Does Segregation Still Matter? The Impact of Student Composition on Academic Achievement in High School

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The Coleman report, published 12 years after the Brown *decision, confirmed that widespread school segregation in the United States created inequality of educational opportunity. This study examines whether racial and socioeconomic segregation, which is on the rise in the United States, is still contributing to the achievement differences among students. The study used data from the National Education Longitudinal Survey of 1988 to estimate multilevel models of achievement growth between Grades 8 and 12 in mathematics, science, reading, and history for a sample of 14,217 students attending a representative sample of 913 U.S. high schools. The study found that the average socioeconomic level of students' schools had as much impact on their achievement growth as their own socioeconomic status, net of other background factors. Moreover, school socioeconomic status had as much impact on advantaged as on disadvantaged students, and almost as much impact on Whites as on Blacks, raising questions about the likely impact of widespread integration. The impact of socioeconomic composition was explained by four school characteristics: teacher expectations, the amount of homework that students do, the number of rigorous courses that students take, and students' feelings about safety. The results suggest that schools serving mostly lower-income students tend to be organized and operated differently than those serving more-affluent students, transcending other school-level differences such as public or private, large or small. This article then addresses the question of whether such school characteristics can be changed by policies to reform schools and funding systems versus policies to desegregate schools.*

> The social composition of the student body is more highly related to achievement, independent of the student's own social background, than is any school factor.
>
> —Coleman et al., 1966, p. 325

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> All children can learn, and your opportunities are not defined by who is sitting at the next desk.
>
> —Assistant Attorney General for New York State regarding a lawsuit alleging harmful effects of high-poverty schools in Rochester (Zehr, 2000, p. 2)

The issue of school segregation came to the forefront of education policy in 1954 when the U.S. Supreme Court declared that the de jure segregation of schools was unconstitutional because it was "inherently unequal" (*Brown v. Board of Education*, 1954). For 30 years following this ruling, subsequent court orders and federal legislation attempted to integrate mainly large urban school systems through both voluntary school choice programs and involuntary "busing" or mandatory reassignment plans (Armor, 1995; Frankenberg, Lee, & Orfield, 2003; Rossell, 1990). Over the last 20 years, however, desegregation policies have been increasingly abandoned because of declining support from the executive and judicial branches of the federal government and the growing concentration of minorities in urban school districts. In most instances, these districts cannot be integrated with separate suburban school districts (Frankenberg et al.; Ogletree, 2004).[1]

Moreover, many education and government officials, as well as some civil rights leaders, have come to believe that integrating schools is less important than providing adequate resources and setting high standards for all students and schools.[2] This latter strategy is premised on the belief that student composition is less important than, and unrelated to, school resources and learning opportunities in producing high student achievement. As a result, there has been very little litigation that challenges the concentration of minority students in high-poverty schools in recent years.[3]

Meanwhile, the rapid growth of school choice policies has both signaled the lack of focus on desegregation and raised concerns about growing school segregation. In response to increased concern about the quality of public schools and growing political support for market-based approaches to school improvement, many states and districts have enacted a variety of choice programs, including charter schools and experimental voucher programs, that provide access to private schools (Howell & Peterson, 2002; Witte, 2000). By 2003, 41 states had passed charter school laws, and another 3 states and the District of Columbia had instituted publicly funded voucher plans (see Bowman, 2004; Hurst, 2004). One concern about these programs is that they may increase socioeconomic segregation because research to date suggests that better educated and more motivated parents are more likely to participate in these choice programs (Levin, 1998, 2002; McEwan, 2000).

Whether the result of residential segregation, education policy, or both, racial segregation in the public schools is increasing (Clotfelter, 2001, 2004;

Frankenberg et al., 2003). More than 70% of all Black and Hispanic students in the United States attended predominantly minority schools in 2000, a higher percentage than 30 years earlier (Frankenberg et al., Figures 6 and 8). Although segregation has often been viewed in racial terms, racial segregation is strongly related to socioeconomic segregation.[4] Not only are Black and Hispanic students more likely to be poor themselves, but they are also more likely to attend high-poverty schools. In 2001, almost one third of all Black and Hispanic children under the age of 18 were living in poverty, compared with 10% of White children (U.S. Department of Education, 2003, Indicator 2). And in 2002–2003, the average Black or Hispanic student attended a school in which almost 50% of students were poor, whereas the average White student attended a school in which 23% of the students were poor (Orfield & Lee, 2005, Table 6). To the extent that both individual poverty and school poverty affect academic achievement, Black and Hispanic students are doubly disadvantaged.

