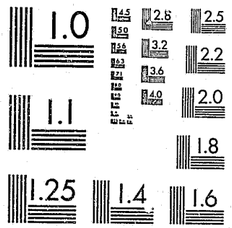

94717

A Causal Analysis of the Relationship Between Learning Disabilities and Juvenile Delinquency

Noel Dunivant

National Center for State Courts

Williamsburg, Virginia

1982

(Revised July 1984)

Contents

Abstract

This research evalulated seven competing hypotheses concerning the causal effects of learning disabilities (LD) on the frequency and seriousness of self-reported delinquent behavior (SRD) and on the probability of being taken into custody by the police, of being officially adjudicated delinquent, and of receiving a disposition of confinement in a juvenile corrections facility. Data were available from a sample of 1,942 teenage boys who were classified with respect to presence or absence of learning disabilities. Results from path analysis indicated that LD exerted significant direct and indirect effects on self-reported delinquency, police pickup, and official adjudication. The causal analyses provided support for the school failure, susceptibility, differential arrest, and differential adjudication hypotheses about the effects of learning disabilities on delinquency. The total causal effect of LD was to increase the frequency of SRD by 45 delinquent acts and to increase the probability of being taken into police custody by .10 and the probability of being adjudicated delinquent by .15. There was no evidence to support the differential disposition hypothesis, which maintains that LD produces more severe court dispositions after taking into account the higher SRD levels of learning-disabled boys. The hypothesis that the relationship between learning disabilities and delinquency is spurious, i.e., that LD and delinquency are correlated only because socioeconomic factors cause both of them, was rejected. Finally, the results did not support the hypothesis that learning-disabled boys report higher frequencies of delinquent behavior because they have less of a tendency to respond in socially desirable ways, or to "fake good." The findings are discussed in terms of psychological and sociological theories of delinquency and courts. The implications for education and juvenile justice are described.

A Causal Analysis of the Relationship Between Learning Disabilities and Juvenile Delinquency

Nontechnical Summary

Background

This report summarizes the results of a research project initiated in 1976 by the National Institute for Juvenile Justice and Delinquency Prevention (NIJJDP), Office of Juvenile Justice and Delinquency Prevention, U.S. Department of Justice, to investigate the relationship between learning disabilities (LD) and juvenile delinquency. Learning disabilities are defined as impairments of perceptual, thinking, and communicative processes which are manifested by a significant discrepancy between a child's expected achievement (based on intelligence test scores) and his or her actual achievement. During the late 1960s and early 1970s many parents and professionals in education and juvenile justice became concerned that the incidence of delinquency appeared to be much higher for learning-disabled youths than for their non-learning-disabled peers. In response to this growing concern NIJJDP commissioned Charles Murray of the American Institutes for Research to review the empirical evidence relevant to the proposition that specific learning disabilities increase the risk of becoming delinquent.

Murray, after evaluating the quantitative evidence gathered through 1975 for a link between learning disabilities and juvenile delinquency, concluded that previous research was so deficient that it could not be used "even for rough estimates of the strength of the link" (p. 65). Furthermore, he argued that "the existence of a causal relationship between learning disabilities and delinquency [had not been] established" and that "the evidence for a causal link [was] feeble" (Murray, 1976, p. 65). His report recommended that carefully controlled investigations of the effects of LD on delinquency be undertaken and that a demonstration remediation program be implemented to assess the efficacy of diagnosing and treating delinquents with learning disabilities. Similar conclusions and recommendations were reached in a study by the General Accounting Office.

In response to these recommendations, NIJJDP funded a research and development project to provide empirical data upon which informed policy decisions could be made. One grant was awarded to the Association for Children with Learning Disabilities (ACLD) to design and conduct a remediation program to improve the academic skills and reduce the delinquency of learning-disabled teenagers who had been officially adjudicated as delinquents by a juvenile court. The National Center for State Courts (NCSC) received a second grant to undertake large-scale studies of the relationship between LD and delinquency and to carry out an extensive evaluation of the effectiveness of the ACLD remediation program. In order to obtain as much information as possible about the causal effects of LD, both age-cross-sectional and longitudinal studies of the relationship between learning disabilities and delinquency were conducted by NCSC. This report describes a causal analysis undertaken as part of the age-cross-sectional study.

Possible Reasons for a Relationship Between LD and Delinquency

A number of possible reasons, or hypotheses, have been advanced to explain why there could be a relationship between learning disabilities and delinquency. The school failure hypothesis maintains that learning disabilities produce academic failure which, in turn, results in delinquent behavior. Stated differently, LD indirectly increases delinquent behavior because of its negative impact on school performance according to this hypothesis. Several explanations have been offered for the fact that poor academic achievement may contribute to delinquency. First, the negative self-image and sense of frustration resulting from failure in school could motivate the learning-disabled student to strike back at society in anger and retaliation. This kind of psychological reaction, which is frequently referred to as frustration/aggression, could make the learning-disabled delinquent especially violence prone. Second, as a result of school failure, learning-disabled children might be labeled as problem students and grouped with other children who have behavior problems. Such negative labeling and association with delinquency-prone children could prompt learning-disabled youths to engage subsequently in socially troublesome behavior. Third, failure in school may decrease the child's attachment, or bond, to school as an institution and to teachers as significant adults. The failure-induced withdrawal of attachment and commitment to socially accepted courses of action may be intensified by the uncaring attitude or active rejection of school teachers and administrators. Social control theory predicts that delinquency would increase among students with LD as their attachment and commitment to school diminished. Fourth, learning-disabled teenagers may experience economic incentives to commit crimes, especially theft, if they anticipate that their poor academic record will make it impossible for them to achieve their aspired levels of occupational prestige or income. Fifth, by causing the child to be unsuccessful at school, learning disabilities could foster the general tendency to attribute blame for negative events to others instead of to oneself. Some research has suggested that youthful offenders tend to make external rather than internal attributions of responsibility for their actions. Any one or combination of these five causal processes could underlie the hypothesized indirect effect of LD on delinquent behavior through school failure.

According to the susceptibility hypothesis, children with learning disabilities possess certain cognitive and personality characteristics which make them more susceptible to opportunities for engaging in delinquent activities. Such characteristics include lack of impulse control, inability to anticipate the future consequences of actions, poor perception of social cues, irritability, suggestibility, and the tendency to act out. Proponents of this view argue that these traits, which are frequently associated with LD, contribute directly to the development of delinquent behavior.

The susceptibility and school failure hypotheses contend that LD (together with other factors) directly or indirectly determines delinquent behavior. Assuming that the probability of arrest is a function of the frequency and seriousness of delinquent acts, the susceptibility and school failure hypotheses would predict a

proportionate increase in the probability of arrest for learning-disabled youths. The differential arrest hypothesis, however, maintains that even for comparable levels of delinquent activity, learning-disabled adolescents have a greater risk of being picked up by the police than do their non-learning-disabled contemporaries. Two causal processes have been proposed as possible explanations for this phenomenon. Learning-disabled youths may be more likely than non-learning-disabled to be detected for the same offenses, since they lack the abilities necessary to plan strategies to avoid being detected, to dissemble during encounters with police (i.e., to conceal their true intentions, feelings, or activities), or to comprehend the questions and warnings of law enforcement officers. Secondly, the police may pick up, interrogate, and arrest learning-disabled adolescents disproportionately, because of the tendency of learning-disabled teenagers to be awkward and abrasive in social interactions. Previous research has demonstrated that demeanor is an extremely important factor in determining whether an arrest will be made in routine encounters with the police. It should be noted that the differential arrest hypothesis can operate even if actual delinquent behavior is not increased by learning disabilities.

Adopting a similar rationale, some have suggested that learning-disabled youths have a higher probability of adjudication following arrest than do their non-learning-disabled cohorts who have committed the same offense. The differential adjudication hypothesis holds that learning-disabled teenagers who have been charged with a violation are at greater risk of adjudication than similarly charged non-learning-disabled adolescents. This could result from two different causal processes. First, it may be that learning-disabled youths are treated differently than their non-learning-disabled counterparts by juvenile justice officials, because of the characteristics associated with learning disabilities, such as social abrasiveness, irritability, and lack of self-control. Different treatment could be received from any of several officials, e.g., intake or probation officers, defense or prosecuting attorneys, or judges. Second, learning-disabled youths may be at greater risk of adjudication than their non-learning-disabled peers, because they lack certain cognitive and social skills. For example, youths with LD may be unable to understand the legal proceedings, to communicate effectively their perception of events (to tell "their side of the story"), and to dissimulate or play what has been called the "strategy game" of juvenile justice proceedings. As was noted with respect to the differential arrest hypothesis, it is possible for the differential adjudication hypothesis to be true regardless of whether learning-disabled youth actually commit relatively more delinquent acts. That is, even if learning disabled teenagers commit the same number of offenses as non-learning-disabled adolescents, the learning-disabled youths may be adjudicated delinquent at a higher rate.

It has been hypothesized also that learning-disabled adolescents have a greater risk of being committed to a training school or other youth correctional facility than non-learning-disabled teenagers who have been adjudicated on the same charge(s). For the same reasons outlined above for differential adjudication, the differential disposition hypothesis contends that learning-disabled youths have a higher probability of receiving a severe disposition from the juvenile court.

Two hypotheses have been advanced which maintain that learning disabilities do not have a causal effect on delinquency, that is, any observed relationship is spurious, or noncausal. According to the sociodemographic characteristics hypothesis, both LD and delinquency are caused by sociodemographic factors, such as parent education and ethnicity. Thus, according to this view, differences in delinquency between learning-disabled and non-learning-disabled juveniles should be attributed to the sociodemographic differences between them, rather than to the cognitive and social characteristics associated with LD.

The response bias hypothesis proposes that actual differences in antisocial behavior do not exist between learning-disabled and non-learning-disabled adolescents. Rather, when being interviewed learning-disabled teenagers do not conceal as much of their antisocial behavior as do their non-learning-disabled peers. Differences in the tendency to dissemble will produce a spurious relationship between LD and delinquency. Thus, according to this explanation, non-learning-disabled children commit just as many delinquent acts as learning-disabled ones, but they more frequently fake the socially desirable response during interviews. The lack of a social desirability response bias among youths with LD would create the incorrect impression that learning-disabled adolescents are more delinquent. It should be understood that these two spuriousness hypotheses are not necessarily mutually exclusive with the preceding five hypotheses, which postulate causal relationships between LD and delinquent behavior or official delinquency. For example, an empirical relationship between learning disabilities and delinquency may be due, in part, to causal factors and, in part, to spurious (noncausal) factors.

In this section we have considered seven hypotheses that have been advanced as possible explanations for a relationship between LD and delinquency. Most of these hypotheses had been proposed before the initiation of this research, but some have grown out of it. Very little systematic research, other than that carried out by the National Center for State Courts, has evaluated any of these hypotheses. Moreover, evaluating the hypotheses poses a complex research problem. For example, finding support for one of the hypotheses does not reduce the credibility of any of the others since they are not mutually exclusive. To test effectively any one of the hypotheses requires a data set which permits testing of the complete set of hypotheses. Such large data sets are very difficult and expensive to obtain. This explains why so few studies of the association between LD and delinquency have furnished information about the specific reasons for any relationship that was observed. Fortunately, the data gathered by NCSC allowed at least a partial test of each of the hypotheses to be made.

Causal Analysis of the Relationship Between LD and Delinquency

Participants in the age-cross-sectional study were boys sampled from public schools, juvenile courts, training schools, and departments of corrections in the metropolitan areas of Baltimore, Indianapolis, and Phoenix during 1977 and 1978. The sample included 973 teenagers from the public schools who had not been adjudicated previously according to

juvenile court records and 970 youths who had been officially adjudicated delinquent by one of the juvenile courts. At the time of data collection, 329, or 34%, of the adjudicated delinquents were confined to youth correctional institutions. The remaining delinquents were on probation or parole or in aftercare supervision. The average age of the boys was 15 years. They came from varied ethnic backgrounds: 50% were white; 35% were black; 6% were Hispanic; and 7% were members of other ethnic groups.

Information from school records, standardized test scores, and behavioral observations was used to assess learning disabilities. Boys were classified as non-learning-disabled either if their records did not indicate the presence of learning problems or if any learning problems that were found could be attributed to mental retardation, severe emotional disturbance, physical handicap, or to the fact that their primary language was not English. The remainder of the sample was administered a battery of tests by the Educational Testing Service (ETS) under contract to the National Center for State Courts, from which learning disabilities could be diagnosed. The tests included the Wechsler Intelligence Scale for Children---Revised, the Woodcock Reading Mastery Tests, the KeyMath Diagnostic Arithmetic Test, and the Visual Motor Gestalt Test. In addition, the tester rated the child's behavior during testing for hyperactivity, inattentiveness, and other signs of learning disabilities.

LD classifications were made on the basis of significant discrepancies among ability and achievement test scores and the presence of perceptual and behavioral problems. In general, a two-year difference between ability as measured by the IQ test and achievement in reading and arithmetic was diagnostic of learning disabilities. To increase the consistency and objectivity of LD diagnoses, the classification rules were incorporated into a computer program which processed the test scores and behavioral observation ratings. Any youth who achieved at or above the expected grade level for his age on the achievement tests or whose full-scale IQ score was less than 69 was automatically classified as non-learning disabled by the program. Using this procedure, 512, or 26%, of the sample were classified as learning disabled. Examination of the test scores revealed that a large majority of these learning-disabled adolescents had much better quantitative, or performance, skills than verbal competence.

Each youth was interviewed to obtain information about his involvement in delinquent activities, prior encounters with the police, attitude toward school, tendency to give socially desirable responses, and sociodemographic characteristics. In addition, a search of the juvenile court records was made in each of the cities to gather information about each boy's official involvement with the juvenile justice system. From these data, measures of frequency and seriousness of self-reported delinquent behavior, previous arrests, school attitude, social desirability response tendency, and previous adjudications were constructed.

Advanced statistical techniques, including causal modeling and logistic regression, were utilized to detect the presence of a

relationship between learning disabilities and delinquency and to evaluate the hypotheses set out in the preceding section. With data gathered in a nonexperimental or survey research design, such as the one used for this cross-sectional study, it is impossible to prove cause and effect. The analytic methods that we employed provided a means of determining if the data were consistent with a set of causal hypotheses. They also gave us the important capability to reject hypotheses about causal relations which were not consistent with the data. In general, however, data may be consistent with more than one set of causal hypotheses. Some caution, therefore, needs to be exercised when interpreting the results of our causal analyses. In effect, causal analysis enabled us to determine which causal hypotheses were consistent and which were inconsistent with the data, but it could not be used to prove that any causal hypothesis, which might have been consistent the data, was---in fact---true.

The evidence for the existence of a relationship between LD and self-reported delinquent behavior was statistically significant; that is, the observed relationship was not likely to have been the product of chance events in sampling or measurement. Learning-disabled adolescents reported that they had committed an average of 266 delinquent acts during their lives. This is 81 more than the corresponding mean number of delinquent acts for the non-learning-disabled participants (185). Although the mean difference in seriousness of general delinquent behavior between learning-disabled and non-learning-disabled groups was not significant, the groups did differ significantly in frequency of violent acts, e.g., assault with a dangerous weapon and gang fighting, in amount of marijuana and alcohol use, and in number of school discipline problems.

Learning disabilities were also strongly related to official delinquency. Weighting the sample to make it representative of the U.S. youth population, we found that the probability of being officially adjudicated for learning-disabled boys was .09, while the probability of adjudication was only .04 for their non-learning-disabled peers. Thus, the results indicate that on a national basis 9 of every 100 young males with learning disabilities have been officially adjudicated delinquent. This contrasts with the adjudication rate of boys who are not learning disabled, which indicates that only 4 per 100 have become official delinquents. Expressed in a different form, the odds of being adjudicated were 220% greater for learning-disabled than non-learning-disabled adolescents. The odds ratio for being taken into custody by the police was similarly greater for the participants with LD. Finally, the incidence of learning disabilities among the adjudicated delinquents was 36%, indicating that a substantial proportion of the population of official delinquents is handicapped by learning disabilities.

The statistical results led to the rejection of the spuriousness hypotheses concerning sociodemographic characteristics and response bias. Differences between learning-disabled and non-learning-disabled groups in mean self-reported delinquency and in probability of adjudication were somewhat reduced, but were still statistically significant, after the effects of socioeconomic status, intactness of the

family, number of children in the family, and ethnicity had been controlled statistically. Thus, only a minor portion of the association between LD and delinquent behavior could be attributed to the spurious influence of the particular sociodemographic characteristics measured in this study. The response bias hypothesis was rejected on the basis of similar results. The conjecture that learning-disabled youths would conceal less of their delinquent activities during the assessment interview was not confirmed.

Four of the remaining five hypotheses received support from the statistical analysis. First, using (positive-negative) attitude toward school as an indicator of school failure, the findings supported the hypothesis that learning disabilities produced school failure which, in turn, led to delinquent behavior. Even though the analysis demonstrated that the school failure hypothesis was consistent with the data, there was not sufficient information available to determine which specific causal processes, e.g., frustration/aggression or economic incentives, were the bases of this effect.

Second, the susceptibility hypothesis was supported by results indicating that some of the effect of LD on delinquent behavior occurred directly, i.e., without being mediated by school failure. This significant result strongly suggests that characteristics associated with learning disabilities, such as inability to anticipate future consequences of actions and irritability, contributed directly to delinquent behavior. Analyses were conducted to determine if some groups of learning-disabled adolescents were more susceptible to delinquency than others. No differences in degree of vulnerability were found for groups varying in age, ethnicity, or socioeconomic status.

Third, the results were consistent with the differential arrest hypothesis. Learning-disabled youths were more likely to have been arrested than were their non-learning-disabled counterparts who reported committing offenses with equal frequency and seriousness. The available data did not permit us to ascertain the basis for this result. Among other reasons, it may have occurred because of the learning-disabled child's impaired intellectual ability to escape detection and inability to dissemble during encounters with the police. Alternatively, it may have occurred as a result of the policeman's negative reaction to the learning-disabled child's abrasive behavior.

Fourth, the differential adjudication hypothesis received strong confirmation. Even when differences in sociodemographic background, frequency and seriousness of self-reported delinquent behavior, and probability of arrest were controlled statistically, the learning-disabled teenagers in the sample had a significantly higher probability of being officially adjudicated delinquent than did their peers who were not handicapped by learning disabilities. It is not clear which causal process was at work. We can not determine, for example, whether learning-disabled youths were treated differently by juvenile justice officials or whether the cognitive or communication deficits of learning-disabled youths prevented them from effectively defending themselves. Obviously, however, some of these kinds of processes must have been at work.

The differential disposition hypothesis was rejected. After officially adjudicated groups of learning-disabled and non-learning-disabled boys were equated statistically for differences in background characteristics and delinquent behavior, there was no evidence that the learning-disabled delinquents had a greater likelihood of being confined to a corrections facility. Thus, for comparable offenses learning-disabled and non-learning-disabled youths received equally severe punishments.

In summary, the results of the causal analyses indicated that learning disabilities increased the frequency of self-reported delinquent behavior and the probability of arrest and adjudication. The boys with LD had significantly higher overall rates of delinquent behavior. Learning-disabled youths were especially more likely than their non-learning-disabled peers to have committed violent offenses and theft, to have used alcohol and marijuana, and to have been more disruptive in school. The likelihood of having been arrested and adjudicated was substantially higher for the teenagers handicapped by learning disabilities. The greater delinquency of learning-disabled teenagers could not be explained on the basis of sociodemographic characteristics or tendency to disclose socially disapproved behaviors. These results led to the rejection of the sociodemographic characteristics and response bias hypotheses and to the conclusion that the LD-delinquency relationship was not spurious. The data were consistent with the school failure hypothesis showing that boys afflicted by learning disabilities had experienced greater school failure (as indicated by more negative attitudes toward school), and that this failure in school contributed to increases in delinquent conduct. Also supported by the data was the susceptibility hypothesis, which held that among boys who had equally poor school attitudes, those with LD would engage in more frequently in criminal activities. This result suggests that cognitive and personality characteristics associated with learning disabilities, such as lack of impulse control and irritability, contributed directly to increases in delinquency.

For comparable offenses learning-disabled youths had higher probabilities of arrest and adjudication than teenagers who were not learning disabled. Thus, differential arrest and adjudication hypotheses were confirmed. The different rates of arrest and adjudication for the same illegal acts suggest that the cognitive and social deficiencies of learning-disabled teenagers, such as poor verbal skills and social abrasiveness, may prevent them from contributing effectively to their defense in juvenile justice proceedings or from receiving the same treatment accorded youths who do not suffer the negative effects of LD. Among adjudicated delinquents those with LD were not more likely to receive a more severe disposition from the court. Thus, the differential disposition hypothesis failed to receive support.

