Sector Differences in High School Course Taking: A Private School or Catholic School Effect?

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This study investigated the influence of attending public, Catholic, or independent secondary schools on students' course taking in mathematics, using data on 3,374 high school graduates of 184 urban and suburban high schools from the High School Effectiveness Supplement to the National Education Longitudinal Study of 1988. With hierarchical linear modeling methods and accounting for factors associated with selection into schools in different sectors, the authors found that the private school students took more advanced mathematics courses than did the public school students. However, after controlling for additional differences in selectivity between the two types of private schools, they found that Catholic schools influence their students' course-taking behaviors especially strongly and that the social distribution of course taking is especially equitable in Catholic schools.

Of the academic behaviors that strongly influence how much high school students learn, perhaps the most important is the courses the students take. Although course work is linked to learning across the curriculum, the strongest link may be with mathematics because students have little access to learning in this subject outside school. By the time their children reach secondary school, many parents are unwilling or unable to offer informal instruction in mathematics. Nor do adolescents typically attain mathematics skills from the outside world (at least, not the skills required for success on standardized tests). Thus, young people learn mathematics largely in their high school classes.

There is considerable variation in both the number and type of mathematics courses that students take. Students' decisions in this regard are influenced by their demographic and mathematical backgrounds and by the schools the students attend. Schools plan curricula on the basis of what they think students need and want to learn, and students cannot take courses unless the schools offer them. Postsecondary plans are also crucial, since students often take advanced courses to "look good" to colleges.

Considerable research supports the importance of schools in determining students' courses of study, and much of it has contrasted the type and amount of academically rigorous course work offered by and

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completed in private and public schools. Catholic high schools enroll students whose demographic and academic backgrounds are similar to those who attend public schools. Elite private (independent) schools are typically more academically and economically selective than are Catholic schools (through rigorous entrance requirements and high tuition). However, little research has compared students in the elite schools to their counterparts in either Catholic or public high schools.

Catholic and elite private schools are similar in several ways: (1) voluntary attendance, (2) required tuition, (3) control over students' (and teachers') entry and exit, and (4) a primary focus on academics (most students are college bound). But the two types of schools differ considerably in (1) the types of students enrolled, (2) tuition charged, and (3) students' academic preparation at entry. Thus, although all private schools are selective to some extent, Catholic schools are less so.

In the study presented here, we explored the extent to which schools influence the mathematics courses their students take. Students with high educational aspirations, particularly those who are more advantaged socially and academically, take more such courses and are more likely to choose private schools. Do private schools have independent effects on students' pursuit of high-level course work, beyond the types of students they attract? If so, are there differences between how Catholic and independent schools affect their students in this regard?

BACKGROUND

Design of High School Curricula

Differentiation versus constraint. What students learn in high school is largely a function of the courses they take, and they select courses from what is offered (the curriculum). A secondary school's curriculum codifies choices about what knowledge is deemed worthy of transmission to younger generations and within the capacity of its students to master. Attempts to reach a consensus on both common understandings and individual differences in students' abilities and interests reflect a dual pattern of differentiation and constraint in most U.S. high schools (Kleibard 1986; Oakes, Gamoran, and Page 1992).

The curriculum-differentiation approach reflects an ideology that the knowledge available to students should be based on the students' aptitudes and tastes; the underlying dynamic attaches different purposes and missions to educating students in a single building. In contrast, the constrained-curriculum approach is based on a belief in the appropriateness of common academic goals for all participants. According to this approach, students' choices and options are limited. The high school curriculum can be constrained through limited opportunity, as well as through a proactive emphasis on moving students through a common set of experiences.

A student or a school phenomenon? Although most research on this topic is framed within the "student choice" model, another strand views the link between course taking and achievement as primarily a school, rather than a student, phenomenon. This model recognizes that students partake in the curriculum to the extent that it is available and, more subtly, depending on the encouragement they receive (Lantz and Smith 1981; Lee and Ekstrom 1987; Useem 1991). If a school offers a modest number of courses, largely academic, it is no surprise that these are the

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courses that the students take (Lee 1993). Thus, a constrained curriculum is evidenced both structurally, through the number of academic and nonacademic options provided, and behaviorally, through the actual variety of choices that students make. School differences in the design and purpose of curricula were historically linked to school sector, and they still are.

Curricular Differences by Sector

Public schools. The history of the U.S. high school curriculum has been well documented (Conant 1959; Oakes 1985; Powell, Farrar, and Cohen 1985; Tyack 1974). Around 1900, secondary enrollments burgeoned, especially in cities, because of migration to urban areas, immigration from abroad, and new child labor laws (Cremin 1988). Debates about what to offer this new school population polarized around the two alternatives described earlier: (1) a core of courses that were appropriate for all (the constrained model) or (2) varied offerings to accommodate a variety of students (the diversified model). The debate was settled in favor of the latter. A major objective of the comprehensive public high school curriculum was, and still is, to keep students in school until graduation.

In the past 15 years, there has been a move away from the differentiated curriculum toward more students taking more challenging courses (Clune and White 1992; McDonnell 1988; National Commission on Excellence in Education 1983). Some districts have introduced transitional mathematics courses to help move general-track students into academic courses (White, Gamoran, Smithson, and Porter 1996). There is solid public and empirical support for this policy, since taking academic courses is a primary determinant of achievement (Gamoran 1987; Jones, Davenport, Bryson, Bekhuis, and Zwick 1986).

Catholic schools. Early in the century, not all schools abandoned a commitment to rigorous academic training (Kleibard 1986). Catholic schools faced the same demographic shifts as city public schools and felt obliged to accommodate new immigrants (most of whom were Catholic). Despite the similar populations in public and Catholic secondary schools early in the century, the two sectors' curricula diverged. On the basis of fundamentally different views of what an appropriate secondary education should be, the comprehensive model still dominates U.S. public high schools, whereas the narrow academic curriculum typifies Catholic schools. This distinction demonstrates a basic disagreement about whether social and intellectual differences among students are best addressed by diversifying instruction and content.

Independent schools. Elite private schools still embrace the tradition shared by all high schools a century ago: preparing students for selective colleges. Their socializing role has always been social reproduction for children of the elite (Baltzell 1958; Cookson and Persell 1985; Mills 1956). Upper- and middle-class families who choose independent schools seek a shared class culture, which will ensure their children's right to belong to the circle of the wealthy and powerful and to serve as society's leaders (Lewis and Wanner 1978). Although the proportion of the U.S. population that is socioeconomically elite has gradually but steadily declined, their hold on leadership positions in most parts of U.S. life persists (Cookson and Persell 1985; Moore 1979). The clientele of inde-

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pendent schools has become more diversified in the past two decades (Alba and Moore 1982; Schneider and Slaughter 1988), but the purpose of these schools has not changed. Seldom confronted with the same pressures as Catholic schools to enroll immigrants and poor children, there was (and still is) little debate about what a "proper" curriculum should be: college preparatory (Lee and Marks 1992).

