DOCUMENT RESUME

ED 349 729 EC 301 474

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TITLE	"Cognitive Return" of Schooling for Students with Disabilities: Preliminary Findings from "High School and Beyond."
PUB DATE	92
NOTE	30p.; In: Harnisch, Delwyn L., And Others. Selected Readings in Transition; see EC 301 473.
PUB TYPE	Reports - Research/Technical (143)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Academic Persistence; Achievement; *Cognitive Development; *Disabilities; High Schools; *Institutional Characteristics; *Outcomes of Education; Student Characteristics; Withdrawal (Education)
IDENTIFIERS	High School and Beyond (NCES)

ABSTRACT

This paper applies value-added analysis to study the cognitive development of disabled high school sophomores over the period 1980-1982, in order to determine whether staying in school yields any cognitive return for students with disabilities and to identify those school factors that influence the relationship between staying in school and cognitive return. The study used data about 1,144 students from the data tape for the third follow-up of the "High School and Beyond" sophomore cohort. Student variables included graduation status, student background characteristics, and student achievement; school variables were categorized as demographics, teachers and instructional quality, discipline climate, academic climate, and curricular structure. Results indicated that staying in school yielded considerable cognitive return for students with disabilities, with greater gains in the language development areas and smaller gains in science and math. Tentative results also identified the following factors as moderating the effect of schooling: school type and/or school socioeconomic status, quality of academic instruction, reports of disciplinary problems, percentage of students in academic programs, average number of hours spent on homework, parent interest, and participation in vocational education. Appendices define study variables and provide statistical data. (Contains 13 references.) (JDD)

Chapter 1

"Cognitive Return" of Schooling for Students with Disabilities: Preliminary Findings from *High School and Beyond*

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RUNNING HEAD: Cognitive Return

"Cognitive Return" of Schooling for Students with Disabilities: Preliminary Findings from *High School and Beyond*

The present paper applies value-added analysis to study the cognitive development of disabled high school sophomores over the period 1980-1982. Like the previous studies, our research used high school graduates and dropouts to provide an "in-school" versus "out-of-school" comparison of students' tested achievement. At the student level, we hoped to determine whether staying in school yields any cognitive return for students with disabilities. In addition, we extended the approach to the school level, hoping to identify those school factors that influence the relationship between staying in school (or dropping out) and cognitive return.

Two perspectives are represented in this research. The first concerns the usefulness of schooling for students with disabilities. Students with disabilities drop out of high school at a rate far in excess of that for the general population of students—some estimates are as high as 53.3% (Zigmond & Thornton, 1985; see also, Owings & Stocking, 1985). Most students, regardless of the disabling condition, report low grades and a feeling of being alienated from school as their reasons for dropping out. Given the high dropout rate, and the general failure of schools to meet needs of youth with disabilities, it is reasonable to ask whether students with disabilities derive any cognitive benefit from formal schooling.

The second research focus concerns school programs and policies for students with disabilities. Many studies on dropouts have focused on causal factors leading students to drop out of high school and have identified social, family, and personal characteristics associated with dropping out (e.g., Pallas, 1984; Rumberger, 1983). But the high dropout rate among students with disabilities raises questions about the responsiveness of *schools* to the special needs of these students. Causal analyses at the individual student level do not yield implications that are relevant for shaping school policy and practice (Wehlage & Rutter, 1986; Zigmond, 1987). Instead, analyses that focus also on school-level factors are required—preferably, school programs and policies that are amenable to change.

The research described in this paper was undertaken using the Hierarchical Linear Model (HLM) analysis developed by Bryk, Raudenbush, Seltzer, and Congdon (1988). We used this form of analysis for three reasons. First, it is designed for analysis of problems involving multilevel effects. Second, because HLM computes parameter estimates within school, it enables us to control for all observed and unobserved school-level characteristics (e.g., average per-student expenditure) as well as associated geographic variables (e.g., region of country, urban versus rural residence). Third, it provides parameter estimates where conventional OLS techniques might be inapplicable—within limits—because of the small number of disabled students per school. HLM weights the contribution of the individual within-school parameters proportional to their precision; where there is large sampling error, more reliance is placed on the mean within-school slopes pooled over all schools. Thus, HLM enables estimation at the within-school level to be enhanced by capitalizing on all data across schools.

The analysis for this study was conceptualized as a two-level HLM in which we estimated the separate within- and between-school effects as well as cross-level effects. The within-school model related individual students' 1982 tested achievement to their graduation status (graduate/dropout) while controlling for 1980 tested achievement and other background characteristics of students. The between-school model treats the within-school effects as random and relates effects to selected school factors thought to moderate the graduate-dropout-achievement relationship.

