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

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Abstract

In this study we use administrative data from three large urban school districts to describe student sorting within schools. Our data allow us to link students to each of their teachers and to identify students' classmates. We find differences in the average achievement levels, the racial composition, and the socioeconomic composition of classrooms within schools. This sorting occurs even in self-contained elementary school classrooms and is much larger than would be expected if students were assigned to classrooms randomly. Much, but not all, of the racial and socioeconomic sorting we document is accounted for by differences in achievement, particularly at the high school level. Classrooms with the largest composition of low-achieving, minority and poor students are also more likely to have novice teachers. The process of sorting students by their achievement level has the consequence of exposing minority and poor students to lower quality teachers and less-resourced classmates.

Introduction

Large urban school districts serve increasingly diverse student bodies. Though many studies have described racial segregation between 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/ethnicity or family income or achievement. Attendance at the same schools does not ensure that students from different backgrounds will share classrooms or have equivalent educational experiences (Meier, Stewart, and England 1990; Mickelson 2002; Orfield 1975). In this study we examine patterns of sorting across classrooms within schools in three large urban school districts. Though 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 employ in this study. 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? Second, does the extent to which within school sorting occurs vary across grade levels? Third, to what extent can sorting by race/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 among schools but a non-trivial amount of within school sorting occurs, 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 and Sass 2009; Figlio 2007; Nye, Konstantopoulos, and Hedges 2004; Rivkin,

Hanushek, and Kain 2005; Rockoff 2004), the within school sorting we document likely exacerbates inequalities.

Research on Within School Sorting

Researchers and policy makers 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 non-equivalent educational experiences for minority and white students attending the same schools (Meier, Stewart, and England 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 and Berends 2002; Mickelson 2001; Oakes 1985; Oakes and Guiton 1995). Formal tracking, however, is not the only source of within-school sorting; thus, studies of tracking do not shed light on the 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 in national data that include only a few sampled students per school (Gamoran 1992b; Lucas and 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 studies only sample approximately 20-25 students per school so are relatively underpowered for examining differences in class assignments within schools. Only three studies that we are aware of have examined within school sorting by race

using data from a large number of schools and students (Clotfelter, Ladd, and Vigdor 2002; Conger 2005; Morgan and McPartland 1981). Morgan and McPartland (1981) study classroom segregation using data collected in 1976 by the office of Civil Rights. Their data include information about classroom enrollments for 18 randomly sampled classrooms in each of more than 40,000 schools. This paper remains the only national study of classroom segregation to date. More recently, Clotfelter, Ladd, and Vigdor (2002) and Conger (2005) conducted similar analyses in North Carolina and New York. 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 (2005) 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, 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 level, which has 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 homogenous instructional groups (Gamoran 1986; Loveless 1999; Pallas, Entwisle, Alexander, and 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. Since we have data on the population of students, teachers, and classes in three districts over several years, we have more power to detect within-school differences in teacher and

classmate characteristics for students from varying backgrounds. Second, while 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, Ladd, and Vigdor 2002; Conger 2005; Morgan and McPartland 1981). Third, while some studies in the tracking literature find 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 students by achievement. Since 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 school 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 is due 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, where tracking is more common, may differ in from the processes that contribute to sorting in elementary schools which generally lack differentiated curricula.

In a tracked system students are, at least in part, assigned to classrooms based on 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

and 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 (though not entirely) related to students' prior achievement levels (Gamoran 1992a; Oakes and 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, though race and socioeconomic status also play some role (Alexander and McDill 1976; Attewell and Domina 2008; Conger, Long, and Iatarola 2009; Gamoran 1992a; Gamoran and Berends 1987; Kelly 2009; Kilgore 1991; Oakes and 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 based on the schools' formal assignment criteria (Kilgore 1991; Oakes and 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 look for ways to maximize student achievement (Cohen-Vogel 2011; Cohen-Vogel and Rutledge 2009; Mickelson and Everett 2008; Oakes 2008).

The formal assignment of students to different courses that are vertically differentiated (i.e., via 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 where there is no formal differentiation of the curriculum.

