Different Teachers, Different Peers: The Magnitude of Student Sorting Within Schools

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The authors use administrative data from three large urban school districts to describe student sorting within schools. Students are linked to each of their teachers and students' classmates are identified. There are differences in the average achievement levels, racial composition, and socioeconomic composition of classrooms within schools. This sorting occurs even in self-contained elementary school classrooms and is much larger than would be expected were students assigned to classrooms randomly. Much of the racial and socioeconomic sorting is accounted for by differences in achievement, particularly at the high school level. Classrooms with the most low-achieving, minority, and poor students are more likely to have novice teachers. Sorting students by achievement level exposes minority and poor students to lower quality teachers and less resourced classmates.

Keywords: achievement; educational policy; equity; regression analyses; secondary data analysis; tracking

Introduction

Large urban school districts serve increasingly diverse student bodies. Although many studies have described racial segregation among schools and the causes and consequences of such segregation, far fewer have examined the extent to which students are sorted across classrooms within schools by race and ethnicity or by family income or achievement. Attendance at the same school does not ensure that students from different backgrounds will share classrooms or have equivalent educational experiences (Meier, Stewart, & England, 1990; Mickelson, 2002; Orfield, 1975).

In this study, we examine patterns of sorting across classrooms within schools in three large urban school districts. Although the literatures on tracking and segregation are vast, few studies have examined sorting of students within schools with the level of detailed data that we use in this study. We address three research questions. First, to what extent are students sorted across classrooms within schools along the lines of race and ethnicity, poverty status, and prior achievement? Second, does the extent to which within school sorting occurs vary across grade levels? Third, to what extent can sorting by race and ethnicity and poverty level be explained by differences in prior achievement? We find some evidence of sorting by student race and poverty status across classrooms at all grade levels, some (but not all) of which is accounted for by differences in prior achievement. Sorting within schools is smaller than sorting across schools, but within-school sorting is nontrivial, particularly at the middle and high school levels. We also find that students are sorted by their prior achievement across classrooms within schools, even in self-contained elementary school classrooms. Classes made up of lower achieving students tend to have more poor and minority students and less experienced teachers. Given the evidence suggesting that teachers and peers can affect student outcomes (Burke & Sass, 2009; Figlio, 2007; Nye, Konstantopoulos, & Hedges, 2004; Rivkin, Hanushek, & Kain, 2005; Rockoff, 2004), the within-school sorting we document likely exacerbates inequalities.

Research on Within-School Sorting

Researchers and policymakers have long been aware of racial segregation across classrooms within schools. Some researchers have described this type of within-school sorting as one of several "second-generation" segregation problems that result in nonequivalent educational experiences for minority and White students attending the same schools (Meier et al., 1990; Mickelson, 2002; Orfield, 1975). Much of the research on within-school sorting has focused on formal tracking at the high school level. Given the relationship between prior achievement and student demographic characteristics, tracking tends to contribute to within-school sorting by race and socioeconomic status (Gamoran, 1992b; Lucas & Berends, 2002; Mickelson, 2001; Oakes, 1985; Oakes & Guiton, 1995). Formal tracking, however, is not the only source of within-school sorting; thus, studies of tracking do not shed light on the

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Educational Researcher, Vol. 42 No. 6, pp. 304–316
DOI: 10.3102/0013189X13495087

full picture of sorting, especially because they largely have relied on examinations of track placements in a small number of high schools (Mickelson, 2001; Oakes, 1985) or on national data that include only a few sampled students per school (Gamoran, 1992b; Lucas & Berends, 2002).

Studying sorting within schools is complicated by extensive data requirements, including information on students' classroom assignments within schools. Most of the research on tracking has relied on nationally representative data such as High School and Beyond or the National Education Longitudinal Study. These data sets sample only approximately 20 to 25 students per school and so are relatively underpowered for examining differences in class assignments within schools. Only three studies we are aware of have examined within-school sorting by race using data from a large number of schools and students (Clotfelter, Ladd, & Vigdor, 2002; Conger, 2005; Morgan & McPartland, 1981). Morgan and McPartland (1981) studied classroom segregation using data collected in 1976 by the Office of Civil Rights. Their data included information about classroom enrollments for 18 randomly sampled classrooms in each of more than 40,000 schools. Theirs remains the only national study of classroom segregation to date. More recently, Clotfelter et al. (2002) and Conger (2005) conducted similar analyses in North Carolina and New York, respectively. The results of these three studies are similar: classroom segregation is higher in high schools and middle schools than in elementary schools; segregation among schools is larger than segregation within schools; and Black students tend to be more segregated from White students than are Hispanic students from White students. Conger also found that the segregation of immigrants within New York City schools is equal to their segregation across schools.

We build on prior research in a number of ways. First, although the tracking literature focuses on within-school sorting primarily at the high school level, we also examine sorting at the elementary school and middle school levels, which have received comparably less attention. Some research on ability grouping in elementary school has examined within-class grouping and found it fairly common for students in the same class to be assigned to homogeneous instructional groups (Gamoran, 1986; Loveless, 1999; Pallas, Entwisle, Alexander, & Stluka, 1994). However, this research has not focused on across-class, within-school sorting. In addition, this research has some of the same drawbacks as much of the tracking research in that it relies on data from either a small number of schools or from a large number of schools but with small within-school samples. Because we have data on the populations of students, teachers, and classes in three large districts over several years, we have more power to detect within-school differences in teacher and classmate characteristics for students from varying backgrounds. Second, although a few studies in the segregation literature have compared levels of racial segregation within schools at different grade levels, they have not explored sorting by other characteristics, such as poverty or test performance, as we do (Clotfelter et al., 2002; Conger, 2005; Morgan & McPartland, 1981). Third, although some studies in the tracking literature have found that minority students are less likely to be enrolled in high-track courses even after controlling for prior achievement levels, the segregation literature has not examined the extent to which segregation by race reflects the grouping of students by achievement. Because we have rich longitudinal data on students with multiple years of test scores in both math and reading, we are able to provide more robust controls for prior achievement. This analysis allows us to see whether minority and poor students have more minority, poor, or lower achieving classmates than their counterparts at their schools who have similar levels of prior achievement. One purpose of this analysis is to measure how much of the sorting we observe is due to achievement and how much to other factors.

