

STALLED PROGRESS IN CLOSING THE RACE ACHIEVEMENT GAP: THE ROLE OF TEACHER QUALITY*

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Introduction

In January 2002 the federal government enacted *No Child Left Behind* (NCLB), an aggressive effort to hold schools and state education agencies accountable for “clos[ing] the achievement gap between high- and low-performing children, especially the achievement gap between minority and non-minority students.”¹ After decades of progress, the achievement gap between African-American and white children in reading and mathematics had begun to stagnate—or in many cases widen—and lawmakers viewed this legislation as a critical response to growing inequalities in basic skills.²

One principal component of NCLB is the requirement that all core academic subject teachers be “highly qualified.”³ Where states fall short of this mandate, the law requires documentation of actions that will be taken “to ensure that poor and minority children are not taught at higher rates than other children by inexperienced, unqualified, or out-of-field teachers.”⁴ Though there remains much debate over what constitutes a “highly qualified” teacher, the legislation’s emphasis on teachers is well-founded. Nearly all recent research on the subject has demonstrated that teacher quality ranks among the most important inputs that schools contribute to educational outcomes (see Hanushek and Rivkin (2006) for a review).

The central role of teacher quality in educational outcomes has led many researchers and policy analysts to point to differential exposure of white and black students to effective teachers as a possible contributor to the black-white achievement gap (Ferguson, 1998). Recent research has shown that teachers are unevenly distributed across districts and schools, with less-qualified teachers disproportionately located in schools with students from predominately low-income families or racial and ethnic minorities (Lankford, Loeb, and Wyckoff, 2002; Clotfelter, Ladd, and Vigdor, 2005

¹ Elementary and Secondary Education Act (ESEA) Section 1001(3). The ESEA legislation can be viewed here: <http://www.ed.gov/policy/elsec/leg/esea02/index.html> [Access date: May 29, 2007].

² See the introduction to this volume for a comprehensive overview.

³ NCLB defines “highly qualified” as meeting three conditions: (1) possession of a bachelor’s degree, (2) full certification by the state, and (3) demonstrated competence in the subject matter taught (§9101(23)(a)-(c)).

⁴ ESEA §1119(a)(1) and §1111(b)(8)(c).

and 2006). What is less clear, however, is whether *changes* in black-white exposure to high-quality teachers can explain observed trends in the black-white test score gap.⁵ As the introduction to this volume demonstrates, the achievement gap in reading and mathematics steadily narrowed at all levels for more than a decade through the 1980s (1975-1986), only to come to an abrupt halt and reverse course in the 1990s. Growth in the gap was especially pronounced at the middle school (age 13) and high school (age 17) levels, where the gap in reading achievement grew 54.8 and 51.3 percent (respectively) between 1988 and 1999, and the math gap rose 31.8 and 8.8 percent.⁶ By contrast, the elementary (age 9) gap in reading achievement ended the decade 21.2 percent larger in 1999, masking a general reduction in the gap between 1990 and 1996. The gap in elementary math achievement rose only marginally in the 1990s. This variation in trends observed at the elementary and secondary levels suggests that differences in exposure to effective teachers may have evolved differently by schooling level.

There is reason to believe that little has changed in recent years with respect to the distribution of teacher quality across black and white students. School enrollment has not become more racially integrated. Clotfelter (2004) and Orfield and Lee (2006) found that after a long period of desegregation, black students in most regions of the country became *more* racially isolated during the 1990s (see also Vigdor and Ludwig, this volume). Teacher decisions about where to work depend on the class and racial composition of students as much or more as on relative salaries (Hanushek, Kain, and Rivkin, 2004; Scafidi, Sjoquist, and Stinebrickner, 2007), and teacher labor markets themselves are remarkably local.⁷ Teacher placement continues to depend critically on the

⁵ The volume by Jencks and Phillips (1998) hinted at the possibility of a convergence in teacher quality across black and white students (see, for example, the chapter by Grissmer, Flanagan, and Williamson) but provided little data to support any definitive conclusions.

⁶ Based on authors' calculations from the National Assessment of Educational Progress (NAEP) Long-Run Trend Assessments. The long-run trend assessments in reading and math were initially administered in differing years. In the late 1980s, the mathematics assessment was administered in 1986, while reading was assessed in 1988.

⁷ Boyd et al. (2005) find in New York State that an extraordinarily high proportion of teachers accept their first teaching position in the same district in which they attended high school.

seniority privileges and preferences of individual teachers, in addition to parental voice and action. Absent any aggressive policies on the part of states, districts, and schools to more equitably distribute teachers—of which there are few examples—the existing pattern of student enrollment and teacher placement is likely to persist.⁸

In the following sections, we draw upon several large surveys of teachers and high school sophomores to assess how the exposure of white and black students to high quality teachers has changed over a fifteen-year period. We begin by briefly reviewing the evidence on teacher effectiveness, highlighting specific teacher attributes that have been shown to have a consistent relationship with student achievement. Then in our own analysis, we examine the distribution of teacher characteristics over students, focusing in particular teaching experience, advanced degrees, subject-matter preparation, certification, race, gender, and self-reported attitudes and effort. Though observable qualities of teachers have admittedly been found to matter less than unobservable dimensions of quality (Rivkin, Hanushek, and Kain, 2005), attributes such as teaching experience and content knowledge do have important effects on student learning and in select cases appear to play a more powerful role for black students than for whites.

Our analysis produces several key results. First, in annual cross sections, the observed characteristics of teachers teaching black students are mostly similar to those teaching white students, with a few important exceptions (such as teacher race, certification and experience). Where differences exist, they tend to be small in magnitude. Second, time series comparisons demonstrate that the gap in qualifications, characteristics, and attitudes between teachers of the average black and average white student widened during the 1990s. These differences are much more pronounced when comparing teachers in predominately black schools to teachers in predominately non-black schools. Third, almost all of the growing inequality in exposure to experienced or qualified teachers

⁸ Unfortunately it is too early to tell whether or not *No Child Left Behind* has reduced inequities in teacher qualifications. Not until 2005 was the teacher quality provision enforced by the federal government, and even then only weakly.

during the 1990s can be explained by changes occurring at the *elementary* level. The observed characteristics of teachers teaching black students at the secondary level mostly *improved* relative to those of white students over this period. Fourth, we find no evidence that overall improvement at the secondary level masks important changes in teacher-student matching *within* schools (through ability tracking, for example).

Our findings suggest that differential changes in exposure to qualified teachers are an unlikely explanation for stalled progress in the achievement gap. The racial gap in student exposure to qualified teachers grew during the 1990s, but almost entirely at the elementary level. In middle and high schools—where the achievement gap widened the most—exposure to qualified teachers remain quite stable, and in some cases improved. Our cursory look at trends in class size over this period suggests that contrasting findings at the elementary and secondary level may be a byproduct of state class size reduction efforts in the early grades. Pupil-teacher ratios in elementary schools plummeted during the 1990s while class sizes in high school fell only nominally. As other authors have shown, large-scale class size reduction policies can have the unintended consequence of lowering teacher quality in hard-to-staff schools (Jepsen and Rivkin, 2002).

We conclude—at least at the secondary level where most of the growth in the black-white achievement gap has occurred—that changes in the mean quality of teachers is unlikely to have negatively impacted the achievement gap. If anything, trends at the secondary level during the 1990s suggest that the changing distribution of teacher quality may have prevented further worsening of the test score gap.

Dimensions of Teacher Quality

That there exists a set of individual characteristics one can collectively call teacher “quality” or “effectiveness” is rarely disputed. This will come as no surprise to any of us who recall a

particularly masterful or inspirational teacher in our own education. However, despite intense interest in raising the “quality” of teachers, there is little consensus over what teacher attributes contribute most to the academic and social progress of students.⁹ Complicating matters is the likelihood that many important traits in promoting educational outcomes—such as patience, dedication, creativity, and communication—are largely unmeasurable.

One empirical approach to measuring teacher effectiveness that remains agnostic with respect to teacher attributes uses indirect estimates of “teacher effects” to calculate the fraction of overall variation in achievement gains that can be attributed to individual teachers.¹⁰ In a survey of the literature, Nye, Konstantopoulos, and Hedges (2004) conclude that as much as 21 percent of the variance in student achievement gains can be explained by variation in teacher effectiveness. Taking advantage of the random assignment design of the Tennessee STAR experiment, the same authors confirm that teacher effects cannot be attributed solely to a systematic matching of students to teachers based on unobservable characteristics.

Evidence of large teacher effects demonstrates the importance of individual teachers but does little to help researchers, policymakers, and practitioners identify observable metrics of teacher quality. Thus in an attempt to identify observable correlates with teaching effectiveness, the teacher effects literature often goes further to examine the relationship between teacher value-added and specific teacher attributes. For the most part traditional measures of teacher qualifications seem to explain little of the variation in teacher value-added (Rockoff, 2004; Rivkin, Hanushek, and Kain, 2005; Kane, Rockoff, and Staiger, 2006; Aaronson, Barrow, and Sander, 2007). Yet several characteristics—such as experience and content knowledge—are important exceptions.¹¹

⁹ See Rice (2003), Wayne and Youngs (2003), and Hanushek and Rivkin (2006) for recent reviews.

¹⁰ See Nye, Konstantopoulos, and Hedges (2004), Rockoff (2004), Rivkin, Hanushek, and Kain (2005), Boyd et al. (2006), Kane, Rockoff, and Staiger (2006), and Aaronson, Barrow, and Sander (2007).

¹¹ It is important to keep in mind that the teacher effects literature has focused almost exclusively on student achievement gains on standardized tests. Teacher aptitudes that yield gains in math and reading are not necessarily the

Where researchers have attempted to quantify the importance of specific teacher qualities, they have focused on those traditionally tied to compensation (education and subject matter preparation, years of teaching experience, certification), direct or indirect measures of aptitude and intelligence (licensure or standardized test scores, college selectivity), or immutable characteristics (such as race and gender). In the remainder of this section, we motivate the selection of teacher characteristics in our own analysis by briefly reviewing the evidence on teacher attributes and teaching effectiveness.