Prior research suggests that middle and upper class parents often intervene in the class assignment to ensure that their child is taught by a teacher whom they believe to be desirable

(Lareau 1987; 2000). Advantaged parents are more likely to be involved in their child's education and spend time at their school (Lareau 1987; Useem 1991; Useem 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 ability of other students in their child's class. In contrast, working class parents have limited information about most aspects of their child's experience at school (Lareau 1987; Lareau 2000; Lareau 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, and 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 and 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 and 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 will leave anonymous: one from the Southeast (District 1), one from the Midwest (District 2) and one from the West (District 3). Data from District 1 and District 2 are available from the 2003-04 to 2009-10 school years, while data from District 3 are available from 2001-02 to 2009-10. 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 score and basic demographic information for all students, course-level data that links 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 that 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 zero and a standard deviation of one within each grade and school-year.

In addition to having student-level data, we also have demographic information on all staff in each district which we link to the student records via course-level identifiers. We combine this information to construct a dataset 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

course. 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., percent minority, average prior test scores) are computed by excluding the focal student from the class averages.

The districts that we examine are large and diverse. Between 9 and 14 percent of students are white in each district; the majority of students in District 1 are Hispanic (61 percent); the majority of students in District 2 are black (57 percent); and the majority of students in District 3 are Asian or other race/ethnicities (56 percent). The three districts also have high concentrations of poor students with 53, 64, and 39 percent of students, respectively, eligible for free lunch. Eight percent of students in District 1 were chronically absent during our sample period, compared to 23 percent in District 2 and 18 percent in District 3. Nineteen percent of students in District 1 had a novice teacher (first or second year), compared to 12 percent in the second district and four percent 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 that would have to change schools

to be evenly distributed across the district (James and 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/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 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. Here we use a measure of whether the teacher has one or two years of experience to describe novice teachers. We chose this cutoff given prior studies that have found that teachers improve between their first and second years and their second and third years but then level off. Since 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 two years.[1]All models also include a school by grade by year fixed effect which 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 where the outcome is whether or not the class is taught by a novice teacher, the coefficient on free lunch eligibility would show the difference in the probability of having a novice teacher among free lunch and non-free lunch eligible students attending the same school and grade in a given year. In our second research question we ask whether the extent of within school sorting

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

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).

In our third research question we ask to what extent can sorting by race/ethnicity and poverty status 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 evaluating the role of achievement differences in contributing to within school sorting by student race and free lunch eligibility. 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 them 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 which may otherwise bias our estimates. As a final way of controlling for achievement differences, we control for (high school) students' cumulative grade point average. 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-non black segregation as an example, the dissimilarity index is interpreted as the proportion of black students that 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/ethnic segregation is relatively high in all three districts, ranging from around .50 to .70 depending on the grade-level (Clotfelter, Ladd, and Vigdor 2002; Conger 2005). Students are less segregated by poverty status with levels of segregation ranging from .30 to .50. Segregation by achievement is quite high in all three districts, particularly in middle and high schools where it ranges from .70 to .90. For example, in District 3 87 percent 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 .60 or higher in all three districts. Levels of segregation by achievement levels are relatively similar across the three districts. We do find differences across the three districts in levels of segregation by race/ethnicity. For example, black-non-black segregation is lower in District 3, which has a relatively small black population. Similarly, Hispanic-non-Hispanic segregation is highest in District 1 which has a large Hispanic population.

Second, segregation varies across grades. In particular, overall segregation levels tend to decline across grades, driven by lower between school segregation at 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 are a greater number of elementary schools and thus more opportunity for sorting. While 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 increases across grades, as between school segregation stays about the same and within school segregation across classrooms increases.