Cross-sector comparisons. Although most U.S. adolescents are educated in public schools, about 12 percent were in private schools in 1985-86, and 60.2 percent of the students in private schools were enrolled in Catholic schools (Benson and McMillen 1991). These figures have remained constant over the past decade (Smith, Young, Bae, Choy, and Alsalam 1997). The absolute number of students in independent schools is not high, but the influence of graduates argues for considering these schools' efficacy. However, because of the relatively low number of students, few studies have singled out independent schools for special consideration. Rather, these schools are either studied separately or lumped into a heterogeneous group called "non-Catholic private schools" (see, for example, Coleman, Hoffer, and Kilgore 1982).

A relatively sturdy finding of research on the efficacy of Catholic and public high schools in the past decade is that sector differences in schools' academic organization is a major reason why Catholic school students achieve at higher levels and why achievement in these schools is more equitable among students of different backgrounds (Bryk, Lee, and Holland 1993; Coleman et al. 1982; Lee and Bryk 1988, 1989b). Recent research, within a school-restructuring framework, has added empirical support for the importance of a school's academic organization to both excellence and equity (Lee and Smith 1995; Lee et al. 1997).

Why Mathematics?

Studies have found that the largest and most consistent effects of tracking and grouping on achievement are in mathematics (Gamoran 1987; Lee and Bryk 1988, 1989b). Both logic and evidence support the fact that mathematics is an area of the curriculum in which learning is particularly responsive to school experiences (Murnane 1975). First, measures of mathematical performance more closely approximate the training that students receive in school than do measures of other school subjects. Second, the high school mathematics curriculum is relatively standardized in both content and sequence. Teachers rely heavily on a few widely used texts, and the training of mathematics teachers is relatively traditional (Romberg 1992).

Although a close alignment of teaching and testing may not converge on the best mathematical concepts, it suggests that mathematics is a fruitful subject in which to locate a study of the effects of schools on students' course-taking behaviors. In sum, we targeted this subject for several reasons: (1) its linear sequencing, (2) the ability to identify course content by course title (for example, Algebra II has more specified content than English II), (3) differentiation of the curriculum by track or level, (4) its special importance for further education, and (5) the fact that it is learned almost entirely in school. A focus on mathematics allowed us to capture the multidimensional nature of schools' influence on individual students' behavior in relation to the curriculum.

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Research Questions

Our aim was to identify the primary determinants of high school seniors' mathematics course work, emphasizing the role schools play in the process. Because of the differences in curricular structure by high school sector, we focused on the type of high school a student attends (public, Catholic, independent) as a potentially important element of his or her course-work decisions, recognizing the need to take account of the selectivity bias among students in schools. The three research questions we posed were as follows:

Question 1: Course taking and schools. Does how far students advance in high school mathematics depend on the high schools they attend, over and above students' personal inclinations toward academic activities? We expected average course taking to vary significantly among schools.

Question 2: Course taking and sector. Assuming that schools differ in the highest course their students take, do private schools benefit their students in academic course taking? Even after the characteristics of students, as well as the compositional and academic differences among schools, were accounted for, we expected a residual benefit of private schools for students' course taking.

Question 3: Course taking in Catholic and independent schools. Is there a difference in the encouragement that all Catholic and independent school students receive to move further in the high school mathematics curriculum, or are the two private school sectors the same in this regard? Once the relative selectivity of students into the two types of private schools was taken into account, we hypothesized that Catholic schools exert an especially strong influence on their students to take advanced mathematics courses. We also expected the Catholic school effect to be stronger for students of relatively lower ability.

METHOD

Sample and Data

Data. We used data from the High School Effectiveness Study (HSES), a supplement to the U.S. Department of Education's study, the National Education Longitudinal Study of 1988 (NELS:88), collected in conjunction with the first (1990) and second (1992) follow-ups of NELS:88. The purpose of HSES was to increase the within-school sample sizes of students in 247 of the over 700 high schools chosen by multiple students in the original NELS sample to facilitate school-effects studies, such as the one described here. The HSES design called for standardizing within-school samples in certain schools to about 30 students in each school. The HSES high schools that were selected were drawn from the 30 largest metropolitan sampling areas (in and around large cities) in the United States and enrolled at least 5 of the original NELS students in 1990. As a result, the HSES schools were located in suburban or urban areas (rural schools in NELS were dropped). Researchers who consider using these data should study the HSES user's manual (Scott et al. 1996) carefully.

Sample. We chose a subset of students who were sophomores and seniors in the same high schools in 1990 and 1992 and schools that had at least five HSES students and were public, Catholic, or independent schools (members of the National Association of Independent Schools, NAIS).[1] In addition, for this subset, the following information was available: (1) data from the student and

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school questionnaires for both years; (2) mathematics test scores for both years; (3) complete data on gender, socioeconomic status (SES), and race-ethnicity; and (4) full transcript data for the four secondary years. We selected schools with at least five HSES students because we needed adequate within-school samples for the analytic techniques we used and chose NAIS-member schools to eliminate small private schools without an identifiable mission or clientele. Similar school selection criteria were used in other NELS and HSES studies (see, for example, Lee, Burkam, Smerdon, Chow-Hoy, and Geverdt 1998; Lee and Smith 1995; Lee et al. 1997).

These criteria resulted in an analytic sample of 3,374 high school students in 184 high schools, with an average of 18.3 students per school, all of whom had since graduated from high school. The school sample included 133 public schools (72.3 percent), 29 Catholic schools (15.8 percent), and 22 independent schools (12.0 percent). All the HSES high schools, but not all the students, were part of the original NELS data collection effort. The NELS design called for considerable oversampling of private schools (and students in them), which allowed us to draw valid conclusions about these schools; however, we had to take this oversampling into account.

Weights. A major advantage of the HSES over NELS is that the HSES data file provides valid school-level weights. Both our major descriptive and multivariate analyses used one of the three school-level weights supplied or the data file, which we adjusted to a mean of 1 in our sample. The student sample consisted of two distinct groups: (1) those from the original NELS study and (2) those who were added in 1990. The original NELS students were sampled with certainty (probability = 1); the newly sampled HSES students were selected randomly from the remaining 10th graders. Thus, students in the two groups had different sampling probabilities. We constructed a weight appropriate for analyses across the full HSES sample of students, which we used to compute descriptive statistics on the students. More information on the weights and other variables we used is in the Appendix (for a detailed explanation of the HSES sampling framework and construction of school weights, see Scott et al. 1996). Using these weights, our results may be generalized to U.S. public, Catholic, and independent high schools and students in suburban and urban areas in the early 1990s.