Mechanisms Contributing to Within-School Sorting

The sorting of students by prior achievement, race, or socioeconomic status to different classrooms within schools may result from a variety of formal and informal processes. The processes that contribute to sorting at the middle and high school levels, at which tracking is more common, may differ in from the processes that contribute to sorting in elementary schools that have much less differentiated curricula.

In a tracked system, students are, at least in part, assigned to classrooms on the basis of prior achievement. Prior to the 1970s, secondary students were often assigned to mutually exclusive and overarching programs such as vocational, general, or academic tracks (Hallinan, 1994; Lucas & Berends, 2002). In more recent decades, tracking systems have become less deterministic, and the same student may enroll in courses of different levels in different subjects (Lucas, 1999). Given that tracking decisions are largely (although not entirely) related to students' prior achievement levels (Gamoran, 1992a; Oakes & Guiton, 1995), tracking systems create considerable variation in average achievement across classrooms. The bulk of the research suggests that achievement is the main factor influencing track placements, although race and socioeconomic status also play some role (Alexander & McDill, 1976; Attewell & Domina, 2008; Conger, Long, & Iatarola, 2009; Gamoran, 1992a; Gamoran & Berends, 1987; Kelly, 2009; Kilgore, 1991; Oakes & Guiton, 1995). Parent demands for courses, teacher recommendations, or peer influences on students' decisions can put pressure on schools to admit students to courses they may not normally be placed in on the basis of the schools' formal assignment criteria (Kilgore, 1991; Oakes & Guiton, 1995; Useem, 1991). Recent research suggests that tracking may have persisted or even intensified in the era of high-stakes testing as school administrators looked for ways to maximize student achievement (Cohen-Vogel, 2011; Cohen-Vogel & Rutledge, 2009; Mickelson & Everett, 2008; Oakes, 2008).

The formal assignment of students to different courses that are vertically differentiated (i.e., using a tracking system) is only one of several processes that could induce variation across classrooms in achievement levels and demographics. When making class assignment decisions, school administrators may be influenced by pressures from parents and teachers. Such pressures could create variation across classrooms even in elementary schools, in which there is no formal differentiation of the curriculum.

Prior research suggests that middle- and upper-class parents often intervene in class assignment to ensure that their children are taught by teachers they believe to be desirable (Lareau, 1987,

2000). Advantaged parents are more likely to be involved in their children's education and spend time at their school (Lareau, 1987; Useem 1991, 1992). They therefore are likely to have better information about teachers than parents with lower incomes or education levels. Lareau (1987) found that middle-class mothers in her study of elementary school students knew the names and academic reputations of most of the teachers in the school as well as the academic abilities of other students in their children's classes. In contrast, working-class parents have limited information about most aspects of their children's experiences at school (Lareau, 1987, 2000, 2002). Middle-class parents may be able to use this information to request the most desirable classes for their children. School administrators may feel pressure to meet the demands of the parents of higher achieving or middle-class students for fear of losing these students to other schools or districts (Clotfelter, Ladd, & Vigdor, 2005). Such a pattern may result in the concentration of higher achieving and higher income students in classrooms with higher quality teachers.

Teacher preferences for certain classrooms may further influence school administrators' decisions about course assignments. This influence is especially relevant when teachers have alternative employment options in other schools, which may be the case for particularly effective or experienced teachers. In most cases, organizations prefer to retain their most effective employees and will often offer benefits in an effort to do so (Abelson & Baysinger, 1984). Rewarding effective employees may be challenging in schools, given rigidities of salary schedules and limited vertical differentiation of jobs. In lieu of salary increases or promotions, principals may give their best teachers the most desirable class assignments as a retention strategy. Principals may also feel pressure from senior teachers to assign them the students and courses they desire (Carey & Farris, 1994; Finley, 1984). These types of class assignment processes could contribute to differential assignment of lower achieving students to lower quality teachers and peers even in elementary schools.

Data

To examine student sorting, we use data from administrative files on all students in three large urban school districts, whose identities we leave anonymous: one from the Southeast (District 1), one from the Midwest (District 2), and one from the West (District 3). Data from Districts 1 and 2 are available for the 2003–2004 through 2009–2010 school years, and data from District 3 are available for 2001–2002 through 2009–2010. District 1 enrolls about 350,000 students in 550 schools, District 2 enrolls about 82,000 students in 214 schools, and District 3 enrolls about 55,000 students in 117 schools. All three districts are predominately minority, enrolling large concentrations of students from disadvantaged socioeconomic backgrounds.

The data include test scores and basic demographic information for all students, course-level data that link students to each of their teachers and classmates in each year, and a staff-level file with information on all district employees. The student data include race, gender, subsidized lunch eligibility, number of times absent each year, and whether the student was suspended in each year (not available for District 3). Each district provided us with reading and math achievement test scores for all tested students. In each district, we standardize students' test scores to have a mean of 0 and a standard deviation of 1 within each grade and school year.

In addition to having student-level data, we also have demographic information on all staff members in each district, which we link to the student records via course-level identifiers. We combine this information to construct a data set for each district, with one observation for each student in each year with student characteristics and test scores, characteristics of students' teachers, and characteristics of students' classmates. For middle and high school students (who are enrolled in multiple courses), we use the teacher and classmate characteristics for their math courses. If they are enrolled in multiple math courses in a given year, we take the average of the class characteristics across all of their math courses. The characteristics of students' classmates (e.g., percentage minority, average prior test scores) are computed by excluding the focal student from the class averages.