Implications

The findings of the cross-sectional study of the relationship between learning disabilities and delinquency carries important implications for

the design of future research and the formulation of public policy. NIJJDP funded this investigations in order to obtain a definitive answer to the question of whether there was a link between LD and self-reported and official delinquency. The results summarized above should resolve the issue for all practical purposes. The strong evidence for a relationship between learning disabilities and delinquency should prove convincing to researchers, educational practitioners, juvenile justice officials, and policymakers. The findings indicate that the relationship is quite complex, reflecting such factors as school failure, susceptibility, and differential arrest and adjudication. By and large, the data were consistent with causal hypotheses which describe the general ways in which learning disabilities contribute directly and indirectly to delinquent behavior. Of course, LD is only one among many causes of delinquency. Only a relatively small proportion of the youth population is affected by LD. Within this group, however, learning disabilities appear to be one of the important causes of delinquency.

Compared with previous investigations of the LD-delinquency relationship, the present study includes the largest and most representative sample, the most comprehensive assessments of learning disabilities and delinquency, the most systematic research design and procedures, and the most sophisticated statistical analyses. In an era of diminishing resources to support research, it seems highly doubtful that any study of sufficient scope to challenge this investigation will be funded. Although additional research is certainly needed, it is recommended that the present findings, in combination with the other research done to date, be used to guide the formulation of juvenile justice and educational policy. We believe that this research provides a sound basis for informed action.

The findings demonstrate that adolescents handicapped by learning disabilities are a relatively high risk group for delinquency. This implies that juvenile justice, human services, and educational agencies should target special prevention and rehabilitation programs for this population. Learning-disabled youths comprise a substantial percentage of those who have been officially adjudicated, with most estimates falling in the 30%-50% range. Some rehabilitation programs, such as the ACLD remediation program (see below), have been effective in remediating academic deficiencies and reducing future delinquency. Although further research is needed to identify the specific causal processes by which LD affects delinquency, we should not wait until the locus of causation has been completely circumscribed before embarking upon expanded prevention and rehabilitation programs.

Remediation programs can be designed to address several of the hypothesized causal processes simultaneously. The availability of these kinds of rehabilitation services should be expanded. Most practitioners and researchers believe that it is important to identify and offer special services to learning-disabled children before they become official delinquents; that is, while they are still at an early age. Although there is no firm evidence to support this contention, such a prevention strategy for predelinquent learning-disabled children is

reasonable enough to warrant immediate implementation and evaluation. In order to be optimally effective, special delinquency control and prevention programs for learning-disabled children and adolescents will require the close cooperation and coordination of juvenile justice, educational, and youth services agencies.

Learning-disabled youths' relatively greater probability of arrest and adjudication for offenses comparable to those of non-learning-disabled teenagers suggests that special court services may be needed to offset the disadvantage suffered by this handicapped group. Training programs on the difficulties that in the juvenile justice system confront learning-disabled youths could be helpful in augmenting the skills of police and probation officers, prosecutors, defense attorneys, and judges to deal effectively with this group of youthful offenders. Thoughtful consideration ought to be given to special court procedures for handling learning-disabled youths. Recently several of these have been proposed, and some courts have adopted them already.

The report concludes by pointing out the continuing gaps in our knowledge about LD and delinquency. Six major questions are proposed for further study. First, which specific causal processes underlie the relationship between learning disabilities and self-reported and official delinquency? Second, do learning-disabled students commit a disproportionate number of the violent offenses in schools? Third, do learning-disabled juvenile offenders have a higher probability of becoming career youthful and adult criminals? Fourth, are there particular intellectual, personality, social, educational, or family characteristics which either mitigate the deleterious effects of LD or make the individual more vulnerable to them? Fifth, can a method for assessing the presence of learning disabilities be devised which is faster and less costly by equally valid and reliable? Sixth, do learning disabilities contribute to the delinquency of girls in the same way that they do for boys?

A Causal Analysis of the Relationship Between Learning Disabilities and Juvenile Delinquency

Introduction

"The growing interest in LD [learning disabilities] as a cause of delinquency" (Murray, 1976, p. 1) during the past two decades has spawned concern, controversy, and research. During the time when learning disabilities was becoming an official diagnostic category in state and federal statutes, many parents, educators, clinicians, and juvenile justice officials began to express their concerns about what they perceived to be an increased risk of delinquency among learning-disabled children and adolescents. Murray (1976), reviewing the quantitative evidence for a link between learning disabilities and juvenile delinquency that had been gathered through 1975, concluded that previous research was so deficient that it could not be used "even for rough estimates of the strength of the link" (p. 65). Moreover, he argued that "the existence of a causal relationship between learning disabilities and delinquency [had not been] established" and, indeed, that "the evidence for a causal link [was] feeble" (p. 65). The causal analyses described in this report are part of a large-scale research effort to determine the effects of LD on delinquency, which was commissioned by the National Institute of Juvenile Justice and Delinquency Prevention in response to Murray's (1976) review and recommendations.

The preponderance of evidence indicates that learning disabilities and delinquency are related, although the specific nature of and basis

for the relationship are far from clear. A large number of studies have pointed to an elevated frequency of delinquent behavior or higher incidence of official adjudication among learning-disabled youth (Berman, 1976; Berstein & Rulo, 1976; Broder, Dunivant, Smith, & Sutton, 1981; Comptroller General, 1977; Cronk, 1977; Duling, Eddy, & Risko, 1970; Graydon, 1976; Jacobson, 1976; Mauser, 1974; Podboy & Mallory, 1978; Sawicki & Schaeffer, 1979; Smykla & Willis, 1980; Swanstrom, Randle, Livingston, Macrafic, Canfield, & Arnold, 1977, Swanstrom, Randle, & Offord, 1979; Unger, 1978; Werner & Smith, 1979, Zimmerman, Rich, Keilitz & Broder, 1981), although many of these are characterized by the same design and measurement weaknesses noted by Murray (1976). In the largest and most systematic and rigorous of these investigations, Broder et al. (1981) found the odds of being officially adjudicated to be 2.6 times greater for learning-disabled than non-learning-disabled teenage boys after controlling for potentially confounding factors, such as enthnicity and age. The learning-disabled boys also reported significantly higher frequencies of delinquent behavior.[1] In addition, Broder and Dunivant (1981) found that certain learning-disabled subgroups of an initially nonadjudiated sample of adolescent boys showed significantly greater increments in frequency and seriousness of self-reported delinquency (SRD) during a two-year longitudinal study.

The analyses reported in this paper were undertaken to try to assess the extent to which learning disabilities (LD) operate as one of the causes of delinquency. Although the research was not designed originally to test a set of causal hypotheses concerning the relationship between LD and delinquency, it was decided after the data had been collected to

apply causal modeling procedures. Seven different hypotheses, which might explain the effects of LD on self-reported and official delinquency, were evaluated in this study. These will be described in turn, and supporting data for each will be reviewed.

According to the susceptibility hypothesis (Murray, 1976; Post, 1981), learning-disabled children possess cognitive and personality characteristics (which are components of or caused by their learning disabilities) that make them more susceptible to opportunities or situations for engaging in delinquent behavior. Such characteristics include lack of impulse control, inability to anticipate future consequences of acts, poor perception of social cues, irritability, and the tendency to act out. Proponents of this view argue that children with these traits are more likely to respond when exposed to opportunities for committing delinquent acts than are those who do not possess such attributes (Murray, 1976).

Post (1981) suggests that, because these characteristics tend to be socially troublesome, learning-disabled children tend to be labeled as problem children and grouped with other problem children, many of whom are delinquent. The labeling and association with delinquency-prone peers can increase the learning-disabled child's opportunities for behaving antisocially and intensify the pressure to conform to group norms which sanction delinquent activities. Thus, the susceptibility hypothesis incorporates at least two different causal mechanisms whereby LD could affect delinquent behavior. The findings of Sawicki and Schaeffer (1979) and Werner and Smith (1979) concerning the characteristics of learning-disabled adolescents that are related to

delinquent behavior are consistent with the susceptibility hypothesis. In causal modeling, the susceptibility hypothesis would be conceived as a direct effect of LD on SRD and represented as the direct path (a) in Figure 1. A "direct" effect refers to one which is not mediated by or transmitted through another variable.

Insert Figure 1 about here

The second, and most popular, hypothesis about the way LD causes delinquency is the school failure hypothesis (Murray, 1976; Post, 1981). According to this view, learning disabilities produce academic failure which, in turn, results in delinquent behavior. Stated differently, LD indirectly increases delinquent behavior because of its negative impact on school performance according to this hypothesis. The negative relationship between school achievement and delinquency has been well established (Burns, 1971; Elliott & Voss, 1974; Empey & Lubeck, 1971; Farrington, 1973; Fisher, 1970; Frease, 1973; Gold, 1963, 1970; Gold & Mann, 1973; Hassall, 1974; Hindelang, 1973; Hirsch & Hindelang, 1977; Johnson, 1979; Kelly, 1971; Kelly & Belch, 1971; Kvaraceus, 1945; Lanphier & Faulkner, 1970; Lunden, 1964; Mugishima & Matsumoto, 1973; Offord, Poushinsky, & Sullivan, 1978; Phillips, 1974; Phillips & Kelly, 1979; Polk, 1965; Polk & Halferty, 1966; Rhodes & Reiss, 1969; Shafer & Polk, 1967; Sullinger, 1936; Stark, 1979; Thornberry & Farnworth, 1981; Thrasher, 1963; Toby & Toby, 1957; Weis, 1973). Following a review of the literature, Braithwaite (1981) concluded that with respect to both self-reported and official delinquency: "The weight of the empirical evidence that school failure is a strong correlate of delinquency is beyond question" (p.50). Using a causal modeling approach Johnson (1979)

found that school performance (as measured by grades and perceived success) exerted a significant negative direct effect on total delinquent behavior. School performance also indirectly affected delinquency through its effects on a measure of attachment to school.

The school failure hypothesis identifies poor school achievement as an intermediate, or intervening, link in the causal chain between LD and delinquency. It does not specify, however, the particular causal mechanism which mediates the relationship. At least four different causal processes may be embodied in the school failure hypothesis. First, the negative self-image and sense of frustration resulting from failure in school could motivate the learning-disabled student to strike back at society in anger and retaliation. This kind of psychological reaction, which is frequently referred to as frustration/aggression, could make the learning-disabled delinquent especially violence prone. Second, as a result of school failure, learning-disabled children might be labeled as problem students and grouped with other children who have behavior problems. Such negative labeling and association with delinquency-prone children could prompt learning-disabled youths to engage in socially troublesome behavior subsequently.

Third, failure in school can decrease the child's attachment, or bond, to school as an institution and to teachers as significant adults (Johnson, 1979). The failure-induced withdrawal of attachment and commitment to socially accepted courses of action may be intensified by the active rejection or uncaring attitude of school teachers and administrators. Social control theory predicts that delinquency would increase among students with LD as their attachment and commitment to school diminished. Fourth, learning-disabled teenagers may experience

economic incentives to commit crimes, especially theft, if they anticipate that their poor academic record will make it impossible for them to achieve their aspired levels of occupational prestige or income. Fifth, by causing the child to be unsuccessful at school, learning disabilities could foster the general tendency to attribute blame for negative events to others instead of to oneself. Some research has suggested that youthful offenders tend to make external rather than internal attributions of responsibility for their actions. Any one or combination of these five causal processes could underlie the hypothesized indirect effect of LD on delinquent behavior through school failure. Without specifying which of these causal processes underlies the relationship, the school failure hypothesis can be represented as the indirect path from LD through school attitude (SA), which was used as an indicator of school failure, to SRD, i.e., paths b and c in Figure 1.

According to the susceptibility and school failure hypotheses, LD (together with other factors) directly or indirectly determines delinquent behavior. If being taken into custody by the police is solely a function of delinquent activities, then LD would raise the probability of being arrested indirectly through increased SRD. The indirect paths shown as a-d and b-c-d in Figure 1, however, may not be sufficient to account for the relationship between LD and the probability of being arrested (symbolized as the variable POLICE in the figure). The differential arrest hypothesis maintains that even for comparable levels of delinquent activity, learning-disabled adolescents have a greater risk of being picked up by the police than do their non-learning-disabled counterparts.

Two causal mechanisms have been proposed as the possible basis of this phenomenon. Learning-disabled youths may be more likely than non-learning-disabled young people to be detected for the same offenses, because they lack the cognitive abilities necessary to plan strategies to avoid being caught, to dissemble during encounters with police (i.e., to conceal their true intentions, feelings, and activities), or to comprehend the questions and warnings of law enforcement officers. Secondly, the police may pick up, interrogate, and arrest learning-disabled adolescents disproportionately (to their behavior), because of the tendency of learning-disabled teenagers to be socially awkward and abrasive in social interactions (Bryan & Perlmutter, 1979; Bryan & Sherman, 1980; Bryan, Sherman, & Fisher, 1980; Murray, 1976). Previous research has demonstrated that demeanor is an extremely important factor in determining whether an arrest will be made in routine encounters with the police (Piliavin and Briar, 1964). These two causal processes which constitute the differential arrest hypothesis are represented in Figure 1 as the direct path labeled e, from LD to POLICE. It should be noted that it is possible for the differential arrest hypothesis to be true even if learning-disabled boys commit no more delinquent acts than their non-learning-disabled counterparts.

Adopting a similar rationale, some have suggested that learning-disabled youths have a higher probability of adjudication following arrest than do their non-learning-disabled cohorts who have committed the same offense (Broder et al., 1981; Zimmerman et al., 1981 See also Dunivant, 1982a). The differential adjudication hypothesis holds that learning-disabled teenagers who have been charged with a violation are at

greater risk of adjudication than similarly charged non-learning-disabled adolescents. If all of the effect of LD on the probability of being officially adjudicated delinquent (OAD) by a juvenile court is not channelled through increased delinquent behavior and probability of arrest, there would be a direct effect of learning disabilities on the probability of adjudication. In that case, the total causal effect of LD on OAD would include, in addition to the indirect paths b-c-d-f, b-c-m, a-d-f, a-m, and e-f, the direct path g in Figure 1, which symbolizes the differential adjudication hypothesis.

Broder et al. (1981) found that the probability of being adjudicated delinquent was significantly higher for the learning-disabled youths even when SRD and socioeconomic factors, age, ethnicity, and attitude toward school were controlled statistically. This result, which supports the differential adjudication hypothesis, could have produced by the operation of two different causal processes. First, it may be that learning-disabled youths are treated differently from their non-learning-disabled counterparts by juvenile justice officials, because of the characteristics associated with learning disabilities, such as social abrasiveness, irritability, and lack of self-control. Different treatment could be received from any of several officials, e.g., intake or probation officers, defense or prosecuting attorneys, or judges. Second, learning-disabled youths may be at greater risk of adjudication than their non-learning-disabled peers, because they lack certain cognitive and social skills. For example, youths with LD may be unable to understand the legal proceedings (Grisso & Lovinguth, 1979), to communicate effectively their perception of events (to tell "their side of the story"), and to dissimulate or play what has been called the

"strategy game" of juvenile justice proceedings (Golivaux & Janeksela, 1979). As was noted with respect to the differential arrest hypothesis, it is possible for the differential adjudication hypothesis to be true regardless of whether learning-disabled youth commit comparatively more delinquent acts.

It has been hypothesized also that, learning-disabled adolescents have a greater risk of being committed to a training school or other youth correctional facility than non-learning-disabled teenagers who have been adjudicated on the same charge(s). For the same reasons outlined above for differential adjudication, the differential disposition hypothesis contends that learning-disabled youths have a higher probability of receiving a severe disposition from the juvenile court. This is the fifth hypothesis about the causal connection between LD and delinquency we have identified. In Figure 1 the direct path k connecting LD and INSTIT, the probability of being institutionalized in a juvenile corrections facility, represents the differential disposition hypothesis. If learning-disabled delinquents do not receive more severe dispositions for comparable offenses, all of the causal effect of LD on disposition would be transmitted indirectly through school failure, SRD, POLICE, and OAD. Two previous studies, which have addressed this question (Broder et al., 1981; Smykla and Willis, 1980), both reported that learning-disabled delinquents were not more likely to receive dispositions of greater severity. A number of studies, however, have found that nonlegal factors can affect severity of disposition (e.g., Horwitz & Wasserman, 1980; Thomas & Cage, 1977; Thornberry, 1979).

Two hypotheses have been advanced which maintain that learning disabilities do not have a causal effect on delinquency, i.e., that any

observed relationship is spurious. The sociodemographic characteristics hypothesis holds that both LD and delinquency are caused by sociodemographic factors, such as parent education and ethnicity. This is represented as direct paths n and p in Figure 1. Thus, according to this sixth hypothesis, differences in delinquency between learning-disabled and non-learning-disabled juveniles should be attributed to the sociodemographic differences between them, rather than to the cognitive and social characteristics associated with LD. If all of the covariation between LD and the several delinquency indices is accounted for by their joint dependence on sociodemographic factors (Murray, 1976; Post, 1981), then the direct effect of LD on delinquent behavior (path a) will be zero while the direct effects of various sociodemographic characteristics on delinquent behavior e.g., social status and ethnicity and represented in Figure 1 as path p, will be sizable. In addition, the decomposition of the LD effect will reveal relatively large noncausal covariation components if the sociodemographic characteristics hypothesis is correct. Of course, it is quite possible—and even probable—that LD and sociodemographic characteristics are both causes of delinquent behavior. They are not necessarily mutually exclusive sets of causes. In fact, it may be that some of the effects of the sociodemographic characteristics are transmitted to SRD indirectly through LD. The significance of the sociodemographic hypothesis in this study for those concerned with LD is that it predicts that LD does not have any causal effect on delinquent behavior.

The seventh hypothesis considered in this investigation, the response bias hypothesis, maintains that the relationship between LD and delinquent behavior is spurious. It proposes that actual differences in

antisocial behavior do not exist between learning-disabled and non-learning-disabled adolescents. Rather, learning-disabled teenagers do not conceal as much of their antisocial behavior as do their non-learning-disabled peers when being interviewed. That is, adolescents with LD are not as likely to give socially desirable responses to interview questions. This difference in the tendency to dissemble produces a spurious relatinship between LD and delinquency. Thus, according to this explanation, non-learning-disabled children commit just as many delinquent acts as learning-disabled ones, but they more frequently fake the socially desirable response during interviews. This response style produces the incorrect impression that non-learning-disabled adolescents are less delinquent. The social desirability (SD) response tendency is depicted in Figure 1 as being affected by LD (direct path q). The response bias hypothesis requires that the indirect path connecting LD to SD and SD to SRD (q-r in Figure 1) be significant. As with the sociodemographic characteristics hypothesis the direct path from LD to SRD (labeled a in Figure 1) would be zero if the response bias hypothesis were true. Although it is possible for there to be some response style differences between learning-disabled and non-learning-disabled youths and for LD to exert a limited direct causal effect on delinquent behavior, the response style hypothesis explicitly maintains that all of the relationship between LD and SRD can be attributed to spurious, or noncausal, factors.

To simplify presentation Figure 1 does not give a detailed picture of all the sociodemographic characteristics included in the model. Age, intactness of child's family, number of children in the family, ethnicity, and a measure of social status were evaluated as background

sociodemographic variables in the causal model. These characteristics are selected because they have been found to be related to self-reported and official delinquency in many previous investigations (e.g., Bacon, Child, & Barry, 1963; Berger & Simon, 1974; Braithwaite, 1981; Clelland & Carter, 1980; Clinard & Abbott, 1973; Elliott, 1981; Elliott & Ageton, 1978, 1980; Elliott & Voss, 1974; Glueck & Glueck, 1951; Gold, 1972; Gold & Reimer, 1974; Hindelang, Hirschi, & Weis, 1979; Hirschi, 1969; Johnson, 1980; Reiss & Rhodes, 1961; Wadsworth, 1979; Weiss, 1981; Williams & Gold, 1972; Willie, 1967; Wolfgang, Figlio, & Sellin, 1972).[2] In addition, socioeconomic factors appear to influence success in school (e.g., Stark, 1979) and may be related to learning disabilities (Murray, 1976; Post 1981). Studies by Arnold (1971), Carter (1979), Horwitz and Wasserman (1980), Kruttschnitt (1980), Poole and Regoli (1980), Pope and Feyerherm (1981), Scarpitt and Stephenson (1971), Sieverdes (1973), Thomas and Cage (1977), Thomas and Sieverdes (1975), Thornberry (1973, 1979), and Wolfgang et al. (1972), and have reported evidence that severity of disposition is a function of age, social class, or ethnicity.[3] The primary reason for including these variables in the causal model was to control statistically for their joint effects on learning disabilities and delinquency so that the sociodemographic characteristics hypothesis could be tested. Since the causal effects of sociodemographic factors was not of primary concern, the specific effects of individual socioeconomic and ethnic characteristics will be considered only briefly in the sections to follow.