Measures

Dependent variable. The dependent variable, drawn from students' transcripts, measures the *highest-level mathematics course completed* during the students' four years of high school. Since the U.S. mathematics curriculum is sequential, it measures not only how "far" in the curriculum students progressed but how "deeply." The variable, close to being normally distributed, ranges from 1 (no math courses) to 8 (calculus), with a mean of about 5. Courses included in each level are listed in the Appendix. That many studies have documented that mathematics course taking is a major determinant of learning in that subject argues for the importance of exploring this outcome.[2]

Selection variables on students. One set of control variables includes standard demographic measures: *SES, gender,* and *minority status.* The relationship between these demographic measures and course-taking behaviors (as well as achieve-

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ment) has been well documented. There is also substantial evidence for the association of demographics with the types of schools students attend. Because we focused on sector differences in this study, the incomes of students' families (a component of SES) were especially important (since private schools charge tuition).[3]

Besides its relationship to learning, students' course-taking behavior is also associated with students' prior ability in mathematics. Because we investigated how high schools influence their students, it seemed important to capture students' academic status when they entered high school (at the end of the 8th grade). Since a majority of the HSES students joined the sample in the 10th grade, we imputed their mathematics scores in the 8th grade on the basis of available data (see the Appendix for details). We used this variable to control for *mathematics ability.*

Selection variables on schools. Our focus was on *school sector:* public, Catholic, or independent. Since private schools enroll different types of students from public schools (and both types of private schools enroll different types of students as well), we included several school-level control variables in the multivariate analyses. Besides sector, we also controlled for the demographic composition of the high schools: *average school SES* and *minority concentration.*

Other controls focused more explicitly on school selectivity, an important consideration in any comparison of public and private schools. Private schools select students from among those who apply; parents in all sectors may also choose schools for their children. One variable captures the academic homogeneity in the school population, the *standard deviation* (SD) *of students' 8th-grade mathematics achievement* in each school. A more constrained curriculum, which surely led to less variability in course taking, is at least partly a response to the variation in the abilities of the students each school serves. Other measures also focus on a school's response to its clientele. Because course taking is at least partly a function of students' educational plans, we included *average educational expectations* as a measure of the students' demand for high-level course work. Another measure of responsiveness to students is *whether the school offers calculus,* since obviously, students cannot take this course if it is not available. We considered several other school-level controls, including school size and average 8th-grade achievement. Because both school size and average achievement did not have significant effects in any of our analytic models, we dropped them from the models.

Analytic Method

Partitioning variance. Our research questions put this study in the category of school-effects research, a common pursuit among sociologists of education. Both the research questions and the HSES data structure suggest that hierarchical linear modeling (HLM) is an ideal method of analyzing such data (Bryk and Raudenbush 1992). Since HLM is familiar in this field, we describe the three steps in our analyses only briefly. The first step of any HLM is to partition the variance in the outcome into its within- and between-group parts. This step estimated a fully unconditional HLM model and allowed us to compute the intraclass correlation (ICC)—the proportion of total variability in the dependent variable that lay systematically among the schools. For variables with low ICCs, a search for school effects would probably be unsuccessful.

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Within-school model. The second step estimated how students' characteristics influenced the outcome in each school. Our within-school (Level-1) HLM model calculated the effects of SES, minority status, gender, and mathematics ability on how far the students moved through the mathematics curriculum. It addressed Question 1.

Between-school models. Question 2 asked whether students in private high schools move further in the mathematics curriculum than do those in public schools, even when the selection characteristics of the students and their schools are taken into account. School-effects studies also investigate distributional outcomes. Our models explored average course taking and simultaneously estimated two distributional outcomes: the relationship of both mathematics ability and SES to course taking.

Another aim was to determine whether Catholic and independent schools differ in regard to course taking and its social distribution (Question 3). Thus, we had to take into account factors that influence not only the relative selectivity of public or private schools, but the differential selection of students into the two private school sectors. School factors that are positively related to average course taking and negatively related to its social distribution would be ideal, since they would induce both effectiveness and equity.

RESULTS

Descriptive Differences by Sector

Students. The means and *SDs* of all the variables are shown in Table 1 separately for the three types of schools. The variables that describe students and schools are in Panel A and Panel B, respectively. We tested two contrasts: public versus both types of private schools (see footnote b, Table 1) and Catholic versus independent schools (see footnote c, Table 1). All the contrasts among the students in Panel A are statistically significant. The students in private (especially independent) schools moved significantly further in the mathematics curriculum than did those in the public schools. The course-taking advantage of Catholic over public schools is large (effect size, ES, = .81 *SD*), but the advantage of independent over public school students is even larger (ES = 1.10 *SD*).[4]

Some of this advantage is surely related to other characteristics of students, given the greater prevalence of minority students and lower-SES students in public than in both types of private schools, as well as in Catholic than in independent schools.[5] The same pattern occurs for educational aspirations and students' mathematics ability. Although at entry, the Catholic high school students somewhat outperform their public school counterparts in mathematics (an advantage of .18 *SD*), the advantage of students in independent schools is considerable (.98 *SD* over students in Catholic schools and 1.06 *SD* over those in public schools).

Schools. The patterns are similar for the demographic composition of the schools. Although the heterogeneity of public and Catholic school students' mathematics ability is similar (10.51 and 10.79), the independent schools are more homogeneous (9.08) than the Catholic schools (ES = -.67 *SD*) in this regard. Furthermore, most of the HSES high schools and all the independent schools offer calculus, but fewer public than Catholic schools do. The pattern for expectations is similar for schools and students: The private

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Table 1. Variable Means and Standard Deviations for the Analysis of Course Taking in Mathematics[a]

A. Variables Describing Students (N = 3,374)

	Public Schools (n = 2,142)		Catholic Schools (n = 746)		Independent Schools (n = 486)	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*
Highest mathematics course completed[b,c]	5.31	1.67	6.66	1.25	7.14	1.02
Social class[b,c]	.20	.76	.48	.60	1.15	.45
Gender (female)[b,c]	.52	.50	.30	.46	.45	.50
Minority status[b,c]	.32	.47	.21	.41	.07	.26
8th-grade mathematics achievement[b,c]	37.75	12.12	39.89	11.01	50.64	8.81
Educational expectations[b,c]	16.23	2.33	16.82	2.01	18.00	1.78

B. Variables Describing Schools (n = 184)

	Public Schools (n = 133)		Catholic Schools (n = 29)		Independent Schools (n = 22)	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*
School SES[b,c]	.15	.44	.55	.25	1.06	1.02
Minority concentration[b]	.32	.33	.17	.16	.13	.14
SD, 8th-grade mathematics achievement	10.51	1.93	10.79	2.54	9.08	2.00
School offers calculus[b,c]	.75	.44	.90	.30	1.00	.00
Average years expected education[b,c]	15.76	.87	16.48	.55	17.75	.61

[a] The means in Panel A were calculated with student-level design weights; those in Panel B were calculated with school weights.

[b] Mean differences between public and private schools differ by $p < .05$.

[c] Differences between Catholic and independent schools differ by $p < .05$.

schools have higher average expectations than do the public schools, and the independent schools have higher expectations than do the Catholic schools.

The observed differences among the students and schools in Table 1 indicate a definite (and expected) pattern: The private schools are more selective than the public schools, and in the private sector, the independent schools are typically more selective than the Catholic schools. The substantial variability in selectivity

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between the sectors surely accounts for some of the large observed sector differences in the highest mathematics courses completed by their graduates. These selectivity differences supported the need for controls to investigate our research questions appropriately.

