THE EFFECTS OF EARLY INTERVENTION ON THE LEARNING RATES OF LEARNING DISABLED STUDENTS IN THE BASIC SKILL AREAS OF READING AND MATHEMATICS: A LONGITUDINAL STUDY

A DISSERTATION

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INTRODUCTION

Problem of the Study

A search of the literature revealed little conclusive evidence that early identification and early intervention in educational programs have been significantly beneficial to learning disabled students in promoting academic gains in basic skill subjects such as reading and mathematics. Likewise, an extensive search of the literature revealed no evidence of longitudinal data having been analyzed to determine if there are differences in the learning rates of learning disabled students in basic skill subjects which may be attributed to the students' ages or grade levels when intervention programs were initially implemented.

Increasing emphasis on early intervention programs for handicapped children is supported in the literature, and reported research on child development supports the belief that the early years are critical because growth and development during the early childhood years have lasting effects on children's growth and development.

The search of the literature revealed no evidence of disagreement regarding the beneficial aspects of early intervention in educational programming for handicapped children who manifest the discriminating characteristics of physical, mental, and emotional handicaps. However, evidence of a controversial issue was revealed regarding early intervention processes for young learning disabled children, not with early intervention per se, but regarding the procedures used in identification, assessment, and intervention programming for the learning disabled. There is a growing concern that educators, faced with no clearly defined criteria for identification of learning disabled students, may label nonhandicapped children as handicapped; and the children will have to endure the negative effects of mislabeling.

Since the implementation of Public Law 94-142, the increasing incidence of identified learning disabled children is also a growing concern in public education. The greatest concern is that special education programs for the learning disabled have become dumping grounds for the placement of students who are, in reality, slow learners and/or students whose intelligence levels are within the borderline range of mental retardation, and students whose behaviors create discipline problems in the regular education classrooms.

With consideration of the controversial issue regarding intervention processes and the concerns described above as well as the current emphasis in public education on the development of basic skills in mathematics and reading, it appears to be a reasonable assumption that field-based information would be beneficial to educators in their policy development and decision making processes. Therefore, it was proposed that the analysis of longitudinal data to determine if there are differences in the learning rates of learning disabled students which may be attributed to the age or grade when identification and intervention processes were implemented would be beneficial to public school educators.

Purpose of the Study

The purpose of this study was to analyze data collected over a period of seven years on learning disabled children and youth who have participated in a cooperative district comprehensive special education program which is implemented according to the Child-Centered Education Process in the Texas Education Agency (TEA) *Policies and Procedures for the Education of the Handicapped* (Bulletin ADO-871-1, 1978). These procedures are included as a part of the Texas plan for compliance with the federal regulations mandated in Public Law 94-142, The Education for all Handicapped Children Act of 1975 (Federal Register, 1977). These data reflect the academic gains made by individual learning disabled students in the basic skill areas of reading and mathematics. The data were used internally for program purposes, but no provisions or efforts have been made to analyze them on a longitudinal basis.

The longitudinal data were analyzed to determine if the analyses would reflect differences in the learning rates of learning disabled students who have experienced early identification and early intervention in educational programs and in the learning rates of learning disabled students who were not identified and did not receive educational program intervention until after they had been exposed to academic failure in the basic skill areas of reading and mathematics.

Procedures for Developing the Study

In this study, statements of the problem and purpose precede a brief description of procedures used in developing the study. Following are definitions and background information which describe the special education cooperative program which serves as the setting for the study. This information includes a brief history of the establishment of the cooperative district comprehensive special education program as well as a brief summary of demographic information regarding the location, topographical characteristics, local school districts, school-age population served, economy base, and patrons served by the school districts. A detailed description of the comprehensive special education program is presented and followed by some unanswered questions and uncertainties which establish a strong rationale for the study as well as its importance and significance. A summary of related literature is included as the final part of the background information for substantiating evidence of the concerns of educators and the controversial issue regarding the identification and intervention procedures for learning disabled children and youth.

The hypotheses of the study are stated; the data and the data-collecting procedures are described; and statistical analysis procedures used to test the hypotheses are described. These sections were expanded and/or modified when the data were entered in the computer and frequency counts were determined. Limitations and exceptions of the study are stated.

Included next is a summary of related literature, which covers approximately the last twenty years, and represents the works of eminent authorities in the fields of special education, early childhood education, regular education, and psychology with specific relevance to identification and intervention in educational programming for learning disabled children.

The methodology used in the statistical analyses of the longitudinal data was described, and the results of the statistical analyses were summarized.

The final part of the study includes the conclusions drawn from the results of the study, the implications of the study for the education of learning disabled students, and recommendations based on the implications and conclusions of the study. A list of references used in developing the study are included along with a substantiating bibliography of related literature which was researched but not specifically used.

Educational, psychological, and other research journals, periodicals, and books are the types of literature represented in the summary of related literature.

To facilitate the search for information, a printout of available literature was obtained from an ERIC search at the Texas Woman's University Library in Denton. Three additional print-outs were obtained through three CITE searches, a service provided by the Texas Education Agency in Austin and implemented by the regional education service centers. CITE is an acronym for Coordinating Information for Texas Educators. The service is free to all Texas educators, and includes searches through a large network of information centers such as ERIC to obtain listings of available information.

Definitions

According to the interpretation of the definitions provided in the federal mandate (PL 94-142), the Texas Education Agency has adopted the following definitions:

> "Learning disabled students" are students who demonstrate a significant discrepancy between academic achievement and intellectual abilities in one or more of the areas of oral expression, listening comprehension, mathematics calculation, mathematics reasoning, or spelling; for whom it is determined that the discrepancy is not primarily the result of visual handicap, hearing impairment, mental retardation, emotional disturbance, or environmental, cultural, or economic disadvantage; and for whom the inherent disability exists to a degree such that they cannot be adequately served in the regular classes of the public schools without the provision of special services. (TEA Bulletin ADO-871-1, p. 4)

> "Mentally retarded students" are students with significantly subaverage general intellectual functioning existing concurrently with deficiencies in adaptive behavior and manifested during the developmental

> period such that they cannot be adequately educated in the regular classes of the public schools without the provision of special services. (TEA Bulletin ADO-871-1, p. 3)

The following definitions were developed specifically for this study to provide two subcategories of the learning disabilities category. Each will be used in the analyses of the longitudinal data with reference to the limitations and exceptions of the study.

<u>Slow Learner Learning Disabled Students</u>

Slow learner learning disabled students are those students who experience so much difficulty in progressing through general education that they need special and/or alternative considerations in educational programming because they have developed intellectually at about three fourths the rate of normal students (IQ: 75-85), or about one standard deviation below the normal range of intelligence.

<u>Borderline Mentally Retarded Learning Disabled Students</u>

Borderline mentally retarded learning disabled students are those students who cannot progress through the general education program, but require special education services and alternative education programs because they have developed intellectually at a rate just slightly above one half the rate of normal students (IQ: 65-75), or slightly above two standard deviations below the normal range of intelligence.

Unless some other disabling traits are identified, these students are not able to meet the eligibility criteria for the learning disabilities category; yet, they are certainly learning disabled; and they certainly need special education. The categorical definitions currently being used need clarification to include these students.

Background and Significance of the Study

In Texas, resources are allocated to local school districts by the State to implement comprehensive special education programs according to a formula based on 3,000 students in average daily attendance (ADA), and there is a provision for small school districts to form cooperatives with neighboring school districts in order to meet the 3,000 ADA criterion (TEA Bulletin ADO-871-1, 1978).

It was under this provision that the Greenbelt Special Services Cooperative, the setting for this study, was established in September, 1975 to provide comprehensive special education services to eligible students within the district. This cooperative district includes four independent school districts, one of which is located in the county seat of each of four adjoining counties in the fringe areas of Regions IX and XVI. It is a rural and sparsely populated area along the Red River extending into the Panhandle and North Central Plains areas. The cooperative district covers an area of 2,200 square miles, and the distance between school districts on the extreme edges is 80 miles. The average daily attendance ranges from 325 students in the smallest district to 1,175 in the largest. A majority of the students are transported to school from the outlying countryside.

The patrons support the school band, the football and basketball teams, and the academic programs (in that order) if the school districts do not raise taxes too much. It is a rugged area where the livelihoods of most people depend on ranching, farming, oil production, and related industries. The land is rough; the climate is harsh and variable with short severe winters and long hot summers; blue northers, dust storms, hail storms, tornados, and drought are common occurrences. The people work hard and they play hard. They like parades, rodeos, barbecues, stock shows, contact sports, country-western music, square dancing, rattlesnake hunts, trail drives, water sports, and school-class reunions. The land is rich in resources, but it takes a lot of hard work and fiscal resources to maintain economic stability.

The people are most conservative in accepting changes in their communities. For example, prior to the initiation of the cooperative special education program, special education was not accepted, and less than 2% of the school-age population was served in special education classes. Those classes were totally self-contained, and they were usually hidden away in some isolated area on the school campuses. Most of the handicapped students were classified in the mentally retarded category and were often placed in special education without benefit of assessment other than possibly a reading test. In this atmosphere of resistance, it was no easy task to implement the Texas Plan A for a comprehensive special education program under the policies and procedures established by the Texas Education Agency (TEA) Administrative Guide and Handbook for Special Education, Bulletin 711 (Rev. 1973). This plan was so similar to that which was implemented by federal mandate (PL 94-142) in 1978, that very few changes had to be made for compliance in local school districts. Slowly, but surely, the cooperative district program was accepted to the extent that over 16% of the school-age population was served in special education during the

1981-82 school year. The percentage is too high, but it is evident that special education has attained respectability.

The majority of handicapped students served by the cooperative program are classified as learning disabled, and these are the students with whom this study is concerned. Under the State policies and administrative procedures for implementation of The Child-Centered Educational Process for the Education of the Handicapped (TEA Bulletin ADO-871-1, 1978), children and youth suspected of being educationally handicapped are referred to the appropriate building principal's office where an educational liaison is assigned by the principal. The Educational liaison collects all relevant data available in the home, school, and community to bring to a referral committee meeting where the data are reviewed, alternatives are considered, and recommendations are made either to provide appropriate placement and programming in regular education or to refer the student for comprehensive assessment.

With parental approval, the student enters the comprehensive assessment process which consists of three stages: (a) to determine if a mental, physical, or emotional disability exists to the extent that it could possibly cause an educational handicap; (b) to identify the student's achievement levels, and to determine whether or not the identified disability has caused an educational handicap; and (c) to identify competency levels in order to make recommendations for educational programming and remediation processes. The comprehensive assessment process includes the use of appropriate assessment instruments by certified/licensed personnel, and procedural safeguards are observed in all phases of the assessment process in order to protect the student's and parent's rights.

The members of the multidisciplinary team who conduct the assessment processes do not determine the student's eligibility for special education services, but, in a written summary, report their findings to the Admission, Review, and Dismissal (ARD) Committee. Their findings include a report of the extent the student meets the eligibility criteria for a specific handicapping category; sometimes, more than one category. The ARD Committee is the decision making body, and is composed of members who represent all areas of the public school that are concerned with a particular student's educational program, the student when appropriate, and his/her parents. The ARD Committee reviews all available data, deliberates alternatives, and determines the student's eligibility. After eligibility is established, the ARD Committee develops the plan for the student's individual educational program (IEP) which will be described later on in this section. After the student's IEP is developed, and only then, the least restrictive alternative for placement is considered and recommended. With the parents' written approval, the student is placed in the recommended learning environment where his/her progress is informally assessed quarterly, and his/her program is reviewed annually by the ARD Committee. The student's placement is reviewed annually also, to determine whether or not a less restrictive learning environment is appropriate.

The student's IEP is his/her curriculum, and it is the teacher's guide to develop learning activities to assist the student in attaining the short-term objectives which are stated in the IEP, to assist the student in attaining the goal which is stated in each subject or developmental area for which the student is assigned to special education. The student's functioning level is stated on the IEP, and learning activities are implemented at, or slightly below, that level to ensure a success oriented learning program.

A criterion referenced program has been implemented in each classroom in the cooperative to provide students with a continuum of sequential skills in all areas of the curriculum. The criterion referenced program was developed through the coordinated efforts of Region IX Education Service Center personnel, special education support staff, and special education instructional personnel throughout the region. This is used by the ARD Committee in the development of each of the handicapped student's annual goals and short-term objectives, for identification of learning activities and suggested instructional materials, and for the development of criteria by which student progress can be evaluated. Students' strengths are identified and used for the input of stimuli in learning experiences. Their deficits are identified and remediation processes are implemented. Each student is provided with an individualized instruction plan (IIP) which is geared to his/her individual needs, and through daily and/or weekly progress checks, the teacher determines whether or not the plan is appropriate to the student's identified needs. When a student does not make progress, the teacher modifies the instruction plan, initially, and if the student continues without progressing, he/she is referred back to the ARD Committee for further modification of the IEP. When a student progresses to the point that the teacher deems that he/she is ready for mainstream classes, a special ARD Committee meeting is called and, usually, recommendations are made to place the student in a transitional program in mainstream education with support from special education until he/she can perform independently.

The instructional staff is supported by a member of the cooperative district support staff who visits each classroom at least once each week, and all teachers are provided with paraprofessionals to assist in maintaining a well-organized learning environment which provides optimal opportunities for student learning.

A special education resource system (SERS) has been established to provide appropriate materials for the instruction of handicapped students. The SERS is located in the cooperative district office building, and materials and supplies are purchased according to teachers' requisitions. Each teacher is provided with a SERS Catalog, a listing of all available materials, equipment, and supplies. The listing is updated annually, and teachers check out materials which are appropriate to implement handicapped students' IEPs. Regular education teachers have access to the SERS if handicapped students are served in their classrooms. State, federal, and local funds are utilized to support the SERS component of the cooperative program.

Teachers and students are provided with consultant services according to identified needs, and staff development activities are supported by the cooperative program either in group or individual training activities according to the identified needs of individual staff members.

The comprehensive special education program is accepted by mainstream education personnel to the extent that all handicapped students, with the exception of six severely handicapped, are assigned to a homeroom with their peers, and all participate to the extent they can benefit with their nonhandicapped peers. They have access to all extra-curricular activities and are accepted by the other students. In fact, the special education program has become so respectable that parents refer their own children, and students refer themselves for consideration of their educational programs for their possible placement in special education. Despite a few weak spots here and there, the cooperative district special education program is an excellent program, and the credit goes to master teachers who have worked hard to establish well-organized classrooms where children and youth learn. They have really demonstrated that teaching does make a difference. All of this could not have happened without federal and state mandates and the fiscal resources to support the undertaking.

Although the comprehensive special education program has enabled many students to succeed when otherwise, they would have failed in their educational endeavors, there are uncertainties that need to be explored, especially in the area of the learning disabled. There needs to be longitudinal data collected and analyzed to determine if there are differences in the learning rates of learning disabled children in basic skill subjects which are related to the age or grade level at which they are identified and receive educational intervention. There are many unanswered questions which need to be considered. Can learning disabled children afford to wait until they experience academic failure before intervention processes are implemented? Is mislabeling a child as handicapped, when no handicap exists, more damaging to the child and his/her parents than academic failure is to the unidentified learning disabled child? If learning disabilities cannot be identified until a child has been exposed to academic failure, it appears that a lot of valuable time may be lost when, if identified earlier, the child could have benefited from intervention processes. Can such a child catch up with his/her nonhandicapped peers, or is he/she doomed to lag behind throughout his/her school years? How long should a young child be allowed to experience failure prior to the implementation of intervention procedures? These are questions that educators need to ask, and they are especially relevant in the current area of economic conservatism when higher education research programs are being reduced by funding cuts. Educators should be encouraged to analyze existing longitudinal data and to collect additional data for analysis in order to provide information to educators involved in establishing policies and procedures for the education of learning disabled students.

The questions above are of particular relevance to this study and to educators within the cooperative district because public schools in Texas do not serve handicapped children under 3 years of age, with the exception of those who are handicapped by visual and/or hearing impairments. For this reason, only a very small number of 3 and 4 year old children are served, and these are usually classified in categories where more obvious handicapping disabilities meet the eligibility criteria.

Therefore, the longitudinal study has a scarcity of data collected on children of 3 and 4 years of age, and has no data on children younger than 3 years of age.

With reference to the lack of services to handicapped children under 3 years of age and to the unanswered questions mentioned before, it is proposed that this study is timely and of particular importance in the area of the education of learning disabled children and youth.

It is suggested that further analyses of these longitudinal data, with reference to the limitations and exceptions of the study, may provide results that will serve as indicators of the need for further research regarding the identification and assessment procedures used in education program intervention for learning disabled students. In other words, it is suggested that application of the findings of this study to areas of concern regarding intervention processes for learning disabled students may provide direction for further research.

The significance of the study is that it can serve as a starting point as well as a frame of reference for further research regarding the effects of early intervention on the learning rates of learning disabled children and youth in the basic skill subjects.

Documentation of the importance and significance of the study is provided in the following summary of related literature.

As research in child development, early childhood education, and special education focuses on increasingly younger age groups, assumptions have been made that it is expedient that handicapped children be provided with early intervention processes which include identification, assessment, and education programming. The literature reveals a very strong rationale for early intervention programs for young handicapped children; the earliest age possible at which handicapping conditions can be identified to provide maximum benefits to young children and their parents. However, there is a controversial issue regarding early intervention for learning disabled children. In this summary of related literature, both sides of the issue are presented.

Through his work in the Harvard Preschool Project, White (1973) became convinced that success or failure in school seemed to be determined prior to the time children entered first grade. In further research, White (1978) attempted to identify what influential experiences in the young child's life determined his/her success or failure in school, and proposed that whatever it was that caused the difference between success and failure occurred well before the age of 3 years.

Pines (1973) stated that at least 10% of all children, even in the best environments, are held back by various kinds of perceptual handicaps, lumped under the name of "dyslexia," which interfere with reading and writing. According to Pines, if unrecognized or uncorrected, any one of these can "poision" a child's life, making the child feel worthless as he/she encounters constant failure, regardless of the level of the child's intelligence.

Hayden (1979) stated that handicapped and/or at-risk children of the birth to age three group do not make acceptable progress without early intervention programs, and made the charge that to deny these children the benefits of early intervention is not only wasteful but ethically indefensible.

With reference to the theoretical concept that, at birth, individuals are endowed with a ground-plan for developmental processes to take place, and that a time exists in an individual's ground-plan for optimal growth and development during optimal time segments, Epstein (1974) referred to these optimal growth and time segments as growth spurts. These correlated brain and mind growth spurts have been named phrenoblysis in order to discriminate them from other critical periods such as spurts in physical development. According to Epstein, "...implications for human intellectual development constitute a working hypothesis that remedial interventions will work best if situated during spurt periods" (p. 27). Furthermore, Epstein (1978) stated, "It is important to emphasize that brain growth stages are not a theoretical notion but a scientific fact..." (p. 345). In Chapter II of this study, implications of the consideration of phrenoblysis with relevance to intervention programs for handicapped children will be presented in a more detailed discussion.

With reference to Epstein's work, Hollingsworth (1981) stated that it appears entirely plausible to make the assumption that if the brain circuity is not developed during the critical brain growth spurts, then, attending and responding capacities may go untapped.

For the most part, the literature reveals that the emphasis on early intervention has been beneficial for handicapped children because intervention programs provide teachers with opportunities to work with parents and children before the handicapping conditions have time to interfere with and hamper further development. Based on his work at the University of Washington in the Model Preschool Center, Haring (1974) stated that even Down's Syndrome need not be synonymous with severe mental retardation because Down's Syndrome children approximate normal to near normal developmental patterns when intervention programs begin in infancy.

It is the age factor that is the crux of the controversy regarding early intervention for young children suspected to be potentially learning disabled (Beers, C. & Beers, J., 1980; Keogh & Becker, 1973).

Based on the premise that children classified as learning disabled have not benefited from the increased emphasis on early intervention programs, Beers, C. and Beers, J. (1980) claimed that these children have not benefited because of the flawed assumptions regarding their identification and placement in intervention programs. They stated that false assumptions have been accepted as facts by school districts in their endeavors to attain federal and state monetary resources as well as in their attempts to attain prestige in their educational provisions. They warned that public schools should not attempt to identify, assess, and/or intervene in educational programming for potentially learning disabled children because all of these processes are based on false assumptions. Likewise, they claimed that the assumption that learning disabilities are easy to identify is false because no single characteristic is common to all learning disabled children, and that this makes it most difficult to decide who can be classified as learning disabled.

Furthermore, they stated that the assumption that trained professionals can easily identify young learning disabled children is false because the fact is that both standardized and informal assessment procedures are extremely unreliable when used in the assessment of young children. In general, they claimed that it is almost impossible to distinguish immaturity from actual learning disabilities.

Faust (1970) advised that the belief that there are inherent stable traits of the individual should be abandoned. She stated that it should be recognized that individual traits change as a function of interaction with the environment, and that there are really "...few inherent, stable traits of the individual" (p. 364). Murphy (1966) stated, "Children change from hour to hour, day to day, week to week, tester to tester, and test to test." (p. 369).

According to Keogh and Becker (1973), identification of preschool or kindergarten children who appear to be potential learning failures is, in fact, hypothesizing rather than confirming that a disability exists. The concern appears to be that a disability will develop, not that one already exists. Also, they raised a question regarding the ability to diagnose a reading or other academic problem prior to the time a child has been exposed to reading and other academic subjects. Likewise, they identified some problem areas that need to be considered regarding early identification such as the validity of predicting measures, the implications for remediation or intervention, and the possibility that the negative effects may outweigh the benefits of such identification. In a warning note, they stated that research indicates that extreme caution should be exercised in making predictions about a particular child. As a final concern, they stated that early identification may affect teacher expectancy as was demonstrated by Rosenthal and Jacobson (1966) as the self-fulfilling prophesy.

Since preschool and kindergarten children have not yet developed the disabilities for which they are identified, Keogh and Becker (1973) stated that the effects of labeling may be particularly insidious because the act of predicting a learning disability may have a built-in expectancy factor.

Cohen, Semmes, and Guralnick (1979) also expressed concern regarding the effects of labeling handicapped children, and stated that the negative effects of mislabeling, stigmatizing, self-fulfilling prophesy, etc. are all magnified when related to young children below the age of six years.

Meyen (1971) warned that disability or handicap labels have a self-fulfilling prophesy factor, and that attitudes and beliefs of parents and teachers have their effects on children. Along this same line, Foster, Ysseldyke, and Reese (1975) stated that research has shown negative labels produce negative behavior ratings of observed pupil behavior. According to Foster and Salvia (1977), teachers who hold negative expectations for children may not accurately perceive the children's school performance. In other words, the expectation may produce a halo effect. In their research, they found that teachers are more likely to see nonexistant behaviors when a child is labeled.

Although much of the controversial issue regarding intervention programs for learning disabled children is specifically related to early identification processes, most of it could be related to intervention programming for other age groups of learning disabled students. In essence, much of the controversy has developed because of the lack of clarity in the definition of learning disabilities as a handicapping category, as well as the lack of discriminating criteria to use in identification procedures. Wepman, Cruikshank, Deutsch, Morency, and Strother (1975) made the following statement:

> There is little agreement either in medicine or in education on criteria for identifying children with learning disabilities. Because the disabilities presented by these children are extremely heterogeneous, the search for any commonality . . . has so far been fruitless. (p. 302)

Shipe and Miezitis (1969) proposed that all characteristics associated with learning disabilities could also be associated with the educable mentally retarded and with emotional disturbance as well. Also, Haring (1974) suggested that no clear dividing line exists to distinguish learning disabilities from behavior disorders.

In his definition of a category, Piaget (1964) stated that a category must have one defining trait that identifies the commonality of all in that category. When a trait is identified, it can easily be categorized. According to Smith, Coleman, Dokecki, and Davis (1977), it is quite evident that a great disparity exists between school-labeled learning disabilities and the literature in this field in regard to the characteristics of learning disabled children. In fact, the difficulty in defining learning disabilities as a category is due to this disparity. They also stated that educators should heed the warning that unless they rapidly bring clarity and substance to the process by which learning disabled children can be identified and their characteristics discriminated, special educators will run the risk that school personnel may label and segregate children whom teachers think are unsuitable for the mainstream education classrooms. Likewise, Hallahan and Cruikshank (1973) warned that children identified as potential academic failures may become trapped by a label and seen by peers, teachers, and parents as failures by the time they enter school. They also expressed concern that the learning disability category in special education may become a dumping ground for problems, which are really the responsibility of regular education, such as reading problems, emotional problems, management problems, discipline problems, etc.

Despite the fact that this warning was issued almost a decade ago, there is little evidence that educators have done anything to bring clarity to the definition of the learning disabilities category. In fact, Hallahan and Cruikshank (1973) were correct in their predictions and warnings. Educators are concerned that the learning disabilities category in special education has become a dumping ground for the placement of nonhandicapped students. They are especially concerned with the mislabeling of nonhandicapped children because, now, they have these children placed in special education, and they do not know how to get them out. They are still faced with the lack of clearly defined discriminating criteria for establishing a student's eligibility for special education services in a specifically defined learning disabilities category.

Regardless of all the benefits that handicapped children and youth have received since the implementation of Public Law 94-142, no clear definition exists whereby learning disabled children can be categorized. In fact, the definition adopted by Public Law 94-142 has not facilitated the identification and classification of learning disabled children. It has, instead, tended to further muddle the issue as can be seen from the following definition:

> Children with specific learning disabilities exhibit a disorder of one of the basic psychological processes involved in understanding or in using language, spoken or written, which disorder may manifest itself in imperfect ability to listen, speak, read, write, spell, or do mathematical calculations. Such disorders include such conditions as perceptual

> handicaps, brain injury, minimal brain disfunction, dyslexia, and developmental aphasia. Such term does not include children who are having learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, or emotional disturbance, or environmental, cultural, or economic disadvantage. (PL 94-142)

As stated before, there is really no controversy in the area of early intervention for young handicapped children who can be identified as manifesting a common disability which establishes their eligibility for intervention programming in a specific handicapping category. The controversy exists in the area of learning disabilities because there appears to be no common disabling trait whereby commonality can be established in a clearly defined handicapping category.

This situation provides a strong rationale for the collection and analysis of longitudinal data to compare the learning rates of learning disabled students according to the ages or grade levels at which time they were identified and experienced intervention programs in special education and related services.

Hypotheses of the Study

In the statistical analyses of the longitudinal data, the following null hypotheses were tested:

H_o^1: There will be no significant difference between the learning rates of learning disabled students who received intervention services in reading prior to first grade and those who received intervention services after first grade.

H_o^2: There will be no significant difference between the learning rates of learning disabled students who received intervention services in reading prior to second grade and those who received intervention services after second grade.

H_o^3: There will be no significant difference between the learning rates of learning disabled students who received intervention services in reading prior to third grade and those who received intervention services after third grade.

H_o^4: There will be no significant difference between the learning rates of learning disabled students who received intervention services in reading prior to fourth grade and those who received intervention services after fourth grade.

H_o^5: There will be no significant difference between the learning rates of learning disabled students who received intervention services in reading prior to fifth grade and those who received intervention services after fifth grade.

H_o^6: There will be no significant difference between the learning rates of learning disabled students who received intervention services in reading prior to sixth grade and those who received intervention services after sixth grade.

H_o^7: There will be no significant difference between the learning rates of learning disabled students who received intervention services in mathematics prior to first grade and those who received intervention services after first grade.

H_o^8: There will be no significant difference between the learning rates of learning disabled students who received intervention services in mathematics prior to second grade and those who received intervention services after second grade.

H_o^9: There will be no significant difference between the learning rates of learning disabled students who received intervention services in mathematics prior to third grade and those who received intervention services after third grade.

H_o^{10}: There will be no significant difference between the learning rates of learning disabled students who received intervention services in mathematics prior to fourth grade and those who received intervention services after fourth grade.

H_o^{11}: There will be no significant difference between the learning rates of learning disabled students who received intervention services in mathematics prior to fifth grade and those who received intervention services after fifth grade.

H_o^{12}: There will be no significant difference between the learning rates of learning disabled students who received intervention services in mathematics prior to sixth grade and those who received intervention services after sixth grade.

With reference to the limitations and exceptions of the study, the following hypotheses were tested:

H_o^{13}: In reading, there will be no significant difference between the learning rates of educable mentally retarded students and those of learning disabled students whose intelligence levels are found to be within the retardation borderline to the slow learner ranges of intelligence.

H_o^{14}: In mathematics, there will be no significant difference between the learning rates of educable mentally retarded students and those of learning disabled students whose intelligence levels are found to be within the retardation borderline to the slow learner ranges of intelligence.

H_o^{15}: In reading, there will be no significant difference between the learning rates of the slow learner learning disabled students and those of learning disabled students whose intelligence levels are found to be within the normal range of intelligence.

H_o^{16}: In mathematics, there will be no significant difference between the learning rates of the slow learner learning disabled students and those of learning disabled students whose intelligence levels are found to be within the normal range of intelligence.

Collection and Treatment of the Data

This study analyzed data which had been collected over a period of seven years on learning disabled children who have participated in a cooperative district comprehensive special education program for eligible handicapped students (N = 257). The data included the following control factors: student identification number which also identifies the local school district; birth date, current age, and grade level; age and grade level when intervention began; sex and ethnic origin; verbal, performance, and full scale IQ: attrition status; handicapping category and degree of handicap; pretest and posttest measures, dates, and intervals (in months) between pretests and posttests in the basic skill areas of reading and mathematics.

Prior to the implementation of the cooperative district program, a comprehensive needs assessment was conducted on a district-wide basis. Based on the results of the needs assessment, a <u>Five-Year Plan</u> (1975 Rev. 1978, 1980) was developed for implementing the cooperative program. In this planning process, local district policies and procedures were developed in compliance with State Board policies and procedures (TEA Bulletin 711, 1973); goals, objectives, enabling activities, and evaluation criteria were established for the various components of the comprehensive program; and all of these were categorized according to either administrative, instructional, or program product functions.

Since the program product provided the rationale for establishing and maintaining the special education program, an element of the evaluation design was developed whereby data could be collected on the program product. Results of the analysis of these data were to be used in the evaluation of the total program. It was assumed that, in this manner, the district could establish credibility and demonstrate accountability for the resources provided to the school district by the State.

Procedures were designed to implement the data collecting process with consideration of restraints imposed by internal situations and/or conditions within the local school districts such as teacher over load, limited support staff, limited time, lack of sophistication to analyze or understand complicated statistical analyses and/or results, retest effects, and teacher insecurity regarding any program evaluation procedures. Data collecting procedures were implemented and described in the Five-Year Plan (1975, Rev. 1978, 1980).

With consideration of the restraints mentioned above the Wide Range Achievement Test (WRAT), a testing instrument developed by Jastak, J. and Jastak, S. (1936, Rev. 1946, 1965, 1976, 1978) was selected. The WRAT met the needs of the district because it can be administered in less than 20 minutes; is easily scored and reports results in raw scores and scaled scores from which grade ratings are derived; teaching-to-the-test or coaching effects are minimal or nonexistent after an interval of three months; through common practice, the WRAT is usually administered as part of a battery of tests; can be administered to individuals from preschool age to advanced old age; can be administered to handicapped individuals as well as the nonhandicapped; and is a reliable and valid test of a wide range of skills in reading, mathematics, and spelling. Data relevant to spelling are not included in this study. In a scaling technique for WRAT norms (1978), the raw scores are scaled.

According to Jastak, J. and Jastak, S. (1978), during its 42 years of existence, the WRAT has been researched on many thousands of persons from preschool age to advanced old age, and it is very widely used in both the United States and in Europe.

The support staff were delegated the responsibility of administering the test since they already included it in the assessment battery of tests used in the comprehensive assessment process.

The WRAT was administered to all handicapped students who were already placed in special education, and has been administered to each new student upon his/her entry into the program. The initial test results in reading and mathematics were recorded as pretest or entry-level measures. The same test was administered at the end of the school year, and the results were recorded as posttest or exit-level measures.

Since no handicapped students participated in summer programs, the intervals between pretests and posttests were computed on the basis of a ten-month school year.

Personal identifications were removed, and identification numbers were assigned prior to entering the test results in the district data file. From the results, the average district gains were computed in reading and mathematics according to handicapping categories.

Results of the test were reported in grade ratings in order to facilitate the interpretation by school personnel, students, and school patrons. Since, through common practice, students' academic gains are reported in this manner, all concerned are more familiar with this terminology than with results reported in terms of scaled/standard scores.

The test data were filed and used for the purpose of program evaluation on an annual basis. No efforts or provisions were made to use the data for any other purpose. For students continuing in the special education program, the posttest measures served as the pretest measures the following year. Thus, after the initial year in the program, students were administered the test only at the end of the school year.

Results of the individual achievement test were not used as the only measure to determine an individual student's progress in reading and mathematics in the classroom. Other formal and informal assessment processes were used.

The results of the individual achievement tests were never used to compare students' progress in one classroom with students' progress in another classroom, nor were they used in any way to compare or evaluate teachers' performances.

To determine the difference between the learning rates of learning disabled students which may be attributed to the age or grade level at which they experienced intervention programs, the following statistical analyses were:

1. Use a one-factor analysis of covariance on total gain; and the same on average gain.

   Covariates may be current grade, IQ, sex, age, ethnic orgin, handicapping category, degree of handicap, attrition status, school district, and age or grade level at intervention--to remove any systematic influences of these factors on gain--allowing for inspection of differences between intervention levels free of covariate influences.

2. Use a two-factor repeated measures analysis of covariance; intervention levels by repeated testings; and covariates and rationale the same as above. This analysis will allow inspection of trends across time and differences on such trends due to intervention levels. Nominal covariates were recorded as dummy correlates for the analyses.

Limitations and Exceptions

The study was limited to the statistical analysis of longitudinal data collected on learning disabled students, with the exception of the longitudinal data collected on educable mentally retarded students during the same time span. These latter data were described and analyzed to determine whether or not the results of the statistical analysis would enhance the study, provide a starting point, or serve as a frame of reference for future research.

CHAPTER II

RELATED LITERATURE

Since the education of learning disabled children has evolved from and been influenced by early childhood education and special education for handicapped children, the review will be presented according to the related literature concerning: (a) historical perspectives of early childhood education in European countries, (b) historical perspectives of early childhood education in the United States, (c) intervention by the federal government in early childhood education and special education for handicapped children, (d) implication of early experiences for future development, and (e) the issue regarding the identification of and intervention in educational programs for learning disabled children.

Historical Perspectives of Early Childhood Education In European Countries

Historically, the development of early childhood education does not differ significantly from the development of educational programs for handicapped children. In fact, so many commonalities exist in their origins, growth, and spheres of influence that it appears reasonable to state that both have emerged from a common root; if not from a common root, then with their roots so entwined that their spheres of influence are inseparable.

Spodek (1973) drew attention to the fact that a great many early childhood programs have historically been rooted in concerns for the poor. Whether for altruistic or political reasons, or simply because the children were available, early childhood education programs were established for such groups of children as war orphans, mentally defective children, and disadvantaged children from city slums or other poverty stricken areas. The availability of these children was possibly an influencing factor since affluent families employed private tutors and governesses to educate their children in their own homes.

According to Kirk and Johnson (1951), education for mentally defective children began during the early part of the nineteenth century, and those who contributed most to the diagnosis and education of these children were physicians.

In 1799, a young lad of about twelve years of age was captured in the forest of Aveyron in France. For unknown reasons, he had apparently been abandoned at a very young age to fend for himself among the animals of the forest; in fact, he was more like a wild animal than a human being. He was not able to speak, selected his food by smell, tried to escape, and did not respond as a human being at all (Kirk & Johnson, 1951). Jean Marc Itard, a French philosopher and physican who was working in an institution for the deaf, felt that the wild boy of Aveyron was an example of a completely untutored human being. He believed that with appropriate educational procedures applied to the training of the senses this young boy could be made into a socially acceptable human being. He worked for five years trying to demonstrate to the world that even an idiot could be educated by the training of the senses. Despite all of Itard's efforts, the boy, Victor, did not learn to speak but remained mute until his death in 1828. He did not become socially acceptable and, at the onset of puberty, had to be committed to an institution because he became unmanageable in the home setting. Later, when investigating the case, the French Academy of Science decided that Itard had made a worthwhile contribution and requested that he publish a report of his efforts. As a result, the book, The Wild Boy of Aveyron (trans. 1932), became a classic in the history of the education of the mentally retarded (Braun & Edwards, 1972; Kirk & Johnson, 1951).

Eduard Seguin, a teacher who later became a medical student under Itard, was so influenced by Itard's teaching that he became inspired with the potentialities of the mentally retarded and established the first school devoted to the education of mentally defective children in 1837 (Anastasi, 1968; Kirk & Johnson, 1951).

According to Braun and Edwards (1972) and Spodek (1973), Maria Montessori (1870-1952), a young Italian physician, was appointed to the Psychiatric Clinic in Rome where she came in contact with mentally defective children. She became interested in the works of Itard and Seguin, and, building upon the works of these two French physicians, developed an educational system that was so successful with retarded children that she was offered an opportunity to develop an educational approach for normal children who lived in a slum area of Rome. She accepted the offer and established the first of her schools which she named "Casa Dei Bambini."

Reports of the success of this school for young children spread throughout Italy and, eventually, all over the world as visitors came to observe the innovative educational methods of instruction used by Montessori. As a result, an international movement developed, and Montessori schools were established throughout the countries of the world. These schools were supervised by the International Montessori Association. Montessori's schools, teacher-training programs, didactic materials, and instructional methods are still quite visible in early childhood education and special education programs today (Spodek, 1973; Braun & Edwards, 1972).

Decroly, a physician working in Brussels, Belgium, was influenced by Itard, Seguin, and Montessori. He worked with mentally defective children and their families and, like Montessori, constructed curricula based on educational games. However, he emphasized educational games in a natural setting while Montessori used didactic materials in a structured or contrived setting (Kirk & Johnson, 1951).

Pestalozzi (1746-1827) established schools for children and youth who had been orphaned by the revolutionary wars in European countries. He spent his life in France and Switzerland and dreamed of establishing model schools for young children. He made elaborate plans for these schools, but he spent most of his life teaching the destitute orphans. His greatest contribution to education was made in the foundations he established for educators who followed him to begin what became the forerunner of early childhood education (Braun & Edwards, 1972).

Robert Owen (1771-1858) originated the infant school, the institution of primary education which exists in England today. While managing a cotton mill in Scotland, he became concerned about the deplorable living conditions of the mill workers and their families and instituted reforms to alleviate the misery caused by these conditions. He established schools for children as well as for the adults in the community. He tried to limit the employment of children in the mill by waiting until they were at least 10 years of age rather than the customary age of 6 years (Spodek, 1973).

In 1837, Frederick Frobel (1782-1852), a devoutly religious man, established the first kindergarten, and for this he became known as the father of the kindergarten. This was established in Blankenburg, Germany, and it is from this early period that early childhood education has progressed, sometimes faltering, but continually progressing until this day (Braun & Edwards, 1972; Spodek, 1973).

According to Spodek (1973), the first nursery school was established in England (1911) by Rachel and Margaret McMillan. It was designed to improve the child-rearing conditions of the poor, and it served children from 2 to 7 years of age. The McMillan sisters were influenced by the works of Seguin and Itard.

These early childhood education programs were all established in European countries, and even though they were different in many respects, their similarities reflect the ways in which their roots were entwined. The influences of these early childhood education programs spread to the United States and have undergone changes in program implementation. However, the diversities of the various preschool education programs in existance today do not obscure the contributions made by Itard, Seguin, Montessori, Decroly, Forbel, Pestalozzi, Owen, and the McMillians. Each made a significant contribution to the field of early childhood education.

Historical Perspectives of Early Childhood Education In The United States

During the period following the revolutionary war, the United States was a new nation. The population was increasing rapidly; destitute emigrant families were flocking to the shores of this land of opportunity; city slum areas were growing at an alarming rate; and the population was continually pushing the frontier westward. Early schools were founded by local citizens to serve the needs of the communities, and formal schooling was considered to be of far less importance than the training children received outside the school. Children were not expected to attend school for more than a few weeks each year, and few attended school for more than 2 or 3 years (Smith, Barr & Burke, 1976). Since formal education was of such minor importance among the alternatives for preparing children for independent living, most children were trained by their parents in their homes or in apprenticeships arranged by their parents. The primary goal was for children to learn to work for a living.

In some communities, religious education was considered to be of major importance, but many communities had no established schools during this early period. In fact, schooling was not considered to be of significant importance for the founding fathers to even mention education in the United States Constitution which was ratified in 1789 (Smith, Barr, & Burke, 1976.

In Watertown, Wisconsin (1855), Mrs. Carl Schurz, having studied in Germany under Frobel, opened a kindergarten in her home. This kindergarten was organized originally for the benefit of her own children. She influenced Elizabeth Peabody of Boston who opened her own kindergarten in 1860. She also studied under Frobel at a later time and influenced her sisters, Mrs. Horace Mann and Mrs. Nathaniel Hawthorne who, in turn, influenced Horace Mann, Ralph Waldo Emmerson, the Alcotts, and William Channing in the kindergarten philosophy. These people influenced students who were attending the Concord School among whom were Susan Blow and William Harris who later became the United States Commissioner of Education. Harris and Blow were responsible for opening the first public school kindergarten in Saint Louis in 1873 (Braun & Edwards, 1972).

Noah Webster published the Blue Backed Speller in 1873, and this helped to unify the language and to influence public opinion as well. Patriotism began to vie with religion; the moral rather than the theological began to be emphasized; and the secular values of honesty, thrift, cleanliness, and modesty were preached or disguised in little stories. By 1860, the population had grown to 31 million, and the nation was fast becoming urban rather than rural. The industrial revolution brought the need for public education. Many people lived in poverty, degradation, and misery in the crowded cities, and a free public education was something that few people had even thought about. So, it is to the eternal credit of this nation that men who owned property voted to tax themselves for the purpose of educating the children of other people. This was a rare and surprising accomplishment for a new democracy to attain in a mere fifty years (Smith, Barr, & Burke, 1968; Braun & Edwards, 1972).

According to Kamii (1971), in the 1920s, preschool education consisted mainly of nursery schools established by colleges and universities for the purposes of research. These were private kindergartens in urban areas and some public school kindergartens, but early childhood education did not exist as a priority need until intervention by the federal government brought a new emphasis on education for young children.

Intervention By The Federal Government In Early Childhood Education And Special Education

The first movement by which the federal government became involved in preschool education had as its primary objective the provision of jobs for unemployed teachers (Kamii, 1971). During the 1930s, many teachers were unable to find employment because schools were not able to fund their salaries. Under the Federal Emergency Relief Agency (FERA) and later under the Works Progress Administration (WPA), nursery schools were established. The curriculum for these nursery schools consisted mainly of good health and good habits.

In the same manner, the Lanham Act Day Care Centers were established during World War II for the care of young children whose mothers were working in defence industries (Spodek, 1973).

Although the curriculum continued to be centered on child care, the concern for the emotional life of the child came into being (Kamii, 1971). This came about as a result of the writings of Frank (1938), Gesell

(1940, 1943), and Spock (1946) along with the emergence of emotional problems of children whose mothers were working and whose fathers were absent from the homes. According to Kamii (1971), Child Care Centers gradually took on the function of providing preventative psychiatry. The new cooperative nursery schools placed a new conscious emphasis on the socioemotional development of the children as an objective which was first articulated in the 1940s.

Isaacs (1930), Johnson (1928), and Landreth (1942) had all been concerned with cognitive development of young children, but in the 1960s some major forces contributed to a new emphasis on it. According to Kammi (1971), one of the forces contributing to the emphasis on cognitive development was the accumulation of knowledge that pointed to early childhood as the period when children are most susceptible to intervention.

Skeels & Dye (1939) reported one of the early research studies on the effects of a stimulating environment on the intellectual development of children. Skeels (1942) reported a follow-up study on the same subjects 3 years later and another follow-up study on these subjects after they had attained adulthood (Skeels, 1966). Hunt (1961) published his Intelligence and Experience which aroused an interest in environmental manipulation when he claimed that by properly arranging the early experience of young children, their average levels of intelligence could be raised by 30 points. Then, Bloom (1964) published his book, Stability and Change In Human Characteristics which created a flurry of excitement in the media when he made his dramatic claim that a child attains 50% of adult intelligence by the age of 4 years and 80% by the age of 8 years. He also claimed that a child living in an impoverished environment for the first 4 years of life could possibly lose as many as 2.5 IQ points per year and that the loss would be irreversible.

According to Biehler (1976), the dramatic claims made by Bloom created an impact on educational toy sales, and anxious parents scrambled to enroll their 3 year old children in nursery schools while children's encyclopedia publishers and opportunist experts of varying degrees of reliability experienced a profitable heyday at the expense of concerned parents. All of this had an impact on the federal legislation which followed even though research in the 1930s and 1940s had shown that infant stimulation programs and early childhood stimulation programs had not produced intellectual gains that were permanent since these gains had faded in the early primary school grades (Biehler, 1976).

Deutsch (1964) was working in an experimental government sponsored preschool program for inner-city children in New York City when he drew attention to the possibility that children from deprived environments were at a disadvantage when compared with children from middle class and upper class environments. He reported that children reared in deprived environments showed improvement in their learning behaviors when provided with intensive preschool experiences.