Figure 1 indicates that a scale measuring school attitude (SA) was used as the indicator of school failure in this research. Unfortunately, potentially better measures of school failure, such as school grades or

teacher, peer and self ratings of school performance, were not available. Although not presented in Figure 1, two indices of delinquent behavior were included in the model: the frequency of general self-reported delinquency (GSRD) and the seriousness of self-reported delinquent behavior (SSRD). The complete causal model embodies the seven hypotheses about the possible reasons for any relationship between LD and delinquency. The analyses described in the following sections permitted at least a limited test of each hypothesis.

Ideally, a causal analysis involves a priori formulation of the hypotheses and model. When the model is specified in advance, the variables and research design can be selected to provide optimal measurement of the concepts and estimation of the relationships. Although the data were not collected in order to evaluate this causal model, there is considerable potential value in using it for this purpose. Most of these hypotheses had not been proposed before this research was initiated; several have evolved from it. Very little previous research has undertaken systematic evaluation of the seven hypotheses which were described above. Moreover, the large data sets which are required to test these hypotheses are very difficult and expensive to obtain. To test effectively any one of the five causal or two spurious hypotheses requires a set of data which permits evaluation of all of them. This explains why previous studies of the association between LD and delinquency have furnished so little information about the specific reasons underlying any relationship that was observed. It is fortunate that the data gathered in this investigation allowed at least a partial test of the complete set of hypotheses to be made.

Method

Survey Design

Participants in this study were boys sampled from public schools, juvenile courts, training schools, and departments of corrections in the metropolitan areas of Baltimore, Indianapolis, and Phoenix during 1977 and 1978. A total of 28 public schools were represented in the sample. These had been nominated by local school officials as reflecting the range of socioeconomic and ethnic variation in their systems. An examination of court records confirmed that none of the 972 teenagers from the public schools had been adjudicated previously. Broder et al. (1981) may be consulted for more details on the sampling process and method of obtaining informed consent.

Of the total number of adjudicated delinquents surveyed, 970 boys had sufficient data to be included in the causal analyses.[4] At the time of data collection, 329, or 34 percent, of these were institutionalized. The remaining delinquents were on probation or parole or in aftercare supervision. Detailed descriptions of the sampling and informed consent procedures can be found in Broder et al. (1981), Dunivant (1982b) and Greguras, Broder, and Zimmerman (1978).[5]

Participants

Tables 1, 2 and 3 provide a complete description of the adjudicated and nonadjudicated samples in terms of their sociodemographic characteristics, where the samples have been classified according to the presence or absence of learning disabilities (see below). Compared with the nonadjudicated sample, the adjudicated boys were about one year older on the average, had lower average social status, and came from larger families which had a greater incidence of father absence, and had lower

average social status. Blacks and teenagers from other minorities in the sample were much more likely to have been adjudicated than their white counterparts. Of the total sample, 50% were whites, 36% were blacks, and 14% were Hispanics and other minorities. The adjudicated and nonadjudicated groups differed greatly in frequency of self-reported delinquent behavior, but only slightly in seriousness of SRD.

Predetermined Variables in the Causal Models

Age (AGE). Age was measured in years and ranged from 11.8 to 18.2.

Intactness of Family (INTACT). If both parents were present, INTACT was coded 1; otherwise, 0. Sixty-six percent of the sample came from intact homes.

Number of Children in Family (NUMCHILD). Each participant was asked about the actual number of children in his family, including himself. The average number of children per family was 4.8 for the entire sample.

Ethnicity of the Participant (BLACK, OTHER). Ethnic group membership was dummy coded (Cohen & Cohen, 1975) as two variables. If the participants were black, BLACK was coded 1 and OTHER coded as 0. For members of other minorities (e.g., Hispanics and American Indians), BLACK equaled 0 and OTHER equaled 1. White participants received scores of 0 on both BLACK and OTHER. When both variables are included in regression models, the estimated coefficient for BLACK can be interpreted as a function of the mean difference between black and whites in residualized scores on the dependent variable (Cohen & Cohen, 1975). Analogously, the estimated regression weight for OTHER reflects the magnitude of the difference in residual means between the other minorities and whites. Thus, the regression coefficients for the dummy-coded variables have an

easily intuited interpretation in terms of mean differences between groups while controlling for the effects of other independent variables.

Social Status of Parents (SOCSTAT). A composite scale of social status was constructed from parent's education and items indicating the availability of books, encyclopedias, magazines, and other kinds of educational materials in the home. This scale was designed to be particularly sensitive to the potential of the home environment to provide stimulation for educational growth. The SOCSTAT scores ranged from -6 to +3, with a standard deviation of 1.6.

Jointly Determined Variables

Learning-Disabilities Classification (LD). Boys were classified as learning disabled or not using information from school records, standardized test scores, and behavioral observations according to procedures which have been described in detail by Barrows, Campbell, Slaughter, and Trainor (1977), Broder et al. (1981), Campbell (1978), and Campbell and Varvariv (1979), and Dunivant (1982b). Boys were classified as non-learning-disabled either if their records did not indicate the presence of learning problems or if learning problems were found that could be attributed to mental retardation, severe emotional disturbance, physical handicap, or to the fact that their primary language was not English. The remainder of the sample was administered a battery of tests from which learning disabilities could be diagnosed. The Educational Testing Service (ETS) performed the testing under contract to the National Center for State Courts. The battery included the Wechsler Intelligence Scale for Children--Revised (Wechsler, 1974), the Woodcock Reading Mastery Test (Woodcock, 1973), the KeyMath Diagnostic Arithmetic Test (Connolly, Nachtman, & Pritchett, 1976), and the Visual Motor

Gestalt Test (Bender, 1946). In addition, the tester rated the child's behavior during testing for hyperactivity, inattentiveness, and other signs of learning disabilities. Using a computer algorithm, LD classifications were made on the basis of significant discrepancies among ability and achievement test scores and the presence of perceptual and behavioral problems. However, any youth who achieved at or above the expected grade level for his age on the achievement tests or whose full-scale IQ score was less than 69 was automatically classified as non-learning disabled. (Appendix C contains more information concerning the LD classification method.) Following this procedure, 513, or 26%, of the sample were classified as learning disabled. LD was coded 1 if the boy had been classified as learning disabled, 0 otherwise.

School Attitude (SA). A scale of attitude toward school, intended as an indicator of school failure, was constructed from agree/disagree responses to eight questionnaire items, which had been formulated by ETS (1971). Items, such as "I like school" and "I like to be absent from school when I can," were included. Responses to each item were scored 1 if they reflected a positive attitude toward school and 0 if negative. The average across the set of items answered by the participant was taken as his SA score. Thus, scores ranged from 0 to 1 with a standard deviation of .3.

Social Desirability (SD). Five items, such as "I have never hurt someone's feelings on purpose," were taken from the Marlowe-Crowne Social Desirability Scale--Revised (Crowne & Marlowe, 1964). Keyed responses were scored 1, and a mean score was computed across all items answered by the respondent. Scores ranged from 1, indicating high susceptibility to social desirability response set, to 0, with a standard deviation of .2.

General Self-Reported Delinquency (GSRD). Participants were asked during the course of a personal interview how frequently they had ever engaged in a variety of socially troublesome or delinquent activities. Frequencies up to maximums of 99 were recorded. Typical items, which were adapted from Johnstone (1976), included "deliberately damaged private or public property," "used marijuana," "taken something small from a store," "stolen a car," "used a weapon like a brick, knife, or razor in a fight," and "been suspended from school." Several SRD scores were computed from the responses to 26 of the items, including a total score representing the sum of frequencies of all 26 types of delinquent behavior, a total score based on frequencies that had been standardized following a logarithmic transformation, and three subscale scores measuring the raw frequencies of crimes aginst property, of crimes against persons, and of miscellaneous offenses. (See Table 9 for a list of the 26 items.) The sum of the raw frequencies of the 26 behaviors (GSRD) was used as the primary index of frequency of delinquent behavior, because it had a meaningful metric and produced the same results in the path analyses as did the log transformed general score and the specific types of delinquent behavior scores.[6] The GSRD scores ranged from 0 to 2,194 delinquent acts and had a mean of 206 and a standard deviation of 301. The distribution had a large positive skew.

Seriousness of Self-Reported Delinquency (SSRD). The seriousness of the self-reported delinquent acts was scaled from 0 to 6. The seriousness scale was derived from the work of Sellin and Wolfgang (1964) and Cohen and Klugel (1978) and can be illustrated by the following examples: school misbehavior - 0; truancy, runaway - 1; vandalism,

marijuana use - 2; shoplifting, carrying a weapon - 3; assault and battery, robbery - 4; rape, aggravated assault - 5; and murder - 6. Twenty-three of the items represented illegal acts and had seriousness values greater than 0. For each participant, each of the 23 items that had been committed one or more times was assigned a seriousness scale value from 1 to 5. Then the scale values for the subset of the 23 items with nonzero frequencies were summed. This sum was then divided by the total number of items which had frequencies of one or more. This procedure produced a (mean) seriousness of delinquent behavior score for each participant that could be interpreted in terms of the 5-point metric illustrated above. In the sample the lowest SSRD score was 0 while the highest was 5. The sample mean was 2.6, and standard deviation was .7.

Taken into Custody by the Police (POLICE). During the course of the personal interview, each participant was asked if he had ever been picked up by the police . POLICE was scored 1 if the respondent answered "yes," 0 if he said "no."

Officially Adjudicated Juvenile Delinquent (OAD). Juvenile court records in each of the three metropolitan areas from which the sample was drawn were searched for evidence that the participants had come into contact with the juvenile justice system. If a boy had been officially adjudicated as a delinquent by the court, OAD was coded 1; otherwise OAD equaled 0. (See Broder et al., 1981, Dunivant, 1982b, and Greguras et al., 1978 for more details.)

Confined in a Juvenile Corrections Institution (INSTIT). A variable was created to provide a measure of severity of disposition. If a boy was institutionalized in a training school or other secure facility of

the department of corrections at the time of data collection, INSTIT was given a value of 1. Otherwise, INSTIT was coded 0.

Method of Statistical Analysis

Path Analysis. A statistical method known as path analysis was used to estimate the regression equations symbolized by the paths in Figure 1. (See Appendix A for a detailed, technical description of path analysis.) Basically, each variable with an arrow pointing to it in the path diagram is a dependent variable in a regression equation. The equation includes as independent variables all of the variables which have arrows leading to the dependent variable. In the terminology of causal models, the variables which have no paths leading to them are called predetermined (or exogeneous) variables; they are determined by factors outside the causal, or path, model. The (dependent) variables which are influenced by predetermined or other dependent variables in the model are referred to as jointly determined (or endogeneous) variables.

In path analysis, traditional multiple regression (ordinary least squares) is used to estimate the path coefficients, or regression weights, which correspond to the effects of the predetermined and jointly determined variables in the model. Two systems of regression equations were estimated in this research. The first, a seven-equation model, is presented in Table 4. In it, the seven jointly dependent variables (LD, SA, SD, GSRD, SSRD, POLICE, and OAD) are expressed as functions of 68 raw-score regression coefficients (b_j). These regression weights, also referred to as path or structural coefficients, index the magnitude of the direct effect that each predetermined or jointly determined variable has on a particular jointly determined variable. The regression coefficients were estimated by PROC SYSREG (SAS Institute, 1979) using

the covariance matrix of the predetermined and jointly determined variables. The correlation matrix derived from this covariance matrix is presented in Table 5.

The size of the indirect effect is obtained as the product of the relevant path coefficients. For example, the indirect effect of LD on GSRD through SA is $b_9 \cdot b_{25}$ (see Table 4). These correspond to the paths from learning disabilities to school attitude and from school attitude to general self-reported delinquency. In addition to direct and indirect causal effects, path analysis enables us to estimate the strength of noncausal, or spurious, effects. The relationship between two variables as measured by their covariance is decomposed by path analysis into portions representing direct causal effects, indirect causal effects, and noncausal covariation. These components were estimated in this study using the method described by Fox (1980).

The second causal model estimated in this research consisted of six equations with INSTIT as the final jointly determined variable. Only the data from the boys who had been adjudicated were appropriate for this analysis. Thus, the POLICE and OAD equations were replaced by an equation for INSTIT. The correlation matrix of variables included in the INSTIT model is given in Table 6. It is based on the reduced sample (N = 979) of officially adjudicated delinquent youths.

Two final, cautionary notes about path analysis needs to be expressed. With data gathered in a nonexperimental or survey research design, such as the one employed in this cross-sectional study, it is impossible to prove cause and effect. The path analytic method provides a means for determining if the data are consistent with a set of causal

hypotheses. Importantly, it also gives us the capability to reject hypotheses about causal relations which are not consistent with the data. Since data may be consistent with more than one causal model, some caution should be exercised when interpreting the results of path analyses. Although the method identifies those hypotheses which are and are not consistent with the data, it can not be used to prove that a causal hypothesis that is consistent with the data is, in fact, true. Secondly, errors of measurement can cause the path coefficients to be biased. The same problem exists for traditional regression analysis (Cohen & Cohen, 1975), however, it becomes compounded in multiple-education models. Thus, unreliability or problems with construct validity can distort path analytic results, and this possibility should be borne in mind by the reader.

Logistic Regression Analysis. Four of the dependent variables in the two causal models--LD, POLICE, OAD, and INSTIT--were dichotomous, reflecting only 0, 1 outcomes. Multiple regression and path analysis are frequently inappropriate for this kind of dependent variable (see Appendix B). Logistic regression analysis, a method which is suited for dichotomous dependent variables, was used as a check of the adequacy of path analysis for the data in this study. Comparisons of the path analysis and logistic regression results indicated close agreement and led to the conclusion that the path analytic results had not been biased by the dichotomous nature of the dependent variables. A comprehensive discussion of the logistic method and comparison of the path and logistic results are presented in Appendix B.

Results

Effects on Learning Disabilities

The estimates of the direct effects of the predetermined variables on the probability of being classified as learning disabled are given in Table 7 for the adjudication model, and the path diagram in Figure 2 displays those that are significant ($p < .05$). According to the OLS estimates of the path coefficients the probability of being learning disabled increased by .03 for each year of age. Thus, an 18 year-old youth had a .18 (= .03 x 6) higher probability of being learning disabled than did a 12-year-old in this sample. Some practitioners suggest that the incidence and effects of LD decrease during late adolescence (see Murray, 1976; Post, 1981), a view which would not be supported by this result. It should be remembered, however, that the older boys in this sample came disproportionately from the adjudicated sample (see Tables 1 and 2) and that the incidence of LD was considerably higher among the official delinquents. Thus, this result may reflect only the sampling design of the study and may not apply to the general adolescent population.

The effects of ethnicity on LD were also significant. The probability of being classified LD, holding other predetermined factors constant, was .07 lower for blacks than whites, while other minority group members had .08 higher probability of being learning disabled than did their white counterparts. Inspection of the available IQ and achievement test scores suggested that the black youths had lower average performance than the white and other minority participants and fewer large discrepancies. Thus, although the blacks were significantly less likely to be classified as learning disabled, they were not free of learning or school problems.

Effects of Learning Disabilities

As shown in Figure 2, the direct effect of LD on GSRD was 45 ($p < .001$), which means that the presence of learning disabilities produced an increment of 45 acts in the frequency of the average boy's delinquent behavior after controlling for the other effects in the model. This result provided confirmation of the susceptibility hypothesis with respect to the frequency of delinquent behavior. The direct effect of LD on seriousness of SRD did not attain statistical significance, however. Thus, it appears that LD increased a boy's susceptibility to engaging in delinquent acts, but they did not make him more directly prone to commit serious offenses as defined by the seriousness scale.

Table 7 and Figure 2 reveal that the indirect effects of LD on frequency and seriousness through school attitude were significant. Thus, the school failure hypothesis received support. The indirect effect of LD on GSRD was an increase of 10 offenses, but the indirect effect on SSRD was only .01. While these effects are not very great in absolute terms, it should be kept in mind that the school attitude scale was, at best, an incomplete measure of school failure. To the extent that the SA measure did not capture all of the information implied by the conceptual definition of school failure, its ability to transmit the effects of LD was limited. Thus, it is recommended that the indirect effects be regarded as lower-bound estimates of the consequences of school failure produced by learning disabilities. The significance of the effects substantiated the hypothesis. Measurement inadquacies, however, limited the model's capability to estimate the importance of the causal mechanisms implied by the school failure hypothesis in determining delinquent behavior.[7]

LD increased the probability of being taken into custody by the police indirectly through school attitude, and frequency and seriousness of delinquent conduct (see Table 7 and Figure 2). Learning disabilities produced less positive school attitude, which led to delinquent behavior, which finally resulted in contact with the police. The total indirect effect of LD was to increase the probability of being picked up by the police by .03. Table 7 reveals that this amount was only 34% of the total increment in the probability of pickup caused by LD. Thus, the significant direct effect of LD on POLICE, which was .07, supported the differential arrest hypothesis. Even after controlling for the differences in delinquent conduct, sociodemographic characteristics, attitudes, and other characteristics between learning-disabled and non-learning-disabled boys, those with LD were significantly more likely to have been taken into custody by law enforcement officers. Whether this resulted from inability to avoid detection, unpleasant demeanor, or some other causal factor can not be answered with these data.

The reader should note that the indirect effects of LD through SRD on POLICE were probably underestimated in the same manner as described above for the school failure hypothesis. Only 26 types of behavior were included in the self-reported delinquency questionnaire. There is good reason to believe, however, that the youths in this sample had engaged in many more types of behavior that had brought them into contact with police. For example, the officially delinquent boys had been adjudicated on more than 100 different charges. The self-report scale was, therefore, an incomplete measure of delinquent behavior. To the extent that GSRD and SSRD did not reflect all the offenses that the boys committed, they could not transmit the effects of LD (and other

variables) on delinquent behavior to police pickup. The effects of delinquent behavior resulting from LD on the probability of being taken into custody were probably underestimated by the indirect effects of LD on POLICE. Conversely, the direct effect of LD on POLICE should be regarded as an upper-bound estimate of the importance of the causal processes implied by the differential arrest hypothesis.

The total causal effect of LD on the probability of adjudication was .15. That is, the path analysis indicated that learning-disabled boys had a .15 higher probability of being found delinquent by a juvenile court as direct and indirect consequences of their disabilities than did non-learning-disabled boys, who were comparable in all other respects. Approximately 41% of this difference was attributable to the effects of LD transmitted indirectly through SA, GSRD, SSRD, and POLICE. That is to say, the greater delinquent involvement of learning-disabled boys increased their probability of adjudication by .06 after controlling for all other causes of adjudication.

The significant direct effect of LD on OAD provided empirical confirmation of the differential adjudication hypothesis. The path coefficient (.09) should be interpreted as an upper-bound estimate of the effects of differential response of juvenile justice officials to learning-disabled youths. The direct effect overstates the importance of different treatment to the extent that the school attitude and self-reported delinquency scales did not completely measure the constructs of school failure and delinquent behavior. It is important to recognize that if in a three variable system A causes B which, in turn, causes C, and B is inadequately measured, then the path analytic decomposition of the A-C relation of necessity will attribute the

association primarily to the direct effect of A on C. Path analysis simply can not be counted on to provide accurate estimates of indirect effects when the intervening variables (constructs) are not well measured (operationalized). While there should be no doubt that different treatment does play some role in the increased risk of adjudication of boys with LD, the effects of LD on delinquent behavior are probably the major determinants of the greater adjudication rates. On the basis of the results of the causal analyses, it is now believed that earlier reports of this research (e.g., Broder et al., 1981 and Zimmerman et al., 1981) were mistaken in emphasizing the effects of differential treatment to the exclusion of differences in delinquent behavior between learning-disabled and non-learning-disabled teenagers. A balanced view seems more accurate. LD contributes to increases in delinquent behavior. However, even when the behavioral differences have been taken into account, the findings indicate that boys with LD are at greater risk of adjudication.