Multivariate HLMs

Partitioning variance in course taking. We computed a fully unconditional HLM model to partition the variance in the outcome into its within-and between-school components, which allowed us to compute the ICC. A sizable amount of the variance (41.3 percent) in mathematics course taking is between schools.[6] The outcome is measured reliably (lambda =.770). This finding is a preliminary positive response to Question 2. For school-effects researchers, these results document the value of the HSES. That is, increasing within-school sample sizes (the major advantage of HSES over NELS) has proved useful. An ICC of .413 is higher than has been found in school-effects studies that have explored secondary students' academic outcomes with NELS (see, for example, Lee and Smith 1995; Lee et al. 1997). Both the good reliability of the outcome and the substantial ICC suggested that our search for school effects was likely to be successful.

Within-school HLM model. Table 2 displays the results of our model (presented as HLM Level-1 beta coefficients) that explored how students' social and academic backgrounds influence their course taking. Because we coded the continuous independent variable as a *z*-score ($M = 0$, $SD = 1$) and dummy coded the categorical variables, these effects are in conventional ES (*SD*) units. All the independent variables in our Level-1 HLM were centered on the grand mean for the sample.[7] Since the relationships of SES and ability with course taking were our focus, these variables were left free to differ among schools. All the analyses used school-level weights but were unweighted within the schools.

Each student characteristic was significantly related to the outcome. Although we expected a positive relationship between SES and course taking (ES = .12 *SD*), the findings for gender and minority status were surprising. Once SES and mathematics ability were taken into account, minority and female students advanced somewhat further in the mathematics curriculum, although both effects were small (ES = .05 *SD* for gender and .10 *SD* for minority status). Since this was not our focus, we did not pursue these findings. We found that the major student characteristic that influenced course-taking behavior was ability, specifically mathematical competence on entry into high school (ES = .60 *SD*).

Chi-square tests of the HLM parameters indicated significant variability among the schools in both average course taking and the ability/course-taking slope (both $p < .001$), but the SES/course-taking slope varied only marginally among the schools. Thus, our ability to identify school effects on this parameter was limited. HLM reliabilities of the social distribution parameters were considerably lower than for the intercept. The results in Table 2 provide a definite response to Question 1: Average course taking and its distribution among students of different abilities vary significantly among schools, even when the students' demographic and academic characteristics are taken into account.

School-effects models. Table 3 presents the results of two models that focus on Questions 2 and 3. The

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Table 2. Within-School HLM Model of Highest Mathematics Course Completed (N = 3,374 students in 184 schools)

Independent Variable	HLM Beta Coefficient[a,b]
Intercept (school average)	-.020
Social class	.115***
Gender (female)	.049*
Minority status	.096**
8th-grade mathematics achievement	.599***

	Reliability	Variance Component	*SD*	Chi-square
Average course taking	.528	.118	.343	895.30***
Ability/course-taking slope	.324	.029	.172	413.53***
SES/course-taking slope	.231	.018	.137	208.34~

[a] All the effects in this table are presented as HLM beta coefficients, which represent close to within-school effect sizes.

[b] In the HLM within-school model, independent variables were centered on the grand mean for students in this sample. SES and 8th-grade mathematics achievement were allowed to vary between schools, but the residual parameter variance for gender and minority status was set to zero. These decisions hold for all HLM models in the study.

~ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

model in Column 1 displays sector effects on the three outcomes, adjusted for demographic differences among the schools (average SES and minority concentration). Column 2 shows an expanded model, in which we introduced additional school controls that took into account the full selectivity between the sectors.

We report school effects on three Level-2 HLM outcomes: (1) average course taking in mathematics, (2) the ability/course-taking slope, and (3) the SES/course-taking slope. All the results in Table 3 were adjusted for minority status and gender (the Level-1 HLM model in Table 2). To simplify the presentation and because the results changed little between the Level-1 and Level-2 HLM models, we omitted the within-school effects for gender or minority status from Table 3. On the basis of our coding of the variables, the intercept is the average of the highest course taken by the students in the public schools that did not offer calculus, with average scores on all continuous predictors.[8]

Sector-effects model. The results in Column 1 of Table 3 indicate that both the Catholic and independent school students advanced considerably further in the mathematics curriculum than did the public school students (ESs about .4 *SD* for both).[9] These findings, together with the negative coefficients for both types of private schools on the ability/course-taking slope (ESs over -.2 *SD*), indicate that the private school students moved further in the curriculum than did their

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Table 3. Full HLM Model of Highest Course Completed: Sector Effects Before and After Adjusting for Selectivity Bias (N = 184 schools)

Effect of Independent Variable	HLM Beta Coefficients: Sector Model	HLM Beta Coefficients: Bias Model
On Mean Between-School Course-taking Outcome		
Average Intercept	-.162***	-.334***
Catholic high school	.456***	.370***
Independent high school	.399**	.245~
School SES	.107*	.039
Minority concentration	.001	-.008
SD, 8th-grade mathematics achievement	—	-.052~
Schools offers calculus	—	.254**
Average educational expectations	—	.104*
On Differentiation in Course Taking by Ability Outcome		
Average ability/course-taking slope	.660***	.546***
Catholic high school	-.258***	-.248***
Independent high school	-.223*	-.185~
School SES	-.003	-.044
Minority concentration	-.024	-.015
SD, 8th-grade math achievement	—	.032
Schools offers calculus	—	.123*
Average educational expectations	—	.014
On Differentiation in Course Taking by SES Outcome		
Average SES/course-taking slope	.093*	.173*
Catholic high school	.007	.024
Independent high school	-.084	-.023
School SES	.032	.014
Minority concentration	-.021	-.027
SD, 8th-grade mathematics achievement	—	.035
Schools offer calculus	—	-.103~
Average educational expectations	—	.013

	Reliability	Variance Component	*SD*	Chi-square
Average course taking	.433	.066	.257	511.20***
Ability/course-taking slope	.277	.022	.147	301.38***
SES/course-taking slope	.210	.018	.134	195.97

~ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

public school counterparts, regardless of their ability. No school effects on the SES/course-taking slope were found. The results in Column 1 address Question 2: Both types of private schools exerted positive effects on the students' course-taking behaviors. Moreover, course taking was less related to prior ability in the private schools than in the public schools.

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Full-selectivity model. The HLM model in Column 1 of Table 3 accounts for selectivity only in the demographic composition of the schools. In the model shown in Column 2, we added additional controls for selectivity *among* the private schools. Specifically, we adjusted for heterogeneity among the students by ability, whether calculus was offered, and average educational expectations. When further selectivity was accounted for, the Catholic schools—rather than all the private schools—had an especially strong influence on both average course taking and its equitable distribution by ability (Question 3). For example, the Catholic school effect on the intercept (ES = .37 *SD*) is highly significant ($p < .001$), whereas the independent school effect (ES = .25 *SD*) is marginally so. A similar finding relates to the distribution of course taking by ability. The relationship is very strong in public schools, but significantly lower in Catholic schools (ES = -.25 *SD*, $p < .001$) and marginally lower in independent schools (ES = -.19 *SD*, $p < .10$).[10]

Although sector differences are the focus here, our results indicate the importance of between-school selectivity. The additional selectivity measures were all related to average course taking in mathematics. More important, including these measures reduced the sector effects. Because independent schools are particularly selective—they enroll more homogeneous populations, they universally offer calculus, and their students have very high expectations—their advantage on the outcomes diminished more.