Method

Sample and Data

The analysis used the data tape for the third follow-up (Office of Educational Research and Improvement, 1986) of the *High School and Beyond* (HSB) sophomore cohort. Our initial sample was drawn from the 4,031 mildly disabled students attending Catholic and public schools and who participated in both the base year (1980) and first follow-up (1982) surveys. No differentiation was made among types of disabling condition for this preliminary analysis. The sample included students who identified themselves as learning disabled, hard of hearing, speech impaired, orthopedically impaired, or otherwise health impaired.

Insert Table 1 about here

As shown in Table 1, the number of students per school ranged from one to 15. Based on this distribution, we selected students from schools with seven or more mildly disabled students, for a total of 144 schools. In choosing this cutoff, we were mindful of the tradeoff between the difficulty of estimating parameters at the within-school level given the small numbers of students per school and our ability to generalize to as many high schools as possible. Schools with seven or more students seemed a reasonable compromise. Because of missing data at the student and school levels, our final sample comprised approximately 1,144 students from a total of 135 or 136 schools, depending on the test measure. In all analyses, we used the HSB school-level design weights to account for oversampling of some schools. Student-level weighting was unnecessary since HSB sampled students within schools with equal probability (cf., Lee & Bryk, in press).

Student Variables

Student variables were drawn from the HSB student file. They comprised variables used to define graduation status (graduate/dropout), student background characteristics, and student achievement. Graduation status was coded as a dummy variable (STAYER), contrasting students who stayed in school (code = 1) with those who dropped out before the end of their junior year and never returned (code = 0). We defined graduation status following the procedure of Rock et al. (1986) in order to obtain results reflecting the gains that accrue from schooling, which would be comparable with those from prior research.

Student background characteristics included variables found to be significant predictors of achievement in previous student-level analyses of HSB data (Alexander et al., 1985; Lee & Bryk, in press; Rock et al., 1986). They include: sex, race, socioeconomic status, achieved grades, absenteeism, locus of control mother's educational aspirations for student, nonschool related learning experiences, curriculum type, study aids in the home, and hours per week spent on homework (see Appendix A).

The HSB achievement tests were administered to the sophomore cohort in the spring of the base year (1980) and first follow-up (1982). In order to assess achievement gains, we used the base year and first follow-up raw scores on five cognitive tests: vocabulary, reading, math (the sum of two mathematics subtests), science, and writing. In addition, we included the respective standardized scores from a composite measure of performance in vocabulary, reading, and math. All score distributions showed slight positive skew, though not sufficient to indicate a floor effect and justify transformation.

School Variables

School variables were obtained by combining data from two sources: the entire HSB student file (disabled and nondisabled), aggregated to the school level; and the HSB school file, containing information provided by principals. The variables represented those factors hypothesized to influence the relationship between graduation status and school achievement. Some were selected on the basis of previous school-level analyses of HSB data (Harnisch, 1987; Lee & Bryk, in press; Rock et al., 1986); others were included because of their relevance to the subpopulation under study (e.g., availability of special resource personnel, minimum-competency requirements, alternate program offerings, remedial facilities, extent of mainstreaming). These variables, detailed in Appendix B, were grouped under five categories: demographic characteristics, teachers and instructional quality, discipline climate, academic climate, and curricular structure.

Variables showing highly skewed distributions (percentage of minority students, number of disabled students, percentage of high school dropouts) were dichotomized.

Variables showing less extreme departures from normality were transformed by taking the square root (e.g., number of specialist resource personnel). Values for missing data were imputed. Relationships among the school-level variables did not support the use of OLS estimates for data imputation, so we substituted the mean, median, or mode depending on the type of data and nature of the respective distribution. A similar procedure was adopted for outliers.

Analytical Models

Our analysis was conceptualized as a two-level HLM in which we estimated two equations: a within- and a between-school model. The within-school model related individual students' 1982 tested achievement to their graduation status (graduate/dropout), while controlling for 1980 tested achievement and other student background characteristics. The between-school model treated the within-school parameter representing graduation status as random and tried to explain variability in this parameter as a function of selected school factors thought to moderate the graduate/dropout-achievement relationship.

