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ABILITY GROUPING AND STUDENT ACHIEVEMENT IN ENGLISH, HISTORY, AND SCIENCE

BY

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Abstract

Many educators believe that the practice of ability grouping, or tracking, should be abolished. They argue that students assigned to lower-level classes are harmed in terms of academic achievement, while those assigned to upper-level classes do not benefit. Using a nationally representative student survey, we examine the effects of tracking on achievement in English, history and science. Our results are remarkably consistent across the three subjects: tracking indeed harms students placed lower-level classes, but students placed upper-level classes clearly benefit from the practice.

I. Introduction

Most secondary schools in the U.S. group students according to their ability. Classes that can be considered academically heterogenous are relatively rare (Rees et al. 1996). Although the practice of ability grouping, or tracking, has long been the norm, it has recently come under attack from reformers.[1] In fact, the American educational system seems poised on the brink of a major organizational shift. Schools across the country have begun implementing a policy of "detracking," and important advocacy groups such as the National Education Association and the National Governors Association are on record as supporting such a policy.

The impetus to detrack can be traced, at least in part, to a growing sense among educators that students placed in upper-level classes do not realize academic gains from being sequestered, whereas students placed in lower-level classes would do better academically if allowed to attend classes with their more advanced peers. If this belief is correct, then a detracked environment is clearly pareto superior to grouping students based on their ability. If, however, it proves to be false, then a policy of detracking could potentially have adverse effects on the American educational system and the future productivity of the U.S. work force. For this reason the effects of ability grouping should be of interest to a wide array of researchers and policy makers.

In this paper we extend our previous work, which focused on mathematics achievement, by examining the effects of tracking on 10th grade English, history and science achievement.

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[1]Leading this reform movement are researchers in the field of education such as Jeannie Oakes, Robert Slavin, and Anne Wheelock. For more information on their views see Oakes (1992), Braddock and Slavin (1993), and Wheelock (1992).

We estimate a two-stage model to account for potential selection bias, and control for factors such as prior achievement, teacher quality, and other educational inputs that could also influence student outcomes. Our results suggest that the effects of tracking are strikingly similar across subjects. In English, history, and science, students who are placed in lower-level classes are indeed harmed by the practice of ability grouping. However, students placed in upper-level classes clearly benefit as compared to being assigned to a heterogenous environment. This latter result is contrary to the conventional wisdom in education circles and suggests a much more cautious policy stance than that currently in vogue.

II. The Model

Following Argys et al. (1996), the effect of tracking on achievement is estimated using a two-stage procedure. Imagine that there are M possible tracks into which a student can be sorted. We can define a latent variable, I^*, in the following fashion,

$$(1) \qquad I^*_{is} = z_i\gamma_s + u_{is} \qquad (s = 1,2,\ldots,M) \quad (i = 1,2,\ldots,N),$$

where students are indexed by the subscript i, z_i is a vector of student and school characteristics, and u_{is} is an error term. A student is assigned to the sth track

$$(2) \qquad \text{iff } I^*_{is} > \text{Max } I^*_{ij} \qquad (j = 1,2,\ldots,M,\ j \neq s).$$

Assuming that u_{is} are independently and identically distributed, and follow a type I extreme value distribution, then equation (2) represents a multinomial logit model from which selectivity correction terms, λ_{is}, can be calculated and used in the second stage of the estimation procedure.[2] If track assignment is based in part on unobservables that are also correlated with achievement (e.g., student motivation), omission of the selectivity correction terms will lead to biased results.

As is now standard practice in the literature, let achievement in a particular subject in period *t* (A_{ist}) be a function of prior achievement (A_{it-1}), a vector of student, teacher, and class characteristics (x_{is}), and an error term. Adding the selectivity correction terms, λ_{is}, gives,

$$(3) \qquad A_{ist} = \alpha_s A_{it-1} + \beta'_s x_{is} + \epsilon_{is}.$$

This equation represents an education production function, the parameters of which are estimated separately by subject and track using Ordinary Least Squares. The impact of ability grouping can be determined by using these estimates to calculate predicted achievement in each track for the "mean" individual in the sample. Thus, predicted achievement in track *s* is simply calculated as

$$(4) \qquad E(A_{st}) = \alpha_h A_{t-1} + \beta'_s x + \delta_s \lambda_s.$$

[2] See Maddala (1983, p. 276) and Lee (1983).