Examination of the entries in Table 7 leads to the rejection of the sociodemographic characteristics hypothesis. As has been discussed above, the direct and indirect effects of LD on GSRD, SSRD, POLICE, and OAD are both statistically significant and practically important even after controlling for the effects of various measures of background factors, such as ethnicity, age, and social status. Although fairly large percentages of the bivariate effects of LD on delinquency were spurious, i.e., noncausal (GSRD - 41%, SSRD - 60%, POLICE - 40%, OAD - 41%), most of the LD effects were found to be causal. Furthermore, the magnitude of the spurious path components expressed as percentages of the total effects were no larger for LD than for other variables in the

model. It is concluded that the relationship between LD and delinquency was not completely, or even for the most part, spurious. The path analyses support the proposition that LD exerted causal effects on self-reported and official delinquency.

LD did not affect the tendency to respond in socially desirable ways. Apparently, learning-disabled and non-learning-disabled adolescents were equally susceptible to conformity pressures and the need for approval as indexed by the tendency to give socially acceptable responses. Since there was not a path from LD to SD to GSRD/SSRD, the hypothesis that differences in self-reported frequencies between learning-disabled and non-learning-disabled groups were due to different tendencies to "fake good" or to respond in self-protective ways was not supported. Therefore, the response bias hypothesis, which maintains that the relationship between LD and delinquency is spurious, was rejected. It should be recalled, however, that SD was assessed by means of a 5-item scale. Better measurement of social desirability or need for approval might have produced different results.

The final hypothesis to be evaluated concerns the possibility that among adjudicated youths, the delinquents with LD receive more severe dispositions from the juvenile court. The estimates from the path analysis for INSTIT are contained in Table 8, and the significant paths are diagramed in Figure 3. These reveal many interesting findings, e.g., the fact that disposition determinations appear to have been based on the age, social status, and ethnicity of the boy. They contain no evidence, however, to support the differential disposition hypothesis about the way LD affects delinquency. In this sample the rates of incarceration were equal for learning-disabled and non-learning disabled youths.

As was described above, the path analysis indicated that LD exerted a significant direct effect on frequency of general self-reported delinquency (GSRD). This implies that the mean difference in residualized GSRD scores between learning-disabled and non-learning-disabled youths was significant. It is interesting to examine the differences between boys with and without LD in the various kinds of delinquent activities which are combined in the general score. Table 9 gives both the raw means and residualized, or least squares, means for the 26 items included in the GSRD scale. The residualized means were estimated by PROC GLM (SAS Institute, 1979) while controlling for age, intactness of family, number of children in the family, ethnicity, and social status.

Simple t-tests were used to evaluate the significance of the difference in raw item frequencies between learning-disabled and non-learning-disabled groups. Group differences in residualized item frequencies were tested by hierarchical regression (Cohen & Cohen, 1975). Table 9 shows that boys afflicted with LD committed more delinquent acts of every type. The greater frequency of delinquent conduct of learning-disabled boys was especially pronounced for violent offenses, theft, alcohol and drug use, and school discipline problems. Since these offenses span the range of the seriousness scale, one can understand why the composite seriousness measure (SSRD) was not very sensitive to the effects of LD. Neither the magnitude nor the significance of the differences was reduced very much by taking into account differences in sociodemographic characteristics between the learning-disabled and non-learning-disabled groups. Clearly, learning disabilities were associated with higher levels of delinquent conduct, and the effects of LD could not be attributed to other related variables.

The causal analyses demonstrated that boys with LD were at greater risk of coming into contact with the juvenile justice system even when they had engaged in the same amount of crime as their non-learning-disabled counterparts. Table 10 has been prepared to describe more clearly the degree to which LD youths are at risk. The column of unweighted probabilities and odds illustrates how likely learning-disabled and non-learning-disabled boys were, based on sample proportions, to be picked up by the police, to be officially adjudicated delinquent, or to be confined in a corrections facility following adjudication. For example, the probabilities of being adjudicated were .64 and .45 for learning-disabled and non-learning-disabled teenagers, respectively. Alternatively, the odds of being adjudicated if a boy had LD were 1.78 to 1 compared with the odds of .82 to 1 for boys not handicapped by LD.[8] Since odds do not have to fall in a bounded range, they are much easier to compare statistically than are the corresponding probabilities. Logistic regression analysis was used to evaluate the difference in the odds between the learning-disabled and non-learning-disabled groups (see Appendix B). PROC LOGIST (Harrell, 1980) was employed to determine whether the odds differential, i.e., the ratio of the odds of the learning-disabled boys to the odds of the non-learning-disabled boys departed significantly from 1.0. For example, in Table 10 we find that the ratio of the unweighted odds for adjudication is 1.78/.82 = 2.20, which is significantly greater than 1.0, p .001. That is, the odds of being adjudicated delinquent were 2.2 times greater for the learning-disabled than non-learning-disabled boys in the sample, a difference which the logistic analysis indicated was highly significant.

These unweighted likelihood estimates are limited in two major ways. First, they are based directly on the characteristics of the sample. The sample was not representative of the male youth population, since about half of the participating teenagers were official delinquents. Although exact figures are not available, the percentage of officially adjudicated delinquents in the youth population is approximately 5% (Corbett & Vereb, 1975). The columns headed "Weighted" in Table 10 reflect the estimated probabilities and odds when the sample has been weighted to make it more representative with respect to the delinquent/nondelinquent (.05/.95) proportions in the population. These weighted estimates suggest that boys with LD have a .09 probability (9% chance) of being adjudicated. In contrast, boys without the handicap of LD have only a 4% risk of ever becoming officially delinquent. The risk of being adjudicated that learning-disabled boys face is relatively small in absolute terms (e.g., less than 10%). It is quite large in comparative terms, however, being more than two times greater than the corresponding risk of boys who are free of learning-disabilities. The table shows that the chances of ever being picked up by the police are relatively high (29% to 38%), with the learning-disabled boys having greater risk. The probability of receiving a disposition of confinement to a youth correctional facility following adjudication did not differ significantly for learning-disabled and non-learning-disabled delinquents.

The second major problem with the unweighted estimates is that they fail to separate the effects of LD on likelihood of arrest, adjudication, or institutionalization from the effects of other characteristics correlated with LD. The third column has been calculated to illustrate

the likelihood of having contact with the juvenile justice system of learning-disabled and non-learning-disabled groups after group differences in sociodemographic characteristics have been controlled statistically. In the Control 1 column, estimates have been adjusted for group differences in age, intactness of family, number of children in the family, ethnicity, and social status.[9] It is clear that boys with LD had significantly greater risk of arrest and adjudication than their non-learning-disabled peers. The path analysis suggested that about half of the group differences in probability of being picked up or adjudicated could be attributed to the indirect effects of LD transmitted through school attitude and self-reported delinquency. Applying this adjustment to the probability on odds differences in the Control 2 column reveals that a significant and potentially important difference in the risk of being arrested or adjudicated remained between learning-disabled and non-learning-disabled boys. As was noted above in connection with the differential arrest and adjudication hypotheses, youths handicapped by LD had significantly higher risks of arrest and adjudication even when they had committed the same offenses as their non-learning-disabled counterparts.

Discussion

This research, which was initiated by the National Institute of Juvenile Justice and Delinquency Prevention in direct response to Murray's (1976) call for a large systematic investigation of the relationship between learning disabilities and juvenile delinquency, has provided the most definitive evidence to date that LD is one of the causes of delinquency. The results of the causal analyses indicated that learning disabilities increased the frequency of self-reported delinquent

behavior and the probability of arrest and adjudication. The boys with LD had significantly higher overall rates of delinquent behavior. Learning-disabled youths were especially more likely than their non-learning-disabled peers to have committed violent offenses and theft, to have used alcohol and marijuana, and to have been more disruptive in school. The likelihood of having been arrested and adjudicated was substantialy higher for the teenagers handicapped by learning disabilities.

The greater delinquency of learning-disabled teenagers could not be explained on the basis of sociodemographic characteristics or tendency to disclose socially disapproved behaviors. These results led to the rejection of the sociodemographic characteristics and response bias hypotheses and to the conclusion that the LD-delinquency relationship was not spurious. The data were consistent with the school failure hypothesis showing that boys afflicted by learning disabilities had experienced greater school failure (as indicated by more negative attitudes toward school), and that this failure in school contributed to increases in delinquent conduct. Also supported by the data was the susceptibility hypothesis, which held that among boys who had equally poor school attitudes, those with LD would engage more frequently in criminal activities. This result suggests that cognitive and personality characteristics associated with learning disabilities, such as lack of impulse control and irritability, contributed directly to increases in delinquency.

For comparable offenses learning-disabled youths had higher probabilities of arrest and adjudication than teenagers who were not learning disabled. The differential arrest and adjudication hypotheses,

therefore, were confirmed. The differential rates of arrest and adjudication for the same illegal acts suggested that the cognitive and social deficiencies of learning-disabled teenagers, such as poor verbal skills and social abrasiveness, may have prevented them from contributing effectively to their defense or from receiving the same treatment accorded youths who did not suffer the negative effects of LD. Among adjudicated delinquents, those with LD were not more likely to receive a more severe disposition from the court. Thus, the differential disposition hypothesis failed to receive support.

These findings carry important implications for the formulation of public policy the design of future research. NIJJDP funded these investigations in order to obtain a definitive answer to the question of whether there was a link between LD and self-reported and official delinquency. The results from this investigation, particularly when considered in conjunction with the results from the longitudinal study (Broder & Dunivant, 1981) and the evaluation of the ACLD remediation program for learning-disabled juvenile delinquents (Dunivant 1982), should resolve the issue for all practical purposes. The evidence for a relationship between learning disabilities and delinquency should be convincing to researchers, educational practitioners, juvenile justice officials, and policymakers. The findings indicate that the relationship is quite complex, reflecting such factors as school failure, susceptibility, and differential arrest and adjudication. By and large, the data were consistent with causal hypotheses which describe the general ways in which learning disabilities contribute directly and indirectly to delinquent behavior. The results showed that although the LD-delinquency relationship was not extremely large, it was statistically reliable. Of course, LD is only one among many causes of delinquency.

Only a relatively small proportion of the youth population is affected by LD. Within the group, however, learning disabilities appear to be one of the important causes of delinquency.

Compared with previous investigations of the relationship between LD and delinquency, the present study includes the largest and most representative sample, the most comprehensive assessment of learning disabilities and delinquency, the most systematic research design and procedures, and the most sophisticated statistical analyses. In an era of diminishing resources to support research, it seems highly doubtful that any study of sufficient scope to challenge the authority of this investigation and the companion longitudinal and evaluation studies will be funded. Although additional research is certainly needed, it is recommended that the present findings, in combination with the other research done to date, be used to guide the formulation of juvenile justice and educational policy. I believe that this research provides a sound basis for informed action.

The findings demonstrated that adolescents handicapped by learning disabilities have a relatively higher risk of delinquency. This implies that juvenile justice, human services, and educational agencies should target special prevention and rehabilitation programs for this population. Learning-disabled youths comprise a substantial percentage of those who have been officially adjudicated, with most estimates falling in the 30%-50% range. Some rehabilitation programs, such as the ACLD remediation program, have proven effective in remediating academic deficiencies and reducing future delinquency (Dunivant, 1982b). The availability of such rehabilitation services should be expanded. Although further research is needed to identify the specific causal

processes by which LD affects delinquency, we should not wait until the locus of causation has been completely circumscribed before embarking upon expanded prevention and rehabilitation programs.

Remediation programs can be designed to address several of the hypothesized causal processes simultaneously. Most practitioners and researchers believe that it is important to identify and offer special services to learning-disabled children before they become official delinquents; that is, while they are still at an early age. Although there is no firm evidence to support this contention, such a prevention strategy for predelinquent learning-disabled children is reasonable enough to warrant immediate implementation and evaluation. In order to be optimally effective, special delinquency control and prevention programs for learning-disabled children and adolescents will require the close cooperation and coordination of juvenile justice, educational, and youth services agencies.

Learning-disabled youths' relatively greater probability of arrest and adjudication for offenses comparable to those of non-learning-disabled teenagers suggests that special court services may be needed to offset the disadvantage suffered by this handicapped group. Training programs on the difficulties confronted by learning-disabled youths in the juvenile justice system could be helpful in augmenting the skills of police and probation officers, prosecutors, defense attorneys, and judges to deal effectively with this group of youthful offenders. Thoughtful consideration ought to be given to special court procedures for handling learning-disabled youths. Recently several of these have been proposed, and some courts have adopted them already (Post, 1981).

Having noted the significant policy implications deriving from the cross-sectional and longitudinal studies, it is now appropriate to consider briefly the continuing gaps in our knowledge about LD and delinquency. These very much need to be addressed by future research. Six questions, ranked in approximate order of importance, are proposed for further study. First, which specific causal processes underlie the relationship between learning disabilities and self-reported and official delinquency? A variety of factors have been suggested as the basis for the school failure, susceptibility, differential arrest, and differential adjudication hypotheses. For example, frustration/aggression, labeling, association, bonding, economic incentives, attribution of responsibility, inability to anticipate future consequences of acts, irritability, social abrasiveness, inability to dissimulate, and lack of verbal comprehension and communication skills have been proposed. Although it is theoretically possible that all of these (and more) could be involved, it is likely that only a few play comparatively major roles. It is of paramount importance to determine the relative influences of these causal processes. This information is necessary in order to design prevention and rehabilitation programs which are maximally efficient. Research to obtain this information would be difficult to design and carry out effectively. However, the results would have great value and would be useful in understanding the causal dynamics of delinquency--not just the delinquency of those with learning disabilities.

Second, do learning-disabled students commit a disproportionate number of the violent offenses in schools? Results of the cross-sectional study revealed that boys with learning disabilities engaged in more violence, e.g., assault with a dangerous weapon and gang

fighting, and experienced more school discipline problems than their non-learning-disabled peers. This suggests the possibility that the school might be the site of much of the learning-disabled adolescent's aggression. If school failure produces frustration and anger, then one might expect that much of it would be vented in close spatial and temporal proximity to school.

Third, do learning-disabled juvenile offenders have a higher probability of becoming career youthful and adult criminals? Considering the intellectual impairments and negative personality traits which frequently characterize learning-disabled adolescents, it is reasonable to suppose that they have less capability than the average offender to withdraw from a pattern of crime once it has been started. The general lack of appropriate remedial and other rehabilitative services increases the plausibility of the hypothesis that learning-disabled youthful offenders are at greater risk of becoming career criminals than are non-learning-disabled delinquents.

Fourth, are there particular intellectual, personality, social, educational, or family characteristics which either mitigate the deleterious effects of LD or make the individual more vulnerable to them? The results of one analysis in the longitudinal investigation (Broder & Dunivant, 1981) indicated that learning-disabilities made a bigger contribution to the growth of delinquency in children from middle-class families than they did to the development of delinquent behavior among learning-disabled children from lower-class families. Perhaps the middle-class family placed greater stress on achievement or fostered the development of high self-expectations of school success. This could have produced relatively more strain and delinquency when the

yough failed academically as a result of his learning disabilities. Conceivably there is a wide array of personality, cognitive, social, and other attributes which serve to increase or decrease the vulnerability of the child with LD. For example, one might suspect that learning-disabled children are more likely to have conflictual relations with their parents or to be abused by them. The hyperactivity, irritability, and lack of attention of children with LD could be expected occasionally to elicit strong negative parental reactions. Social control theory would predict higher rates of delinquency for learning-disabled youths if they did not experience the warm and supportive relations needed to bond, or attach, them strongly to their families. Learning-disabled children who have been abused may become exceptionally vulnerable to environmental stress, peer pressures, and other influences and, consequently, disproportionately violent. It would be extremely valuable to know what factors heighten or decrease the vulnerability of children with LD. With this knowledge the learning-disabled youths at greatest risk for delinquency could be identified and given special assistance. It might even be the case that some of the mitigating traits could be trained as part of a prevention or rehabilitatin strategy.

Fifth, can a method for assessing the presence of learning disabilities be devised which is faster and less costly but equally valid and reliable? The assesement technique developed for this research project required a professionally trained examiner to administer four individual tests of intelligence, achievement, and visual perception and to carefully evaluate the adolescent's behavior while taking the tests. Following testing, which usually lasted for 3.5 hours, the tests had to be scored by a specially trained professional. Then the test scores were

entered into a computer to be objectively evaluated by a program, which consisted of rules for defining and counting significant discrepancies between the scores. This assessment procedure is probably too expensive, time-consuming, and demanding of expertise, which is in relatively short supply, to be useful for large-scale prevention or even relatively limited remediation programs. Clearly the need exists for a method that provides quick, accurate, and inexpensive identification of learning disabilities. Exploratory analyses of the test data suggest that reliable assessments could be made on the basis of considerably less information. It seems possible to devise objective, reliable, and accurate means of assessing learning disabilities from the kinds of scores usually contained in school records or from a quick test (requiring less than one hour to complete), which teachers or probation officers could be easily trained to administer and score. The development of this kind of assessment procedure would greatly facilitate implementation of the preceding policy recommendations and investigation of the questions proposed for future research.

Sixth, do learning disabilities affect girls in the same way as they do boys? The analyses described in this report were based only on data from male adolescents. Are girls who suffer from learning disabilities at greater risk for delinquency than their non-learning-disabled peers? Although the percentage of girls who are officially delinquent and the percentage of girls who are learning-disabled are appreciably smaller than the corresponding percentages for boys, the question is, nonetheless, socially significant. Rationales can be advanced which would lead one to predict that LD would have both greater and lesser effects on girls than boys. Certainly this issue deserves to be resolved in the only way possible—by empirical study.

It is in the nature of scientific research for one inquiry to spawn two new questions while answering one. As a result of this project, there is now a new agenda for research on the link between LD and delinquency. This should not be discouraging, however. The deeper we pursue the sequence of questions, the closer we come to discovering the knowledge necessary to break the link, which is what has motivated our search from the beginning.

References

Arnold, W.R. Race and ethnicity relative to other factors in juvenile court dispositions. American Journal of Sociology, 1972, 77, 211-227.

Bacon, M.K., Child, I.L., & Barry, H. A cross-cultural study of correlates of crime. Journal of Abnormal and Social Psychology, 1963, 66, 291-300.

Bailey, W.C., & Peterson, R.D. Legal versus extra-legal determinants of juvenile court dispositions. Juvenile & Family Court Journal, 1981, (May), 41-59.

Barrows, T.B., Campbell, P.B., Slaughter, B.A., & Trainor, M.L. Psychoeducational diagnostic services for learing disabled youths: Research procedures. Princeton, N.J., Educational Testing Service, 1977.

Bender, L. Visual motor gestalt test. New York: American Orthopsychiatric Association, 1946.

Berger, A.S., & Simon, W. Black families and the Moyniham report: A research evaluation. Social Problems, 1974, 22, 146-161.

Berman, A. From the perspective of Allan Berman, Ph.D. In N.P. Ramos (Ed.), Delinquent youth and learning disabilities. San Rafael, Cal.: Academic Therapy Publications, 1978.

Bernstein, S., & Rulo, J.H. Learning disabilities and learning problems: Their implications for the juvenile justice system. Juvenile Justice, 1976, 24(4), 43-47.

Braithwaite, J. The mythe of social class and criminality reconsidered. American Sociological Review, 1981, 46, 36-57.

Broder, P.K., & Dunivant, N. Change in delinquent behavior as a function of learning disabilities: A two-year longitudinal study. Unpublished manuscript, 1980. (Available from the National Center for State Courts, 300 Newport Avenue, Williamsburg, VA 23185 for the cost of reproduction.)

Broder, P.K., Dunivant, N., Smith, E.C., & Sutton L.P. Further observations on the link between learning disabilities and juvenile delinquency. Journal of Educational Psychology, 1981, 73, 838-850. [See also erratum and Dunivant 1982 (a)].

Bryan, J.H., & Perlmutter, B. Female adults' immediate impressions of learning disabled children. Learning Disability Quarterly, 1979, 2(2), 80-88.

Bryan, J.H., & Sherman, R.E. Immediate impressions of nonverbal ingratiation attempts by learning disabled boys. Learning Disability Quarterly, 1980, 3(2), 19-28.

Bryan, J.H., Sherman, R.E., & Fisher, A. Learning disabled boys' nonverbal behaviors within a dyadic interview. Learning Disability Quarterly, 1980, 3(1), 65-72.

Burns, J.L. Delinquents failed by the system. Special Education, 1971, 60, 13-16.