For this analysis, we specified the within-school model using only a subset of variables listed in Appendix A. Preliminary examination of the data revealed sufficient variability within schools to estimate only six random parameters. As a result, we chose the student background characteristics found to be significant in Alexander et al.'s (1985) analysis. We had little substantive interest in the relationships between student achievement and student background characteristics. Our purpose for including these variables was to minimize the influence of any pre-existing differences between graduates and dropouts and thereby obtain relatively unbiased estimates of the "effect" of staying in school.

Our within-school model regressed 1982 tested achievement (1982ACH) for student i in school j as a function of 1980 tested achievement (1980ACH), sex (SEX), race (MINORITY), socioeconomic status (SES), high school grades (GRADES), absenteeism (ABSENT), and graduation status (STAYER), plus random error (e_{ij}). The equation took the form:

$$1982ACH_{ij} = B_{0j} + B_{1j}1980ACH + B_{2j}SEX + B_{3j}MINORITY + B_{4j}SES + B_{5j}GRADES + B_{6j}ABSENT + B_{7j}STAYER + e_{ij}$$

Preliminary examination of the data showed no significant between-school variability in the SEX or SES relationships. As a result, we fixed these slopes (i.e., set their residual variances to zero) for all analyses. The variables 1980ACH, SES, GRADES, and ABSENT were centered around their respective school means. SEX, MINORITY, and STAYER were dummy variables and we retained their 1/0 coding. The eight parameters may be interpreted as follows:

B_{0j} = The mean 1982 achievement for the average male, nonminority student who dropped out of school j.

B_{1j} = The degree to which initial differences in 1980 (sophomore) achievement relate to 1982 achievement differences.

B_{2j} = The mean difference between the achievement of female and male students in school j.

B_{3j} = The mean difference between the achievement of minority and nonminority students in school j.

B_{4j} = The degree to which SES differences among students in school j relate to achievement.

B_{5j} = The degree to which differences in high school grades among students in school j relate to achievement.

B_{6j} = The degree to which differences in absenteeism among students in school j relate to achievement.

B_{7j} = The mean difference between the achievement of students who stay in school j and those who drop out early.

Our between-school model was formulated in stages. First, we specified an unconditional or random regression model for each parameter assumed to vary across schools. As noted earlier, level 2 and 4 of k are not included:

$$B_{kj} = Y_{k0} + u_{kj} \qquad \text{for } k = 0,13, 5, 6, 7$$

where Y_{k0} (the gamma coefficients) are the mean within-school regression coefficients adjusted for other variables in the model, and u_{kj} are random errors associated with each school.

Second, we examined the extent of variability in the within-school parameters. Here, our interest centered on the parameter representing the effect of staying in school (B_{7j}).

HLM imposes a measurement model on the B_{kj}, so the key concern is the amount of parameter variance relative to sampling variance—only true parameter variances can be explained by school factors.

Third, though not reported in the present paper, if sufficient variability across schools was found, we would formulate a more elaborate between-school model in order to identify those school factors that are responsible for moderating the graduate/dropout-achievement relationship. The between-school model would represent the variability in B_{7j} as a function of school-level variables (e.g., AVSES, TCHQUAL, HOMEWK) and random error (u_{jk}). For example, the equation might take the form:

$$B_{7j} = Y_{0k} + Y_{1k}AVSES + Y_{2k}TCHQUAL + Y_{3k}HOMEWK + u_{jk}$$

School characteristics that provide high cognitive return for students with disabilities should be those that have a positive relationship with the effect of STAYER. Ideally, such variables would account for all the parameter variance in B_{7j}; that is, no residual parameter variance would be left after all relevant school factors had been incorporated into the between-school model.

Results and Discussion

Within School

Results from testing the unconditional model for each *B* coefficient in the within-school equations showed no significant SES relationship ($p > .05$) and no variability across schools in the slope for ABSENT. These results were obtained for all six cognitive tests (composite, vocabulary, reading, math, science, writing). Therefore, we deleted SES from our within-school models and fixed ABSENT to facilitate convergence in HLM's estimation routine. Results of fitting the reduced models are given in Tables 2 through 7. All results are for weighted analyses.

Insert Tables 2 - 7 about here

The gamma coefficients show the mean within-school regression equations for each test. The average school achievement scores of dropouts (the coefficients for within-school base) are greater than those reported elsewhere (e.g., Alexander et al., 1985). However, they pertain to nonminority males only. All variables show significant relationships, except for an absence of a sex difference in reading scores and an only marginal contribution of absenteeism for science achievement. The absence of a significant relationship between student achievement and SES is puzzling as it contradicts the findings of Lee and Bryk (in press), among others. Perhaps it can be attributed to the truncated nature of our sample (i.e., those students who have disabilities), especially within school. For most tests, s .aying in school, good grades, and high initial entry-level ability are positively associated with 1982 tested achievement. In the other direction, females, minority students, and students with a high level of absenteeism tend to do worse n 1982 tested achievement.