III. The Data

The *National Education Longitudinal Study of 1988* (NELS) is a representative student survey conducted by the National Center for Education Statistics containing detailed information on the family background and academic performance of the 1988 cohort of eighth graders, who were subsequently resurveyed in the 10th grade.[3] It is unique in that it provides the opportunity to link a large sample of students with information about their parents, schools, teachers, and classroom environment. While other researchers have investigated many dimensions of the tracking debate, much of this work has been qualitative in nature, raising doubts about the generalizability of its findings. Our continuing study is the first to draw on a data set of such breadth and detail.

Students were tested in the spring of their 8th and 10th grade years. English, history, and science test scores, scaled from 1 to 100, provide our measures of achievement.[4] The tests were designed by the Educational Testing Service to accurately assess cognitive skills. The same version of each test was given to all students in the 8th grade, but several versions were administered in the 10th grade, the level of difficulty being determined by student performance on the 8th grade test. The 10th grade scores were made

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[3]To date, students have been surveyed in the 8th (1988), 10th (1990), and 12th (1992) grades, and two years after leaving school (1994). Our study utilizes data from 8th and 10th grades only.

[4]See Argys et al. (1996) for an examination of the effects of tracking on mathematics achievement. Achievement in English was measured through a reading comprehension exam. Achievement in history was measured through an American history/citizenship/geography exam.

compatible through the use of Item Response Theory.[5]

We concentrate on the effect of 10th grade track on end-of-year 10th grade achievement.[6] Information with regard to class track was provided by teachers in each of the three subjects examined. Specifically, teachers were asked, "[w]hich of the following best describes the achievement level of the 10th graders in this class compared with the average 10th grade student in the school? Higher achievement levels, average achievement levels, lower achievement levels, or widely differing achievement levels." Using the answers to this question, we classify classes as above average, below average, average, or heterogeneous. Measures of educational inputs are also obtained from responses to the teacher questionnaire, and are specific to a particular subject/class.

We restrict our analysis to students who attended public schools in both the 8th and 10th grade, and for whom information is available on all variables used in the analysis. In English our sample consists of 4419 students. In history and science the sample sizes are 1860 and 2926, respectively. Variable definitions, means, and standard deviations are given in the appendix.

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[5]IRT is a method that uses the pattern of right, wrong, and omitted responses to the questions on each test and the difficulty, discriminating ability, and "guessability" of each question to place each student on a continuous scale, regardless of the test he or she was given. A core of items shared among the different test forms makes it possible to establish a common scale.

[6]We assume that the effect of 8th grade inputs to the educational process, including the track to which a student was assigned, are captured through the inclusion of 8th grade achievement in the 10th grade production function. No information on students' 9th grade is available.

IV. Achievement Equation Results

Tables 1 through 3 present results from the achievement equations by subject and track.[7] As is often the case with education production function models, many of the estimated coefficients are not significant at conventional levels (see Hanushek, 1989). However, some patterns in the data are discernable. For instance, there is evidence that female students fare worse than males in history and science, holding constant prior achievement and class-level inputs. In English, however, the two sexes perform comparably on the 10th grade exams except in the average track where females actually outperform males.

For the most part, the coefficients of the race/ethnicity variables are not statistically significant at conventional levels. However, there is evidence that black and Hispanic students do worse than whites in terms of science achievement. This differential is present in almost all of the tracks. In addition, Asian students assigned to above average science and English classes, average science classes, and below average history classes perform better than whites.

Socio-economic status is positively related to performance in almost all of the tracks. The exceptions to this rule can be found in the below average equations for English and history, where the coefficient of socio-economic status variable is insignificant.

None of the teacher characteristics seem to be particularly good predictors of performance on the 10th grade exams. There is, however, an interesting pattern with regard

[7] Track selection results are presented in the appendix, Tables A2 through A4.

to the class size results. In the below average track, an increase in class size is often associated with an increase in achievement, whereas in other tracks the opposite (and expected) relationship between class size and achievement is typically found. The positive relationship between class size and achievement in the lower-level track may serve as a caution against thinking of class size as exogenously determined when it could in fact be jointly determined with unobserved factors that also impact on achievement.[8]

Finally, the selection correction terms are statistically significant in three of the achievement equations, indicating the presence of sample selection bias. In the below average equation for English, the coefficient of λ is positive, which suggests that unobservables associated with assignment to that track lead to higher English scores. In the heterogenous and above average equations for science, the coefficients of λ are also positive and significant. No evidence of sample selection bias was found for history.