Education and Content Knowledge

The fraction of teachers holding masters' degrees has skyrocketed in recent decades (Larsen 2006), yet evidence from the teacher effects literature finds little if any relationship between teacher value-added and advanced degrees (Nye, Konstantopoulos, and Hedges, 2004; Rivkin, Hanushek, and Kain, 2005; Aaronson, Barrow, and Sander, 2007). More direct estimates of the effects of advanced degrees draw similar conclusions (Goldhaber and Brewer, 1996 and 2000; Clotfelter, Ladd, and Vigdor, 2007; Croninger et al., 2007).

The finding that advanced degrees are unrelated to teacher effectiveness is not universal, however. Several authors have found differential effects of masters' degrees by race and gender of the student. For example, Ehrenberg and Brewer (1994 and 1995) found that teachers' education had beneficial effects on the achievement gains and high school completion rates of black students, but not for white students. In an experimental context, Dee (2004) found that in the early grades, girls performed at a statistically significant higher level in mathematics when taught by teachers with an advanced degree, though no beneficial effects were found in reading for either gender.

same skills that promote social development, high school completion, or many of the other educational outcomes commonly expected of schools. On the indirect estimates of teacher effects on the social development of students, see Booher-Jennings and DiPrete (2007).

The evidence on college major and subject matter preparation is more robust, particularly for science and mathematics. Of a large set of observed teacher characteristics, Aaronson, Barrow, and Sander (2007) found that prior preparation in mathematics was the most important characteristic in explaining variation in teacher value-added in ninth grade math. Likewise, Goldhaber and Brewer (1996 and 2000) and Monk and King (1996) uncovered evidence that undergraduate or graduate preparation in math and science yields higher test score gains in those subjects among secondary students (no such effects are found for English or history).¹²

Teaching Experience

The teacher effectiveness literature provides conflicting evidence on the relationship between teaching experience and achievement gains. While Rivkin, Hanushek, and Kain (2005) and Boyd et al. (2006) found no additional returns to experience after the first three years in elementary math and reading, Rockoff (2004) uncovered persistent returns in elementary reading and Aaronson, Barrow, and Sander (2007) found no return to experience in ninth grade mathematics. In the Tennessee STAR experiment, Nye, Konstantopoulos, and Hedges (2004) detected only a weak relationship between K-3 teacher value-added and experience, while in their analysis of the NELS cohort Goldhaber and Brewer (1996 and 2000) found no evidence of returns to teaching experience.¹³ Recent work by Clotfelter, Ladd, and Vigdor (2007), Croninger et al. (2007), and Harris and Sass (2007), on the other hand, all found sustained improvements in teacher productivity with experience in both the early and later grades.

¹² Contrary to most findings, two recent studies—Harris and Sass (2007) and Betts, Zau, and Rice (2003)—find no evidence that pre-service preparation such as undergraduate major affects student outcomes.

¹³ Dee's (2004) analysis of the Tennessee STAR data provides similar results in the aggregate, but with variation by race and gender. He shows that teaching experience had greater returns for white males in mathematics than for black males or (all) females, and greater returns in reading for (all) whites and black females in reading than for black males.

Aptitude and College Selectivity

Where such measures are available, empirical evidence strongly suggests that teachers who score higher in a distribution of standardized test takers produce more favorable academic outcomes than teachers who score lower in the distribution (Ferguson, 1991; Ferguson and Ladd, 1996; Ehrenberg and Brewer, 1995; Clotfelter, Ladd, and Vigdor, 2006 and 2007). Unfortunately, few large-scale databases contain this particular metric of teacher quality.

Undergraduate college selectivity—perhaps serving as a proxy for aptitude—has been found to have a qualitatively similar relationship with teacher effectiveness as teacher test scores. Ehrenberg and Brewer (1994) and Clotfelter, Ladd, and Vigdor (2007), for example, found higher gain scores among students whose teachers attended more selective institutions, though in the former case selectivity was more strongly related to achievement among black students than whites. In one prominent exception, Aaronson, Barrow, and Sander (2007) found no relationship between teacher aptitude or college selectivity and high school mathematics scores.

Professional Licensure and Certification

One of the more consistent results in the literature is the finding that state-licensed teachers rarely produce superior academic outcomes to unlicensed teachers (Goldhaber and Brewer, 1996; Ballou and Podgursky, 2000; Hanushek et al., 2005; Kane, Rockoff, and Staiger, 2006; Aaronson, Barrow, and Sander, 2007; Croninger et al., 2007). Here again this finding is not universal, as other recent studies have found returns to standard state licensure (Clotfelter, Ladd, and Vigdor, 2007). Other authors have explored the effects of alternative pathways into teaching (Teach for America and the New York City Teaching Fellows program are prominent examples) and typically find that teachers who enter the profession through non-traditional routes produce smaller test score gains in

their early years of teaching, but soon catch up to traditionally certified teachers (Boyd et al., 2006; Decker, Mayer, and Glazerman, 2004).

An exception to the literature on professional licensure concerns the more rigorous National Board for Professional Teaching Standards (NBPTS) certification. In this case, research has shown that teachers with National Board certification are demonstrably more effective in raising student achievement than those without such credentials, although there is nothing about the credentialing process *per se* that enhances teacher productivity (Goldhaber and Anthony, 2007; Harris and Sass, 2007; Clotfelter, Ladd, and Vigdor, 2007).

Teacher Race and Gender

Student exposure to teachers of the same gender, race, or ethnic background is often cited as a possible avenue for closing the achievement gap between minority and non-minority students or between boys and girls in science and mathematics. As such, the under-representation of African-Americans and Hispanics in the teacher workforce as compared to the student population leads to frequent calls for greater minority recruitment into teaching. The argument that students may perform better when exposed to a teacher of the same race or gender is rooted in the idea that teacher expectations, interactions, or assumptions regarding ability can vary (whether consciously or not) by the race and gender of the student (Ferguson, 1998; Ehrenberg et al., 1995). Or, students' own enthusiasm, behavior, or interest in academic work may in turn vary with teacher characteristics.

In fact, there is a fair amount of evidence in support of this hypothesis. Under random assignment of students to teachers, Dee (2004) found that both black and white students score

higher in math and reading when they share the same race with their teacher.¹⁴ Similarly, Dee (2005) showed that middle school girls scored higher (and boys lower) in science, social studies, and English when their teacher was female. Dee offers further evidence that gender differences in scores may be due to the kinds of behaviors cited above—for example, teacher perceptions are found to vary with the gender of the student, as do student attitudes about learning.¹⁵

Summary

Taken together there are few observable teacher characteristics that have consistently shown evidence of large and systematic effects on student achievement on standardized tests. The metric offering the most compelling evidence—a teacher’s own academic aptitude—is seldom available to researchers, particularly those interested in drawing inferences about changes in teacher quality over time.¹⁶ Yet each of the attributes cited above have been found in at least one rigorous empirical study to have an important effect—if sometimes small—on student achievement. Several observable qualifications or traits—such as teaching experience, content knowledge, NBPTS certification, and race—more often than not show systematic effects on student outcomes. Other qualifications such as advanced degrees may matter more for the academic achievement of black students than for white students.

Beyond the independent effects of individual teacher characteristics on student learning, there is only limited evidence on how teacher attributes interact or cumulate in the production of education. It may be that students exposed to teachers lacking along multiple dimensions fall behind

¹⁴ Dee’s estimates rely on within-school variation in student-teacher race assignment, so they are unlikely to be driven by between-school differences in teacher quality. Ehrenberg and Brewer (1995) and Clotfelter, Ladd, and Vigdor (2007) find similar results.

¹⁵ For example, girls are more likely to report that they do not look forward to a subject, or that they are afraid to ask questions in class, if their teacher is male (especially true in science). Ehrenberg et al. (1995) and Ferguson (1998) offer evidence that the subjective evaluations of students made by teachers vary by race, gender, and ethnicity.

¹⁶ General evidence on the quality of teachers entering the teaching profession can be found in Corcoran, Evans, and Schwab (2004) and Bacolod (2007). Unfortunately, data on the academic proficiency of teachers in those studies cannot be matched to the students of those teachers.

more than those whose teachers fall short on only one qualification. Further, repeated exposure to inexperienced or under-qualified teachers may have cumulative effects where differences that appear small in any one year of achievement growth compound into a much larger inequalities in acquired skills over time (Sanders and Rivers, 1996). In the following section, we consider how a wide range of teacher attributes varies across schools and classrooms of varying racial compositions, and how the distribution of teachers over students has changed over time.

Trends in Exposure to Quality Teachers

A number of recent studies have documented the extent to which teacher qualifications are unevenly distributed across schools and students (Lankford, Loeb, and Wyckoff, 2002; Clotfelter, Ladd, and Vigdor, 2005 and 2006). Most of this work shows that teachers in predominately urban, low-income, and high-minority schools have less experience, are less likely to be licensed or hold National Board Certification, come from less selective colleges, and have lower academic aptitude overall than other teachers.¹⁷ The role of nonpecuniary factors such as working conditions and the “draw of home” documented by Boyd et al. (2005) has important ramifications for the distribution of teachers across schools; as net importers of teachers, urban districts face persistent difficulties attracting teachers from other regions of the state.

Less is known about how differential black-white exposure to high quality teachers has changed over time. The persistence of teacher sorting patterns and school segregation by race suggest that considerable change is unexpected. Indeed, in an analysis of teacher sorting in New York State, Lankford, Loeb and Wyckoff (2002) found little to no change in the distribution of

¹⁷ For example, in North Carolina Clotfelter, Ladd, and Vigdor (2005 and 2006) show that the average black student in 2000-01 was 54 percent more likely to face a novice teacher than the average white student, and that two-thirds of the overall black-white difference in exposure to novice teachers can be attributed to within- rather than between-district differences. As in New York (Lankford, Loeb, and Wyckoff 2002), teachers with better qualifications, more experience, degrees from more selective colleges and universities, National Board Certification, and high licensure test scores, were more likely to work in school with fewer nonwhite students and students eligible for free or reduced price lunch.

teacher attributes across school districts between 1985 and 1999.¹⁸ In another study similar to our own, Phillips and Chin (2003) noted very few changes in the qualifications of teachers by school minority enrollment composition.