Another way of describing student sorting is to compare the average characteristics of students' classmates. 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-non-poor, 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. Here we use a measure of whether the teacher has one or two years of experience to describe novice teachers. We chose this cutoff given prior studies that have found that teachers improve between their first and second years and their second and third years but then level off. Since 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 two years.[2] 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, free-lunch status, and prior year

[2] Teacher experience is the only measure of teacher qualifications we have available. Though it might be interesting to study differential access to teachers with other types of qualifications, we believe that teacher experience is the most relevant given that it is one of few observable teacher characteristics found to be associated with effectiveness. Therefore, differences in assignment to novice teachers is a concern from an equity perspective.

achievement quartile variables are each entered in a separate model so that the differences do not control for other characteristics. Students have different classmates. Black elementary school students have between one and six percent more black classmates and black high school students have five to nine percent more black classmates than do white students in their grade at their school in a given year. Similarly, poor students have between one and three percent more poor classmates than non-poor students do in their grade at their school in a given year (though 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 one-fifth of a standard deviation 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 one-tenth of a standard deviation. The differences are even larger in middle and high schools (0.1-0.5 standard deviations), likely due to greater tracking and ability grouping at these grades. We observe similar patterns for Hispanics compared to whites and for poor students compared to non-poor 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 four-fifths of a standard deviation for high versus low scoring students (-.399+.392=-.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 the 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 (defined as a teacher in their first or second year working in the district) in the bottom panel of Table 2. We focus on teaching experience since prior research suggests that novice teachers are less effective at raising student achievement than their more experienced counterparts (Clotfelter, Ladd, and Vigdor 2006; Rivkin, Hanushek, and Kain 2005; Rockoff 2004) and that other teacher characteristics commonly measured in administrative datasets are generally unrelated to student achievement (Aaronson, Barrow, and Sander 2007; Clotfelter, Ladd, and Vigdor 2006). 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 percent higher for black students than for white students. Similarly, poor students are more likely to have novice teachers, though 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 more likely to be assigned novice teachers than students in the middle 50 percent of the prior year's achievement distribution, while high achieving students are the least likely. For example, in District 1 the probability of having a novice teacher is about two percent higher for low achieving students and four percent lower for high achieving students within elementary schools. At the middle and high school level, the probability of having a novice teacher is about two percent higher for low achieving students and two to seven percent lower for high achieving students within schools across the three districts. These results are consistent with prior research on teacher sorting (Boyd, Lankford, Loeb, and Wyckoff 2005a; Boyd, Lankford, Loeb, and Wyckoff 2005b; Clotfelter, Ladd, and Vigdor 2006; Feng 2010;

Hanushek, Kain, and Rivkin 2004; Kalogrides, Loeb, and Béteille 2013; Lankford, Loeb, and Wyckoff 2002).

Though 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 and 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 a 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-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 lunch and not free 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.[3]

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

The next stage of our analysis adds controls for prior achievement to the models shown in Tables 2. 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; 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 one percent. The same is true for the difference between poor and non-poor 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 one to five percent more black classmates than similar scoring white students in their grade. Across all 3 districts the black-white difference in the proportion of black classmates declines by about half from model 1 to the full model.

[3] A table with the results of the simulation is available from the authors upon request.

The bottom panel of Table 3 shows the relationship between student race/ethnicity, socioeconomic status and average classmate achievement. In elementary school we find that while some significant differences remain in the full model, controlling for students' own prior achievement substantially reduces race/ethnic and socioeconomic gaps in the average achievement of students' classmates. The same is true at the high school level, though in District 2 and 3 the gaps that remain unexplained in the full model are still between .03 and .08 standard deviations in magnitude. The poor-non-poor gaps are small in the full model across all three districts.

Discussion

In this paper we studied the pattern of sorting within schools in three large urban districts using detailed administrative data that covers the population of student, classes, and teachers in more than 900 schools. We examined the relationship between student characteristics and the characteristics of their teachers and classmates. Descriptively, we found that sorting among schools is larger than sorting within schools but some level of sorting across classrooms within schools occurs at all grade levels, with greater sorting in middle and high school. These findings support analyses conducted in other large urban school districts that have looked at sorting by race but not by other student characteristics (Clotfelter, Ladd, and Vigdor 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 to white and non-poor 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. In sum, these findings suggest that most but not all of the variation in peer and teacher characteristics occurs between schools, rather than within

schools, and that much of the within school sorting we document is explained by differences in prior achievement.