The writings of Hunt (1961), Bloom (1964), and Deutsch (1964); the uproar created by the civil rights movement; the availability of federal funds to support educational projects; and the increased public awareness of the poverty-stricken people in inner-city slum areas, in black communities in the South, in depleted-mining communities in Appalachia, and other areas across the nation, were all contributing major forces which led to the implementation of the Head Start program in 1965 as a part of President Lyndon Johnson's " War on Poverty" (Braun & Edwards, 1972; Spodek, 1973; Kamii, 1971; Biehler, 1976).

Head Start was implemented as a summer program for disadvantaged preschool children. The purpose of the program was to provide educational opportunities for disadvantaged children to catch up with their non-disadvantaged peers. The Office of Economic Opportunity (OEO) spent millions of dollars establishing the Head Start programs, and wanted proof that the programs were effective before investing additional money. Therefore, the OEO arranged carefully controlled studies in which the school performances of Head Start participants were compared with those of children of similar backgrounds who had not enrolled in Head Start. The results of the studies were disappointing to the advocates of early experience to develop intellectual ability. Gains made by Head Start participants faded in the primary grades (Moore, 1978; Biehler, 1976; Braun & Edwards, 1972; Yussen & Santrock, 1978).

According to Yussen and Santrock (1978), Congress established Project Follow Through in 1967 when it became apparent that Head Start was not enough to provide the educational support needed by disadvantaged children. Hunt and others felt that perhaps the intervention age of the children was too high, and should be lowered. Nevertheless, Follow Through was implemented as an extension of Head Start and extended through the third grade. Moore (1978) stated that Follow Through, an extension of Head Start, was based on the assumption that intervention through third grade was needed by high risk children even if they had attended Head Start.

The Nixon administration reduced the funding appropriation before the program really got started, and the whole design of the project had to be altered. The decision was made to redesign the project as a planned-variation research project in the attempt to find the most suitable educational program for providing educational support for disadvantaged minority children (Anderson, 1977).

Follow Through programs were comprehensive in that they provided not only in-school instruction but also included medical and dental services, nutrition, psychological services, staff development, and social services as well as parent and community involvement (Biehler, 1976; Yussen & Santrock, 1978; Moore, 1978).

According to Moore (1978), Follow Through offered alternative models of classroom styles. These models ranged from highly structured, didactic classrooms to those with flexible open classrooms organized around individual units of study. All models stressed instruction of basic skills in reading, writing, and arithmetic; some also addressed broader educational goals in the areas of language and cognitive functioning, student initiative, and classroom participation. Parent participation was stressed in varying degrees. For some models, parent involvement was the major source of intervention as a supplement to classroom activities.

The Follow Through Planned Variation Project consisted of 22 models which were based on a variety of theoretical orientations. Examples include: (a) the University of Oregon Engleman-Becker Model for Direct Instruction, a highly structured program with sequentially programmed lessons for the development of basic academic skills in language, reading, and arithmetic; (b) the High/Scope Cognitively Oriented Curriculum developed by Weikart, a program based on Piaget's theory of cognitive development; (c) the Florida Parent-Education Program developed by Gordon, a program which stresses parent training and parent involvement in children's learning; (d) the Far West Laboratory Responsive Educational Program, a program that has much in common with the humanistic view of child development; (e) the Bank Street College of Education Approach, an eclectic model in which academic skills are acquired within a broad context of planned activities; and (f) the Tucson Early Education Model developed by the University of Arizona, a comprehensive child centered program which stresses strong involvement of the home and community as extensions of the learning environment (Spodek, 1973; Yussen & Santrock, 1978).

Follow Through is the largest effort ever made by the United States government to provide educational services to any group of children, and the impact, whether good or bad, will probably not be known for decades to come, if it is ever fully analyzed. This project has cost the American taxpayers over a billion dollars with evaluation efforts estimated at 50 million (Anderson, 1977).

The Handicapped Children's Early Education Program (HCEEP) was initiated by Congress in 1968 by the passage of Public Law 90-538, the Handicapped Children's Early Assistance Act. The HCEEP is a seed-money program the basic objective of which is to plant a seed (award a competitive grant for the development of an innovative idea) and to nurture that seed from 3 to 5 years until it reaches maturity. When the development of the idea is completed, it should be self-sustaining. For example, it should no longer need the seed money but should be funded by state or local funds so that other educators can use components of the model to initiate programs (Swan, 1980).

The Education Amendment of 1974, Public Law 93-380, introduced new requirements which were supportive to preschool education for handicapped children. One of these was the requirement that each state set a goal for serving all handicapped children from birth through age 21. However, no target dates for implementation were established. Another mandate of Public Law 93-380 was the requirement that all states establish and maintain a systematic effort to find all handicapped children from birth through age 21 (Cohen, Semmes, & Guralnick, 1979).

The State Implementation Grant Program which began in 1974 under Public Law 90-538 is another federally funded program in support of preschool education for the handicapped. Its primary objective is to encourage and support implementation of comprehensive early childhood education plans by the state (Cohen, Semmes, & Guralnick, 1979).

In 1975, President Ford signed the Head Start Economic Opportunity, Community Partnership Act of 1974 into law. This act amended the Economic Opportunity Act of 1964, and changed the name from the Office of Economic Opportunity (OEO) to the Community Services Administration (CSA). Head Start was transferred to the Department of Health, Education, and Welfare (HEW). The act stipulated that beginning in fiscal year 1976, no less than 10% of the enrollment opportunities in each state must be available to handicapped children (Nazzaro, 1974; Ensher, Blatt, & Winschel, 1977; LaVor, & Harvey, 1976).

According to LaVor and Harvey (1976), the effects of this new legislation would force each state to focus on and meet the needs of handicapped children within the state. It would no longer be possible to disregard the minimum 10% requirement by averaging their totals with overall national or regional enrollments. In the enactment of this legislation, the Congress also directed the Office of Child Development (OCD) to coordinate efforts with other state and federal agencies that provide preschool services to handicapped children. The directive was also given to OCD to pay particular attention to coordinating with state plans which were developed under the Education of the Handicapped Act and the Developmental Disabilities Services Act.

According to Abeson and Zettel (1977), the beginning of the end of the final phase of the revolution to achieve public policy affirming the right to an education for every handicapped child was on November 29, 1975 when President Ford signed into law Public Law 94-142, the Education for all handicapped Children Act of 1975. This law became fully effective in September, 1978. It was considered to be a milestone of great importance in the education of handicapped children.

Through the enactment of the Education for all Handicapped Children Act of 1975, handicapped children of preschool age received a mandate of sorts since this law was the base for the changes that occurred in public school systems throughout the nation. According to Cohen, Semmes, and Guralnick (1979), the basic concepts of this law--free appropriate public education, least retrictive learning environment, nondiscriminatory assessment, individualized education program, parent involvement and consulation, and the right to due process throughout the identification and intervention process--have transformed both the quality and quantity of public education for handicapped children and youth; however, they claimed that the mandate is a flawed mandate for preschool-age handicapped children because many of these children will not be enrolled in school until they are 5 or 6 years of age. The flaw in the mandate exists because the free appropriate education for preschool-age children as mandated is inconsistent with the law or educational practices in some states, and thus, the federal mandate does not apply to them. In recognition of the flaw in the mandate, an amendment was enacted to provide additional funds to state entitlements for each 3, 4, and 5 year old child served and counted by the state. This amendment was added to Section 619 of Public Law 94-142, and created the Preschool Incentive Grant Program for which states can apply for funds to initiate, improve, and expand services to preschool-age handicapped children.

Implications of Early Experiences For Future Development

The importance of early experience for later development has been widely debated in literature, particularly with reference to the most appropriate types of early experiences to provide for the intellectual development of young children. Educators are faced with the responsibility for making some awesome decisions regarding intervention in educational programs for young children because of the possible impact their decisions have on the courses the lives of these children may take. The research studies reviewed in this section have been selected with particular reference to the implications of early experiences for future development in young children.

Cognitive developmentalists have been concerned with the implications of early experience for future development of intellectual abilities. The concern has centered around the kinds of experiences that promote cognitive growth as well as the time in an individual's life when it is most crucial for specific types of experiences to be most effective in promoting the development of cognitive skills to enhance future learning.

According to Kamii (1979), cognitive developmentalists believe that the process of education is one of building structures in the mind of a child. Prior to the early 1930s, structures of knowledge were theorized to be orderly packages, templates, or schemata located in the cortext of the brain which acted as a storehouse of past impressions, and recall was possible when a stimulus re-excited a particular structure and caused it to rise into consciousness (Barlett, 1932).

However, Bartlett (1932) refuted this theory with the notion that the way knowledge is packages or structured is entirely different from the storehouse idea with its implications for retrieving intact information much as neatly stored items can be retrieved from a storage facility. Bartlett described the way knowledge is structured as an organized living mass which is constantly changing, developing, and being influenced by every bit of incoming sensational experience. He disliked the words schema and schemata as being both too definitive and too sketchy, but chose to use them with some reservations. He proposed that terms such as actively developing patterns and organized settings would be more appropriately descriptive. He defined schemata as all of the experiences connected by a common interest which operate in mass where the latest incoming constituents have predominant influence. He contended that remembering appears to be far more decisively an affair of construction/reconstruction than one of mere reproduction. Bartlett received little attention to his notion of schema theory until the last decade or so when cognitivists began to explore the implications of early experience for future intellectual development.

According to Anderson (1977), a schema is a knowledge structure containing slots or placeholders for each component piece of information subsumed under a general idea or structure. Comprehending a thing, event, or a relationship occurs when a sufficient number of slots are filled with particular examples of things, events, or relationships. In other words, comprehension of an event, thing, or relationship depends upon the learner's finding a one-to-one match between the slots in a schema and the givens in a message.

Menisky, (1975) described schemata as abstract knowledge structures whose elements are other schemata, slots, placeholders, or variables which can take on a range of values. Implications of schema theory for education are that it lends credibility to the experience approach to learning.

Schema theory is much the same as Piaget's (1963) fundamental distinction between physical knowledge and logico-mathematical knowledge. The former refers to knowledge of physical objects which are observable in physical reality. The latter refers to the knowledge that is within the individual; inner knowledge that an individual constructs for one's self. Piaget believed that the process of education should be that of building cognitive structures in the mind through self-directed experiences. He referred to cognitive structures as schema, and both he and Bartlett contended that prior knowledge/experience were essential for an individual's comprehension of things, events, and relationships. Piaget was convinced that inner knowledge could only be attained by a child's acting on his/her environment; that the child had to have meaningful experiences with an object prior to structuring concepts in the mind regarding the object. Application of Piaget's theory of cognitive development to the processes of early childhood education has implications for the development of cognitive skills for young children to enhance their future learning.

Much of what Featherston (1968) described with reference to his analysis of the Plowden Report (Weber, 1971) can be applied to the current status of early childhood education in the United States. He stated that despite a decade of more or less unified innovation, there is still a great pedagogical vacuum in educational programs for young children. It is true that research has continued through an additional decade; that Head Start, Follow Through, and other innovations have been implemented; and there are volumes of rhetoric regarding the development and education of young children. Yet, teachers of young children are still bound by formal methods of teaching; traditional classroom environments are still prevalent (especially if associated with public schools);

and parents are still looking for concrete examples of effective early childhood education programs.

According to Featherston (1968), American educators have concentrated on the external features of English informal education such as the use of vast amounts of materials, varieties of activities going on simultaneously, etc. without looking into what teachers and children really do in a classroom. In other words, the unique characteristics of the learning environment that are conducive to children's learning need to be explored. Educators need to determine what types of experiences are most critical for developing potentialities in young children for successful achievement in the courses of their lives. Likewise, the potentials for intellectual development need to be explored with regard to whether child-structured learning experiences or adult-structured learning experiences are most effective.

One of the earliest studies related to the effects of a stimulating environment on the intellectual development of children was a study reported by Skeels and Dye (1939). This study compared infants placed on a ward in an orphanage with infants placed in a cottage setting with older girls as surrogate mothers. After an intervention period of 19 months, the infants in the cottage setting manifested a mean gain of 27.5 IQ points while the infants in the orphanage ward indicated a mean loss of 26.2 IQ points. The enriched environment of the cottage setting where the surrogate mothers gave extra attention to the infants appeared to be the factor which made the difference in the infants' intellectual gains. The point in question at that time concerned the degree of permanence of the gains.

Three years later, Skeels (1942) reported that the experimental children had maintained their accelerated rates of development in foster homes while the children who remained in the orphanage maintained their decreased rates of intellectual performance. Implications were that the stimulated environments of the foster homes had been effective in the maintenance of accelerated rates of development for the experimental children.

Skeels (1966) did a second follow-up study of the two groups of children after they had reached adulthood and reported that members of the experimental group were far more successful in maintaining stable marriages, in educational achievement, and in maintaining gainful employment and economic stability that were the orphanage-reared individuals.

White and Castle (1964) studied infant care techniques in a 30-day infant-stimulation project. In this study, week-old institutionalized infants were given 20 minutes of extra handling each day. At the end of 30 days, developmental-test ratings were compared with the ratings of non-stimulated infants. The only significant difference between the 2 groups was a greater amount of visual attention shown by the infants who were handled each day.

In another study, White (1967) used institutionalized infants whom he provided with extra stimulation by arranging their cribs so they could see out, see objects hung over their cribs, or see patterned crib bumpers. Compared to a control group of infants who were placed in plain cribs with high sides which prevented their seeing outside the cribs, the extra-stimulated infants showed not only more visual attentiveness but an increase in reaching behaviors.

In an attempt to determine the effects of different types of environmental stimulation, White and Held (1966) placed 1 group of infants in the stimulated environment cribs, another group in cribs which had large disks with pacifiers projecting from them suspended on each side of the cribs, and a 3rd group in the plain cribs with high sides.

The 1st group of infants apparently had so many things to look at that they were so busy looking they forgot to reach. The group with the disks and pacifiers apparently concentrated on the within-reach object and demonstrated more reaching behaviors. The 3rd group did not demonstrate either increased visual attention or increased reaching behaviors.

In another study, White (1971) placed colored mittens on a group of institutionalized infants and found that they tended to look at their hands about a month earlier than a control group of infants who wore no mittens.

As a result of his interest in the study of infant reactions to stimulation, White was asked to direct a research project, the Harvard Preschool Project, funded under the Head Start division of the Office of Economic Opportunity in 1965 (Biehler, 1976).

According to Pines (1971), when the project started, the country was just awakening to the fact that children's success or failure in school seemed to be determined before they entered 1st grade at 6 years of age. The purpose of the research was to find out what it is that causes a child to be able to succeed when he/she enters school at age 6. To determine specifically what competence is at age 6, White and a group of other researchers visited kindergartens and Head Start programs and observed children once each week. They tested a number of children, talked with their teachers, and eventually selected 2 groups of normal 3 to 6 year old children whom they divided into 2 groups, A and C. Group A children rated exceptionally high on all aspects of competence-readiness for 1st grade and dealing with problems on the school yard as well as in the classroom. Group C children never seemed able to cope either in or out of the classroom.

Having selected the A and C groups of children, White and Watts (1973) studied the children according to a set of social and intellectual skills broken down into 17 specific abilities which the A children possessed but the others lacked. Each of these abilities could be tested in some form at all ages. A startling conclusion was reached when it was discovered that the youngest members of the A group, who were barely 3 years of age, had exactly the same cluster of abilities as the group A children who were 6 years of age. The conclusion was that whatever happened to produce the difference between the A and C groups had occurred before the children were 3 years of age.

Pines (1971) presented a detailed description of the next step in the study when White abandoned the study of the older children and took his team of researchers into the homes of toddlers from 1 to 3 years of age. During 2 years of intensive study of 40 mothers and their children, the project tracked down the point at which the paths of A and C toddlers began to diverge. The differences between the A and the C groups were clear by the age of 2 years. Even at 18 months, the children appeared to be on paths that were predictable. Observing children who were 10 months of age, the researchers were unable to find enough differences to discriminate the A group from the C group. The conclusion drawn by White and Watts (1973) was that whatever it was that determined a child's success or failure occurred between 10 and 18 months of age.

The next step in the research was the study of the interactions of the mothers and toddlers to find out just what the mothers did during this period to produce group A children. In general, the findings indicated that the mothers who produced group A children allowed the children to explore and test the home environment on their own initiatives without the freedom hampering devices such as playpens and restraining gates. White, in reference to the short mother-child interactions which went on throughout the busy day, stated that the mothers were teaching "on the fly." In other words, they did not stop their busy days for long periods of mother-initiated interaction but were available and responsive when the toddlers initiated the interactions. The children were allowed the freedom to initiate their own activities from whatever the environment provided, which might have been no more than a cardboard box, different sizes of blocks, a spoon, some plastic bowls, etc. Toys were also available, but somehow, the children (as most children do) preferred the ordinary things found in the household such as pots and pans. The important aspect of the mother-child interactions were that they were meaningful communication experiences for both participants. The mothers made every interaction count; even when changing the toddler's diaper, they played peek-a-boo.

White stated that educational handicaps can be identified very early, even by the age of 2 years, and he called for a commitment from society to move into this age range with educational intervention. He stated that it should be done before the children start to school.

Hunt (1961) published his book, <u>Intelligence and Experience</u> in which he described his analysis of some nature-nurture studies and proposed that environmental experiences were the most important factor in determining the development of an individual's intellectual ability. He was convinced that experiences could be arranged to increase intelligence, and made the following statement:

> With a sound educational psychology of early experience, it might become feasible to raise the average level of intelligence, as now measured, to a substantial degree. In order to be explicit, it is conceivable that this "substantial degree might be of the order of 30 points of IQ." (p. 267)

In a study of orphanage-reared infants, Hunt, Mohandessi, Ghodssi, and Akiyama (1971) researched the longitudinal outcomes of 5 successive interventions in the rearing of infants in an orphanage in Tehran.

Infants in 5 successive interventions called Waves were assessed using the Uzgiris-Hunt Ordinal Scales. The Waves consisted of infants selected at less than 4 weeks of age without detectable physical defects. They were assessed every other week the first year and every 4th week thereafter.

Wave I consisted of 15 infants, the controls; Wave II, 10 infants provided with audio-visual intervention (not fully implemented); Wave III, 10 infants provided with extra untutored human care (ratio 10:3); Wave IV, 20 infants provided with audio-visual intervention plus access to responsive inanimate objects (colored paper, toys, etc.); and Wave V, 11 infants provided with tutored caretakers (ratio 2 : 1 and 3 : 1). Results revealed that each successive Wave, except Wave II, achieved the top steps of nearly all of the Ordinal Scales at mean ages younger than the preceding Wave. The 5th Wave even surpassed home-reared American children from predominately professional families in 5 of the 7 scales.

Implications of such studies are that early intervention programs in early childhood can make a difference in children's learning, particularly for children from homes on the poverty level. It appears that evidence supports the establishment of home-intervention or community-centered programs where mothers of disadvantaged children can be trained in programs similar to the tutoring program for the caretakers in Wave V in the study by Hunt, et al.

Bloom (1964) reviewed research on height, weight, IQ scores, and personality measures of individuals which had been studied for a period of several years and became convinced that the results revealed that changes across time in these measures were related to environmental influences; that experiences in an individual's environment have a great impact on the development of human traits at their most rapid periods of change. Since the early childhood years are when the most rapid changes in developmental processes occur, Bloom concluded that early experiences are of critical importance in an individual's life.

When Stability and Change in Human Characteristics (Bloom 1964) was published, it had a tremendous impact on the growing interest in the importance of early education for young children. Based on his research, Bloom claimed that an individual attains 50% of adult intelligence by 4 years of age and 80% by the age of 8 years; that living in an impoverished environment for the first 4 years of life could cause an individual to lose as much as 2.5 IQ points per year; and that the loss would be irreversible.

In response to the claims by Bloom (1964), Jensen (1969) stated that having analyzed Bloom's data, he found that his method of estimating mental growth, if applied to physical growth, the resulting prediction would be that an average 4-year old child would attain a height of 6 feet and 7 inches by the age of 17 years. In other words, Jensen had doubts about the accuracy of Bloom's research.

Jensen (1969) aroused a storm of protest when he published an article in which he disclaimed the notion that intelligence is almost exlusively the result of environmental experience. He suggested that heredity is much more influential in determining intelligence than environmental experience. The most controversial aspect of Jensen's article was his claim that distinct differences exist between the average intelligence of different ethnic groups.

In a cross-cultural study of cognitive development, Kagan (1972) observed active, competent 11-year old Guatemalan children living in an isolated Indian village whose counterparts at age 3 and below were listless, silent, and manifested apparent instances of gross discontinuity. Most of the younger children remained passive and apathetic until 5 or 6 years of age. These young children spent the first year of their lives in the dark interior of their huts near their mothers. They were prevented from crawling; they were seldom spoken to, played with, or taken outside; and they experienced markedly less interaction with their parents and older children than American children.

According to Kagan (1972), when assessed on recall and recognition, perceptual analysis, and conceptual inference, the differences between rural Guatemalan children and urban Guatemalan and American children from 5 to 12 years of age were found to diminish sharply, in some instances, to disappear altogether. Based upon these findings, Kagan proposed that infant retardation is reversible and that cognitive development, during early years, is more plastic than had been supposed. He suggested that experiental factors mainly influence the time of emergence of particular intellectual skills rather than their ultimate level of development.

According to Elkind (1981), it would be a pleasant experience to be able to relate to parents and school personnel that strong evidence supports the notion that early entrance into formal schooling is less effective than later entrance. If such a statement were made on the basis of research studies of large numbers of children across periods of time with acceptable data, it would have a strong impact on educational practices. However, Elkind stated that there is a lack of a data base for argument that one educational practice is better than another.

According to Biehler (1976), the analysis of the relative influence of heredity and environment on intellectual development of disadvantaged children is an emotion-charged issue because of the racial and other minority-group differences. However, it is generally accepted that the notion of early experiences for the development of cognitive ability is a reasonable assumption, especially for young children whose home environments are within disadvantaged communities as well as for young children who are at risk for handicapping conditions.

The Issue Regarding Early Intervention for Learning Disabled Children

Intervention programs which provide special education services for learning disabled (LD) children are not based on the assumption that the handicapping disability will disappear, or be cured. Instead, they are based on the assumption that LD children will learn in spite of the disability if provided appropriate individualized educational programs. In other words, while remediation processes may alleviate the disability, they will not remove it. By assessing LD children's strengths and deficits and directing learning to their strengths, it is hoped that they will develop coping skills which will assist them in becoming independent learners.

One assumption upon which early intervention programs are based is the expectancy that LD children will benefit from the special programs to the extent that they will be able to participate in regular education with their non-handicapped peers within a reasonable length of time. Switzer (1971) expressed a growing concern that this expectation was not being met, that "...once in, one never gets out" (p. 1).

The extent that LD children attain independence in learning depends not only on the degree of the severity of the handicapping disability but on how far behind in academic achievement they have become when intervention processes are initiated. According to Wetter (1966), with reference to deficiency in spite of progress, these students have made less than 10 months of progress during each academic year. Therefore, in order for them to catch up with their nonhandicapped peers, normal progress (1 month of gain per academic month) is not enough. They need to attain more than the normal rate of gain per school year to participate in regular education on the level with their peers. Consequently, to anticipate a quick return to regular education for most LD students is an unrealistic expectation.

Unless LD children can be identified in their early childhood years and receive intervention services before they lag so far behind their peers in academic progress, they face an almost impossible situation in ever reaching the level of academic attainment commensurate with their ages and intellectual abilities.

According to Gallagher, (1968), early intervention is of great importance for handicapped children because their problems in early development compound themselves if remediation processes are not provided at a early age. Also, he stated that the returns for energy spent are directly related to how early handicapped children receive educational intervention.

According to Hayden (1970), the notion is erroneous that children in the birth to 3 group are only in need of help in the realms of health and medical care; they and their families also need early educational intervention. For emphasis, Hayden stated:

> While nonhandicapped young children may make acceptable progress without early educational interventions, handicapped or at risk children do not. To deny them the attention that might increase their chances for improved functioning is not only wasteful; it is ethically indefensible. (p. 510)

According to Hayden, the failure to provide early intervention services to young handicapped or at-risk children compounds difficulties for everyone. She claimed that critical periods exist for learning different skills, and that once these periods are past, learning becomes much more difficult.

McDaniels (1977) stated that research studies have revealed that the long-term effects of early intervention programs have shown that children with preschool experience make better progress than children who needed such services but did not receive them before 5 or 6 years of age. McDaniels also made the following statement:

> Those infants at risk for handicapping conditions cannot wait until age six, or even age three, before receiving intervention that will help them. If, as we are learning, children as young as one year or less can make fine discriminations, then that is the age at which programs should begin. (p. 26)

Regarding children who are irregular in achieving their developmental milestones or who have discontinuous patterns of development, Glidewell (1971) noted that "...failure to accomplish the [developmental] tasks at one stage influences the approach to, and limits the resources available for, accomplishing the tasks at later stages" (p. 145).

Hunter (1978) stated that early education is important for young children from all social levels because early education programs provide for social interaction, materials not provided in the home, and for opportunities to develop real responsibility.

Assumptions regarding the expediency of early intervention in the education of handicapped children are drawn from many and diverse theoretical orientations among which are those who base their cases on the assumption that, at birth, individuals are endowed with a ground plan for developmental processes to take place; that a time exists in an individual's ground plan for maximum growth and development during optimal time segments; and should individuals miss their opportunities for maximum growth and development during the optimal time segments, their losses would be irreversible. Epstein (1974) referred to the optimal time segments as growth spurts, and to the correlated brain and mind growth spurts as phrenoblysis in order to discriminate these spurt periods from others such as physical growth spurt periods. According to Epstein, "...implications for human intellectual development constitute a working hypothesis that remedial interventions will work best if situated during spurt periods" (p. 27). Epstein (1978 suggested that children at stages of rapid brain growth might best benefit from intensive and novel intellectual inputs. He stated, "It is important to emphasize that brain growth stages are not a theoretical notion but a scientific fact..." (p. 345).

Furthermore, he stated that critical stages of rapid brain growth occur in human beings at the age intervals of 3 to 10 months, 2 to 4 years, 6 to 8 years, 10 to 12+

years, and 14 to 16^+ years. He also claimed that these brain growth spurts correspond to Piaget's classical stages of intellectual development with the exception of the 14 to 16^+ years-of-age span.

According to Epstein (1978), the failures of Head Start to reach its goals for cognitive development are attributed to biological causes related to phrenoblysis. Since the target population for Head Start was $3\frac{1}{2}$ to 5 years of age which is a definite plateau in terms of phrenoblysis. He contrasted Head Start's failure with the successes of three other programs, the Milwaukee Project, the Mother Child Home Program, and the Robinson Project in North Carolina which were all initiated for the 2 to 4 year age span, a definite growth spurt period for the brain.

Epstein (1976) described how the brain growth spurts operate in the following manner:

> A brain growth spurt from, say, age 6 to 8 years means that no child begins this growth spurt before age 6 and every child finishes that growth spurt by age 8. The duration of each spurt is not known but is likely to be less than 6 months for any one individual. The fact that the spurts can be demonstrated in the data means that the vast majority of children fall into these categories, though there is no way at present to determine if the synchronization is genetic, cultural, or both. (p. 26)

According to Epstein (1976), it is a reasonable assumption that spurt periods are times when children are capable of new intellectual performance, and he recommended that educational programs should be designed to take advantage of these periods to enhance the learning capacities of all students. Also, he suggested that intervention programs as well as prevention programs should be designed to accomodate the biologically based periods of greatest brain development.

According to Teyler (1978), "It has been shown that brain processes present at birth will degenerate if the environmental stimulation necessary to activate them is withheld" (p. 27).

According to Chomsky (1972), language appears during the 2 to 4 year brain growth period, and a second language competence level appears during the 6 to 8 year brain growth period.

Essentially, the assumption has been made that should handicapped children miss their optimal opportunities for developing readiness in basic skill areas such as reading and mathematics, their chances for growth in these areas are forever hampered.

For the most part, the literature reveals that the emphasis on early intervention has been beneficial for handicapped children because intervention programs provide teachers with opportunities to work with parents and children before the handicapping conditions have time to interfere with and hamper further development. However, the literature reveals that a controversy exists regarding early identification and early intervention for young children who are suspected of having learning disabilities. The issue is not concerned with intervention per se but with the implications that improper identification procedures may result in the labeling of nonhandicapped children who may suffer needless indignities to their self concepts because of the mislabeling.

According to Beers, C. and Beers, J. (1980), the assumption that young learning disabled children can be easily identified is an erroneous one; learning disabilities do not fit into any handicapping category that is clearly defined by common traits which identify all within the category. They stated that this is demonstrated by the various attempts to describe the learning disabled child such as the terms: brain injury, minimal brain damage, and minimal cerebral disfunction, all of which are neurological indicators. The terms also include perceptual indicators such as perceptual handicaps and auditory impairment; likewise, learning disability, specific disabilities, and learning disorders which are all behavioral indicators. The learning disabled child has been described as hyperactive, impulsive, distractable, dyslexic, aphasic, dyscalculic, disgraphic, etc. Yet, none of these characteristics are common to any one learning disabled child.

The assumption that young learning disabled children can be easily identified by trained personnel is also an erroneous one according to Beers, C. and Beers, J. (1980). They claimed that the problem stems from the reliability and validity of standardized tests, the reliability and validity of informal measures as well as the difficulty in distinguishing the potentially learning disabled child from an immature child. They stated that one reason for the unreliability of standardized tests concerns the nature of children of preschool age. Depending on whether or not young children are tired, bored, hungry, anxious, or afraid, they can change from hour to hour, or day to day. The same test administered in the morning and again in the afternoon can yield entirely different results.

The assumption that early identification of learning disabilities will naturally result in appropriate educational program intervention for the identified children, according to Beers, C. and Beers, J. (1980), is also an erroneous assumption because the fact is that prevention and/or remediation of learning disabilities is the most difficult part of the identification process. Some educators recommend perceptual training programs to remediate perceptual disabilities. According to Hammill (1972), 10 out of 13 studies showed no difference in the performance between perceptually trained subjects and those who had not had perceptual training. Goodman and Hammill (1973) found that remedial programs based on visual-motor perceptual approaches have generally not been shown to result in significant reading improvement.

According to Divoky (1977), the notion of early identification comes from a medical model where certain conditions are relatively easy to identify by implementing procedures which identify particular traits such as Down's Syndrome, hydrocephaly, etc. Keogh and Becker (1973) stated that support for early identification comes from the physical disability or disease model. This model includes the assumption that when a condition exists, and when identified, carries with it the prescriptions for treatment; the sooner the treatment is begun, the greater the liklihood that the identified condition will be alleviated or even cured. Keogh and Becker expressed concern that when attempting to identify at-risk children and very young children as potentially learning disabled, that the condition was not actually being confirmed, but merely hypothesized that the disability would develop at some time in the future. They were very concerned that this could result in the mislabeling of nonhandicapped children which carries with it the implications that the children would have to endure the negative effects of stigmatizing and self-fulfilling prophesy. According to Cohen, Semmes, and Guralnick (1979), these are all magnified when related to young children below the age of 6 years.

There are reasonable arguments on both sides of the early intervention issue, but Public Law 94-142 has settled part of the controversy in that, by federal and state mandates, public schools are held responsible for identifying and providing appropriate educational programs to all handicapped children from age 3 through 21 years of age, and some states already have state mandates which require that intervention programs serve handicapped children from birth through 21 years of age.

CHAPTER III

METHODOLOGY

Introduction

This study analyzed data which had been collected over a period of 7 years on learning disabled students who participated in a cooperative district comprehensive special education program. The purpose of the study was to determine (a) whether or not differences in the learning rates of learning disabled students in reading and mathematics exist in systematic trends across time, (b) whether or not those differences can be attributed to the ages or grade levels when the students received intervention services, and (c) whether or not the results of the statistical analyses of the longitudinal data support the notion of early intervention of learning disabled children.

This chapter is presented according to (a) description of the subjects of the study, (b) description of the longitudinal data, (c) description of the statistical analysis procedures which were used to test the hypotheses of the study, and (d) explanation of the treatment of the longitudinal data collected on educable mentally retarded students in the same time span to determine whether or not the results of the analysis of these data would enhance the study.

Description of the Subjects

The subjects on whom the longitudinal data were collected were learning disabled students who participated in a cooperative district comprehensive special education program (N = 257). Other subjects on whom data were collected in the same time span (7 years) were educable mentally retarded students. These data were referred to in the limitations and exceptions of the study. A brief description of these subjects is presented in the final part of this section.

Learning Disabled (LD) Subjects

The sex composition of the learning disabled group of subjects was 74% (191) male and 26% (66) female. The ethnic origin composition was 19% Black American, 17% Mexican American, and 64% Caucasian American. The attrition status of the group consisted of 35% who had either moved, been dismissed, or graduated from the program and 65% who continued in the program on the date of the last posttest.

Composition of the group of subjects according to the degree of severity of the handicapping condition consisted of 62% (160) classified in the mild-to-moderate category and 38% (97) classified in the severely handicapped category. The age composition of the group at the time the final measures in the data were collected is described in Table 1. This age level was referred to in the data as the current age, but it does not infer that it was the age level of the subjects in 1982, the last year in the study when posttests were administered. Current age means that was the age of particular students when they were administered their last posttests. The same explanation applies to current grade level which is referred to in the data.

Subjects were selected from the four local school districts which were served by the cooperative district. The number of subjects selected from each school district is representative of the school-age population in each of those school district. There were 104 subjects drawn from School District A, 23 from School District B, 61 from School District C, and 69 from School District D.

The composition of the group of subjects according to current grade level on the final posttest date is

Table 1

Chronological Ages of LD Subjects

On Final Posttest Date

Age (Yrs.)	Absolute Freq.	Relative Freq. (%)	Adjusted Freq. (%)	Cumulative Freq. (%)
6	3	1.2	1.2	1.2
7	6	2.3	2.4	3.6
8	16	6.2	6.3	9.9
9	13	5.1	5.1	15.0
10	29	11.3	11.5	26.5
11	25	9.7	9.9	36.4
12	22	8.6	8.7	45.1
13	32	12.5	12.6	57.7
14	23	8.9	9.1	66.8
15	23	8.9	9.1	75.9
16	23	8.9	9.1	85.0
17	16	6.2	6.3	91.3
18	15	5.8	5.9	97.2
19	6	2.3	2.4	99.6
21	1	0.4	0.4	100.00
Missing	4	1.6	Missing	100.00
	257	100.0	100.0	

Mean 12.9 Median 12.9 Mode 13 Valid Cases 253

Note. Missing cases lacked complete data.

described in Table 2. Composition of the group according to intelligence levels is presented in Table 3; this includes verbal, performance, and full scale intelligence quotients.

The intervention grade levels of the subjects are displayed in Table 4, and Table 5 depicts the composition of the group of subjects according to number of subjects who received intervention services according to the year in which they were administered the initial pretest.

Educable Mentally Retarded Subjects

The group of 51 educable mentally retarded subjects was composed of 30 males and 21 females; 25 were Black American; 10 were Mexican American; and 16 were Caucasian American. The composition of the group according to intelligence quotients consisted of a range of full scale IQs from 49 to 76. The mean IQ for the group was 64.5; the mode was 55; and the median was 65.37. Subjects' ages ranged from 6 to 19 years. The median age was 13 years; the mean age was 12.7 years; and the mode was 13 years. Current grade levels ranged from the first through the twelfth grade with a mean grade of 6.9, median grade of 7.1, and the mode was grade 7.

Over 50% of the subjects received intervention services prior to the fourth grade. This included 10% before first grade, 30% in first grade, 10% in second grade, and 8% in the third grade. The attrition status of the group consisted of 35% moved or dismissed and 65% continued in the program.

Table 2

Grade Levels of LD Subjects

On Final Posttest Date

Grade Level	Absolute Freq.	Relative Freq. (%)	Adjusted Freq. (%)	Cumulative Freq. (%)
1	3	1.2	1.2	1.2
2	12	4.7	4.7	5.9
3	18	7.0	7.1	12.9
4	22	8.6	8.6	21.6
5	29	11.3	11.4	32.9
6	27	10.5	10.6	43.5
7	33	12.8	12.9	56.5
8	19	7.4	7.5	63.9
9	30	11.7	11.8	75.7
10	12	4.7	4.7	80.4
11	20	7.8	7.8	88.2
12	30	11.7	11.8	100.00
Missing	2	0.8	Missing	100.0
Totals	257	100.0	100.0	

Note. Missing cases lacked complete data.

Table 3

Composition of LD Group

According to Intelligence Quotients

Groups	Number of Subjects		
IQ Range	Verbal	Performance	Full Scale
50-59	6	0	1
60-69	26	11	11
70-79	63	36	72
80-89	69	80	84
90-99	62	73	67
100-124	21	47	22
Missing Cases	10	10	0
Totals	257	257	257
Mean	83.3	88.8	84.9
Mode	90.0	85.0	80.0
Median	82.3	88.3	84.2

Note. Missing cases had incomplete data.

Table 4

Composition of LD Group According to

Subjects' Grade Levels on Intervention Date

Grade Level	Absolute Freq.	Relative Freq. (%)	Adjusted Freq. (%)	Cumulative Freq. (%)
Pre Kg	1	0.4	0.4	0.4
Kg.	4	1.6	1.6	2.0
1	25	9.8	10.2	11.8
2	32	12.5	12.5	24.3
3	53	20.6	20.8	45.1
4	22	8.6	8.6	53.7
5	21	8.2	8.2	61.9
6	36	14.0	14.1	76.0
7	23	8.9	9.0	85.0
8	12	4.7	4.7	89.7
9	8	3.1	3.1	92.8
10	11	4.3	4.3	97.1
11	5	1.9	2.0	99.1
12	2	0.8	0.8	99.9
0	2	0.8	Missing	100.0
Total	257	100.0	100.0	100.0

Mean 4.8 Mode 3 Median 4.3

Note. Missing cases had incomplete data.

Table 5

Composition of LD Group According to

Initial Pretest Date

Date	Subjects			
Grade	Absolute Freq.	Relative Freq. (%)	Adjusted Freq. (%)	Cumulative Freq. (%)
1975	41	16.0	16.1	16.1
1976	23	8.9	9.1	25.2
1977	32	12.5	12.6	37.8
1978	39	15.2	15.4	53.1
1979	32	12.5	12.6	65.7
1980	36	14.0	14.2	79.9
1981	44	17.1	17.3	97.2
1982	7	2.7	2.8	100.0
0	3	1.2	Missing	100.0
Total	257	100.0	100.0	

Mean 78.28 Mode 81.00 Median 78.30

Note. Missing cases had incomplete data.

Description of the Longitudinal Data

The longitudinal data which were analyzed in this study consisted of pretest and posttest measures in reading and mathematics collected over a period of 7 years on learning disabled students who had participated in a cooperative district comprehensive special education program for eligible handicapped students. The data included the following control factors: student identification number which identified the school district; birth date, current age, and grade level; intervention age and grade level; sex and ethnic origin; verbal, performance, and full scale IQ; attrition status; handicapping category and degree of severity of handicap; pretest and posttest measures, dates, and intervals (in months) between pretest and posttests.

The data were collected on learning disabled subjects (N = 257) and educable mentally retarded subjects (N = 51). Subjects had varying numbers of testing measures in the 7 years in which the data were collected because they had entry and exit dates which varied. When subjects entered the program a pretest was administered, and posttests were administered annually for as long as the subjects remained in the program.

Therefore, subjects whose entry dates were in 1976 and who remained in the program through 1982 could possibly have 8 repeated measures of testing data while other subjects with later entry dates would have less than 8 repeated measures.

Description of Testing Instrument

The Wide Range Achievement Test (WRAT), a testing instrument developed by Jastak, J. and Jastak, S. (1936, Rev. 1946, 1965, 1976, 1978) was used to collect the data. According to the authors, the WRAT can be administered in less than 20 minutes; is easily scored and reports results in raw scores and scaled scores from which grade ratings are derived; teaching-to-the-test or coaching effects are minimal or nonexistent after an interval of three months; is usually administered as part of a battery of tests; can be administered to individuals from preschool age to advanced old age and to handicapped individuals as well as the nonhandicapped; and is a reliable and valid test of a wide range of skills in reading, mathematics, and spelling. According to Jastak, J. and Jastak, S. (1978), on the basis of clinical esperience and past validity calculations, the clinical reliability of the WRAT is that the coefficients vary from .90 to .95

for each subtest with an average reliability of .93. Validity studies have included (a) the correlation of WRAT results with outside criteria such as teachers' ratings or chronological age, (b) the correlation of WRAT scores with those of other achievement tests, (c) the correlation of WRAT scores with mental ability or intelligence ratings, and (d) a factor analysis of abilities to determine the factor loadings inherent in each subtest of the WRAT. According to the authors, correlation coefficients were significant beyond the .0001 level of confidence.

The WRAT can be administered to individuals or to groups of individuals, and the testing forms consist of 2 levels (a) below 11 years of age and (b) from 11 years to adult level.

According to Jastak, J. and Jastak, S. (1978), during its 42 years of existence, the WRAT has been researched on many thousands of persons from preschool age to advanced old age, and it is widely used in both the United States and Europe.

Description of Statistical Analysis Procedures

Analyses of the longitudinal data of the study consisted of a one-factor statistical analysis of variance (ANOVA) on total gain and on average gain in both reading and mathematics. Covariates were current grade level, sex, ethnic origin, IQ, handicapping category, degree of severity of the handicapping condition, attrition status, school district, and intervention level.

The statistical analysis procedures were implemented to remove any systematic influences of the covariate factors on gain in order to allow for the inspection of differences between intervention levels free of covariate influences.

To allow for inspection of trends across time and the differences on such trends due to intervention levels, a two-factor repeated measures analysis of covariance (ANCOVA) was employed. The intervention levels (pretests) were always used as the covariate. The rationale for these procedures was to remove any systematic influences of the covariates on gain. This allowed for inspection of differences in gains made by groups defined by their intervention levels free of covariate influences.

Due to the fact that subjects had varying numbers of observations (repeated measures) in the 7 years that the data were collected, statistical analysis strategies were employed for reading and mathematics to provide for all possible combinations of sequential testings and intervention grade levels to be analyzed.

All possible sequential combinations of testing measures were systematically inspected by analysis of covariance. The pretest was always the covariate, the independent variable. Where two or more testing measures were dependent variables, they constituted levels of a repeated factor.

Each analysis contained somewhat diverse samples of subjects, i.e., only those subjects with complete data for the specific testings involved. Table 6 displays the pattern of the statistical analysis procedures which were conducted for blocks composed of intervention grades 1 through 6 and all those above grade 6 (group 7).

For inspection of all possible sequential combinations of available data in reading, see Table 7; for mathematics, see Table 8.

The statistical procedures used in the analyses of the longitudinal data provided the results which were interpreted to test the null hypotheses, which were rejected at the .05 level of significance. Otherwise, it was assumed that no significant differences existed.

Table 6

The Pattern of Statistical Analysis of All Possible Combinations of Sequential Testing Measures and Intervention Levels

Covariate	Repeated Testings (Posttests)						
Pretest	1976	1977	1978	1979	1980	1981	1982
X							X
X						X	X
X				X	X	X	X
X			X	X	X	X	X
X		X	X	X	X	X	X
X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X

Note. Only subjects with complete sets of data in each of the cells were included in the samples which were analyzed.

There are 8 separate cells from which the data were drawn for the statistical analyses of reading data and 8 for mathematics data. The cells are represented by cardinal numbers, and number 1 always referred to the pretest. In the reporting of the results of the statistical analyses, the sequential combination of cells from which the data were drawn for each analysis is presented as a part of a side heading which identifies the series of the analyses as well as the data source for each analysis in the series. It will be helpful to remember that the cell numbers do not refer to grade levels; each cell, or combinations of cells, may possibly represent subjects' testing data from all grade levels from < 1st through = > 7th grade.

The repeated-measures ANCOVA consisted of two different series of analyses for reading and two for mathematics. The first series consisted of blocking on intervention levels 1 through 6 for all possible sequential combinations of the cells in Table 6. The second series consisted of the null hypotheses, H_o^1 through H_o^{16} (i.e., blocking on intervention levels before and after 3rd grade).

For each of the null hypotheses, all of the possible sequential combinations of data in the cells were analyzed.

Table 7

All Possible Sequential Combinations of Reading Cells From Which the Data Were Drawn for Statistical Analysis

Date	Covariate (Pretest)	Reading Cells of Repeated Testings (Posttests) 1976	1977	1978	1979	1980	1981	1982
1982	1							8
1981-82	1						7	8
1980-82	1					6	7	8
1979-82	1				5	6	7	8
1978-82	1			4	5	6	7	8
1977-82	1		3	4	5	6	7	8
1976-82	1	2	3	4	5	6	7	8

Table 8

All possible Sequential Combinations of Mathematics Cells From Which the Data Were Drawn for Statistical Analysis

	Covariate (Pretest)	Mathematics Cells of Repeated Testings (Posttests)						
Date		1976	1977	1978	1979	1980	1981	1982
1982	1							8
1981-82	1						7	8
1980-82	1					6	7	8
1979-82	1				5	6	7	8
1978-82	1			4	5	6	7	8
1977-82	1		3	4	5	6	7	8
1976-82	1	2	3	4	5	6	7	8

Treatment of Data on EMR Subjects

Each of the null hypotheses was restated to include EMR subjects rather than LD subjects, and all of the possible sequential combinations of available data in the reading and mathematics cells were analyzed using the same repeated-measures ANCOVA procedures that were used to analyze the data on LD subjects.