The significant results for the STAYER coefficient indicate mean differences in achievement gains between students who stay in school and those who drop out for all cognitive tests. Thus, staying in school yielded considerable cognitive return for students with disabilities—at least in so far as the tests measured the cognitive abilities described.

Figure 1 summarizes the results in terms of adjusted gains in pretest standard deviation units, using the standard deviations of the 1980 tests reported by Alexander et al. (1985). On the composite measure, the effect size is .08. On the five tests in specific subject areas, the effect sizes are strongest in writing (.36), vocabulary (.21), and reading (.19), and weakest in science (.15) and math (.09). The poor showing of the mildly disabled students in science and math probably is to be expected given a preference for a general or vocational rather than an academic curriculum, especially among students with learning disabilities.

Insert Figure 1 about here

While larger than those for the general high school population as reported by Alexander et al. (1985) and Rock et al. (1986), the effect sizes are consistent with those reported for females and minorities (see Rock et al., 1986). The results reinforce the trend for disadvantaged students to demonstrate greater return from staying in school. Conversely, to use Rock et al.'s (1986) words, such students are "proportionately bigger losers when they drop out of school" (p. 374). The pattern of effects across subject areas is also the same as that reported for disadvantaged students; greater gains in the language-development areas of vocabulary, writing, and reading, and smaller gains in science and math (see Rock et al., 1986).

Between School

Only tentative results at the between-school level can be reported because of the small n per school and the small amount of within-school variability. While data from the entire sample were used in estimating the within-school regression coefficients (above), only 33 to

50 schools contained sufficient variability to support OLS estimation and hence provide the information necessary to model between-school variability. This is reflected in the reliability estimates and the calculation of chi-squares for the random effects (see Tables 2 through 7).

Typically base estimates are more reliable than the regression coefficients and this is the case in most of our analyses. However, the reliabilities are much smaller than those found in other research using HLM (cf., Lee & Bryk, in press). In part, this might reflect the unreliability of the tests—especially given the subpopulation. Mostly, however, it reflects the small number of schools and students within schools on which our estimates are based. The reliability of the STAYER coefficient ranged from .038 for science to .181 for the composite. Hence, much of the observed variability in the regression coefficient is sampling variance and cannot be explained by school factors.

The chi-square results, also shown in the tables, show the results of homogeneity of variance tests. These indicate on which cognitive tests school-level effects are most likely to be found. Results indicate significant variation in the STAYER slope (p less than or equal to .001) for vocabulary and writing—at least among the 34 or 36 schools in which there was sufficient variability to compute OLS estimates. The hypothesis of slope homogeneity for the STAYER coefficient could not be rejected for the other four tests.

We obtained preliminary indications of the school variables likely to explain variability in the STAYER slope for vocabulary and writing by regressing the Empirical Bayes residuals from the unconditional models on school characteristics, taking each school factor separately (see Appendix B). For vocabulary, these univariate results suggest that the effect of schooling may be moderated by school type (SECTOR) (Y = -.32, t = -29.92) and/or school socioeconomic status (AVSES) (Y = .67, t = 35.51), and possibly the quality of academic instruction (TCHQUAL) (Y = .71, t = 32.12), reports of disciplinary problems (DISCLIM) (Y = -1.15, t = -31.41), and the percentage of students in the academic program (AVACPGM) (Y = .97, t = 31.94). For writing, the results suggest a similar set of variables: school type (Y = -.82,

t = -40.18), school socioeconomic status (Y = 1.62, t = 47.89), quality of academic instruction (Y = 1.39, t = 36.17), discipline problems (Y = -2.19, t = -34.05), and percentage of students in the academic program (Y = 2.63, t = 48.91). In addition, three other variables may have moderating effects: school average of hours spent on homework (AVHOMWK) (Y = 2.18, t = 42.96), parent interest (Y = .76, t = 40.68), and participation in vocational education programs (Y = -.30, t = 31.15). Of course, there is considerable collinearity among these school variables, so these results need to be interpreted cautiously.

Conclusion

It could be argued that the results of the present study overestimate the effects of staying in school for students with disabilities. Given error of measurement and our inability to control only a few student background characteristics, it might be argued that the parameter estimates are inflated. However, two factors give us reason to doubt such arguments.