Our data do not allow us to investigate all of the possible mechanisms that may generate differences in student characteristics across classrooms within schools. Prior achievement does explain some of the difference in teacher experience and classmate characteristics for minority and poor students relative to white and non-poor students. Interestingly, this is true across grade levels. The elementary school classrooms included in our data are self-contained with one teacher – these are the types of contexts where we would not necessarily expect prior achievement differences across classrooms. However, low achieving students in elementary schools are more likely to have novice teachers and to have low achieving, poor and minority classmates. In analysis not presented here we also find that low achieving students also have more classmates with attendance and disciplinary problems. We are not certain as to why this is the case. Prior research suggests that principals may feel pressure from parents and teachers 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 at the elementary school level. 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. Principals may also group students from similar backgrounds together in classes due to 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 and Pribesh 2004). Given these findings, principals may view teacher-student race

matching as a potential way of boosting average achievement at their school. 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, Loeb, and Béteille 2013). The same processes may also be at work at the middle and high school levels, though class assignments in the higher grades are more complex given the differentiation of the curriculum.

Though we cannot be certain of the causes of the sorting we document, some of the patterns we document could have implications for inequality, though the evidence on this is not entirely clear. Grouping students in classrooms by ability (or by race and socioeconomic status) might have significant impacts on student achievement but this depends on the magnitude of peer influences (Burke and Sass 2009; Epple, Newlon, and Romano 2002). Rigorous studies on the effects of tracking on student achievement find no evidence that tracking hurts lower ability students (Duflo, Dupas, and Kremer 2011; Figlio and Page 2002). This lack of an effect could be because peer effects are actually smaller than often assumed (Burke and 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 (not shown) show that low-achieving, poor and minority students are in classrooms with more peers who were suspended in the prior year.

While it is unclear whether sorting to different peers influences within school achievement gaps, we think that there is clear evidence from prior studies that the assignment of novice teachers to disadvantaged and low-achieving students is not an ideal practice and likely has negative consequences for equity. Although student learning gains do not necessarily increase linearly with teacher experience, novice teachers are, on average, less effective at

raising student achievement compared to their more experienced peers (Rockoff 2004). Consequently, given their higher likelihood of receiving an inexperienced teacher, 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.

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Table 1. Dissimilarity Indices for Segregation Across Schools and Classrooms

	District 1			District 2			District 3		
	Grades K to 5	Grades 6 to 8	Grades 9 to 12	Grades K to 5	Grades 6 to 8	Grades 9 to 12	Grades K to 5	Grades 6 to 8	Grades 9 to 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
Percent Between	98%	94%	86%	97%	94%	61%	88%	91%	64%
Percent 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
Percent Between	98%	91%	84%	95%	94%	82%	93%	93%	76%
Percent 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
Percent Between	95%	83%	89%	96%	82%	75%	86%	80%	71%
Percent Within	5%	17%	11%	4%	18%	25%	14%	20%	29%
Free Lunch-Not Free 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
Percent Between	92%	87%	88%	92%	86%	78%	87%	76%	68%
Percent 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
Percent Between	86%	58%	82%	88%	55%	66%	84%	53%	70%
Percent Within	14%	42%	18%	12%	45%	34%	16%	47%	30%

Notes: 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, for example: 60 percent 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 percent comes from sorting among classrooms within schools.

Table 2. Classmate Characteristics by Student Characteristics, Bivariate Relationships