Data on EMR subjects and LD subjects were analyzed to compare rates of gain in reading and mathematics according to intervention groups specified in H_o13 and H_o14. The results of these analyses were reported as exceptions to the study.

CHAPTER IV

RESULTS OF THE STATISTICAL ANALYSES

Introduction

Results of the statistical analysis of the longitudinal data, which were used in the study of the effects of intervention levels on the learning rates of learning disabled (LD) students in the basic skill areas of reading and mathematics, are reported according to (a) results of the one-factor analysis of variance (ANOVA) on total and average gain in reading and mathematics, (b) results of the repeated-measures analysis of covariance (ANCOVA), and (c) results of the treatment of the data on subjects classified as educable mentally retarded (EMR).

Results of the One-factor ANOVA

The only variable used as a covariate in any analysis was the pretest in reading or mathematics (entry-level testing). While other variables were available for potential use as covariates, none were judged to be appropriate for various reasons specific to the variables. An overriding concern, in view of relatively small subsamples for each analysis, was the preservation of degrees of freedom (one degree lost for the addition of each covariate) and preservation of statistical power for detecting differences.

Of the candidate variables, current grade and age were judged to be highly redundant with the grade-equivalent dependent variable; therefore, they were not appropriate for use. Sex, IQ, and degree of handicap were minimally and inconsistently correlated with the dependent variable; for this reason, they were judged to be inappropriate for use as covariates. Intercorrelates among the dependent variables (grade, age, IQ, and degree of handicap) are displayed for inspection in Appendix A, Table 53 for reading and Table 54 for mathematics. Race and school district were similarly found to be minimally and inconsistently related to the dependent variables, and were judged to be inappropriate for use as covariates (see Appendix A, Table 55).

The relative inappropriateness of a given candidate covariate and the need to preserve degrees of freedom, together, justify the decision to retain the pretest as the only covariate.

Results of the Repeated-measures ANCOVA

Preceding the presentation of the results of each of a series of statistical analyses, the null hypotheses to be tested in a specific series are stated in a simplified form to facilitate the reporting process and to avoid needless repetition. Each analysis in a series is identified according to the groups selected for blocking as well as the reading cells and mathematics cells from which the data are drawn for the analysis.

Hypotheses Relevant to Reading

The null hypotheses stated that there will be no significant difference between the learning rates of learning disabled (LD) students who received intervention services:

H_o1: prior to and after first grade;

H_o2: prior to and after second grade;

H_o3: prior to and after third grade;

H_o4: prior to and after fourth grade;

H_o5: prior to and after fifth grade; and

H_o6: prior to and after sixth grade.

Results of the testing of the null hypotheses are reported immediately following the reported results of each statistical analysis. H_o is rejected at .05, $p < .05$.

Blocking on Intervention Levels 1 Through 6

Reading Cells 1, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels 1 through 6, with testing dates from 1979 through 1982, the covariate was the pretest in reading. The sample sizes are displayed in Figure 1.

The main effect for the intervention grade was not significant, F (5, 62) = 1.40, p = .24; the covariate was significant, F (1, 62) = 50.53, p < .0001; the pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect for testing was significant, F (3, 189) = 149.40, p <.0001; the testing by grade interaction was significant; F (15, 189) = 3.04, p <.05.

Due to the significant interaction, all main effects were ignored, and trends across testings between groups were interpreted according to Figure 1.

H_o^1 could not be tested because there were no preschool subjects represented in the cells from which the data were drawn. Based on the significant interaction, H_o^2 through H_o^5 were all rejected at the .05 level of significance; p = .0002. H_o^6 could not be tested because no = > 7th grade subjects were represented in the sample.

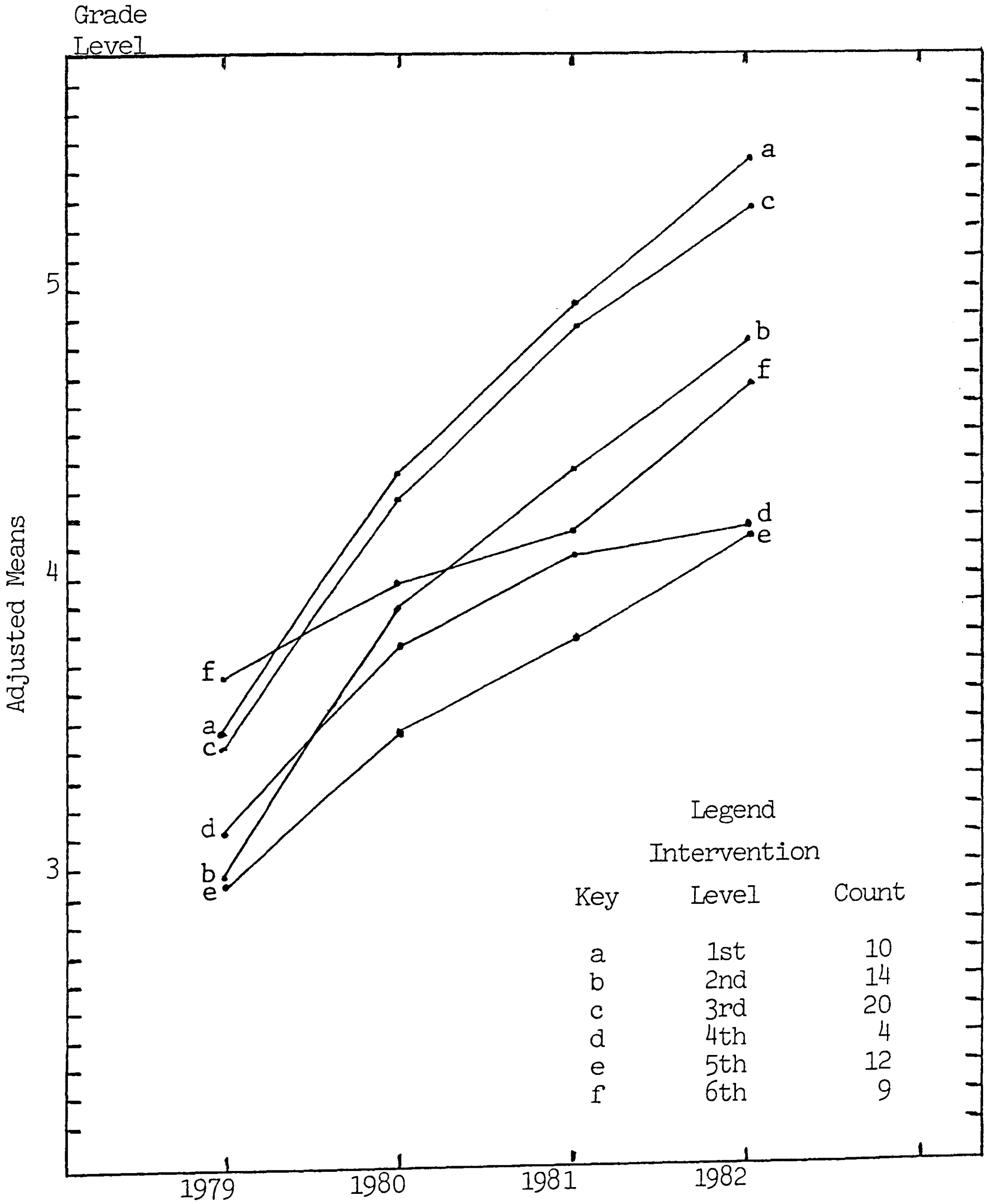

Figure 1. Intervention by Testing Interaction:

Reading Cells 1, 5, 6, 7, and 8 (LD Only).

Significant differences in learning rates were found to exist between groups of subjects, diverging according to their intervention levels. Rates of gain were demonstrated in the descending order of 1st, 2nd, 3rd, 5th, 4th, and 6th grade. Adjusted cell means are displayed in Table 9; unrefined means in Appendix C, Table 58.

Table 9

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels					
Cells	1st	2nd	3rd	4th	5th	6th
5	3.47	2.97	1.40	3.10	2.93	3.65
6	4.34	3.89	4.27	3.75	3.47	3.98
7	4.98	4.37	4.86	4.09	3.78	4.14
8	5.41	4.83	5.26	4.17	4.10	4.65

Blocking on Intervention Levels 1 Through 6

Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels 1 through 6, with testing dates from 1978 through 1982, the covariate was the pretest in reading. The sample sizes are displayed in Figure 2.

The main effect for intervention grade was not significant, F (5, 38) = 1.07, p = .39; the covariate was significant, F (1, 38) = 30.13, p < .0001. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect for testing was significant, F (4, 156) = 101.81, p < .0001; the testing by grade interaction was significant, F (20, 156) = 2.75, p < .05.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 2.

H_o1 could not be tested because no preschool subjects were included in the cells from which the data were drawn. H_o2 through H_o5 were all rejected at the .05 level of significance; p = .0002. H_o6 could not be tested because the sample included no subjects = > 7th grade.

Subjects who received intervention services prior to the 4th grade demonstrated accelerated rates of gain while those subjects who received intervention services in or after the 4th grade demonstrated depressed rates of gain. Rates of gain were demonstrated in the descending order of 2nd, 3rd, 1st, 4th, 6th, and 5th grade. See Table 10 for

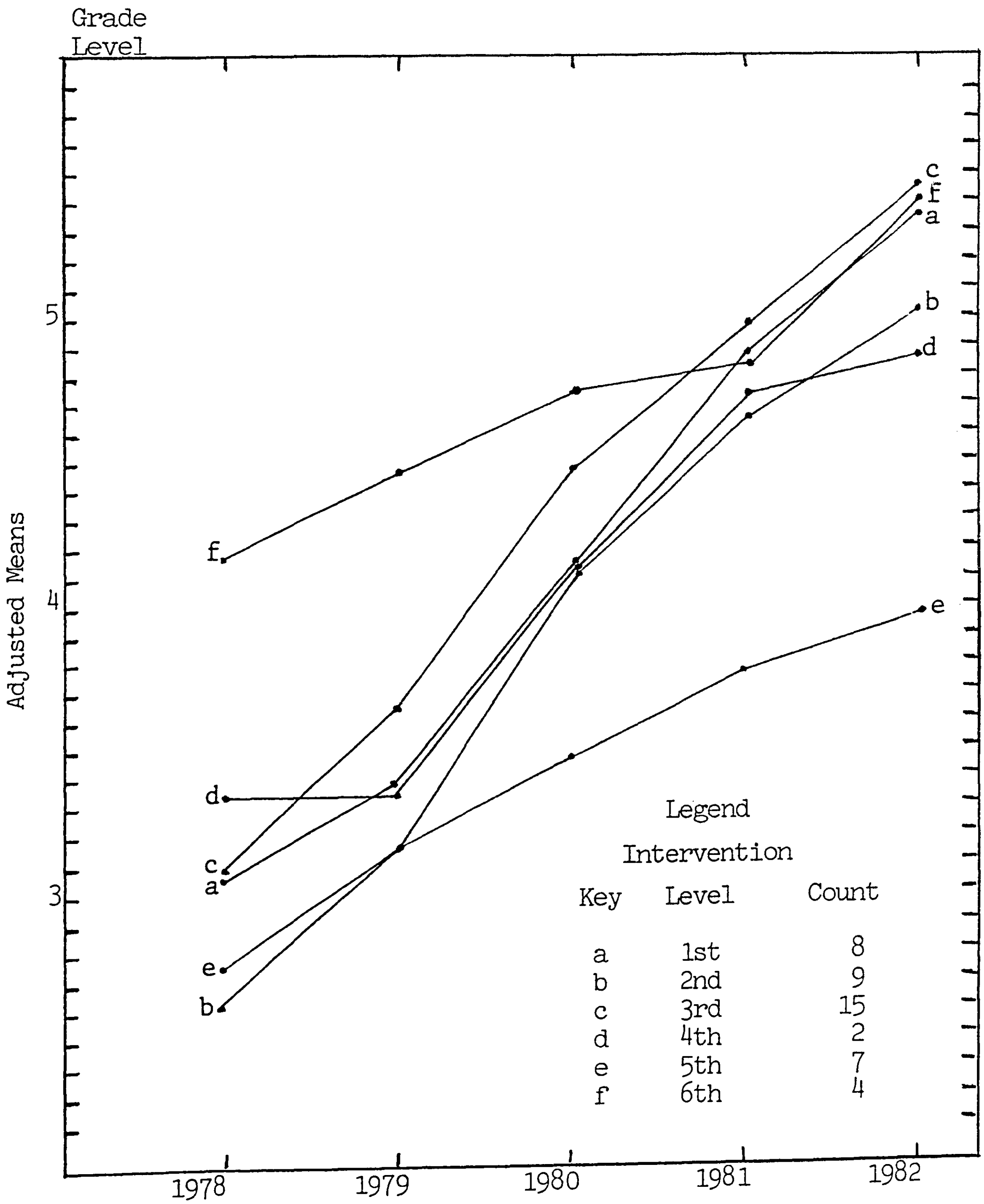

Figure 2. Intervention by Testing Interaction: Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only).

adjusted means; Appendix C, Table 59 for unrefined means.

Table 10

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels					
Cells	1st	2nd	3rd	4th	5th	6th
4	3.03	2.60	3.06	3.31	2.74	4.17
5	3.37	3.14	3.63	3.31	3.14	4.35
6	4.14	4.10	4.46	4.11	3.47	4.72
7	4.87	4.62	4.97	4.71	3.77	4.82
8	5.33	5.08	5.44	4.86	3.96	5.40

Blocking on Intervention Levels 1 Through 6 Reading Cells 1, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels 1 through 6, with testing dates from 1979 through 1982, the covariate was the pretest in reading. The sample sizes are displayed for inspection in Figure 3.

The main effect for the intervention grade was not significant, F (6, 67) = 1.34, p = .25; the covariate was

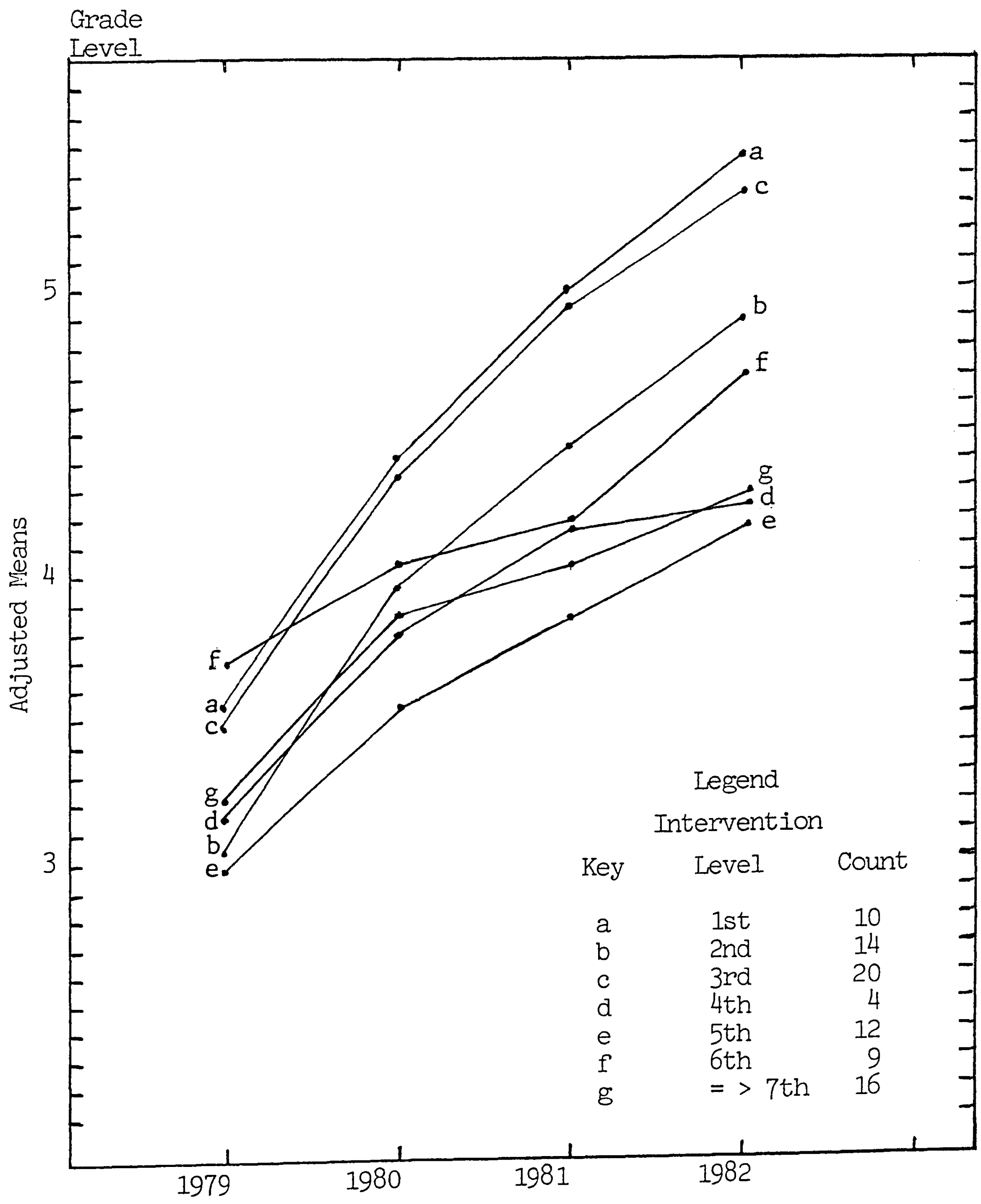

Figure 3. Intervention by Testing Interaction: Reading Cells 1, 5, 6, 7, and 8 (LD Only).

significant, F (1, 67) = 60.88, $p < .0001$. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect for testing was significant, F (3, 204) = 153.13, $p < .0001$; the testing by grade interaction was significant, F (18, 204) = 2.96, $p = .0001$.

Due to the significant interaction, all main effects were ignored, and trends across testings between groups were interpreted according to Figure 3.

H_o^1 could not be tested because no preschool subjects were included in the cells from which the data were drawn. H_o^2 through H_o^6 were all rejected at the .0001 level of significance; $p = .0001$.

Significant differences in rates of gain were demonstrated by the intervention groups in the descending order of 1st, 2nd, 3rd, 5th, = > 7th, 4th, and 6th grade. The point at which the accelerated rates of gain and the depressed rates diverged was at the intervention level prior to 4th grade. Adjusted cell means for the dependent variable are displayed in Table 11; for unrefined means, see Appendix C, Table 60.

Table 11

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels						
Cells	1st	2nd	3rd	4th	5th	6th	7th
5	3.53	3.03	3.45	3.14	2.98	3.69	3.20
6	4.40	3.95	4.32	3.79	3.51	4.02	3.85
7	4.99	4.43	4.91	4.14	3.82	4.18	4.01
8	5.47	4.89	5.31	4.21	4.15	4.69	4.28

Blocking on Intervention Levels 1 through 6

Reading Cells 1, 4, 5, 6, 7, and 8

In a repeated-measures ANCOVA, blocking on intervention grade levels 1 through 6, with testing from 1978 through 1982, the covariate was the pretest in reading. The sample sizes are displayed for inspection in Figure 4.

The main effect for intervention grade was not significant, F (6, 42) = 1.06, p = .40; the covariate was significant, F (1, 42) = 38.57, p < .0001. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect for testing was significant, F (4, 172) = 111.36, p < .0001. The testing

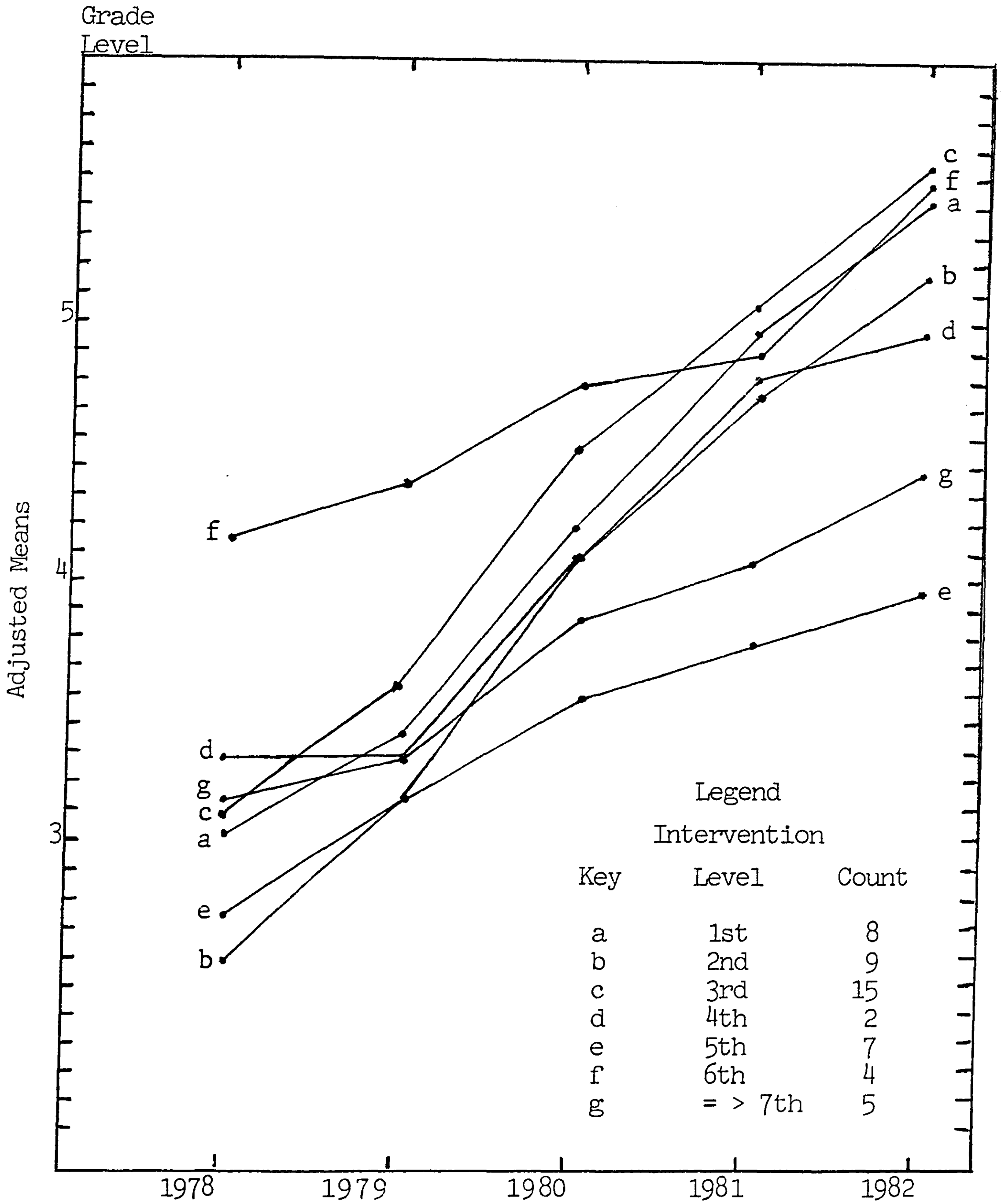

Figure 4. Intervention by Testing Interaction:
Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only).

by grade interaction was significant, F (24, 172) = 2.81, p = .0001.

Due to the significant interaction, all main effects were ignored, and trends across testings between groups were interpreted according to Figure 4.

H_o^1 could not be tested because no preschool subjects were represented in the sample. Based on the significant interaction, H_o^2 through H_o^6 were all rejected at the .0001 level of significance; p = .0001.

The intervention groups demonstrated significant differences in rates of gain which were demonstrated in the descending order of 2nd, 3rd, 1st, 4th, = > 7th, 6th, and 5th grade. The intervention level at which the accelerated and depressed rates of gain diverged was prior to 4th grade. For inspection of the adjusted cell means of the dependent variable, see Table 12 on the following page; for unrefined means, see Appendix C, Table 61.

Table 12

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels						
Cells	Pre	1st	2nd	3rd	4th	5th	6th
4	3.12	2.69	3.14	3.39	2.82	4.24	3.18
5	3.45	3.22	3.71	2.39	3.22	4.42	3.38
6	4.23	4.19	4.54	4.19	3.55	4.79	3.94
7	4.95	4.71	5.05	4.79	3.85	4.89	4.14
8	5.42	5.16	5.52	4.94	4.03	5.47	4.46

<u>Blocking on Intervention Levels 1 Through 6</u>

<u>Reading Cells 1, 5, 6, 7, and 8</u>

In a repeated-measures ANCOVA, blocking on intervention grade levels 1 through 6, with testing dates from 1979 through 1978, the covariate was the pretest in reading. Sample sizes are displayed in Figure 5.

The main effect for the intervention grade was not significant, F (6, 62) = 1.29, p = .28; the covariate was significant, F (1, 62) = 50.53, p < .0001. The pretest accounted for significant variation among the intervention

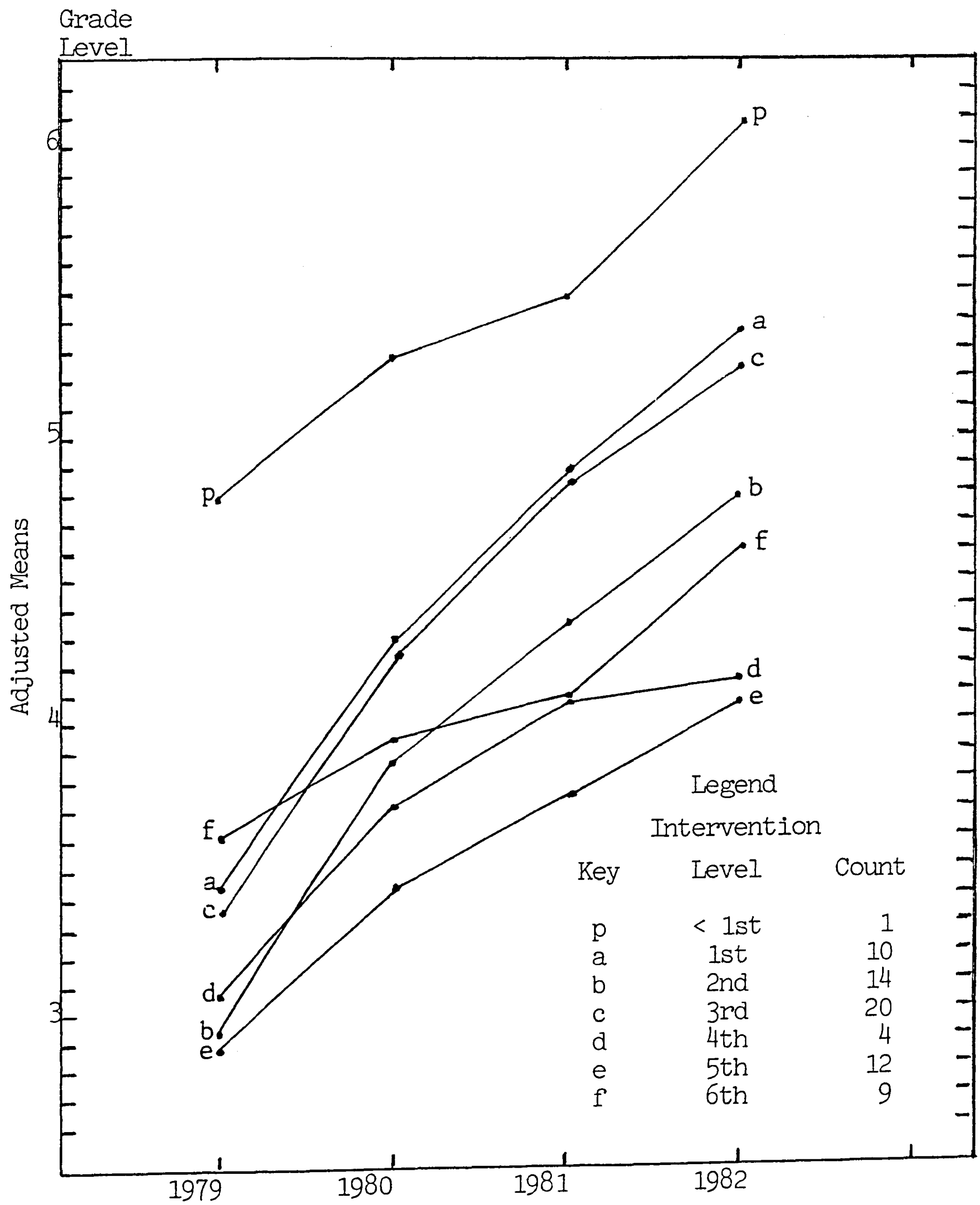

Figure 5. Intervention by Testing Interaction:
Reading Cells 1, 5, 6, 7, and 8 (LD Only).

levels on the dependent variable. The main effect for testing was significant, $\underline{F}$ (3, 189) = 77.29, $\underline{p} < .0001$; the testing by grade interaction was significant, $\underline{F}$ (18, 189) = 2.58, $\underline{p} < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings between groups were interpreted according to Figure 5.

Based on the results of the testing by grade interaction, H_o^1 through H_o^5 were all rejected at the .05 level of significance; $\underline{p}$ = .0008. H_o^6 could not be tested because no subjects were represented in the sample = > 7th grade.

Subjects demonstrated rates of gain in the descending order of 1st, 2nd, 3rd, < 1st, 5th, 4th, and 6th grade. Adjusted cell means are displayed for inspection in Table 13 which is on the following page; for unrefined means, see Appendix C, Table 62.

Table 13

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels						
Cells	Pre	1st	2nd	3rd	4th	5th	6th
5	4.78	3.42	2.92	3.35	3.05	2.88	3.60
6	5.28	4.29	3.84	4.22	3.70	3.42	3.93
7	5.48	4.88	4.32	4.81	4.05	3.73	4.08
8	6.08	5.36	4.78	5.21	4.12	4.06	4.60

Blocking on Intervention Levels 1 Through 6

Reading Cells 1, 4, 5, 6, 7, and 8

In a repeated-measures ANCOVA, blocking on intervention grade levels 1 through 6, with testing dates from 1978 through 1980, the covariate was the pretest in reading. Sample sizes are displayed in Figure 6.

The main effect for the intervention grade was not significant, $\underline{F}$ (6, 38) = 1.01, p = .43; the covariate was significant, $\underline{F}$ (1, 38) = 30.13, p < .0001. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect for testing was significant, $\underline{F}$ (4, 156) = 71.14, p < .0001;

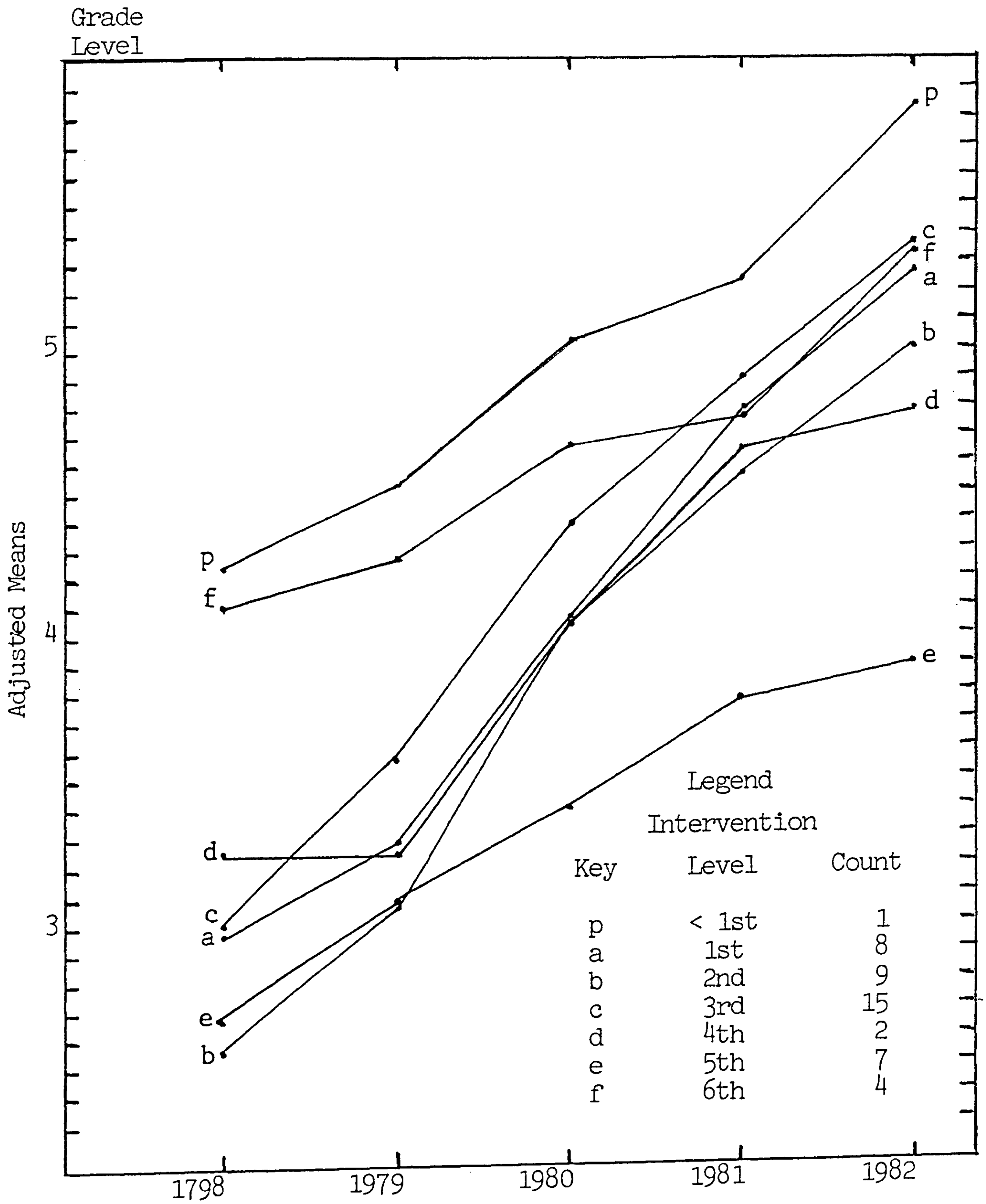

Figure 6. Intervention by Testing Interaction: Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only).

the testing by grade interaction was significant, $\underline{F}$ (24, 156) = 2.36, $\underline{p} < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings between groups were interpreted according to Figure 6.

$H_o{}^1$ through $H_o{}^5$ were all rejected at the .05 level of significance; $\underline{p} = .0009$. $H_o{}^6$ could not be tested because no subjects were represented in the sample = > 7th grade.

Subjects demonstrated rates of gain in the descending order of 2nd, 3rd, 1st, < 1st, 4th, 6th, and 5th grade. Subjects receiving intervention services prior to 4th grade made accelerated rates of gain when compared with those subjects who received intervention services in and after 4th grade. Adjusted means for the dependent variable are displayed in Table 14 on the following page; for unrefined means, see Appendix C, Table 63.

Table 14

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels						
Cells	Pre	1st	2nd	3rd	4th	5th	6th
4	4.22	2.96	2.53	2.98	3.23	2.67	4.10
5	4.52	3.29	3.06	3.36	3.23	3.07	4.28
6	5.02	4.07	4.03	4.39	4.03	3.40	4.65
7	5.22	4.79	4.55	4.90	4.63	3.70	4.75
8	5.82	5.26	5.01	5.36	4.78	3.89	5.33

Blocking on Intervention Levels 1 Through 6

Reading Cells 1, 3, 4, 5, 6, 7, and 8

In a repeated-measures ANCOVA, blocking on intervention grade levels 1 through 6, with testing dates from 1977 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 7.

The main effect for the intervention grade was not significant, F (5, 23) = .78, p = .58; the covariate was significant, F (1, 23) = 8.00, p < .05. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect

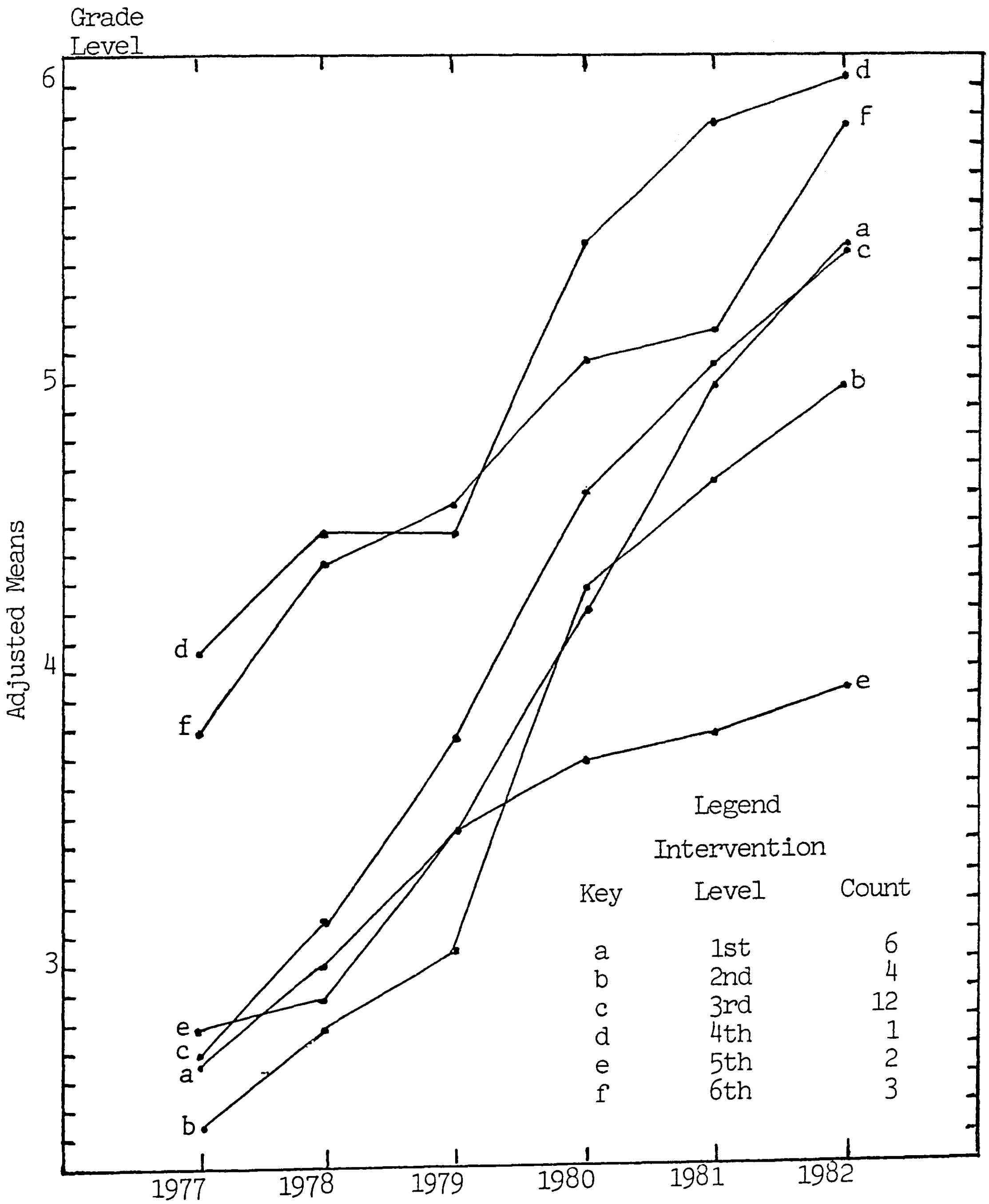

Figure 7. Intervention by Testing Interaction: Reading Cells 1, 3, 4, 5, 6, 7, and 8 (LD Only).

for testing was significant, F (5, 120) = 64.85, p < .0001; the testing by grade interaction was significant, F (25, 120) - 1.88, p < .05.

Due to the significant interaction, all main effects were ignored, and trends across testings between groups were interpreted according to Figure 7.

H_o^1 could not be tested because no preschool subjects were represented in the sample. H_o^2 through H_o^5 were all rejected at the .05 level of significance; p = .0130. H_o^6 could not be tested because no subjects = > 7th grade were represented in the sample.

Subjects whose intervention levels were prior to the 4th grade demonstrated accelerated rates of gain in the descending order of 1st, 3rd, and 2nd grade. Depressed rates of gain were demonstrated in the descending order of 6th, 4th, and 5th grade by those students whose intervention levels were in and after 4th grade. For inspection of the adjusted cell means, see Table 15 on the following page; for unrefined means, see Appendix C, Table 64.

Table 15

Adjusted Cell Means

Reading (LD) Only)	Intervention Grade Levels					
Cells	1st	2nd	3rd	4th	5th	6th
3	2.62	2.41	2.66	4.06	2.77	3.79
4	2.99	2.76	3.16	4.46	2.87	4.36
5	3.41	3.31	3.74	4.46	3.42	4.56
6	4.19	4.26	4.60	5.46	3.67	5.06
7	4.96	4.61	5.04	5.86	3.75	5.16
8	5.44	4.96	5.43	6.06	3.90	5.86

Blocking on Intervention Levels Before and After 3rd Grade Reading Cells 1, 5, 6, 7, and 8

In a repeated-measures ANCOVA, blocking on intervention grade levels before and after 3rd grade, with testing dates from 1979 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 8.

The main effect for the intervention grade was not significant, F (1, 75) = .10, p = .75; the covariate was significant, F (1, 75) = 58.95, p < .0001. The pretest accounted for significant variation among the intervention

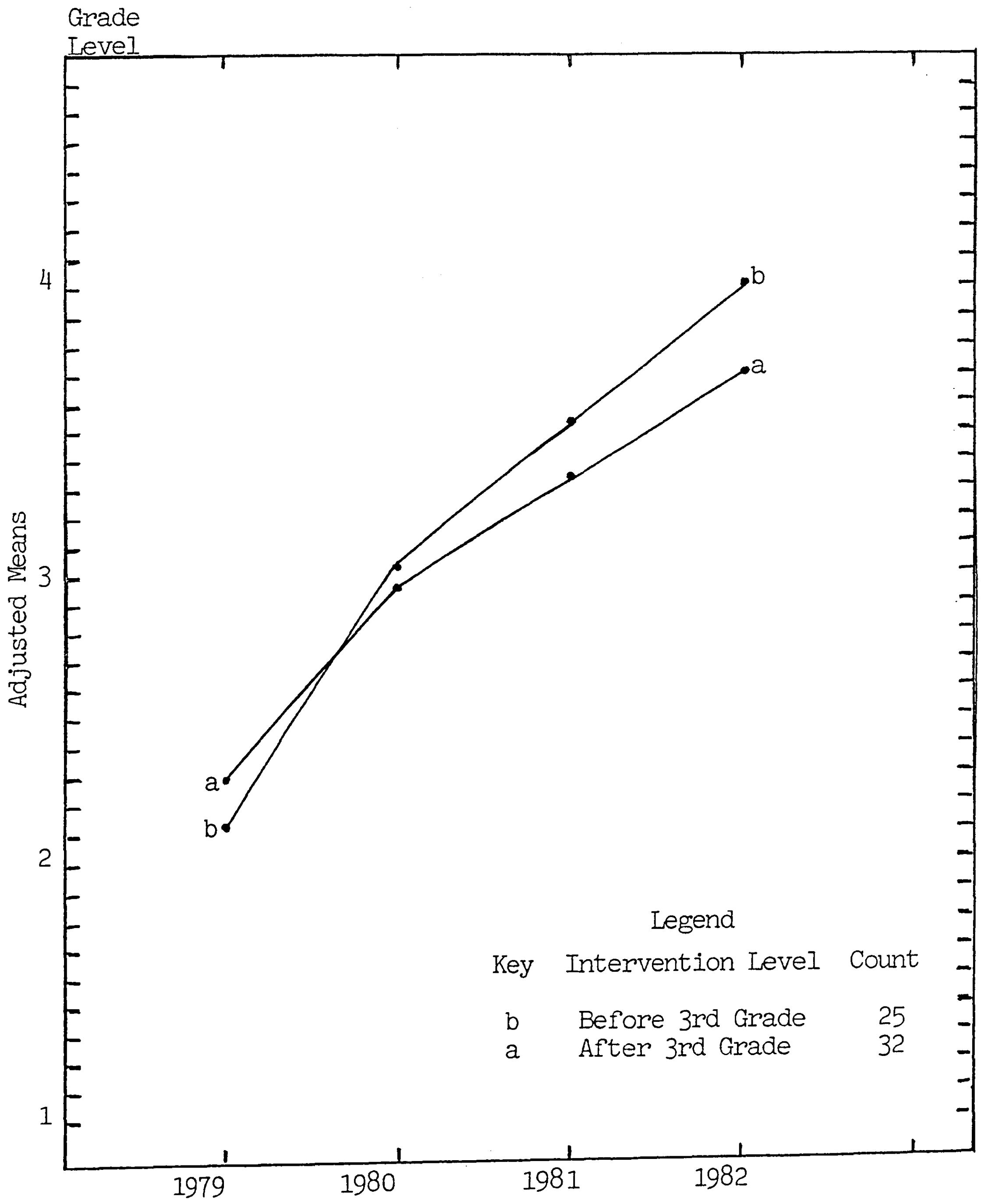

Figure 8. Intervention by Testing Interaction:
Reading Cells 1, 5, 6, 7, and 8 (LD Only).

levels on the dependent variable. The main effect for testing was significant, *F* (3, 228) = 215.00, $p < .0001$; the testing by grade interaction was significant, *F* (3, 228) = 4.35, $p < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings between groups were interpreted according to Figure 8.

