the present investigation--teacher practices, teacher expectations, and referral and placement biases--may contribute to the usually found disproportion and it is recommended that they be included in future research.

Of the 16 variables contributing to the discrimination of males and females within the LD group, nine were associated with "maleness" and seven with "femaleness". Those associated with maleness included SCAT Quantitative, SCAT Total, WISC-R Verbal IQ, STEP Math Computation, STEP Math Concepts, retention, SCAT Verbal, STEP Writing, and STEP Reading. Speech referral; both parents

working; reading standard score; one or no natural parents residing in the home; divorced, separated, or divorced and remarried parents, STEP Vocabulary; and health problem/injury were associated with femaleness.

Results of variables associated with LD maleness and LD femaleness do not suggest a definitive explanation for the preponderance of males. However, it appears that the interaction of male vulnerability, his slower rate of maturation, and societal expectations likely influence the sex ratio. Although referral and assessment bias were not assessed, the lower achievement and ability estimates obtained for LD females and the higher rate of male retention support certain socio-cultural explanations.

Of the 14 variables contributing to the discrimination of LD and RE, five were associated with LD and nine with RE. The variables associated with LD were speech referral; health problem/injury; divorced, separated, or divorced and remarried parents; retention; and only one or no natural parents living in the home. All achievement measures were associated with RE, as well as both parents working.

Several variables differentiated LD females from RE females and LD males from RE males. All ability and achievement measures were associated with the RE group, with language-laden subtests proving to be the most potent predictors. Both parents working was also associated with the RE group. Retention; speech referral; health

problem/injury; and divorced, separated, or divorced and remarried parents were associated with both LD groups.

The results of analyses by sex suggest that females who receive LD services differ more from RE females than LD males from RE males. Overall males and females in LD are highly similar, with the female manifesting more symptoms of stress and health impairment. The results suggest that familial factors play a role not only in differentiating LD students from RE students but also in differentiating LD males from LD females. While the role of these variables is unclear, they are felt to represent additional stresses which may interact with biological variables to produce a child who experiences academic difficulty. The role of Familial variables requires further investigation.

The findings of this study provide additional support for the use of pre-existing file data and group achievement tests for distinguishing both LD males from LD females and LD from RE as suggested by Piwowarski (1981). The next logical step would be to take the variables that contributed significantly to the current discriminant functions into a school district and predict LD and RE placement without prior knowledge and determine the rate of successful classification. While a post hoc design does not necessitate the generation of new data, a combination of variables from the current study and Satz and Friel's (1974) battery may produce a highly effective method for the early identification of learning

disabilities. Familial stress and health problem/injury in addition to Satz and Friel's test measures may improve the overall rate of successful classification.

The major conclusions of this study were as follows:

1. The efficacy of pre-existing data to predict need for LD placement as suggested by Piwowarski (1981) was again demonstrated.

2. Inclusion of medical, familial, and group achievement and ability data may produce more effective and efficient early identification batteries than batteries relying solely on newly generated test results.

3. Males and females within LD possess similar characteristics--early health problem/injury, familial stress, low ability and achievement scores, retention, and speech referral.

4. The high risk female is more deviant from RE females than the high risk male is from RE males.

5. An interactionary explanation, with its emphasis on male vulnerability, male slower rate of maturation, societal expectations, and possible biases in the referral and placement process probably best accounts for the preponderance of males in the current study.

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