Campbell, P.B. The definition and prevalence of learning disabilities. Paper presented at the 15th International Conference of the Association for Children with Learning Disabilities, Kansas City, Mo., March 1978.

Campbell, P.B., & Varvariv, D.S. Psychoeducational diagnostic services for learning disabled youths: Validation analysis. Unpublished manuscript, 2979. (Available for the Learning Disabilities/Juvenile Delinquency Project, National Center for State Courts, 300 Newport Avenue, Williamsburg, VA 23185 for the cost of reporduction.)

Carter, T.J. Juvenile court dispositions: A comparison of status and nonstatus offenders. Criminology, 1979, 17, 341-359.

Clelland, D., & Carter, T.J. The new myth of class and crime. Criminology, 1980, 18, 319-336.

Clinard, M.B., & Abbott, D.J. Crime in developing countries: A comparative perspective, New York: Wiley, 1973.

Cohen, J., & Cohen, P. Applied multiple regression/correlation analysis for the behavioral sciences. Hillsdale, N.J.: Lawrence Erlbaum, 1975.

Cohen, L.E. Juvenile dispositions: Social and legal factors related to the processing of Denver delinquency cases. Washington, D.C.: U.S. Government Printing Office, 1975.

Cohen, L.E., & Kluegel, J.R. Determinants of juvenile court dispositions: Ascriptive and achieved factors in two metropolitan courts. American Sociological Review, 1978, 43, 162-176.

Comptroller General of the United States. Learning disabilities: The link to delinquency should be determined, but schools should do more now. Washington, D.C.: General Accounting Office, 1977.

Connolly, A.J., Nachtman, W., & Pritchett, E.M. KeyMath diagnostic arithmetic test. Circle Pines, Minn.: American Guidance Service, 1976.

Coons, W.H. Learning disabilities and criminality. Unpublished manuscript, February 1981. (Available from Department of Psychology, York University, 4700 Keele Street, Downsview, Ontario M3J 1P3)

Corbett, J., & Vereb, T.S. Juvenile court statistics, 1974. Washington, D.C.: National Institute for Juvenile Justice and Delinquency Prevention/OJJDP, U.S. Department of Justice, 1975.

Cronk, M. The link between delinquency and students who fail. San Jose Mercury, 1977, 52, 46-47.

Crowne, D.P., & Marlowe, D. The approval motive: Studies in evaluative dependence. New York: Wiley, 1964.

Duling, F., Eddy, S., & Risko, V. Learning disabilities of juvenile delinquents. Morgantown, W.Va.: Department Educational Services, Robert F. Kennedy Youth Center, 1970.

Dunivant, N. A note on differences between learning-disabled and non-learning-disabled teenagers in delinquent behavior: Addendum to "Some Observations" and "Further Observations" reports. Williamsburg, VA.: National Center for State Courts, 1982 (a). (Available at the cost of reproduction.)

Dunivant, N. Improving academic skills and preventing delinquency of learning-disabled juvenile delinquents: Evaluation of the ACLD remediation program. Williamsburg, VA.: National Center for State Courts, 1982(b)--rev. 1984. (Available at the cost of reproduction).

Educational Testing Service. Michigan assessment of basic skills, From UMT, Book 2. Princeton, N.J.: Author, 1971.

Elliott, D.S. Social class and delinquent behavior in a national youth panel: 1976-1980. Paper presented at meetings of the American Society of Criminology, Washington, D.C., November 1981.

Elliott, D.S., & Ageton, S.S. Reconciling race and class differences in self-reported and official estimates of delinquency. American Sociological Review, 1980, 45, 95-110.

Elliott, D.S., & Ageton, S.S. The social correlates of delinquent behavior in a national youth panel. Paper presented at the meeting of the American Society of Criminology, Dallas, November 1978.

Elliott, D.S., & Voss, H. Delinquency and dropout. Lexington, Mass.: Heath, 1974.

Empey, L.T., & Lubeck, S.G. Explaining delinquency: Construction, test, and reformulation of a sociological theory. Lexington, Mass.: Lexington, 1971.

Erickson, M.L., & Smith, W.B., Jr. On the relationship between self-reported and actual deviance: An empirical test. Humbolt Journal of Social Relations, 1974, 2, 106-113.

Farrington, D. Self-reports of deviant behavior: Predictive and stable? Journal of Criminal Law, Criminology and Police Science, 1973, 64, 99-110.

Fienberg, S.E., & Picard, R.R. Designing surveys for measuring change in categorial structures overtime. In P.R. Krishnaiah (ed.), Multivariate analysis V. Amsterdam: North-Hollard, 1980.

Fisher, R. Borstal recall delinquency and the Cloward-Ohlin theory of criminal subcultures. British Journal of Criminology, 1970, 10, 52-63.

Fox, J. Effect analysis in structural equation models. Sociological Methods and Research, 1980, 9, 3-28.

Frease, D.E. Delinquency, social class and the schools. Sociology and Social Research, 1973, 57, 443-459.

Glueck, S., & Glueck, E. Unraveling juvenile delinquency. Cambridge, Mass.: Harvard University Press, 1951.

Gold, M. Status forces in delinquent boys. Ann Arbor: University of Michigan, Institute for Social Research, 1963.

Gold, M. Delinquent behavior in an American city. Belmont, Calif.: Brooks/Cole, 1970.

Gold, M., & Mann, D. Delinquency as defense. American Journal of Orthopsychiatry, 1973, 42, 463-479.

Gold, M., & Reimer, D.J. Changing patterns of delinquent behavior among Americans 13 to 16 years old - 1972 (Report No. 1 of the National Survey of Youth). Ann Arbor: University of Michigan, Institute for Social Research, 1974.

Goldman, N. The differential selection of juvenile offenders for court appearances. New York: National Council on Crime and Delinquency, 1963.

Golinvaux, J.P., & Janeksela, G.M. Strategic games in juvenile justice: A perspective on system-client interation. Juvenile & Family Court Journal, 1979, 30(3), 49-55.

Gordon, R.A. Prevalence: The rare datum in delinquency measurement and its implications for the theory of delinquency. In M.W. Klein (ed.), The juvenile justice system. Beverly Hills, Calif.: Sage, 1976.

Graydon, J. From the perspective of Lt. Jack Graydon. In N.P. Ramos (Ed.), Delinquent youth and learning disabilities. San Rafael, Cal.: Academic Therapy Publications, 1978.

Greguras, F.M., Broder, P.K., & Zimmerman, J.S. Establishing an operational definition of juvenile delinquency. Omaha, Neb.: Creighton University, Institute for Business, Law and Social Research, 1978. (Available from the National Center for State Courts, 300 Newport Avenue, Williamsburg, Virginia 23185 for the cost of reproduction.)

Grisso, T., & Lovinguth, T. Juveniles' definitions of legal defense and right to silence. Paper presented at meetings of the American Psychological Association, New York, September 1979. (Abstract)

Hale, C., Mariano, R.S., & Ramage, J.G. Finite sample analysis of misspecification in simultaneous equation models. Journal of the American Statistical Association, 1980, 75, 418-427.

Hanushek, E.A., & Jackson, J.E. Statistical methods for social scientists. New York: Academic Press, 1977.

Hardt, R.H., & Bodine, G. Development of self-report instruments in delinquency research. Syracuse, N.Y.: Syracuse University, Youth Development Center, 1965.

Hardt, R.H., & Peterson-Hardt, S. On determining the quality of the delinquency self-report method. Journal of Research in Crime and Delinquency, 1977, 14, 247-261.

Harrell, F. The LOGIST procedure. In SAS Institute, SAS supplemental library user's guide, 1980 edition. Cary, N.C.: Author, 1980.

Hassall, P. Schools and delinquency: A self-report study of delinquency in Christchurch, New Zealand. Paper presented at the meeting of the Sociological Association of Australia and New Zealand, University of New England, Australia, 1974.

Hindelang, M.J. Causes of delinquency: A partial replication and extension. Social Problems, 1973, 20, 471-487.

Hindelang, M.J., Hirschi, T., & Weiss, J.G. Correlates of delinquency: The illusion of discrepancy between self-report and official measures. American Sociological Review, 1979, 44, 995-1014.

Hirschi, T. Causes of delinquency. Berkeley, Calif.: University of California Press, 1969.

Hirschi, T., & Hindelang, M.J. Intelligence and delinquency: A revisionist review. American Sociological Review, 1977, 42, 571-587.

Horwitz, A., & Wasserman, M. Formal rationality, substantive justice, and discrimination: A study of a juvenile court. Law and Human Behavior, 1980, 4, 103-115.

Illinois Institute for Juvenile Research. Juvenile delinquency in Illinois. Chicago: Illinois Department of Mental Health, 1973.

Jacobson, F.N. The juvenile court judge and learning disabilities. Reno, Nev.: National Council of Juvenile Court Judges, 1976.

Jensen, G.F. Race, achievement and delinquency: A further look at delinquency in a birth cohort. American Journal of Sociology, 1976, 82, 379-387.

Jerse, F.W., & Fakouri, M.E. Juvenile delinquency and academic deficiency. Contemporary Education, 1978, 49(2), 106-109.

Johnson, R.E. Are adolescent theft, vandalism, and assault due to the same causal processes? International Journal of Comparative and Applied Criminal Justice, 1979, 3, 59-68.

Johnson, R.E. Social class and delinquent behavior: A new test. Criminology, 1980, 18, 86-93.

Johnstone, J.W.C. The family and delinquency: A reappraisal. Unpublished manuscript, Institute for Juvenile Justice, Chicago, 1976.

Kelly, D.H. School failure, academic self-evaluation and school avoidance and deviant behavior. Youth and Society, 1971, 2, 489-503.

Kelly, D.H., & Balch, R.W. Social origins and school failure: A reexamination of Cohen's theory of working-class delinquency. Pacific Sociological Review, 1971, 14, 413-430.

Kenny, D.A. Correlation and causality. New York: Wiley, 1979.

Krohn, M.D., Akers, R.L., Radosevich, M.J., & Lanza-Kaduce, L. Social status and deviance: Class context of school, social status, and delinquent behavior. Criminology, 1980, 18, 303-318.

Kruttschnitt, C. Social status and sentences of female offenders. Law & Society Review, 1980, 15(2), 247-265.

Kvaraceus, W.C. Juvenile delinquency and the school. New York: World Book, 1945.

Lane, B.A. The relationship of learning disabilities to juvenile delinquency: Current status. Journal of Learning Disabilities, 1980, 13, 21-29.

Lamphier, C.M., & Faulkner, J.E. Deviance in a middle-class community. International Journal of Comparative Sociology, 1970, 11, 146-156.

Lunden, W.A. Statistics on delinquents and delinquency. Springfield, Ill.: Thomas, 1964.

Mauser, A.J. Learning disabilities and delinquent youth. Academic Therapy, 1974, 9(6), 389-400.

McCord, J. Some child-rearing antecedents of criminal behavior in adult men. Journal of Personality and Social Psychology, 1979, 37, 1477-1486.

McDonald, Learning disabilities as possible factors in delinquency. California Youth Authority Quarterly, 1977, 30, 35.

McEachern, A.W., & Banzer, R. Factors related to disposition in juvenile police contacts. In W. Klein & B.G. Myerhoff (Eds.), Juvenile gangs in context. Englewood Cliffs, N.J.: Prentice-Hall, 1967.

Mugishima, F., & Matsumoto, Y. An analysis of delinquent differentiation related to boys' social origin and education attainment. Reports of the Japanese Research Institute of Police Science, 1973, 14.

Murray, C.A. The link between learning disabilities and juvenile delinquency: Current theory and knowledge. Washington, D.C.: U.S. Government Printing Office, 1976.

Neter, J., & Wasserman, W. Applied linear statistical models: Regression, analysis of variance, and experimental designs. Homewood, Ill.: Irwin, 1974.

Nettler, G. Explaining crime. New York: McGraw-Hill, 1974.

Nye, F.I., & Short, J.F., Jr. Scaling delinquent behavior. American Sociological Review, 1957, 22, 326-331.

Offord, D.R., Poushinsky, M.F., & Sullivan, K. School performance, IQ and delinquency. British Journal of Criminology, 1978, 18, 110-127.

Phillips, J.C. The creation of deviant behavior in high schools: An examination of Cohen's general theory of subcultures. Unpublished doctoral dissertation, University of Oregon, 1974.

Phillips, J.C., & Kelly, D.H. School failure and delinquency: Which causes which? Criminology, 1979, 17, 194-207.

Piliavin, I., & Briar, S. Police encounters with juveniles. American Journal of Sociology, 1964, 70, 206-214.

Podboy, J.W., & Mallory, W.A. The diagnosis of specific learning disabilities in a delinquent population. Federal Probation, 1978, 42(3), 26-33.

Polk, K. Those who fail. Eugene, Oregon: Lane County Youth Project, 1965.

Polk, K., & Halferty, D.S. Adolescence, commitment and delinquency. Journal of Research in Crime and Delinquency, 1966, 3, 82-96.

Poole, E.D., & Regoli, R.M. An analysis of the determinants of juvenile court dispositions. Juvenile & Family Court Journal, 1980, 31(3), 23-32.

Pope, C.E., & Feyerherm, W.H. Race and juvenile court dispositions: An examination of initial screening decisions. Criminal Justice and Behavior, 1981, 8, 287-301.

Post, C.H. The link between learning disabilities and juvenile delinquency: Cause, effect and "present solutions." Juvenile & Family Court Journal, 1981, February/March, 58-68.

Reiss, A.J., & Rhodes, A.L. The distribution of juvenile delinquency in the social class structure. American Sociological Review, 1961, 26, 720-732.

Rhodes, A.L., & Reiss, A.J. Apathy, truancy and delinquency as adaptations in school. Social Forces, 1969, 48, 12-22.

SAS Institute. SAS User's Guide, 1979 Edition. Raleigh, N.C.: Author, 1979.

Sawicki, D., & Schaeffer, B. An affirmative approach to the LD/JD link. Juvenile & Family Court Journal, 1979, 30(2), 11-16.

Scarpatti, F., & Stephenson, R. Juvenile court dispositions: Factors in the decision making process. Crime and Delinquency, 1971, 17 (April), 142-151.

Sellin, T., & Wolfgang, M.E. The measurement of delinquency. New York: Wiley, 1964.

Shafer, W.E., & Polk, K. Delinquency and the schools. In the President's Commission on Law Enforcement and Administration of Justice, Task Force Report: Juvenile Delinquency and Youth Crime. Washington, D.C.: U.S. Government Printing Office, 1967, pp. 222-229.

Short, J.F., Jr., & Strodtbeck, F.L. Group process and gang delinquency. Chicago: University of Chicago Press, 1965.

Sieverdes, C. Differential disposition of juvenile offenders: A study of juvenile court labeling. Unpublished doctoral dissertation, Mississippi State University, 1973.

Smykla, J.O., & Willis, T.W. The incidence of learning disabilities and mental retardation in youth under the jurisdiction of the juvenile court. Unpublished report, 1980. (Available from Criminal Justice Program, University of Alabama, University, Alabama 35486.)

Stark, R. Whose status counts? Comment on Title, Villemez and Smith. American Sociological Review, 1979, 44, 668-669.

Sullinger, T.E. Social determinants in juvenile delinquency. New York: Wiley, 1936.

Swanstrom, W., Randle, C., Livingston, V., Macrafic, K., Caufield, M., & Arnold, S. Blue Earth/Nicollet Counties Prevalence Study. Unpublished manuscript, Dodge-Fillmore & Olmstead County Community Corrections Learning Disabilities Research Project (Rochester, Minn.), 1977.

Swanstrom, W.J., Randle, C.W., & Offord, K. The frequency of learning disability: A comparison between juvenile delinquent and seventh grade populations. Unpublished manuscript, Dodge-Fillmore & Olmsted County Community Corrections Learning Disabilities Research Project (Rochester, Minn.), 1979.

Terry, R. Discrimination in the handling of juvenile offenders by social control agencies. Journal of Research in Crime and Delinquency, 1967, 4, 218-230.

Thomas, C.W., & Cage, R.J. The effect of social characteristics on juvenile court dispositions. Sociological Quarterly, 1977, 18, 237-252.

Thomas, C., & Sieverdes, C.M. Juvenile court intake: An analysis of discretionary decisionmaking. Criminology, 1975, 12, 413-432.

Thornberry, T. Race, socioeconomic status, and sentencing in the juvenile justice system. Criminology, 1973, 64, 90-98.

Thornberry, T.P. Sentencing disparities in the juvenile justice system. Journal of Criminal Law and Criminology, 1979, 70, 164-171.

Thornberry, T.P., & Farnworth, M. Educational attainment and adult criminality. Paper presented at meetings of The American Society of Criminology, Washington, D.C., November 1981.

Thrasher, F. The gang. Chicago: University of Chicago Press, 1963. (Originally published 1927.)

Tittle, C.R. The theoretical inadequacy of a class/criminology linkage. Paper presented at meetings of the American Society of Criminology, Washington, D.C., November 1981.

Tittle, C.R., & Villemez, W. Social class and criminality. Social Forces, 1977, 56, 474-503.

Tittle, C.R., Villemez, W.J., & Smith, D.A. The myth of social class and criminality: An empirical assessment of the empirical evidence. American Sociological Review, 1978, 43, 643-656.

Toby, E.J., Toby, M.L. Law school status as a predisposing factor in subcultural delinquency. New Brunswick, N.J.: Rutgers University, 1957.

Unger, K.V. Learning disabilities and juvenile delinquency Journal of Juvenile and Family Courts, 1978, 29(1), 25-30.

Wadsworth, M.E. Roots of delinquency. New York: Barnes & Noble, 1979.

Wechsler, D. Wechsler intelligence scale for children - Revised. New York: The Psychological Corporation, 1974.

Weis, J.G. Delinquency among the well-to-do. Unpublished doctoral dissertation, University of California, Berkeley, 1973.

Weis, J.G. One more time: Social class and delinquency. Paper presented at meetings of the American Society of Criminology, Washington, D.C., November 1981.

Wellford, C. Labeling theory and criminology: An assessment. Social Problems, 1975, 22, 332-345.

Werner, E.E., & Smith, R.S. An epidemologic perspective on some antecedents and consequences of childhood mental health problems and learning disabilities. Journal of Child Psychiatry, 1979, 18, 292-306.

Williams, J.R., & Gold, M. From delinquent behavior to official delinquency. Social Problems, 1972, 20, 209-229.

Willie, C.V. The relative contribution of family status and economic status to juvenile delinquency. Social Problems, 1967, 14, 326-335.

Wolfgang, M., Figlio, R.M., & Sellin, T. Delinquency in a birth cohort. Chicago: University of Chicago Press, 1972.

Woodcock, R.W. Woodcock reading mastery tests. Circle Pines, Minn.: American Guidance Service, 1973.

Zimmerman, J., Rich, W.D., Keilitz, I., & Broder, P.K. Some observations on the link between learning disabilities and juvenile delinquency. Journal of Criminal Justice, 1981, 9, 1-17.

Footnotes

The preparation of this report was supported by Grant Number 78-JN-AX-0028 from the National Institute for Juvenile Justice and Delinquency Prevention, Office of Juvenile Justice and Delinquency Prevention, U.S. Department of Justice. Points of view or opinions in this paper are those of the author and do not necessarily represent the official position or policies of the U.S. Department of Justice or the National Center for State Courts. I wish to express my appreciation to Jack Infinger for his assistance in data processing. The assistance and cooperation of the many representatives of community agencies and organizations who cooperated in the implementation of this research is gratefully acknowledged. The participating agencies included the public school systems of Baltimore, Maryland, Indianapolis, Indiana, and Phoenix Arizona; the juvenile courts of Maricopa County, Marion County, and Madison County, and the Juvenile Division of the Supreme Bench of Baltimore City; the Indiana and Arizona departments of corrections and the Maryland Juvenile Services Administration. In addition, I would like to express my sincere gratitude to the hundreds of youths and their parents, who--through their willingness to participate--made this research possible. Paul K. Broder, Pamela Swain, and Joel Zimmerman made valuable suggestions on earlier drafts of this report.

Correspondence concerning the reported research should be sent to Institute on Mental Disability and The Law, National Center for State Courts, 300 Newport Avenue, Williamsburg, Virginia 23185.

[1]The original article (Broder et al., 1981) mistakenly reported that learning-disabled boys evidenced less delinquent behavior than their non-learning-disabled peers. In actuality, the mean frequency of general delinquent behavior was greater for youths with LD than for teenagers who were not similarly handicapped. (See Dunivant, 1982a and Correction to Broder et al.)