The districts we examine are large and diverse. Between 9% and 14% of students are White in each district, the majority of students in District 1 are Hispanic (61%), the majority of students in District 2 are Black (57%), and the majority of students in District 3 are Asian or other races or ethnicities (56%). The three districts also have high concentrations of poor students, with 53%, 64%, and 39% of students, respectively, eligible for free or reduced-price lunch. Eight percent of students in District 1 were chronically absent during our sample period, compared with 23% in District 2 and 18% in District 3. Nineteen percent of students in District 1 had novice teachers (first or second year), compared with 12% in the second district and 4% in the third.

Methods

We address three research questions. First, to what extent are students sorted across classrooms within schools along the lines of race/ethnicity, poverty status, and prior achievement? To address this question, we examine the extent to which students from different backgrounds are assigned to classrooms with different types of teachers and peers. We start descriptively, using the dissimilarity index to compute segregation between schools and between classrooms. The Black-White dissimilarity index measures departures from evenness by taking the average absolute difference of each school's Black population from the district's Black population, weighted by the enrollment of each school. The dissimilarity index may range from 0 to 1 and can be interpreted as the proportion of Black students who would have to change schools to be evenly distributed across the district (James & Taeuber, 1985). We compare segregation that occurs between schools to that which occurs between classrooms.

The dissimilarity index measures the extent of sorting but does not provide direct measures of the attributes of students' teachers and peers. For this description, we model classroom characteristics as a function of student characteristics, including race and ethnicity, poverty, and whether a student was in the top or bottom quartile of the achievement distribution in the prior year. The classroom characteristics we consider are the proportions of Black, Hispanic, and poor classmates in addition to the average prior year achievement of students' classmates. We also examine differences by student attributes in access to experienced teachers. Here we use a measure of whether the teacher has

1 or 2 years of experience to describe novice teachers. We chose this cutoff given prior studies that have found that, on average, teachers improve at particularly large rates between their 1st and 2nd years and their 2nd and 3rd years (Atteberry, Loeb, & Wyckoff, 2013). Because the relationship between effectiveness and experience is relatively flat in Year 3 and later, we chose to define novice teachers as those in their first 2 years.[1] All models also include a school-by-grade-by-year fixed effect that allows us to compare differences in teacher or class characteristics among students attending the same school and grade in a given year. For example, in a model in which the outcome is whether the class is taught by a novice teacher, the coefficient on eligibility for free or reduced-price lunch would show the difference in the probability of having a novice teacher among students eligible and those not eligible for free or reduced-price lunch attending the same school and grade in a given year.

For our second research question, we ask whether the extent of within-school sorting varies across grade levels. To address this question, we estimate models separately for elementary school (Grades K–5), middle school (Grades 6–8), and high school (Grades 9–12).

Our third research question asks to what extent sorting by race and ethnicity and poverty status can be explained by differences in prior achievement. Poor students as well as Black and Hispanic students might be concentrated in classrooms with other poor or similar-race or similar-ethnicity students or with low-achieving students because they themselves have lower achievement. We take a variety of approaches to evaluate the role of achievement differences in contributing to within-school sorting by student race and eligibility for free or reduced-price lunch. First, building on the regression models above, we control for students' prior-year test scores in both math and reading. Models with controls for prior achievement show whether students of different race and poverty status but with the same prior achievement are assigned different types of classrooms.

Schools have more information about students' ability levels than a single test score (i.e., multiple years of test scores, course grades, teacher evaluations, etc.) and are likely to use this information when making assignment decisions. Measurement error in a single year's test score makes test scores imperfect measures of student ability. We therefore adjust for measurement error in prior test scores by instrumenting for the prior year's score using the twice-lagged score, thus using only variation in test scores that is persistent across the two tests. This helps adjust for mean reversion that may otherwise bias our estimates. As a final way of controlling for achievement differences, we control for (high school) students' cumulative grade point averages. Our full model examines whether students who attend the same school and have the same grades and prior test scores are assigned to different types of teachers and classmates.

Results

Description of Within-School Sorting and Variation by Grade Level

First, we describe the extent to which students are sorted across classrooms within schools and whether these patterns vary across grade levels. Table 1 describes sorting between schools and classrooms using the dissimilarity index. The table shows the total segregation between classrooms; this is equal to the across- and within-school segregation combined. Using Black and non-Black segregation as an example, the dissimilarity index is interpreted as the proportion of Black students who would have to change schools or classrooms to make Blacks and non-Blacks evenly distributed across all schools or classrooms.

Table 1 reveals a few key findings. First, consistent with prior research, overall racial and ethnic segregation is relatively high in all three districts, ranging from about 0.50 to 0.70 depending on the grade level (Clotfelter et al., 2002; Conger, 2005). The three districts differ somewhat in segregation. For example, Black and non-Black segregation is lower in District 3, which has a relatively small Black population. Similarly, Hispanic and non-Hispanic segregation is highest in District 1, which has a large Hispanic population. Students are less segregated by poverty status, with levels of segregation ranging from 0.30 to 0.50.

A second finding evident in Table 1 is that racial, ethnic, and poverty segregation varies across grades. In particular, overall segregation levels tend to decline across grades, driven by lower between-school segregation in the middle and high school grades relative to the elementary grades. Segregation across schools is higher at the elementary school level on most measures because there is a larger number of elementary schools and thus more opportunity for sorting. Although overall segregation is smaller in middle and high school than in elementary school, the proportion of segregation that occurs within schools increases across grades. In all grades, the majority of segregation comes from sorting across schools; however, the proportion of sorting that occurs within schools is largest in middle and high schools.