The results of this statistical analysis were not applicable to test any of the null hypotheses except H_o3 which was rejected at the .05 level of significance; $p = .0008$. Subjects who received intervention services prior to 3rd grade demonstrated accelerated rates of gain when compared with those subjects who received intervention services = > 3rd grade. For inspection of the adjusted cell means, see Table 16 on the following page; for unrefined means, see Appendix C, Table 65.

Table 16

Adjusted Cell Means

Reading (LD Only) Cells	Intervention Grade Levels	
	Before 3rd	After 3rd
5	3.13	3.30
6	4.02	3.96
7	4.53	4.34
8	5.00	4.71

<u>Blocking on Intervention Levels Before and After 3rd Grade Reading Cells 1, 4, 5, 6, 7, and 8</u>

In a repeated-measures ANCOVA, blocking on intervention grade levels before and after 3rd grade, with testing dates from 1978 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 9.

The main effect for the intervention grade was not significant, F (1, 50) = .00, p = .99; the covariate was significant, F (1, 50) = 46.92, p < .0001. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect for

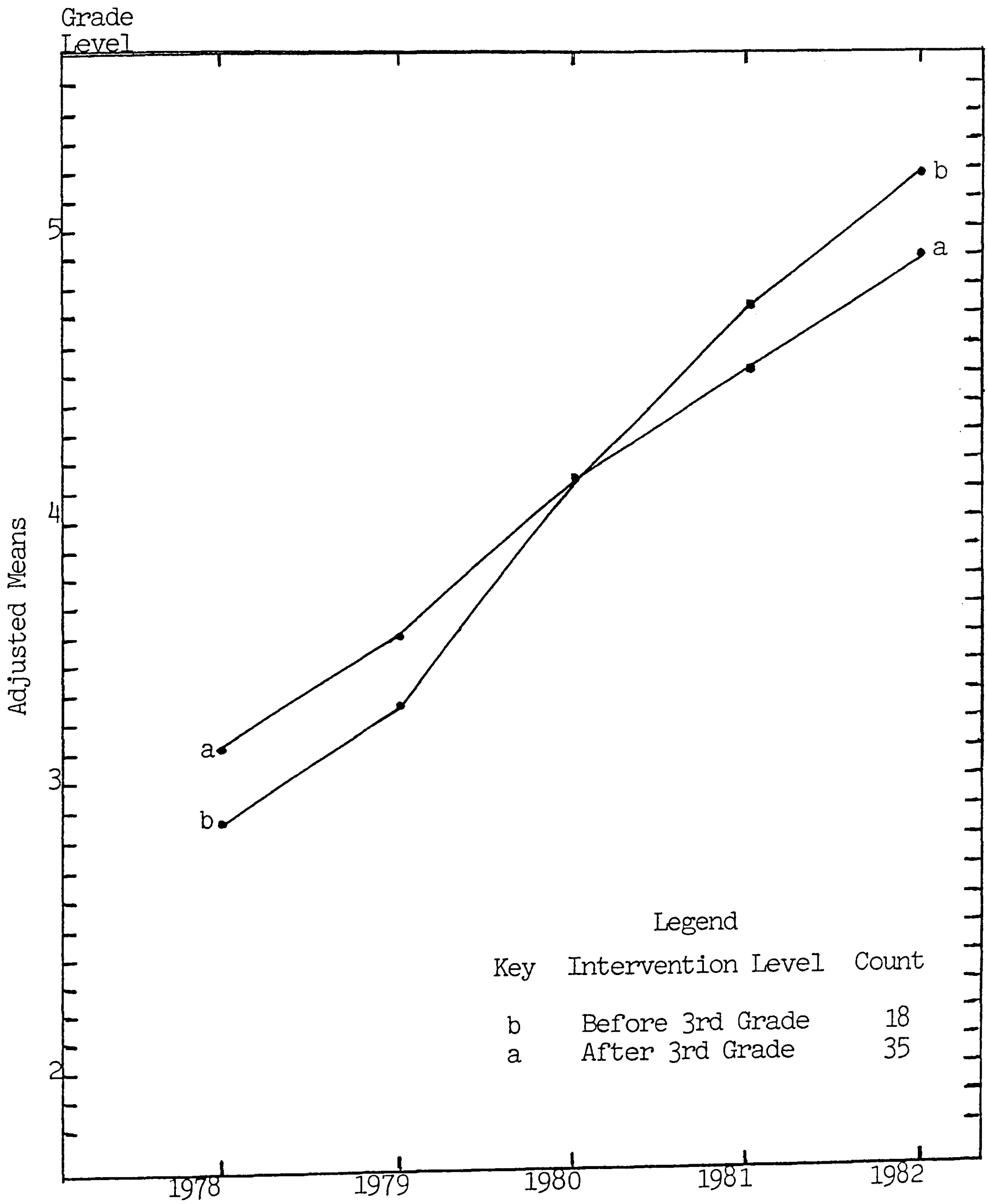

Figure 9. Intervention by Testing Interaction:
Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only).

testing was significant, F (4, 204) = 178.94, $p < .0001$; the testing by grade interaction was significant, F (4, 204) = 3.77, $p < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 9.

The results of this statistical analysis were not applicable to test any of the null hypotheses with the exception of H_o3 which was rejected at the .05 level of significance; $p = .0008$. Subjects who received intervention services prior to the 3rd grade demonstrated accelerated rates of gain when compared with those subjects who received intervention services = > 3rd grade. For inspection of the adjusted cell means, see Table 17 on the following page; for unrefined means, see Appendix C, Table 66.

Table 17

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels	
Cells	Before 3rd	After 3rd
4	2.85	3.11
5	3.29	3.51
6	4.14	4.15
7	4.74	4.52
8	5.20	4.92

Blocking on Intervention Levels Before and After 4th Grade Reading Cells 1, 6, 7, and 8

In a repeated-measures ANCOVA, blocking on intervention levels before and after 4th grade, with testing dates from 1980 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 10.

The main effect for the intervention grade was not significant, F (1, 103) = 2.04, p = .16; the covariate was significant, F (1, 103) = 114.89, p < .0001. The pretest accounted for significant variation among the

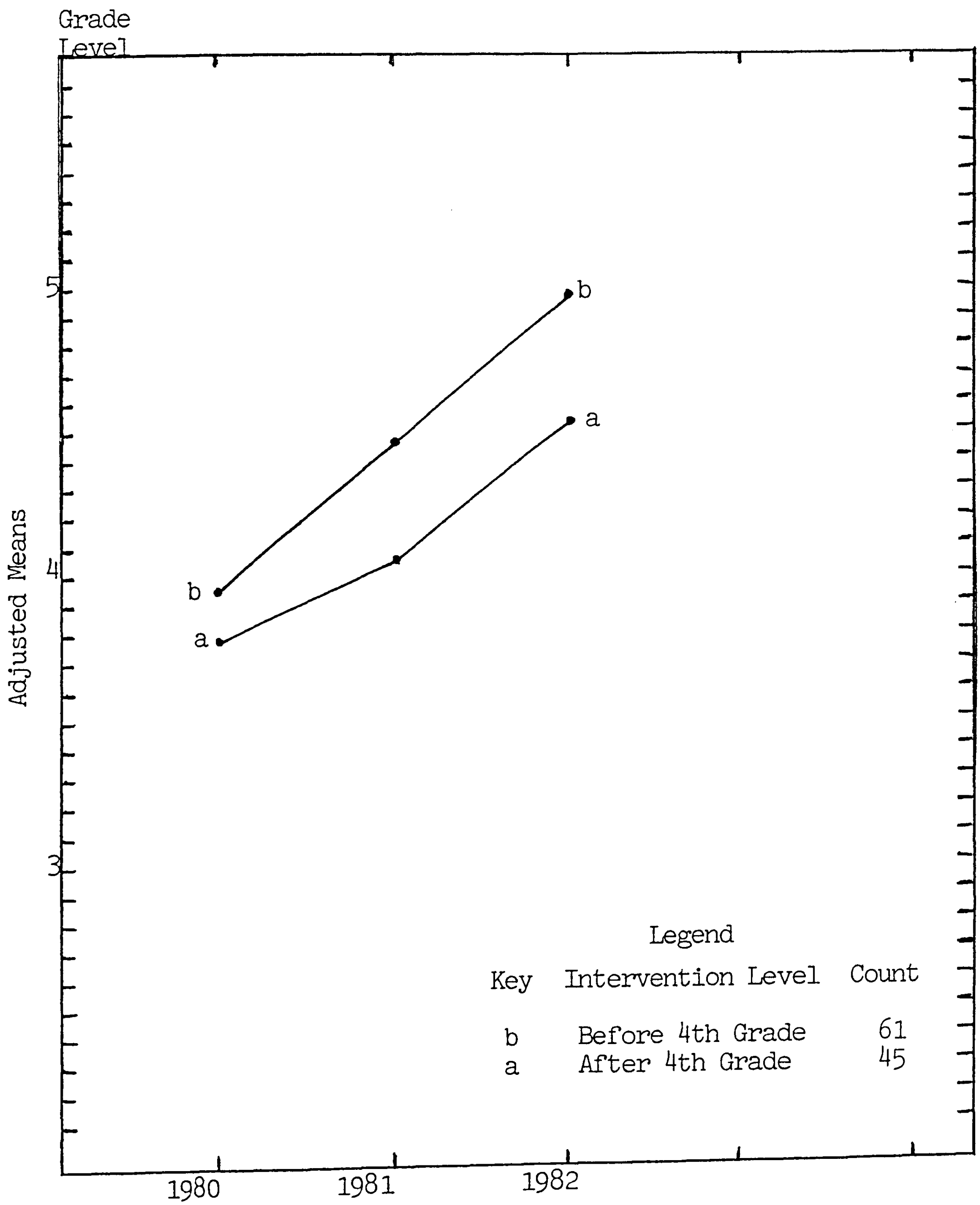

Figure 10. Intervention by Testing Interaction: Reading Cells 1, 6, 7, and 8 (LD Only).

intervention levels on the dependent variable. The main effect for testing was significant, F (2, 208) = 133.95, $p < .0001$; the testing by grade interaction was significant, F (2, 208) = 4.14, $p < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 10.

The only null hypothesis applicable to be tested by these results was H_o^4 which was rejected at the .05 level of significance; $p = .0173$.

Subjects who received intervention services in reading prior to the 4th grade demonstrated accelerated rates of gain when compared with those subjects who received intervention = > 4th grade. Adjusted cell means are displayed in Table 18 on the following page; for unrefined means, see Appendix C, Table 67.

Table 18

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels	
Cells	Before 4th	After 4th
6	3.94	3.78
7	4.45	4.04
8	4.96	4.51

Blocking on Intervention Levels Before and After 4th Grade Reading Cells 1, 5, 6, 7, and 8

In a repeated-measures ANCOVA, blocking on intervention grade levels before and after 4th grade, with testing dates from 1979 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 11.

The main effect for intervention grade was significant, $F\ (1, 75) = 4.63$, $p < .05$; the covariate was significant, $F\ (1, 75) = 78.77$, $p < .0001$. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect for

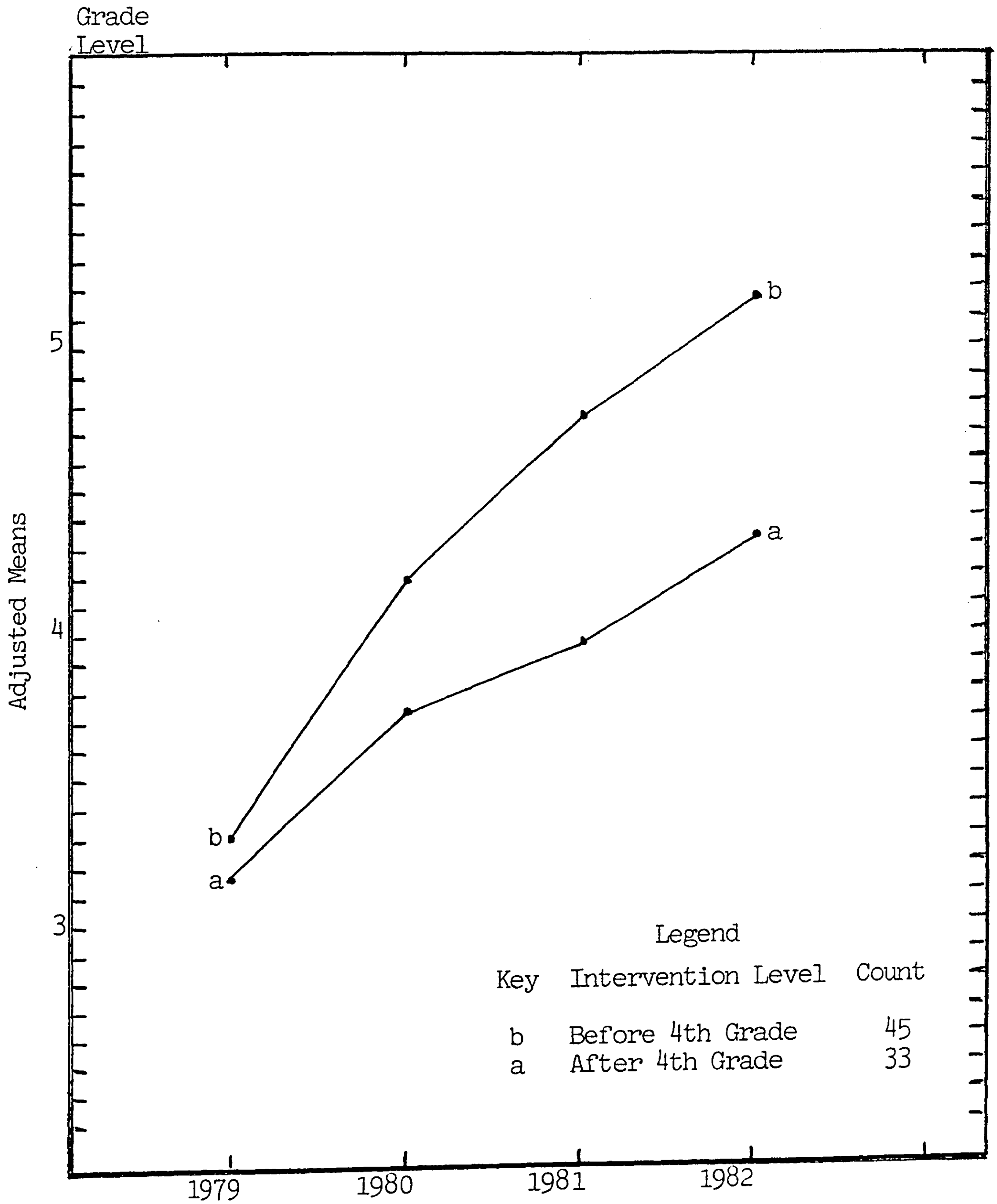

Figure 11. Intervention by Testing Interaction: Reading Cells 1, 5, 6, 7, and 8 (LD Only).

testing was significant, $\underline{F}$ (3, 228) = 227.69, $\underline{p} < .0001$; the testing by grade interaction was significant, $\underline{F}$ (3, 228) = 15.02, $\underline{p} < .0001$.

Due to the significant interaction, the main effects were all ignored, and trends across testings between groups were interpreted according to Figure 11.

Inspection of the results reveals that H_o^4 was rejected at the .0001 level of significance, $\underline{p} < .0001$. H_o^4 was the only null hypothesis applicable to be tested by these results.

Subjects whose intervention levels were prior to the 4th grade demonstrated accelerated rates of gain when compared with those subjects whose intervention levels were = > 4th grade. Adjusted cell means are displayed in Table 19 on the following page; for unrefined means, see Appendix C, Table 68.

Table 19

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels	
Cells	Before 4th	After 4th
5	3.30	3.17
6	4.18	3.71
7	4.73	3.96
8	5.17	4.31

Blocking on Intervention Levels Before and After 4th Grade Reading Cells 1, 4, 5, 6, 7, and 8

In a repeated-measures ANCOVA, blocking on intervention grade levels before and after 4th grade, with testing dates from 1978 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 12.

The main effect for intervention grade was not significant, F (1, 50) = 1.78, p = .19, the covariate was significant, F (1, 50) = 60.80, p < .0001. The pretest accounted for significant variation among the intervention

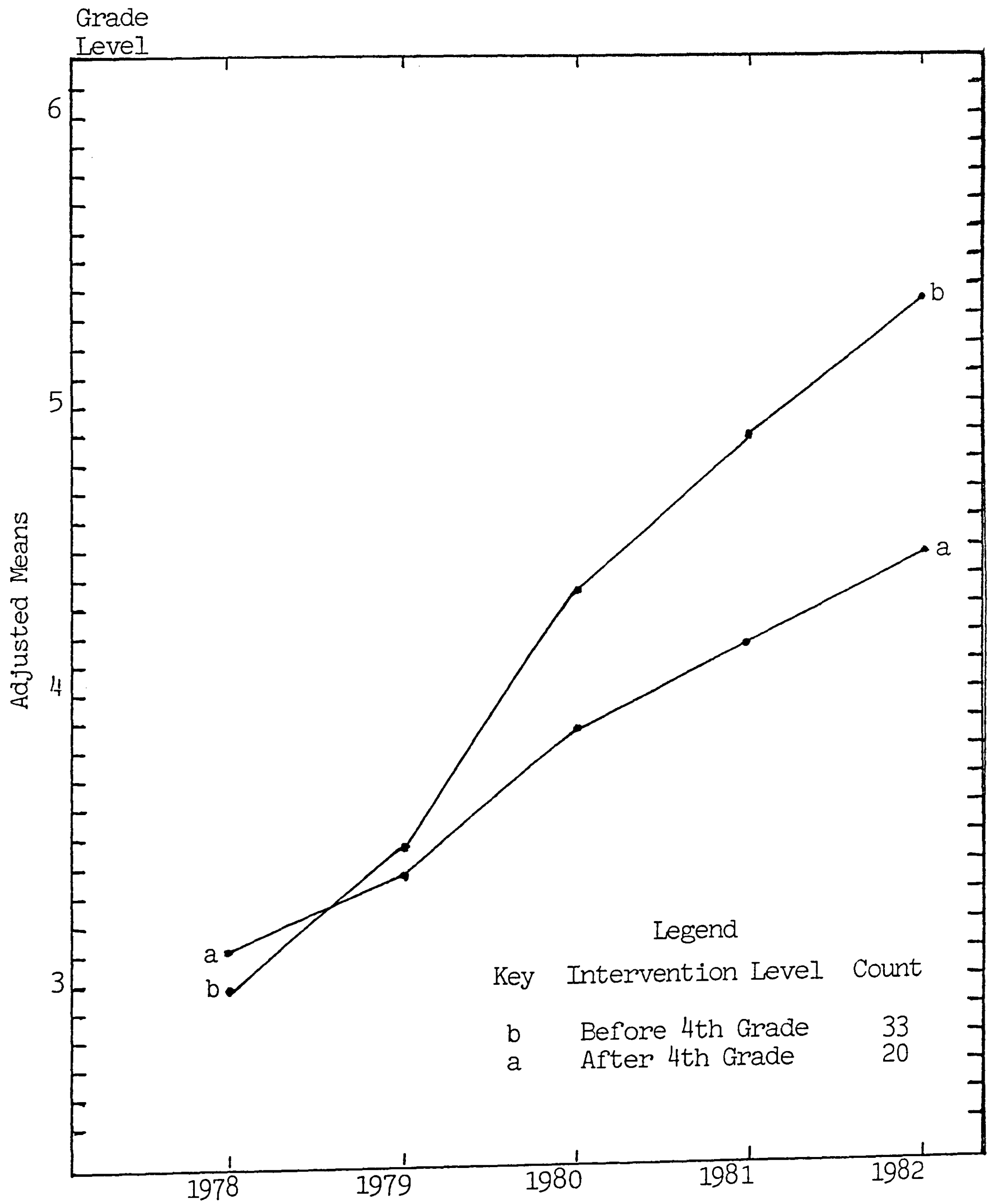

Figure 12. Intervention by Testing Interaction:

Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only).

levels on the dependent variable. The main effect for testing was significant, F (4, 204) = 175.62, $p < .0001$; the testing by grade interaction was significant, F (4, 204) = 13.15, $p < .0001$.

Due to the significant interaction, the main effects were ignored, and trends across testings were interpreted according to Figure 12.

The only null hypothesis applicable to be tested by these results was H_o^4 which was rejected at the .0001 level of significance; $p < .0001$. Subjects who received intervention services prior to the 4th grade demonstrated higher rates of gain than those subjects who received intervention services = > 4th grade. For inspection of the adjusted cell means, see Table 20 on the following page; for unrefined means, see Appendix C, Table 69.

Table 20

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels	
Cells	Before 4th	After 4th
4	2.98	3.10
5	3.48	3.37
6	4.32	3.86
7	4.88	4.13
8	5.34	4.47

Blocking on Intervention Levels Before and After 4th Grade Reading Cells 1, 3, 4, 5, 6, 7, and 8

In a repeated-measures ANCOVA, blocking on intervention grade levels before and after 4th grade, with testing dates from 1977 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 13.

The main effect for intervention grade was not significant, F (1, 29) = .02, p = .90, the covariate was significant, F (1, 29) = 16.03, p < .05. The pretest

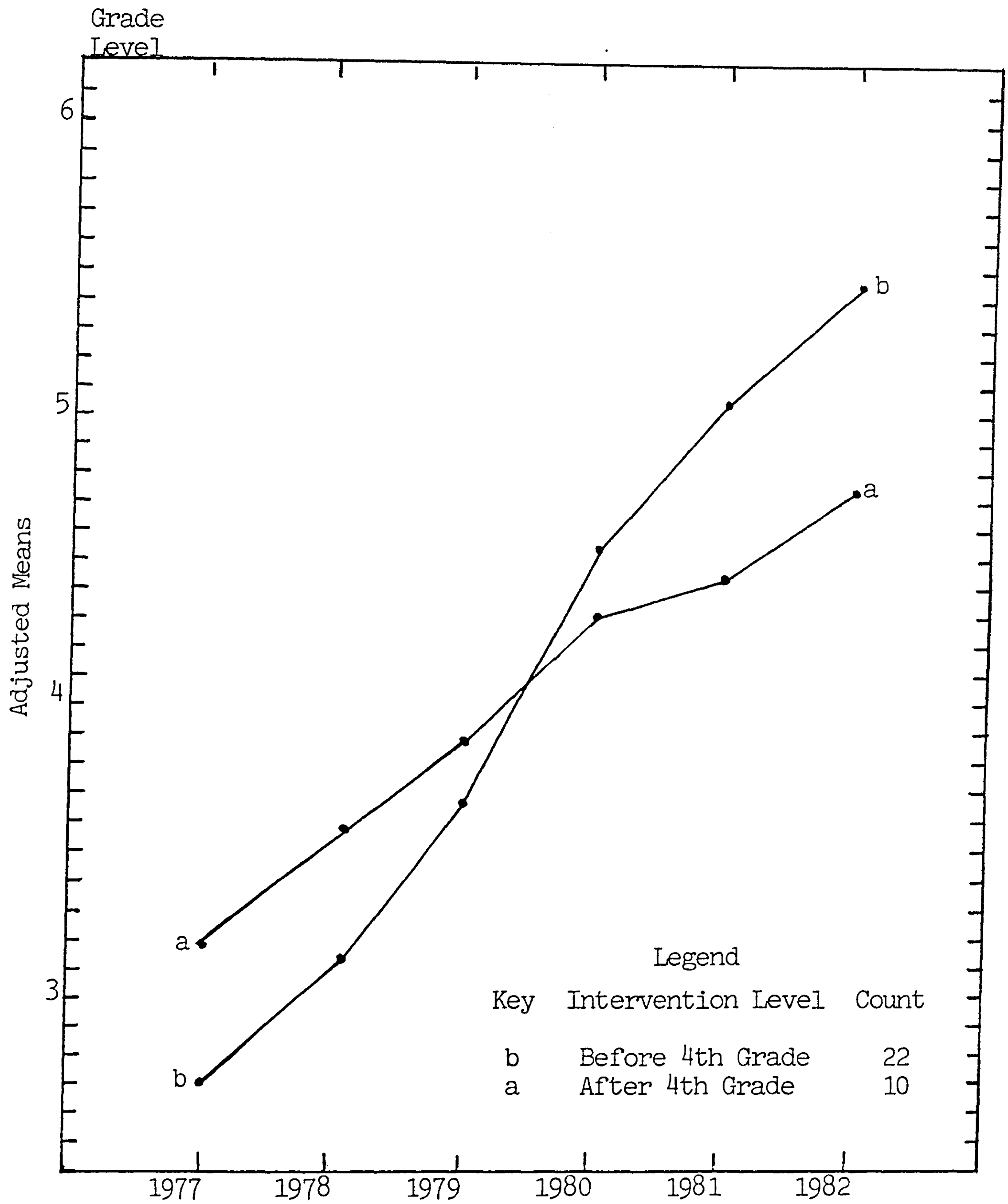

Figure 13. Intervention by Testing Interaction

Reading Cells 1, 3, 4, 5, 6, 7, and 8 (LD Only).

accounted for significant variation among the intervention levels on the dependent variable. The main effect for testing was significant, F (5, 150) = 104.22, $p < .0001$; the testing by grade interaction was significant, F (5, 150) = 10.35, $p < .0001$.

Due to the significant interaction, the main effects were all ignored, and trends across testings were interpreted according to Figure 13.

The only null hypothesis that was applicable to be tested by these results was H_o^4 which was rejected at the .0001 level of significance; $p < .0001$.

Subjects whose intervention levels were prior to 4th grade demonstrated accelerated rates of gain while those subjects whose intervention levels were = > 4th grade demonstrated depressed rates of gain. For inspection of the adjusted cell means, see Table 21 on the following page; for unrefined means, see Appendix C, Table 70.

Table 21

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels	
Cells	Before 4th	After 4th
3	2.70	3.19
4	3.13	3.59
5	3.66	3.87
6	4.52	4.30
7	5.03	4.43
8	5.44	4.74

Blocking on Intervention Levels Before and After 5th Grade Reading Cells 1, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels before and after 5th grade, with testing dates from 1979 through 1982, the covariate was the pretest in reading. The sample sizes are displayed for inspection in Figure 14.

The main effect for intervention grade was not significant, F (1, 75) = 3.41, p = .07; the covariate was

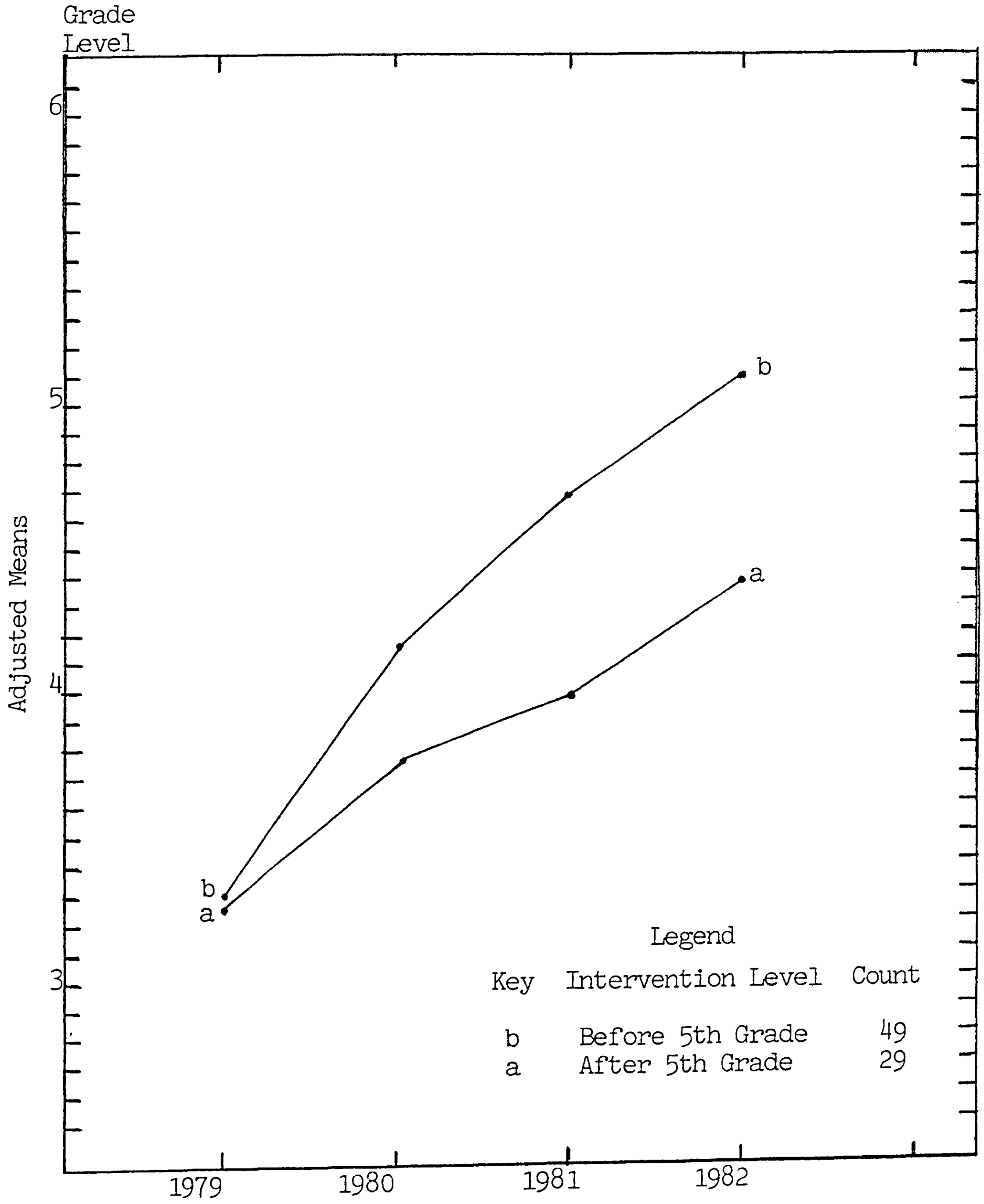

Figure 14. Intervention by Testing Interaction:

Reading Cells 1, 5, 6, 7, and 8 (LD Only).

significant, $F\ (1, 75) = 78.78$, $p < .0001$. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect for testing was significant, $F\ (3, 228) = 202.33$, $p < .0001$; the testing by grade interaction was significant, $F\ (3, 228) = 12.15$, $p < .0001$.

Due to the significant interaction, the main effects were all ignored, and trends across testings were interpreted according to Figure 14.

Based on the significant interaction, $H_o{}^5$ was rejected at the .0001 level of significance; $p < .0001$. No other null hypothesis was applicable to be tested by the results of this analysis.

Subjects whose intervention levels were prior to 5th grade demonstrated accelerated rates of gain when compared with subjects whose intervention levels were = > 5th grade. Adjusted cell means for the dependent variable are displayed in Table 22 on the following page; for unrefined means, see Appendix C, Table 71.

Table 22

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels	
Cells	Before 5th	After 5th
5	3.27	3.21
6	4.13	3.73
7	4.66	3.96
8	5.07	4.36

Blocking on Intervention Levels Before and After 5th Grade Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels before and after 5th grade, with testing dates from 1978 through 1982, the covariate was the pretest in reading. The sample sizes are displayed in Figure 15.

The main effect for intervention grade was not significant, F (1, 150) = 1.94, p = .17; the covariate was significant, F (1, 50) = 60.31, p < .0001. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect

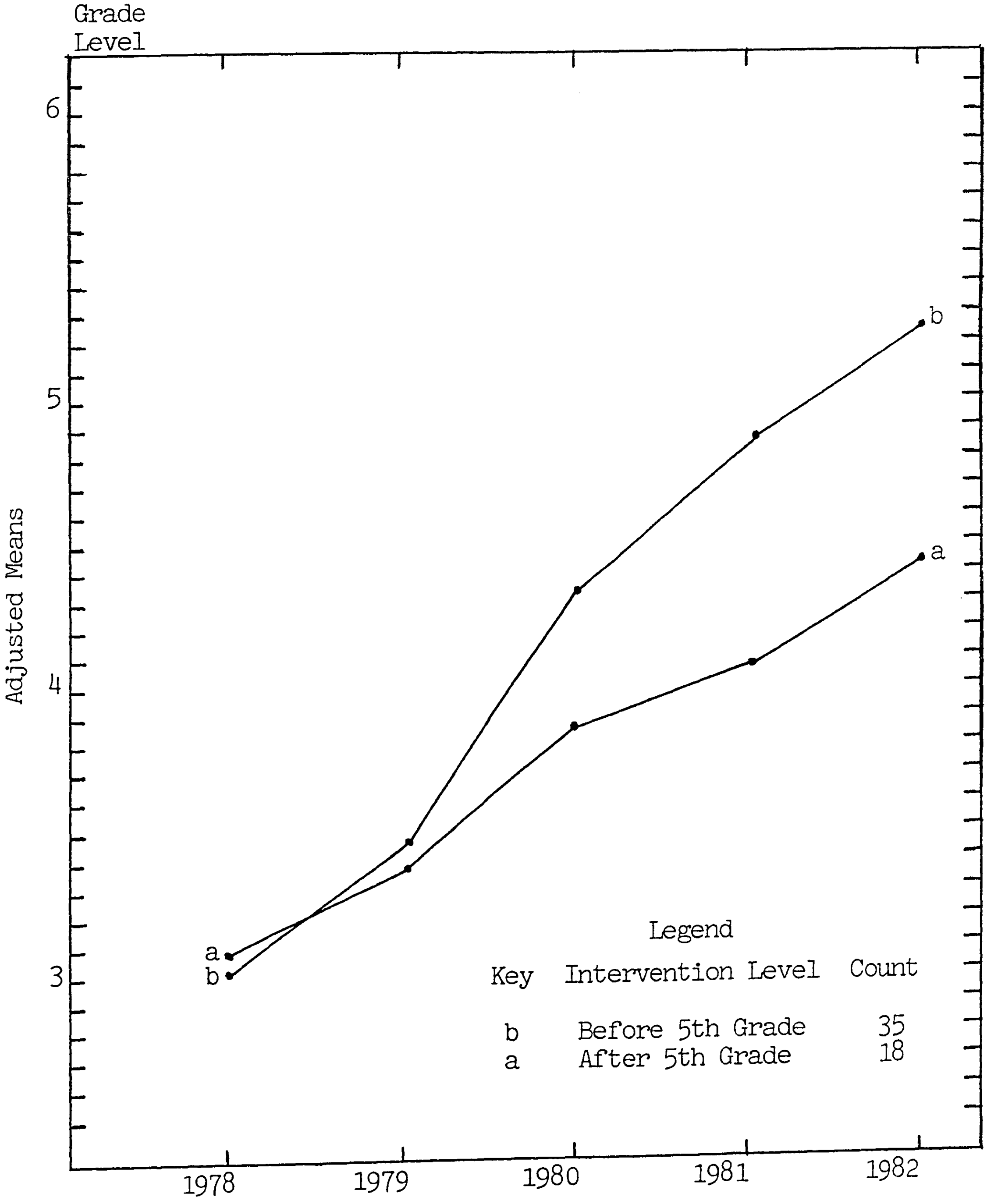

Figure 15. Intervention by Testing Interaction:
Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only).

for testing was significant, F (4, 204) = 159.76, $p < .0001$; the testing by grade interaction was significant, $p < .0001$.

Due to the significant interaction, all the main effects were ignored, and trends across testings were interpreted according to Figure 15.

The only null hypothesis applicable to be tested by the results of this analysis was H_o^5 which was rejected at the .0001 level of significance, $p < .0001$. Subjects whose intervention levels were prior to 5th grade demonstrated accelerated rates of gain when compared with subjects whose intervention levels were = > 5th grade. For inspection of the adjusted cell means for the dependent variable, see Table 23 on the following page; for unrefined means, see Appendix C, Table 72.

Table 23

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels	
Cells	Before 5th	After 5th
4	3.00	3.07
5	3.47	3.36
6	4.31	3.82
7	4.87	4.06
8	5.32	4.42

Blocking on Intervention Levels Before and After 5th Grade Reading Cells 1, 3, 4, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels before and after 5th grade, with testing dates from 1977 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 16.

The main effect for intervention grade was not significant, $\underline{F}$ (1, 29) = .39, $\underline{p}$ = .54; the covariate was significant, $\underline{F}$ (1, 29) = 18.34, $\underline{p}$ < .05. The pretest accounted for significant variation among the intervention levels on

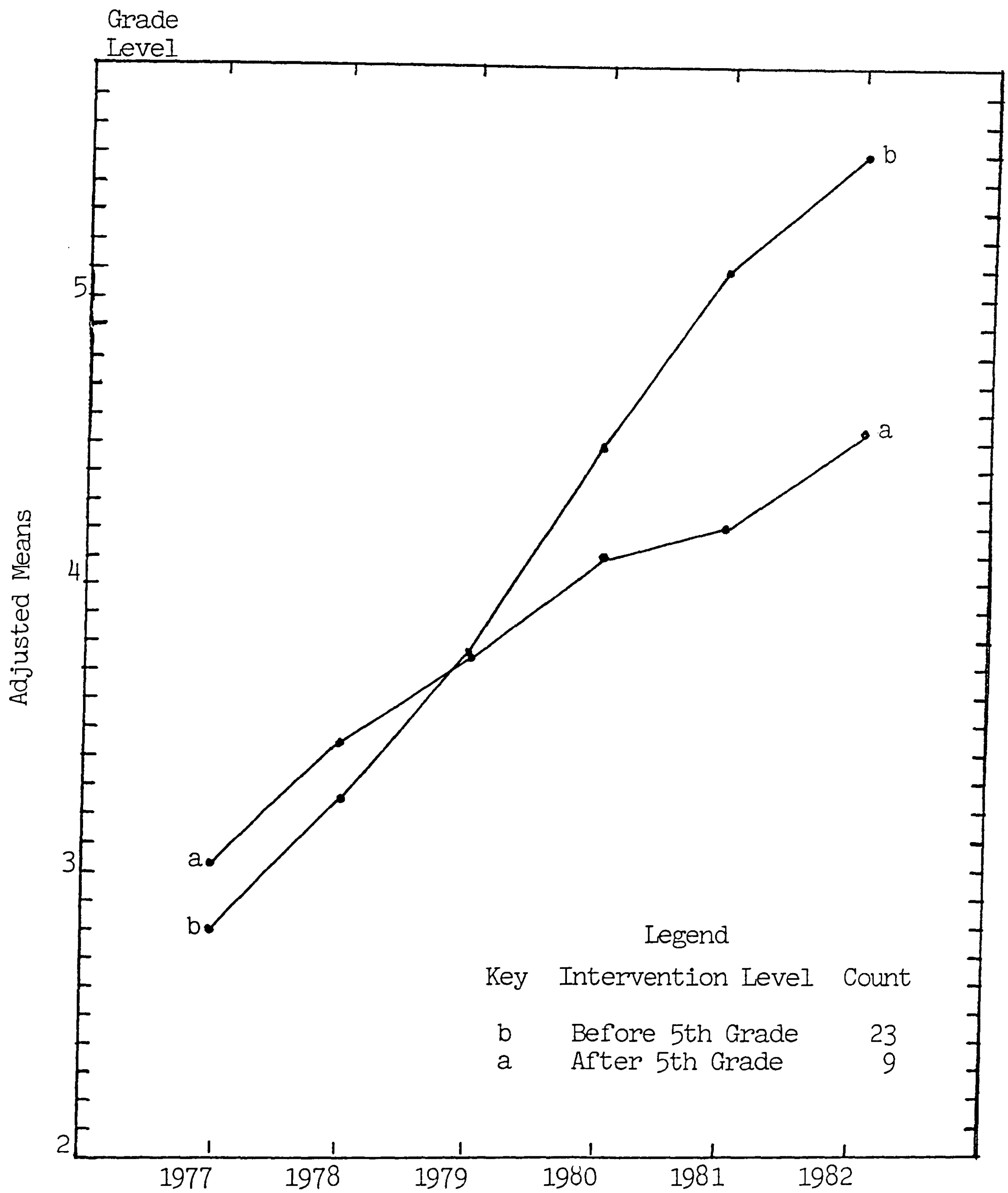

Figure 16. Intervention by Testing Interaction

Reading Cells 1, 3, 4, 5, 6, 7, and 8 (LD Only).

the dependent variable. The main effect for testing was significant, F (5, 150) = 93.94, $p < .0001$; the testing by grade interaction was significant, F (5, 150) = 10.54, $p < .0001$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 16.

The only null hypothesis which was applicable to be tested by the results of this analysis was H_o^5 which was rejected at the .0001 level of significance; $p < .0001$. Subjects whose intervention levels were prior to the 5th grade demonstrated accelerated gains when compared with subjects whose intervention levels were = > 5th grade. Adjusted cell means for the dependent variable are displayed in Table 24 on the following page; for unrefined means, see Appendix C, Table 73.

Table 24

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels	
Cells	Before 5th	After 5th
3	2.79	3.02
4	3.22	3.42
5	3.73	3.73
6	4.59	4.10
7	5.10	4.20
8	5.50	4.52

Blocking on Intervention Levels Before and After 6th Grade Reading Cells 1, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels before and after 6th grade, with testing dates from 1980 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 17.

The main effect for intervention grade was not significant, F (1, 103) = .13, p = .72; the covariate was significant, F (1, 103) = 115.73, p < .0001. The pretest

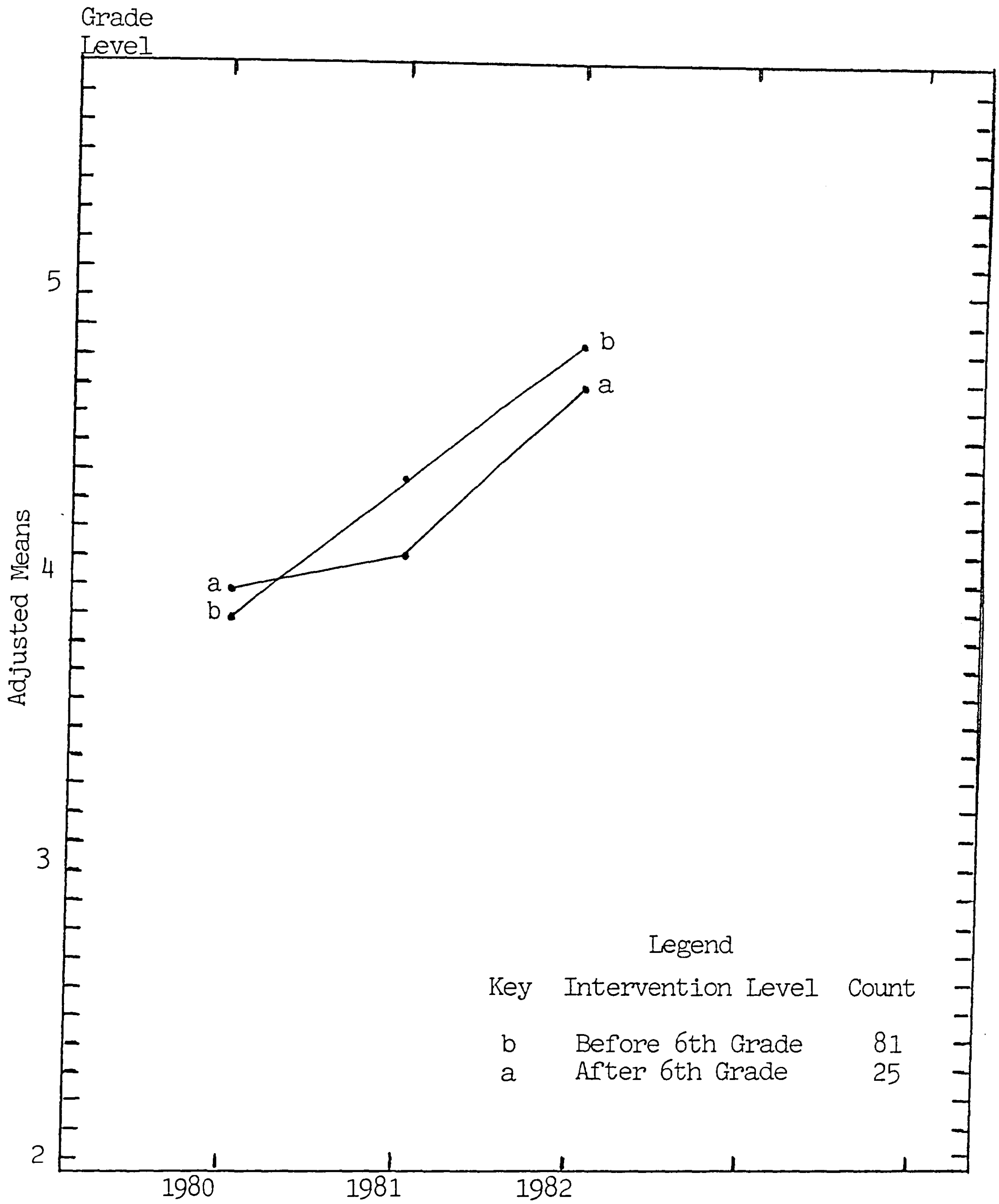

Figure 17. Intervention by Testing Interaction:

Reading Cells 1, 7, and 8 (LD Only).

accounted for significant variation among the intervention levels on the dependent variable. The main effect for testing was significant, F (2, 208) = 92.32, $p < .0001$; the testing by grade interaction was significant, (2, 208) = 3.26, $p < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 17.