Social distribution of course taking. Relative differences the distribu-

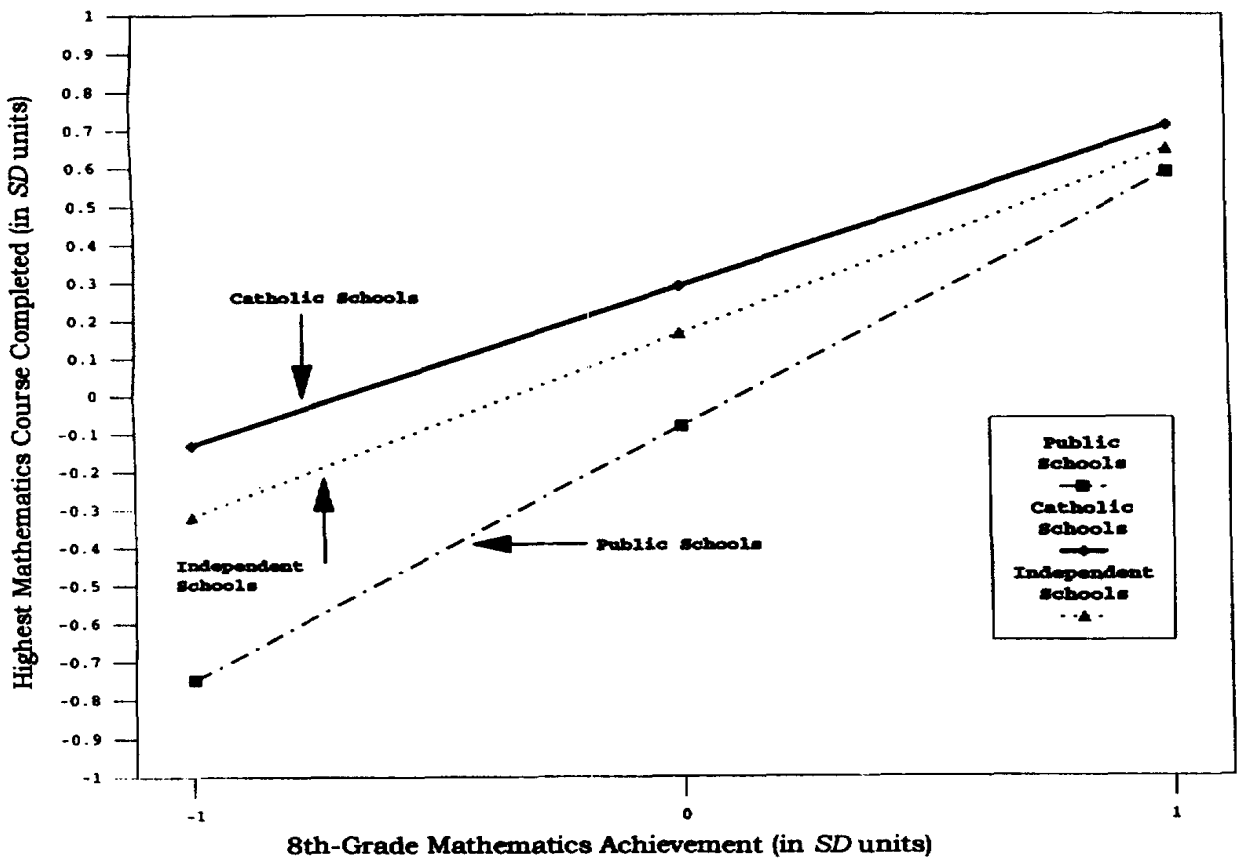

Figure 1. Relationship of Highest Course Taken in High School Mathematics with Mathematics Ability for Students in Public, Catholic, and Independent Schools

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tion of average course taking by students' mathematics ability are displayed in Figure 1. The lines (one for each sector) were plotted using gamma coefficients from Column 2 of Table 3.[11] Thus, they were adjusted for all student and school selectivity factors in that model. Since calculus was available in the majority of schools in all three sectors, the slopes and intercepts were computed for schools offering that course.

Course taking in mathematics is strongly dependent on students' ability in that subject in public, Catholic, and independent schools. However, the course-taking advantage for students of attending Catholic high schools (solid line) in relation to independent schools (dotted line) and particularly compared to public schools (dashed line) is also evident. Not only is school average course taking higher in Catholic schools, but the relationship between course taking and ability is more equitable (the slope of the line is less steep). The greatest advantage of attending private (especially Catholic) schools is for students with relatively low mathematical ability.

DISCUSSION

Private School Effects Are Not Universal

Effectiveness and equity in course taking. Our findings suggest that high schools influence the courses their students take. Even when the demographic and academic characteristics of students who attend public and private schools are taken into account, private school students take more advanced mathematics courses. The main contribution of this study, however, is to demonstrate that private school effects are sector specific. Because the students who attend Catholic high schools are different in so many ways from those who attend independent schools, we explored differences in school effects on course taking between these two types of private schools. After we took selection differences among schools and students in the Catholic and independent sectors into account, we found that Catholic schools influence their students' course-taking behaviors more than do independent schools. This finding is especially noteworthy because Catholic high school students typically are not advantaged—culturally, economically, or academically.

Another feature of our analysis was the distribution of course taking among students of various levels of ability. Although we found that both types of private schools are more equitable than public schools in this regard, our results again suggest that Catholic schools are especially equitable in who completes advanced course work. This finding suggests a normative stance toward academic pursuits for all students (especially the relatively less able) who attend Catholic schools. There is a suggestion of a similar effect in independent schools, but the advantages are smaller.

Two types of private schools. Although comparisons of Catholic and public schools have been common in the past decade or two, few studies have compared Catholic schools to other private schools or both types of schools to public schools. A major arena for such discussions has been privatization and school choice (see, for example, Chubb and Moe 1990). In discussing the relevance of research on Catholic schools to the issue of school choice, Bryk et al. (1993:311–12) concluded:

> [M]any of the positive effects found in Catholic schools are not characteristic of non-Catholic private schools. For example, the more equitable distribution of achievement, or "common school effect," that occurs in

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Catholic schools does not typify other private schools. Similarly, the reduced dropout rates and unusual effectiveness of Catholic high schools for at-risk youth are not characteristic of private schools in general.

Revisiting the "selection explanation." A common explanation for the advantages that Catholic school students have over their public school counterparts rests on selectivity. Many say, "Well, of course, these schools can take and keep whom they want and expel the rest." However, Catholic schools are not especially selective (particularly academically). We hope that our results undercut this selection explanation to discount the effectiveness of Catholic schools. Bryk et al. (1993:294) suggested that the overreliance on selectivity arguments to diminish the positive finding for Catholic schools was part of "a larger world view in which individuals are seen as primary and the operations of institutions as simply an aggregate manifestation of individuals pursuing their self-interests."