Segregation by achievement is high in all three districts, particularly in middle and high schools, in which it ranges from 0.70 to 0.90. Segregation by achievement increases across grades, as between-school segregation stays about the same and within-school segregation across classrooms increases. For example, in District 3, 87% of low-achieving high school students would have to change classrooms to make low-achieving and high-achieving students evenly distributed across all classrooms. Levels of achievement segregation are lower in elementary schools than in higher grades but still at 0.60 or higher in all three districts. Levels of segregation by achievement are relatively similar across the three districts.

Another way of describing student sorting is to compare the average characteristics of students' classmates. For the analyses reported in Table 2, we predict attributes of students' classmates as a function of students' own characteristics. The models examine the Black-White, Hispanic-White, poor-nonpoor, and high-low prior achievement gaps in the proportion of Black, Hispanic, and poor classmates in addition to the average prior-year achievement of students' classmates. We also examine differences by student attributes in access to experienced teachers. As discussed above, we focus on teaching experience because prior research suggests that novice teachers are less effective at raising student achievement than their more experienced counterparts (Clotfelter, Ladd, & Vigdor, 2006; Rivkin et al., 2005; Rockoff, 2004) and that other teacher characteristics commonly measured in administrative data sets are generally unrelated to

Table 1
Dissimilarity Indices for Segregation Across Schools and Classrooms

	District 1			District 2			District 3		
Variable	Grades K–5	Grades 6–8	Grades 9–12	Grades K–5	Grades 6–8	Grades 9–12	Grades K–5	Grades 6–8	Grades 9–12
Black–non-Black									
Total	0.70	0.76	0.60	0.68	0.68	0.52	0.52	0.65	0.59
School	0.69	0.72	0.52	0.65	0.64	0.32	0.46	0.60	0.38
Class	0.01	0.04	0.08	0.02	0.04	0.20	0.06	0.06	0.22
Percentage between	98	94	86	97	94	61	88	91	64
Percentage within	2	6	14	3	6	39	12	9	36
Hispanic–non-Hispanic									
Total	0.74	0.63	0.59	0.71	0.56	0.51	0.54	0.55	0.53
School	0.72	0.58	0.50	0.67	0.53	0.42	0.50	0.51	0.40
Class	0.02	0.06	0.10	0.04	0.03	0.09	0.04	0.04	0.13
Percentage between	98	91	84	95	94	82	93	93	76
Percentage within	2	9	16	5	6	18	7	7	24
White–non-White									
Total	0.64	0.62	0.54	0.63	0.54	0.47	0.52	0.53	0.47
School	0.61	0.52	0.48	0.60	0.45	0.35	0.45	0.43	0.33
Class	0.03	0.10	0.06	0.03	0.10	0.12	0.07	0.10	0.14
Percentage between	95	83	89	96	82	75	86	80	71
Percentage within	5	17	11	4	18	25	14	20	29
Free or reduced-price lunch–not free or reduced-price lunch									
Total	0.44	0.49	0.40	0.39	0.43	0.34	0.30	0.35	0.32
School	0.40	0.43	0.36	0.35	0.37	0.26	0.26	0.27	0.22
Class	0.04	0.06	0.05	0.03	0.06	0.07	0.04	0.08	0.10
Percentage between	92	87	88	92	86	78	87	76	68
Percentage within	8	13	12	8	14	22	13	24	32
Low achieving–high achieving									
Total	0.60	0.77	0.68	0.63	0.89	0.84	0.68	0.86	0.87
School	0.52	0.45	0.56	0.55	0.49	0.55	0.57	0.46	0.61
Class	0.08	0.32	0.12	0.08	0.41	0.29	0.11	0.40	0.27
Percentage between	86	58	82	88	55	66	84	53	70
Percentage within	14	42	18	12	45	34	16	47	30

Note. The dissimilarity indices are computed separately for each grade and each year, and the averaged estimates are presented here. The numbers in the tables are interpreted as follows, for example: 60% of low-achieving elementary school students in District 1 would have to change classrooms to make low- and high-achieving students evenly distributed across all classrooms. Eighty-six percent of this segregation comes from sorting among schools, while 14% comes from sorting among classrooms within schools.

student achievement (Aaronson, Barrow, & Sander, 2007; Clotfelter et al., 2006). The models include a school-by-grade-by-year fixed effect so that comparisons are made among students with different characteristics who attend the same grade in the same school. Student race/ethnicity, eligibility for free or reduced-price lunch, and prior-year achievement quartile variables are each entered in a separate model so that the differences do not control for other characteristics.

Students have systematically different classmates. Black elementary school students have between 1% and 6% more Black classmates, and Black high school students have 5% to 9% more Black classmates than do White students in their grade at their school in a given year. Similarly, poor students have between 1% and 3% more poor classmates than nonpoor students in their grade at their school in a given year (although there is an exception in District 2).

The most striking difference in peer characteristics among different groups of students is differences in peer achievement. Black elementary school students in District 1 have classmates whose average prior achievement is nearly 0.2 standard deviations lower than the average achievement of Whites' classmates at their school in their grade in that year. In District 3, the difference in average classmate achievement for Blacks and Whites is about 0.1 standard deviations. The differences are even larger

Table 2
Classmate Characteristics by Student Characteristics: Bivariate Relationships