But does segregation—racial or socioeconomic segregation—matter? Although desegregation may have valuable and important impacts on self-esteem and intergroup relations, particularly in the long term (for a review of this literature, see Schofield, 1995, and Wells & Crain, 1994), much of the interest and research has focused on its impact on academic achievement. The Coleman report was the first major national study to demonstrate that a student's achievement is more highly related to the characteristics of other students in the school than any other school characteristics (Coleman et al., 1966). He further found that the achievement of all racial and ethnic groups was higher in schools with higher proportions of White students because of the better educational backgrounds and higher aspirations of White students (Coleman, 1990, p. 93). This middle-class peer effect became one of the central arguments for more school desegregation by race, given the relationship between race and SES.

But the Coleman study has been widely criticized on a number of methodological grounds (Mosteller & Moynihan, 1972). Since then, a great many studies have examined the impact of segregation (and desegregation) on student achievement, but many of these too are plagued by a host of methodological problems (Schofield, 1995). A later reanalysis of Coleman's data, along with an in-depth review of more rigorous studies, concluded that the effects of school social composition on student achievement and other educational outcomes are far from conclusive (Jencks & Mayer, 1990). If desegregation has little or no impact on student achievement, then perhaps this issue no longer warrants serious policy concern, at least for this reason.

Another issue concerns what aspects of social composition matter—racial composition, socioeconomic composition, the prior achievement of classmates, or all of the above (Jencks & Mayer, 1990). Although much of the earlier research focused on racial segregation, some observers have argued that what matters most is the socioeconomic, not the racial, composition of schools (Kahlenberg, 2001). Yet because these characteristics are generally correlated, researchers who focus on only one aspect of social composition without taking into consideration the other characteristics may fail to identify the salient features of students and schools that make a difference. This in turn could lead to policy prescriptions that focus on the wrong features of schools. For example, should policies attempt to integrate high-poverty schools or schools with high minority populations?

Still another important question is *why* the social composition of schools matters. If the social composition affects student achievement largely because of its relationship to other, seemingly alterable characteristics of schools, such as school resources, structures, or practices, then segregation itself may not be as problematic, and efforts to increase school resources and to reform school structures and practices may be sufficient to address the already large achievement gap between minority and White students in American schools. If the effects of student composition cannot be traced to such alterable school characteristics, however, then the peer effects of segregation itself may be the problem. Or third, even if the effects of segregation can be explained by seemingly alterable school characteristics but such characteristics appear to be triggered by the social makeup of the students served—for example, educators and school officials consistently respond to high concentrations of poor minority students with lower expectations and a less challenging curriculum—then segregation is again problematic. In these last two cases, policies that either exacerbate segregation (such as school choice) or fail to reverse segregation caused by residential patterns could undermine equality of opportunity and worsen the achievement gap.

The final issue concerns whether social composition affects all students or whether it has stronger effects on some student groups than others. Coleman found that Blacks and ethnic minorities were more sensitive to school environments than Whites, leading him to conclude that desegregation would benefit Blacks more than Whites (Coleman et al., 1966).[5] However, a reanalysis of Coleman's data found that the racial composition of schools impacted the test scores of Whites as much as Blacks, but it also found that the mean socioeconomic status (SES) of schools had a greater impact on the test scores of Blacks than of Whites (Jencks & Mayer, 1990). Both studies suggest that desegregation would help Blacks more than it would hurt Whites. Yet, ironically enough, such issues are rarely discussed in this era of standards and accountability. Indeed, the critical question of who gains and who loses from segregated schools is no longer broached.

This study investigates these policy issues by analyzing a large national sample of U.S. high schools to address the following research questions:

1. Does high school racial and SES segregation affect student achievement? More specifically, do various measures of the social composition of

high schools affect student achievement above and beyond the individual effects of student background characteristics?

2. Can the compositional effects of student background characteristics be explained by school characteristics that can be altered through policies and reforms that do not require desegregation, or are they due to other factors that can only be altered through policies designed to integrate schools?

3. Does a school's social composition affect White and Black students similarly, or is one group impacted more than the other?

Our findings suggest that segregation still matters, but it is the socioeconomic composition, not the racial composition, of high schools that impacts student achievement. We also find that the effects of socioeconomic segregation can largely be explained by its association with such school characteristics as academic climate and teacher expectations. We further find that students attending the most affluent schools (those with the highest socioeconomic composition) receive the greatest academic benefits, which raises questions about the political and individual will to integrate schools in order to achieve equality of educational opportunity.