One, because our analysis takes into account the nested structure of the data (i.e., students within schools), we have controlled for a large number of selection artifacts that are only imperfectly controlled in conventional student-level analyses. For this reason, as well as the fact that our estimates are more precise than those that ignore dependence among students within schools, we believe our estimates are much more accurate than those reported in other value-added studies of the effects of schooling.

Two, even when we include all variables found to be significant in previous student-level studies (see Appendix A) in the within-school model, and test the model by fixing parameters, we find little change in the parameter estimates representing the effect of staying in school. This result obtains for all test measures. Our estimates are remarkably robust over the variables included in the within-school model once 1980 achievement is entered, as well as over the iterations specified for HLM and the choice of school-level weight.

Our results at the between-school level, of course, are much more tentative. The nature of our sample and the manner in which we specified the within-school model are inadequate to support OLS estimates from a sufficient number of schools to warrant serious exploration at the between-school level. In a future analysis, we hope to provide a more powerful test at the between-school level by capitalizing on variation among all students within schools—disabled as well as nondisabled. This may be done by specifying a more elaborate within-school model to handle estimation with sparse data. For such a model, disability would be dummy coded and the model would include interaction terms that show the decrements (or increments) to the prediction coefficients for disabled students (cf., Braun, Jones, Rubin, & Thayer, 1983).

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APPENDIX A: Description of Student Background Characteristics

SEX: The HSB composite variable based on codes from the base year questionnaire, the base year Student Identification Pages, and the first follow-up questionnaire. Dummy coded: 1 = female, 0 = male.

MINORITY: A dummy variable based on the HSB composite variable (RACE), coded: 1 = black/hispanic, 0 = otherwise.

SES: The standardized score from the HSB base year composite variable (BYSES) or, if missing, from the first follow-up composite variable (FUSES).

GRADES: Achieved grades reported in the first half of the sophomore year from the HSB composite variable (HSGRAD), scored on an eight-point scale and recoded, ranging from 8 = "mostly A's" to 1 = "mostly below D".

ABSENT: The self-reported number of unexcused absences from school in the first half of the sophomore year (BB016). Responses range from "21 or more" (coded 7) to "none" (coded 1).

LOCCNB: The mean of the base year questions BB058B, BB058E, B058F, BB058G, where 4 = high and 1 = low.

MEDASP: Mother's educational aspirations for the student (BB066), ranging from 5 = graduate/professional school to 1 = less than high school.

NONSCHL: The number of reported types of nonschool-related learning experiences: music lessons (YB056A), out-of-state travel (YB056B), dance lessons (YB056C), museum (YB056D), travel outside U.S. (YB056F).

CURRIC: Student's curriculum type from the HSB composite (HSPROG) coded: 1 = academic, 0 = general/vocational.

STUDYAID: The number of study aids in the home: place for study (BB104A), daily newspaper (BB104B), reference books (BB104C), typewriter (BB104D), books (BB104G), calculator (BB104I).

HOMEWK: The number of hours spent on homework per week from the HSB composite variable (HSHOMEWK), where 3 = more than five hours, 2 = one to five hours, 1 = less than one hour.

APPENDIX B: Description of School-Level Variables

I. Demographic Characteristics

SECTOR: An effects-coded dichotomous variable representing original school type obtained from the HSB composite (HSTYPE) coded: 1 = public, -1 = Catholic.

SURBAN: An effects-coded dichotomous variable representing community type of original school from the HSB composite (HSURBAN) coded: 1 = nonrural (suburban + urban), -1 = rural.

REGION: An effects-coded dichotomous variable representing region of country of original school from the HSB composite (HSREG) coded: 1 = non-South (north-east + north-central + west), -1 = South.

SIZE: Total enrollment of the school as reported by the principal (SB002A) divided by 100.

HIMNRTY: An effects-coded dichotomous variable representing percentage of minority students as reported by the principal (SB0093S, SB0094S) coded: 1 = greater than 40% minority black or hispanic, -1 = otherwise.

HIHANDC: An effects-coded dichotomous variable representing number of students with disabilities as reported by the principal (SB034) coded: 1 = more than 65 disabled, -1 = otherwise.

AVSES: School average of the student-level variable SES.