Self-selection is, of course, at work here. Students and their parents choose Catholic schools, and many of them are willing to pay the required tuition. Students and their parents who do not want an academic environment, with a focus on attending college, do not select Catholic high schools in the first place. On the other hand, these are not highly selective institutions (in either economic or academic terms). But the selection that accompanies a voluntary choice surely plays a part here. We also know that more and more families are choosing among public schools, either through explicit school-choice plans or by selecting their places of residence on the basis of the perceived or actual quality of the public schools.

Some Caveats

Weaknesses. Despite our suggestions of the important implications of the findings, we remind readers about several aspects of the data we used, the HSES, that may have influenced our findings. One is the sample, which focused on schools in the country's largest metropolitan areas and excluded rural schools. Results using HSES data thus may systematically downplay the effectiveness of public schools by excluding states (such as Kentucky and Vermont) in which public school reform is a high priority. Although rural schools were excluded from the HSES, it also made sense to structure comparisons of the type we attempted here in locations where there is access to both public and private schools, since most Catholic schools and many independent schools are located in urban and suburban areas. It is also possible that the sector differences we reported would have been smaller if the sample was representative of the entire U.S. population of public schools.

Another feature of the HSES that may have influenced our results is the data structure, specifically the lack of baseline test scores on more than half the sample. We addressed this difficulty by imputing scores for those students, on the basis of demographics and the students' mathematics test scores measured at the end of the 10th grade. Clearly, these scores were influenced by the courses the students took during their first half of high school, as well as by their ability. However, by using imputed scores for these students that were based largely on 10th-grade test scores, we probably underestimated the full impact of ability on course taking. Though both these shortcomings of the HSES may have influenced our results, the biases resulting from the two features may go in

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opposite directions.[12] Lee and Bryk's (1989a:649) argument regarding research using data from High School and Beyond (HS&B) seems equally applicable here: "Many of the student variables measured at sophomore year [in HS&B] . . . are not pure pretreatment measures, and controlling for them is likely to partial out a major portion of the effect of . . . schooling expected to result between sophomore and senior year."

Strengths. The HSES has both strengths and weaknesses compared to other data with which the sector comparisons made here could be conducted. The nonrepresentative samples of schools and the lack of baseline data for many students are clear weaknesses. However, two qualities make the HSES useful for the type of analysis we conducted. A major strength, in fact, the reason that the U.S. Department of Education invested in the HSES, is the increase in within-school sample sizes compared to the full NELS file. Studies of school effects (such as this) rely on valid and reliable estimates of within-school parameters. Having more cases on which to base such estimates has both statistical and substantive implications. Simply, more students mean better estimates. Another strength, of practical value, is the availability of school weights. Because of the original NELS sampling design, which influenced the HSES sampling design, schools that were included in the HSES were far from a random sample of the schools in targeted areas. The original NELS had no such weights, so few school-effects studies have been conducted with it.

Final Comment

We reflect on our findings that schools can have a real impact on their students' academic behaviors. We suggest that adults who work in schools need to discuss and, it is hoped, come to some consensus about what all their students should know (about the courses that they offer and do not offer and the standards they set). Since the demands on today's high school graduates are consistently high, we suggest that students' course work—how far they progress in the academic curriculum—should be based less on students' academic preparation or future aspirations than on what is worth knowing. Such conversations are uncommon in public high schools. There is considerable evidence that taking the right courses makes a substantial difference in learning, at least in mathematics. Our results suggest that both types of private schools are following the constrained curriculum model and that the Catholic schools are using this model without a particularly selective clientele. We wonder why this curriculum model—with obvious benefits to all students—is not more widespread.

NOTES

1. NAIS is an organization of about 800 members that any private school (elementary or secondary) may join and pay a substantial membership fee. NAIS includes a small number of Catholic schools (the more selective schools), as well as schools affiliated with other denominations (mostly Episcopal).

2. In the HSES sample, our dependent variable is highly correlated with mathematics achievement in the 12th grade (r = .744). Such a high correlation supports the importance of our efforts to identify the characteristics of students and schools that lead students to take more high-level courses.

3. Although we considered exam-

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ining the influence of each SES component (especially income) separately, we did not pursue this strategy for two reasons. First, more data are missing on income than on other components of the SES measure in the NELS data. Because the SES composite makes use of all its separate components, there is virtually complete data on SES for all NELS (and HSES) students. Second, within-school samples in the HSES are still small (averaging 18.3 students per school). Because our multilevel analyses focused specifically on the relationship between SES and course taking in each school, the degrees of freedom were inadequate to accommodate expanding the number of independent variables.

4. ESs represent an increasingly common metric to describe group differences. Rosenthal and Rosnow (1984) provided a useful standard: Effects of .5 *SD* or more are large, effects between .3 and .5 *SD* are moderate, effects between .1 and .3 *SD* are small, and effects below .1 *SD* are trivial. The ESs shown in Table 1 were computed using the pooled *SD* (for students or schools) of each variable.

5. It is curious that the proportion of Catholic school students who were female in this sample was low (30 percent). Since we have not observed this phenomenon in our other research on Catholic schools, we assume it is a condition peculiar to the HSES sample. Lower proportions of girls in independent schools was documented elsewhere (Lee and Marks 1992).

6. In this model, the between-school variance, tau, is .321. We adjusted the within-school variance, sigma-squared (.592), for reliability because this part of the total variance in the outcome also includes measurement error (which is captured by the lambda reliability estimate in HLM). Sigma-squared is a combination of true score variance and error variance (Bryk and Raudenbush 1992). Thus, we computed the ICC as follows:

$$ICC = .321 / [.321] + [(.542) * (.770)] = .413$$

7. Our research questions focused on comparing schools across sectors. However, the results in Table 1 suggest that students who attended schools in the three sectors differed considerably, particularly in SES and 8th-grade ability. Thus, we wanted to control for all independent variables across the entire sample. The decision to center all variables on the grand mean accomplished this aim. Typically, "free" parameters (ability and SES in this analysis) are centered on their respective school means, and "fixed" variables (here, gender and minority status) are centered on the grand mean. However, school-mean centering (more common with HLM) would control for these variables only in each school.

8. The results in Table 3 could also be presented in between-school ESs. To compute these ESs, the effects would be divided by the between-school *SD* of each outcome from the within-school model, shown in the bottom panel of Table 2, which would result in much larger between-school ESs. We did not include these results here, simply to reduce the number of numbers in our tables. However, this is the procedure we followed in our other recent studies published in this journal (see Lee and Smith, 1995; Lee et al. 1997).

9. Although the sector differences here are noteworthy, it is also evident that compared to the unadjusted sector differences in course taking in Table 1 (.81 *SD* for Catholic schools and 1.10 *SD* for independent schools), the differences are reduced considerably. These comparisons provide evidence of the need for selection controls.