Evidence from the Schools and Staffing Survey

We begin with an analysis of the Schools and Staffing Survey (SASS) series, five large cross-sectional surveys of teachers, schools, and administrators conducted by the National Center for Education Statistics (NCES) in the school years ending 1988, 1991, 1994, 2000, and 2004.¹⁹ In each of these survey years, we compare average teacher qualifications and attributes in schools attended by the “typical” white and black student. We do this by first averaging teacher characteristics within schools and then computing a weighted average over schools using total white or black enrollment as weights.²⁰ Such measures indicate the average exposure of white and black students to particular teacher characteristics or qualifications, allowing us to compute an “exposure gap” for each characteristic in each survey year.

Tables 1 and 2 summarize our results. During the 1990s teachers of the average white and black student differ in some notable ways. The average black student is more likely to have a female teacher and much more likely to have an African-American teacher. For example, in 2003-04 the fraction of teachers who are black in the average black student’s school exceeded that in the average white student’s school by more than 22 percentage points (25.7 percent versus 3.0), though black

¹⁸ These authors find that the composition of new and all teachers in both urban and rural areas remained approximately the same along almost every dimension over this 15-year period, with one exception—the fraction of teachers who failed a test of general knowledge rose in New York City relative to suburban areas, though the authors note this may have been due to changes in the exam itself.

¹⁹ More information on the SASS can be found at <http://nces.ed.gov/surveys/sass/overview.asp> [Access Date: October 21, 2006].

²⁰ SASS sampling weights are used where appropriate. We use the restricted use versions of the Schools and Staffing Surveys, which provide the exact racial composition of teachers’ schools. Given this information we are able to examine mean characteristics of teachers in overwhelmingly black or overwhelmingly white schools. Phillips and Chin (2003) summarize teacher characteristics by four categories of minority enrollment shares (where the top category is 50 or more percent).

teachers were still considerably underrepresented relative to enrollment in these schools.²¹ Teachers teaching black students were consistently less likely to be state certified, more likely to hold emergency or temporary certification and had fewer years of experience working at the same school. These differences are statistically significant in almost all cases, but many are small in magnitude. For example, during the 1990s, teachers of the average black student consistently had lower mean teaching experience than teachers of the average white student. However, in the 1999-00 sample this difference amounted to little more than nine months.

Of greater interest to this volume is how differences in exposure to teacher characteristics *changed* during the 1990s. In Table 2 we present the black-white gap in mean teacher characteristics in each of the five SASS surveys, with a calculated change in this gap for the 1990s (1991 to 2000) and for the entire length of the SASS (1988 to 2004). Gaps in exposure to male or black teachers fell consistently through the 1990s, with the gap in exposure to male teachers falling nearly in half from 1988 and 2004 (a statistically significant change). The gap in exposure to black teachers also narrowed over the same period, though as Table 1 indicates this occurred via an overall decline in black teachers, with a disproportionate decline among teachers teaching black students.

By contrast the black-white gap in exposure to qualified teachers—as measured by experience, education, and certification—steadily expanded in the 1990s. Average teaching experience and rates of new and novice (first-year) teaching were generally comparable across students in 1988 and 1991, but by the end of the decade, the black-white gap in these metrics had risen markedly. In 2000, exposure to first-year teachers was 27 percent higher for black students than for white (6.2 vs. 4.9 percent) and exposure to teachers with three or fewer years of teaching experience 23 percent higher (17.7 vs. 14.4). Mean teaching experience was 3.4 percent lower in the average black student’s school. Average tenure at the same school fell from 1988 to 2000 among

²¹ For example, the average black student in 2000 attended a school where 54.6 percent of students were also black, yet only 27.6 percent of the teachers in these schools were African-American.

teachers of the typical black student while rising for the typical white student.²² Every gap in exposure to experienced teachers widened further between 2000 and the 2003-04 wave of the SASS.

Gaps in exposure to teachers with high levels of training and traditional state certification also widened during the 1990s. In 1988, the fraction of teachers holding masters' degrees was more than 2.5 percentage points *higher* for the average black student; by 2000 this fraction had dropped 1.5 points below that for the typical white student.²³ In most years the average black student was statistically significantly less likely to be taught by a teacher with a bachelor's degree in education—a difference that grew steadily between 1988 and 2004—while rates of exposure to teachers holding master's degrees in education were roughly the same.²⁴ Subject matter preparation of secondary teachers also varied across the average white and black student. Among math teachers, the fraction with a degree in mathematics rose for both groups between 1991 and 2000.²⁵ However the increase was considerably larger among teachers of the average white student. As a result, the gap in math teacher preparation widened to 3.6 percentage points by 2000.²⁶ The opposite trend occurred for teachers of science and English (although only the former change was statistically significant). The black-white gap in exposure to state-certified teachers more than doubled between 1991 and 2000 (from a 1.4 percentage point gap in 1991 to 3.4 point gap in 2000) and quadrupled between 1991 and 2004 (from a 1.4 point gap to 5.8). By 2004, more than 16 percent of teachers in the average

²² While we are not aware of any evidence that tenure at the same school has beneficial effects on student outcomes (in fact, estimating the effect of tenure on student achievement would be difficult in practice due to the nonrandom assignment of teachers to schools), this measure might be thought of as a broader indicator of teacher turnover or long-run job satisfaction at individual schools.

²³ The last section noted that empirical evidence on the effectiveness of advanced degrees in teaching is weak; yet where the evidence tilted in favor of advanced degrees it tended to be most beneficial for black students.

²⁴ Unfortunately the degree codes used in the 2003-04 wave of the SASS do not appear to be comparable to earlier waves, with the proportion of teachers with a BA in education falling by an implausible amount.

²⁵ Both the 1987-88 and 2003-04 waves of the SASS included questions related to college major. Teacher responses to these questions, however, differed markedly from responses in the intervening years (particularly in 2003-04). We have elected to omit results from 2003-04 in Tables 1-2; results from 1987-88 results should be taken with caution.

²⁶ In subjects other than math, the black-white gap in subject-matter preparation is typically negative, but rarely statistically significant at conventional levels. One area in which the black-white gap in teacher preparation appears to have narrowed during the 1990s is in English/reading, where the difference in the fraction of teachers who majored in English fell in half, from -0.026 to -0.013 (likely due to the small sample size, this change is not statistically significant).

black student's school did not have full state certification, as compared with 11 percent in the average white student's school. Similarly, 11.3 percent of teachers in the average black student's school held emergency or temporary certification while only 6.2 percent of teachers in white students' schools held such credentials.

The picture emerging from Tables 1 and 2 is that teacher characteristics differed between black and white students in every survey year, but trends in teacher sorting during the 1990s appear to have worked to the relative disadvantage of black students. That is, the likelihood that a teacher in the average black student's school was inexperienced, in her first year, uncertified, or lacking an advanced degree all rose relative to that for teachers of the average white student. This said, in many cases the magnitude of the change in these disparities was small.

The staffing patterns reflected here may be indicative of differences in job satisfaction among teachers across schools. The SASS teacher questionnaire includes several questions pertaining to attitudes toward teaching, students and school leadership. Mean responses to a few of these questions are included in Table 1. Teachers of the average black student were persistently less likely to state that they would choose to become a teacher again if given the chance to start over, though this gap was mostly unchanged between 1991 and 2000 (this gap fell in half between 2000 and 2004).²⁷ On the other hand, black-white differences in the fraction of teachers who indicated a desire to exit the teaching profession as soon as possible rose during the 1990s (among teachers teaching black students, the fraction with such plans was approximately 5 – 6 percent).²⁸ Teachers of the average black student also held a much more negative view of the school environment and administration during this period. For example, in 2000 more than half affirmed that “the level of

²⁷ The question reads, “if you could go back to your college days and start over again, would you become a teacher or not?” Table 1 shows the percent of teachers that responded “certainly would” or “probably would.”

²⁸ A question posed in the 1991 and 1994 survey that was unfortunately discontinued showed a similar trend—a growing gap in teachers' intentions to remain in the same school, with 13.5 percent of the average black student's teachers indicating they did not plan to return to the same school in 1994.

student misbehavior ... interferes with my teaching,” and more than 23 percent felt their principal was not supportive of their efforts. The black-white gap in these teacher sentiments grew substantially during the 1990s—with the gap in perceptions of the work environment growing 3.0 percentage points between 1991 and 2000 (or 5.5 points between 1987 and 2004), and the gap in views about school administration growing four points between 1991 and 2000 (or two points over the full survey period).

We also examined differences in the weekly work hours and earnings of teachers (the latter results are not presented here). While required hours of work did not vary much with the racial composition of the school (and—if anything—the gap in these work hours narrowed), hours spent working *outside* of the classroom did vary considerably. Altogether, average weekly hours outside of the classroom on school-related activities (either with students present or not) were almost an hour lower for the average black student’s teacher (see Table 2). This gap improved only slightly (and statistically insignificantly) during the 1990s.²⁹ Compensation was higher among teachers of the average black student (partly due to differences in location and urbanicity) and these teachers were less likely to hold a second job outside of school, a propensity that changed little over this period.

Table 3 disaggregates black-white gaps in teacher quality by school level, presenting only the differences for 1991 and 2000 and the changes in these gaps over time.³⁰ The results in Table 3 show that most of the time series changes observed in Table 2 between 1991 and 2000 occurred at the elementary level. For example, we find a statistically significant drop in the relative experience of teachers at schools attended by the average black elementary student, but virtually no change in

²⁹ Assuming a 180-day school year (36 weeks), 0.86 hours per week—the black-white gap in 1991—amounts to 31 fewer hours each school year, nearly equivalent to a week’s worth of classroom instruction. Unfortunately, the measurement of teacher work hours outside of the classroom differed considerably in 2003-04. As such, we have not presented averages for that year.

³⁰ Teachers are included in the elementary averages if they predominately taught students in kindergarten through 6th grade. Teachers are included in the secondary average if they predominately taught students in grades 7 through 12. As in Tables 1 and 2, these averages are taken over schools, where schools are included in the elementary average if they are designated as elementary (or combined elementary-secondary) schools, and schools are included in the secondary average if they are designated as secondary (or combined elementary-secondary) schools.

relative teacher experience at the secondary level. On the other hand, the gap in exposure to traditionally-certified teachers widened more in secondary schools (2.3 percentage points) than at the elementary level (1.5 points). Differences in teacher satisfaction with the teaching environment and level of principal support grew much more at the elementary level than at the secondary level, where the 1991-2000 change was statistically insignificant.