V. The Effect of Tracking on Achievement

The effect of tracking can be measured by comparing predicted achievement in above average, below average or average classes with predicted achievement in heterogenous classes. For instance, according to our calculations, if the typical English student were assigned to an above average class he or she could expect a test score of 64.66 (Table 4).

[8]The same pattern of results was found in mathematics (Argys et al., 1996)

This same student would score 60.59 if assigned to a heterogenous class. In history, assignment to an above average class is associated with a score of 69.51, approximately 3 percentage points greater than the score associated with placement in a heterogenous class, while in science the corresponding differential is closer to 4 percentage points.[9] These results suggest that tracking benefits those students placed in above average classes.

However, other students are clearly harmed by tracking. The typical English student would score 57.97 if placed in a below average class, or 2.6 percentage points less than the score associated with placement in a heterogenous class. The typical science student loses almost 6 percentage points by being placed in a below average as opposed to a heterogenous class. In history the loss associated with assignment to a below-average class is approximately 3 percentage points.[10]

In order to create a common scale across subjects, Table 5 presents the above differentials as a percentage of the heterogenous score.[11] The largest achievement differentials seem to be in science. Placement in an above average class is associated with a gain of 6.4 percent as compared to placement in a heterogenous class, and placement in a below average class is associated with a loss of more than 10 percent. In English the above average/heterogenous differential is 6.7 percent, but the below average/heterogenous

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[9]These differentials are statistically significant at the .05 level.

[10]The history differential is not statistically significant at the .10 level.

[11]For instance, predicted English achievement in an above average class is 64.66. Predicted heterogenous achievement is 60.59. Thus the percent differential reported in Table 4 is

$$(64.66 - 60.59)/60.59 = 6.72\%$$

differential is only 4.3 percent. In history the corresponding differentials are 4.9 and 4.5 percent. These results suggest that the effect of tracking on 10th grade achievement is substantial. If the effects of tracking are cumulative, over the course of an entire high school career the gap between tracked and untracked students should be even larger than indicated by these estimates.

VI. Conclusion

The effect of tracking on achievement is remarkably similar for each of the three subjects examined. In English, history, and science placement in an above average class is associated with an achievement gain, whereas placement in a below average class is associated with a loss in achievement. This pattern of results is consistent with our previous work (Argys et al., 1996), but is at odds with current thinking in education circles. It suggests that reform efforts may be based on an overly optimistic assessment of the opportunity costs involved with detracking.

The decision to track or detrack is of considerable import. Our results suggest that students currently placed into lower-level tracks graduate with a broad-based deficit in human capital. This deficit should translate into lower wages and fewer job opportunities.[12] It may also be associated with increased dependence on public assistance programs and even

[12] See Murnane et al. (1995) for a discussion of the link between student test scores and labor market outcomes.

criminal behavior. On the other hand, students who are assigned to the upper-level tracks probably reap benefits in terms of wages and job opportunities. In addition, one can imagine the existence of positive externalities associated with allowing the most gifted individuals in society to reach their full potential. The loss in leadership ability and creativity due to a policy of detracking is potentially immense. A full accounting of the costs and benefits of tracking is obviously needed before a policy of detracking is actively pursued in our nation's schools.