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10. Given the disagreements among social science researchers about the advisability of using design weights in multivariate analyses, we also ran our multilevel analyses unweighted (at the school level). The magnitude of all the coefficients changed only slightly; the relative magnitudes (and nominal significance levels) did not. In general, the unweighted effects on the intercept were slightly smaller, but the unweighted effects on the slope were slightly larger. For example, for the full selectivity model (comparable to Column 2 of Table 3), the unweighted results show a Catholic school effect on the intercept of ES = .323 (p < .001) and on the differentiation in course taking by ability of ES -.288 (p < .001). The full results of the unweighted analyses are available from the authors.

11. The lines were drawn using the intercept and slope figures from the gamma coefficients in the selectivity bias model from Table 3. Average course taking for schools in each sector is represented by the intercept (-.334 for public schools, -.334 + .370 for Catholic schools, and -.334 + .245 for independent schools). Since most of the schools in all sectors offered calculus, we added the calculus effect (.254) to each intercept. These intercepts represent average course taking when 8th-grade mathematics ability is average (zero). The slopes of the lines in the three sectors were computed similarly (.546 for public schools, .546 - .248 for Catholic schools, and .546 - .185 for independent schools). We added the calculus effect on the slope (.123) to each figure.

12. Although we decided to impute ability scores on a substantial proportion of the sample, we compared our results with separate multilevel models using other ability controls available on the entire HSES student sample: (1) grade point average (GPA) in 9th-grade math courses (from the transcripts) and (2) mathematics achievement at the end of the 10th grade. Each of these choices had its own difficulties, which showed up in the analyses.

Compared with our results in Table 2, for example, the 9th-grade GPA was a weaker control for ability (ES = .475) than the imputed 8th-grade test score (ES = .599), and the demographic controls had larger effects (SES, ES = .270; minority status, ES = -.118). The 10th-grade achievement score had a larger effect (ES = .896 versus .599), since it "controlled away" school effects on the outcome that accrued during the first half of high school (Lee and Bryk 1989a). The complete results of these comparative analyses are available from the authors.

APPENDIX

Construction of Variables and Weights Used in the Study

Variables Describing Students

Highest-level mathematics course taken. We used the NELS-HSES transcript data to construct this eight-level variable. From student course credits in mathematics, we selected the highest-level course each student took during his or her four years. The variable, which is close to normally distributed with a slight negative skew, is available on new releases of NELS and HSES data from NCES. Details of the construction are available from NCES. The eight levels are as follows:

Level 1: No Math. Student took no math courses in high school.

Level 2: Nonacademic. General math 1 or 2, basic math 1, 2, or 3, consumer math, vocational math, or review.

Level 3: Low Academic. Pre-alge-

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bra, Algebra I stretched over two years, informal geometry.

Level 4: Middle Academic I. Algebra I, plane geometry, solid geometry, unified math 1 or 2, pure math.

Level 5: Middle Academic II. Algebra II, unified math 3.

Level 6: Advanced I. Algebra 3, algebra/trigonometry, analytic geometry, trigonometry, probability, statistics, independent study.

Level 7: Advanced II. Precalculus, introductory analysis.

Level 8: Advanced III. Calculus, AP calculus, calculus/analytic geometry.

We used the eight-level metric for descriptive statistics in Table 1. In multivariate analyses, it was converted to a *z*-score ($M = 0$, $SD = 1$).

Socioeconomic status (SES). We used S2SES1, a composite made by NCES. The variable was *z*-scored ($M = 0$, $SD = 1$) on the full HSES file. The NELS SES measure is a composite of family income, parents' education, and parents' occupational prestige.

Gender. We used S1SEX from the student file. The variable was coded female = 1, male = 0.

Minority status. We used the S1RACE from the student's file. If a student indicated that he or she was African American, Hispanic, or American Indian, the variable was coded 1; if a student indicated that he or she was white, Asian, or "Other," it was coded 0.

8th-grade mathematics achievement. Because many students in the HSES file entered the sample in the 10th grade, we imputed 8th-grade math scores for them. We began with the full sample of HSES students with full data on 10th-grade mathematics achievement, gender, race, SES, and school sector.

For the 2,320 students from the original NELS sample with 8th-grade scores, we used a backwards regression technique, regressing the 8th-grade score on the following variables: 10th-grade achievement, gender, race-ethnicity (dummy variables for black, Hispanic, and Asian), and sector (dummy variables for Catholic, independent, and other private schools). We also included any interaction terms among the predictors. By far the largest effect was for 10th-grade achievement ($r = .83$ for the 8th and 10th-grade scores).

We used these predicted values to impute an 8th-grade mathematics score for HSES students without such a score. For all NELS students with such scores, the imputed score was their actual score. For those without 8th-grade scores, the imputed score was the predicted score plus a random error term based on the regression residuals from the predicted scores. We used this variable in the test metric for Table 1. In multivariate analyses, it was a *z*-score ($M = 0$, $SD = 1$). Further details on the imputation are available from the authors.

Variables Describing Schools

Sector. We used G10CNTRL2 from the school file to create two dummy variables: (1)Catholic = 1, public and independent schools = 0, and (2) Independent (NAIS) = 1, public and Catholic schools = 0.

School SES. The school-level aggregate of the student SES variable.

Minority concentration. A dummy variable, with schools with 40 percent or more minority students coded 1, otherwise coded 0. First, we created a school-level variable by aggregating students' minority status to the school level. The distribution of the aggregate was skewed and bimodal.

Standard deviation, 8th-grade mathematics achievement. The

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school-level aggregate of the *SD* of 8th-grade mathematics achievement. The variable measures academic heterogeneity in a school. Although we used the variable in this metric for Table 1, in multivariate analyses, it was a *z*-score ($M = 0$, $SD = 1$).

School offers calculus. Coded 1 = yes, 0 = no. School administrators indicated the courses their schools offered in 1990. S1C75EE1 is the calculus indicator. If an administrator indicated "calculus offered as a regular course" or "AP calculus offered at the school," the measure was coded 1, otherwise 0. For schools with missing data on course offerings, we used student data. If any sampled student scored 8 on the outcome, the school was coded 1.

Average years of expected education. First, the student-level variable S1S49 (at the 10th grade) was recoded into years of education (HS graduation = 12, college graduation = 16). Then this variable was aggregated to the school level. We used the metric of years for Table 1. For multivariate analyses, it was a *z*-score ($M = 0$, $SD = 1$).

Weights

School-level weights. The HSES data file includes three separate school-level weights, which were computed differently. We chose to use the third of these weights, S1SCWT3A—the Qian-Frankel weight. We normalized this weight to have a mean of 1 on our 184 schools and used it to compute the means in Panel B of Table 1.

Overall student-level weight. The HSES student sample is composed of two groups: the original NELS students and the augmented sample collected in the 10th grade in the HSES schools. We created an overall student-level weight by blending separate student weights for each group: S1QWT3 for the HSES augmented sample and S288PNWT for the original NELS sample of students in the HSES schools. Separately for each group, we normalized these weights by dividing the existing weight by its mean for each group (to retain the appropriate sample sizes and the relative proportions of NELS and HSES-only students). We used this student-level weight to create new variables and to compute descriptive statistics in Panel A of Table 1.