AVACBKGD: School average of a student-level variable ACADBKGD, after Lee and Bryk (in press). ACADBKGD is a factor composite of the HSB variables: taken remedial English (BB011A) and/or Math (BB011B)—a dummy variable called REMEDIAL, coded 1 = if student took either, 0 = otherwise; expected to attend college in the 8th grade (BB068A); has been read to before starting school (BB095); and has repeated a grade before starting high school (FY59). Student-level factor loadings were: REMEDIAL -.33, BB068A .34, BB095 .24, FY59 -.22. The factor had an eigenvalue of .33 and accounted for 8.35% of the common variance.

II. Teachers and Instructional Quality

TCHINTR: School average of students' rating of their teachers interest in them (BB053E).

STFPBLM: Mean of principals' reports about staff absenteeism and lack of commitment and motivation (SB056E, SB056F).

TCHQUAL: School average of students' rating of the quality of academic instruction (BB053C).

SPECRES: Total number of specialist resource personnel: counselors (SB039B), remedial specialists (SB039E), and psychologists (SB039G). A square-root transformation was applied to this variable.

III. Discipline Climate

DISCLIM: A composite index (mean) based on: (i) school average of factor scores from students' reports about the incidence of students talking back to teacher (YB019C), refusal to obey instructions (YB019D), fighting with each other (BY019E), and attacking teachers (YB019F); student-level factor loadings were: YB019C .70, YB019D .73, YB019E .59, YB019F .46; the factor had an eigenvalue of 1.58, accounting for 39.42% of the common variance. (ii) school average of factor scores from students' reports about their own discipline problems in school (BB059B), suspension or probation (BB059D), and cutting classes (BB059E); student-level factor loadings were: BB059B .53, BB059D .51, BB059E .40; the factor had an eigenvalue of .70, accounting for 23.41% of the common variance.

SAFETY: Percentage of students who felt safe in the school environment; school average of dummy coded BB059F (1 = safe, 0 = not safe).

AUTHRTY: School average of students' mean rating of the effectiveness (BB053F) and fairness (BB053G) of discipline within the school.

IV. Academic Climate

AVHOMWK: School average of hours per week students spent on homework, obtained from HSHOMEWK.

AVATTAC: School average of factor composite based on student attitudes toward getting good grades (YB052AA and YB052AB) and interest in academics (BB008AB, BB008AC, BB008BB, BB008BC). Student-level factor loadings were: YB052AA .73, YB052AB .72, BB008AB .13, BB008AC .09, BB008BB .12, BB008BC .07. The factor had an eigenvalue of 1.09, accounting for 18.21% of the common variance.

AVACPGM: Percentage of students in the academic program (from HSPROG).

MINCREQ: An effects-coded dichotomous variable showing whether seniors are required to pass a minimum competency test in order to graduate, obtained from SB023, coded: 1 = yes, -1 = no.

AVREMED: The percentage of students taking remedial English or remedial math (school average of REMEDIAL based on BB011A, BB011B).

HIDROP: An effects-coded dichotomous variable representing the percentage of students who drop out as reported by the principal (SB014) coded: 1 = greater than 15% drop out, -1 = otherwise.

PARINTR: Parents' interest in students and school as reported by principal (mean of SB056C, SB056D).

V. Curricular Structure

SCHLSPEC: An effects-coded dichotomous variable representing specialization of school (SB003) coded: 1 = school for vocational education, physically disabled, educationally or emotionally disabled, or other; -1 = general high school.

SCHLTIME: Time spent in schooling measured as the product of number of days in school year (SB005), duration of standard class period (in hours) (SB006), and the number of standard class periods the average student has each day (SB007A).

MATHSCC: Number of math and science courses offered by school: second-year algebra (SB018A), calculus (SB018D), chemistry (SB018E), geometry (SB018K), physics (SB018P), and trigonometry (SB018S).

LASOTHC: Number of liberal arts and sciences and other courses offered by school: auto mechanics (SB018C), drama (SB018F), driver training (SB018G), economics (SB018H), ethnic or black studies (SB018I), family life or sex education (SB018J), third-year Spanish (SB018L), third-year German (SB018M), third-year French (SB018N), home economics (SB018O), psychology (SB018Q), Russian (SB018R), wood or machine shop (SB018T).

ALTPROG: Number of alternative programs offered by school: credit by contract (SB029AA), travel for credit (SB029AB), work experience or occupational training credit (SB029AC), college board advanced placement courses (SB029AD), student exchange program (SB029AE), alternative school program (SB029AF), program for pregnant girls or mothers (SB029AG), continuation school (SB029AH), program for gifted or talented (SB029AI), bilingual program (SB029AI), upward bound (SB032A), talent search (SB032B), junior ROTC (SB032I).