RESEARCH LITERATURE

Researchers have long recognized that both the individual background characteristics of students and the compositional characteristics of their school's student body can affect individual student achievement (Coleman et al., 1966; Gamoran, 1992; Jencks & Mayer, 1990). The compositional or contextual effects occur when the aggregate of person-level variables are related to outcomes even after controlling for the effects of individual characteristics. For example, the average SES of a school may have an effect on student achievement above and beyond the individual SES levels of students in that school. In other words, a student attending a school where the average SES of the student body is low may have lower achievement outcomes than a student from a similar background attending a school where the average SES of the student body is high.

Data from the 2000 National Assessment of Educational Progress illustrate this: Both low-income and middle-income fourth-grade students had lower math scores in high-poverty schools compared with low-poverty schools (U.S. Department of Education, 2002, Indicator 11). In fact, low-income students attending schools with fewer than 50% low-income students had higher scores in the fourth-grade math exam than middle-income students attending schools with more than 75% low-income students.

Despite the importance of social composition on academic achievement, there has been relatively little research on the subject, especially at the high school level. As Jencks and Mayer (1990) observed in their review of this topic in 1990, "Given the central role that everyone assigns to residential and school segregation, we were surprised by how little effort social scientists had made to measure the effect on individual behavior of either neighborhood or school composition" (p. 178).

Although a number of studies of segregation were conducted in the 1970s and 1980s, most focused on the short-term effects of racial composition and school desegregation on the academic achievement of Blacks and Whites at the elementary school level (for a recent review of this literature see Schofield, 1995).[6] Since 1990, a number of studies have been conducted on high school effectiveness, yet few have explicitly investigated the impact of social composition on student achievement (e.g., Carbonaro & Gamoran, 2002; Gamoran, 1996; Morgan & Sorensen, 1999).

In addition to the dearth of focused studies, existing research on the effects of social composition suffers from a number of conceptual and empirical shortcomings (Jencks & Mayer, 1990; Schofield, 1995). First, some existing studies do not adequately control for individual background characteristics of students and families, making it difficult to identify the unique contribution of school social composition on student outcomes. Fortunately, new statistical techniques, particularly hierarchical or multilevel modeling, have been developed that facilitate this process (Lee, 2000; Raudenbush & Bryk, 2002; Rumberger & Palardy, 2004a).

Second, some studies do not investigate the effects of different compositional characteristics—such as race, SES, and academic background—on student outcomes. Because many of these characteristics are correlated, as we mentioned earlier, failing to include multiple indicators makes it difficult to determine which aspects of a school's social composition impact student achievement.

Third, many studies, including the original Coleman study, do not control for the prior academic achievement of students. As a result, the effects of social composition on current student achievement are probably overstated. This is particularly problematic for studies of high school achievement because, as we demonstrate below, students' academic backgrounds vary widely at the start of high school.

Finally, few studies that investigate the effects of social composition are able to identify what explains those effects. As Jencks and Mayer (1990) pointed out in their review, "Almost all of it relies on a 'black box' model of neighborhood and school effects that makes no assumptions about how social composition influences individual behavior" (p. 115). Because social composition is often correlated with an array of school characteristics, from resources to the nature of peer relations to the quality of teachers, it is often hard to identify the causal relationship between social composition and student outcomes. This is related to the earlier point that many studies of school effectiveness were not designed to explicitly study the effects of social composition; although these studies can often demonstrate that social composition has an independent impact on student outcomes, they do not reveal why. For example, although Gamoran's (1996) study of student achievement in public magnet, public comprehensive, and private schools demonstrates that social composition helps to explain differences among these types of schools, he does not investigate how or why this occurs.

Given these limitations, what can we learn from the existing research literature and how do the gaps in this literature inform this study? Prior research on the effects of social composition has focused on a number of educational, social, and economic outcomes: attitudes and behaviors, cognitive skills (test scores), educational attainment, crime, teenage sexual behavior, and labor market success (Jencks & Mayer, 1990; Schofield, 1995; Wells, 1995). We focus on short-term and longitudinal studies of the effects of high school social composition on academic achievement as measured by test scores[7] and what students learn during high school, controlling for prior achievement.[8] In essence, we are updating the in-depth review of this literature by Jencks and Mayer (1990). We learned that prior studies employed only three longitudinal data sets and examined the effects of several compositional variables on high school achievement in a number of subject areas. As a result, the findings from these studies provide incomplete or inconsistent answers to each of the research questions that our study addresses.