REFERENCES

Alba, Richard, D., and Gwen Moore. 1982. "Ethnicity in the American Elite." *American Sociological Review* 47:373–83.

Baltzell, Edward D. 1958. *Philadelphia Gentleman: The Making of a National Upper Class.* Glencoe, IL: Free Press.

Benson, Peter, and Marilyn M. McMillen. 1991. *Private Schools in the United States: A Statistical Profile, with Comparisons to Public Schools* (NCES publication 91–054). Washington, DC: National Center for Education Statistics.

Bryk, Anthony S., Valerie E. Lee, and Peter B. Holland. 1993. *Catholic Schools and the Common Good.* Cambridge, MA: Harvard University Press.

Bryk, Anthony S. and Steven W. Raudenbush. 1992. *Hierarchical Linear Models: Applications and Data Analysis Methods.* Newbury Park, CA: Sage.

Chubb, John E., and Terry M. Moe. 1990. *Politics, Markets, and America's Schools.* Washington, DC: Brookings Institution.

Clune, William H., and Paula A. White. 1992. "Education Reform in the Trenches: Increased Academic Coursetaking in High Schools with Lower Achieving Students in States with Higher Graduation Requirements." *Educational Evaluation and Policy Analysis* 14(1):2–20.

Coleman, James, S., Thomas Hoffer, and Sally Kilgore. 1982. *High School Achievement.* New York: Basic Books.

Conant, James B. 1959. *The American High School Today.* New York: McGraw Hill.

Cookson, Peter W., Jr., and Carolyn H. Persell. 1985. *Preparing for Power: America's Elite Boarding Schools.* New York: Basic Books.

Cremin, Lawrence A. 1988. *American Education: The Metropolitan Experience 1876–1980.* New York: Harper & Row.

Gamoran, Adam. 1987. "The Stratification of High School Learning Opportunities." *Sociology of Education* 60:135–55.

Jones, Lyle V., Ernest C. Davenport, Aloha Bryson, Tanya Bekhuis, and Rebecca

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

Zwick. 1986. "Mathematics and Science Test Scores as Related to Courses Taken in High School and Other Factors." *Journal of Educational Measurement* 23:197–208.

Kleibard, Herbert M. 1986. *The Struggle for the American Curriculum 1893–1958.* New York: Routledge.

Lantz, Alma E., and Gregory P. Smith. 1981. "Factors Influencing the Choice of Nonrequired Mathematics Courses." *Journal of Educational Psychology 73*:825–37.

Lee, Valerie E. 1993. "Educational Choice: The Stratifying Effects of Selecting Schools and Courses." *Educational Policy* 7:125–48.

Lee, Valerie E., and Anthony S. Bryk. 1988. "Curriculum Tracking as Mediating the Social Distribution of High School Achievement." *Sociology of Education* 61:78–94.

_____. 1989a. "Effects of Single-Sex Schools: Response to Marsh." *Journal of Educational Psychology* 81:647–50.

_____. 1989b. "A Multilevel Model of the Social Distribution of High School Achievement." *Sociology of Education* 62:172–92.

Lee, Valerie E., David T. Burkam, Becky A. Smerdon, Todd Chow-Hoy, and Douglas Geverdt. 1998. *High-School Curriculum Structure: Effects on Coursetaking and Achievement in Mathematics for High-School Graduates* (draft research and development report). Washington, DC: National Center for Education Statistics.

Lee, Valerie E., and Ruth B. Ekstrom. 1987. "Student Access to Guidance Counseling in High School." *American Educational Research Journal* 24:287–310.

Lee Valerie E., and Helen M. Marks. 1992. "Who Goes Where? Choice of Single-Sex and Coeducational Independent Secondary Schools." *Sociology of Education* 65:226–53.

Lee, Valerie E., and Julia B. Smith. 1995. "Effects of School Restructuring and Size on Gains in Achievement and Engagement for Early Secondary School Students." *Sociology of Education* 68:241–70.

Lee, Valerie E., Julia B. Smith, and Robert G. Croninger. 1997. "Understanding How High School Organization Influences the Equitable Distribution of Learning in Mathematics and Science." *Sociology of Education* 70:128–50.

Lewis, Lionel S., and Richard A. Wanner. 1979. "Private Schooling and the Status Attainment Process." *Sociology of Education* 52:99–112.

McDonnell, Lorraine M. 1988. *Coursework Policy in Five States and Its Implications for Indicator Development.* Santa Monica, CA: RAND Corp.

Mills, C. Wright. 1956. *The Power Elite.* New York: Oxford University Press.

Moore, Gwen. 1979. "The Structure of a National Elite Network." *American Sociological Review* 44:673–92.

Murnane, Richard. 1975. *The Impact of School Resources on Inner City Children.* Cambridge, MA: Ballinger.

National Commission on Excellence in Education. 1983. *A Nation at Risk: The Imperative for Educational Reform.* Washington, DC: U.S. Government Printing Office.

Oakes, Jeannie. 1985. *Keeping Track: How Schools Structure Inequality.* New Haven, CT: Yale University Press.

Oakes, Jeannie, Adam Gamoran, and Reba Page. 1992. "Curriculum Differentiation: Opportunities, Outcomes, and Meaning." Pp. 560–608 in *Handbook of Research on Curriculum,* edited by Philip W.. Jackson. New York: Macmillan.

Powell, Arthur, Eleanor Farrar, and David K. Cohen. 1985. *The Shopping Mall High School.* Boston: Houghton-Miflin.

Romberg, Thomas A. 1992. "Problematic Features of the School Mathematics Curriculum." Pp. 749–88 in *Handbook of Research on Curriculum,* edited by Philip W. Jackson. New York: Macmillan.

Rosenthal, Robert, and Ralph L. Rosnow. 1984. *Essentials of Behavioral Research.* New York: McGraw-Hill.

Schneider, Barbara L., and Diana T. Slaughter. 1988. "Educational Choice for Blacks in Urban Private Secondary Schools." Pp. 294–310 in *Class, Race, and Gender in American Education,* edited by Lois Weis. Albany: State University of New York Press.

Scott, Leslie A., Steven L. Ingels, Paul Pulliam, Supriti Sehra, John R. Taylor, and Diana Jergovic. 1996. *National Education Longitudinal Study of 1988. High School Effectiveness Study: Data File User's Manual (Draft).* Washington, DC: National Center for Education Statistics.

Smith, Thomas M., Beth A. Young, Yupin Bae, Susan P. Choy, and Nabeel Alsalam. 1997. *The Condition of Education 1997* (NCES Publication 97–388). Washington, DC: National Center for Education Statistics.

Tyack, David. 1974. *The One Best System.* Cambridge, MA: Harvard University Press.

Useem, Elizabeth L. 1991. "Student Selection into Course Sequences in Mathematics: The Impact of Parental Involvement and School Policies." *Journal of Research on Adolescence* 1:231–50.

White, Paula A., Adam Gamoran, John Smithson, and Andrew C. Porter 1996. "Upgrading the High School Math Curriculum: Math Course-taking Patterns in Seven High Schools in California and New York." *Educational Evaluation and Policy Analysis* 18:285–307.

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