Given the evidence linking teacher sorting patterns to student race and socioeconomic status (Hanushek, Kain, and Rivkin, 2004; Scafidi, Sjoquist, and Stinebrickner, 2007; Boyd et al., 2002) there is good reason to believe that schools with particularly high minority or low-income student populations were affected disproportionately by changes in the distribution of teachers across schools. Black students experience a high rate of racial isolation in U.S. public schools, and there is no evidence that school segregation by race diminished during the 1990s (see Vigdor and Ludwig, this volume).

Table 4 uses the Common Core of Data Public Schools Universe to illustrate the extent to which black students were in racially isolated schools in 1990 and 2000. In both years, 23 percent of all black students in public schools attended schools that were more than 90 percent black, and an additional 28 percent attended schools that were at least majority black. By contrast, three quarters of all white public school students were in schools where 10 percent or fewer students were African-American. Less than 3 percent of all white students attended schools where blacks were in the majority. (If students had been randomly distributed across schools the average school would have been comprised of approximately 16 – 17 percent non-Hispanic blacks).³¹ Average within-district school segregation grew slightly over this period, mostly attributable to increased segregation among the most highly segregated districts (the median and 75th percentile student—when sorted by the

³¹ Based on Fall 1991 and 1999 tabulations of public K-12 enrollment, Digest of Education Statistics (see http://nces.ed.gov/programs/digest/d01/lt2.asp#c2_1 and <http://nces.ed.gov/programs/digest/d03/tables/dt042.asp> [Access date: October 20, 2006].

extent of their district's segregation—were in less segregated districts in 2000 than in 1990, while the 90th percentile student was in a much more racially segregated district).³²

Given these patterns of racial segregation, we examined how the characteristics of teachers differed between predominately black (>90 percent black), majority black (50 – 90 percent) and predominately non-black (0 – 10 percent) schools. Our results are provided in Table 5. Here we see more pronounced disparities in teacher characteristics between high- and low- percent black schools as well as notable nonlinearities in exposure to teacher attributes.³³ In any given year the black-white gap in exposure to male or black teachers is twice as large when comparing predominately black and predominately non-black schools, though this gap narrowed slightly between 1991 and 2000. In each year the gaps in teaching experience and tenure are similar in magnitude (or sometimes smaller) than in Table 2; however the *growth* in the gap between low- and high-percent black schools is larger. For example, the growth in the gap in exposure to inexperienced teachers (less than or equal to three years) is 45 percent larger (3.2 points versus 2.2), and the increased gap in mean experience more than twice as large as at the mean. Differences in teacher satisfaction and views of their work environment were much more pronounced when comparing predominately black schools with predominately non-black schools than at the mean (Table 2). For example, the black-white gap in exposure to teachers affirming that student behavior is disruptive was 24.4 percentage points in 1991 and 25.8 points in 2000 when comparing these categories, versus 14.9 and 17.9 points at the mean.

Differences in teacher satisfaction and views of their work environment are also more pronounced when comparing predominately black schools with predominately non-black schools and low-percent black schools, and the growth in these gaps mirrored those at the mean. One

³² Our segregation measure is the average (student-weighted) difference between a school's exposure rate of white students to black students and the district-wide proportion black. On this see Clotfelter (2004).

³³ We use the predominately black (>90 percent) and predominately non-black (<10 percent black) categories as our basis for comparison here. In a number of cases the gaps in teacher characteristics are larger when comparing predominately non-black schools to schools with 51 – 90 percent black enrollment.

notable gap is in the fraction of teachers who do not find their principal supportive of their work efforts. The black-white gap in the fraction of teachers who do not find their school administration supportive rose to 15 percentage points in 2000, with 31 percent of teachers in predominately black schools holding this view (compared with 16 percent in predominately non-black schools). Differences in teacher work effort outside of school hours are larger when comparing mostly black and mostly non-black schools, though this gap improved by almost half in the 1990s. Altogether, the gap between these groups in teacher hours outside of class narrowed from 2.1 hours per week to 1.2.³⁴

Comparing the extremes of the distribution masks a few interesting nonlinearities in exposure to certain teacher characteristics. In many cases—as with mean teaching experience, tenure, and certification—black-white differences in teacher qualities are larger when comparing predominately non-black schools to schools where black students constitute 50 – 90 percent of enrollment. While we do not explore the hypothesis here, these nonlinearities may suggest some effects of student heterogeneity (or at least, student heterogeneity when the majority of enrollment is black) on teacher turnover and job satisfaction.

Evidence from Matched Teacher-Student Data from the NEELS and ELS

A disadvantage of using the Schools and Staffing Survey to estimate average exposure to teacher qualifications and characteristics is its reliance on *school-level* teacher and student attributes. As Clotfelter, Ladd, and Vigdor (2005) and others have shown, there are likely to be differences in the matching of students to teachers *within* schools as well as between them. Average teacher characteristics at the school level may thus underestimate the differences in teachers experienced by white and black students. To investigate this possibility we turn to two nationally representative

³⁴ The remaining gap still appears to be a sizable difference. Assuming 36 weeks in the school year this amounts to 42.8 fewer hours devoted to school work over one year.

longitudinal surveys of high school sophomores—the National Education Longitudinal Survey (NELS-88) and the Education Longitudinal Study of 2002 (ELS)—that explicitly match students to teachers in several subjects.³⁵ The set of teacher attributes captured in these two surveys is smaller than that in the SASS, and we will only be able to examine the characteristics of mathematics and English teachers of high school sophomores. Still, the use of these surveys does allow us to avoid the potential measurement error issue encountered with the use of school-level data. For comparability with our SASS results, we restrict our attention to non-Hispanic black and white students who are enrolled in math or English and whose teacher also participated in the survey.³⁶

Following the same presentation format used in Tables 1 and 2, we report in Tables 6 and 7 the average exposure of black and white sophomores to English and mathematics teachers with various attributes in 1990 and 2002, along with the gaps in those years and a difference-in-difference estimate that measures the change in the black-white gap over the 1990 to 2002 period. Among students in 10th grade English classes (Table 6) we find that black students are less likely to have male or white teachers in every year than the average white student; teacher experience is systematically lower among teachers of black students, as is experience working at the same school. Consistent with our findings in the SASS for secondary teachers, we find only minor changes in the black-white gap in teacher characteristics, and in many cases the gap improved. For example, we observe a more than 50 percent reduction in the black-white gap in teacher experience, and smaller differences in exposure to new or inexperienced teachers. The race gap in the fraction of teachers with advanced degrees and degrees in-subject also narrowed, from a deficit (in favor of white

³⁵ NELS-88 is a nationally representative, multi-stage probability sample of eighth graders who were first surveyed in the spring of 1988. A sub-sample of respondents were then surveyed again in 1990, 1992, 1994, and 2000. Questionnaires were also sent to parents, math and English teachers, and school administrators. ELS is similar in design to NELS-88, but the base-year survey was conducted of a nationally representative sample of high school sophomores in 2002. We use the first follow-up survey from NELS and the base-year survey from ELS as our sample of high school sophomores in 1990 and 2002. Base year student weights are used in all calculations.

³⁶ Table A.x in the Data Appendix reports the sample sizes used in this analysis. After appropriate sample restrictions we have similarly sized samples for students taking English classes in the two surveys, but there are approximately 1,700 fewer students with valid data on their math teachers in the NELS than the ELS.

students) to an advantage for the typical black sophomore. The only adverse change observed here is in the gap in the fraction of teachers who believed they would choose to teach again, which nearly doubled between 1990 and 2002 (though the change is not statistically significant).

For mathematics teachers (Table 7) we find similar black-white differences in teacher gender, race, experience, tenure, educational attainment, and job satisfaction as for English teachers. The gap in the fraction of teachers who are male, white, or black narrowed during the 1990s as did the black-white gap in teaching experience. Likewise, the gap in the fraction of mathematics teachers who held a degree in math narrowed considerably, from a deficit of 11.0 percentage points in 1990 to 5.5 points in 2002 (a result that contrasts with a *growing* gap in exposure to secondary math teachers with math degrees found in Table 3). Changes in the black-white gap in novice teaching, teacher tenure, advanced degree attainment, and job satisfaction were not statistically significant but in all cases the point estimate of the change suggests a narrowing of the gap.

Another advantage of teacher-student matched data is the ability to examine teacher-student matching on the basis of race or gender. In English, we find that black students are more likely to have a same-gender English teacher but significantly less likely to have a teacher of the same race; only 24 percent of black sophomores had an English teacher who was also black, a propensity that was unchanged over the 1990s. In mathematics, the average black sophomore was again much less likely to have an African-American teacher, and somewhat less likely to have a math teacher of the same gender. In contrast to English, we observe a widening of the black-white gap in exposure to same-race teachers (a statistically significant change).

Do Teacher Sorting Patterns Reflect Concentrations of Student Poverty, or Race?

Our tabulations from the Schools and Staffing Surveys, NELS, and ELS find that teacher attributes and qualifications are unevenly distributed across schools, in most cases to the relative

disadvantage of black students. This evidence mirrors that found in recent studies relying on state personnel data, such as Lankford, Loeb, and Wyckoff (2002) in New York, Clotfelter, Ladd, and Vigdor (2005) in North Carolina, and Jepsen and Rivkin (2002) in California. Taken at face value, however, it is unclear whether these observed differences in teacher characteristics across schools can be attributed to the racial composition of schools, or whether these sorting patterns in fact reflect some other school characteristic, such as student poverty. This distinction is important. Given recent black-white convergence in family income (Campbell et al., this volume), if teachers are selecting into schools based on student income as opposed to race, income convergence would imply an eventual convergence in exposure to qualified teachers. On the other hand, if teacher sorting depends (at least in part) on the racial composition of schools, these gaps are likely to persist as long as there is persistent school segregation.

Existing research on teacher sorting across schools suggests that a school's minority concentration has a substantial negative impact on teacher recruitment and retention, over and above that explained by student income. For example, Scafidi, Sjoquist, and Stinebrickner (2007) find using Georgia administrative data that a school's racial composition is a stronger predictor of teacher attrition than student poverty. Likewise, Bacolod (2007) and Hanushek, Kain, and Rivkin (2004) find that both new and experienced teachers are more likely to leave or avoid schools with a high concentration of minority students, controlling for a wide array of individual teacher and school characteristics (including poverty).