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Appendix

VARIABLE DEFINITIONS

10th Grade Score	- Student's IRT (Item Response Theory) score on a scale of 1 to 100. Exams in were taken in the spring of the student's 10th grade year.
8th Grade Score	- Student's IRT (Item Response Theory) score on a scale of 1 to 100. Exams were taken in the spring of the student's 8th grade year.
Socio-economic Status	- A composite variable supplied by NCES and constructed using information on parents' occupation, education, and income. This variable is normally distributed with a mean of 0 and standard deviation equal to 1.
Female	- Dichotomous variable equal to 1 if student female, equal to 0 otherwise.
Black	- Dichotomous variable equal to 1 if student black, equal to 0 otherwise.
Hispanic	- Dichotomous variable equal to 1 if student Hispanic, equal to 0 otherwise.
Asian	- Dichotomous variable equal to 1 if student Asian, equal to 0 otherwise.
Native American	- Dichotomous variable equal to 1 if student Native American or Alaskan, equal to 0 otherwise.
Above Average	- Dichotomous variable equal to 1 if students in 10th grade math class were considered by teacher to have "higher achievement levels" than the average student in the school, equal to 0 otherwise.
Average	- Dichotomous variable equal to 1 if students in 10th grade math class were considered by teacher to have "average achievement levels" as compared to the average student in the school, equal to 0 otherwise.

Below Average	- Dichotomous variable equal to 1 if students in 10th grade math class were considered by teacher to have "lower achievement levels" than the average student in the school, equal to 0 otherwise.
Heterogenous	- Dichotomous variable equal to 1 if students in 10th grade class were considered by teacher to have "widely differing achievement levels," equal to 0 otherwise.
Class Size	- Number of pupils in student's 10th grade class.
School Experience	- Years of teaching experience at current school for student's 10th grade teacher.
Total Experience	- Years of total teaching experience for student's 10th grade teacher.
Substitute Teacher	- Dichotomous variable equal to 1 if student's 10th grade teacher was a substitute, equal to 0 otherwise.
Part Time	- Dichotomous variable equal to 1 if student's 10th grade teacher was employed part-time, equal to 0 otherwise.
Absent More than 7 Days	- Dichotomous variable equal to 1 if student's 10th grade teacher was absent more than seven days in the fall semester, equal to 0 otherwise.
Certified in Subject	- Dichotomous variable equal to 1 if student's 10th grade teacher was certified by the state to teach in the relevant subject, equal to 0 otherwise.
Education Specialist Degree	- Dichotomous variable equal to 1 if student's 10th grade teacher held a education specialist or professional diploma based on at least one year of work beyond the bachelors, equal to 0 otherwise.
Masters	- Dichotomous variable equal to 1 if student's 10th grade teacher held a master's degree, equal to 0 otherwise.
PhD	- Dichotomous variable equal to 1 if student's 10th grade teacher held a doctorate degree, equal to 0 otherwise.

Undergraduate Major in Subject	- Dichotomous variable equal to 1 if student's 10th grade teacher was a major in the relevant subject as an undergraduate, equal to 0 otherwise.
Graduate Major in Subject	- Dichotomous variable equal to 1 if student's 10th grade teacher was a major in the relevant subject in graduate school, equal to 0 otherwise.
Urban	- Dichotomous variable equal to 1 if school in an urban community, equal to 0 otherwise.
Suburban	- Dichotomous variable equal to 1 if school in a suburban community, equal to 0 otherwise.
Rural	- Dichotomous variable equal to 1 if school in a rural community, equal to 0 otherwise.
South	- Dichotomous variable equal to 1 if school in south, equal to 0 otherwise.
West	- Dichotomous variable equal to 1 if school in west, equal to 0 otherwise.
North Central	- Dichotomous variable equal to 1 if school in north central, equal to 0 otherwise.
Northeast	- Dichotomous variable equal to 1 if school in northeast, equal to 0 otherwise.
Percent Free Lunch	- Percent of school enrollment receiving free lunch.
Percent Black	- Percent of school enrollment black.
Percent Hispanic	- Percent of school enrollment Hispanic.
10th Grade Enrollment	- Total 10th grade enrollment.

Table A1. Sample Means by Subject
(standard deviations in parentheses)