The only null hypothesis applicable for testing by the results of this analysis was $H_o{}^6$ which was rejected at the .05 level of significance; $p = .04$.

Significant differences in rates of gain were demonstrated by the groups according to intervention levels. Subjects whose intervention levels were prior to 6th grade demonstrated accelerated gains when compared with subjects whose intervention levels were = > 6th grade. For inspection of the adjusted cell means for the dependent variable, see Table 25 on the following page; for unrefined means, see Appendix C, Table 74.

Table 25

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels	
Cells	Before 6th	After 6th
6	3.85	3.93
7	4.33	4.09
8	4.80	4.67

Blocking on Intervention Levels Before and After 6th Grade Reading Cells 1, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels before and after 6th grade, with testing dates from 1979 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 18.

The main effect for the intervention grade was not significant, F (1, 175) = .20, p = .65; the covariate was significant, F (1, 75) = 74.33, p < .0001. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect

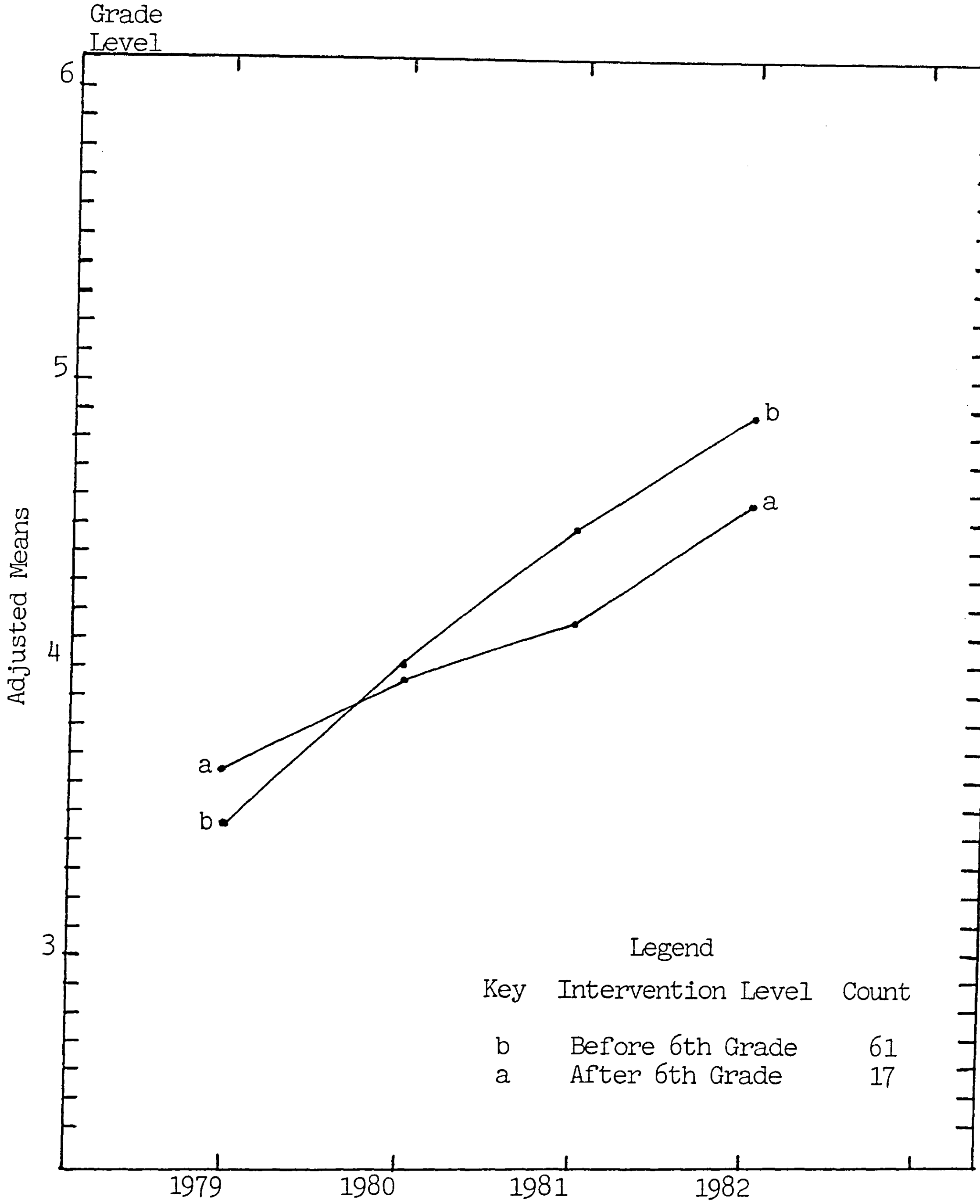

Figure 18. Intervention by Testing Interaction:

Reading Cells 1, 5, 6, 7, and 8 (LD Only).

for testing was significant, F (3, 228) = 123.56, $p < .0001$; the testing by grade interaction was significant, F (3, 228) = 6.58, $p < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 18.

The only null hypothesis applicable to testing by the results of this analysis was H_o^6 which was rejected at the .05 level of significance; $p = .0003$.

Significant differences in rates of gain were demonstrated by the groups according to intervention levels. Subjects whose intervention levels were prior to 6th grade demonstrated accelerated rates of gain when compared with subjects whose intervention levels were = > 6th grade. For inspection of the adjusted cell means for the dependent variable see Table 26 on the following page; for unrefined means, see Appendix C, Table 75.

Table 26

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels	
Cells	Before 6th	After 6th
5	3.20	3.43
6	3.99	3.93
7	4.48	4.12
8	4.87	4.56

Blocking on Intervention Levels Before and After 6th Grade Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels before and after 6th grade, with testing dates from 1978 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 19.

The main effect for intervention grade was not significant, F (1, 50) = .00, p = .99; the covariate was significant, F (1,50) = 55.32, p < .0001. The pretest accounted for significant variation among the intervention

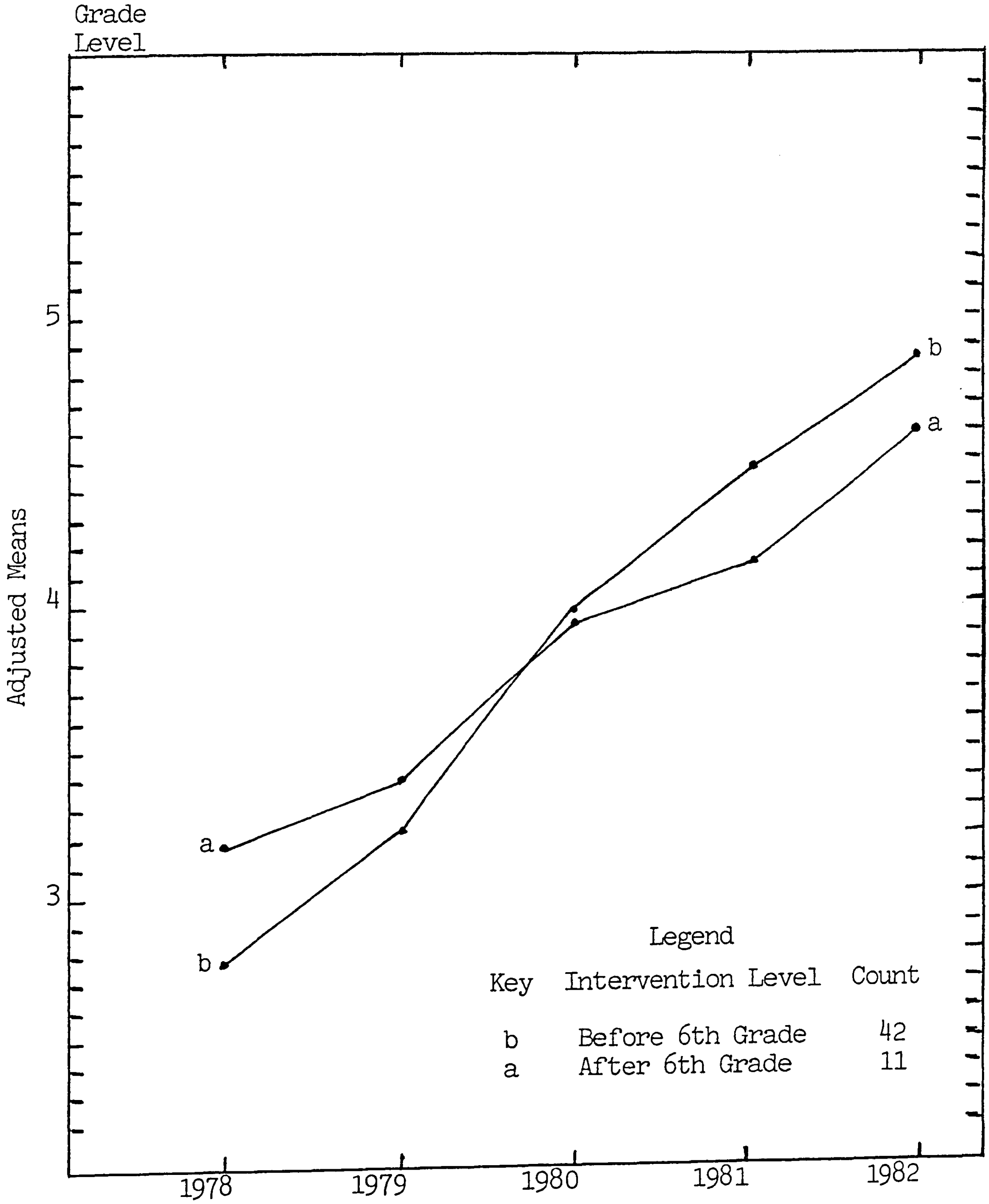

Figure 19. Intervention by Testing Interaction:

Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only).

levels on the dependent variable. The main effect for testing was significant, $\underline{F}$ (4, 204) = 96.22, $\underline{p} < .0001$; the testing by grade interaction was significant, $\underline{F}$ (4, 204) = 4.65, $\underline{p} < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 19.

The only null hypothesis applicable to testing by the results of this analysis was H_o^6 which was rejected at the .05 level of significance; $\underline{p} = .0013$.

Significant differences in rates of gain were demonstrated by the groups according to intervention levels. Subjects whose intervention levels were prior to 6th grade demonstrated accelerated rates of gain when compared with subjects whose intervention levels were = > 6th grade. For inspection of the adjusted cell means for the dependent variable, see Table 27 on the following page; for unrefined means, see Appendix C, Table 76.

Table 27

Adjusted Cell Means

Reading (LD Only) Cells	Intervention Grade Levels	
	Before 6th	After 6th
4	2.94	3.36
5	3.39	3.59
6	4.15	4.13
7	4.67	4.32
8	5.07	4.79

Blocking on Intervention Levels Before and After 6th Grade Reading Cells 1, 3, 4, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels before and after 6th grade, with testing dates from 1977 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 20.

The main effect for intervention grade was not significant, $F\ (1, 29) = .47$, $p = .50$; the covariate was significant, $F\ (1, 29) = 13.10$, $p < .0001$. The pretest accounted for significant variation among the intervention

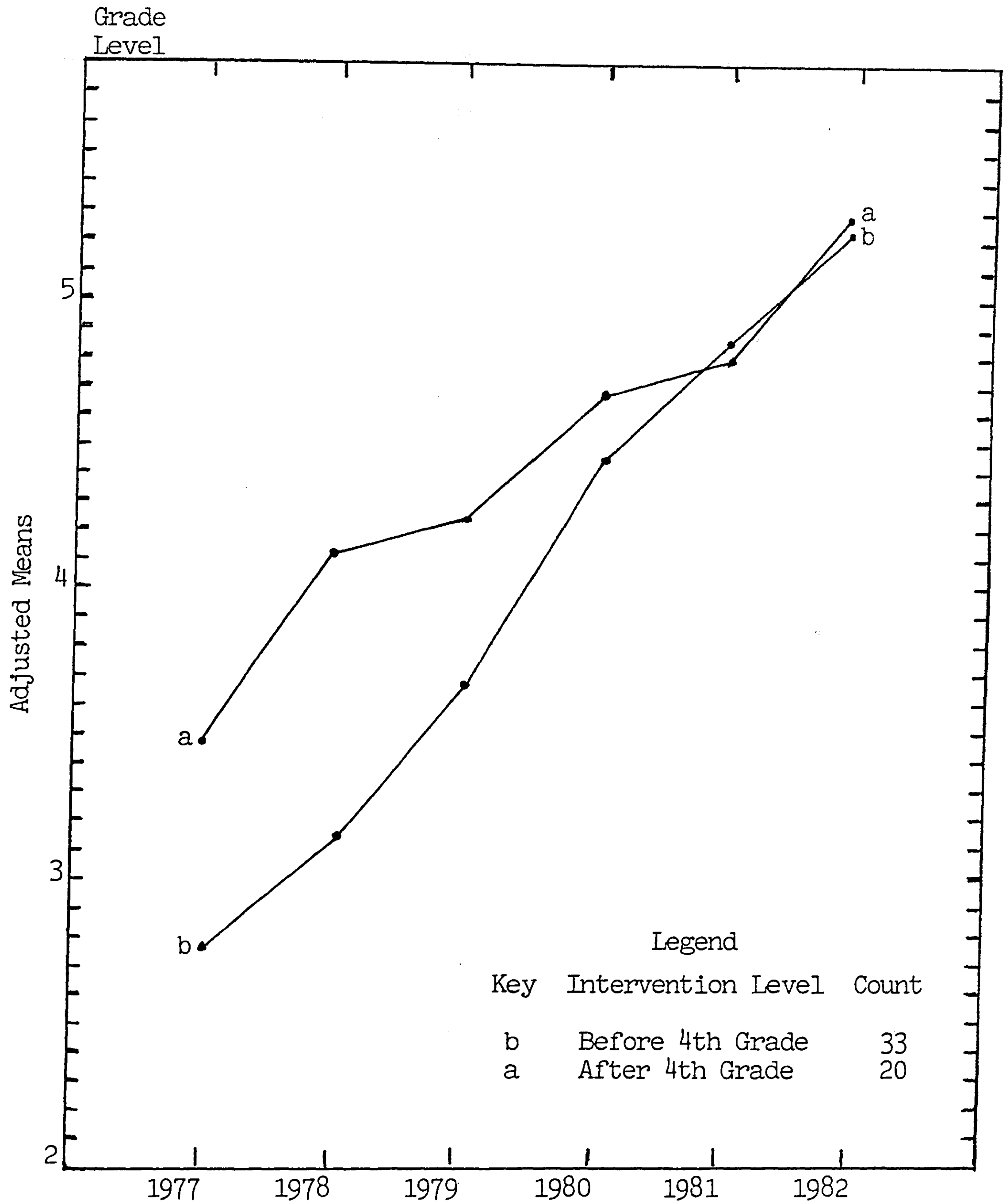

Figure 20. Intervention by Testing Interaction:

Reading Cells 1, 3, 4, 5, 6, 7, and 8 (LD Only).

levels on the dependent variable. The main effect for testing was significant, F (5, 150) = 48.85, p < .0001; the testing by grade interaction was significant, F (5, 150) = 3.08; p < .05.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 20.

The only null hypothesis applicable to testing by these results was H_o^6 which was rejected at the .05 level of significance; p = .0111.

Significant differences in rates of gain were demonstrated by the groups according to intervention levels. Subjects whose intervention levels were prior to 6th grade demonstrated accelerated rates of gain when compared with subjects whose intervention levels were = > 6th grade. For inspection of the adjusted cell means for the dependent variable, see Table 28 on the following page, for unrefined means, see Appendix C, Table 77.

Table 28

Adjusted Cell Means

Reading (LD Only)	Intervention Grade Levels	
Cells	Before 6th	After 6th
3	2.74	3.46
4	3.12	4.10
5	3.64	4.22
6	4.41	4.68
7	4.85	4.80
8	5.21	5.26

This concludes the results of the Statistical Analyses for LD subjects in reading. A summary of the results is presented according to the rank order of the intervention levels in Table 40 on page 207.

Hypotheses Relevant to Mathematics

The null hypotheses stated that there will be no significant difference between the learning rates in mathematics of learning disabled (LD) students who received intervention services:

H_o^7: prior to and after first grade;

H_o^8: prior to and after second grade;

H_o^9: prior to and after third grade;

H_o^{10}: prior to and after fourth grade;

H_o^{11}: prior to and after fifth grade;

H_o^{12}: prior to and after sixth grade.

Results of the testing of the null hypotheses are reported immediately following the reported results of each statistical analysis. H_o was rejected at the .05 alpha level.

Blocking on Intervention Levels 1 Through 6 Mathematics Cells 1, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels 1 through 6, with testing dates from 1981 through 1982, the covariate was the pretest in mathematics. Sample sizes are displayed in Figure 21.

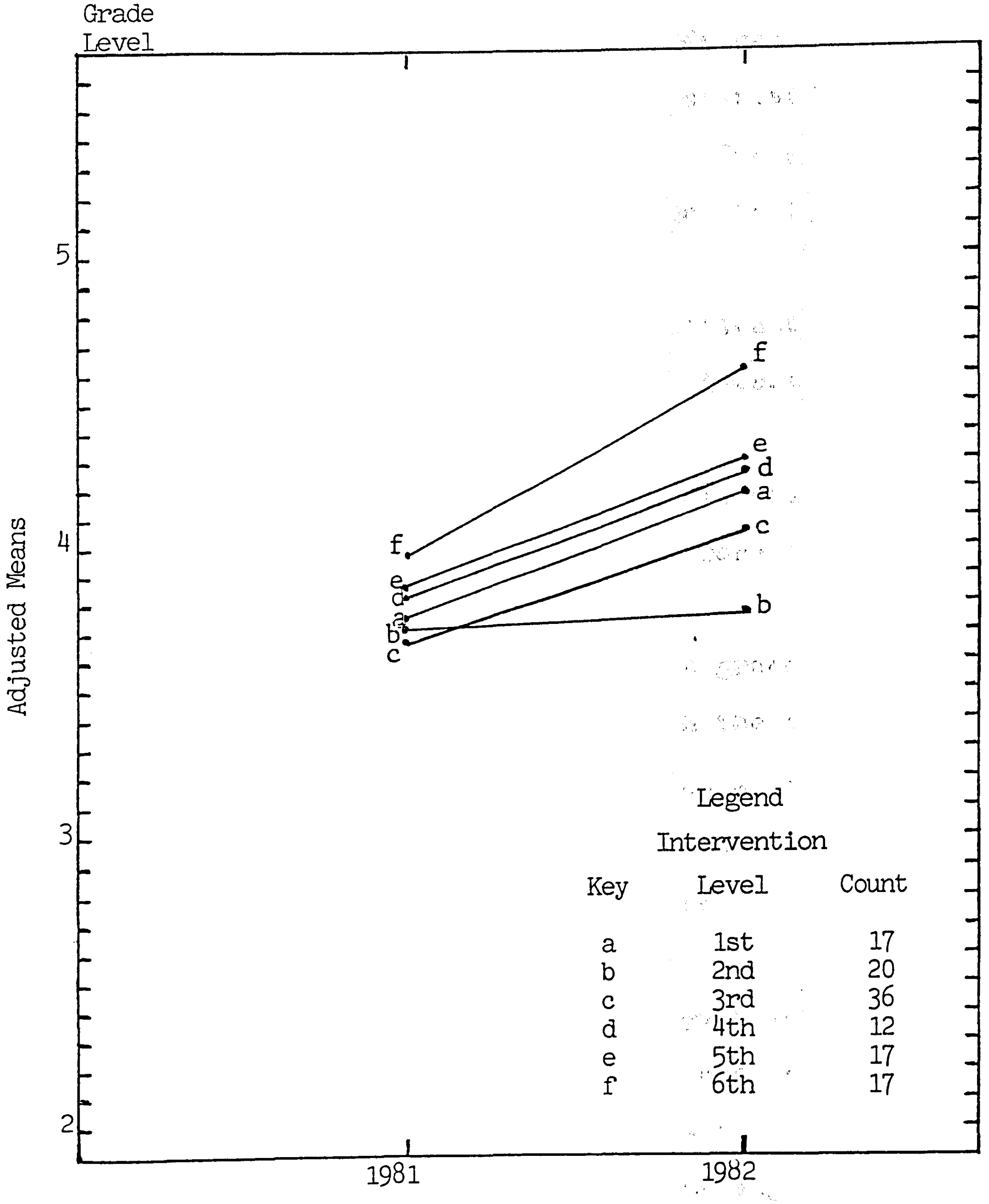

Figure 21. Intervention by Testing Interaction: Mathematics Cells 1, 7, and 8 (LD Only).

The main effect for intervention grade was not significant $\underline{F}$ (5, 112) = 1.09, $\underline{p}$ = .37; the covariate was significant, $\underline{F}$ (1, 112) = 17.62, $\underline{p}$ < .0001. The pretest accounted for significant variation among the intervention levels on the dependent variable.

The main effect for testing was significant, $\underline{F}$ (1,113) = 61.79, $\underline{p}$ < .0001; the testing by grade interaction was significant, $\underline{F}$ (5, 113) = 2.50, $\underline{p}$ < .05.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 21.

H_o7 could not be tested because < 1st grade subjects were not included in the cells from which the data were drawn. H_o8 through H_o11 were all rejected at the .05 level of significance; $\underline{p}$ = .0346. H_o12 could not be tested because = > 7th grade subjects were not included in the sample.

Significant differences in rates of gain were demonstrated by the groups according to intervention levels ranked in the descending order of 6th, (4th & 5th), 1st, 3rd, and 2nd grade. For inspection of the adjusted cell means for the dependent variable, see Table 29; for unrefined means, see Appendix C, Table 78.

Table 29

Adjusted Cell Means

Mathematics (LD Only)	Intervention Grade Levels					
Cells	1st	2nd	3rd	4th	5th	6th
7	3.74	3.71	3.67	3.80	3.84	3.97
8	4.18	3.76	4.05	4.25	4.29	4.60

Blocking on Intervention Levels 1 Through 6

Mathematics Cells 1, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels 1 through 6, with testing dates from 1980 through 1982, the covariate was the pretest in mathematics. Sample sizes are displayed in Figure 22.

The main effect for intervention grade was not significant, F (5, 86) = 1.39, p = .24; the covariate was significant, F (1, 86) = 19.90, p < .0001. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect for testing was significant, F (2, 174) = 67.58, p < .0001; the testing by grade interaction was significant, F (10, 174) = 2.06, p < .05.

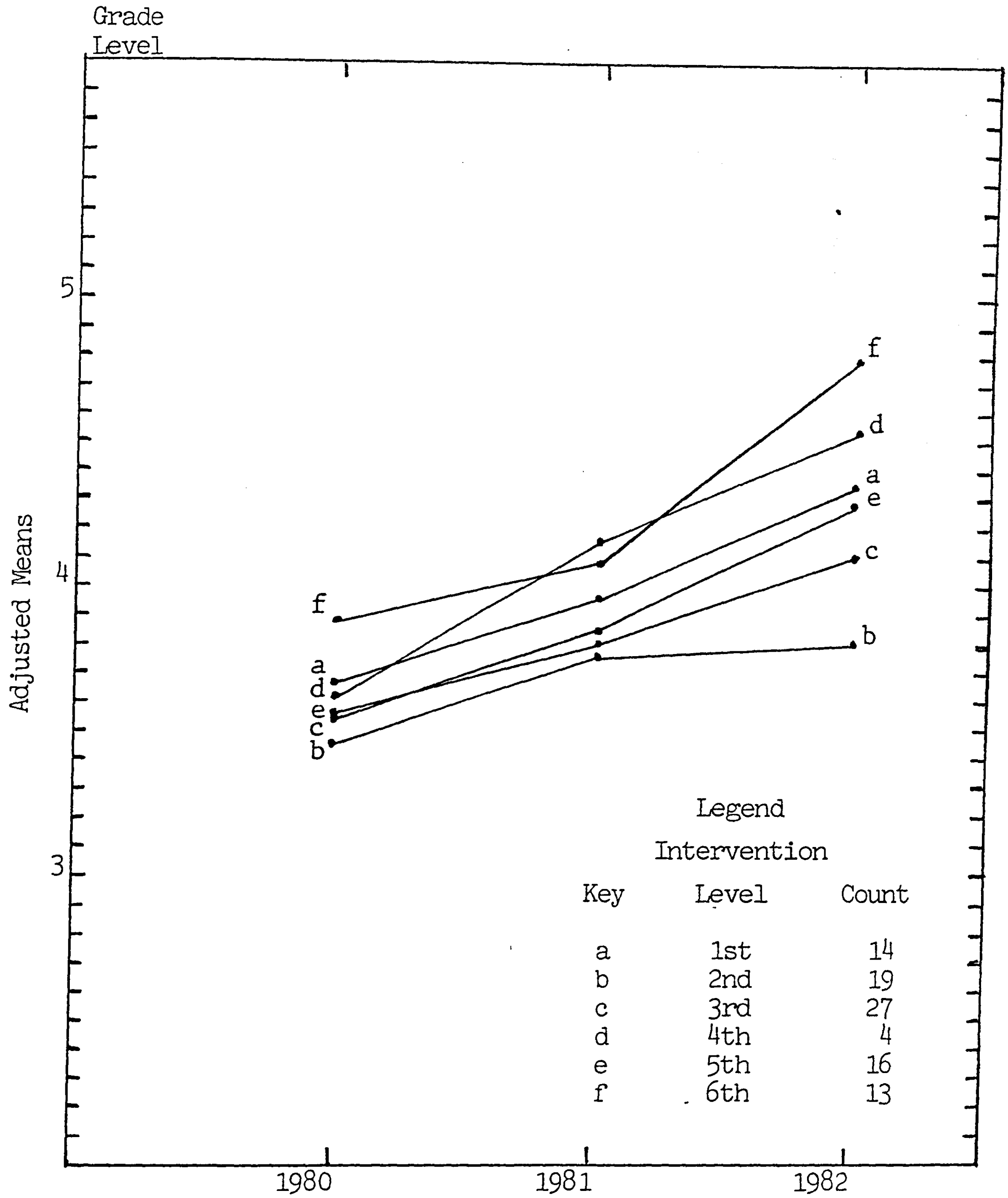

Figure 22. Intervention by Testing Interaction:

Mathematics Cells 1, 6, 7, and 8 (LD Only).

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 22.

H_o^7 could not be tested because < 1st grade subjects were not included in the cells from which the data were drawn.

H_o^8 through H_o^{11} were all rejected at the .05 level of significance; $\underline{p} = .0299$. H_o^{12} could not be tested because = > 7th grade subjects were not included in the sample.

Significant differences in rates of gain were demonstrated by the subjects according to intervention levels ranked in the descending order of (4th and 6th), 5th, 1st, 3rd, and 2nd grade. For inspection of the adjusted cell means for the dependent variable, see Table 30 on the following page; for unrefined means, see Appendix C, Table 79.

Table 30

Adjusted Cell Means

Mathematics (LD Only)	Intervention Grade Levels					
Cells	1st	2nd	3rd	4th	5th	6th
6	3.66	3.45	3.54	3.61	3.53	3.88
7	3.96	3.75	3.80	4.14	3.83	4.08
8	4.34	3.80	4.10	4.51	4.29	4.78

Blocking on Intervention Levels 1 Through 6

Mathematics Cells 1, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels from 1 through 6, with testing dates from 1981 through 1982, the covariate was the pretest in mathematics. Sample sizes are displayed in Figure 23.

The main effect for intervention grade was not significant, F (6, 129) = 1.62, p = .15; the covariate was significant, F (1, 129) = 38.61, p < .0001. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect for testing was significant, F (1, 130) = 79.07, p < .0001;

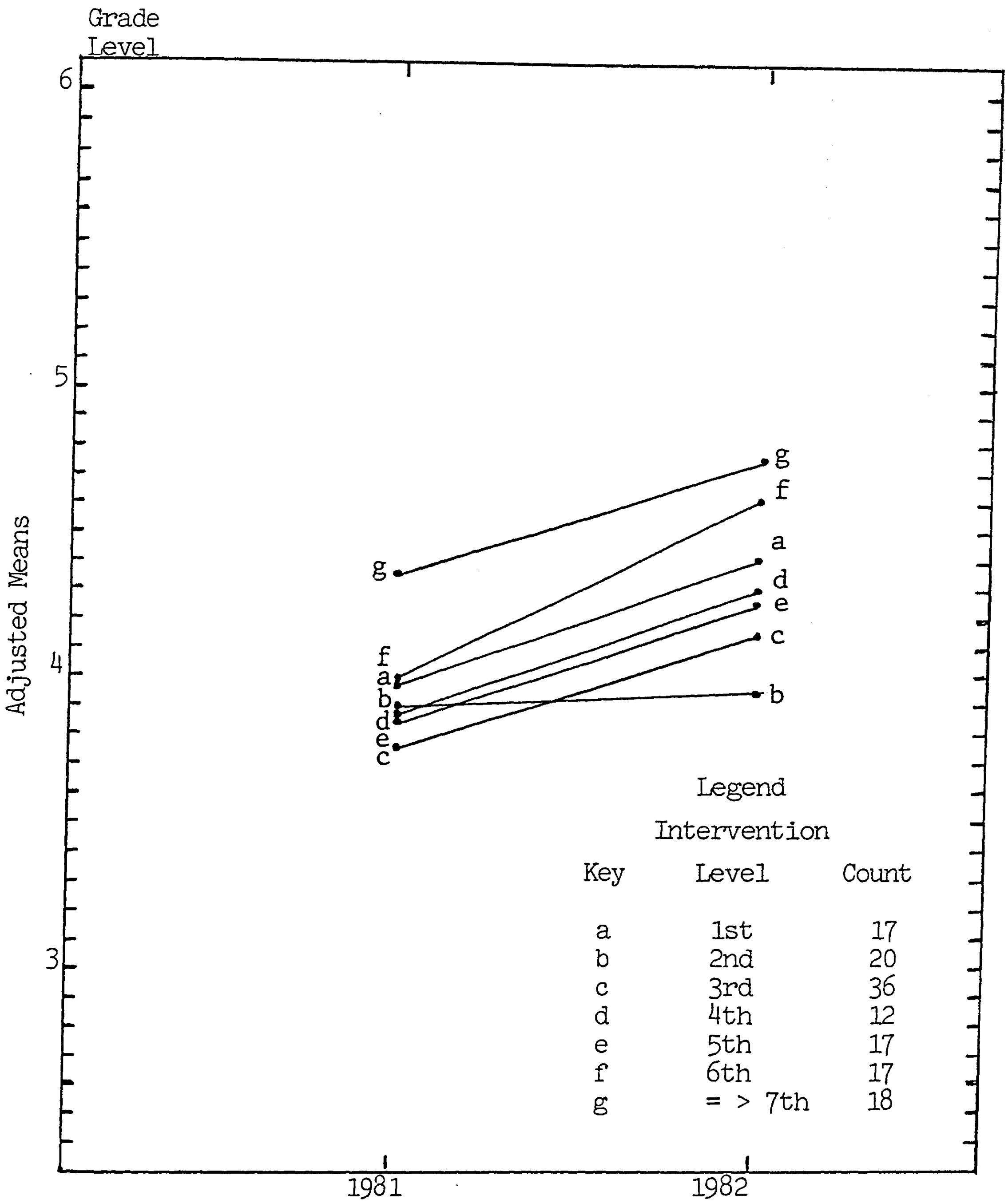

Figure 23. Intervention by Testing Interaction:
Mathematics Cells 1, 7, and 8 (LD Only).

the testing by grade interaction was significant, F (6, 130) = 2.25, $p < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 23.

$H_o{}^7$ could not be tested because no < 1st grade subjects were included in the cells from which the data were drawn. $H_o{}^8$ through $H_o{}^{12}$ were all rejected at the .05 level of significance; $p = .0422$.

Significant differences in rates of gain were demonstrated by the subjects according to intervention levels ranked in the descending order of 6th, (1st, 4th and 5th) = > 7th, 3rd, and 2nd grade. For inspection of the adjusted cell means for the dependent variable, see Table 31 on the following page; for unrefined means, see Appendix C, Table 80.

Table 31

Adjusted Cell Means

Mathematics (LD Only)	Intervention Grade Levels						
Cells	1st	2nd	3rd	4th	5th	6th	=> 7th
7	3.95	3.86	3.74	3.85	3.82	3.96	4.31
8	4.40	3.91	4.12	4.30	4.27	4.60	4.74

<u>Blocking on Intervention Levels 1 Through 6</u>

<u>Methematics Cells 1, 6, 7, and 8 (LD Only)</u>

In a repeated-measures ANCOVA, blocking on intervention grade levels 1 through 6, with testing dates from 1980 through 1982, the covariate was the pretest in mathematics. Sample sizes are displayed in Figure 24.

The main effect for intervention grade was not significant, F (6, 95) = 1.26, p = 129; the covariate was significant, F (1, 95) = 26.06, p < .0001. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect for testing was significant, F (2, 192) = 77.59, p < .0001; the testing by grade interaction was

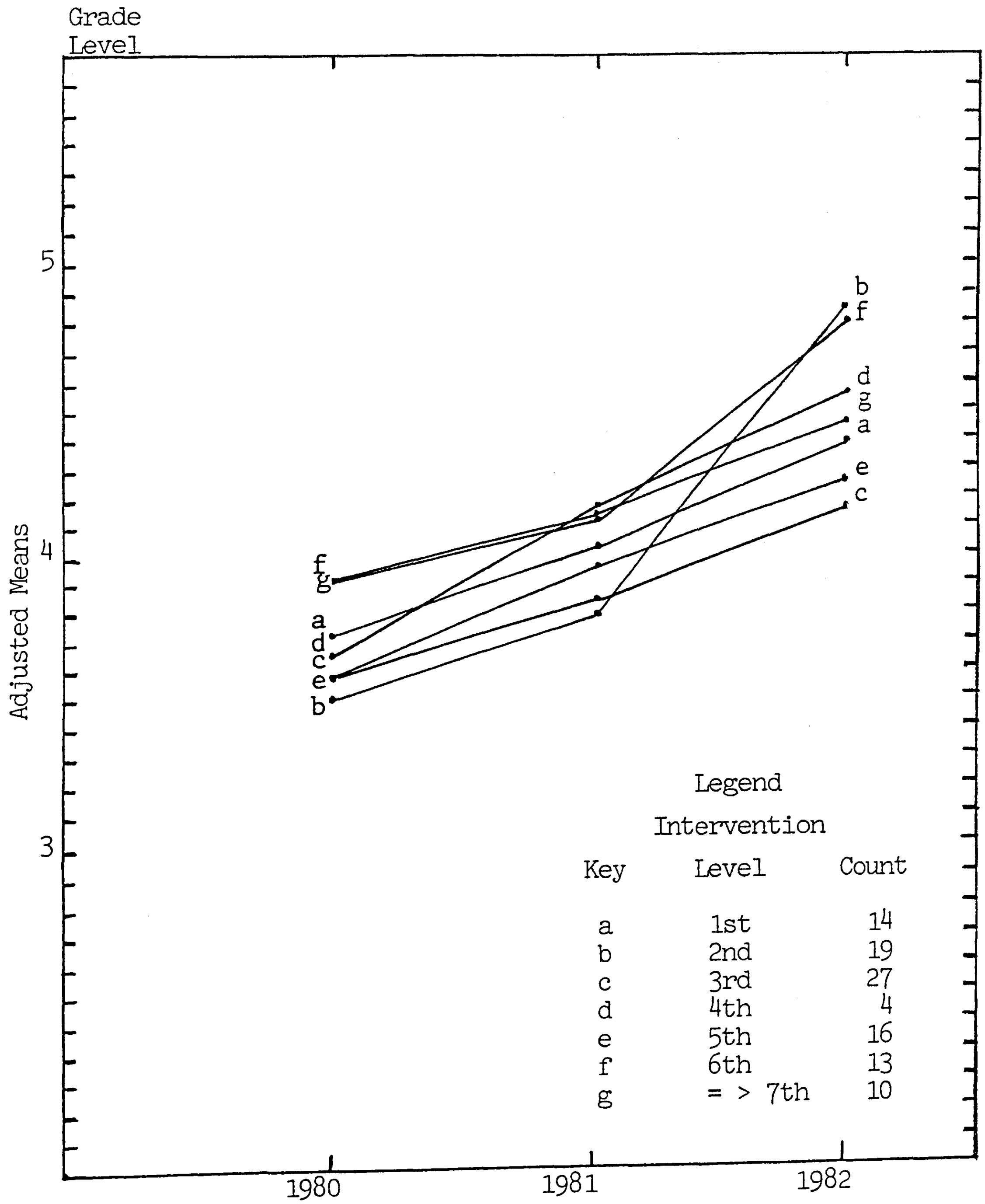

Figure 24. Intervention by Testing Interaction: Mathematics 1, 6, 7, and 8 (LD Only).

significant, F (12, 192) = 1.86, $p < .05$. Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 24.

H_o^7 could not be tested because no < 1st grade subjects were represented in the cells from which the data were drawn. H_o^8 through H_o^{12} were all rejected at the .05 level of significance; $p = .0409$.

Significant differences in rates of gain were demonstrated by the subjects according to their intervention levels ranked in the descending order of 2nd, (4th and 6th), 5th, 1st, 3rd, and = > 7th grade. For inspection of the adjusted cell means for the dependent variable, see Table 32 on the following page; for unrefined means, see Appendix C, Table 81.

Table 32

Adjusted Cell Means

Mathematics (LD Only)	Intervention Grade Levels						
Cells	1st	2nd	3rd	4th	5th	6th	7th
6	3.71	3.50	3.57	3.64	3.57	3.90	3.90
7	4.01	3.79	3.83	4.16	3.84	4.10	4.12
8	4.39	4.84	4.13	4.54	4.31	4.80	4.43

Blocking on Intervention Levels 1 Through 6

Mathematics Cells 1, 4, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels 1 through 6, with testing dates from 1978 through 1982, the covariate was the pretest in mathematics. Sample sizes are displayed in Figure 25.

The main effect for intervention grade was not significant, F (6, 37) = 1.82, p = .12; the covariate was significant, F (1, 37) = 22.55, p < .0001. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect for testing was significant, F (4, 152) = 55.30, p < .0001;

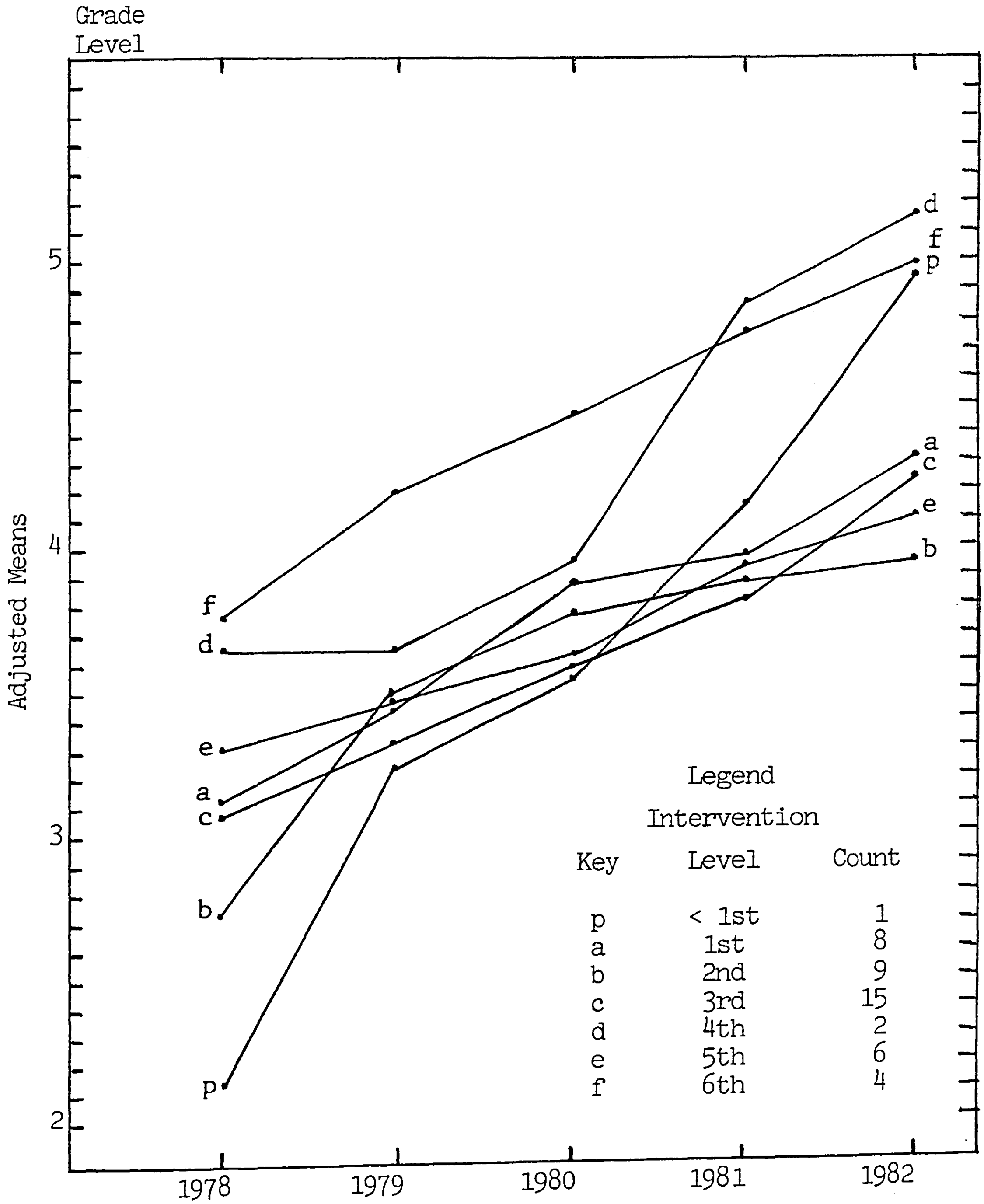

Figure 25. Intervention by Testing Interaction:

Mathematics Cells 1, 4, 5, 6, 7, and 8 (LD Only).

the testing by grade interaction was significant, $\underline{F}$ (24, 152) = < .05.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 25.

H_o^7 through H_o^{11} were all rejected at the .05 level of significance; $\underline{p}$ = .0413. H_o^{12} could not be tested becuase no = > 7th grade subjects were included in the cells from which the data were drawn.

Significant differences in rates of gain were demonstrated by the subjects according to their intervention levels ranked in the descending order of < 1st, 4th, (1st, 2nd, and 6th), 3rd, and 5th grade. For inspection of the adjusted cell means for the dependent variable, see Table 33 on the following page; for unrefined means, see Appendix C, Table 82.

Table 33

Adjusted Cell Means

Mathematics (EMR Only)	Intervention Grade Levels						
Cells	<1st	1st	2nd	3rd	4th	5th	6th
4	2.12	3.11	2.73	3.07	3.65	3.30	3.78
5	3.22	3.42	3.50	3.31	3.65	3.48	4.20
6	3.52	3.87	3.73	3.57	3.95	3.62	4.48
7	4.12	3.97	3.88	3.81	4.85	3.92	4.75
8	4.92	4.31	3.93	4.23	5.25	4.10	4.98

Blocking on Intervention Levels Before and After 1st Grade Mathematics Cells 1, 4, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention levels before and after 3rd grade, with testing dates from 1978 through 1982, the covariate was the pretest in mathematics. Sample sizes are displayed in Figure 26.