As a rough test of this hypothesis in our own data, we return to the Schools and Staffing Survey and regress school-level teacher characteristics—those summarized in Tables 1 and 2—on the percent of school enrollment that is black, the percent of enrollment eligible for free or reduced price lunch, and dummy variables for Census region, school level (elementary, secondary, or combined), and urbanicity. The results are displayed in Table 8, which shows our estimated

coefficients on percent black and percent free lunch eligible from a series of regressions from the 1987-88 and 2003-04 SASS data (region, level, and urbanicity coefficients are not shown).

Controlling for a limited set of covariates, teacher attributes and qualifications measured at the school level tend to be related to both the racial composition of the school and student poverty. This finding is particularly strong in our most recent set of data (2004), where a school's percent black is in many cases a stronger predictor of average school teacher quality than is student income. For example, in 2003-04, holding constant the percent eligible for free lunch, a one standard deviation rise in the percent black (0.252) is associated with a 0.5 percentage point higher rate of first-year teaching (on a baseline of 4.4 percent). By contrast, a one standard deviation higher rate of poverty (0.281) is associated with a 0.4 percentage point higher rate of novice teaching. This pattern holds for many other teacher attributes in 2004, including inexperienced teaching, tenure at the same school, certification, and intent to leave. The same regressions in 1987-88 present a much more mixed picture, where only in a small number of cases is the racial composition of the school associated with teacher characteristics when controlling for student poverty.

Taken together, our results in Table 8 suggest that observed correlations between student race and teacher qualifications are not merely a reflection of the effects of concentrated poverty. Rather, the racial composition of student enrollment appears to matter for the distribution of teachers over schools as much or more as student income, a result broadly consistent with the existing literature. This relationship if anything appears to have strengthened over the 1988 – 2004 period.

Can Trends in the Teacher Quality Gap be explained by Trends in Class Size?

Our analysis in the preceding sections suggests that most of the changes in black-white exposure to qualified and experienced teachers occurred in elementary rather than secondary

schools. One hypothesis for the growing teacher quality gap at the elementary level is the wave of class size reduction policies that occurred during this decade.³⁷ The much-publicized benefits of class size reduction in the early grades in Tennessee's Project STAR led to a widespread movement to cut already-shrinking class sizes in other states. California's 1996 initiative to cut K-3 class sizes by a third is the most prominent example of this movement, although similar policies were enacted earlier in Nevada (1989), Utah (1990), and North Carolina (1991).³⁸

Sweeping class size reduction initiatives that require large increases in the teacher workforce have the potential to shift the level and distribution of teacher quality within and between schools. The large number of new hires required to accommodate smaller classes is likely to lower the overall experience level of teachers in affected grades (and perhaps in other grades to the extent teachers move between grades). Further, the growing demand for teachers across *all* schools may lead to a movement of experienced and well-qualified teachers toward opportunities in more desirable schools and away from hard-to-staff classrooms, compounding the challenges faced by already disadvantaged schools and school districts. Indeed, Jepsen and Rivkin (2002) found that predominately black schools in California suffered a significant deterioration in teacher quality after that state's class size reduction initiative.

As Figure 1 shows, pupil-teacher ratios fell slowly in the late 1980s but began an accelerated decline in the mid 1990s.³⁹ The average black student in every year of this series was enrolled in a school with a lower pupil-teacher ratio than the average white student, although the two groups converged in the mid-1990s, only to diverge again at the end of the decade. Figures 2 and 3 illustrate

³⁷ Other authors have pointed out that the economics of teacher quality in recent decades may have resulted in a substitution away from teacher *quality* (highly skilled teachers) and toward teacher *quantity* (i.e. smaller class sizes). See Lakdawalla (2006).

³⁸ On the California Class Size Reduction Initiative see <http://www.classize.org/resplan/resplan1.htm> [Access date: June 3, 2007]. For other examples see http://www.wested.org/policy/pubs/full_text/pb_ft_csr23.htm [Access date: June 3, 2007].

³⁹ The reader should keep in mind that pupil-teacher ratios are not the same as class size. Pupil-teacher ratios include more than full-time classroom teachers in the denominator and thus tend to be smaller than actual class sizes. The two statistics do tend to move together over time, however (Lewitt and Baker 1997).

the trend in pupil-teacher ratios separately for elementary and secondary schools. It is clear that the vast majority of the declining pupil-teacher ratio in the U.S. can be explained by changes at the elementary level. Between 1995 and 2000, pupil-teacher ratios dropped from approximately 19 to 17 in elementary schools—a drop of 10.5 percent in five years—but less than 5 percent at the high school level. Class sizes continued to fall in elementary schools after the turn of the century but turned up again at the secondary level. Of course, more research is needed to establish a causal link between changes in class size and black-white exposure to teacher quality, but the trends observed here are fully consistent with our divergent findings on teacher quality at the elementary and secondary level.

Differential trends in class size may have independently contributed to changes in the black-white achievement gap in the 1990s. Class size itself has been shown to have modest impacts on student achievement, and may matter more for the academic success of African-American students than for whites (Krueger, 1999). At the elementary level (Figure 2), average class sizes converged between these groups in the 1990s, with pupil-teacher ratios falling faster for white students than for black at the beginning of the decade (the opposite was true at the end of the decade). In secondary schools (Figure 3)—where the black-white achievement gap worsened—pupil-teacher ratios mostly moved in tandem through the 1990s. Thus a cursory look at resource intensity in schools attended by white and black students does not reveal any differential experiences of class size that are likely to explain changes in the achievement gap.

Conclusion

Evidence on the role of observed teacher qualifications in students' academic achievement remains inconclusive. It is also clear that unobserved dimensions of teaching effectiveness matter as much or more than the acquisition of any advanced degree or state licensure. Yet—as our brief

review of the literature indicated—there are a number of characteristics and qualifications that have been found empirically to have large and important effects on student learning. Attributes such as teaching experience and subject matter preparation are important in the short run for student achievement, and may have cumulative effects over time. Repeated exposure to inexperienced or under-qualified teachers may eventually yield adverse outcomes considerably larger than those observed in any cross-sectional study.

The importance of teacher quality in the academic success of children has led many to point to differential exposure to qualified teachers as a possible explanation for the black-white achievement gap. Our analysis in this chapter cannot rule out this possibility. In fact, our results reveal that teachers of the average black student are consistently more likely to be inexperienced, uncertified, and unhappy with her career choice and work environment than teachers of the average white student. However, we have no evidence to suggest that *changes* in exposure to high-quality teachers adversely affected the black-white achievement gap during the 1990s. We find that black-white differences in exposure to quality teachers grew most at the elementary level—not at the secondary level where the achievement gap suffered most. In fact, our analysis of teacher-student matched data at the high school level suggests that the “exposure gap” to high quality teachers actually narrowed in secondary schools.

The lack of change in the relative quality of teachers for black and white students is not altogether surprising. Teacher labor markets are rigid, local, and as responsive to student demographics as to salary. If anything, public schools in the U.S. became more racially segregated during the 1990s. Only through significant changes in teacher sorting behavior would the race gap in teacher characteristics be likely to close. Policymakers should be cognizant of the links between the quality of a school’s teaching staff, its student composition, and working conditions, tailoring policies that recognize these links. Policies offering additional compensation to teachers working in

hard-to-staff schools have shown promise (Clotfelter et al., 2006), but it is unclear whether such policies are sufficient to overcome the powerful effects of residential and school segregation.

Perhaps of some concern is our finding that the gap in exposure to experienced and qualified teachers grew significantly in elementary schools over this period. Our cursory look at trends in pupil-teacher ratios during the 1990s suggests that efforts to reduce class sizes in the early grades may have had a deleterious effect on teacher quality in hard-to-staff schools. Additional research on this question is needed.

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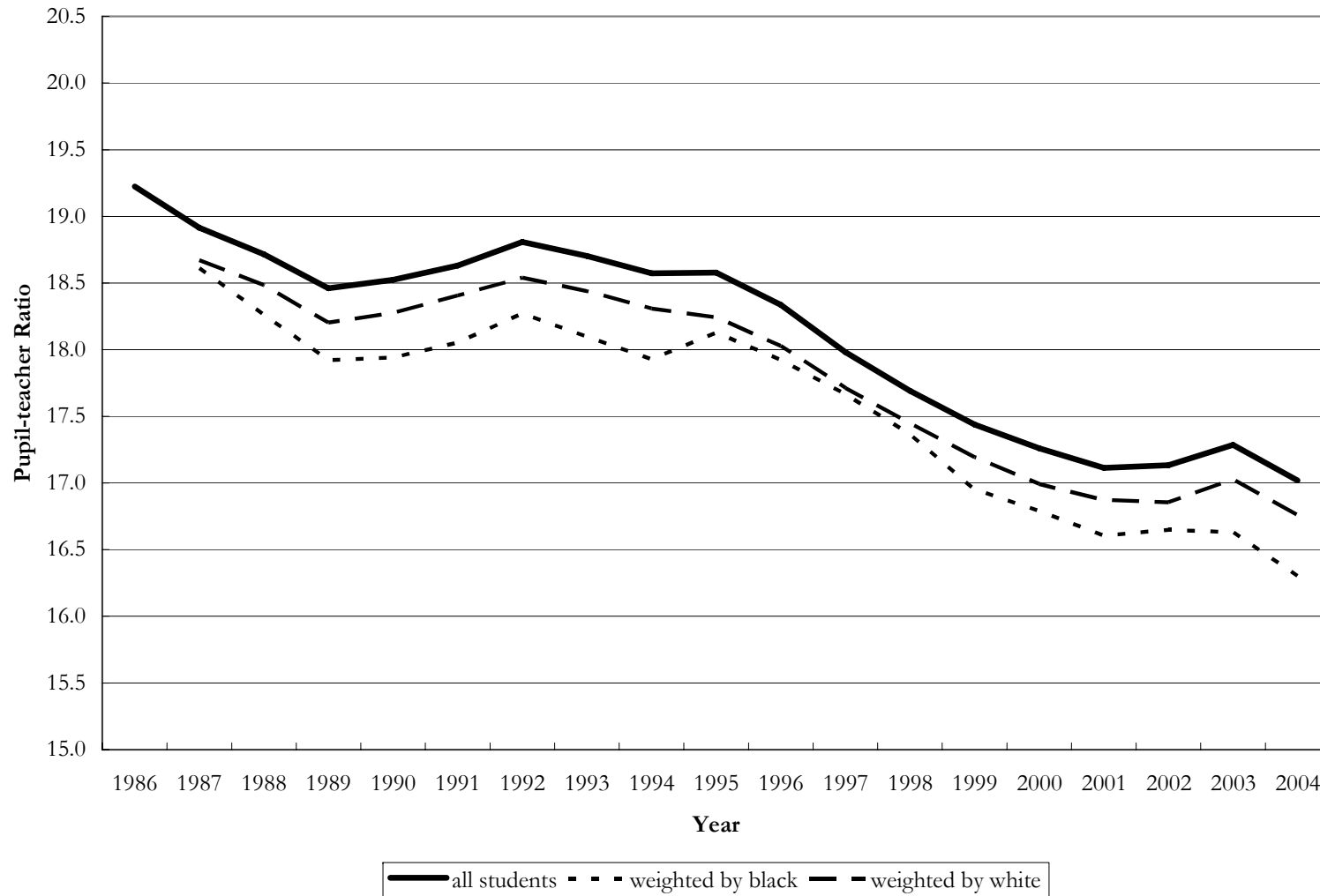
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Figure 1: Average Pupil-Teacher Ratio, All U.S. Schools, 1986 – 2004