Variables	**English**	**History**	**Science**
8th Grade Score	54.7 (19.8)	57.6 (17.8)	47.2 (17.63)
10th Grade Score	61.5 (21.6)	66.7 (18.7)	56.1 (20.41)
Socio-economic Status	-.057 (.748)	.010 (.101)	-.021 (.765)
Female	.507 (.500)	.506 (.500)	.518 (.500)
Black	.104 (.306)	.068 (.251)	.107 (.309)
Hispanic	.118 (.323)	.082 (.275)	.105 (.306)
Asian	.056 (.231)	.052 (.221)	.053 (.227)
Native American	.013 (.113)	.010 (.100)	.016 (.124)
Urban	.217 (.412)	.184 (.387)	.214 (.410)
Rural	.165 (.371)	.208 (.406)	.176 (.381)
South	.378 (.485)	.339 (.473)	.402 (.491)
West	.209 (.407)	.181 (.385)	.215 (.411)
North Central	.272 (.445)	.272 (.445)	.229 (.420)
Percent Free Lunch	21.0 (21.2)	18.96 (17.6)	19.8 (19.8)
Percent Black	13.1 (39.2)	8.97 (15.9)	16.4 (68.4)
Percent Hispanic	11.0 (39.4)	6.84 (15.0)	12.97 (68.1)
10th Grade Enrollment	339 (224)	321 (197)	345 (211)
Class Size	23.6 (6.0)	25.2 (7.1)	23.8 (6.7)
Experience at School	4.01 (2.60)	4.20 (2.58)	4.07 (2.70)
Total Experience	5.67 (2.76)	5.79 (2.81)	5.31 (2.97)
Part-time	.013 (.113)	.006 (.077)	.013 (.112)
Substitute	.002 (.048)	.010 (.098)	.003 (.052)
Certified in Subject	.990 (.098)	.999 (.046)	.995 (.074)
Education Specialist Degree	.073 (.260)	.076 (.266)	.046 (.211)
Masters	.533 (.499)	.502 (.500)	.543 (.498)
PhD	.012 (.111)	.010 (.103)	.022 (.145)
Undergraduate Major in Subject	.756 (.430)	.811 (.392)	.741 (.438)
Graduate Major in Subject	.294 (.455)	.375 (.484)	.347 (.476)
Absent > 7 Days	.052 (.221)	.052 (.221)	.030 (.171)
Sample Size	4419	1860	2926

Table A2. The Determinants of Track Assignment in English: Multinomial Logit Model Results (absolute t-statistics in parentheses).

Variables	*Tracks*		
	Above Average	**Average**	**Below Average**
Constant	2.301 (4.7)	.354 (0.9)	2.078 (4.3)
8th Grade Score	.033 (2.1)	.011 (0.8)	-.061 (1.4)
8th Grade Score Squared	.00001 (0.1)	-.00015 (1.2)	.0002 (1.4)
Female	.306 (2.9)	-.054 (0.6)	-.389 (3.4)
Black	-.211 (0.9)	-.155 (0.7)	-.236 (1.0)
Hispanic	-.479 (2.2)	-.203 (1.1)	-.292 (1.3)
Asian	.484 (2.0)	-.199 (0.9)	-.668 (2.1)
Native American	.845 (1.8)	-.049 (0.1)	.564 (1.1)
Socio-economic Status	.401 (4.9)	.001 (0.0)	-.593 (6.4)
Urban	-.359 (2.4)	-.412 (3.1)	-.442 (2.8)
Rural	.112 (0.7)	.486 (3.6)	-.124 (0.7)
South	.131 (0.8)	.424 (2.7)	-.612 (3.2)
West	-.404 (2.2)	.253 (1.5)	-.317 (1.5)
North Central	-.219 (1.4)	.163 (1.1)	.044 (0.2)
Percent Free Lunch	.003 (0.8)	-.010 (3.3)	-.012 (3.4)
Percent Black	.008 (2.1)	-.010 (2.8)	.009 (2.5)
Percent Hispanic	.009 (2.4)	.006 (1.7)	.005 (1.4)
10th Grade Enrollment[a]	.213 (6.4)	-.155 (4.9)	-.159 (4.4)
Log Likelihood	-5021.839		
Sample Size	4419		

[a] Coefficient multiplied by 100.

Note: omitted track is heterogenous.

Table A4. The Determinants of Track Assignment in Science: Multinomial Logit Model Results (absolute t-statistics in parentheses).