Variable	Grades K–5			Grades 6–8			Grades 9–12		
	District 1	District 2	District 3	District 1	District 2	District 3	District 1	District 2	District 3
Proportion of Black classmates									
Black	.055***	.006***	.035***	.042***	.013***	.092***	.054***	.082***	.093***
	(.000)	(.001)	(.001)	(.001)	(.002)	(.002)	(.001)	(.001)	(.001)
Hispanic	−.011***	−.037***	−.034***	.013***	−.018***	.001	.011***	−.005**	.009***
	(.000)	(.001)	(.001)	(.000)	(.002)	(.002)	(.000)	(.002)	(.001)
Eligible for free or reduced-price lunch	.003***	.002***	.002***	.014***	.004***	.011***	.008***	.015***	.002*
	(.000)	(.000)	(.000)	(.000)	(.001)	(.001)	(.000)	(.001)	(.001)
Bottom quartile of prior math score	.006***	.004***	.016***	.024***	.005***	.060***	.027***	.014***	.067***
	(.000)	(.001)	(.001)	(.000)	(.001)	(.001)	(.000)	(.002)	(.001)
Top quartile of prior math score	−.015***	−.004***	−.005***	−.039***	−.012***	−.045***	−.043***	−.077***	−.037***
	(.000)	(.001)	(.001)	(.000)	(.001)	(.001)	(.000)	(.002)	(.001)
Proportion of Hispanic classmates									
Black	−.030***	−.014***	−.027***	−.001	−.006***	.014***	−.012***	−.016***	.024***
	(.001)	(.001)	(.001)	(.001)	(.002)	(.002)	(.001)	(.001)	(.002)
Hispanic	.041***	.055***	.155***	.016***	.038***	.085***	.018***	.065***	.096***
	(.000)	(.001)	(.001)	(.001)	(.002)	(.002)	(.000)	(.001)	(.002)
Eligible for free or reduced-price lunch	.012***	.001**	.020***	.005***	.002*	.019***	.005***	.001	.009***
	(.000)	(.000)	(.001)	(.000)	(.001)	(.001)	(.000)	(.001)	(.001)
Bottom quartile of prior math score	.006***	−.009***	.031***	−.005***	−.001	.053***	−.007***	−.002	.061***
	(.001)	(.001)	(.001)	(.000)	(.001)	(.001)	(.000)	(.001)	(.001)
Top quartile of prior math score	−.015***	.004***	−.021***	−.015***	−.002+	−.061***	−.012***	.001	−.056***
	(.001)	(.001)	(.001)	(.000)	(.001)	(.001)	(.000)	(.001)	(.001)
Proportion of classmates eligible for free or reduced-price lunch									
Black	.034***	.008***	.020***	.053***	.014***	.051***	.038***	.035***	.018***
	(.001)	(.001)	(.001)	(.001)	(.002)	(.002)	(.001)	(.001)	(.002)
Hispanic	.034***	.007***	.036***	.035***	.013***	.056***	.028***	.025***	.025***
	(.000)	(.001)	(.001)	(.001)	(.002)	(.002)	(.001)	(.001)	(.002)
Eligible for free or reduced-price lunch	.025***	−.001**	.004***	.031***	−.008***	.031***	.024***	.008***	.023***
	(.000)	(.000)	(.000)	(.000)	(.001)	(.001)	(.000)	(.001)	(.001)
Bottom quartile of prior math score	.041***	.003***	.019***	.052***	.012***	.058***	.039***	.012***	.031***
	(.001)	(.001)	(.001)	(.000)	(.001)	(.001)	(.000)	(.001)	(.001)
Top quartile of prior math score	−.056***	−.003***	−.009***	−.095***	−.013***	−.073***	−.066***	−.043***	−.020***
	(.001)	(.001)	(.001)	(.000)	(.001)	(.001)	(.000)	(.001)	(.001)

(continued)

Table 2 (continued)

Variable	Grades K–5			Grades 6–8			Grades 9–12		
	District 1	District 2	District 3	District 1	District 2	District 3	District 1	District 2	District 3
Average prior (standardized) math score of classmates									
Black	−.166***	−.003	−.074***	−.294***	−.064***	−.468***	−.295***	−.214***	−.320***
	(.004)	(.004)	(.005)	(.004)	(.007)	(.010)	(.004)	(.006)	(.008)
Hispanic	−.129***	.041***	−.093***	−.165***	−.037***	−.414***	−.169***	−.130***	−.268***
	(.004)	(.004)	(.004)	(.004)	(.008)	(.009)	(.003)	(.007)	(.007)
Eligible for free or reduced-price lunch	−.152***	−.007**	−.041***	−.205***	−.042***	−.186***	−.136***	−.067***	−.070***
	(.002)	(.003)	(.002)	(.002)	(.004)	(.005)	(.002)	(.004)	(.004)
Bottom quartile of prior math score	−.399***	−.038***	−.151***	−.654***	−.130***	−.461***	−.664***	−.109***	−.356***
	(.002)	(.003)	(.003)	(.002)	(.005)	(.005)	(.002)	(.006)	(.005)
Top quartile of prior math score	.392***	.013***	.087***	.679***	.063***	.690***	.612***	.303***	.601***
	(.002)	(.003)	(.003)	(.002)	(.005)	(.005)	(.002)	(.005)	(.005)
Assignment to novice teacher (linear probability)									
Black	.017***	.006***	.003*	.023***	.007+	.015***	.031***	.019***	.021***
	(.001)	(.002)	(.001)	(.002)	(.004)	(.002)	(.002)	(.004)	(.003)
Hispanic	.006***	.008***	.002	.017***	−.007+	.007***	.016***	.011**	.017***
	(.001)	(.002)	(.001)	(.002)	(.004)	(.002)	(.002)	(.004)	(.003)
Eligible for free or reduced-price lunch	.012***	.001	.002**	.012***	.006**	.002+	.011***	.007**	−.002
	(.001)	(.001)	(.001)	(.001)	(.002)	(.001)	(.001)	(.002)	(.001)
Bottom quartile of prior math score	.020***	.007**	.006***	.022***	.018***	.015***	.060***	.005	.020***
	(.001)	(.002)	(.001)	(.001)	(.003)	(.001)	(.001)	(.005)	(.002)
Top quartile of prior math score	−.032***	−.006*	−.000	−.056***	−.006*	−.007***	−.079***	−.037***	−.017***
	(.001)	(.002)	(.001)	(.001)	(.003)	(.001)	(.002)	(.004)	(.002)
School-year-grade fixed effect	X	X	X	X	X	X	X	X	X

Note. The outcomes are noted by the text within the row headings. Student race/ethnicity, eligibility for free or reduced-price lunch, and prior achievement are entered in separate models. White is the omitted racial/ethnic group. A variable for other race students is also included in the model but excluded from the table. Students who scored in the middle 50% of the achievement distribution in the prior year are the omitted group for the prior achievement measure. Classroom averages are computed by excluding student *i* from the mean.