	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	0.055 ***	0.006 ***	0.035 ***	0.042 ***	0.013 ***	0.092 ***	0.054 ***	0.082 ***	0.093 ***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Hispanic	-0.011 ***	-0.037 ***	-0.034 ***	0.013 ***	-0.018 ***	0.001	0.011 ***	-0.005 **	0.009 ***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.002)	(0.002)	(0.000)	(0.002)	(0.001)
Eligible for Free Lunch	0.003 ***	0.002 ***	0.002 ***	0.014 ***	0.004 ***	0.011 ***	0.008 ***	0.015 ***	0.002 *
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Bottom Quartile of Prior Math Score	0.006 ***	0.004 ***	0.016 ***	0.024 ***	0.005 ***	0.060 ***	0.027 ***	0.014 ***	0.067 ***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.002)	(0.001)
Top Quartile of Prior Math Score	-0.015 ***	-0.004 ***	-0.005 ***	-0.039 ***	-0.012 ***	-0.045 ***	-0.043 ***	-0.077 ***	-0.037 ***
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.002)	(0.001)
Proportion of Hispanic Classmates									
Black	-0.030 ***	-0.014 ***	-0.027 ***	-0.001	-0.006 ***	0.014 ***	-0.012 ***	-0.016 ***	0.024 ***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Hispanic	0.041 ***	0.055 ***	0.155 ***	0.016 ***	0.038 ***	0.085 ***	0.018 ***	0.065 ***	0.096 ***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.000)	(0.001)	(0.002)
Eligible for Free Lunch	0.012 ***	0.001 **	0.020 ***	0.005 ***	0.002 *	0.019 ***	0.005 ***	0.001	0.009 ***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Bottom Quartile of Prior Math Score	0.006 ***	-0.009 ***	0.031 ***	-0.005 ***	-0.001	0.053 ***	-0.007 ***	-0.002	0.061 ***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Top Quartile of Prior Math Score	-0.015 ***	0.004 ***	-0.021 ***	-0.015 ***	-0.002 +	-0.061 ***	-0.012 ***	0.001	-0.056 ***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Proportion of F/R Lunch Classmates									
Black	0.034 ***	0.008 ***	0.020 ***	0.053 ***	0.014 ***	0.051 ***	0.038 ***	0.035 ***	0.018 ***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Hispanic	0.034 ***	0.007 ***	0.036 ***	0.035 ***	0.013 ***	0.056 ***	0.028 ***	0.025 ***	0.025 ***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
Eligible for Free Lunch	0.025 ***	-0.001 **	0.004 ***	0.031 ***	-0.008 ***	0.031 ***	0.024 ***	0.008 ***	0.023 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Bottom Quartile of Prior Math Score	0.041 ***	0.003 ***	0.019 ***	0.052 ***	0.012 ***	0.058 ***	0.039 ***	0.012 ***	0.031 ***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Top Quartile of Prior Math Score	-0.056 ***	-0.003 ***	-0.009 ***	-0.095 ***	-0.013 ***	-0.073 ***	-0.066 ***	-0.043 ***	-0.020 ***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)

Table 2, Continued

	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	-0.166 ***	-0.003	-0.074 ***	-0.294 ***	-0.064 ***	-0.468 ***	-0.295 ***	-0.214 ***	-0.320 ***
	(0.004)	(0.004)	(0.005)	(0.004)	(0.007)	(0.010)	(0.004)	(0.006)	(0.008)
Hispanic	-0.129 ***	0.041 ***	-0.093 ***	-0.165 ***	-0.037 ***	-0.414 ***	-0.169 ***	-0.130 ***	-0.268 ***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.008)	(0.009)	(0.003)	(0.007)	(0.007)
Eligible for Free Lunch	-0.152 ***	-0.007 **	-0.041 ***	-0.205 ***	-0.042 ***	-0.186 ***	-0.136 ***	-0.067 ***	-0.070 ***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.004)	(0.005)	(0.002)	(0.004)	(0.004)
Bottom Quartile of Prior Math Score	-0.399 ***	-0.038 ***	-0.151 ***	-0.654 ***	-0.130 ***	-0.461 ***	-0.664 ***	-0.109 ***	-0.356 ***
	(0.002)	(0.003)	(0.003)	(0.002)	(0.005)	(0.005)	(0.002)	(0.006)	(0.005)
Top Quartile of Prior Math Score	0.392 ***	0.013 ***	0.087 ***	0.679 ***	0.063 ***	0.690 ***	0.612 ***	0.303 ***	0.601 ***
	(0.002)	(0.003)	(0.003)	(0.002)	(0.005)	(0.005)	(0.002)	(0.005)	(0.005)
Assignment to Novice Teacher (Linear Probability)									
Black	0.017 ***	0.006 ***	0.003 *	0.023 ***	0.007 +	0.015 ***	0.031 ***	0.019 ***	0.021 ***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.003)
Hispanic	0.006 ***	0.008 ***	0.002	0.017 ***	-0.007 +	0.007 ***	0.016 ***	0.011 **	0.017 ***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.003)
Eligible for Free Lunch	0.012 ***	0.001	0.002 **	0.012 ***	0.006 **	0.002 +	0.011 ***	0.007 **	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
Bottom Quartile of Prior Math Score	0.020 ***	0.007 **	0.006 ***	0.022 ***	0.018 ***	0.015 ***	0.060 ***	0.005	0.020 ***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.005)	(0.002)
Top Quartile of Prior Math Score	-0.032 ***	-0.006 *	-0.000	-0.056 ***	-0.006 *	-0.007 ***	-0.079 ***	-0.037 ***	-0.017 ***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)	(0.004)	(0.002)
School-Year-Grade FE	X	X	X	X	X	X	X	X	X