For instance, when we ask whether the social composition of schools affects student achievement and, if so, what aspects of social composition make a difference, evidence from existing studies is mixed. In their review of three longitudinal studies, two of which employed High School and Beyond (HSB), a national longitudinal database of 25,000 high school sophomores and seniors begun in 1980, Jencks and Mayer (1990) concluded, "a high school's mean SES has a negligible impact on how much the average student learns in high school" (p. 144). None of the studies found any overall effect of racial composition on student achievement. A later study, also based on HSB data, found very strong effects of school SES on test score gains, even after controlling for 10^{th}-grade achievement and school resources, but no effect for racial composition (Chubb & Moe, 1990).[9] One problem with the HSB data is that students were first tested in the 10^{th} grade, making it impossible to assess the impact of social composition on student achievement over the entire 4 years of high school.

Several more recent studies have been based on the National Education Longitudinal Study (NELS), a database of 25,000 eighth graders begun in 1988. NELS provides an ideal data set for examining the impacts of social composition during high school because it measures student achievement just before the start of high school (spring of eighth grade) and achievement during high school (10^{th} and 12^{th} grades). Yet despite the large number of studies of school effectiveness that have been conducted using NELS, none has focused specifically on the effects of social composition. One study, for example, found that school SES had a significant impact on gains in math and reading achievement between 8^{th} and 12^{th} grades, but it did not determine whether that impact was due to individual or contextual effects of SES (Lee & Smith, 1997). Another NELS-based study found that several measures of social composition—percent minority students, percent of students on free or reduced lunch, and percent of students from single-parent families—affected 10^{th}-grade student achievement, but the study did not report the size or significance of the three individual measures (Gamoran, 1996). An additional study found a large and statistically significant positive effect of high-SES composition on mathematics (but not science) achievement growth between grades 8 and 10 and grades 10 and 12 even after controlling for a variety of reform-oriented structural practices, such as interdisciplinary teaching teams and cooperative learning (Lee, Smith, & Croninger, 1997). Still another study found no impact of the percent of the students on free or reduced lunch on the growth in reading achievement during high school after controlling for student background characteristics (Carbonaro & Gamoran, 2002). Of the three social composition variables included in one final NELS study—percent White students in the school, percent students from single-parent families, and percent minority students in the classroom—only the latter had a small yet significant negative effect on student outcomes (Goldhaber & Brewer, 1997).

In terms of our third question—Does school social composition affect student achievement similarly for all students?—the research evidence was quite thin. For instance, in their review of the earlier studies, Jencks and Mayer (1990) acknowledged some differential effects of social composition on students. They found that a school's mean SES may have more effect on Black students than White students and more effect on high-SES students than low-SES students, but they pointed out that more research using longitudinal data would need to verify these findings. Second, they found that Blacks would probably benefit from attending predominantly White schools in the North, but there is no evidence about the impact in the South. One more recent study examined the differential impact of segregation and found that school racial composition (percent White) had no significant effect on 12^{th}-grade composite test scores for Black students after controlling for 10^{th}-grade achievement (Rivkin, 2000).[10]

Overall, the prior research is far from conclusive but does provide some limited evidence that the social composition of high schools has a significant impact on the achievement of all students but that this impact is greater on some students than others. Furthermore, it is important to note that although the overall results of hundreds of studies on school desegregation and student outcomes were inconclusive, the majority of them suggest greater academic gains for Black students in desegregated schools and no negative impact on White students (Hochschild & Scovronik, 2003).

Thus, we have been left with a dearth of answers to the following critical questions related to the effects of school desegregation—by race or class: Why does social composition matter? What are the underlying causal mechanisms that explain this relationship? What research evidence supports these claims?

Two explanations have been offered to explain *why* social composition matters in terms of student achievement. The first suggests that the effects of social composition are directly related to the influence of peers. According to Jencks and Mayer (1990), students with high achievement and motivation levels can help create a ''culture of success'' in school, while students with low achievement and motivation levels can create a sense of deprivation and despair. This schoolwide culture can have a negative affect on otherwise high-achieving students in low-achieving (generally poorer) schools because it means that the schools are organized around lower expectation and less challenging curriculum. Meanwhile, Jencks and Mayer (1990) and Coleman et al. (1966) also suggested that poor, disadvantaged students may be more susceptible to these influences because they are less likely to find supportive influences at home or in the community.