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

in middle and high schools (0.1–0.5 standard deviations), likely because of greater tracking and ability grouping at these grades. We observe similar patterns for Hispanics compared with Whites and for poor students compared with nonpoor students. Students' prior achievement is also strongly related to their classmates' prior achievement, even in elementary schools. For example, in District 1, the average difference in classmates' prior math achievement is nearly 0.8 standard deviations for high- versus low-scoring students (–0.399 – 0.392 = –0.791). The difference is between 0.05 or 0.24 standard deviations in District 2 and District 3. The differences are even larger among middle and high school students, at between 0.2 and 1.1 standard deviations.

Within-school sorting may create inequities in access to high-quality teachers as well as to high-performing peers. We examine the relationship between student characteristics and the probability of having a novice teacher in the bottom panel of Table 2. The results are quite consistent: Black and Hispanic students are more likely than White students to have novice teachers than their peers at their school. The differences are larger in the middle and high school grades than in the elementary grades, but significant differences are evident across grade levels. In District 1, the probability of having a novice teacher is approximately 2% higher for Black students than for White students. Similarly, poor students are more likely to have novice teachers, although this relationship is not as consistent within elementary schools; the magnitude is small in all three districts, and the point estimates are strongly significant only in the third district.

Low-achieving students are the most likely to be assigned to novice teachers, while high-achieving students are least likely. For example, in District 1, the probability of having a novice teacher is about 2% higher for low-achieving students and 4% lower for high-achieving students compared with the middle half of students within elementary schools. At the middle and high school levels, the probability of having a novice teacher is about 2% higher for low-achieving students and 2% to 7% lower for high-achieving students within schools across the three districts. These results are consistent with prior research on teacher sorting (Boyd, Lankford, Loeb, & Wyckoff, 2005a, 2005b; Clotfelter et al., 2006; Feng, 2010; Hanushek, Kain, & Rivkin, 2004; Kalogrides, Loeb, & Béteille, 2013; Lankford, Loeb, & Wyckoff, 2002).

Although there are many statistically significant differences in the characteristics of the teachers and peers to which minority, poor, and low-achieving students are exposed, some differences could occur even if students were assigned to classrooms randomly. Only a deliberate effort to achieve perfect racial or socioeconomic integration within schools would result in evenly distributed classrooms. A random allocation process is likely to deviate somewhat from a perfectly even distribution (Carrington & Troske, 1997; Conger, 2005), and it is not clear whether the differences shown in Table 2 are larger than what we would expect to find if assignments were random. To investigate this further, we examine how students are distributed across classrooms after randomly assigning them to classrooms via simulation.

The simulation works as follows: First, we count the number of classrooms that enroll students in a given grade at a school each year. Then we randomly assign students to classes within schools, grades, and years. We assign students to the same number of classrooms that are observed and make the classes each have equal size. We repeat the simulation 100 times. After randomly assigning students to classes within school-grade-year groups, we compute characteristics of students' randomly assigned classrooms and then compare the distribution of student characteristics that results from random assignment to the distribution observed in the data. We repeat this process for each simulation (100 times) and then average the estimates. The results of the simulation consistently show few differences in classmate characteristics between White and Black, White and Hispanic, free or reduced-price lunch and not free or reduced-price lunch, and low-achieving versus higher achieving students within schools when students are assigned to classes randomly. Thus, the differences we see in the districts are unlikely to be due to random sorting.[2]

Do Achievement Differences Drive Sorting by Race/Ethnicity and Poverty Status?

The next stage of our analysis adds prior achievement to the models shown in Tables 2 to ask whether differences in achievement can explain within-school sorting by race, ethnicity, or poverty. The goal of this analysis is to understand the extent to which racial/ethnic and socioeconomic differences in prior achievement contribute to the differences in teacher and classmate characteristics observed for poor, minority, and low-achieving students. In Table 3, Model 1, we show the raw bivariate relationships also presented in Table 2 for comparison; in Model 2, we include controls for students' prior-year reading and math test scores; in Model 3, we instrument for prior math test scores using the twice-lagged math score; and in Model 4, we control for middle and high school students' cumulative grade point averages.

Including controls for prior achievement explains much of the racial, ethnic, and socioeconomic differences in the probability of having a novice teacher. Some significant differences remain for District 3; for example, the probability of having a novice teacher is higher for Black and Hispanic high school students relative to White students after controlling for prior achievement, but the differences in the probability are less than 1%. The same is true for the difference between poor and nonpoor students.

Controlling for prior achievement, however, does not entirely explain the relationship between student race and the proportion of Black classmates. Even after controlling for prior achievement and grade point average, Black high school students still have 1% to 5% percent more Black classmates than similar scoring White students in their grade. Across all three districts, the Black-White difference in the proportion of Black classmates declines by about half from Model 1 to the full model.