Notes: *p<.05, **p<.01, ***p<.001 The outcomes are noted by the text within the gray headings. Student race/ethnicity, free lunch status, 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 percent 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.

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

	ELEMENTARY SCHOOL						HIGH SCHOOL							
	1		2		3		1		2		3		4	
Outcome: Novice Teacher														
District 1														
Black	0.017	***	0.002		0.001		0.031	***	0.004		-0.000			
	(0.001)		(0.002)		(0.004)		(0.002)		(0.002)		(0.003)			
Hispanic	0.006	***	0.002		-0.001		0.016	***	0.000		-0.002			
	(0.001)		(0.002)		(0.003)		(0.002)		(0.002)		(0.002)			
Eligible for Free Lunch	0.012	***	0.002		0.001		0.011	***	0.001		0.001			
	(0.001)		(0.001)		(0.002)		(0.001)		(0.001)		(0.001)			
District 2														
Black	0.006	***	0.001		-0.003		0.019	***	0.009		0.021	*	0.005	
	(0.002)		(0.004)		(0.006)		(0.004)		(0.006)		(0.009)		(0.006)	
Hispanic	0.008	***	0.001		-0.000		0.011	**	0.014	+	0.027	**	0.011	
	(0.002)		(0.004)		(0.006)		(0.004)		(0.007)		(0.010)		(0.007)	
Eligible for Free Lunch	0.001		-0.001		-0.002		0.007	**	0.007		0.000		0.006	
	(0.001)		(0.002)		(0.003)		(0.002)		(0.004)		(0.006)		(0.004)	
District 3														
Black	0.003	*	0.005	*	0.006	*	0.021	***	0.009	*	0.009	*	0.008	*
	(0.001)		(0.002)		(0.003)		(0.003)		(0.003)		(0.004)		(0.004)	
Hispanic	0.002		-0.004	+	-0.004		0.017	***	0.009	**	0.008	*	0.008	**
	(0.001)		(0.002)		(0.003)		(0.003)		(0.003)		(0.004)		(0.003)	
Eligible for Free Lunch	0.002	**	0.002	*	0.003	*	-0.002		-0.004	**	-0.004	*	-0.004	**
	(0.001)		(0.001)		(0.001)		(0.001)		(0.002)		(0.002)		(0.002)	