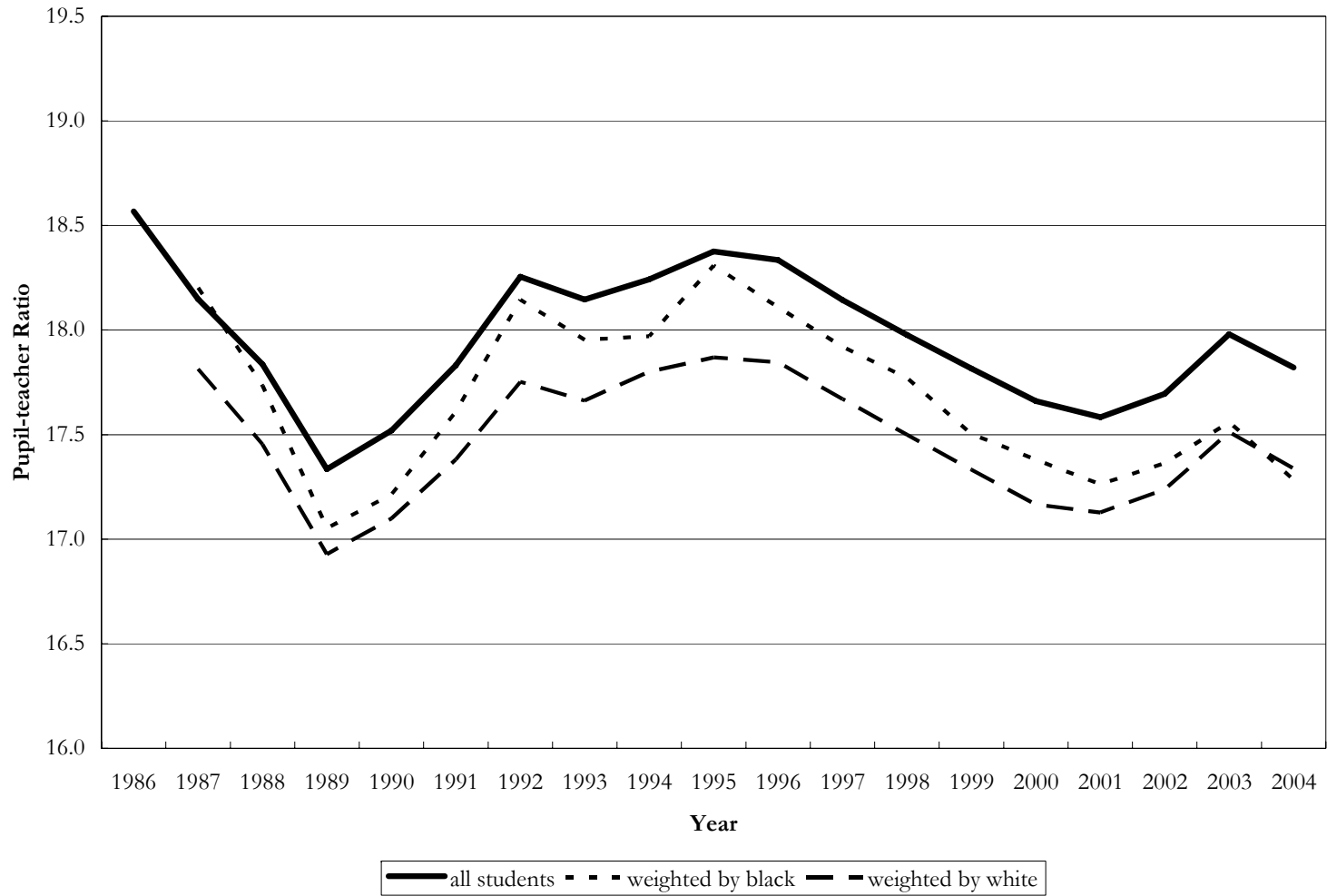
Source: authors' calculations, using the NCES Common Core of Data School Universe Survey Longitudinal Data File (1986 – 1998) and annual Public School Universe files 1999-00 through 2004-05. Pupil-teacher ratios are calculated as: fall membership / full-time equivalent teachers. Each series is a weighted average over schools using total (“all students” series), African-American, or white enrollment as weights.

Figure 2: Average Pupil-Teacher Ratio, U.S. Elementary Schools, 1986 – 2004



Source: authors' calculations, using the NCES Common Core of Data School Universe Survey Longitudinal Data File (1986 – 1998) and annual Public School Universe files 1999-00 through 2004-05. Pupil-teacher ratios are calculated as: fall membership / full-time equivalent teachers. Each series is a weighted average over elementary schools using total (“all students” series), African-American, or white enrollment as weights.

Figure 3: Average Pupil-Teacher Ratio, U.S. Secondary Schools, 1986 – 2004



Source: authors' calculations, using the NCES Common Core of Data School Universe Survey Longitudinal Data File (1986 – 1998) and annual Public School Universe files 1999-00 through 2004-05. Pupil-teacher ratios are calculated as: fall membership / full-time equivalent teachers. Each series is a weighted average over secondary schools using total (“all students” series), African-American, or white enrollment as weights.

Table 1: Characteristics, Qualifications, and Attitudes of Teachers—Average White and Black Student, 1988 - 2004

Teacher characteristics:	Average White Student					Average Black Student				
	1988	1991	1994	2000	2004	1988	1991	1994	2000	2004
Percent male	28.6	27.4	26.9	25.5	25.7	23.4	23.5	23.4	22.4	22.9
Percent white	94.3	93.0	93.1	93.0	93.7	69.2	68.9	70.6	67.5	69.6
Percent black	3.9	4.2	3.6	3.5	3.0	29.1	27.4	25.6	27.6	25.7
Percent first-year teacher	3.5	3.6	4.1	4.9	4.2	3.5	4.0	4.5	6.2	6.0
Percent ≤ 3 years experience	10.1	10.1	10.7	14.4	12.6	10.9	11.2	13.1	17.7	17.5
Years of experience	14.6	15.2	15.3	14.9	14.7	14.8	15.1	14.9	14.2	13.2
Years at current school	8.2	8.6	8.8	8.6	8.4	7.4	7.6	7.5	7.2	6.7
Percent with MA or higher	47.5	46.8	46.2	47.9	48.4	49.9	49.1	47.6	46.4	44.6
Percent with BA in education	73.5	77.1	74.1	69.3	81.4	72.8	76.0	71.7	67.0	77.8
Percent of MAs in education	86.4	85.1	84.9	83.4	90.3	87.6	85.0	85.0	82.3	89.4
Secondary math: percent with math degree	39.3	24.3	26.9	32.6	-	39.8	26.2	25.5	29.0	-
Secondary science: percent with science degree	58.3	56.0	54.3	54.1	-	59.8	50.3	49.5	53.7	-
Secondary English: percent with English degree	27.9	26.6	26.1	31.3	-	31.0	24.3	24.3	30.4	-
Percent with traditional state certification	97.8	97.8	97.1	95.0	89.3	95.3	96.5	95.2	91.7	83.5
Percent with emergency or temporary certification	5.0	3.4	1.1	5.0	6.2	5.7	4.6	1.8	6.9	11.3
Percent would teach again	58.5	65.3	65.3	68.2	69.2	53.3	60.3	59.4	63.6	67.0
Percent that plan to exit teaching as soon as possible	3.8	2.8	3.9	2.8	2.0	5.0	3.5	6.0	5.0	2.5
Percent that agree student behavior interferes	40.1	32.8	41.2	37.1	32.3	52.5	47.7	55.8	55.0	50.2
Percent that do not believe principal supports them	16.3	12.3	18.0	16.4	11.4	17.6	15.2	21.6	23.3	14.7
Hours required to be at school per week	32.2	35.4	32.0	36.4	37.0	31.3	35.2	31.8	36.7	37.0
Hours spent on school work outside of school	9.4	11.2	12.1	11.9	-	8.6	10.3	10.3	11.1	-

Notes: mean teacher responses within schools averaged over schools using white or black enrollment as weights. Source: authors' calculations using Schools and Staffing Surveys, 1987-88 1990-91, 1993-94, 1999-2000, and 2003-04. Degree codes in the 2003-04 survey are not directly comparable with those used in the other survey waves. The measurement of required work hours in 1987-88 differs from the remaining surveys.