Variables	*Tracks*		
	Above Average	**Average**	**Below Average**
Constant	-.275 (0.4)	1.901 (3.3)	3.665 (5.6)
8th Grade Score	.035 (1.5)	.007 (0.3)	-.072 (2.8)
8th Grade Score Squared	.0000 (0.0)	-.0000 (0.0)	.0005 (1.7)
Female	.371 (2.6)	.097 (0.7)	-.400 (2.6)
Black	-.110 (0.4)	-.012 (0.1)	.052 (0.2)
Hispanic	-.444 (1.7)	-.425 (1.9)	-.234 (0.9)
Asian	.922 (2.5)	.335 (0.9)	-.406 (0.9)
Native American	-.826 (1.7)	-.889 (2.2)	-1.264 (2.3)
Socio-economic Status	.204 (1.9)	-.183 (1.8)	-.710 (6.0)
Urban	-.049 (0.3)	-.187 (1.1)	.037 (0.2)
Rural	.224 (1.1)	.397 (2.0)	-.089 (0.4)
South	-.359 (1.5)	-.198 (0.8)	-.601 (2.3)
West	-.342 (1.2)	-.262 (1.0)	-.406 (1.4)
North Central	-.498 (1.9)	-.387 (1.6)	-.632 (2.3)
Percent Free Lunch	-.005 (1.3)	-.016 (4.6)	-.015 (3.8)
Percent Black	-.002 (0.6)	-.003 (1.1)	-.001 (0.4)
Percent Hispanic	-.000 (0.1)	.004 (1.3)	-.001 (0.2)
10th Grade Enrollment[a]	-.056 (1.4)	-.050 (1.4)	-.044 (1.0)
Log Likelihood	-3319.741		
Sample Size	2926		

[a] Coefficient multiplied by 100.

Note: omitted track is heterogenous.

Table A3. The Determinants of Track Assignment in History: Multinomial Logit Model Results (absolute t-statistics in parentheses).

Variables	*Tracks*		
	Above Average	**Average**	**Below Average**
Constant	-.335 (0.4)	1.891 (2.7)	1.758 (1.9)
8th Grade Score	.010 (0.4)	-.002 (0.1)	.004 (0.1)
8th Grade Score Squared	.0002 (0.9)	.0001 (0.3)	-.0003 (0.9)
Female	.166 (1.0)	-.180 (1.3)	-.562 (3.0)
Black	-.233 (0.6)	-.208 (0.6)	.312 (0.8)
Hispanic	-.146 (0.4)	-.159 (0.6)	-.056 (0.2)
Asian	.958 (2.4)	-.497 (1.3)	-.707 (1.1)
Native American	-1.23 (1.3)	-.668 (1.0)	.757 (1.1)
Socio-economic Status	.187 (1.6)	-.044 (0.4)	-.562 (3.9)
Urban	.583 (2.4)	.804 (3.6)	.315 (1.1)
Rural	-.390 (1.8)	-.213 (1.2)	-.773 (2.9)
South	-.745 (2.8)	-.359 (1.4)	-.640 (2.1)
West	-1.17 (4.0)	-.821 (3.1)	-.656 (2.0)
North Central	-1.80 (7.2)	-1.13 (4.9)	-1.90 (6.2)
Percent Free Lunch	.007 (1.2)	-.008 (1.6)	-.006 (0.9)
Percent Black	.025 (3.5)	.009 (1.2)	.001 (0.2)
Percent Hispanic	-.021 (2.9)	-.004 (0.8)	.000 (0.0)
10th Grade Enrollment[a]	-.033 (0.6)	-.053 (1.1)	-.060 (1.0)
Log Likelihood	-2114.006		
Sample Size	1860		

[a] Coefficient multiplied by 100.

Note: omitted track is heterogenous.

Table 1 Estimates of English Achievement Equations by Track (absolute t-statistics in parentheses).