The bottom panel of Table 3 shows the relationship among student race, ethnicity, socioeconomic status, and average classmate achievement. In elementary school, we find that although some significant differences remain in the full model, controlling for students' own prior achievement substantially reduces racial, ethnic, and socioeconomic gaps in the average achievement of students' classmates. The same is true at the high school

Table 3
Student Race, Poverty Status, and Characteristics of Classrooms, With Controls for Prior Achievement

	Elementary School			High School			
Variable	**1**	**2**	**3**	**1**	**2**	**3**	**4**
Outcome: novice teacher							
District 1							
Black	.017***	.002	.001	.031***	.004	–.000	
	(.001)	(.002)	(.004)	(.002)	(.002)	(.003)	
Hispanic	.006***	.002	–.001	.016***	.000	–.002	
	(.001)	(.002)	(.003)	(.002)	(.002)	(.002)	
Eligible for free or reduced-price lunch	.012***	.002	.001	.011***	.001	.001	
	(.001)	(.001)	(.002)	(.001)	(.001)	(.001)	
District 2							
Black	.006***	.001	–.003	.019***	.009	.021*	.005
	(.002)	(.004)	(.006)	(.004)	(.006)	(.009)	(.006)
Hispanic	.008***	.001	–.000	.011***	.014+	.027***	.011
	(.002)	(.004)	(.006)	(.004)	(.007)	(.010)	(.007)
Eligible for free or reduced-price lunch	.001	–.001	–.002	.007***	.007	.000	.006
	(.001)	(.002)	(.003)	(.002)	(.004)	(.006)	(.004)
District 3							
Black	.003*	.005*	.006*	.021***	.009*	.009*	.008*
	(.001)	(.002)	(.003)	(.003)	(.003)	(.004)	(.004)
Hispanic	.002	–.004+	–.004	.017***	.009***	.008*	.008***
	(.001)	(.002)	(.003)	(.003)	(.003)	(.004)	(.003)
Eligible for free or reduced-price lunch	.002***	.002*	.003*	–.002	–.004***	–.004*	–.004***
	(.001)	(.001)	(.001)	(.001)	(.002)	(.002)	(.002)
Outcome: percentage of Black classmates							
District 1							
Black	.055***	.018***	.012***	.054***	.034***	.027***	
	(.000)	(.001)	(.001)	(.001)	(.001)	(.001)	
Hispanic	–.011***	.003***	.002*	.011***	.008***	.007***	
	(.000)	(.001)	(.001)	(.000)	(.001)	(.001)	
Eligible for free or reduced-price lunch	.003***	.003***	.003***	.008***	.001***	.002***	
	(.000)	(.000)	(.001)	(.000)	(.000)	(.000)	
District 2							
Black	.006***	–.008***	–.014***	.082***	.047***	.038***	.043***
	(.001)	(.001)	(.002)	(.001)	(.002)	(.003)	(.002)
Hispanic	–.037***	–.017***	–.017***	–.005***	–.006*	–.002	–.009***
	(.001)	(.001)	(.002)	(.002)	(.003)	(.004)	(.003)
Eligible for free or reduced-price lunch	.002***	.003***	.002	.015***	.004***	.004+	.003+
	(.000)	(.001)	(.001)	(.001)	(.001)	(.002)	(.001)
District 3							
Black	.035***	.013***	.007***	.093***	.047***	.042***	.046***
	(.001)	(.002)	(.002)	(.001)	(.002)	(.002)	(.002)
Hispanic	–.034***	–.022***	–.015***	.009***	.004*	.001	.003*
	(.001)	(.001)	(.002)	(.001)	(.002)	(.002)	(.002)
Eligible for free or reduced-price lunch	.002***	.003***	.001	.002*	–.001+	.001	–.002*
	(.000)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Outcome: prior achievement of classmates							
District 1							
Black	–.166***	–.018***	.004	–.295***	–.020***	.025***	
	(.004)	(.004)	(.006)	(.004)	(.003)	(.004)	
Hispanic	–.129***	–.012***	–.012*	–.169***	–.019***	–.009***	
	(.004)	(.003)	(.005)	(.003)	(.003)	(.003)	

(continued)

Table 3 (continued)

	Elementary School			High School			
Variable	1	2	3	1	2	3	4
Eligible for free or reduced-price lunch	−.152***	−.035***	−.021***	−.136***	−.026***	−.019***	
	(.002)	(.002)	(.003)	(.002)	(.001)	(.002)	
District 2							
Black	−.003	.009*	.016*	−.214***	−.098***	−.062***	−.083***
	(.004)	(.005)	(.006)	(.006)	(.007)	(.010)	(.007)
Hispanic	.041***	.031***	.028***	−.130***	−.059***	−.043***	−.046***
	(.004)	(.005)	(.007)	(.007)	(.008)	(.011)	(.008)
Eligible for free or reduced-price lunch	−.007***	−.001	.002	−.067***	−.012***	−.004	−.008+
	(.003)	(.003)	(.004)	(.004)	(.004)	(.006)	(.004)
District 3							
Black	−.074***	.001	.003	−.320***	−.041***	−.017+	−.034***
	(.005)	(.006)	(.008)	(.008)	(.007)	(.009)	(.007)
Hispanic	−.093***	−.048***	−.026***	−.268***	−.042***	−.020*	−.036***
	(.004)	(.006)	(.007)	(.007)	(.006)	(.008)	(.006)
Eligible for free or reduced-price lunch	−.041***	−.011***	−.011***	−.070***	−.005+	−.018***	−.005+
	(.002)	(.003)	(.003)	(.004)	(.003)	(.004)	(.003)
School-by-grade-by-year fixed effect	X	X	X	X	X	X	X
Prior math and reading achievement	X	X	X	X	X	X	X
Instrumental variable for prior math achievement	—	—	X	—	—	X	—
Student grade point average	—	—	—	—	—	—	X

Note. Classmate characteristics for high school students refer to the attributes of students' peers in their math classes. Classroom averages are computed by excluding student *i* from the mean. In the instrumental-variables model, we instrument for prior-year math test scores using students' twice-lagged math scores. Grade point average is not available for District 1.
*$p < .05$. **$p < .01$. ***$p < .001$.

level, although in Districts 2 and 3, the gaps that remain unexplained in the full model are still between 0.03 and 0.08 standard deviations in magnitude. The poor-nonpoor gaps are small in the full model across all three districts.