The main effect for intervention grade was not significant, F (1, 47) = .02, p = .89; the covariate was significant, F)1,47) = 70.92, p < .0001. The pretest accounted for significant variation among the intervention

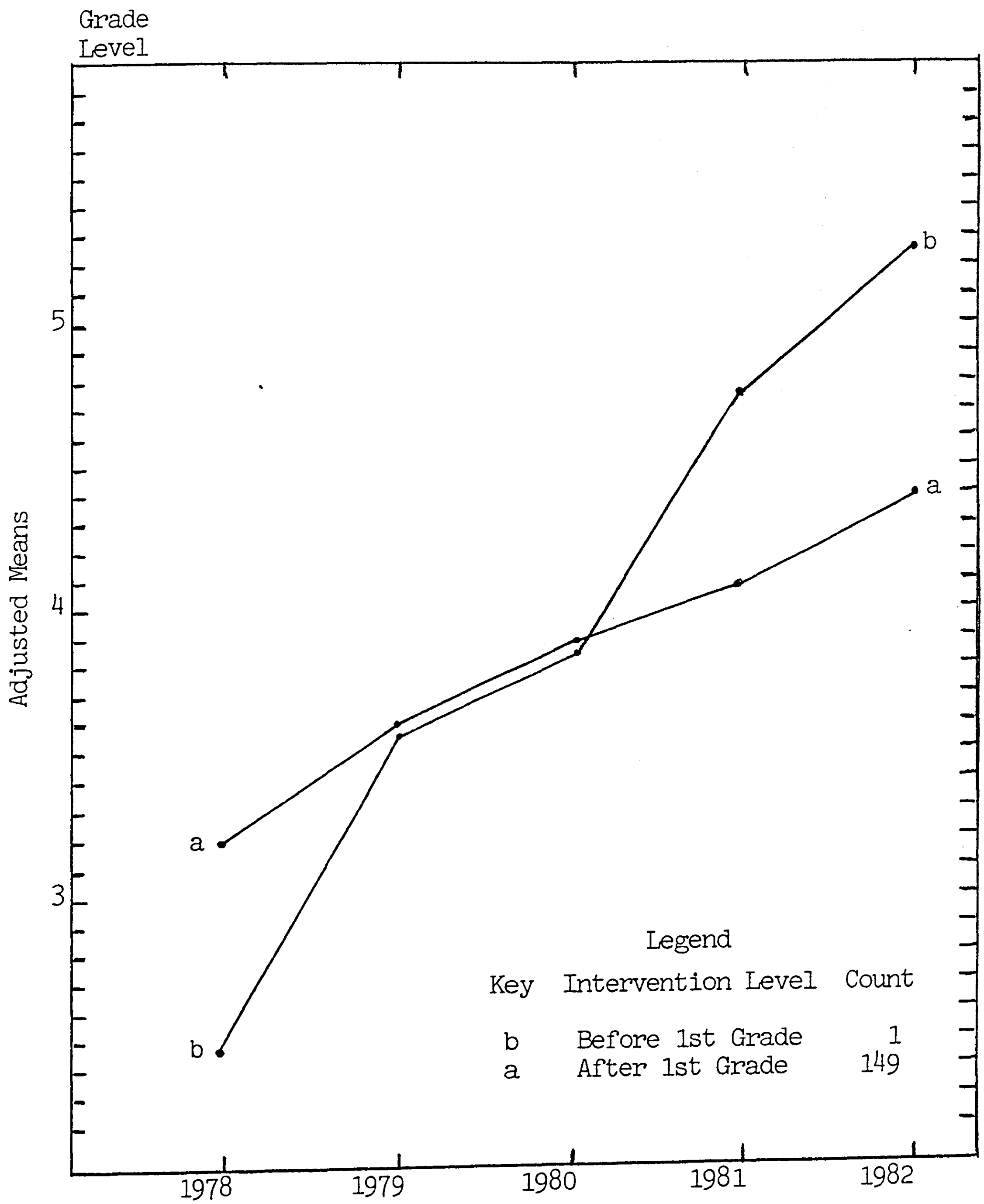

Figure 26. Intervention by Testing Interaction:
Mathematics Cells 1, 4, 5, 6, 7, and 8 (LD Only).

levels on the dependent variable. The main effect for testing was significant, $\underline{F}$ (4, 92) = 17.60, $\underline{p} < .0001$; the testing by grade interaction was significant, $\underline{F}$ (4, 192) = 2.71, $\underline{p} < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 26.

The only null hypothesis applicable to testing by the results of this analysis was $H_o{}^7$ which was rejected at the .05 level fo significance; $\underline{p}$ = .0313.

Significant differences in rates of gain were demonstrated by the groups according to the intervention levels. Subjects whose intervention levels were prior to 1st grade demonstrated accelerated rates of gain when compared with those subjects whose intervention levels were = > 1st grade. For inspection of the adjusted cell means for the dependent variable, see Table 34 on the following page; for unrefined means, see Appendix C, Table 83.

Table 34

Adjusted Cell Means

Mathematics (LD Only) Cells	Intervention Grade Levels	
	Before 1st	After 1st
4	2.44	3.19
5	3.54	3.57
6	3.84	3.85
7	4.74	4.09
8	5.24	4.38

Blocking on Intervention Levels Before and After 3rd Grade Mathematics Cells 1, 7, and 8 (LD Only)

In a repeated measures ANCOVA, blocking on intervention grade levels before and after 3rd grade, with testing dates from 1981 through 1982, the covariate was the pretest in mathematics. Sample sizes are displayed in Figure 27.

The main effect for intervention grade was not significant, F (1, 138) = .02, p = 89; the covariate was significant, F (1, 138) = 81.09, p < .0001. The pretest

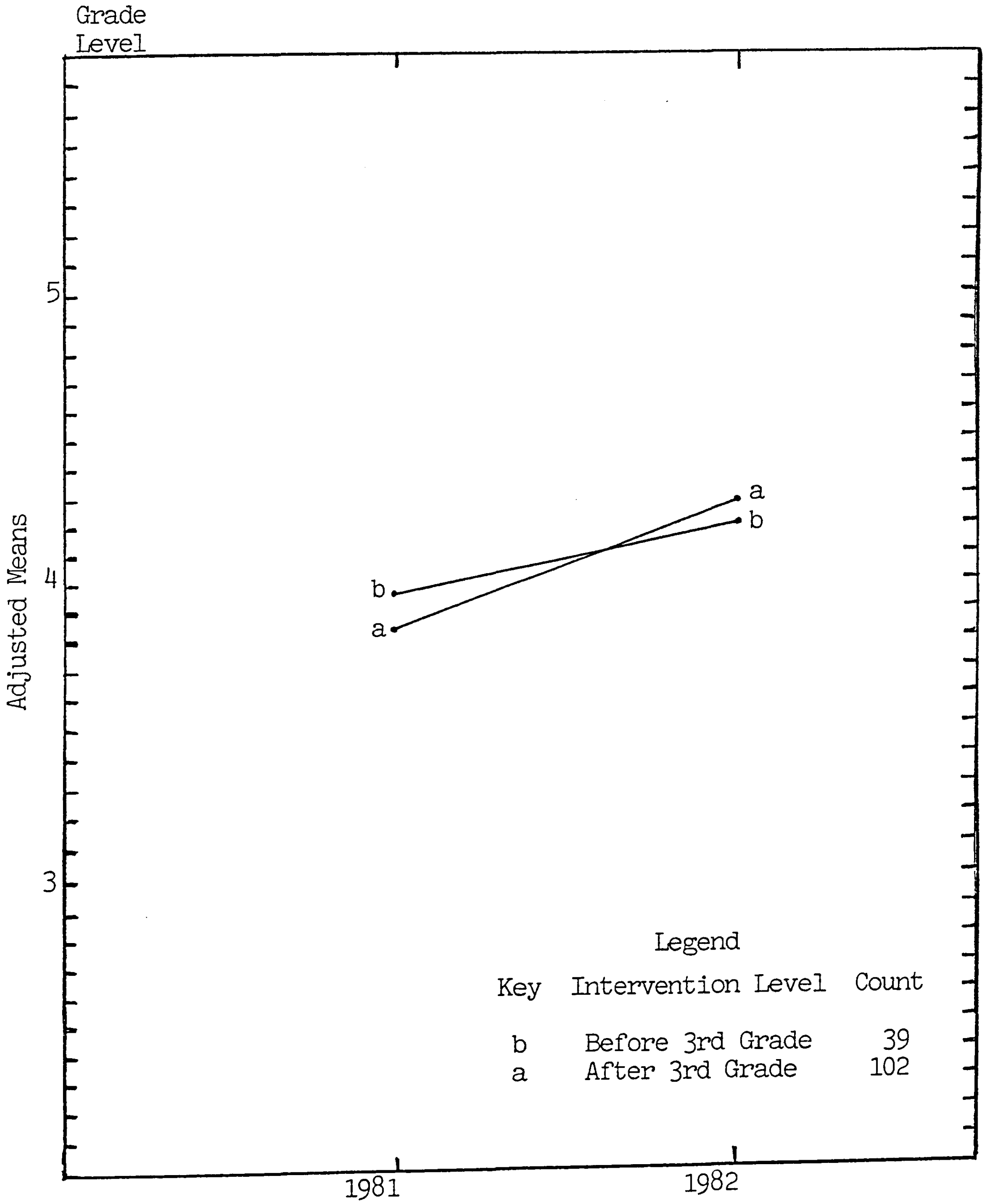

Figure 27. Intervention by Testing Interaction: Mathematics Cells 1, 7, and 8 (LD Only).

accounted for significant variation among the intervention levels on the dependent variable. The main effect for testing was significant, F (1, 139) = 52.49, $p < .05$; the testing by grade interaction was significant, F (1, 139) = 4.36, $p < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 27.

The only null hypothesis applicable to testing by the results of this analysis was H_o9 which was rejected at the .05 level of significance; $p = .0387$.

Significant differences in rates of gain were demonstrated by the groups before and after 3rd grade. Subjects whose intervention levels were prior to 3rd grade demonstrated depressed rates of gain when compared with those of subjects whose intervention levels were = > 3rd grade. For inspection of the adjusted cell means for the dependent variable, see Table 35 on the following page; for unrefined means, see Appendix C, Table 84.

Table 35

Adjusted Cell Means

Mathematics (LD Only)	Intervention Grade Level	
Cells	Before 3rd	After 3rd
7	3.95	3.82
8	4.20	4.27

Blocking on Intervention Levels Before and After 3rd Grade Mathematics Cells 1, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels before and after 3rd grade, with testing dates from 1979 through 1982, the covariate was the pretest in mathematics. Sample sizes are displayed in Figure 28.

The main effect for intervention grade was not significant, F (1, 76) = .02, p = .89; the covariate was significant, F (1, 76) = 50.08, p < .0001. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect for testing was significant, F (3, 231) = 77.45, p < .0001;

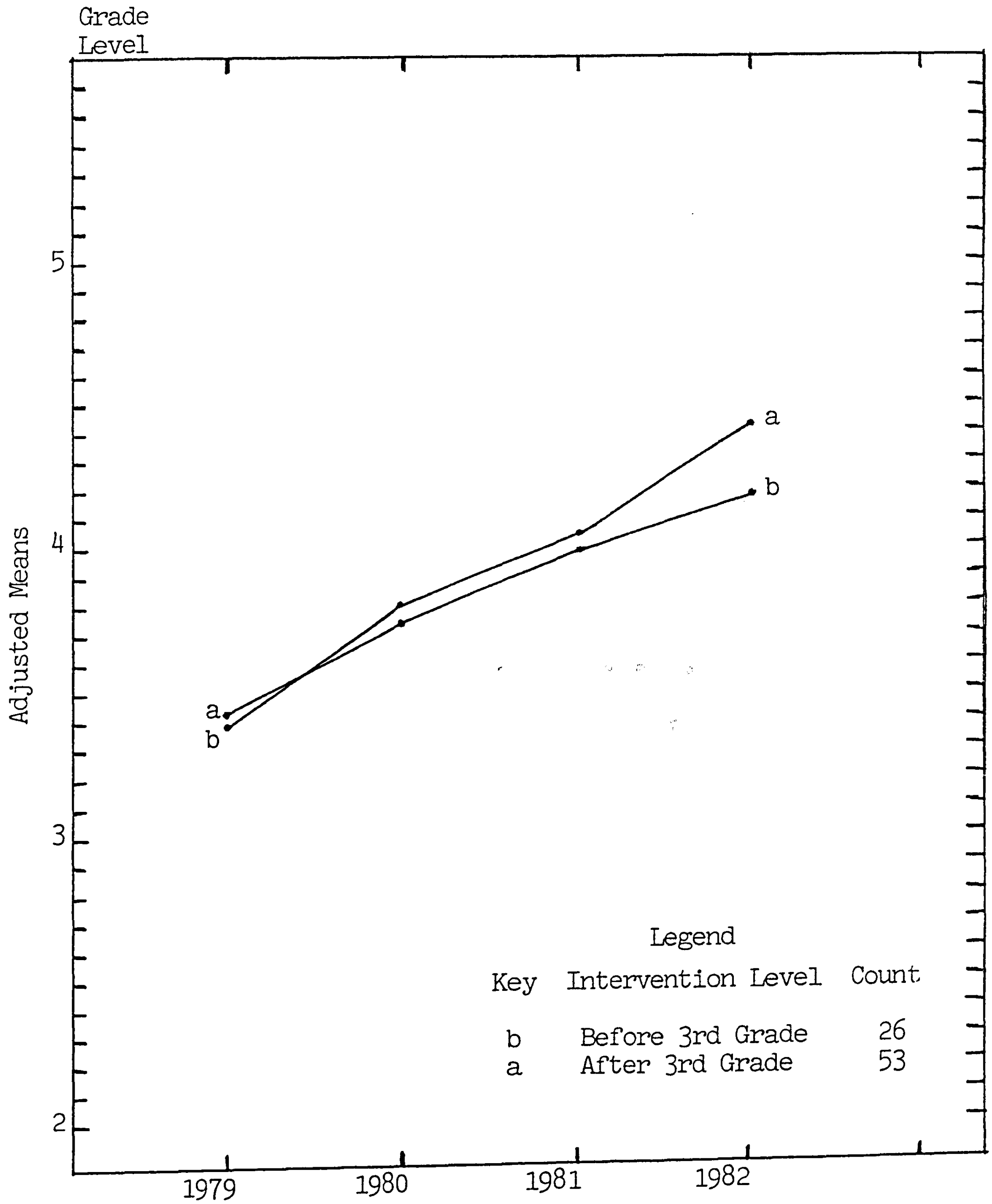

Figure 28. Intervention by Testing Interaction:
Mathematics Cells 1, 5, 6, 7, and 8 (LD Only).

the testing by grade interaction was significant, F (3, 231) = 2.72, $p < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 28.

The only null hypothesis applicable to testing by the results of this analysis was H_o^9 which was rejected at the .05 level of significance; $p = .0454$.

Significant differences in rates of gain were demonstrated by the intervention groups. Subjects whose intervention levels were prior to 3rd grade demonstrated depressed rates of gain when compared with those of subjects whose intervention levels were = > 3rd grade. For inspection of the adjusted cell means for the dependent variable, see Table 36 on the following page; for unrefined means, see Appendix C, Table 85.

Table 36

Adjusted Cell Means

Mathematics (LD Only)	Intervention Grade Levels	
Cells	Before 3rd	After 3rd
5	3.39	3.40
6	3.80	3.72
7	4.80	3.99
8	4.19	4.42

Blocking on Intervention Levels Before and After 4th Grade Mathematics Cells 1, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels before and after 4th grade, with testing dates from 1981 through 1982, the covariate was the pretest in mathematics. Sample sizes are displayed in Figure 29.

The main effect for intervention grade was not significant, F (1, 138) = 1.60, p = .21; the covariate was significant, F (1, 138) = 74.93, p < .0001. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect

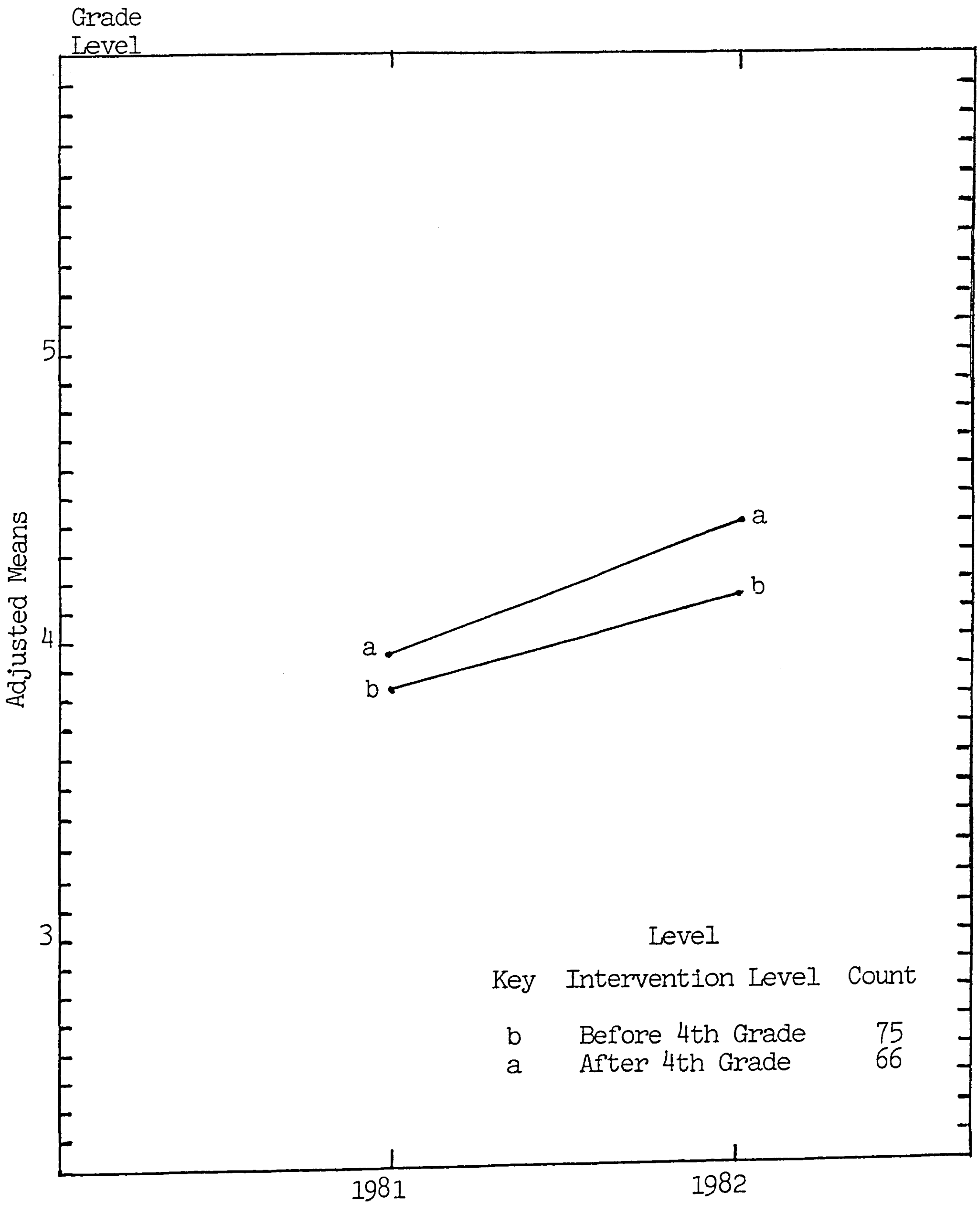

Figure 29. Intervention by Testing Interaction: Mathematics Cells 1, 7, and 8 (LD Only).

for testing was significant, $\underline{F}$ (1, 139) = 85.35, $\underline{p} < .0001$; the testing by grade interaction was significant, $\underline{F}$ (1, 139) = 4.00, $\underline{p} < .05$.

Due to the significant interaction, all main effects were ignored and trends across testings were interpreted according to Figure 29. The only null hypothesis applicable to testing by the results of this analysis was H_o^{10} which was rejected at the .05 level of significance; $\underline{p} = .0476$.

Significant differences in rates of gain were demonstrated by the intervention groups. Subjects whose intervention levels were prior to 4th grade demonstrated depressed rates of gain when compared with those of subjects whose intervention levels were = > 4th grade. For inspection of the adjusted cell means for the dependent variable, see Table 37 on the following page; for unrefined means, see Appendix C, Table 86.

Table 37

Adjusted Cell Means

Mathematics (LD Only)	Intervention Grade Levels	
Cells	Before 4th	After 4th
7	3.80	3.92
8	4.12	4.40

Blocking on Intervention Levels Before and After 4th Grade

Mathematics Cells 1, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels before and after 4th grade, with testing dates from 1980 through 1982, the covariate was the pretest in mathematics. Sample sizes are displayed in Figure 30.

The main effect for intervention grade was not significant, $\underline{F}$ (1, 104) = .64, $\underline{p}$ = .42; the covariate was significant, $\underline{F}$ (1, 104) = 56.62, $\underline{p}$ < .0001. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect for testing was significant, $\underline{F}$ (2, 210) = 96.93,

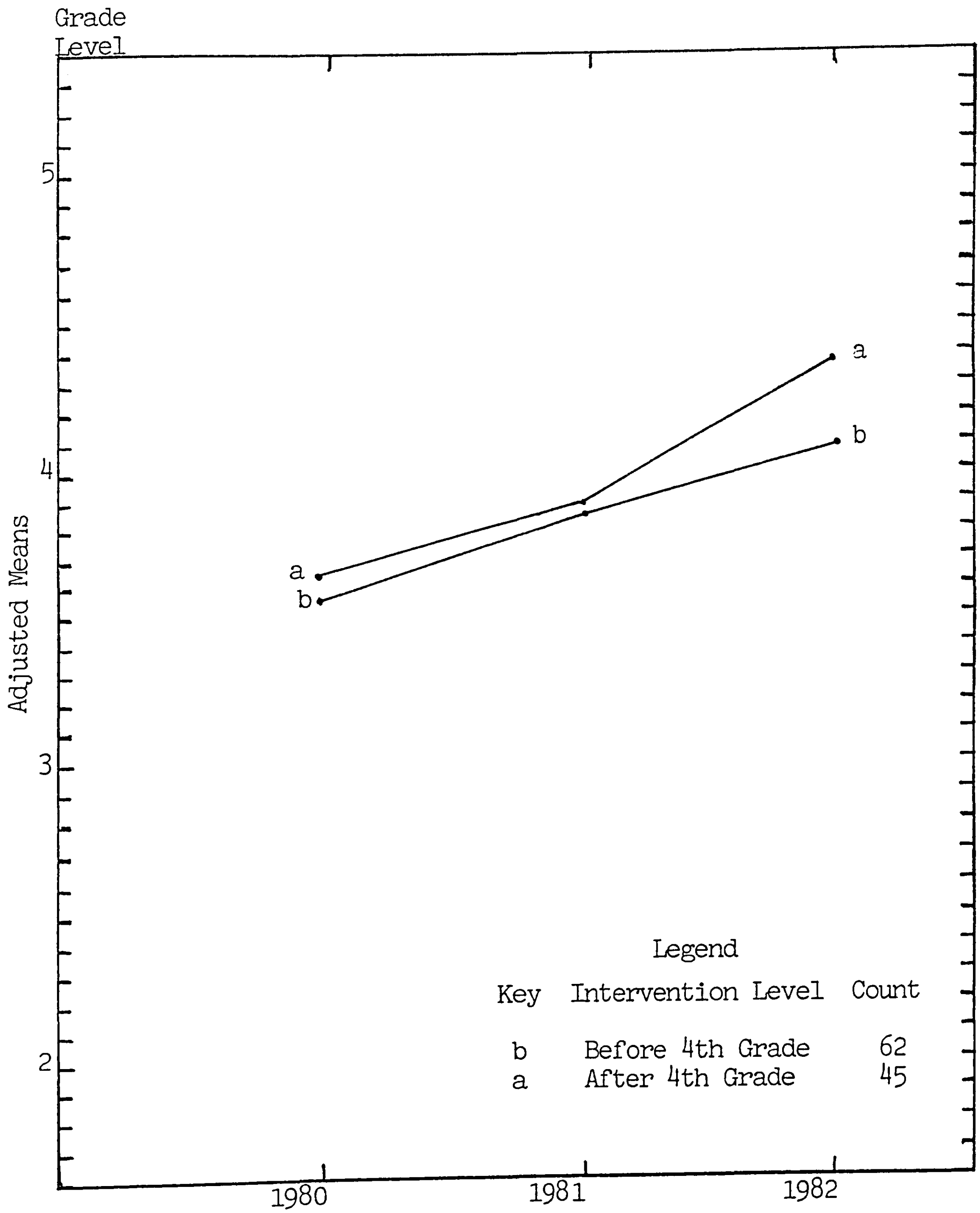

Figure 30. Intervention by Testing Interaction: Mathematics Cells 1, 6, 7, and 8 (LD Only).

$p < .0001$; the testing by grade interaction was significant, $F\ (2, 210) = 3.73$, $p < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 30.

The only null hypothesis applicable to testing by the results of this analysis was H_o^{10} which was rejected at the .05 level of significance; $p = .0257$.

Significant differences in rates of gain were demonstrated by the intervention groups. Subjects whose intervention levels were prior to 4th grade demonstrated depressed rates of gain when compared with those of subjects whose intervention levles were = > 4th grade. For inspection of the adjusted cell means for the dependent variable, see Table 38 on the following page; for unrefined means, see Appendix C, Table 87.

Table 38

Adjusted Cell Means

Mathematics (LD Only)	Intervention Grade Levels	
Cells	Before 4th	After 4th
6	3.56	3.63
7	3.84	3.89
8	4.09	4.37

Blocking on Intervention Levels Before and After 5th Grade Mathematics Cells 1, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention grade levels before and after 5th grade, with testing dates from 1980 through 1982, the covariate was the pretest in mathematics. Sample sizes are displayed in Figure 31.

The main effect for the intervention grade was not significant, F (1, 104) = .35, p = .55; the covariate was significant, F (1, 104) = 59.76, p < .0001. The pretest accounted for significant variation among the intervention levels on the dependent variable. The

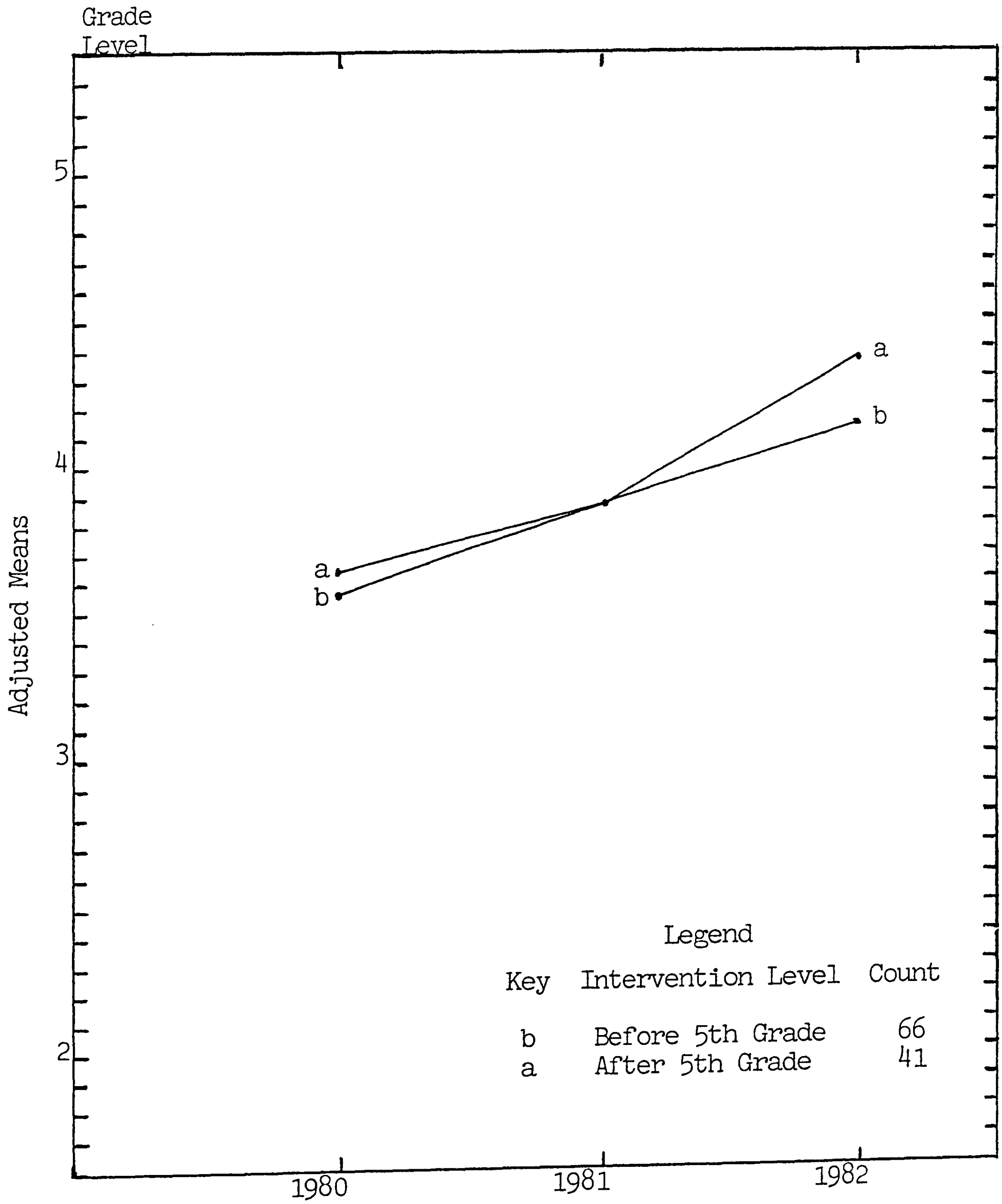

Figure 31. Intervention by Testing Interaction: Mathematics Cells 1, 6, 7, and 8 (LD Only).

main effect for testing was significant, F (2, 210) = 94.72, $p < .0001$; the testing by grade interaction was significant, F (2, 210) = 3.25, $p < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 31.

The only null hypothesis applicable to testing by the results of this analysis was H_o^{11} which was rejected at the .05 level of significance; $p = .0408$.

Significant differences in rates of gain were demonstrated by the intervention groups. Subjects whose intervention levels were prior to 5th grade were depressed when compared with those of subjects whose intervention levels were = > 5th grade. For inspection of the adjusted cell means for the dependent variable, see Table 39 on the following page; for unrefined means, see Appendix C, Table 88.

Table 39

Adjusted Cell Means

Mathematics (LD Only)	Intervention Grade Levels	
Cells	Before 5th	After 5th
6	3.56	3.63
7	3.86	3.86
8	4.12	4.35

Supplementary Information Relevant to the Analyses

Results of the repeated-measures ANCOVA, blocking on intervention levels 1 through 6 in reading are summarized in Table 40; for mathematics, in Table 41.

A listing of statistical analyses in which the results were not significant (p > .05) is available for inspection in Appendix B, Table 56 for reading and Table 57 for mathematics.

For inspection of the unrefined reading cell means, see Appendix C, Tables 58 through 77; for mathematics, see Tables 78 through 88. These tables are arranged in sequential order according to the sequence of the reported results of the statistical analyses.

Table 40

Rank Order of Results of Statistical Analyses

Blocking on Intervention Levels 1 Through 6

Rates of Gain According to Intervention Levels

Data Sources

Reading (LD Only)	Cells 1, 5-8	Cells 1, 4-8	Cells 1, 5-8	Cells 1, 4-8	Cells 1, 5-8	Cells 1, 4-8	Cells 1, 3-8
	1st	2nd	1st	2nd	1st	2nd	<1st
	2nd	3rd	2nd	3rd	2nd	3rd	3rd
	3rd	1st	3rd	1st	3rd	1st	2nd
	5th	4th	5th	4th	< 1st	< 1st	6th
	4th	6th	=> 7th	=> 7th	5th	4th	4th
	6th	5th	4th	6th	4th	6th	5th
			6th	5th	6th		

Table 41

Rank Order of Results of Statistical Analyses

Blocking on Intervention Levels 1 Through 6

Rates of Gain According to Intervention Levels					
			Data Sources		
Mathematics (LD Only)	Cells 1, 7-8	Cells 1, 6-8	Cells 1, 7-8	Cells 1, 6-8	Cells 1, 4-8
	6th	4th 6th	6th	2nd	1st
	4th 5th	5th	1st 4th 5th	4th 6th	4th
	1st	1st 1st	7th	5th	1st 2nd 6th
	3rd	3rd	3rd	1st	3rd
	2nd	2nd	2nd	3rd	5th
				=> 7th	

Exceptions to the Study

Hypotheses Relevant to EMR and Retardation Borderline LD

H_o13: In reading, there will be no significant difference between the learning rates of EMR students and those of LD students whose intelligence levels are found to be within the retardation borderline to the slow-learner ranges of intelligence (EMR, IQ < 65; LD, IQ 65-75).

H_o14: In mathematics, there will be no significant difference between the learning rates of EMR students and those of LD students whose intelligence levels are found to be within the retardation borderline to the slow-learner ranges of intelligence (EMR, IQ < 65; LD, IQ 65-75).

The same pattern was used for selecting the cells from which the reading and mathematics data were drawn as was used for the statistical analyses of the data on LD subjects. The results of the repeated-measures ANCOVA were reported in the same manner as reported for the analyses of the LD data. H_o was rejected at the .05 level of significance ($p < .05$).

Blocking on Intervention Groups of EMR and LD

Reading Cells 1, 2, 3, 4, 5, 6, 7, and 8 (EMR and LD)

In a repeated-measures ANCOVA, blocking on intervention groups of EMR (IQ <65) and LD (IQ 65-75), with testing dates from 1976 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 32.

The main effect for intervention grade was not significant, F (1, 13) = 3.29, p = .09; the covariate was significant, F (1, 13) = 29.29, $p < .0001$. The pretest accounted for significant variation between the intervention groups on the dependent variable. The main effect for testing was significant, F (6, 84) = 66.35, $p < .0001$; the testing by group interaction was significant, F (6, 84) = 2.45, $p < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 32.

The only null hypothesis applicable to testing by the results of this analysis was H_o^{13} which was rejected at the .05 level of significance; p = .0310. Significant differences in rates of gain were demonstrated by the intervention groups. Subjects in the EMR group

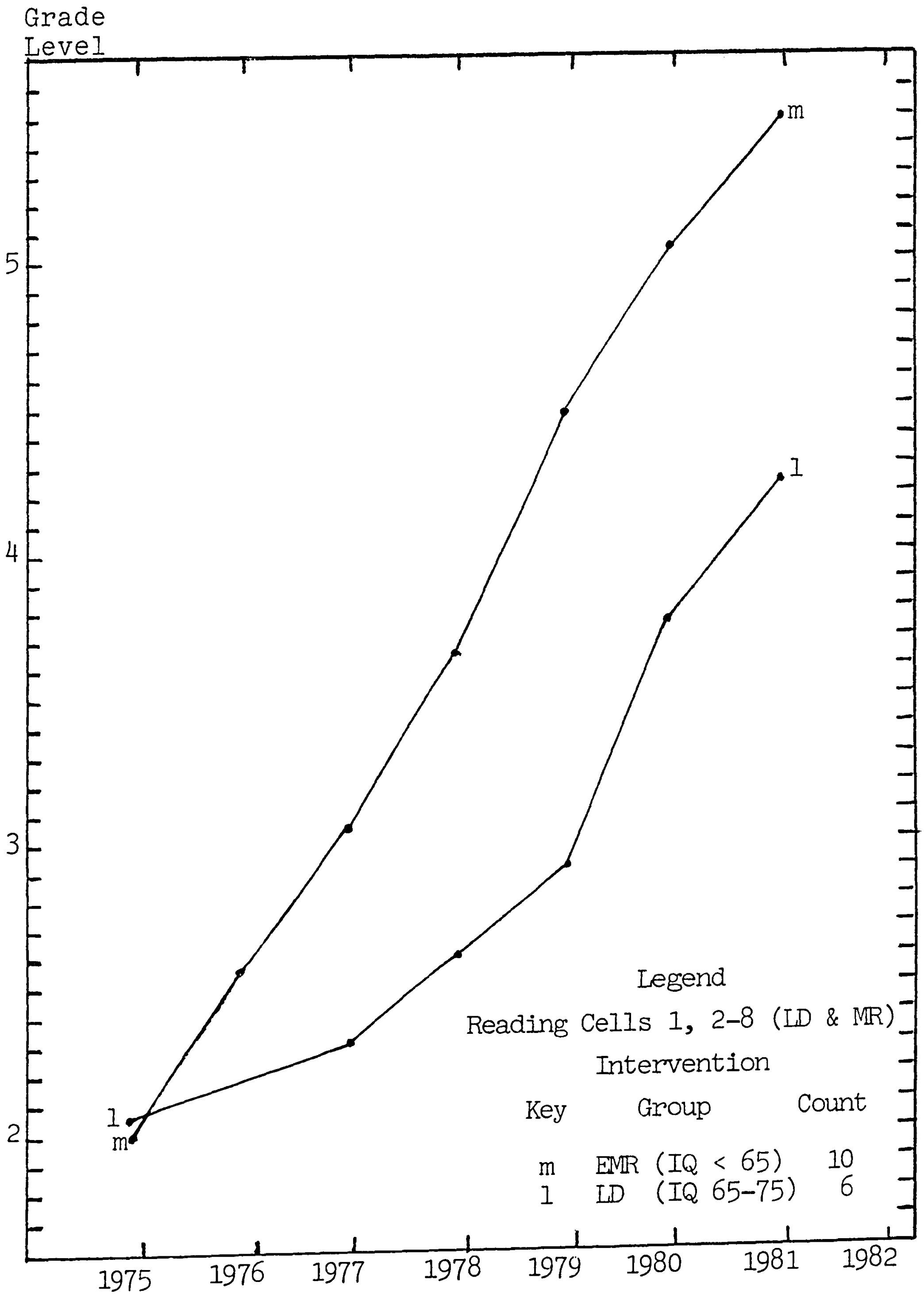

Figure 32. Intervention by Testing Interaction.

demonstrated accelerated rates of gain when compared with those of subjects in the retardation borderline LD group. For inspection of the adjusted cell means for the dependent variable, see Table 42.

Table 42

Adjusted Cell Means

Reading (EMR and LD)	Intervention Groups	
Cells	EMR (IQ 65)	LD (IQ 65-75)
2	1.98	2.01
3	2.54	2.30
4	3.02	2.60
5	3.63	2.90
6	4.45	3.77
7	5.04	4.03
8	5.09	4.32

Blocking on Intervention Groups EMR and LD Mathematics Cells Including all 8 Measures

The same repeated-measures ANCOVA was used to analyze the data for the intervention groups of EMR

(IQ < 65) and LD (IQ 65-75) in mathematics as was used in reading. According to the results of the repeated-measures ANCOVA, no significant differences in rates of gain were found to exist between the EMR and LD groups Therefore, it was assumed that no significant differences in learning rates existed between the EMR and LD groups. The only null hypothesis applicable to be tested by the results of this analysis was H_o^{14} which was retained.

Hypotheses Relevant to Low and High IQ (LD Only)

In the repeated-measures ANCOVA, all 8 measures were used in the analysis of the data on LD subjects blocking on low and high IQ groups in both reading and mathematics. The groups were identified according to LD subjects whose intelligence levels were found to be within the range of intelligence of the slow learner (IQ 75-85) for the low IQ group and LD subjects whose intelligence levels were > 85 for the high IQ group. The same repeated-measures ANCOVA was used to analyze the data according to verbal (VIQ), performance (PIQ), and full scale (FIQ). The null hypotheses which are applicable to be tested by the results of these analyses are stated for easy reference.

$H_o 15$: In reading, there will be no significant difference between the learning rates of slow-learner LD students and those of LD students whose intelligence levels are found to be within the normal range of intelligence.

$H_o 16$: In mathematics, there will be no significant difference between the learning rates of slow-learner LD students and those of LD students whose intelligence levels are found to be within the normal range of intelligence.

Blocking on Intervention Groups of Low and High FIQ Reading Cells 1, 2, 3, 4, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention groups of low and high FIQ, with testing dates from 1976 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 33.

The main effect for the intervention group was not significant, F (1, 9) = 1.83, p = .20; the covariate was not significant, F (1,9) = 1.83, p > .05. There was significant variation between the intervention groups on the dependent variable. The main effect for testing was significant, F (6, 60) = 38.69, p < .0001; the testing by group interaction was significant, F (6, 60) = 2.91, p < .05.

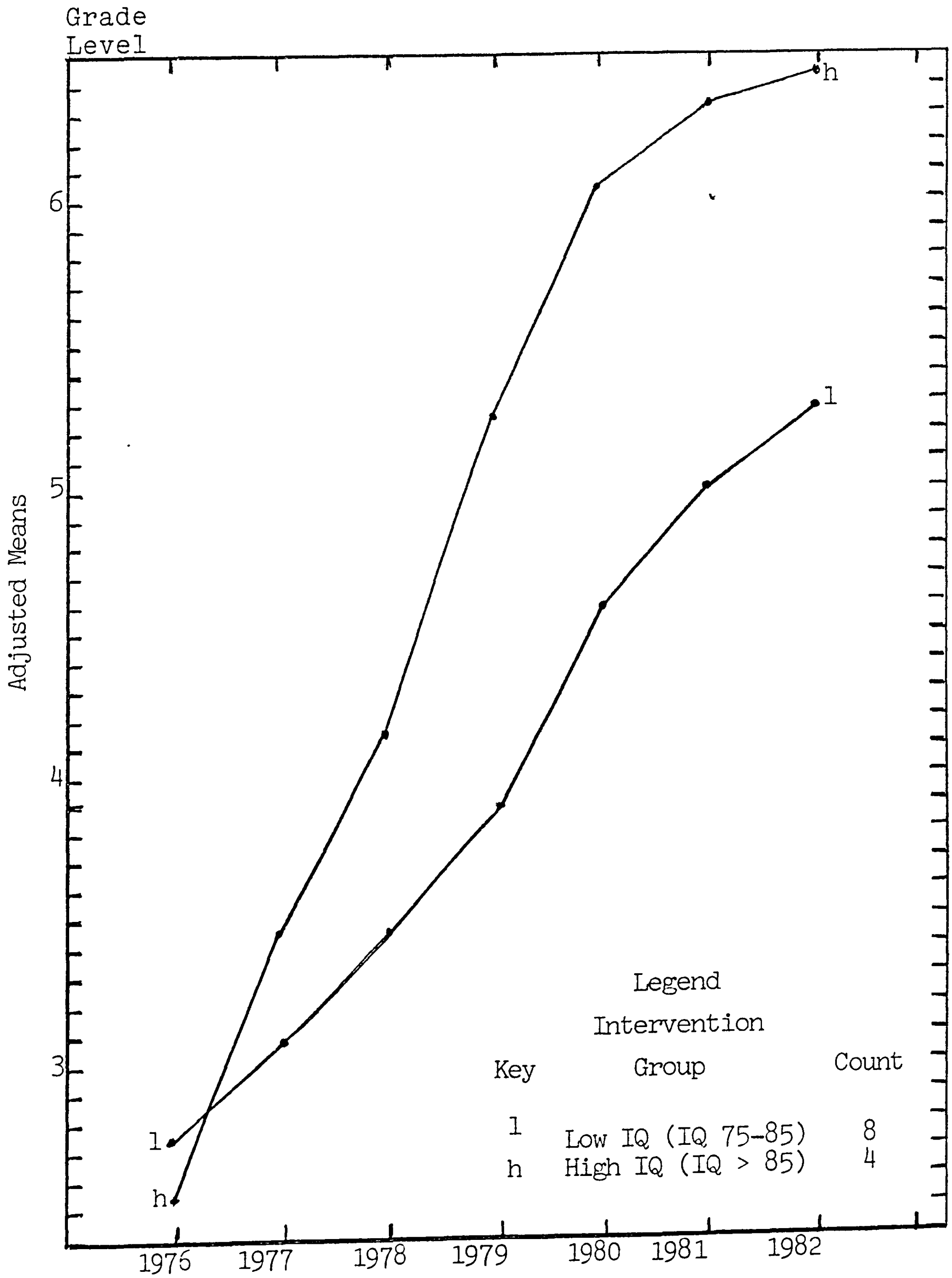

Figure 33. Intervention by Testing Interaction: Reading Cells 1, 2, 3, 4, 5, 6, 7, and 8 (LD Only).

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 33.

The only null hypothesis applicable to testing by the results of this analysis was H_o^{15} which was rejected at the .05 level of significance; $p = .0149$. Significant differences in rates of gain were demonstrated by the groups. The high FIQ group of subjects demonstrated accelerated rates of gain when compared with those of subjects in the low FIQ group. For inspection of the adjusted cell means for the dependent variable, see Table 43 on the following page.

Table 43

Adjusted Cell Means

Reading (LD Only)	Intervention Groups	
Cells	Low (FIQ 75-85)	High (FIQ 85)
2	2.73	2.52
3	3.08	3.52
4	3.43	4.12
5	3.88	5.22
6	4.58	6.02
7	5.00	6.32
8	5.28	7.22

Blocking on Intervention Groups of Low and High FIQ Reading Cells 1, 3, 4, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention groups of low and high FIQ, with testing dates from 1977 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 34.