Variables	*Tracks*			
	Above Average	**Average**	**Below Average**	**Heterogenous**
Constant	13.83 (1.4)	10.98 (1.7)	7.30 (1.1)	22.13 (2.2)
8th Grade Score	1.34 (9.7)	1.15 (9.5)	.311 (1.6)	1.07 (6.2)
8th Grade Score Squared	-.0054 (6.0)	-.0040 (3.5)	-.0026 (1.6)	-.0026 (1.7)
Female	.253 (0.3)	1.24 (1.8)	-1.76 (1.4)	1.02 (0.9)
Black	.036 (0.0)	-1.42 (1.2)	-1.25 (0.9)	-4.68 (2.1)
Hispanic	3.32 (2.3)	-.492 (0.5)	-1.93 (1.2)	-.655 (0.3)
Asian	3.35 (2.1)	2.23 (1.3)	1.04 (0.3)	-.269 (0.1)
Native American	-4.08 (1.2)	-3.03 (0.9)	-2.20 (0.6)	1.18 (0.2)
Socio-economic Status	1.96 (2.6)	2.44 (4.8)	-2.00 (1.5)	1.90 (2.2)
Class Size	-.182 (2.8)	-.025 (0.4)	.148 (1.8)	.038 (0.4)
School Experience	-.071 (0.3)	.277 (1.6)	-.312 (1.2)	.111 (0.4)
Total Experience	.217 (1.0)	-.302 (2.0)	.186 (0.7)	-.197 (0.7)
Part Time	-5.59 (1.6)	5.31 (1.8)	-2.43 (0.7)	4.26 (0.4)
Substitute	-8.85 (0.7)	5.15 (0.8)	-2.03 (0.2)	-5.27 (0.5)
Certified in English	1.44 (0.4)	.463 (0.1)	3.35 (0.7)	-4.79 (0.7)
Education Specialist Degree	-.563 (0.4)	.272 (0.2)	-.779 (0.4)	-1.84 (0.8)
Masters	-.156 (0.2)	.967 (1.4)	1.10 (1.0)	-1.63 (1.3)
Phd	.927 (0.3)	-8.35 (2.7)	4.13 (0.7)	6.19 (0.9)
Undergraduate English Major	1.29 (1.3)	-2.05 (2.5)	1.94 (1.6)	-.128 (0.1)
Graduate English Major	.155 (0.2)	.253 (0.3)	2.92 (2.5)	-.538 (0.4)
Absent > 7 Days	-3.59 (2.0)	-1.68 (1.1)	4.32 (2.1)	2.32 (0.8)
λ	-.574 (0.2)	2.68 (0.9)	10.93 (2.7)	-3.47 (1.1)
R-Squared	.526	.470	.476	.548
Sample Size	1195	1869	729	626

Note: The dependent variable is 10th grade score in English.

Table 2. Estimates of History Achievement Equations by Track
(absolute t-statistics in parentheses).

Variables	*Tracks*			
	Above Average	**Average**	**Below Average**	**Heterogenous**
Constant	37.43 (2.8)	13.98 (1.0)	25.65 (1.9)	23.05 (2.7)
8th Grade Score	.853 (4.7)	.545 (3.7)	.388 (1.2)	.442 (1.8)
8th Grade Score Squared	-.0015 (1.1)	.0017 (1.3)	.0031 (1.0)	.0022 (1.0)
Female	-1.80 (1.7)	-1.59 (1.8)	.719 (0.4)	1.33 (0.9)
Black	-.420 (0.2)	-3.19 (1.7)	-3.34 (1.1)	.155 (0.0)
Hispanic	-.317 (0.1)	1.00 (0.6)	-6.11 (2.3)	-3.18 (1.3)
Asian	-.219 (0.1)	.482 (0.2)	15.28 (2.2)	-.439 (0.1)
Native American	6.83 (0.9)	.094 (0.0)	-.385 (0.1)	-19.33 (3.2)
Socio-economic Status	2.08 (2.7)	1.43 (2.2)	-.737 (0.5)	2.56 (2.6)
Class Size	-.163 (2.5)	.115 (1.6)	.231 (1.6)	.002 (0.0)
School Experience	.567 (2.3)	.454 (1.9)	-.728 (1.5)	.309 (0.7)
Total Experience	-.025 (0.1)	-.698 (0.3)	.456 (1.0)	.079 (0.2)
Part Time	-.244 (0.0)	-7.18 (1.7)	---	-16.70 (1.4)
Substitute	-.320 (0.1)	7.17 (1.2)	6.87 (1.0)	22.12 (2.6)
Certified in History	-10.06 (0.9)	15.77 (1.3)	-3.05 (0.3)	---
Education Specialist Degree	-6.90 (3.7)	.281 (0.2)	2.21 (0.7)	2.11 (0.5)
Masters	-1.60 (1.5)	-1.19 (1.2)	-.448 (0.2)	1.59 (1.0)
Phd	-.711 (0.1)	-8.29 (1.2)	2.47 (0.5)	2.54 (0.5)
Undergraduate History Major	1.75 (1.2)	-.294 (0.3)	-.573 (0.3)	1.08 (0.5)
Graduate History Major	2.43 (2.4)	-.132 (0.1)	-.096 (0.0)	1.37 (0.8)
Absent > 7 Days	-3.75 (0.1)	-2.13 (0.9)	.924 (0.2)	1.98 (0.4)
λ	.147 (0.1)	-3.35 (0.9)	.857 (0.2)	3.21 (1.2)
R-Squared	.584	.547	.480	.578
Sample Size	513	813	234	300

Note: The dependent variable is 10th grade score in history.