[2]The relationship between social class and delinquency has been vigorously debated in the literature on the sociology of crime. For the evidence supporting the view that the relationship is either nonexistent or unimportant, see Johnson (1979), Krohn, Akers, Radosevich, & Lanza-Kaduce (1980), McCord (1979), Title (1981), Title & Villemez (1977), Villemez, & Smith (1978).

[3]Several studies have failed to show that nonlegal factors affect the severity of juvenile court dispositions (Cohen, 1975; Cohen & Kluegel, 1978; McEachern & Bauzer, 1967; Terry, 1967; Wellford, 1975).

[4]It should be pointed out that the sample in this investigation overlapped somewhat with the samples used by Zimmerman et al. (1981) and Broder et al. (1981). Zimmerman et al. (1981) analyzed data from a subset of the boys included in the present study and from a small sample of delinquent girls ($\underline{N}$ = 107). The sample in Broder et al. (1981) was a proper subset of the sample used in this study. Broder et al. (1981) chose only boys who were between 12 and 15 years old. No age restrictions were imposed on the sample used for the causal analyses reported in this paper.

[5]Written informed consent was sought from the parents or guardians of each prospective participant. Except for the superintendents of training schools, who gave consent for the youths in their custody, the initial contacts were made by mail. These were followed by telephone calls whenever possible, follow-up letters, and, in some instances, personal visits. Those who consented represented approximately 36 percent of those contacted initially. The consent rates for the adjudicated and nonadjudicated groups were approximately 34 percent and 37 percent, respectively. Because of time limitations, logistical constraints and the requirements for being included in the study, not all youths for whom consent was received were included in the final sample. Those who were included represented approximately half of those for whom consent was received. In addition to written parental consent, verbal consent was obtained personally from each participant.

[6]The validity and reliability of self-report measures, such as GSRD, have been assessed by Erickson and Smith (1974), Farrington (1973), Hardt and Peterson-Hardt (1977), and Hindelang, Hirschi, and Weis (1979).

[7]Separate path analyses carried out using sum of frequency measures of property offenses and crimes against persons (see Method section). The effects of LD on these two types of offenses were approximately equal. Thus, the results are consistent with the expectations derived from frustration-agression and economic incentive hypotheses. Since the analyses of the raw total and logarithmic transformed scores yielded results that were closely similar, only the raw score analyses have been included in this report.

[8]Probabilities (P) and odds (O) are interchangeable ways of quantifying the chances that a given event will occur. The formula for odds in terms of probabilities is O = P/(1-P). The equivalent formula for probability is P = O/(1+O).

[9]Probability and odds estimates were computed by substituting group means on these variables in the regression equations estimated by PROC LOGIST.

Table 1

Descriptive Statistics for Learning-disabled and Non-learning-disabled Teenagers Who Had Not Been Adjudicated Delinquent

Variable	Non-learning-disabled			Learning-disabled		
	N	M	SD	N	M	SD
AGE	788	14.11	.98	184	14.25	1.03
INTACT	783	.71	.45	184	.71	.45
NUMCHILD	789	4.12	2.18	184	4.21	2.10
SOCSTAT	789	.50	1.39	184	.26	1.43
SA	788	.66	.26	184	.62	.27
SD	787	.55	.20	184	.54	.20
GSRD	786	66.37	119.24	184	47.32	69.23
SSRD	786	2.38	.88	184	2.37	.90

Table 2

Descriptive Statistics for Learning-disabled and Non-learning disabled Teenagers Who Had Been Adjudicated Delinquent

Variable	NLD			LD		
	N	M	SD	N	M	SD
AGE	641	15.50	1.14	329	15.35	1.16
INTACT	628	.61	.49	325	.64	.48
NUMCHILD	641	5.66	2.81	329	5.26	2.90
SOCSTAT	641	- .51	1.65	329	- .30	1.62
SA	637	.53	.30	329	.50	.31
SD	636	.52	.20	329	.52	.21
GSRD	636	330.62	350.06	328	388.24	371.46
SSRD	636	2.73	.41	328	2.77	.38

Table 3

Frequencies of Subgroups of NLD/LD by NJD/JD Cross-classification

Variable	Non-learning-disabled		Learning-disabled	
	NJD (N = 789)	JD (N = 641)	NJD (N = 184)	JD (N = 329)
Ethnicity				
White	478	221	104	158
Black	214	325	45	100
Other	77	84	29	67
City				
Baltimore	152	274	39	89
Indianapolis	343	178	49	68
Other	294	189	96	172
Institutionalized				
No	--	324	--	317
Yes	--	177	--	152

Note. Frequencies include only those participants without missing data on the indicated variables.

Table 4

Multiequation Model of the Effects of Learning Disabilities on Self-Reported and Adjudicated Delinquency

Equation	Intercept	Jointly Determined Variables	Predetermined Variables	Error
(1) LD	$= b_1 +$		b_2 AGE + b_3 INTACT + b_4 NUMCHILD + b_5 BLACK + b_6 OTHER + B_{17}SOCSTAT +	E_1
(2) SA	$= b_8 +$	b_9 LD +	b_{10}AGE + b_{11}INTACT + b_{12}NUMCHILD + b_{13}BLACK + b_{14}OTHER + B_{15}SOCSTAT +	E_2
(3) SD	$= b_{16} +$	0 + b_{17}LD +	b_{18}AGE + b_{19}INTACT + b_{20}NUMCHILD + b_{21}BLACK + b_{22}OTHER + B_{23}SOCSTAT +	E_3
(4) GSRD	$= b_{24} +$	b_{25}SD + b_{25}SA + b_{27}LD +	b_{28}AGE + b_{29}INTACT + b_{30}NUMCHILD + b_{31}BLACK + b_{32}OTHER + B_{33}SOCSTAT +	E_4
(5) SSRD	$= b_{34} +$	0 + b_{35}SD + b_{35}SA + b_{37}LD +	b_{38}AGE + b_{39}INTACT + b_{40}NUMCHILD + b_{41}BLACK + b_{42}OTHER + B_{43}SOCSTAT +	E_5
(6) POLICE	$= b_{44} +$	b_{45}SSRD + b_{46}GSRD + b_{47}SD + b_{48}SA + b_{49}LD +	b_{50}AGE + b_{51}INTACT + b_{52}NUMCHILD + b_{53}BLACK + b_{54}OTHER + B_{55}SOCSTAT +	E_6
(7) OAD	$= b_{56} +$	b_{57}POLICE + b_{58}SSRD + b_{59}GSRD + b_{60}SD + b_{61}SA + b_{62}LD +	b_{63}AGE + b_{64}INTACT + b_{65}NUMCHILD + b_{66}BLACK + b_{67}OTHER + B_{68}SOCSTAT +	E_7

Table 5

Intercorrelations Among Variables in the Causal Model for Adjudication and Descriptive Statistics

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. AGE													
2. INTACT	-049*												
3. NUMCHILD	194***	028											
4. BLACK	048*	-209***	182***										
5. OTHER	029	014	070**	-287***									
6. SOCSTAT	-069**	143***	-178***	-100***	-161***								
7. LD	078***	004	011	-087***	097***	-042							
8. SA	-164***	-026	004	141***	-021	074***	-092***						
9. SD	-058**	014	-036	005	-038	052*	-025	-035					
10. GSRD	393***	017	169***	-069**	073***	-099***	119***	-295***	-027				
11. SSRD	245***	-017	091***	-051*	062**	-077***	056**	-186***	066**	266***			
12. POLICE	402***	-055*	218***	117***	060**	-193***	123***	-238***	-041	424***	277***		
13. JD	520***	-099***	264***	183***	068**	-285***	170***	-223***	-085***	478***	263***	651***	
N	1967	1945	1968	1968	1968	1968	1943	1962	1960	1958	1958	1936	1968
M	14.79	.665	4.83	.352	.132	.010	.264	.586	.533	205.9	2.55	.598	.497
SD	1.26	.472	2.62	.478	.339	1.59	.441	.290	.201	300.96	.719	.491	.500

Note. Decimals omitted in correlations.

* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 6
Intercorrelations Among Variables in the Causal Model for Institutionalization and Descriptive Statistics

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1.	AGE												
2.	INTACT	-019											
3.	NUMCHILD	112	065*										
4.	BLACK	042	-146***	159***									
5.	OTHER	-029	-010	057	-379***								
6.	SOCSTAT	105***	084**	-109***	056	-198***							
7.	LD	-060	037	-068*	-194***	095**	059						
8.	SA	-001	-101***	118***	254***	-008	013	-059					
9.	SD	-059	-037	-034	047	-036	-017	003	-023				
10.	GSRD	200***	097**	052	-225***	058	042	076*	-228***	004			
11.	SSRD	105***	-065*	034	-139***	078*	-046	048	-083**	-010	260***		
12.	INSTIT	215***	-088**	046	207***	-042	132***	-031	080*	-095**	189***	088**	
	N	979	962	979	979	979	979	970	975	974	973	973	979
	M	15.45	.617	5.52	.439	.155	-.445	.339	.521	.515	350.63	2.75	.483
	SD	1.15	.486	2.84	.497	.362	1.648	.474	.302	.201	357.87	.40	.500

Note. Decimals omitted in correlations.

*p < .05.
**p < .01.
***p < .001.

Table 7
Decomposition of the Effects from Path Analysis for JD

	Causal Effects			Noncausal	
	Direct Effect	Indirect Effect	Total Causal Effect	Covariation	R^2
Effects on LD					.019
of AGE	.027	0	.027	-.000	
of INTACT	-.007	0	-.007	.007	
of NUMCHILD	-.001	0	-.001	.002	
of BLACK	-.067	0	-.067	-.010	
of OTHER	.082	0	.082	.037	
of SOCSTAT	-.010	0	-.010	-.002	
Effects on SA					.064
of LD	-.043	0	-.043	-.017	
of AGE	-.040	-.001	-.041	.002	
of INTACT	-.008	.000	-.007	-.007	
of NUMCHILD	.002	.000	.002	-.002	
of BLACK	.098	.003	.101	-.017	
of OTHER	.050	-.004	.047	-.057	
of SOCSTAT	.016	.000	.017	-.003	
Effects on SD					.009
of LD	-.008	0	-.008	-.004	
of AGE	-.010	-.000	-.010	-.001	
of INTACT	.002	.000	.002	.002	
of NUMCHILD	-.002	.000	-.002	-.001	
of BLACK	.003	.001	-.003	-.001	
of OTHER	-.018	-.001	-.018	-.006	
of SOCSTAT	.004	.000	.004	.002	
Effects on GSRD					.234
of SA	-233.14	0	-233.4	-77.23	
of SD	-12.11	0	-12.11	-54.46	
of LD	44.96	10.03	54.99	38.06	
of AGE	79.47	10.92	90.39	4.49	
of INTACT	14.37	1.37	15.74	-1.88	
of NUMCHILD	12.36	-.59	11.77	7.77	
of BLACK	-40.59	-26.67	-67.25	22.05	
of OTHER	18.06	-6.99	11.08	53.70	
of SOCSTAT	-8.69	-4.35	-13.03	-6.04	

	Causal Effects			Noncausal	
	Direct Effect	Indirect Effect	Total Causal Effect	Covariation	R^2
Effects on SSRD					.099
of SA	-.341	0	-.341	-.115	
of SD	.273	0	.273	-.084	
of LD	.028	.012	.040	.059	
of AGE	.121	.012	.133	.006	
of INTACT	-.023	.003	-.020	-.005	
of NUMCHILD	.013	-.001	.012	.012	
of BLACK	-.074	-.036	-.109	.033	
of OTHER	.065	-.019	.046	.087	
of SOCSTAT	-.023	-.005	-.028	-.010	
Effects on POLICE					.321
of GSRD	.0004	0	.0004	.0003	
of SSRD	.089	0	.089	.085	
of SA	-.187	-.124	-.310	-.217	
of SD	-.051	.020	-.031	-.077	
of LD	.067	.034	.100	.068	
of AGE	.086	.058	.144	.014	
of INTACT	-.015	.005	-.010	-.052	
of NUMCHILD	.015	.005	.020	.021	
of BLACK	.137	-.060	.077	.043	
of OTHER	.048	.006	.054	.027	
of SOCSTAT	-.030	-.012	-.042	-.018	
Effects on JD					.478
of POLICE	.400	0	.400	.265	
of GSRD	.0003	.0002	.0005	.0005	
of SSRD	.023	.036	.059	.145	
of SA	-.062	-.202	-.264	-.333	
of SD	-.100	-.010	-.110	-.139	
of LD	.088	.061	.149	.104	
of AGE	.098	.094	.192	.018	
of INTACT	-.029	.000	-.029	-.082	
of NUMCHILD	.009	.012	.021	.030	
of BLACK	.142	-.004	.138	.058	
of OTHER	.045	.032	.077	.026	
of SOCSTAT	-.042	-.024	-.066	-.025	

Table 8
Decomposition of the Effects from Path Analysis for INSTIT

	Causal Effects			Noncausal	
	Direct Effect	Indirect Effect	Total Causal Effect	Covariation	R^2
Effects on LD					.048
of AGE	-.025	0	-.025	-.002	
of INTACT	.007	0	.007	.251	
of NUMCHILD	-.006	0	-.006	-.007	
of BLACK	-.165	0	-.165	-.018	
of OTHER	.048	0	.048	.065	
of SOCSTAT	.023	0	.023	-.005	
Effects on SA					.084
of LD	-.008	0	-.008	-.032	
of AGE	-.005	.000	-.005	.005	
of INTACT	-.039	.000	-.039	-.239	
of NUMCHILD	.009	.000	.009	.003	
of BLACK	.163	.001	.164	-.010	
of OTHER	.085	.000	.085	-.084	
of SOCSTAT	.004	.000	.004	-.004	
Effects on SD					.013
of LD	.005	0	.005	-.004	
of AGE	-.012	.000	-.012	-.001	
of INTACT	-.011	.000	-.011	-.033	
of NUMCHILD	-.003	.000	-.003	.000	
of BLACK	.022	.001	.023	.002	
of OTHER	-.016	.000	-.016	-.008	
of SOCSTAT	-.004	.000	-.004	.000	
Effects on GSRD					.140
of SA	-220.266	0	-220.266	-70.913	
of SD	42.146	0	42.146	-74.608	
of LD	37.550	1.931	39.481	25.223	
of AGE	62.222	.891	63.113	.166	
of INTACT	35.523	.276	35.799	269.804	
of NUMCHILD	11.160	-.237	10.923	-1.953	
of BLACK	-138.295	-6.488	-144.783	15.692	
of OTHER	-6.254	1.895	-4.359	84.809	
of SOCSTAT	7.170	.909	8.079	1.928	

	Causal Effects			Noncausal	
	Direct Effect	Indirect Effect	Total Causal Effect	Covariation	R^2
Effects on SSRD					.046
of SA	-.086	0	-.086	-.038	
of SD	-.035	0	-.035	-.035	
of LD	.023	.001	.024	.011	
of AGE	.036	.001	.037	-.002	
of INTACT	-.072	.000	-.072	.172	
of NUMCHILD	.007	.000	.007	-.002	
of BLACK	-.098	.004	-.102	.015	
of OTHER	.012	.001	.013	.072	
of SOCSTAT	-.012	.001	-.013	-.002	
Effects on INSTIT					.162
of GSRD	.000	0	0	-.000	
of SSRD	.086	0	0	.022	
of SA	.105	-.007	.098	.045	
of SD	-.228	-.003	-.231	.014	
of LD	.004	.002	.006	-.034	
of AGE	.060	.000	.060	.009	
of INTACT	-.067	.000	-.067	-.297	
of NUMCHILD	-.003	.000	-.003	.006	
of BLACK	.257	.000	.257	-.001	
of OTHER	.089	.000	.089	-.145	
of SOCSTAT	.033	.000	.033	.004	

Table 9

Raw and Residualized SRD Item Means for Learning-Disabled and Non-Learning-Disabled Boys

Item[a]	Severity Scale Value[b]	Raw Means		Residualized Means[e]	
		LD[c]	NLC[d]	LD	NLD
Use of Force					
Had a fist fight in which someone got hurt badly enough to go to a doctor or hospital	5	3.9	2.7**	3.7	2.7*
Carried a weapon like a gun, knife, or razor in case you had to use it against another person	3	17.7	12.6***	16.8	13.1**
Taken part in a gang fight	4	7.2	3.8***	7.0	4.0***
Used a weapon like a brick, knife, or razor in a fight	5	4.4	3.0*	4.2	3.1
Major Theft					
Taken at least $20 or something worth $20 that did not belong to you	3	10.2	6.3***	9.6	6.6***
Broken into someone's home, or a store, or some other place in order to steal something	4	6.5	3.4***	6.1	3.6***
Used force or threatened to use force to get money from another person	4	2.2	1.9	2.2	1.9
Auto Theft					
Ridden around in a car that was stolen just for the ride	3	2.4	2.0	2.3	2.1
Stripped someone else's car of parts to use or sell	3	2.5	1.1***	2.4	1.1**
Stolen a car	4	1.8	1.4	1.6	1.5

Table 5, cont.

Raw and Residualized SRD Item Means for Learning-Disabled and Non-Learning-Disabled Boys

Item[a]	Severity Scale Value[b]	Raw Means		Residualized Means[e]	
		LD[c]	NLC[d]	LD	NLD
Minor Theft					
Taken things that don't cost too much from home or school without permission	3	10.9	8.5**	10.3	8.7
Taken something small from a store	3	16.2	11.3***	15.4	11.5***
Kept or used something that you knew had been stolen	3	11.2	6.9***	10.7	7.0***
Drug Use					
Used LSD, mescaline, or other psychedelics	3	3.0	2.6	2.5	2.8
Used downers or barbituates without a prescription	3	5.1	3.8	4.4	4.1
Used methedrine (speed) or other uppers or amphetamines without a prescription	3	5.4	3.8*	4.7	4.1
Auto Theft					
Drank beer, wine, or liquor without parent's permission	2	30.9	22.6***	28.3	23.5***
Been drunk	2	21.0	12.8***	18.7	13.7***
Bought beer, wine, or liquor	2	10.7	8.0**	9.7	8.3
Used marijuana or hashish (grass, pot, hash)	2	32.8	22.0***	31.9	23.0***
Speeding or Reckless Driving					
Driven a car too fast or recklessly	2	4.4	2.6*	4.0	2.8*

Table 9, cont.

Raw and Residualized SRD Item Means for Learning-Disabled and Non-Learning-Disabled Boys

Item[a]	Severity Scale Value[b]	Raw Means		Residualized Means[e]	
		LD[c]	NLC[d]	LD	NLD
Vandalism					
Deliberately damaged private or public property	2	6.3	5.4	6.0	5.5
School-Related Misbehavior					
Cheated on an exam in school or turned in work that was not your own	0	13.3	11.3	12.7	11.5
Stayed away from school for at least part of the day because you wanted to	1	21.9	14.9***	20.2	15.5***
Been suspended from school	0	6.1	5.0	6.1	5.0
Been thrown out of class by a teacher	0	11.9	9.2**	11.6	9.3**

[a]Items were presented during a interview introduced with the question, "How many times have you ever?" Frequencies up to maximums of 99 were recorded for each item.

[b]The seriousness scale ranged in value from 0 to 5 and is described in the Method section under SSRD.

[c]The number of learning-disabled (LD) boys responding to each item ranged from 495 to 511.

[d]The number of non-learning disabled (NLD) boys responding to each item ranged from 1,365 to 1,402

[e]Residualized, or least square, means were estimated using PROC GLM of the SAS package (SAS Institute, 1980). The effects of age, intactness of family, number of children in family, ethnicity, and social status were controlled.

* $p < .10$.

** $p < .05$.

*** $p < .01$.

Table 10

Estimates of Probabilities and Odds of Having
Official Contacts With Juvenile Justice System
for Learning-Disabled and Non-Learning-Disabled Boys

Group/Odds Differential[a]	Unweighted[d] P[b]	Unweighted[d] O[c]	Weighted[e] P	Weighted[e] O	Control 1[f] P	Control 1[f] O	Control 2[g] P	Control 2[g] O
Probability/Odds of Being Picked Up by the Police[h]								
LD	.70	2.33:1	.38	.61:1	.71	2.46:1	.80	4.08:1
NLD	.56	1.27:1	.29	.41:1	.59	1.46:1	.73	2.23:1
Odds Differential		1.81***		---		1.69***		1.30**
Probability/Odds of Being Officially Adjudicated Delinquent[i]								
LD	.64	1.78:1	.09	.10:1	.67	1.99:1	.74	2.84:1
NLD	.45	.82:1	.04	.04:1	.44	.78:1	.53	1.13:1
Odds Differential		2.20***		---		2.55***		2.51***
Probability/Odds of Being Institutionalized Following Adjudication[j]								
LD	.46	.85:1	.46	.85:1	.49	.97:1	.49	.94:1
NLD	.49	.96:1	.50	1.00:1	.47	.90:1	.48	.92:1
Odds Differential		.88		---		1.07		1.02

[a]The Odds Differential is the ratio of the odds of the specified outcome (being picked up, being adjudicated, or being institutionalized) for the learning-disabled (LD) boys to the odds for the non-learning-disabled (NLD) boys.