TITLEI: An effects-coded dichotomous variable showing whether school participated in ESEA Title I program for economically disadvantaged, obtained from SB032C1, coded: 1 = yes, -1 = no.

VOCED: Extent of school's participation in programs sponsored by the Vocational Education Act of 1963: sum of dichotomous variables showing students' participation in consumer and homemaking education (SB032H1), basic programs (SB032H2), special needs (SB032H3), cooperative vocational education (SB032H4), and high school work-study program (SB032H5).

ABILGRP: An effects-coded dichotomous variable showing whether school used homogeneous ability grouping for the 10th- or 12th-grade English classes (SB019, SB020) coded: 1 = yes, -1 = no.

MINCREM: An effects-coded dichotomous variable showing whether school had a remedial program for students who fail minimum competency test (SB025G) coded: 1 = yes, -1 = no.

REMLAB: An effects-coded dichotomous variable showing whether school had remedial English or math lab (SB027E) coded: 1 = yes, -1 = no.

MAINSTR: A composite (mean) index of extent of mainstreaming of students with disabilities based on placement of special students in regular classes only (coded 3), special and regular classes (coded 2), and special classes only (coded 1) (SB035A, SB035B, SB035C, SB035D, SB035E, SB035F, SB035G, SB035H, SB035I, SB035J, SB035K, SB035L).

Table 1
Distribution of Mildly Disabled Students per School

Number of Students	Number of Schools	Percent	Cumulative Frequency	Cumulative Percent
1	85	9.1	85	9.1
2	145	15.5	230	24.6
3	157	16.8	387	41.1
4	161	17.2	548	58.6
5	143	15.3	691	73.9
6	100	10.7	791	84.6
7	58	6.2	849	90.8
8	27	2.9	876	93.7
9	23	2.5	899	96.1
10	17	1.8	916	98.0
11	9	1.0	925	98.9
12	6	0.6	931	99.6
13	1	0.1	932	99.7
14	2	0.2	934	99.9
15	1	0.1	935	100.0

Note: Office of Educational Research and Improvement, U.S. Department of Education, Center for Statistics. (1986, April). High school and beyond 1980 sophomore cohort second follow-up (1984) data file user's manual. Washington, DC: National Center for Educational Statistics.

Table 2
Unconditional Model for Composite Test

		Gamma	Standard Error	t statistic	p
For BASE					
	Mean	47.52	0.14	331.45	.000
For STAYER					
	Mean	0.85	0.13	6.70	.000
For SEX*					
	Mean	-0.76	0.07	-10.97	.000
For MINORITY					
	Mean	-2.42	0.10	-23.55	.000
For GRADES					
	Mean	0.96	0.04	26.91	.000
For ABSENT*					
	Mean	-0.37	0.02	-15.17	.000
For 1980ACH					
	Mean	0.60	0.01	94.13	.000

*Residual variance for this parameter was set at zero.

Random Parameter	Estimated Parameter Variance	df	Chi-square	p
BASE	21.16	33	65.26	.001
STAYER slope	8.63	33	39.53	.201
MINORITY slope	9.40	33	56.17	.007
GRADES slope	0.92	33	52.81	.016
1980ACH slope	0.03	33	61.46	.002

Reliability of School-Level Random Effects	
BASE	0.370
STAYER	0.181
MINORITY	0.183
GRADES	0.107
1980ACH	0.109

Table 3
Unconditional Model for Vocabulary

		Gamma	Standard Error	t statistic	p
For BASE					
	Mean	10.86	0.08	130.43	.000
For STAYER					
	Mean	1.14	0.08	15.10	.000
For SEX*					
	Mean	-0.92	0.04	-21.25	.000
For MINORITY					
	Mean	-1.91	0.06	-32.60	.000
For GRADES					
	Mean	0.65	0.02	31.97	.000
For ABSENT*					
	Mean	-0.33	0.02	-20.95	.000
For 1980ACH					
	Mean	0.47	0.01	65.84	.000

*Residual variance for this parameter was set at zero.