Table 2: Black – White Differences in Exposure to Teacher Attributes, 1988 - 2004

	1988	1991	1994	2000	2004	Change 1991-2000	Change 1987-2004
Percent male	-5.1 (0.8)*	-3.9 (0.7)*	-3.5 (0.7)*	-3.0 (0.8)*	-2.8 (0.7)*	0.9 (1.1)	2.3 (1.1)*
Percent black	25.2 (0.6)*	23.3 (0.6)*	22.1 (0.6)*	24.1 (0.6)*	22.7 (0.6)*	0.9 (0.9)	-2.5 (0.9)*
Percent first-year teacher	0.0 (0.3)	0.4 (0.3)	0.4 (0.3)	1.3 (0.4)*	1.8 (0.4)*	0.9 (0.5)	1.8 (0.5)*
Percent ≤ 3 years experience	0.7 (0.5)	1.1 (0.5)*	2.4 (0.6)*	3.3 (0.7)*	5.0 (0.6)*	2.2 (0.8)*	4.2 (0.8)*
Years of experience	0.23 (0.09)*	-0.10 (0.08)	-0.43 (0.09)*	-0.75 (0.10)*	-1.45 (0.09)*	-0.65 (0.13)*	-1.68 (0.13)*
Years at current school	-0.82 (0.08)*	-0.99 (0.08)*	-1.31 (0.08)*	-1.38 (0.09)*	-1.65 (0.08)*	-0.39 (0.12)*	-0.83 (0.11)*
Percent with MA or higher	2.5 (0.9)*	2.3 (0.9)*	1.4 (0.9)	-1.5 (0.9)	-3.8 (0.9)*	-3.8 (1.2)*	-6.3 (1.2)*
Percent with BA in education	-0.8 (0.8)	-1.0 (0.7)	-2.4 (0.8)*	-2.3 (0.8)*	-3.6 (0.7)*	-1.2 (1.1)	-2.9 (1.1)*
Percent of MAs in education	1.2 (0.7)	-0.1 (0.7)	0.1 (0.7)	-1.1 (0.7)	-0.9 (0.6)	-1.1 (1.0)	-2.2 (0.9)*
Secondary math: percent with math degree	0.5 (1.6)	1.9 (1.3)	-1.3 (1.2)	-3.6 (1.4)*	-	-5.5 (1.9)*	-
Secondary science: percent with science degree	1.5 (1.7)	-5.7 (1.6)*	-4.7 (1.5)*	-0.4 (1.6)	-	5.3 (2.2)*	-
Secondary English: percent with English degree	3.1 (1.5)*	-2.2 (1.2)	-1.8 (1.1)	-0.9 (1.3)	-	1.4 (1.8)	-
Percent with traditional state certification	-2.5 (0.3)*	-1.4 (0.3)*	-1.9 (0.3)*	-3.4 (0.5)*	-5.8 (0.6)*	-2.0 (0.5)*	-3.3 (0.7)*
Percent with emergency or temporary certification	0.8 (0.4)*	1.2 (0.3)*	0.7 (0.2)*	2.0 (0.4)*	5.1 (0.5)*	0.8 (0.5)	4.3 (0.6)*
Percent would teach again	-5.2 (0.9)*	-5.0 (0.8)*	-5.9 (0.8)*	-4.6 (0.9)*	-2.3 (0.8)*	0.4 (1.2)	3.0 (1.2)*
Percent that plan to exit teaching as soon as possible	1.2 (0.4)*	0.7 (0.3)*	2.0 (0.4)*	2.2 (0.4)*	0.5 (0.3)*	1.5 (0.5)*	-0.6 (0.5)
Percent that agree student behavior interferes	12.4 (0.9)*	14.9 (0.8)*	14.7 (0.8)*	17.9 (0.9)*	17.8 (0.8)*	3.0 (1.2)*	5.5 (1.2)*
Percent that do not believe principal supports them	1.4 (0.7)*	2.9 (0.6)*	3.5 (0.7)*	6.9 (0.7)*	3.4 (0.6)*	4.0 (0.9)*	2.0 (0.9)*
Hours required to be at school per week	-0.82 (0.09)*	-0.19 (0.07)*	-0.17 (0.11)	0.34 (0.07)*	0.00 (0.05)	0.53 (0.10)*	0.87 (0.10)*
Hours spent working outside of school	-0.77 (0.07)*	-0.86 (0.07)*	-0.96 (0.08)*	-0.74 (0.08)*	-	0.13 (0.11)	-

Notes: standard errors in parentheses. Exposure gap calculated as black – white difference in means from Table 1. (*) denotes difference is statistically significant at the 5% level. Source: authors' calculations using Schools and Staffing Surveys, 1990-91, 1993-94, 1999-2000, and 2003-04. Degree codes in the 2003-04 survey are not directly comparable with those used in the other survey waves. The measurement of required work hours in 1987-88 differs from the remaining surveys.

Table 3: Black – White Differences in Exposure to Teacher Attributes, by School Level

	Elementary Teachers			Secondary Teachers		
	1991	2000	Change 1991-2000	1991	2000	Change 1991-2000
Percent male	-0.4 (0.8)	0.9 (0.8)	1.3 (1.2)	-5.7 (1.3)*	-3.5 (1.4)*	2.2 (1.9)
Percent black	25.2 (0.9)*	24.3 (0.9)*	-0.9 (1.3)	20.5 (0.9)*	24.1 (1.0)*	3.5 (1.3)*
Percent first-year teacher	0.7 (0.5)	2.1 (0.6)*	1.4 (0.8)	-0.6 (0.4)	0.0 (0.6)	0.6 (0.8)
Percent ≤ 3 years experience	1.9 (0.8)*	5.4 (1.0)*	3.5 (1.3)*	-0.7 (0.7)	0.5 (1.0)	1.3 (1.2)
Years of experience	-0.36 (0.14)*	-1.41 (0.17)*	-1.05 (0.22)*	0.37 (0.11)*	0.34 (0.13)*	-0.03 (0.17)
Years at current school	-0.91 (0.12)*	-1.71 (0.14)*	-0.80 (0.18)*	-0.73 (0.10)*	-0.67 (0.12)*	0.06 (0.16)
Percent with MA or higher	2.5 (1.3)*	-1.4 (1.3)	-3.9 (1.8)*	3.4 (1.3)*	-0.4 (1.4)	-3.8 (1.9)*
Percent with BA in education	-1.9 (0.9)	-4.4 (1.1)*	-2.6 (1.4)*	-3.1 (1.2)*	-2.6 (1.4)	0.5 (1.8)
Percent of MAs in education	-2.0 (0.8)*	-2.7 (0.9)*	-0.6 (1.2)	-0.4 (1.2)	-1.9 (1.3)	-1.5 (1.7)
Percent with traditional state certification	-1.7 (0.4)*	-3.2 (0.6)*	-1.5 (0.7)*	-0.8 (0.4)	-3.0 (0.7)*	-2.3 (0.8)*
Percent with emergency or temporary certification	1.0 (0.5)*	2.6 (0.6)*	1.6 (0.8)	0.3 (0.5)	1.7 (0.7)*	1.4 (0.8)
Percent would teach again	-5.2 (1.2)*	-5.3 (1.2)*	-0.1 (1.7)	-6.0 (1.3)*	-4.2 (1.3)*	1.8 (1.8)
Percent that plan to exit teaching as soon as possible	1.0 (0.4)*	2.3 (0.5)*	1.3 (0.6)*	0.9 (0.5)	2.4 (0.6)*	1.5 (0.8)
Percent that agree student behavior interferes	15.4 (1.2)*	20.0 (1.3)*	4.6 (1.8)*	14.6 (1.3)*	14.1 (1.4)*	-0.5 (1.8)
Percent that do not believe principal supports them	2.8 (0.8)*	8.5 (1.0)*	5.7 (1.3)*	3.5 (0.9)*	5.1 (1.1)*	1.6 (1.5)

Notes: standard errors in parentheses. Exposure gap calculated as black – white difference in means (computed separately for elementary and secondary teachers). (*) denotes difference is statistically significant at the 5% level. Source: authors' calculations using Schools and Staffing Surveys, 1990-91, 1993-94, 1999-2000, and 2003-04.

Table 4: Within-District School Segregation and the Racial Composition of Schools Attended by White and Black Students, 1990 and 2000

	1990	2000
Percent of white students in schools that are:		
0 – 10% black	75.5	74.6
11 – 50% black	22.1	22.9
51 – 90% black	2.3	2.4
>90% black	0.001	0.001
Percent of black students in schools that are:		
0 – 10% black	8.7	9.2
11 – 50% black	40.5	39.7
51 – 90% black	28.1	28.4
>90% black	22.8	22.8
Mean school district segregation index (weighted by student enrollment)		
Elementary students only	0.097	0.104
Secondary students only	0.052	0.055
Distribution of school district segregation index (weighted by student enrollment)		
10 th centile	0.002	0.001
25 th centile	0.006	0.004
50 th centile	0.034	0.017
75 th centile	0.122	0.110
90 th centile	0.258	0.321

Source: authors' calculations using the Common Core of Data Public Schools Universe 1989-90 and 1999-00.