[b]P is the probability of the specified outcome for the designated group.

[c]O is the odds of the specified outcome for the designated group.

[d]The unweighted probabilities correspond to the actual proportions of LD and NLD boys in the sample who were picked up, adjudicated, or institutionalized.

[e]The weighted probabilities correspond to the sample proportions which have been weighted to make the sample more representative of the U.S. youth population.

[f]Control 1 probability estimates were obtained from logistic regression analysis controlling for the effects of age, intactness of family, number of children in the family, ethnicity, and social status.

[g]Control 2 probability estimates were obtained from logistic regression analysis controlling for the effects of age, intactness of family, number of children in the family, ethnicity, social status, and frequency of general self-reported delinquency.

[h]N = 1,912.

[i]N = 1,943.

[j]N = 970.

*p < .05.

**p < .01.

***p < .001.

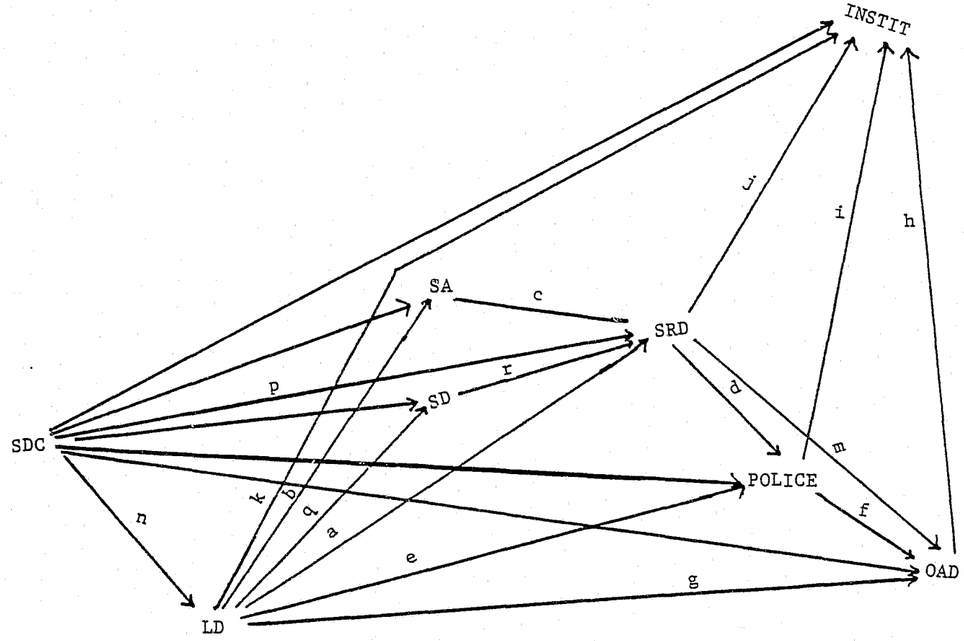

Figure 1. Causal model depicting hypothesized effects of learning disabilities on delinquency.

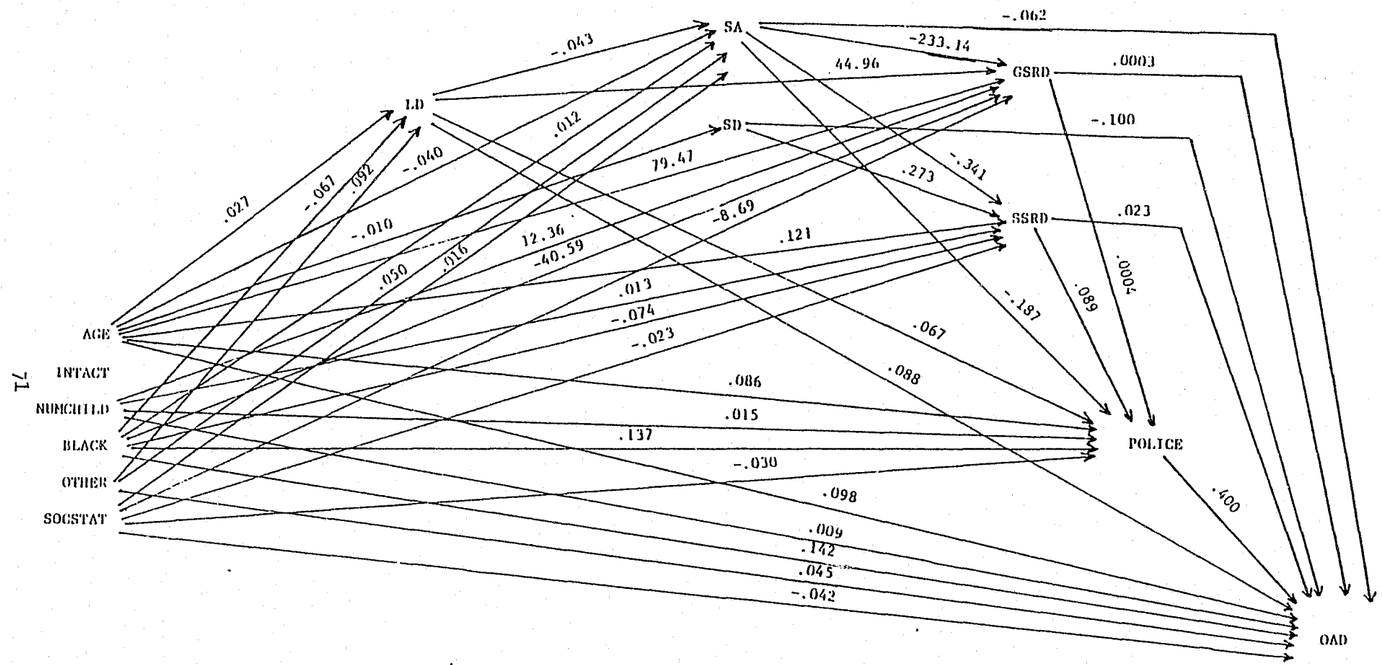

Figure 2. Estimated Path Model for the Effects of LD on SRD, POLICE, and OAD.

Note. Only paths with coefficients significant at $p < .05$ are displayed.

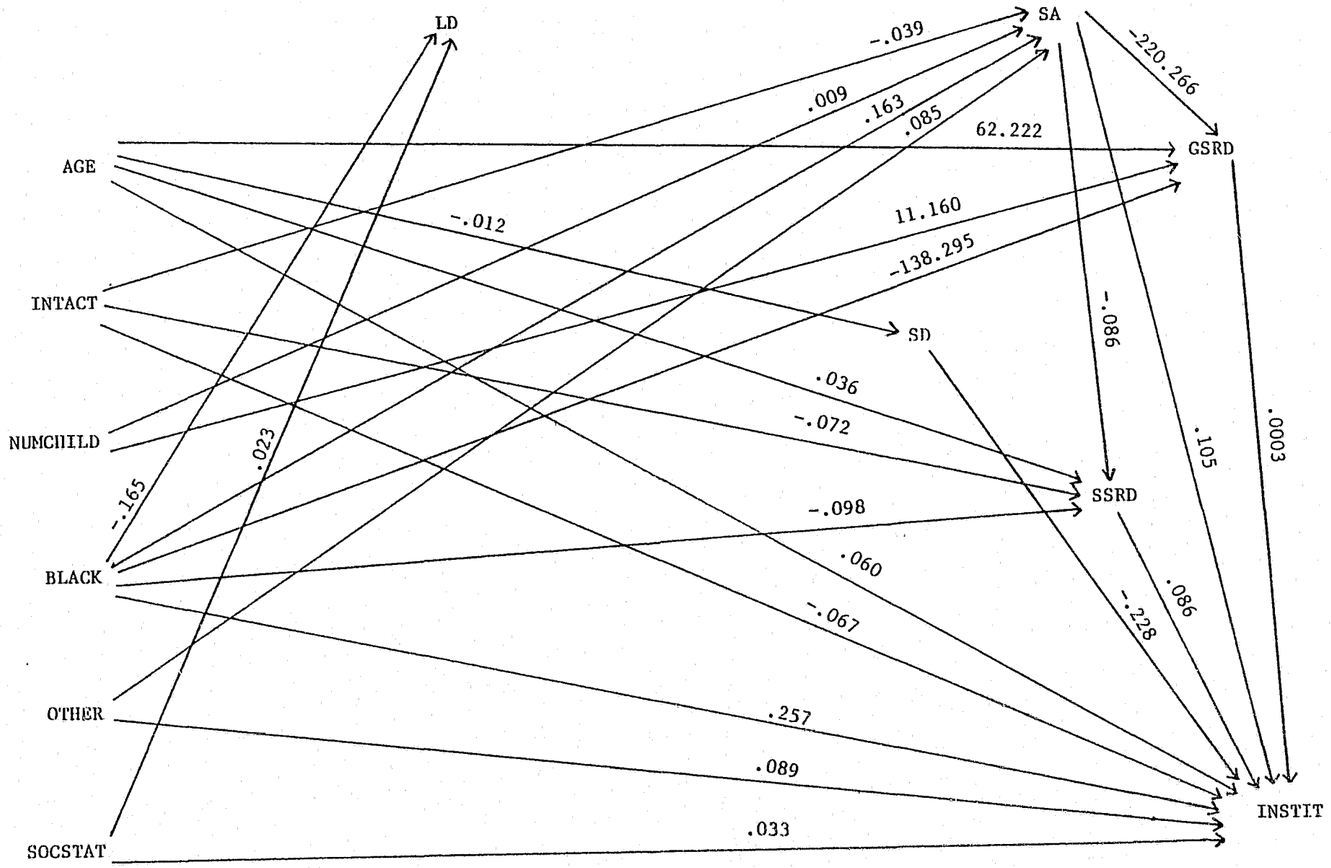

Figure 3. Estimated Path Model for Institutionalization

CONTINUED

1 OF 2

Appendix A

Method of Statistical Analysis

Path Analysis. Path analysis, or ordinary least squares (OLS) estimation of a recursive system of structural equations, was used to estimate the parameters of the hypothesized causal models. (See Hanushek & Jackson, 1977, and Kenny, 1979, for complete expositions of the method.) Basically, path analysis is a method for estimating a multiequation causal model and decomposing the effect of one variable on another into direct causal effects, indirect causal effects, and noncausal covariation. Variables which are determined by factors not included in the model (i.e., whose causes are outside the model) are called predetermined, or exogeneous, variables. Variables which are caused directly or indirectly by variables in the model are referred to as jointly determined, or endogeneous, variables. The noncausal covariation component mentioned above comprises unanalyzed association between an exogenous and an endogenous variable (due to covariation among the predetermined variables) and spurious association between two endogenous variables (due to their dependence on antecedent causes common to both.)

Although the assumption of uncorrelated equation errors made in recursive (path analytic) models is frequently unjustified (cf. Hanushek & Jackson, 1977), path analysis (i.e., OLS regression) was employed in this research for two reasons. First, simulation studies (e.g., Hale, Mariano, & Ramage, 1980) have demonstrated that OLS regression is more robust than two-stage least squares (2SLS) and other estimation techniques when the causal model is not completely and correctly

specified. We can be certain that the causal model investigated in this study does not include all of the factors which cause delinquency. Second, the identification requirements of 2SLS and other estimation methods for nonrecursive models were difficult, if not impossible, to satisfy and still obtain tests of the seven hypotheses considered in this investigation. Since the estimation of causal models had not been envisioned when data collection was planned, variables were not included needed to fully identify a set of nonrecursive equations.

Two structural equation systems were estimated. In the first, which is presented in Table 4, OAD was the final endogenous variable in a seven-equation model containing 68 structural coefficients (direct effects) and seven equation error variances (or, equivalently, seven squared multiple correlation coefficients) to be estimated. Two a priori restrictions in addition to those required by recursiveness have been imposed on the model in Table 4, viz., that the effects of school attitude and social desirability on each other were zero and that the effects of frequency and seriousness of SRD on each other were zero. The covariance matrix of the jointly determined and predetermined variables in the system was used in PROC SYSREG (SAS Institute, 1979) to estimate the structural parameters. Since most of the variables were scaled in a meaningful metric, raw-score regression coefficients ($\underline{b}_j$) were estimated. For endogenous variables that were coded 0 or 1, e.g., OAD, the $\underline{b}_j$ can be interpreted as the change in probability that the outcome equals 1 for a unit change in the causal variable.

After the direct effects had been estimated, the total indirect and noncausal path components were calculated using the matrix equations presented by Fox (1980). All direct, indirect, and noncausal components

are expressed in the same metric and can be summed to estimate the bivariate regression of an endogeneous variable on a determining variable. The correlation matrix of the variables in the first model, which is the standardized form of the covariance matrix used in the OLS regression analysis, is presented in Table 5.

The second causal model had INSTIT as its final jointly determined variable and consisted of only six equations. Since only the adjudicated sample was relevant to the analysis of court disposition, POLICE and OAD equations were replaced by an equation for INSTIT. Estimation was based only on the data from officially delinquent boys (i.e., those for whom OAD=1). With these exceptions, analysis of the causal model for severity of disposition followed the same logic and procedure as outlined for the adjudication model. The correlation matrix of the variables included the INSTIT model is given in Table 6.

Advanced statistical techniques, including causal modeling and logistic regression, were utilized to detect the presence of a relationship between learning disabilities and delinquency and to evaluate the hypotheses set out in the preceding section. With data gathered in a nonexperimental or survey research design, such as the one used for this cross-sectional study, it is impossible to prove cause and effect. The analytic methods that we employed provided a means of determining if the data were consistent with a set of causal hypotheses. However, in general, data may be consistent with more than one set of causal hypotheses. Some caution, therefore, needs to be exercised when interpreting the results of our causal analyses. The methods did give us the important capability to reject hypotheses about causal relations which were not consistent with the data. In sum, causal analysis enabled

us to determine which hypotheses were consistent and which were inconsistent with the data. It could not be used, however, to prove that any causal hypothesis that was found to be consistent the data was, in fact, true.

Logistic Regression Analysis. Four of the endogenous variables in the two models--LD, POLICE, OAD, and INSTIT--were dichotomous, reflecting only 0, 1 outcomes. OLS regression is frequently inappropriate for such variables because of three reasons: (a) the homoscedasticity assumption is violated, (b) the predicted values generated by the model can take impermissible values falling outside the 0, 1 interval, and (c) the relationship between the dichotomous dependent and independent variables is usually nonlinear (see Hanushek & Jackson, 1977).

A model which overcomes these potential problems is the logistic regression model which fits the log of the odds ratio to the independent variables (Hanushek & Jackson, 1977; Neter & Wasserman, 1974). An important feature of this model is that although the probabilities have a nonlinear relation to the determining variables, the log of the odds ratio is linear in the independent variables. Thus, the logistic response function specifies that for a unit change in an independent variable the amount of change in the probability that the outcome variable equals 1 depends upon the value of the initial probability. Since the log of the odds ratio is a linear function of the independent variables, however, the parameters of a logistic response function may be given an intuitively meaningful interpretation in terms of the change in the odds of a given outcome. Specifically, the antilog of the regression coefficients estimated by a logistic regression can be interpreted as the amount by which the odds of an outcome are multiplied for a unit change

in an independent variable while controlling for the effects of all the other variables in the equation.

Unfortunately, the logic for path analysis with continuous and dichotomous dependent variables can not be easily implemented in logistic regression. In order to evaluate the degree to which the linear probability models estimated by the OLS regressions were problematic, e.g., having expected values less than 0 or greater than 1, the equations for LD, POLICE, OAD, and INSTIT also were estimated by PROC LOGIST (Harrell, 1980) which uses the method of Maximum Likelihood (ML) to estimate the parameters of the logistic response function. Comparisons of the OLS and ML logistic regression results provided a basis for assessing the adequacy of the path estimates.

Appendix B

Comparison of Path and Logistic Estimates

In Table B-1 the estimates from the OLS and ML logistic regression analyses of LD are compared. The two methods led to the same conclusions about the effects of the exogenous variables on LD. For example, the logistic analysis indicated that the odds of being learning disabled were multiplied by 1.2 for each year of increase in age. If the odds of being learning disabled for a 14-year-old boy were 1 to 4 (i.e., .20 probability), then the odds would be 2.4 (= 1.2 x 2 x 1) to 4 (i.e., .38 probability) for a 16-year-old with similar background characteristics according to the logistic model. Although the OLS and ML logistic models agreed on which exogenous variables were significant, the magnitude of the age and ethnicity effects appeared to be slightly larger using the logistic estimates. Table B-2 displays the actual probabilities of LD classification for various age-by-ethnicity groups calculated from the sample data. Although these proportions are not adjusted for the effects of INTACT, SOCSTAT, etc., they seem to have been well approximated by both the OLS and ML logistic estimates.

Reference to Table B-1 finds close agreement between the OLS and ML logistic regression analyses for POLICE. An odds multiplier of 1.5 for LD indicated that if the odds of being picked up by the police were 1 to 1 (.50 probability) for non-learning-disabled boys in this sample, then controlling for all other factors the odds for learning-disabled boys would have been 1.5 to 1 (.60 probability). The difference between these probabilities of .10 = (.60 - .50) is approximately equal to the linear probability estimate of .07 from the path analysis. The reader may be

interested to note that in addition to LD, other characteristics appeared to represent a vulnerability to arrest, including age, ethnicity and social status. Boys who were older, black or other minority, or from lower social status were all more likely to have been apprehended by the police even when other characteristics and levels of delinquent activities were controlled.

Comparison of the OLS and ML logistic regression results for OAD in Table B-1 reveals greater discrepancy than was found for the LD and POLICE equations. The odds multiplier for LD was estimated to be 2.8. It can be deduced that if the odds of being adjudicated were 2 to 3 (.4 probability) for non-learning-disabled boys in this sample with other things equal, the odds for boys with LD would have been 5.6 to 3 (.65 probability). The difference in probabilities of .25 suggests that the OLS estimates might have underestimated the magnitude of the LD effect. This was explored by plotting the expected probability of adjudication for LD and ethnicity groups across the range of social status using the OLS and ML logistic regression weights given in Table B-1. Figure B-1 shows that although the values of the linear probability function all fell within the 0, 1 permissible range, the difference between the learning disabled and non-learning-disabled expectations was underestimated relative to the logistic function. Furthermore, the OLS model tended to underestimate the probability of adjudication for low social status values and overestimate it for high social status scores. The models were most consistent in the mid-range of SOCSTAT. Figure B-2 shows a similar plot for learning-disabled and non-learning-disabled groups across the range of school attitude. Again the linear probability model appears to have underestimated the difference between

learning-disabled and non-learning-disabled boys in probability of adjudication. In general, the inconsistencies between the response functions do not cast doubt on the appropriateness and validity of the path analyses. The inferences about the direct and indirect effects of LD, therefore, should not be discounted simply because binary endogenous variables have been estimated.