Random Parameter	Estimated Parameter Variance	df	Chi-square	p
BASE	5.62	35	97.04	.000
STAYER slope	2.02	35	69.91	.001
MINORITY slope	1.81	35	66.32	.001
GRADES slope	0.24	35	49.09	.057
1980ACH slope	0.04	35	59.19	.007

Reliability of School-Level Random Effects	
BASE	0.263
STAYER	0.095
MINORITY	0.084
GRADES	0.076
1980ACH	0.093

Table 4
Unconditional Model for Reading

		Gamma	Standard Error	t statistic	p
For BASE					
	Mean	8.38	0.06	130.64	.000
For STAYER					
	Mean	0.92	0.06	14.74	.000
For SEX*					
	Mean	-0.01	0.04	-0.24	.808
For MINORITY					
	Mean	-0.96	0.05	-18.91	.000
For GRADES					
	Mean	0.48	0.02	24.35	.000
For ABSENT*					
	Mean	-0.06	0.01	-4.36	.000
For 1980ACH					
	Mean	0.47	0.01	64.98	.000

*Residual variance for this parameter was set at zero.

Random Parameter	Estimated Parameter Variance	df	Chi-square	p
BASE	1.73	33	47.25	.051
STAYER slope	1.27	33	42.31	.129
MINORITY slope	1.50	33	66.00	.001
GRADES slope	0.24	33	66.42	.001
1980ACH slope	0.03	33	49.72	.031

Reliability of School-Level Random Effects	
BASE	0.145
STAYER	0.084
MINORITY	0.079
GRADES	0.075
1980ACH	0.057

Table 5
Unconditional Model for Mathematics

		Gamma	Standard Error	t statistic	p
For BASE					
	Mean	17.46	0.11	155.41	.000
For STAYER					
	Mean	0.86	0.11	8.08	.000
For SEX*					
	Mean	-0.62	0.07	-9.19	.000
For MINORITY					
	Mean	-2.43	0.08	-31.46	.000
For GRADES					
	Mean	0.87	0.03	25.77	.000
For ABSENT*					
	Mean	-0.23	0.02	-9.63	.000
For 1980ACH					
	Mean	0.57	0.01	76.15	.000

*Residual variance for this parameter was set at zero.

Random Parameter	Estimated Parameter Variance	df	Chi-square	p
BASE	8.67	50	120.18	.000
STAYER slope	4.61	50	60.56	.146
GRADES slope	0.77	50	88.70	.001
1980ACH slope	0.04	50	72.73	.019

Reliability of School-Level Random Effects	
BASE	0.299
STAYER	0.136
GRADES	0.112
1980ACH	0.124

Table 6
Unconditional Model for Science

		Gamma	Standard Error	t statistic	p
For BASE					
	Mean	10.58	0.07	160.15	.000
For STAYER					
	Mean	0.70	0.06	11.34	.000
For SEX*					
	Mean	-0.56	0.04	-14.56	.000
For MINORITY					
	Mean	-1.85	0.05	-39.38	.000
For GRADES					
	Mean	0.30	0.02	18.34	.000
For ABSENT*					
	Mean	-0.03	0.01	-2.02	.043
For 1980ACH					
	Mean	0.46	0.01	69.25	.000

*Residual variance for this parameter was set at zero.

Random Parameter	Estimated Parameter Variance	df	Chi-square	p
BASE	2.65	34	54.31	.015
STAYER slope	0.97	34	44.21	.113
MINORITY slope	0.91	34	59.41	.005
GRADES slope	0.04	34	49.86	.039
1980ACH slope	0.01	34	28.61	<.500

Reliability of School-Level Random Effects	
BASE	0.147
STAYER	0.038
MINORITY	0.059
GRADES	0.006
1980ACH	0.020

Table 7
Unconditional Model for Writing

		Gamma	Standard Error	t statistic	p
For BASE					
	Mean	8.20	0.06	139.69	.000
For STAYER					
	Mean	1.83	0.06	29.95	.000
For SEX*					
	Mean	1.29	0.04	32.68	.000
For MINORITY					
	Mean	-1.57	0.05	-31.48	.000
For GRADES					
	Mean	0.44	0.02	22.17	.000
For ABSENT*					
	Mean	-0.17	0.01	-11.79	.000
For 1980ACH					
	Mean	0.44	0.01	61.22	.000

*Residual variance for this parameter was set at zero.

Random Parameter	Estimated Parameter Variance	df	Chi-square	p
BASE	0.99	33	46.88	.055
STAYER slope	1.81	33	69.86	.000
MINORITY slope	1.07	33	54.65	.010
GRADES slope	0.24	33	75.39	.000
1980ACH slope	0.03	33	75.87	.000

Reliability of School-Level Random Effects	
BASE	0.078
STAYER	0.107
MINORITY	0.068
GRADES	0.066
1980ACH	0.070

Figure 1. **Effect size by cognitive test (using STAYER).**