Table 3, Continued

	ELEMENTARY SCHOOL						HIGH SCHOOL							
	1		2		3		1		2		3		4	
Outcome: Percentage of Black Classmates														
District 1														
Black	0.055	***	0.018	***	0.012	***	0.054	***	0.034	***	0.027	***		
	(0.000)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)			
Hispanic	-0.011	***	0.003	***	0.002	*	0.011	***	0.008	***	0.007	***		
	(0.000)		(0.001)		(0.001)		(0.000)		(0.001)		(0.001)			
Eligible for Free Lunch	0.003	***	0.003	***	0.003	***	0.008	***	0.001	***	0.002	***		
	(0.000)		(0.000)		(0.001)		(0.000)		(0.000)		(0.000)			
District 2														
Black	0.006	***	-0.008	***	-0.014	***	0.082	***	0.047	***	0.038	***	0.043	***
	(0.001)		(0.001)		(0.002)		(0.001)		(0.002)		(0.003)		(0.002)	
Hispanic	-0.037	***	-0.017	***	-0.017	***	-0.005	**	-0.006	*	-0.002		-0.009	***
	(0.001)		(0.001)		(0.002)		(0.002)		(0.003)		(0.004)		(0.003)	
Eligible for Free Lunch	0.002	***	0.003	**	0.002		0.015	***	0.004	**	0.004	+	0.003	+
	(0.000)		(0.001)		(0.001)		(0.001)		(0.001)		(0.002)		(0.001)	
District 3														
Black	0.035	***	0.013	***	0.007	***	0.093	***	0.047	***	0.042	***	0.046	***
	(0.001)		(0.002)		(0.002)		(0.001)		(0.002)		(0.002)		(0.002)	
Hispanic	-0.034	***	-0.022	***	-0.015	***	0.009	***	0.004	*	0.001		0.003	*
	(0.001)		(0.001)		(0.002)		(0.001)		(0.002)		(0.002)		(0.002)	
Eligible for Free Lunch	0.002	***	0.003	***	0.001		0.002	*	-0.001	+	0.001		-0.002	*
	(0.000)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	

Table 3, Continued

	ELEMENTARY SCHOOL						HIGH SCHOOL							
	1		2		3		1		2		3		4	
Outcome: Prior Achievement of Classmates														
District 1														
Black	-0.166	***	-0.018	***	0.004		-0.295	***	-0.020	***	0.025	***		
	(0.004)		(0.004)		(0.006)		(0.004)		(0.003)		(0.004)			
Hispanic	-0.129	***	-0.012	***	-0.012	*	-0.169	***	-0.019	***	-0.009	**		
	(0.004)		(0.003)		(0.005)		(0.003)		(0.003)		(0.003)			
Eligible for Free Lunch	-0.152	***	-0.035	***	-0.021	***	-0.136	***	-0.026	***	-0.019	***		
	(0.002)		(0.002)		(0.003)		(0.002)		(0.001)		(0.002)			
District 2														
Black	-0.003		0.009	*	0.016	*	-0.214	***	-0.098	***	-0.062	***	-0.083	***
	(0.004)		(0.005)		(0.006)		(0.006)		(0.007)		(0.010)		(0.007)	
Hispanic	0.041	***	0.031	***	0.028	***	-0.130	***	-0.059	***	-0.043	***	-0.046	***
	(0.004)		(0.005)		(0.007)		(0.007)		(0.008)		(0.011)		(0.008)	
Eligible for Free Lunch	-0.007	**	-0.001		0.002		-0.067	***	-0.012	**	-0.004		-0.008	+
	(0.003)		(0.003)		(0.004)		(0.004)		(0.004)		(0.006)		(0.004)	
District 3														
Black	-0.074	***	0.001		0.003		-0.320	***	-0.041	***	-0.017	+	-0.034	***
	(0.005)		(0.006)		(0.008)		(0.008)		(0.007)		(0.009)		(0.007)	
Hispanic	-0.093	***	-0.048	***	-0.026	***	-0.268	***	-0.042	***	-0.020	*	-0.036	***
	(0.004)		(0.006)		(0.007)		(0.007)		(0.006)		(0.008)		(0.006)	
Eligible for Free Lunch	-0.041	***	-0.011	***	-0.011	**	-0.070	***	-0.005	+	-0.018	***	-0.005	+
	(0.002)		(0.003)		(0.003)		(0.004)		(0.003)		(0.004)		(0.003)	
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	
IV for Prior Math Achievement	---		---		X		---		---		X		---	
Student GPA	---		---		---		---		---		---		X	

Notes: *p<.05, **p<.01, ***p<.001 Classmate characteristics for high school students refers 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 (IV) model we instrument for prior year math test scores using students' twice lagged math score. Grade point average is not available for District 1.