Table B-1
Ordinary Least Squares and Maximum Likelihood Logistic Regression Estimates of Direct Effects on Dichotomous Dependent Variables

	Dichotomous Dependent Variables											
	LD			POLICE			OAD			INSTIT		
Causal Variables	OLS	ML Log	Odds Multiplier	OLS	ML Log	Odds Multiplier	OLS	ML Log	Odds Multiplier	OLS	ML Log	Odds Multiplier
INTERCEPT	-.1146	-3.0756***		-.9884***	-7.1945***		-1.7184***	-15.2152***		-.7860***	-6.1251***	
AGE	.0272***	.1450***	1.2	.0862***	.3879***	1.5	.1323***	.7913***	2.2	.0602***	.2863***	1.3
INTACT	-.0073	-.0151		-.0149	-.0246		-.0351*	-.2690		-.0669*	-.3019*	.7
NRICHILD	-.0010	-.0046		.0145***	.0879***	1.1	.0151***	.0810**	1.1	-.0025	-.0138	
BLACK	-.0672**	-.3632**	.7	.1369***	.8647***	2.4	.1970***	1.5060***	4.5	.2572***	1.2142***	3.4
OTHER	.0823**	.3775**	1.5	.0479	.2817		.0639*	.4152		.0886*	.4227*	
SOCSTAT	-.0095	-.0469		-.0304***	-.1786***	.8	-.0544***	-.4408***	.6	.0330***	.1579***	1.5
LD				.0665**	.3905**	1.5	.1141***	1.0348***	2.8	.0043	.0182	
SA				-.1866***	-.9128***	.4	-.1370***	-.5009		.1049*	.4916*	1.6
SD				-.0505	-.2592		-.1206**	-.8760*	.4	-.2283**	-1.0735**	.3
GSRD				.0004***	.0064***	1.006	.0005***	.0043***	1.004	.0031***	.0015***	1.002
SSRD				.0894***	.3791***	1.5	.0589	.3319**	1.4	.0857*	.4067*	1.5
POLICE								2.4789***	11.9			

Table B-2
Probability of Being Classified as Learning Disabled
for Age-by-Ethnic Groups

Age Group	Ethnic Group		
	White	Black	Other
Less than 14	.23	.18	.33
14	.23	.21	.36
15	.32	.23	.42
16 or older	.34	.23	.37

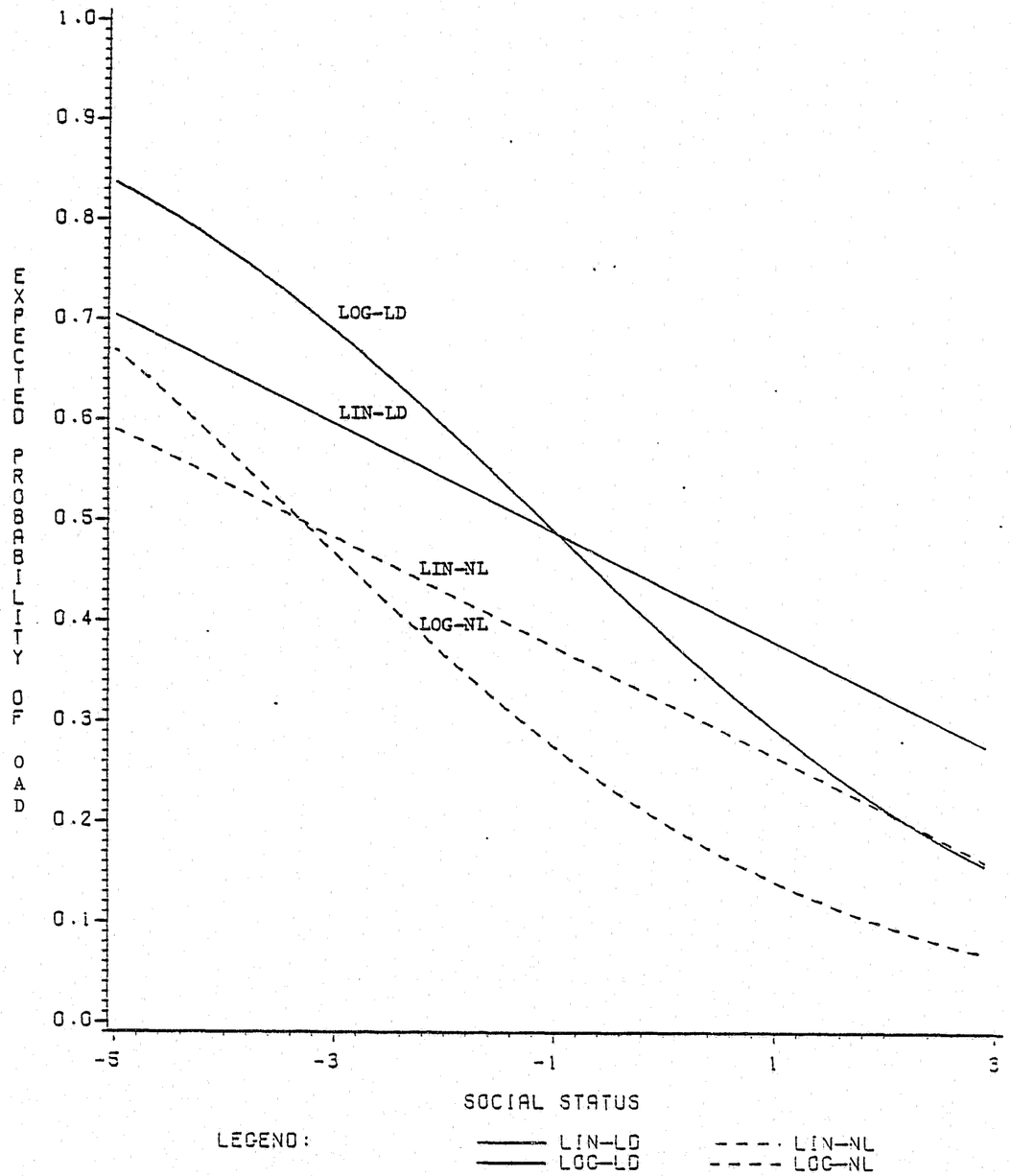

Figure B-1. OLS and ML Logistic Regressions for the Effects of Learning Disabilities, Ethnicity, and Social Status on Probability of Adjudication.

BLACK

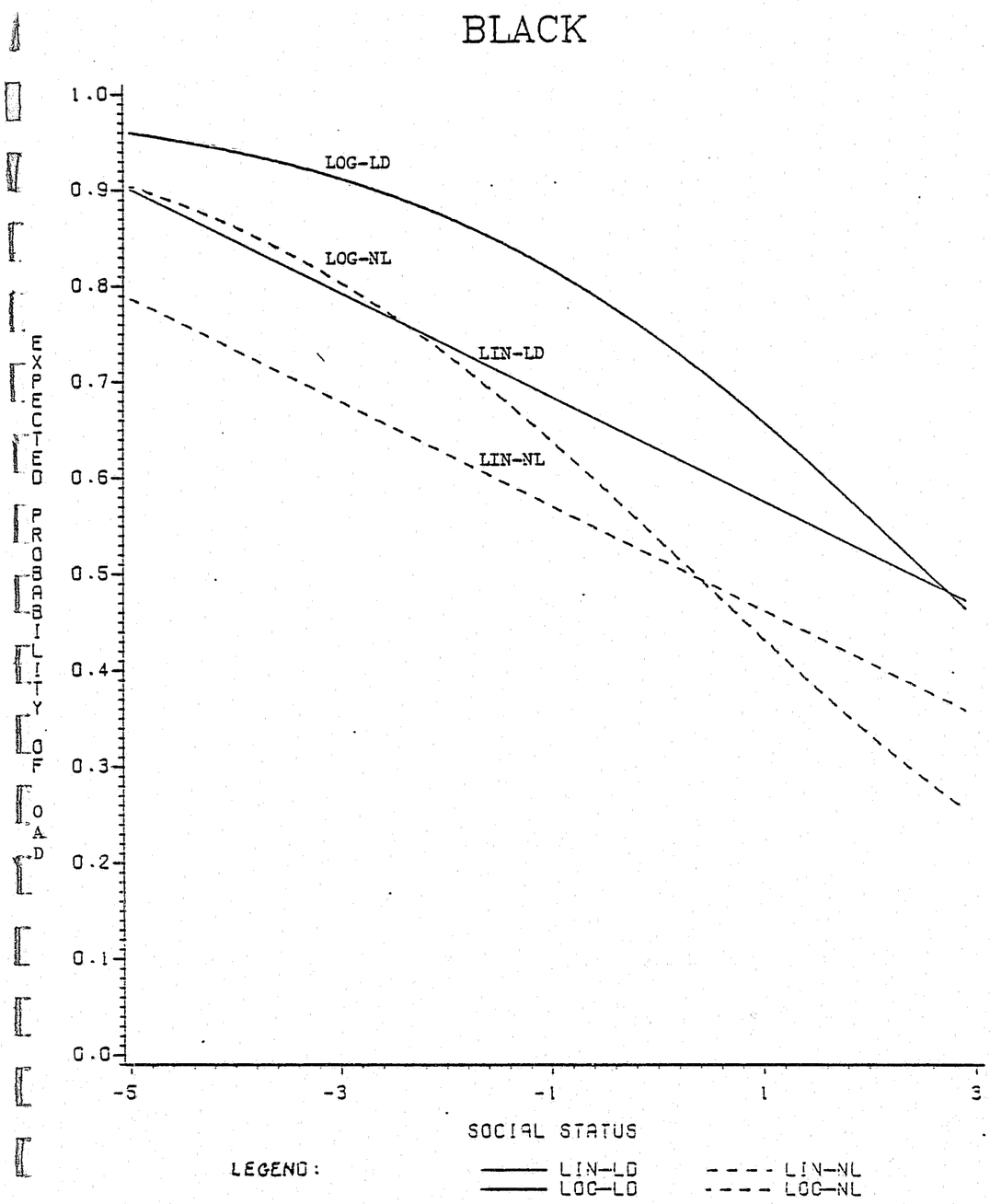

Figure B-1.

OTHER

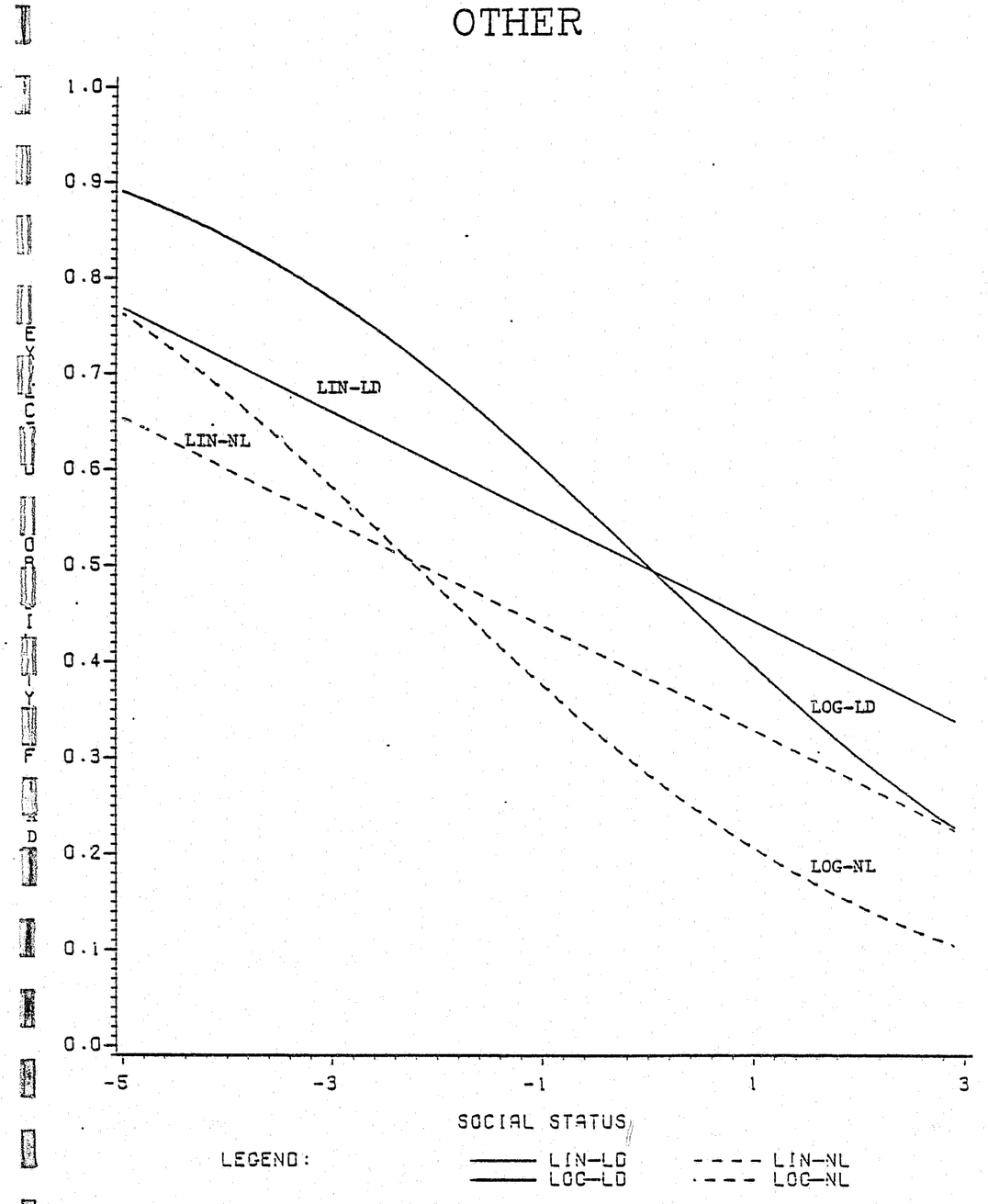

Figure B-1.

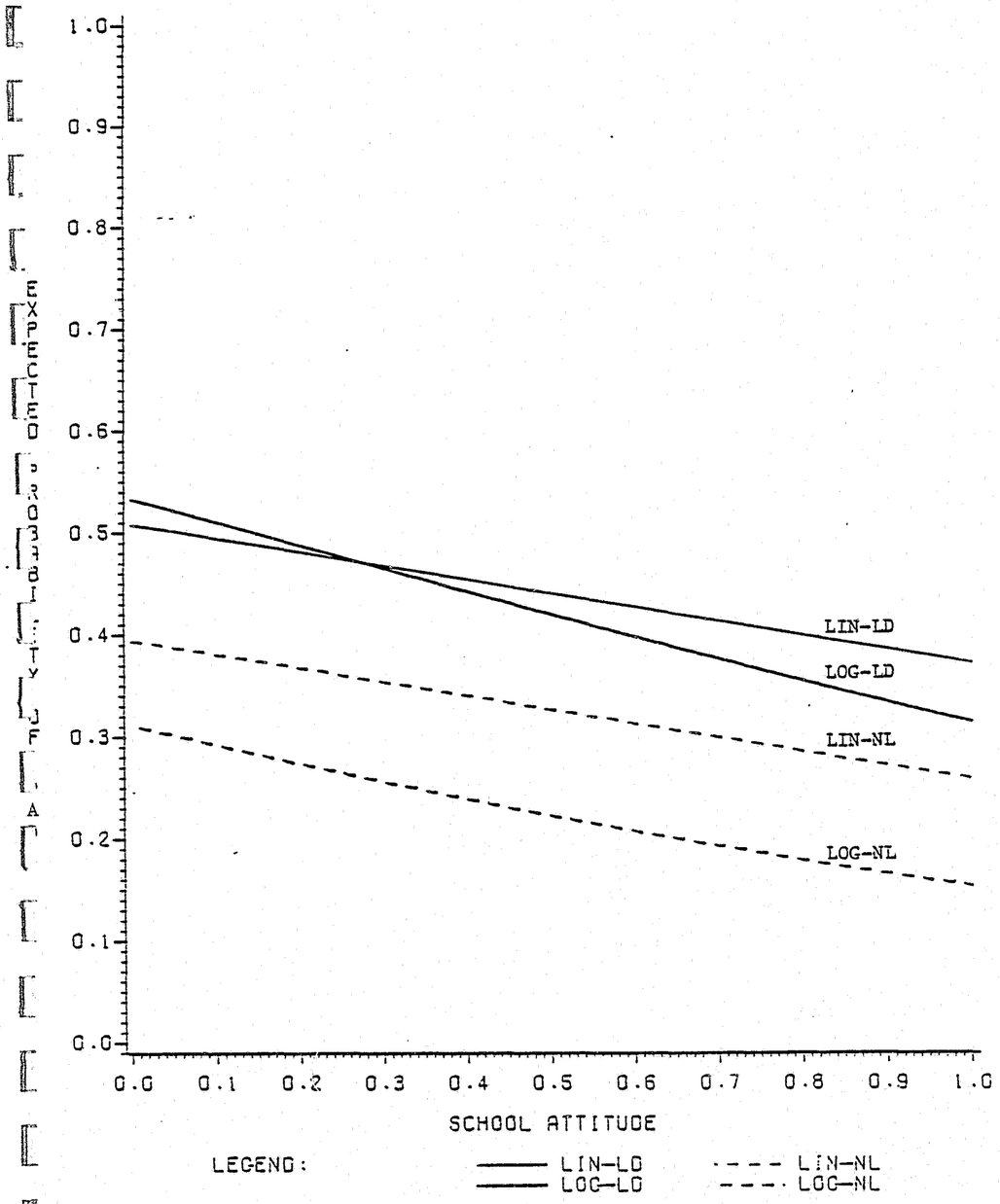

Figure B-2. OLS and ML Logistic Regressions for the Effects of Learning Disabilities and School Attitude on Probability of Adjudication.

APPENDIX C

Learning Disabilities Classification

The presence of learning disabilities was determined on the basis of the participant's performance on a battery of aptitude and achievement tests. Scores from the WISC-R, Woodcock, KeyMath and Visual Motor Gestalt Test (Bender, 1946), together with ratings of test-taking difficulties observed by testers during the testing sessions, were used in an algorithm, a computerized set of objective classification rules, to make LD-NLD determinations. In evaluating test performance, significant discrepancies between achievement expected on the basis of the intelligence test scores and actual achievement as measured by the criterion-referenced tests, or between arithmetic and reading achievement, were taken as evidence of the presence of learning disabilities. The conceptual framework which guided the development of this assessment model assumed that the discrepancies reflected the interference of learning disabilities in mental processes related to receiving, associating, or communicating information (Campbell, 1978; Campbell & Varvariv, 1979). By definition, learning disabilities were distinct from learning problems associated primarily with physical handicaps, mental retardation, emotional disturbance, or socioeconomic disadvantage.

Learning disabilities classifications were made objectively and consistently for all sites and types of youths by the use of the computer algorithm. The operational definition of LD developed by ETS appears in Dunivant (1982).

Although the classification rules are somewhat complex, they may be summarized as follows. Youths were classified learning disabled when their protocols revealed at least three significant discrepancies among test scores or clear indications of perceptual or behavioral problems. In terms of IQ-scale units ($\underline{M}$ = 100, $\underline{S.D.}$ = 15), differences of approximately 15 points were required among the Witkin WISC-R factors themselves and between the Woodcock total reading score and the Witkin WISC-R factors. Discrepancies of about 23 points between the KeyMath and Woodcock scores and among the KeyMath and the Witkin WISC-R factors were deemed significant. A Bender-Gestalt score of three or more (Koppitz, 1964, scoring) and two or more ratings of pronounced test-taking difficulties were taken as indicators of major visual perception and behavioral problems. Any youth who achieved at or above the expected grade level for his age on the achievement tests or whose full-scale IQ score was less than approximately two standard deviations below the mean was classified non-learning disabled. Approximately 74 percent of the LD classifications were made exclusively on the basis of discrepancies among the WISC-R and achievement test scores.

There has been and continues to be much disagreement concerning the nature and definition of learning disabilities among practitioners, researchers, and parents. No commonly agreed upon theoretical or operational definitions of learning disabilities exist. NCSC researchers, ACLD program staff and the project's advisory committee devoted much time and effort to devising the theoretical and operational definitions of learning disabilities used in this study. They embodied the best thinking on learning disabilities in the mid-1970s but necessarily were compromises among researchers, practitioners, parents,

and agency officials. In order to evaluate the construct validity and operational definition of learning disabilities adopted in this research, ETS carried out an extensive series of analyses. These were described by Campbell and Varvariv (1979), who concluded that the evidence for the validity of the conceptual definition and classification algorithm was substantial.

Although some readers will disagree with the definition of learning disabilities used in this study, the strengths of the approach should be appreciated. The definition has a sound theoretical base (Campbell, 1978) and a system for applying it objectively and consistently. Finally, large-scale validation analyses have been performed. Not as much can be said for most other measures of learning disabilities.

Throughout this report reference is made to various characteristics of learning disabled individuals, such as lack of impulse control, inability to anticipate future consequences of action, poor perception of social cues, and irritability. It should be remembered by the reader that these attributes were not directly measured by the ETS assessment procedure. They are characteristics of LD that have been frequently observed in previous research and by practitioners. They are consistent with the observations of the Learning Disabilities Specialists who tutored the LD delinquents in the remediation component of this project. But, strictly speaking, these attributes were not directly assessed in this research. Some have questioned whether these characteristics are really intrinsic to LD or products, or outcomes, of learning disabilities. Although this is an interesting question for future research, in this report the interpretation of the effect of LD remains same whether these attributes are central to or only symptomatic of learning disabilities.

END