The main effect for intervention group was not significant, F (1, 21) = .97, p = .34; the covariate was

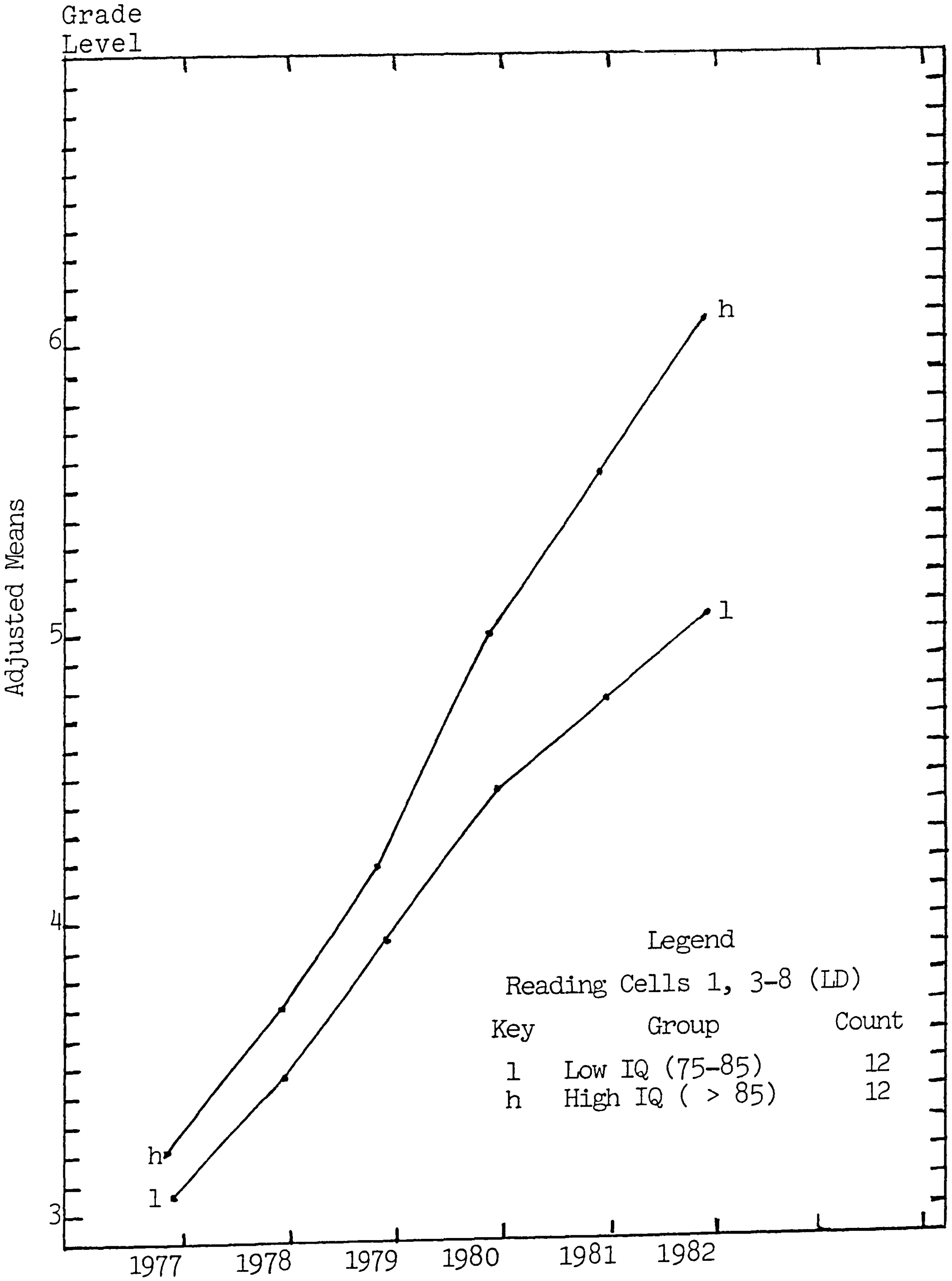

Figure 34. Intervention by Testing Interaction.

significant, *F* (1, 210 = 15.09, *p* < .05. The pretest accounted for significant variation between the intervention groups on the dependent variable. The main effect for testing was significant, *F* (5, 110) = 78.62, *p* < .05; the testing by group interaction was significant, *F* (5, 110) = 2.64, *p* < .05.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 34.

The only null hypothesis applicable to testing by the results of this analysis was H_o^{15} which was rejected at the .05 level of significance; *p* = .0269.

Significant differences in rates of gain were demonstrated by the low and high FIQ groups. The high FIQ group demonstrated accelerated rates of gain when compared with those of the low FIQ group. For inspection of the adjusted cell means for the dependent variable, see Table 44 on the following page.

Table 44

Adjusted Cell Means

Reading (LD Only)	Intervention Group	
Cells	Low (FIQ 75-85)	High (FIQ 85)
3	3.04	3.19
4	3.44	3.64
5	3.90	4.18
6	4.44	4.97
7	4.77	5.52
8	5.02	6.06

<u>Blocking on Intervention Groups of Low and High FIQ Mathematics Cells 1, 6, 7, and 8 (LD Only)</u>

In a repeated-measures ANCOVA, blocking on intervention groups of low and high FIQ, with testing dates from 1980 through 1982, the covariate was the pretest in mathematics. Sample sizes are displayed in Figure 35.

The main effect for intervention group was not significant, $\underline{F}$ (1, 83) = .01, $\underline{p}$ = .94; the covariate was significant, $\underline{F}$ (1, 83) = 47.37, $\underline{p}$ < .0001. The pretest

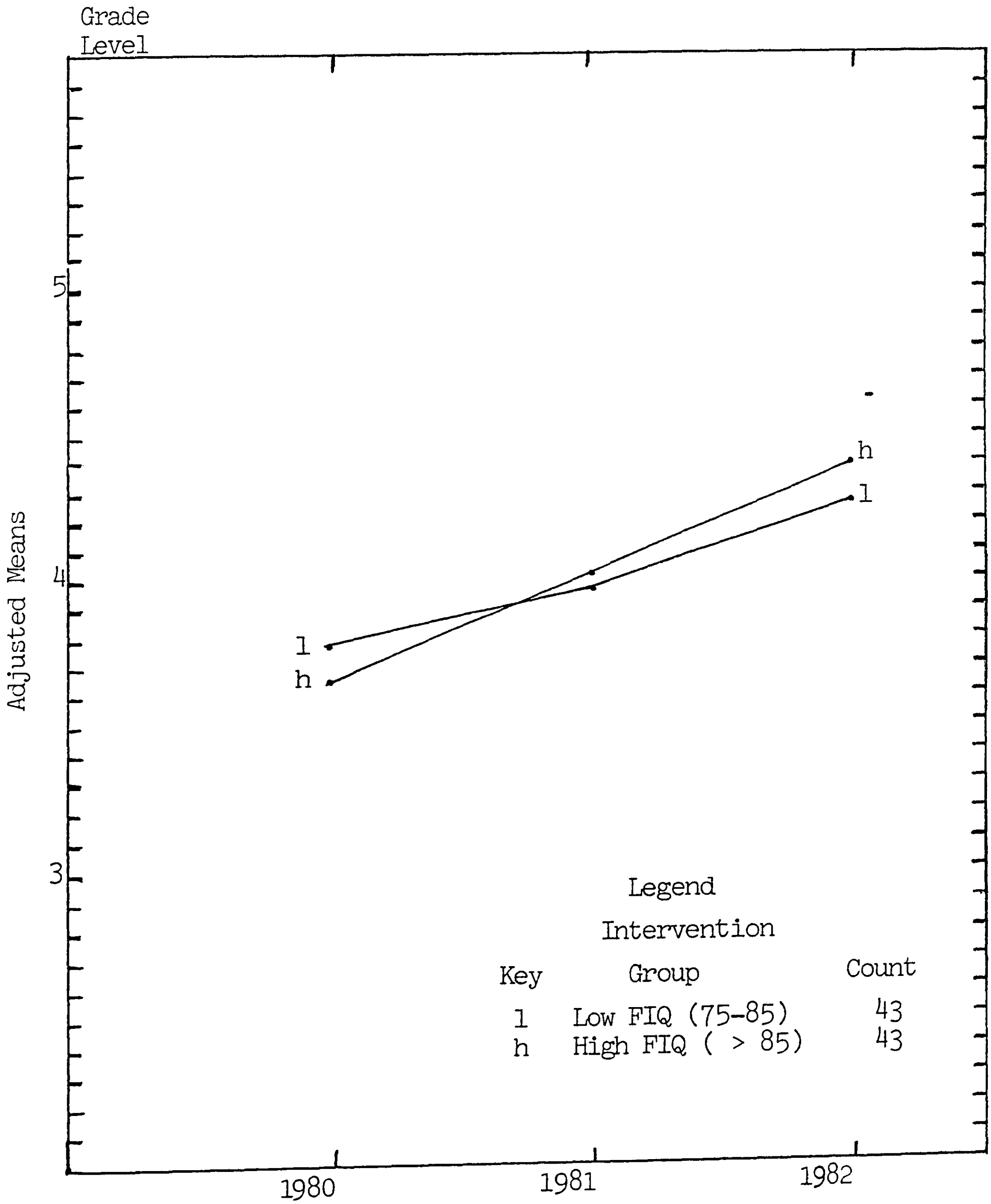

Figure 35. Intervention by Testing Interaction:

Mathematics Cells 6, 7, and 8 (LD Only).

accounted for significant variation between the intervention groups on the dependent variable. The main effect for testing was significant, $\underline{F}$ (2, 168) = 67.62, $\underline{p} < .0001$; the testing by group interaction was significant, $\underline{F}$ (2, 168) = 3.48, $\underline{p} < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 35.

The only null hypothesis applicable to testing by the results of this analysis was H_o^{16} which was rejected at the .05 level of significance; p = .0330. Significant differences in rates of gain were demonstrated by the low and high FIQ groups. The high FIQ subjects demonstrated accelerated rates of gain when compared with those demonstrated by the low FIQ group. For inspection of the adjusted cell means for the dependent variable, see Table 45 on the following page.

Table 45

Adjusted Cell Means

Mathematics (LD Only)	Intervention Groups	
Cells	Low FIQ	High FIQ
6	3.76	3.63
7	4.00	3.95
8	4.25	4.39

Blocking on Intervention Groups of Low and High FIQ Mathematics Cells 1, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention groups of low and high FIQ, with testing dates from 1981 through 1982, the covariate was the pretest in mathematics. Sample sizes are displayed in Figure 36.

The main effect for intervention group was not significant, F (1, 114) = .34, p = 56; the covariate was significant, F (1, 114) = 70.83, $p < .0001$. The pretest accounted for significant variation between the intervention groups on the dependent variable. The main effect for testing was significant, F (1, 115) = 56.66,

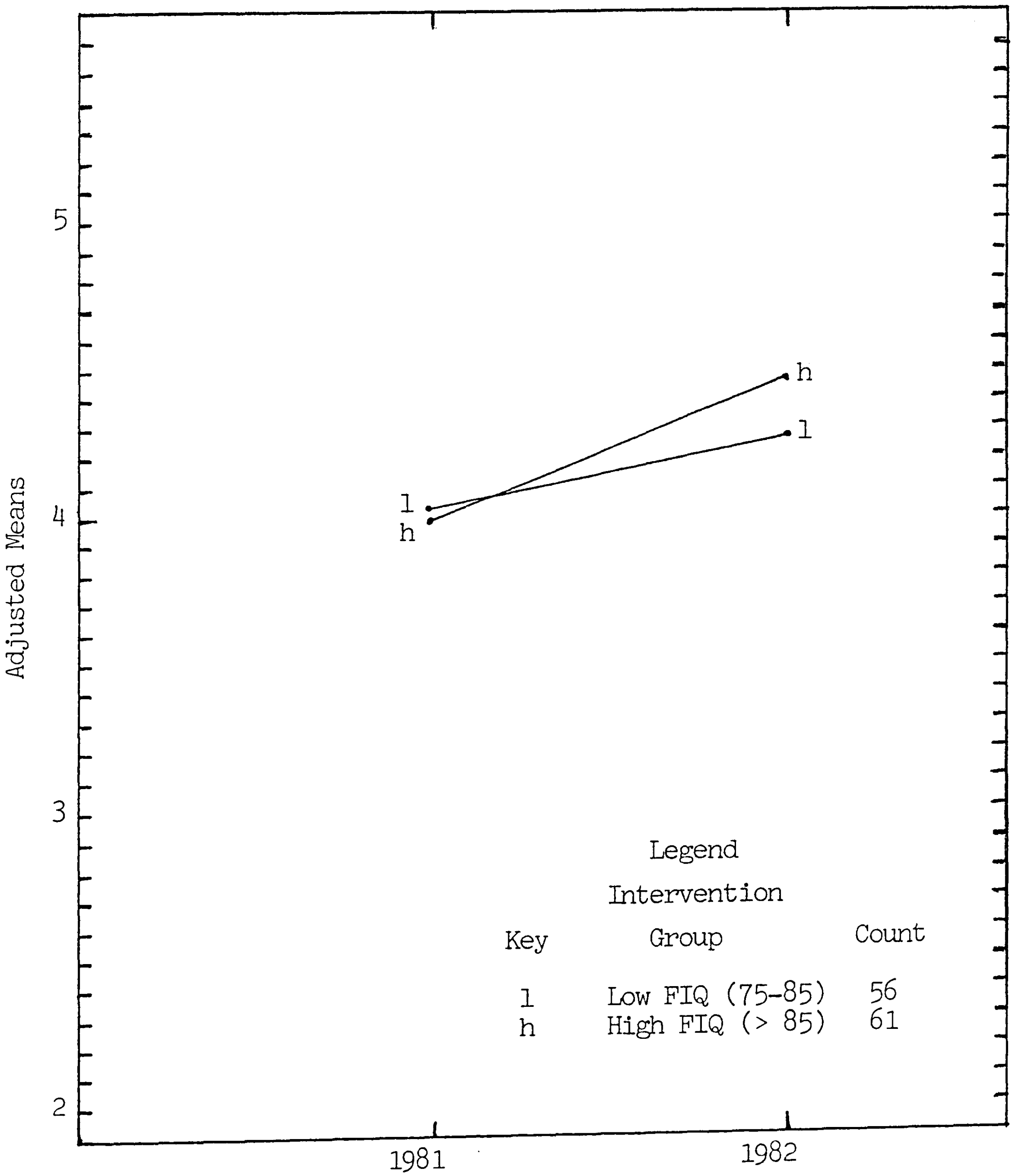

Figure 36. Intervention by Testing Interaction: Mathematics Cells 1, 7, and 8 (LD Only).

$p < .0001$; the testing by group interaction was significant, F (1, 115) = 4.94, $p < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 36.

The only null hypothesis applicable to testing by the results of this analysis was H_o^{16} which was rejected at the .05 level of significance; $p = .0281$. Significant differences in rates of gain in mathematics were demonstrated by the FIQ groups. Subjects in the high FIQ group demonstrated accelerated rates of gain when compared with those of subjects in the low FIQ group. For inspection of the adjusted cell means for the dependent variable, see Table 46 on the following page.

Table 46

Adjusted Cell Means

Mathematics (LD Only)	Intervention Groups	
Cells	Low FIQ	High FIQ
7	3.98	3.95
8	4.25	4.45

Blocking on Intervention Groups of Low and High VIQ Reading Cells 1, 2, 3, 4, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention groups of low and high VIQ, with testing dates from 1972 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 37.

The main effect for intervention groups was not significant, F (1, 8) = 3.57, p = .10; the covariate was not significant, F (1, 8) = 3.13, $p > .05$. There was significant variation between the intervention groups on the dependent variable. The main effect for testing was significant, F (6, 54) = 32.36, $p < .0001$; the testing by group interaction was significant, F (6, 54) = 3.13; $p < .05$.

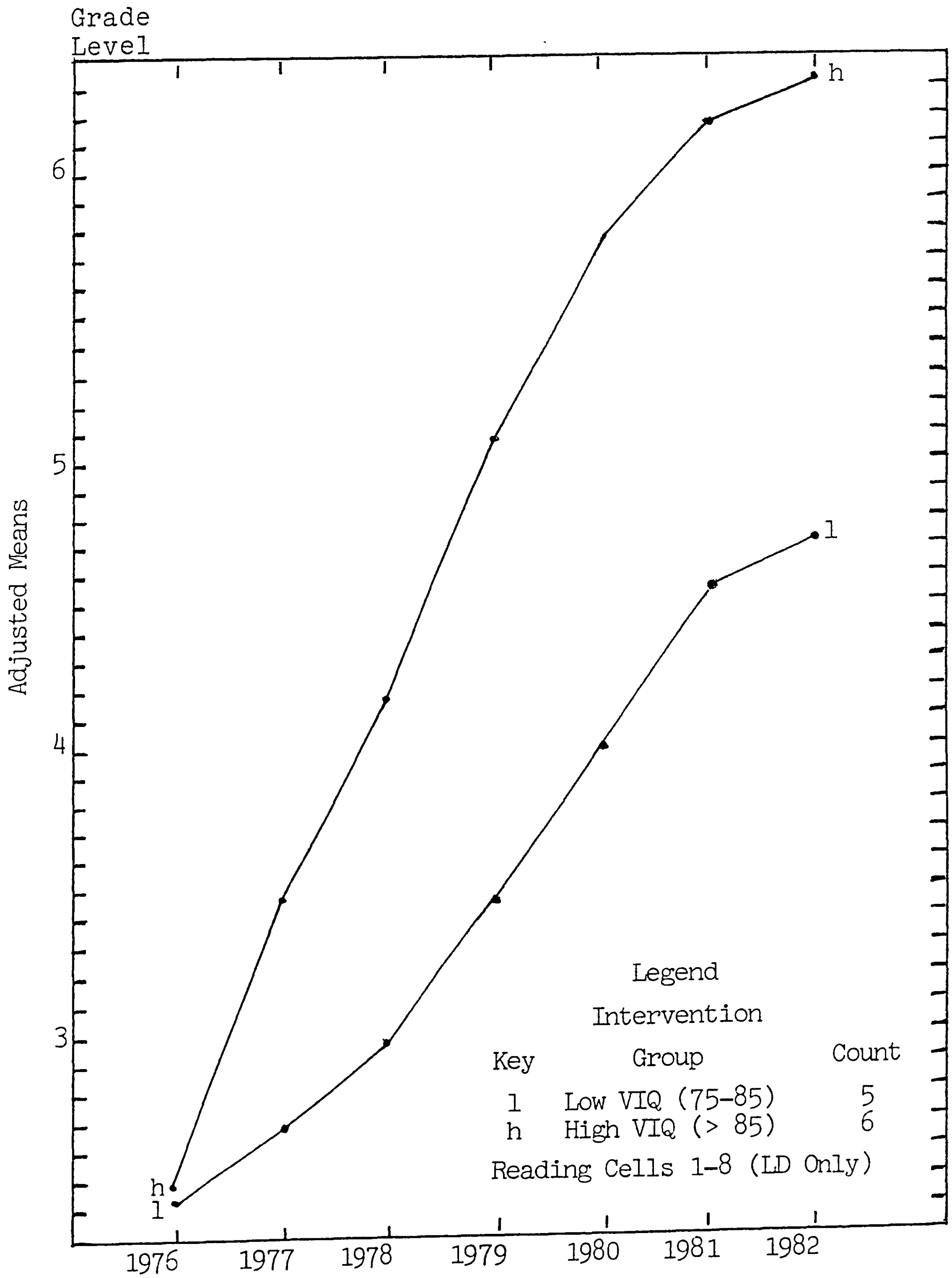

Figure 37. Intervention by Testing Interaction.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 37.

The only null hypothesis applicable to testing by the results of this analysis was H_o^{15} which was rejected at the .05 level of significance; $p = .0104$. Significant differences in rates of gain in reading were demonstrated by the VIQ groups. Subjects in the high VIQ group demonstrated accelerated rates of gain when compared with those demonstrated by the low VIQ group. For inspection of the adjusted cell means for the dependent variable, see Table 47 on the following page.

Table 47

Adjusted Cell Means

Reading (LD Only)	Intervention Groups	
Cells	Low VIQ	High VIQ
2	2.54	2.57
3	2.78	3.46
4	2.94	4.15
5	3.42	5.05
6	3.98	5.75
7	4.54	6.15
8	4.70	7.00

Blocking on Intervention Groups of Low and High PIQ Reading Cells 1, 2, 3, 4, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention groups of low and high PIQ, with testing dates from 1976 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 38.

The main effect for intervention group was not significant, F (1, 11) = 3.50, p = .09; the covariate

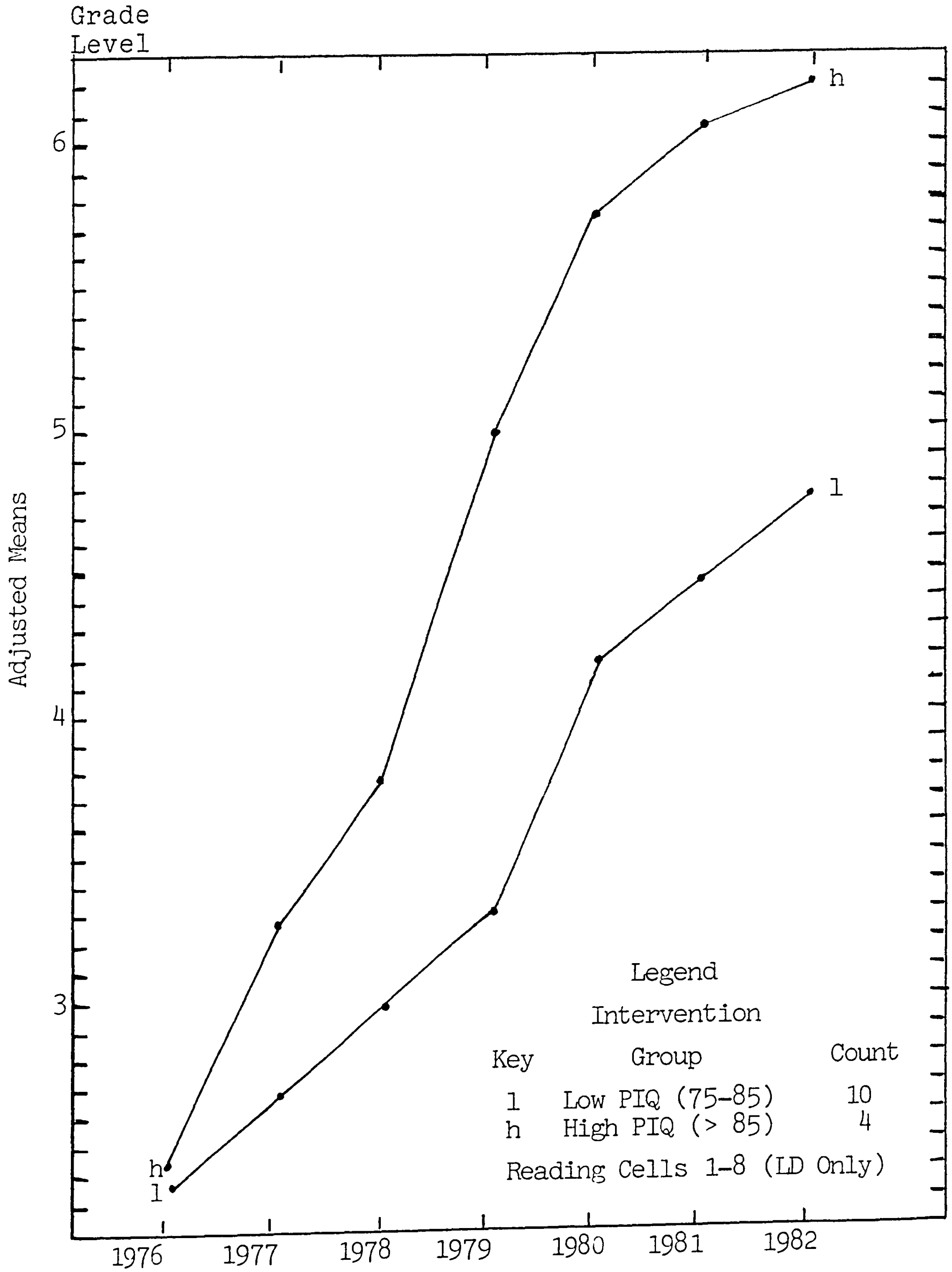

Figure 38. Intervention by Testing Interaction.

was significant, F (1, 11) = 8.56, $p < .05$. The pretest accounted for significant variation between the groups on the dependent variable. The main effect for testing was significant, F (6, 72) = 44.09, $p < .0001$; the testing by group interaction was significant, F (6, 72) = 3.76, $p < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 38.

The only null hypothesis applicable to testing by the results of this analysis was H_o^{15} which was rejected at the .05 level of significance; $p = .0026$. Significant differences in rates of gain in reading were demonstrated by the PIQ groups. Subjects in the high PIQ group demonstrated accelerated rates of gain in reading when compared with those of subjects in the low PIQ group. For inspection of the adjusted cell means for the dependent variable, see Table 48 on the following page.

Table 48

Adjusted Cell Means

Reading (LD Only) Cells	Intervention Group Low PIQ	High PIQ
2	2.34	2.41
3	2.65	3.23
4	2.97	3.76
5	3.29	4.96
6	4.16	5.73
7	4.42	6.03
8	4.72	6.91

Blocking on Intervention Groups of Low and High PIQ Reading Cells 1, 3, 4, 5, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention groups of low and high PIQ, with testing dates from 1977 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 39.

The main effect for intervention group was not significant, F (1, 23) = 2.16, p = .15; the covariate was

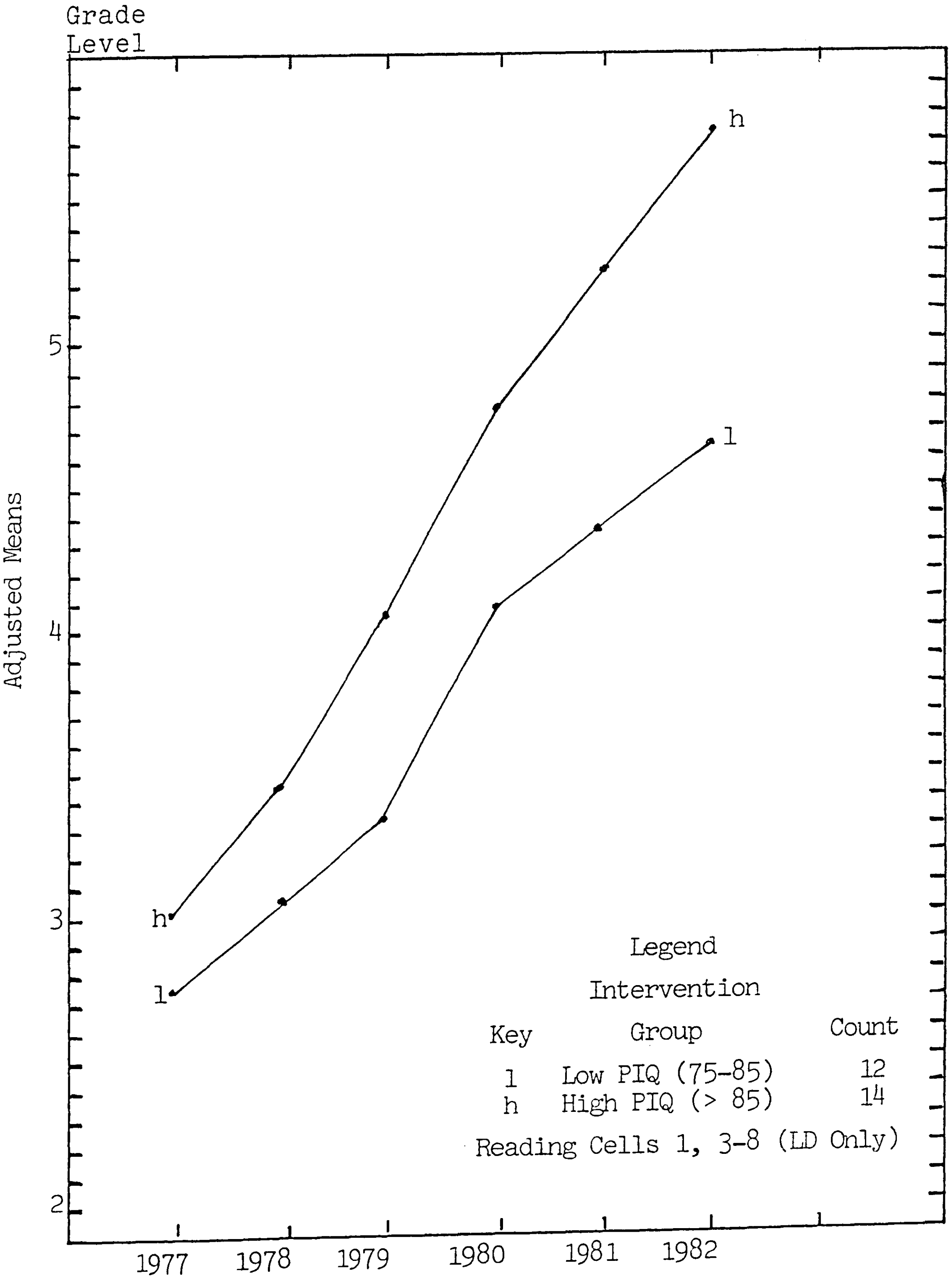

Figure 39. Intervention by Testing Interaction.

significant, F (1, 23) = 22.09, $p < .0001$. The pretest accounted for significant variation between the intervention groups on the dependent variable. The main effect for testing was significant, F (5, 120) = 83.95, $p < .0001$; the testing by group interaction was significant, F (5, 120) = 2.43, $p < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 39.

The only null hypothesis applicable to testing by the results of this analysis was H_o^{15} which was rejected at the .05 level of significance; $p = .0397$. Significant differences in rates of gain in reading were demonstrated by the PIQ groups. Subjects in the high PIQ group demonstrated accelerated rates of gain in reading when compared with those demonstrated by subjects in the low PIQ group. For inspection of the adjusted cell means for the dependent variable, see Table 49 on the following page.

Table 49

Adjusted Cell Means

Reading (LD Only) Cells	Intervention Groups Low PIQ	High PIQ
3	2.73	3.01
4	3.06	3.45
5	3.34	4.03
6	4.09	4.78
7	4.33	5.23
8	4.62	5.72

Blocking on Intervention Groups of Low and High PIQ Mathematics Cells 1, 6, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention groups of low and high PIQ, with testing dates from 1980 through 1982, the covariate was the pretest in mathematics. Sample sizes are displayed in Figure 40.

The main effect for intervention group was not significant, F (1, 89) = 1.35; the covariate was significant, F (1,89) = 39.70, $p < .0001$. The pretest accounted

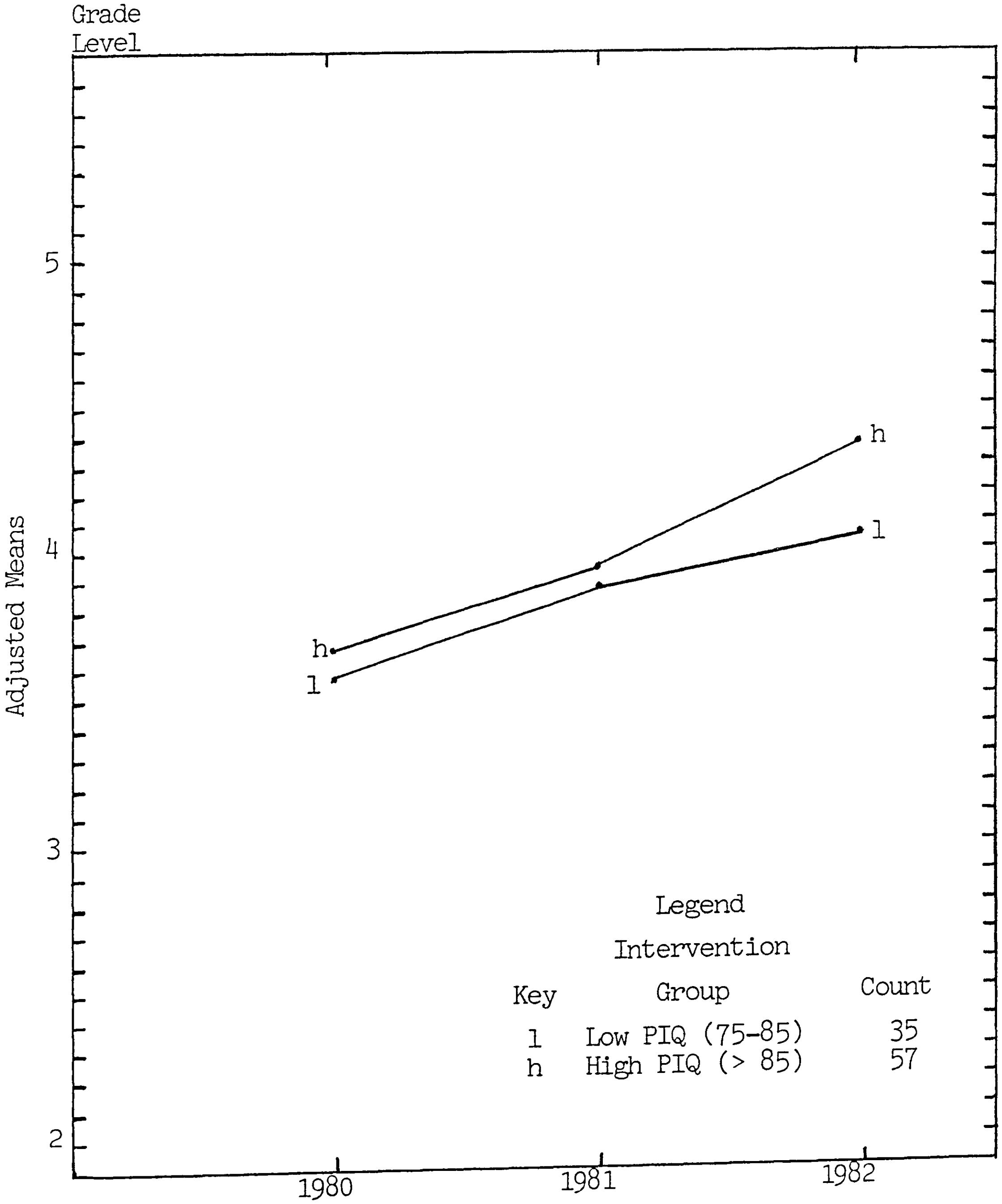

Figure 40. Intervention by Testing Interaction:
Mathematics Cells 1, 6, 7, and 8 (LD Only).

for significant variation between the intervention groups on the dependent variable. The main effect for testing was significant, F (2, 80) = 64.24, $p < .0001$; the testing by group interaction was significant, F (2, 80) = 3.70, $p < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 40.

The only null hypothesis applicable to testing by the results of this analysis was $H_o{}^{16}$ which was rejected at the .05 level of significance; $p = .0266$. Significant differences in rates of gain in mathematics were demonstrated by the intervention groups. Subjects in the high PIQ group demonstrated accelerated rates of gain in mathematics when compared with those rates of gain demonstrated by the low PIQ group. For inspection of the adjusted cell means for the dependent variable, see Table 50 on the following page.

Table 50

Adjusted Cell Means

Mathematics (LD Only)	Intervention Groups	
Cells	Low PIQ	High PIQ
6	3.55	3.66
7	3.86	3.93
8	4.03	4.35

Blocking on Intervention Groups of Low and High PIQ Mathematics Cells 1, 7, and 8 (LD Only)

In a repeated-measures ANCOVA, blocking on intervention groups of low and high PIQ, with testing dates from 1981 through 1982, the covariate was the pretest in mathematics. Sample sizes are displayed in Figure 41.

The main effect for intervention group was not significant, *F* (1, 119) = .80, *p* = .37; the covariate was significant, *F* (1, 119) = 61.27, *p* < .0001. The pretest accounted for significant variation between the intervention groups on the dependent variable. The main effect for testing was significant, *F* (1, 120) = 51.18,

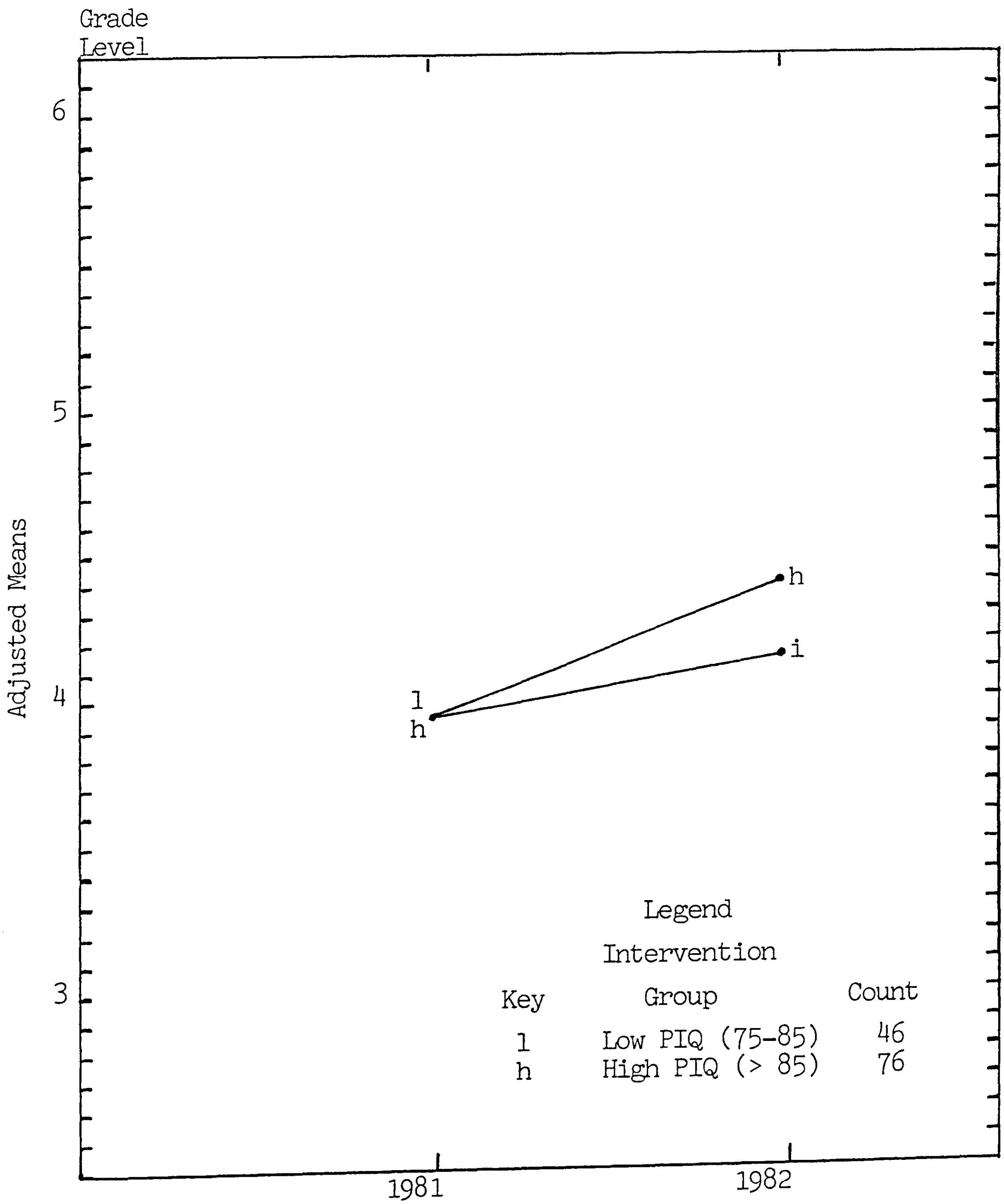

Figure 41. Intervention by Testing Interaction: Mathematics Cells 1, 7, and 8 (LD Only).

$p < .0001$; the testing by group interaction was significant, F (1, 120) = 6.25, $p < .05$.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 41.

The only null hupothesis applicable to testing by the results of this analysis was $H_o{}^{16}$ which was rejected at the .05 level of significance; $p = .0119$. Significant differences in rates of gain in mathematics were demonstrated by the intervention groups. Subjects in the high PIQ group demonstrated accelerated rates of gain in mathematics when compared with those demonstrated by the low PIQ group. For inspection of the adjusted cell means for the dependent variable, see Table 51 on the following page.

Table 51

Adjusted Cell Means

Mathematics (LD Only)	Intervention Groups	
Cells	Low PIQ	High PIQ
7	3.93	3.93
8	4.15	4.40

Treatment of the Data On Educable Mentally Retarded Subjects

Since the data were available on subjects classified as educable mentally retarded (EMR), each of the first 12 hypotheses were restated to specify EMR rather than LD subjects. The same repeated-measures ANCOVA found that only those EMR subjects whose intervention levels were prior to 2nd grade demonstrated significant differences in rates of gain when compared with those EMR subjects whose intervention levels were = > 2nd grade. The results of this statistical analysis is presented in the same manner that has been used in reporting the results in the preceding analyses.

Blocking on Intervention Levels Before and After 2nd Grade Reading Cells 1, 2, 3, 4, 5, 6, 7, and 8 (EMR Only)

In a repeated measures ANCOVA, blocking on intervention grade levels before and after 2nd grade, with testing dates from 1976 through 1982, the covariate was the pretest in reading. Sample sizes are displayed in Figure 42.

The main effect for intervention grade was not sig- F (1, 7) = .26, p = .63; the covariate was significant, F (1, 7) = 14.01, $p <$ .05. The pretest accounted for significant variation among the intervention levels on the dependent variable. The main effect for testing was significant, F (6, 48) = 44.77, $p <$ .0001; the testing by intervention grade was significant, F (6, 48) = 2.43, $p <$ .05.

Due to the significant interaction, all main effects were ignored, and trends across testings were interpreted according to Figure 42.

The only null hypothesis applicable to testing by the results was H_o^2 which was rejected at the .05 level of significance; p = .0395. Subjects demonstrated significant differences in rates of gain according to their intervention levels. Subjects whose intervention

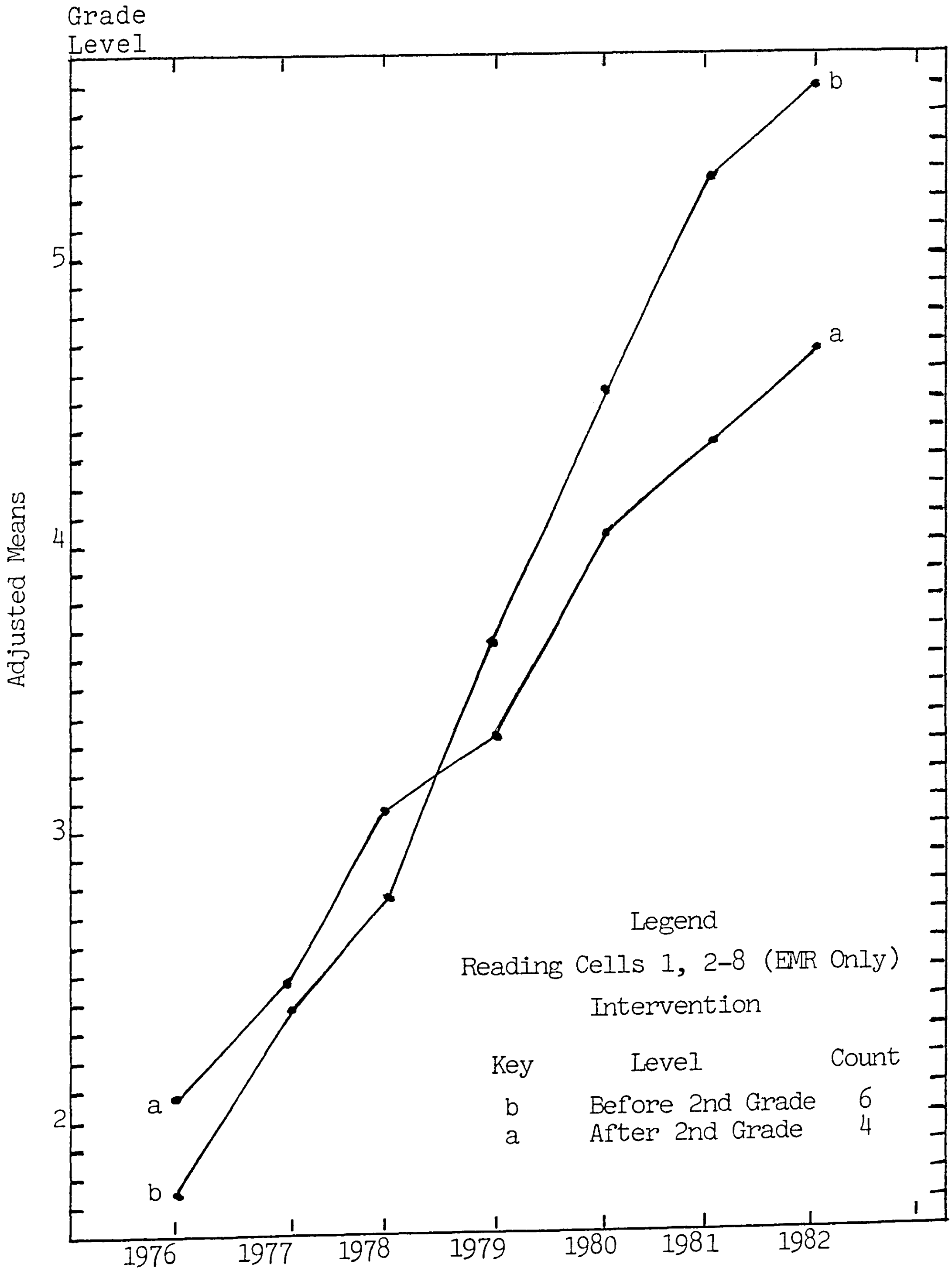

Figure 42. Intervention by Testing Interaction.

levels were prior to 2nd grade demonstrated accelerated rates of gain when compared with those subjects whose invervention levels were = > 2nd grade. For inspection of the adjusted cell means for the dependent variable, see Table 52.