Table 3. Estimates of Science Achievement Equations by Track
(absolute t-statistics in parentheses).

Variables	*Tracks*			
	Above Average	**Average**	**Below Average**	**Heterogenous**
Constant	-25.36 (1.7)	22.76 (2.4)	16.73 (2.5)	2.58 (0.2)
8th Grade Score	1.59 (7.3)	.596 (4.3)	.681 (2.4)	1.25 (5.0)
8th Grade Score Squared	-.0056 (3.6)	.0013 (1.0)	-.0003 (0.1)	-.0052 (2.1)
Female	.517 (0.1)	-2.50 (3.3)	-2.31 (1.3)	-3.76 (2.5)
Black	-5.81 (3.5)	-4.25 (3.2)	-4.07 (2.4)	-4.00 (1.7)
Hispanic	-4.02 (2.2)	-1.86 (1.4)	-1.56 (0.9)	.858 (0.4)
Asian	6.37 (2.4)	3.97 (2.2)	4.73 (1.1)	-2.56 (0.6)
Native American	-3.91 (1.0)	-2.62 (0.8)	-4.83 (0.8)	8.59 (2.0)
Socio-economic Status	7.34 (5.5)	3.48 (6.2)	2.45 (1.4)	4.18 (3.6)
Class Size	-.120 (2.2)	-.088 (1.2)	-.095 (1.1)	-.089 (0.9)
School Experience	-.245 (1.0)	.425 (2.0)	.611 (1.8)	.474 (1.0)
Total Experience	.216 (0.9)	-.182 (0.9)	.580 (1.9)	-.512 (1.1)
Part Time	-1.70 (0.4)	-4.47 (1.3)	-6.68 (0.7)	6.13 (1.1)
Substitute	6.03 (0.5)	12.38 (1.6)	2.43 (0.3)	-28.05 (3.2)
Certified in Science	---	6.58 (0.8)	7.63 (1.9)	-4.01 (0.3)
Education Specialist Degree	-2.01 (1.0)	1.45 (0.8)	.456 (0.2)	.496 (0.1)
Masters	.716 (0.7)	.939 (1.1)	3.11 (2.2)	1.65 (1.0)
Phd	-2.48 (1.0)	.362 (0.1)	-1.50 (0.3)	-1.78 (0.3)
Undergraduate Science Major	.539 (0.5)	.219 (0.2)	-1.66 (1.2)	1.87 (1.1)
Graduate Science Major	.869 (0.9)	1.04 (1.2)	-.703 (0.5)	2.97 (1.7)
Absent > 7 Days	6.49 (2.6)	-2.10 (0.8)	3.76 (1.0)	1.30 (0.4)
λ	21.16 (3.2)	-3.06 (0.9)	-.703 (0.1)	7.62 (1.7)
R-Squared	.568	.513	.392	.624
Sample Size	838	1307	479	302

Note: The dependent variable is 10th grade score in science.

Table 4. Predicted Achievement by Track
(standard errors in parentheses)

	Above Average	Average	Below Average	Heterogenous
English N = 4419	64.66 (0.50)	61.72 (0.36)	57.97 (0.82)	60.59 (0.65)
History N = 1860	69.51 (0.64)	66.85 (0.45)	63.30 (1.40)	66.26 (0.90)
Science N = 2926	59.68 (0.54)	55.92 (0.39)	50.26 (0.87)	56.07 (0.82)

Table 5. Achievement Differentials as a Percent of Heterogenous Achievement.

	Above Average-Heterogenous Differential	Average-Heterogenous Differential	Below Average-Heterogenous Differential
English	6.7**	1.9	-4.3*
History	4.9**	0.9	-4.5
Science	6.4**	0.3	-10.4**

*Statistically significant at the .10 level; **significant at the .05 level.