Table 5: Characteristics, Qualifications, and Attitudes of Teachers by Percent Black Enrollment—1990 and 2000

	1991				2000				Diff-in-Diff
	0 – 10%	51 – 90%	>90%	Difference	0 – 10%	51 – 90%	>90%	Difference	
Percent male	29.3	24.6	21.6	-7.7 (1.4)*	27.1	20.4	20.5	-6.6 (1.3)*	1.1 (1.9)
Percent black	1.5	32.6	61.2	59.6 (1.6)*	1.6	32.3	56.6	55.0 (1.5)*	-4.6 (2.2)*
Percent first-year teacher	3.7	4.8	4.0	0.4 (0.7)	4.7	7.0	6.4	1.7 (0.8)*	1.3 (1.0)
Percent ≤ 3 years experience	10.0	12.9	9.9	-0.1 (1.0)	14.3	17.0	17.4	3.0 (1.2)*	3.2 (1.5)*
Years of experience	15.2	14.7	16.3	1.1 (0.3)*	15.0	14.0	14.7	-0.3 (0.3)	-1.4 (0.5)*
Years at current school	8.8	7.2	8.0	-0.8 (0.3)*	8.8	7.2	7.0	-1.8 (0.3)*	-1.0 (0.4)*
Percent with MA or higher	45.7	48.4	51.1	5.5 (1.7)*	47.8	47.1	47.3	-0.5 (1.6)	-6.0 (2.3)*
Percent with BA in education	76.3	77.8	79.6	3.2 (1.3)*	68.2	70.5	72.1	3.9 (1.4)*	0.7 (1.9)
Percent of MAs in education	84.6	84.1	86.0	1.4 (1.6)	83.9	85.7	83.3	-0.6 (1.6)	-2.0 (2.3)
Percent with traditional state certification	98.0	95.9	96.3	-1.6 (0.6)*	95.4	91.0	91.1	-4.3 (0.9)*	-2.6 (1.1)*
Percent with emergency or temporary certification	3.2	4.7	2.9	-0.3 (0.6)	5.5	7.2	7.4	2.0 (0.8)*	2.3 (1.0)*
Percent would teach again	66.3	60.7	58.8	-7.6 (1.6)*	69.4	63.3	65.1	-4.3 (1.5)*	3.3 (2.2)
Percent that plan to exit teaching as soon as possible	2.6	3.2	4.5	1.9 (0.7)*	2.7	4.7	6.4	3.7 (0.8)*	1.8 (1.0)
Percent that agree student behavior interferes	30.7	51.5	55.1	24.4 (1.7)*	34.9	59.9	60.8	25.8 (1.5)*	1.4 (2.2)
Percent that do not believe principal supports them	12.4	16.8	17.8	5.4 (1.3)*	16.3	21.0	31.0	14.6 (1.4)*	9.2 (1.9)*
Hours spent working outside of school	11.3	10.6	9.2	-2.1 (0.2)*	12.0	10.4	10.8	-1.2 (0.2)*	0.9 (0.3)*

Notes: standard errors in parentheses. (*) denotes difference is statistically significant at the 5% level. Source: authors' calculations using Schools and Staffing Surveys, 1990-91 and 1999-2000.

Table 6: Characteristics of Tenth Grade English Teachers in Matched Teacher-Student Data—Average White and Black Student, 1990 and 2002

	NELS 1 st follow-up, 1990			ELS Base Year, 2002			Difference-in-Difference
	Average White Student	Average Black Student	Black – White Difference	Average White Student	Average Black Student	Black – White Difference	
Percent male	30.2 (0.6)	20.8 (1.4)	-9.5 (1.6)*	23.3 (0.6)	18.0 (1.1)	-5.3 (1.3)*	4.1 (2.1)
Percent black	3.6 (0.3)	24.3 (1.5)	20.7 (0.8)*	3.0 (0.2)	24.3 (1.1)	21.3 (0.8)*	0.5 (1.2)
Percent same-gender teacher	49.3 (0.7)	52.7 (1.7)	3.4 (1.8)	50.0 (0.7)	50.9 (1.4)	0.9 (1.6)	-2.5 (2.5)
Percent same-race teacher	95.2 (0.3)	24.2 (1.5)	-70.9 (0.9)*	93.8 (0.3)	24.3 (1.2)	-69.5 (0.9)*	1.4 (1.4)
Years of teaching experience	16.6 (0.1)	15.0 (0.3)	-1.6 (0.3)*	14.7 (0.2)	14.1 (0.3)	-0.6 (0.3)	1.0 (0.5)*
Years of secondary teaching experience	15.9 (0.1)	14.0 (0.3)	-1.9 (0.3)*	14.0 (0.2)	13.4 (0.3)	-0.6 (0.3)	1.3 (0.5)*
Percent ≤2 years experience	6.3 (0.3)	8.5 (0.9)	2.2 (0.9)*	12.9 (0.5)	14.6 (1.0)	1.7 (1.1)	-0.4 (1.5)
Years at current school	11.5 (0.1)	8.9 (0.2)	-2.7 (0.3)*	10.1 (0.1)	8.8 (0.2)	-1.7 (0.3)*	0.9 (0.4)*
Percent with MA or higher	52.9 (0.7)	49.5 (1.7)	-3.3 (1.7)	46.8 (0.7)	50.9 (1.7)	4.1 (1.6)*	7.4 (2.4)*
Percent with degree in field	79.4 (0.6)	76.6 (1.5)	-2.8 (1.5)	81.9 (0.6)	84.4 (1.0)	2.5 (1.3)	5.3 (2.0)*
Percent that would teach again	55.6 (0.7)	52.1 (1.7)	-3.6 (1.7)*	69.6 (0.6)	63.1 (1.3)	-6.4 (1.5)*	-2.8 (2.4)

Notes: standard errors in parentheses. (*) denotes statistically significant difference at the 5% level. Source: authors' calculations using NELS-88 first follow-up survey (1990) and ELS base year survey (2002). Base-year student weights are used in all calculations.

Table 7: Characteristics of Tenth Grade Math Teachers in Matched Teacher-Student Data—Average White and Black Student, 1990 and 2002

	NELS 1 st follow-up, 1990			ELS Base Year, 2002			Difference-in-Difference
	Average White Student	Average Black Student	Black – White Difference	Average White Student	Average Black Student	Black – White Difference	
Percent male	55.8 (0.7)	36.8 (1.9)	-18.9 (1.9)*	43.7 (0.7)	42.9 (1.3)	-0.9 (1.5)	18.0 (2.7)
Percent black	2.1 (0.2)	27.6 (1.7)	25.5 (0.9)*	2.1 (0.2)	21.2 (1.1)	19.1 (0.7)*	-6.4 (1.2)*
Percent same-gender teacher	50.7 (0.7)	50.5 (0.2)	-0.2 (1.9)	51.6 (0.7)	49.9 (1.4)	-1.7 (1.6)	-1.5 (2.7)
Percent same-race teacher	96.1 (0.3)	27.6 (1.7)	-68.4 (1.0)*	93.4 (0.3)	21.2 (1.1)	-72.3 (0.9)*	-3.9 (1.4)*
Years of teaching experience	16.4 (0.1)	15.1 (0.3)	-1.1 (0.4)*	15.0 (0.1)	15.6 (0.3)	0.6 (0.3)	1.7 (0.6)*
Years of secondary teaching experience	15.7 (0.1)	14.4 (0.3)	-1.2 (0.3)*	14.7 (0.2)	15.1 (0.3)	0.4 (0.3)	1.7 (0.6)*
Percent ≤2 years experience	7.8 (0.4)	9.0 (1.1)	1.2 (1.1)	10.1 (0.4)	9.4 (0.8)	-0.7 (1.0)	-1.9 (1.6)
Years at current school	11.2 (0.1)	8.5 (0.3)	-2.7 (0.3)*	10.0 (0.1)	8.1 (0.2)	-1.9 (0.3)*	0.8 (0.5)
Percent with MA or higher	50.9 (0.7)	45.3 (1.9)	-5.6 (2.0)*	50.7 (0.7)	49.1 (1.4)	-1.5 (1.6)	4.1 (2.7)
Percent with degree in field	77.4 (0.6)	66.4 (1.9)	-11.0 (1.7)*	82.0 (0.5)	78.8 (1.2)	-5.5 (1.3)*	5.5 (2.3)*
Percent that would teach again	55.5 (0.7)	49.6 (2.0)	-5.9 (1.9)*	66.7 (0.6)	64.0 (1.3)	-2.7 (1.5)	3.2 (2.6)

Notes: standard errors in parentheses. (*) denotes statistically significant difference at the 5% level. Source: authors' calculations using NELS-88 first follow-up survey (1990) and ELS base year survey (2002). Base-year student weights are used in all calculations.

Table 8: Relationship between Teacher Characteristics, School Racial Composition, and School Poverty

	1987-88 SASS (7,288 Observations)			2003-2004 SASS (7,050 Observations)		
	Mean of Dep. Var.	% Black	% Free Lunch	Mean of Dep. var.	% Black	% Free Lunch
<u>Dependent variable:</u>						
Percent first-year teacher	0.0376	-0.0120 (0.0064)	0.0210 (0.0059)*	0.0441	0.0214 (0.0061)*	0.0136 (0.0055)*
Percent ≤ 3 years experience	0.1112	-0.0341 (0.0104)*	0.0425 (0.0095)*	0.1355	0.0534 (0.0101)*	0.0450 (0.0090)*
Years of experience	14.313	2.347 (0.288)*	-1.461 (0.263)*	14.400	-1.566 (0.3287)*	-1.824 (0.2941)*
Years at current school	7.808	0.4681 (0.2576)	-0.6424 (0.2353)*	8.095	-1.987 (0.2745)*	-0.3912 (0.2456)
Percent with MA or higher	0.4339	0.0904 (0.0296)*	-0.0598 (0.0271)*	0.4869	0.0164 (0.0287)	-0.0750 (0.0257)*
Percent with traditional state certification	0.9737	-0.0036 (0.0058)	-0.0429 (0.0053)*	0.8877	-0.0847 (0.0103)*	-0.0256 (0.0093)*
Percent with emergency or temporary certification	0.0539	0.0034 (0.0081)	0.0229 (0.0074)*	0.0665	0.0753 (0.0083)*	0.0212 (0.0074)*
Percent would teach again	0.5884	-0.0715 (0.0298)*	-0.0104 (0.0272)	0.6744	0.0354 (0.0269)	-0.0293 (0.0241)
Percent that plan to exit teaching as soon as possible	0.0368	0.0091 (0.0114)	0.0173 (0.0104)	0.0187	0.0175 (0.0078)*	-0.0096 (0.0070)
Percent that agree student behavior interferes	0.4047	0.1423 (0.0295)*	0.1446 (0.0269)*	0.3362	0.1939 (0.0267)*	0.1943 (0.0240)*
Percent that do not believe principal supports them	0.1576	-0.0033 (0.0220)	0.0819 (0.0201)*	0.1171	0.0104 (0.0186)	0.0505 (0.0166)*

Notes: each row-year combination presents the coefficient estimates from a separate OLS regression in which the listed dependent variable (measured at the school level) is regressed on the percent black enrollment, percent free lunch eligible enrollment, four Census region dummies, three school level dummies (elementary, secondary and combined), and three urbanicity dummies (large or mid-size central city, urban fringe, and small town/rural). Only estimated coefficients on percent black and percent free lunch eligible are shown, and standard errors are in parentheses. (*) denotes coefficient estimate is statistically significant at the 5% level. Source: authors' calculations using Schools and Staffing Surveys, 1987-88 and 2003-04.