Table 52

Adjusted Cell Means

Reading (EMR Only)	Intervention Grade Levels	
Cells	Before 2nd	After 2nd
2	1.72	2.05
3	2.38	2.45
4	2.77	3.08
5	3.63	3.30
6	4.52	4.03
7	5.28	4.35
8	5.82	4.68

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Purpose

The study analyzed data which had been collected over a period of 7 years in reading and mathematics on 257 learning disabled (LD) students who had participated in a cooperative district comprehensive special education program for eligible handicapped students. Exceptions to the study included data which had been collected on 51 educable mentally retarded (EMR) students during the same time span.

The purpose of the study was to determine (a) whether or not significant differences in the learning rates of LD subjects in reading and mathematics exist in systematic trends across time; (b) whether or not those differences could be attributed to the ages or grade levels when the subjects initially received intervention services; and (c) whether or not the results of the statistical analyses support the notion of early intervention for young LD children.

The purpose of the exceptions to the study was to determine if analysis of the longitudinal data on LD subjects according to different levels of intellectual ability would provide information which would enhance the study or serve as a point of reference for future research. The longitudinal data on EMR stubjects were analyzed for the purpose of comparing EMR subjects' learning rates in reading and mathematics with those of LD subjects whose intelligence levels were found to be within the retardation borderline range of intelligence to determine if the results of the analyses would provide information which would enhance the study or serve as a point of reference for future research.

Procedures

Statistical analysis procedures used to analyze the longitudinal data included a one-factor statistical analysis of variance (ANOVA) on total gain and on average gain in both reading and mathematics. Covariates were current grade level, sex, ethnic origin, IQ, handicapping category, degree of severity of the handicap, attrition status, school district, and intervention level. The one-factor ANOVA procedures were implemented to remove any systematic influences of the covariate factors on gain in order to allow for the inspection of differences between intervention levels free of covariate influences.

To allow for inspection of trends across time and the differences on such trends due to intervention levels, a two-factor repeated-measures analysis of covariance (ANCOVA) was employed. The intervention levels (pretests) were always used as the covariate. The rationale for these procedures was to remove any systematic influences of the covariates on gain. This allowed for inspection of differences in gains made by groups defined by their intervention levels free of covariate influences.

Results of the Analyses of Reading Data

Two series of the repeated-measures ANCOVA were used to analyze the longitudinal data in reading. The first series consisted of all 8 measures, blocking on intervention levels 1 through 6, and the second series consisted of all eight measures, blocking on each level from 1 through 6 as specifically identified in each of the null hypotheses, H_o^1 through H_o^6. In the first series of analyses, H_o^1 through H_o^6 were all rejected at either the .05 or the .0001 level of significance. Significant differences in mean rates of gain were demonstrated by the groups according to their intervention levels. For inspection of the rank order in which the intervention levels demonstrated significant differences in the mean rates of gain, see Table 40. This table displays only the results of the 7 tests of significance blocking on intervention levels 1 through 6.

Inspection of the results of these analyses revealed a distinct point at which the groups diverged according to their intervention levels. Subjects in the groups whose intervention levels were prior to 4th grade demonstrated accelerated mean rates of gain when compared with those demonstrated by subjects in the groups whose intervention levels were = > 4th grade.

In the accelerated group, subjects whose intervention levels were = < 1st grade demonstrated the highest mean rate of gain in 57% of the analyses, and those at 2nd grade level demonstrated the highest mean rate of gain in 43% of the analyses. The groups whose intervention levels were either in 4th or 5th grade demonstrated the highest of the depressed mean rates of gain while those whose intervention levels were in 6th grade demonstrated the lowest mean rates of gain in all except one of the analyses. The 4th, 5th, and 6th grade intervention groups were never ranked among the accelerated group, and groups whose intervention levels were < 1st, 1st, 2nd, and 3rd grade were never ranked among those groups who demonstrated depressed mean rates of gain. Inspection of the results of the second series of analyses blocking on each intervention level 1 through 6 as specifically identified in each of the null hypotheses, H_o^1 through H_o^6, revealed that all except H_o^1 and H_o^2 were rejected at either the .05 or .0001 level of significance. Results of the analyses to test H_o^1 and H_o^2 were not significant at the .05 level of significance. Therefore, it was assumed that no significant differences existed which could be attributed to the effects of the intervention levels, and H_o^1 and H_o^2 were retained. H_o^3 through H_o^6 were all rejected at either the .05 or .0001 level of significance, and without exception, subjects whose intervention levels were at the level specified in the H_o demonstrated accelerated mean rates of gain when compared with the mean rates of gain demonstrated by the groups of subjects whose intervention levels were = > the level specified in H_o.

Results of the Analysis of Mathematics Data

Two series of the repeated-measures ANCOVA were used to analyze the longitudinal data in mathematics. The first series consisted of all 8 measures, blocking on intervention levels 1 through 6, and the second series consisted of all 8 measures, blocking on each level from 1 through 6 as specifically identified in each of the null hypotheses, $H_o 7$ through $H_o 12$.

In the first series of analyses, $H_o 7$ through $H_o 12$ were all rejected at either the .05 or .0001 level of significance. Significant differences in mean rates of gain were demonstrated by the groups according to their intervention levels. For inspection of the rank order in which the intervention levels demonstrated significant differences in the mean rates of gain, see Table 41. This table displays only the results of the 5 tests of significance blocking on intervention levels 1 through 6.

Inspection of the results of the analyses revealed that significant differences in mean rates of gain exist, and that they can be attributed to the intervention levels of the subjects. Further inspection of the results revealed that those subjects whose intervention levels were in 6th grade demonstrated the highest accelerated mean rate of gain in 50% of the analyses; 4th, 5th, and 6th grade intervention levels demonstrated accelerated mean rates of gain when compared with the mean rates of gain demonstrated by subjects whose intervention levels were > 4th grade. Among those groups which demonstrated depressed mean rates of gain, subjects whose intervention levels were at 2nd grade ranked lowest in 60% of the analyses; at 3rd grade, subjects ranked next to the lowest in 80% of the analyses. There was no clearly defined point at which the intervention groups diverged because all levels were dispersed throughout the rank order of the results with the exception of intervention level, 3rd grade, which was never ranked higher than or next to last.

Results of the Analyses of the Longitudinal Data Relevant to the Exceptions of the Study

In reading, the analysis of the longitudinal data blocking on retardation borderline LD subjects and EMR subjects to test H_o^{13} revealed that significant differences in the mean rates of gain exist between the groups, and the differences can be attributed to the intelligence levels of the groups. EMR subjects demonstrated accelerated mean rates of gain when compared with the LD subjects' mean rates of gain. H_o^{13} was rejected at the .05 level of significance.

In mathematics, blocking on the same groups of subjects, H_o^{14} was tested. No significant differences were revealed in the results of the repeated-measures ANCOVA. Therefore, it was assumed that no significant differences existed in the mean rates of gain between the groups, and H_o^{14} was retained. In the analyses of the longitudinal data to determine whether or not there were significant differences in the learning rates of LD subjects which could be attributed to their intelligence levels, 3 series of analyses were implemented for reading and 3 for mathematics. The 3 series included blocking on low and high VIQ, low and high PIQ, and low and high FIQ (low IQ 75-85; high IQ > 85).

Inspection of the results of the 3 series of analyses of reading data revealed that significant differences in mean rates of gain exist between the groups. The VIQ, PIQ, and FIQ groups demonstrated accelerated mean rates of gain when compared with those of the low VIQ, PIQ, and FIQ groups, and the differences can be attributed to the intelligence levels of the subjects within the groups. H_o^{15} was rejected at the .05 level of significance.

H_o^{15} was rejected at the .05 level of significance. Significant differences in the mean rates of gain in mathematics were demonstrated by the groups. The high VIQ, PIQ, and FIQ groups demonstrated accelerated mean rates of gain when compared with those demonstrated by the low VIQ, PIQ and FIQ groups.

Results of the Analysis of the Longitudinal EMR Data

Each of the null hypotheses, H_o^1 through H_o^{12}, were restated to include EMR subjects rather than LD subjects. All 8 measures of the repeated-measures ANCOVA were employed in 2 series of analyses in the same manner that was used to analyze the data on LD subjects.

Inspection of the results of the analyses revealed only one test of significance. In a repeated-measures ANCOVA, blocking on intervention groups before and after 2nd grade, reading cells 1, 2, 3, 4, 5, 6, 7, and 8, $p < .05$. The only null hypothesis applicable to be tested by the results of this analysis was H_o^2 which was rejected at the .05 level of significance. EMR subjects whose intervention levels were prior to 2nd grade demonstrated accelerated mean rates of gain when compared with those of subjects whose intervention levels were = > 2nd grade.

Inspection of the results of the analyses of the data on EMR subjects revealed no other results which were significant at the .05 level of significance. Therefore, it was assumed that no significant differences in the mean rates of gain existed among the groups of EMR subjects, therefore, H_o^1 through H_o^6, and H_o^7 through H_o^{12} were all retained.

Conclusions

Results of Analyses Relevant to Reading

The summary of the results of the statistical analyses of the longitudinal data on LD subjects in reading revealed that (a) significant differences in the learning rates of LD subjects exist in systematic trends across time, (b) these differences can be attributed to the grade levels when the subjects initially received intervention services, and (c) the results of the statistical analyses support the notion of early intervention programs for young LD children in order to enhance their learning rates in reading.

Inspection of the results revealed that intervention prior to the 4th grade is the crucial time for the acceleration of learning rates in reading, and the optimal time for intervention services to enhance the learning rates of LD subjects is prior to 1st, in the 1st, or in 2nd grade. Therefore, it is concluded that for school-age LD children, it is imperative that intervention services are implemented as early as possible after it is suspected that a learning disability exists in order that they have the optimal opportunity to develop skills in reading.

It is interesting to note that 1st, 2nd, and 3rd grade subjects fall within the ages of 6, 7, and 8 years, which are the years that fit within one of the brain growth spurts described by Epstein (1978). Subjects in the 2nd grade, at 7 years of age would be at a definite peak in the 6 to 8 year spurt period. Also, at the 4th grade level, subjects would be 9 years of age which is a definite plateau between spurt periods.

Results of Analyses Relevant to Mathematics

In mathematics, inspection of the summary of the results of the analyses revealed that (a) significant differences in the learning rates of LD students exist in systematic trends across time, (b) the differences can be attributed to the grade levels when the subjects initially received intervention services, and (c) the results of the analyses do not support the notion of early intervention to enhance the learning rates of young LD children in mathematics. Further inspection of the results revealed that intervention prior to 4th grade did not positively affect the learning rates of LD subjects. Intervention at the 4th grade level or above 4th grade appears to be the crucial time for intervention to positively affect the learning rates of LD subjects, and the optimal time appears to be at the 6th grade level.

Subjects at the 6th, 5th, and 4th grade levels would fall within Epstein's (1978) brain growth spurt period from 10 to 12 years with 6th grade subjects at 11 years of age at a definite peak in that spurt period.

Results of the Analyses Relevant to the Exceptions of the Study

In the analyses of the longitudinal data on LD subjects blocking on low and high VIQ, PIQ, and FIQ, the results were of the nature that could be expected because it would be a reasonable assumption that subjects whose levels of intelligence were above 85 IQ points would be able to demonstrate more accelerated learning rates than those whose intelligence levels were between 75 and 85 IQ points. However, it was not anticipated that LD subjects whose intelligence levels were within the retardation borderline and slow learner ranges of intelligence (IQ 65-75) would demonstrate more depressed learning rates than the EMR subjects (IQ > 65). The conclusion reached is that LD subjects, already hampered in their learning by a learning disability, are more disadvantaged than EMR subjects because their low intelligence levels cause them to be more learning disabled.

Recommendations

Based on the results of the study, the following recommendations are suggested.

1. Implement a similar study under controlled conditions, employing a different assessment instrument to collect the data in order to have a basis for comparing the results.

2. Since there was such a wide discrepancy between the results of the analyses of the reading and mathematics data on LD subjects, conduct a similar longitudinal study under controlled conditions to analyze data on LD subjects; and repeat for nonhandicapped subjects matched for age and grade level whose intelligence levels are within the same range of intelligence as the LD subjects.

The discrepancy which existed between the results of the analyses of the reading and the mathematics data needs to be further investigated. Are young LD children more able to cope with developing reading skills than with mathematics skills? Does this discrepancy indicate that LD children manifest such fragmented cognitive processing abilities that they are not able to deal with abstract mathematics as well as with the symbolism of letters and words in developing reading skills? Does the discrepancy relate to the LD child's distractability in that the mathematics test requires more concentrated on-task behaviors than the reading test? Does it relate to the LD child's impulsiveness, i.e.; writes down the first thing that pops into mind regardless of whether it is appropriate or not?

3. Since there was such a scarcity of preschool-age subjects represented in the data, conduct a similar study and collect the data in a school district that has had an early childhood education program long enough for subjects whose intervention levels were prior to 1st grade to have advanced far enough in school to have this preschool-age group represented in the data.

4. Since all of the subjects in the study in or above 7th grade were included in one group, = > 7th grade, replicate the study using longitudinal data collected on secondary students only, and define each grade level from 8 through 12.

APPENDICES

APPENDIX A

PEARSON CORRELATION COEFFICIENTS

Table 53

Pearson Correlation Coefficients

Dependent Variable		Correlates					
Reading (LD Only)		Current Grade	VIQ	PIQ	FIG	Degree of Handicap	Current Age
Pretest							
	r	.50	.22	.25	.29	.26	.47
	n	(255)	(247)	(247	(257)	(257)	(257)
1976							
	r	.62	NS	.39	.36	.41	.49
	n	(38)		(37)	(38)	(38)	(38)
1977							
	r	.59	.34	.28	.38	.44	.62
	n	(62)	(59)	(59)	(62)	(62)	(62)
1978							
	r	.60	.31	NS	.31	.27	.64
	n	(86)	(82)		(82)	(87)	(87)
1979							
	r	.70	.24	NS	.27	.21	.65
	n	(113)	(108)		(114)	(114)	(114)
1980							
	r	.67	.26	.17	.32	.13	.62
	n	(135)	(130)	(130)	(135)	(135)	(135)
1981							
	r	.66	.30	.22	.33	.18	.53
	n	(169)	(162)	(162)	(169)	(169)	(169)
1982							
	r	.66	.30	.22	.33	.18	.45
	n	(169)	(162)	(162)	(169)	(169)	(192)

Note. Only coefficients with $p < .05$ are reported.

[a]Coefficients with $p > .05$ are indicated by NS

Table 54

Pearson Correlation Coefficients

Dependent Variable		Correlates					
Math (LD Only)		Current Grade	VIQ	PIQ	FIQ	Degree of Handicap	Current Age
Pretest	r	.51	.22	.31	.36	.19	.48
	n	(225)	(247)	(247)	(257)	(257)	(257)
1976	r	.69	NS	.45	.41	.44	.39
	n	(39)		(38)	(39)	(39)	(39)
1977	r	.62	.32	.32	.41	.42	.63
	n	(62)	(59)	(59)	(62)	(62)	(62)
1978	r	.50	NS	NS	.33	.25	.58
	n	(85)			(86)	(86)	(86)
1979	r	.58	NS	.25	.25	.25	.60
	n	(113)		(108)	(114)	(114)	(114)
1980	r	.66	NS	.20	.29	.11	.61
	n	(135)		(130)	(135)	(135)	(135)
1981	r	.65	.13	.22	.27	.17	.55
	n	(169)	(162)	(162)	(169)	(169)	(169)
1982	r	.66	.17	.28	.31	.19	.59
	n	(192)	(187)	(187)	(193)	(193)	(193)

Note. Only coefficients with $p < .05$ are reported.

[a]Coefficients with $p > .05$ are indicated by NS

Table 55

Pearson Correlation Coefficients

	School District	Race
Variable	Effect	Effect
Reading (Initial)	.11	NS
Reading 1976	.15	NS
Reading 1977	.16	NS
Reading 1978	.11	NS
Reading 1979	NS	NS
Reading 1980	NS	NS
Reading 1981	.14	NS
Reading 1982	.15	NS
Mathematics (Initial)	NS	NS
Mathematics 1976	NS	NS
Mathematics 1977	.12	NS
Mathematics 1978	.10	NS
Mathematics 1979	NS	NS
Mathematics 1980	NS	NS
Mathematics 1981	NS	NS
Mathematics 1982	NS	NS

Note. Only significant differences are reported.

APPENDIX B

LIST OF NONSIGNIFICANT RESULTS

Table 56

Results of Statistical Analyses

Identifying No Significant Differences

Attributed to Intervention Levels, $p > .05$

Intervention Grade Levels	Reading (LD Only) Cells	Intervention Grade Levels	Reading (LD Only) Cells
1 Through 6	1 and 8 1, 7-8 1, 6-8 1, 3-8 1, 2-8 1 and 8 1, 7-8 1, 6-8 1, 3-8 1, 2-8 1 and 8 1, 7-8 1, 6-8 1, 2-8	Before and After 3rd	1 and 8 1, 7-8 1, 6-8 1, 3-8 1, 2-8
Before and After 1st	1, 2-8	Before and After 4th	1 and 8 1, 7-8 1, 2-8
Before and After 2nd	1 and 8 1, 7-8 1, 6-8 1, 5-8 1, 4-8 1, 3-8 1, 2-8	Before and After 5th	1 and 8 1, 7-8 1, 6-8 1, 2-8
		Before and After 6th	1 and 8 1, 7-8 1, 2-8

Table 57

Results Identifying No Significant Differences

Attributed to Intervention Levels

Intervention	Math (LD Only)
Grades Levels	Cells
1 Through 6	1 and 8
	1, 5-8
	1, 4-8
	1, 3-8
	1, 2-8
	1 and 8
	1, 5-8
	1, 4-8
	1, 3-8
	1, 2-8
	1, 7-8
	1 and 8
	1, 6-8
	1, 5-8
	1, 3-8
	1, 2-8
Before and After 1st	1 and 8
	1, 7-8
	1, 6-8
	1, 5-8
	1, 3-8
	1, 2-8
Before and After 2nd	1 and 8
	1, 7-8
	1, 6-8
	1, 5-8
	1, 4-8
	1, 3-8
	1, 2-8

Intervention	Math (LD Only)
Grade Levels	Cells
Before and After 3rd	1 and 8
	1, 6-8
	1, 4-8
	1, 3-8
Before and After 4th	1 and 8
	1, 5-8
	1, 4-8
	1, 3-8
	1, 2-8
Before and After 5th	1 and 8
	1, 7-8
	1, 5-8
	1, 4-8
	1, 3-8
	1, 2-8
Before and After 6th	1 and 8
	1, 7-8
	1, 6-8
	1, 5-8
	1, 4-8
	1, 3-8
	1, 2-8

APPENDIX C

TABLES OF UNREFINED MEANS

Table 58

Unrefined Means for Intervention Levels 1-6

Reading Cells 1, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels						
Covariate (Pretest)	1st	2nd	3rd	4th	5th	6th	Grand Mean
1	1.23	1.49	2.13	3.08	3.03	3.09	2.20
1	1.23	1.49	2.13	3.08	3.03	3.09	2.20
1	1.23	1.49	2.13	3.08	3.03	3.09	2.20
1	1.23	1.49	2.13	3.08	3.03	3.09	2.20
Grand Mean	1.23	1.49	2.13	3.08	3.03	3.09	2.20
Count	10	14	20	4	12	9	69
Dependent Variable							
5	2.54	2.29	3.33	3.93	3.72	4.49	3.26
6	3.41	3.21	4.20	4.58	4.25	4.82	4.00
7	4.00	3.69	4.79	4.93	4.56	4.98	4.44
8	4.48	4.15	5.19	5.00	4.89	5.49	4.85
Grand Mean	3.61	3.33	4.38	4.61	4.35	3.94	4.14
Count	10	14	20	4	12	9	69

Table 59

Unrefined Means for Intervention Levels 1-6

Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels						
Covariate (Pretest)	1st	2nd	3rd	4th	5th	6th	Grand Mean
1	1.20	1.62	2.22	1.90	2.93	3.46	2.13
1	1.20	1.62	2.22	1.90	2.93	3.46	2.13
1	1.20	1.62	2.22	1.90	2.93	3.46	2.13
1	1.20	1.62	2.22	1.90	2.93	3.46	2.13
1	1.20	1.62	2.22	1.90	2.93	3.46	2.13
Grand Mean	1.20	1.62	2.22	1.90	2.93	3.46	2.13
Count	8	9	15	2	7	4	45
Dependent Variable							
4	2.19	2.14	3.15	3.10	3.47	5.38	3.02
5	2.53	2.68	3.72	3.10	3.87	5.55	3.46
6	3.30	3.64	4.55	3.90	4.20	5.93	4.19
7	4.03	4.17	5.06	4.50	4.50	6.03	4.67
8	4.49	4.62	5.53	4.65	4.69	6.60	4.09
Grand Mean	3.31	3.45	4.40	3.85	4.15	5.90	4.08
Count	8	9	15	2	7	4	45

Table 60

Unrefined Means for Intervention Levels 1-6

Reading Cells 1, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels							
Covariate (Pretest)	1st	2nd	3rd	4th	5th	6th	=> 7th	Grand Mean
1	1.23	1.49	2.13	3.08	3.03	3.09	2.87	2.26
1	1.23	1.49	2.13	3.08	3.03	3.09	2.87	2.26
1	1.23	1.49	2.13	3.08	3.03	3.09	2.87	2.26
1	1.23	1.49	2.13	3.08	3.03	3.09	2.87	2.26
Grand Mean	1.23	1.49	2.13	3.08	3.03	3.09	2.87	2.26
Count	10	14	20	4	12	9	6	75
Dependent Variable								
5	2.54	2.29	3.33	3.93	3.72	4.49	3.78	3.30
6	3.41	3.21	4.20	4.58	4.25	4.82	4.43	4.03
7	4.00	3.69	4.80	4.93	4.56	4.98	4.60	4.46
8	4.49	4.15	5.19	5.00	4.90	4.49	4.87	4.85
Grand Mean	3.61	3.33	4.38	4.61	4.36	4.94	4.42	4.16
Count	10	14	20	4	12	9	6	75

Table 61

Unrefined Means for Intervention Levels 1-6

Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels							
Covariate (Pretest)	1st	2nd	3rd	4th	5th	6th	=> 7th	Grand Mean
1	1.20	1.62	2.23	1.90	2.93	3.45	3.00	2.21
1	1.20	1.62	2.23	1.90	2.93	3.45	3.00	2.21
1	1.20	1.62	2.23	1.90	2.93	3.45	3.00	2.21
1	1.20	1.62	2.23	1.90	2.93	3.45	3.00	2.21
1	1.20	1.62	2.23	1.90	2.93	3.45	3.00	2.21
Grand Mean	1.20	1.62	2.23	1.90	2.93	3.45	3.00	2.21
Count	8	9	15	2	7	4	5	50
Dependent Variable								
4	2.19	2.14	3.15	3.10	3.47	5.38	3.90	3.11
5	2.53	2.68	3.72	3.10	3.87	5.55	4.10	3.52
6	3.30	3.64	4.55	3.90	4.20	5.93	4.66	4.23
7	4.03	4.17	5.06	4.50	4.50	6.03	4.86	4.69
8	4.49	4.62	5.53	4.65	4.69	6.60	5.18	5.10
Grand Mean	3.31	3.45	4.40	3.85	4.15	5.90	4.54	4.13
Count	8	9	15	2	7	4	5	50

Table 62

Unrefined Means for Intervention Levels 1-6

Reading Cells 1, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels							
Covariate (Pretest)	<1st	1st	2nd	3rd	4th	5th	6th	Grand Mean
1	PK.50	1.23	1.49	2.13	3.08	3.03	3.09	2.15
1	PK.50	1.23	1.49	2.13	3.08	3.03	3.09	2.15
1	PK.50	1.23	1.49	2.13	3.08	3.03	3.09	2.15
1	PK.50	1.23	1.49	2.13	3.08	3.03	3.09	2.15
Grand Mean	PK.50	1.23	1.49	2.13	3.08	3.03	3.09	2.15
Count	1	10	14	20	4	12	9	70
Dependent Variable								
5	1.30	2.54	2.29	3.33	3.93	3.72	4.49	3.23
6	1.80	3.41	3.20	4.20	4.58	4.25	4.82	3.96
7	2.00	4.00	3.69	4.80	4.93	4.56	4.98	4.41
8	2.60	4.49	4.15	5.19	5.00	4.89	5.49	4.82
Grand Mean	1.93	3.61	3.33	4.38	4.61	4.36	4.94	4.10
Count	1	10	14	20	4	12	9	70

Table 63

Unrefined Means for Intervention Levels 1-6

Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels							
Covariate (Pretest)	<1st	1st	2nd	3rd	4th	5th	6th	Grand Mean
1	K.50	1.20	1.62	2.23	1.90	2.93	3.45	2.05
1	K.50	1.20	1.62	2.23	1.90	2.93	3.45	2.05
1	K.50	1.20	1.62	2.23	1.90	2.93	3.45	2.05
1	K.50	1.20	1.62	2.23	1.90	2.93	3.45	2.05
1	K.50	1.20	1.62	2.23	1.90	2.93	3.45	2.05
Grand Mean	K.50	1.20	1.62	2.23	1.90	2.93	3.45	2.05
Count	1	8	9	15	2	7	4	46
Dependent Variable								
4	1.00	2.19	2.14	3.15	3.10	3.47	5.38	2.98
5	1.30	2.53	2.68	3.72	3.10	3.87	5.55	3.41
6	1.80	3.30	3.64	4.55	3.90	4.20	5.93	4.13
7	2.00	4.03	4.17	5.06	4.50	4.50	6.03	4.61
8	2.60	4.49	4.62	5.53	4.65	4.69	6.60	5.03
Grand Mean	1.74	3.31	3.45	4.40	3.85	4.15	5.90	4.03
Count	1	8	9	15	2	7	4	46

Table 64

Unrefined Means for Intervention Levels 1-6

Reading Cells 1, 3, 4, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels						
Covariate (Pretest)	1st	2nd	3rd	4th	5th	6th	Grand Mean
1	1.32	1.83	2.03	2.30	2.70	3.73	2.13
1	1.32	1.83	2.03	2.30	2.70	3.73	2.13
1	1.32	1.83	2.03	2.30	2.70	3.73	2.13
1	1.32	1.83	2.03	2.30	2.70	3.73	2.13
1	1.32	1.83	2.03	2.30	2.70	3.73	2.13
1	1.32	1.83	2.03	2.30	2.70	3.73	2.13
Grand Mean	1.32	1.83	2.03	2.30	2.70	3.73	2.13
Count	6	4	12	1	4	3	30
Dependent Variable							
3	1.98	2.18	2.58	4.20	3.23	5.07	2.80
4	2.35	2.53	3.08	4.60	3.33	5.63	3.20
5	2.77	3.08	3.66	4.60	3.88	5.83	3.68
6	3.55	4.03	4.52	5.60	4.13	6.33	4.42
7	4.42	4.38	4.96	6.00	4.20	6.43	4.83
8	4.80	4.73	5.35	6.20	4.35	7.13	5.23
Grand Mean	3.29	3.48	4.02	5.20	3.85	6.07	4.03
Count	6	4	12	1	4	3	30

Table 65

Unrefined Means for Intervention Levels

Before and After 3rd Grade

Reading Cells 1, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 3rd Grade	After 3rd Grade	Grand Mean
1	1.26	2.64	2.20
1	1.26	2.64	2.20
1	1.26	2.64	2.20
1	1.26	2.64	2.20
Grand Mean	1.26	2.64	2.20
Count	25	53	78
Dependent Variable			
5	2.35	3.67	3.25
6	3.23	4.33	3.98
7	3.74	4.71	4.40
8	4.32	5.08	4.81
Grand Mean	3.39	4.45	4.11
Count	25	53	78

Table 66

Unrefined Means for Intervention Levels

Before and After 3rd Grade

Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 3rd Grade	After 3rd Grade	Grand Mean
1	1.26	2.58	2.13
1	1.26	2.58	2.13
1	1.26	2.58	2.13
1	1.26	2.58	2.13
1	1.26	2.58	2.13
Grand Mean	1.26	2.58	2.13
Count	18	35	53
Dependent Variable			
4	2.10	3.50	3.02
5	2.53	3.90	3.43
6	3.39	4.54	4.15
7	3.98	4.91	4.59
8	4.45	5.30	5.01
Grand Mean	3.29	4.43	4.04
Count	18	35	53

Table 67

Unrefined Means for Intervention Levels

Before and After 4th Grade

Reading Cells 1, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 4th Grade	After 4th Grade	Grand Mean
1	1.68	3.32	2.38
1	1.68	3.32	2.38
1	1.68	3.32	2.38
Grand Mean	1.68	3.32	2.38
Count	61	45	106
Dependent Variable			
6	3.32	4.62	3.87
7	3.83	4.88	4.27
8	4.34	5.35	4.77
Grand Mean	3.83	4.95	5.30
Count	61	45	106

Table 68

Unrefined Means for Intervention Levels

Before and AFter 4th Grade

Reading Cells 1, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 4th Grade	After 4th Grade	Grand Mean
1	1.65	2.95	2.20
1	1.65	2.95	2.20
1	1.65	2.95	2.20
1	1.65	2.95	2.20
Grand Mean	1.65	2.95	2.20
Count	45	33	78
Dependent Variable			
5	2.78	3.88	3.25
6	3.66	4.41	3.98
7	4.21	4.66	4.40
8	4.65	5.02	4.81
Grand Mean	3.83	4.50	4.11
Count	45	33	78

Table 69

Unrefined Means for Intervention Levels

Before and After 4th Grade

Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 4th Grade	After 4th Grade	Grand Mean
1	1.70	2.84	2.13
1	1.70	2.84	2.13
1	1.70	2.84	2.13
1	1.70	2.84	2.13
1	1.70	2.84	2.13
Grand Mean	1.70	2.84	2.13
Count	33	20	53
Dependent Variable			
4	2.58	3.77	3.02
5	3.07	4.03	3.43
6	3.92	4.53	4.15
7	4.47	4.80	4.59
8	4.94	5.14	5.01
Grand Mean	3.80	4.45	4.04
Count	33	20	53

Table 70

Unrefined Means for Intervention Levels

Before and After 4th Grade

Reading Cells 1, 3, 4, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 4th Grade	After 4th Grade	Grand Mean
1	1.80	3.09	2.20
1	1.80	3.09	2.20
1	1.80	3.09	2.20
1	1.80	3.09	2.20
1	1.80	3.09	2.20
1	1.80	3.09	2.20
Grand Mean	1.80	3.09	2.20
Count	22	10	32
Dependent Variable			
3	2.35	3.97	2.85
4	2.78	4.37	3.28
5	3.31	4.65	3.73
6	4.16	5.08	4.45
7	4.68	5.21	4.84
8	5.09	5.52	5.22
Grand Mean	3.73	4.80	4.06
Count	22	10	32

Table 71

Unrefined Means for Intervention Levles

Before and After 5th Grade

Reading Cells 1, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 5th Grade	After 5th Grade	Grand Mean
1	1.77	2.93	2.20
1	1.77	2.93	2.20
1	1.77	2.93	2.20
1	1.77	2.93	2.20
Grand Mean	1.77	2.93	2.20
Count	49	29	78
Dependent Variable			
5	2.88	3.87	3.25
6	3.73	4.39	3.98
7	4.27	4.62	4.40
8	4.68	5.02	4.81
Grand Mean	3.89	4.48	4.11
Count	49	29	78

Table 72

Unrefined Means for Intervention Levels

Before and After 5th Grade

Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 5th Grade	After 5th Grade	Grand Mean
1	1.71	2.94	3.13
1	1.71	2.94	3.13
1	1.71	2.94	3.13
1	1.71	2.94	3.13
1	1.71	2.94	3.13
Grand Mean	1.71	2.94	3.13
Count	35	18	53
Dependent Variable			
4	2.61	3.84	3.02
5	3.07	4.13	3.43
6	3.92	4.59	4.15
7	4.47	4.83	4.59
8	4.92	5.19	5.01
Grand Mean	3.80	4.52	4.04
Count	35	18	53

Table 73

Unrefined Means for Intervention Levels

Before and After 5th Grade

Reading Cells 1, 3, 4, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 5th Grade	After 5th Grade	Grand Mean
1	1.82	3.18	2.20
1	1.82	3.18	2.20
1	1.82	3.18	2.20
1	1.82	3.18	2.20
1	1.82	3.18	2.20
1	1.82	3.18	2.20
Grand Mean	1.82	3.18	2.20
Count	23	9	32
Dependent Variable			
3	2.43	3.94	2.85
4	2.86	4.34	3.28
5	3.37	4.66	3.73
6	4.23	5.02	4.45
7	4.73	5.12	4.84
8	5.13	5.44	5.22
Grand Mean	3.79	4.76	4.06
Count	23	9	32

Table 74

Unrefined Means for Intervention Levels

Before and After 6th Grade

Reading Cells 1, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 6th Grade	After 6th Grade	Grand Mean
1	2.01	3.56	2.38
1	2.01	3.56	2.38
1	2.01	3.56	2.38
Grand Mean	2.01	3.56	2.38
Count	81	25	106
Dependent Variable			
6	3.55	4.92	3.87
7	4.03	5.08	4.27
8	4.49	5.66	4.30
Grand Mean	4.02	5.22	4.30
Count	81	25	106

Table 75

Unrefined Means for Intervention Levels

Before and After 6th Grade

Reading Cells 1, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 6th Grade	After 6th Grade	Grand Mean
1	3.01	3.86	3.20
1	3.01	3.86	3.20
1	3.01	3.86	3.20
1	3.01	3.86	3.20
Grand Mean	3.01	3.86	3.20
Count	61	17	78
Dependent Variable			
5	3.04	3.98	3.25
6	3.84	4.49	3.98
7	4.32	4.67	4.40
8	4.72	5.11	4.81
Grand Mean	3.98	4.56	4.11
Count	61	17	78

Table 76

Unrefined Means for Intervention Levels

Before and After 6th Grade

Reading Cells 1, 4, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 6th Grade	After 6th Grade	Grand Mean
1	2.91	3.95	3.13
1	2.91	3.95	3.13
1	2.91	3.95	3.13
1	2.91	3.95	3.13
1	2.91	3.95	3.13
Grand Mean	2.91	3.95	3.13
Count	42	11	53
Dependent Variable			
4	2.75	4.07	3.02
5	3.21	4.30	3.43
6	3.96	4.85	4.15
7	4.48	5.04	4.59
8	4.88	5.51	5.01
Grand Mean	3.86	4.75	4.04
Count	42	11	53

Table 77

Unrefined Means for Intervention Levels

Before and After 6th Grade

Reading Cells 1, 3, 4, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 6th Grade	After 6th Grade	Grand Mean
1	1.95	3.56	2.20
1	1.95	3.56	2.20
1	1.95	3.56	2.20
1	1.95	3.56	2.20
1	1.95	3.56	2.20
1	1.95	3.56	2.20
Grand Mean	1.95	3.56	2.20
Count	27	5	32
Dependent Variable			
3	2.54	4.52	2.85
4	2.93	5.16	3.28
5	3.44	5.28	3.73
6	4.21	5.74	4.45
7	4.66	5.86	4.84
8	5.02	6.32	5.22
Grand Mean	3.80	5.48	4.06
Count	27	5	32

Table 78

Unrefined Means for Intervention Levels 1-6

Math Cells 1, 7, and 8 (LD Only)

Cells	Intervention Grade Levels						
Covariate (Pretest)	1st	2nd	3rd	4th	5th	6th	Grand Mean
1	1.34	1.88	2.51	2.63	3.24	3.10	2.44
1	1.34	1.88	2.51	2.63	3.24	3.10	2.44
Grand Mean	1.34	1.88	2.51	2.63	3.24	3.10	2.44
Count	17	20	36	12	17	17	119
Dependent Variable							
7	3.28	3.49	3.70	3.88	4.18	4.24	3.77
8	3.73	3.54	4.09	4.33	4.62	4.88	4.16
Grand Mean	3.51	3.51	3.89	4.10	4.40	4.56	3.96
Count	17	20	36	12	17	17	119

Table 79

Unrefined Means for Intervention Levels 1-6

Math Cells 1, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels						
Covariate (Pretest)	1st	2nd	3rd	4th	5th	6th	Grand Mean
1	1.45	1.84	2.40	2.70	3.26	3.06	2.40
1	1.45	1.84	2.40	2.70	3.26	3.06	2.40
1	1.45	1.84	2.40	2.70	3.26	3.06	2.40
Grand Mean	1.45	1.84	2.40	2.70	3.26	3.06	2.40
Count	14	19	27	4	16	13	93
Dependent Variable							
6	3.23	3.20	3.54	3.75	3.94	4.18	3.59
7	3.53	3.49	3.80	4.28	4.23	4.38	3.87
8	3.91	3.54	3.10	4.65	4.69	5.08	4.22
Grand Mean	3.55	3.41	3.81	3.23	4.29	4.55	3.90
Count	14	19	27	4	16	13	93

Table 80

Unrefined Means for Intervention Levels 1-6

Math Cells 1, 7, and 8 (LD Only)

Cells	Intervention Grade Levels							
Covariate (Pretest)	1st	2nd	3rd	4th	5th	6th	=> 7th	Grand Mean
1	1.34	1.88	2.51	2.63	3.24	3.10	3.56	3.58
1	1.34	1.88	2.51	2.63	3.24	3.10	3.56	3.58
Grand Mean	1.34	1.88	2.51	2.63	3.24	3.10	3.56	3.58
Count	17	20	36	12	17	17	18	137
Dependent Variable								
7	3.28	3.49	3.70	3.88	4.18	4.24	4.83	3.91
8	3.73	3.54	4.08	4.33	4.62	4.88	5.27	4.30
Grand Mean	3.51	3.51	3.89	4.10	4.40	4.56	5.05	4.10
Count	17	20	36	12	17	17	18	137

Table 81

Unrefined Means for Intervention Levels 1-6

Math Cells 1, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels							
Covariate (Pretest)	1st	2nd	3rd	4th	5th	6th	=> 7th	Grand Mean
1	1.45	1.84	2.40	2.70	3.26	3.06	3.10	2.46
1	1.45	1.84	2.40	2.70	3.26	3.06	3.10	2.46
1	1.45	1.84	2.40	2.70	3.26	3.06	3.10	2.46
Grand Mean	1.45	1.84	2.40	2.70	3.26	3.06	3.10	2.46
Count	14	19	27	4	16	13	10	103
Dependent Variable								
6	3.23	3.20	3.54	3.75	3.94	4.18	4.20	3.65
7	3.53	3.49	3.80	4.28	4.23	4.38	4.24	3.93
8	3.91	3.54	4.10	4.65	4.69	5.08	4.73	4.27
Grand Mean	3.55	3.41	3.81	4.23	4.29	4.55	4.45	3.95
Count	14	19	27	4	16	13	10	103

Table 82

Unrefined Means for Intervention Levels 1-6

Math Cells 1, 4, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels							
Covariate (Pretest)	<1st	1st	2nd	3rd	4th	5th	6th	Grand Mean
1	PK.20	1.40	2.03	2.21	2.40	3.37	3.25	2.23
1	PK.20	1.40	2.03	2.21	2.40	3.37	3.25	2.23
1	PK.20	1.40	2.03	2.21	2.40	3.37	3.25	2.23
1	PK.20	1.40	2.03	2.21	2.40	3.37	3.25	2.23
1	PK.20	1.40	2.03	2.21	2.40	3.37	3.25	2.23
Grand Mean	PK.20	1.40	2.03	2.21	2.40	3.37	3.25	2.23
Count	1	8	9	15	2	6	4	45
Dependent Variable								
4	0.70	2.63	2.61	3.06	3.75	3.97	4.78	3.11
5	1.80	2.94	3.39	3.30	3.75	4.15	4.08	3.49
6	2.10	3.39	3.61	3.56	4.05	4.28	5.08	3.76
7	2.70	3.49	3.77	3.80	4.95	4.58	5.35	4.01
8	3.50	3.83	3.81	4.22	5.35	4.77	5.78	4.30
Grand Mean	2.16	3.25	3.44	3.59	4.37	4.35	5.04	3.73
Count	1	8	9	15	2	6	4	45

Table 83

Unrefined Means for Intervention Levels

Before and After 1st Grade

Math Cells 1, 4, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 1st Grade	After 1st Grade	Grand Mean
1	1.80	2.39	2.33
1	1.80	2.39	2.33
1	1.80	2.39	2.33
1	1.80	2.39	2.33
1	1.80	2.39	2.33
Grand Mean	1.80	2.39	2.33
Count	1	49	50
Dependent Variable			
4	1.70	3.23	3.18
5	1.80	3.61	3.57
6	2.10	3.89	3.85
7	2.70	4.12	4.10
8	3.50	4.42	4.40
Grand Mean	2.16	3.85	3.82
Count	1	49	50

Table 84

Unrefined Means for Intervention Levels

Before and After 3rd Grade

Math Cells 1, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 3rd Grade	After 3rd Grade	Grand Mean
1	1.50	2.93	2.53
1	1.50	2.93	2.53
Grand Mean	1.50	2.93	2.53
Count	39	102	141
Dependent Variable			
7	3.25	4.09	3.86
8	3.50	4.54	4.25
Grand Mean	3.38	4.31	4.06
Count	39	102	141

Table 85

Unrefined Means for Intervention Levels

Before and After 3rd Grade

Math Cells 1, 5, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 3rd Grade	After 3rd Grade	Grand Mean
1	1.56	2.75	2.36
1	1.56	2.75	2.36
1	1.56	2.75	2.36
1	1.56	2.75	2.36
Grand Mean	1.56	2.75	2.36
Count	26	53	79
Dependent Variable			
5	2.89	3.64	3.39
6	3.31	3.97	3.75
7	3.56	4.23	4.01
8	3.70	4.67	4.35
Grand Mean	3.37	4.13	3.88
Count	26	53	79

Table 86

Unrefined Means for Intervention Levels

Before and After 4th Grade

Math Cells 1, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 4th Grade	After 4th Grade	Grand Mean
1	1.98	3.16	2.53
1	1.98	3.16	2.53
Grand Mean	1.98	3.16	2.53
Count	75	66	141
Dependent Variable			
7	3.47	4.30	3.86
8	3.78	4.79	4.25
Grand Mean	3.62	4.54	4.06
Count	75	66	141

Table 87

Unrefined Means for Intervention Levels

Before and After 4th Grade

Math Cells 1, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 4th Grade	After 4th Grade	Grand Mean
1	1.91	3.08	2.40
1	1.91	3.08	2.40
1	1.91	3.08	2.40
Grand Mean	1.91	3.08	2.40
Count	62	45	107
Dependent Variable			
6	3.26	4.04	3.59
7	3.55	4.30	3.86
8	3.80	4.77	4.21
Grand Mean	3.53	4.37	3.89
Count	62	45	107

Table 88

Unrefined Means for Intervention Levles

Before and After 5th Grade

Math Cells 1, 6, 7, and 8 (LD Only)

Cells	Intervention Grade Levels		
Covariate (Pretest)	Before 5th Grade	After 5th Grade	Grand Mean
1	1.96	3.12	2.40
1	1.96	3.12	2.40
1	1.96	3.12	2.40
Grand Mean	1.96	3.12	2.40
Count	66	41	107
Dependent Variable			
6	3.29	4.07	3.59
7	3.59	4.30	3.86
8	3.85	4.79	4.21
Grand Meand	3.78	4.38	3.89
Count	66	41	107

APPENDIX D

LETTER OF APPROVAL

AND DATA REPORTING FORM

aley Jaggers
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IECTOR
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GNOSTICIANS
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August 24, 1982

The College of Education
Texas Woman's University
Denton, TX 76204

To Whom It May Concern:

The purpose of this letter is to assure you that the local school administrators of the cooperative district are aware of the study in which Mrs. Carmon Welch is using longitudinal data which were collected on handicapped students served by the cooperative district special education program. Students' personal identifications were removed from the data, and identification numbers were assigned.

These data were collected and used for specific program purposes, but no efforts or provisions have been made to analyze them on a longitudinal basis.

Therefore, I see no problem in Mrs. Welch's using the data in her longitudinal study.

Dissertation/Theses signature page is here.

To protect individuals we have covered their signatures.

Form for Reporting Data

		Birthdate			Sex		Ethnic Origin				Intelligence Quotient				Attrition Status		Degree of Handicap		Age
Handicapping Code	Subject Identification Number	Year	Month	Day	Male	Female	Black Amer.	Mexican Amer.	White Amer.	Current Grade (Last Posttest)	Verbal IQ	Performance IQ	Full Scale IQ	Intervention Grade Level	Graduated, Moved, or Dismissed	Continued In	Mild to Moderate	Severe	Current or at Last Posttest
			-	-	M	F	B	M	W			-	-		M	C	M	S	

Intervention Data

	Pre Test Mo-Yr	Post Test Mo-Yr	Post Test Mo-Yr	Post Test Mo-Yr	Post Test Mo-Yr	Post Test Mo-Yr	Post Test Mo-Yr	Post Test Mo-Yr
Test Dates:	____	____	____	____	____	____	____	____
Months Intervals:	____	____	____	____	____	____	____	____
Measures:								
Reading	____	____	____	____	____	____	____	____
Mathematics	____	____	____	____	____	____	____	____

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