Discussion

In this study, we analyzed the pattern of sorting within schools in three large urban districts using detailed administrative data that cover the populations of students, classes, and teachers in more than 900 schools. We examined the relationship between student characteristics and the characteristics of their classmates and teachers. Descriptively, we found that the sorting among schools by students race, ethnicity, poverty status, and achievement is larger than sorting within schools but that some level of sorting across classrooms within schools occurs at all grade levels. This within-school sorting is greater in middle and high schools but still evident in elementary schools. These findings support analyses conducted in other large urban school districts that have looked at sorting by race, though no prior study that we know of has looked similarly at sorting by poverty or achievement (Clotfelter et al., 2002; Conger, 2005).

We also find that Black, Hispanic, poor, and low-achieving students are more likely to be in classes taught by novice teachers and to have lower achieving and less advantaged classmates compared with White and nonpoor students in their grade at their school. Racial, ethnic, and socioeconomic differences in prior achievement explain most but not all of the inequality in teacher and peer characteristics we document. That is, most of the sorting of by race and poverty can be explained by a sorting by achievement. Again, this sorting by achievement occurs even within elementary schools. In sum, most but not all of the variation in peer and teacher characteristics occurs between schools, rather than within schools, and much of the within-school sorting by race, ethnicity, and poverty is explained by differences in prior achievement. Nonetheless, the sorting results in Black, Hispanic, poor, and low-achieving students in classrooms with lower achieving peers and less experienced teachers.

Prior research provides insights into the mechanisms behind the patterns we observe. Why, for instance, would Black, Hispanic, poor, and lower achieving students be more likely to have novice teachers than other students in their schools? First, several studies have found that teachers prefer teaching high-achieving students and more advanced course content (Kalogrides et al., 2013; Monk, 1987; Neild & Farley-Ripple, 2008). If more experienced teachers have greater power within schools and are able to influence their school leaders' decisions, they may use this power to obtain preferable assignments (Monk, 1987). Moreover, principals may feel pressure from parents when making class assignments. In particular, the preferences of middle-class parents to have their children in classes with more experienced or effective teachers and better students and the preferences of senior teachers

to teach high-achieving students could contribute to the patterns we document even at the elementary school level (Carey & Farris, 1994; Lareau, 2000). Similarly, parents and students may request to be assigned to courses with friends, which could contribute to the patterns we document, given tendencies toward segregated friendship networks (Moody, 2001). Principals may also group students from similar backgrounds together in classes because of perceived educational benefits. For example, some studies have found that minority students learn more when they have a same-race teacher (Dee, 2005), and teachers tend to rate their students' behavior more favorably when they share the same race (Downey & Pribesh, 2004). Given these findings, principals may view teacher-student race matching as a potential way of boosting average achievement at their schools. In prior research, we found that Black and Hispanic teachers tend to be assigned more Black and Hispanic students than their White colleagues in their grade at their school (Kalogrides et al., 2013). The same processes may also be at work at the middle and high school levels, although class assignments in the higher grades are more complex given the differentiation of the curriculum.

The patterns we document could have implications for inequality, although the evidence on this is not entirely clear. Grouping students in classrooms by ability (or by race, ethnicity, or poverty status) might have significant impacts on student achievement, but this depends on the magnitude of peer influences and the ability of teachers to appropriately differentiate instruction within classrooms (Burke & Sass, 2009; Epple, Newlon, & Romano, 2002). Rigorous studies on the effects of tracking on student achievement have found little evidence that tracking hurts lower ability students (Duflo, Dupas, & Kremer, 2011; Figlio & Page, 2002), although the practice of ability grouping is still highly controversial (Gamoran, 1992b). The lack of an effect of ability grouping could be because peer effects are actually smaller than often assumed (Burke & Sass, 2009) or because teachers are better able to tailor the curriculum to students' ability levels in tracked classrooms. At the same time, however, there is fairly clear evidence that having more delinquent peers (which may be correlated with peer achievement levels as well) has negative effects on achievement (Figlio, 2007), and our results (available on request) show that low-achieving, poor, and minority students are in classrooms with more peers who were suspended in the prior year.

Although it is somewhat unclear whether sorting to different peers influences within school achievement gaps, there is clear evidence from prior studies that the assignment of novice teachers to disadvantaged and low-achieving students likely has negative consequences for equity. Although student learning gains do not necessarily increase linearly with teacher experience, there is ample evidence that novice teachers are, on average, less effective at raising student achievement compared with their more experienced peers (Rockoff, 2004). Consequently, given their higher likelihood of receiving inexperienced teachers, the achievement of Black, Hispanic, low-income, and initially low-achieving students is likely to suffer as a result of the patterns of assignment we document.

This study is the first that we know of to use large-scale data to systematically document the sorting of students by race, ethnicity, poverty, and achievement within large urban school districts. The findings point first to the clear evidence of sorting even within schools. They also point to the importance of achievement differences in explaining sorting by race/ethnicity and poverty and to implications of the sorting for the peer and teacher resources available to lower achieving students.

NOTES

[1]Teacher experience is the only measure of teacher qualifications we have available across all three districts. Although it might be interesting to study differential access to teachers with other types of qualifications, teacher experience is particularly relevant given that it is one of few observable teacher characteristics found to be associated with effectiveness.

[2]A table with the results of the simulation is available from the authors on request.

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Manuscript received November 16, 2012
Revision received February 20, 2013, and May 24, 2013
Accepted June 2, 2013