On the other hand, such a schoolwide culture can have a positive affect on otherwise low-achieving students in high-achieving (generally more affluent) schools (see Wells & Crain, 1997). Kahlenberg (2001) reviewed evidence to support his contention that the socioeconomic composition of schools directly affects student achievement through three peer mechanisms: the influence of peers on learning through in-class and out-of-class interactions (e.g., cooperative work groups, study groups), the influence of peers on the motivation and aspirations of fellow students, and the influence of peers on the social behavior of other students.

The second explanation suggests that the effects of social composition are indirect, operating through their association with resources and the organizational and structural features of schools. For example, minority students are more likely to attend large high-poverty urban schools with fewer qualified teachers and more traditional organizational features that inhibit student learning (U.S. Department of Education, 1997). Moreover, the quality of schools attended by Blacks in particular has declined over time, especially in urban and highly segregated schools (Cook & Evans, 2000).[11] Evidence regarding this decline suggests that it occurs in a highly political and complex way, meaning that schools in more affluent communities end up with better trained teachers and more challenging curriculum for a number of reasons. Most obviously, schools—public and private—respond to demands of more affluent constituents more readily, but also because those schools are seen as more desirable places to teach and work (see Darling-Hammond, 2004; Hanushek, Kain, & Rivkin, 2004; Wells & Crain, 1997).

In fact, there is evidence of ethnic and social inequality associated with four important educational resources: school disciplinary climate, access to high school algebra, teachers with math backgrounds, and teacher emphasis on classroom reasoning (Raudenbush, Fotiu, & Cheong, 1998). Another organizational feature of high schools may be highly related to the social composition of high schools: tracking. Some scholars have argued that racial segregation within schools, sometimes known as second-generation segregation, is as important as segregation between schools in inhibiting the educational opportunities of racial and ethnic minorities (Lucas, 1999; Michelson, 2001; Oakes, 1990; Wells & Oakes, 1996).

In summary, not only is there a dearth of studies that have examined the impact of social composition on student achievement during high school, but few studies have investigated the causal mechanisms between social composition and educational achievement. Yet these relationships are important to investigate because they suggest different policy responses. If the adverse effects of segregation are related to school resources and practices, then those effects could, in theory, be addressed through policies designed to reallocate resources and promote school reform. But if they are related to the effects of peers, then those adverse effects can only be addressed through policies designed to desegregate schools. Or third, if the inequalities regarding school resources, structures, or practices are tied to the way in which schools respond differently to different school constituencies, then student segregation by race and class would have implications for the extent to which educational reform in and of itself can be effective.

METHODOLOGY

Data for this study came from the NELS of 1988. In our analysis of NELS data, we examined the responses from a sample of 14,217 students who attended 913 high schools in 1990 from across the country.[12] In the first part of our study, we analyzed the entire sample of high schools. In the last part of the study, we subdivided the schools into three groups: 151 high-SES schools (those with an average student SES at least one standard deviation above the overall average); 641 middle-SES schools (within one standard deviation of the mean SES), and 121 low-SES schools (average SES at least one standard deviation below the mean for all schools). As a result of this procedure, 17% were classified as high

SES, 70% were classified as middle SES, and 13% of the schools were classified as low SES.[13]

We used five dependent variables: student scores on standardized achievement test in math, science, reading, and social science administered in the spring of 1988, 1990, and 1992 (when most students were enrolled in grades 8, 10, and 12, respectively), and a composite score for each year based on the mean of the four tests in that year.[14] Although many studies of high school effectiveness using NELS data have examined only one or two of the achievement tests, particularly mathematics (e.g., Carbonaro, 1998; Lee & Smith, 1997; Lee et al., 1997; Morgan & Sorensen, 1999), we decided to use all four tests and the composite score for two reasons. First, because students are required to learn—and schools are required to teach—four core academic subjects, using all four tests gives a more comprehensive view of high school effectiveness. Second, studies that have used all four measures have found that different characteristics of schools tend to affect different outcomes, which suggests that studies that rely on a single test could draw incomplete conclusions about school effectiveness.[15]

Data from student, parent, teacher, and principal surveys were used to construct a comprehensive set of independent variables to measure various aspects of individual, family, and school characteristics. Individual and family variables were used to control for differences in the background characteristics and prior schooling of students in order to yield more accurate estimates of student achievement during high school. A large number of variables were constructed to measure four types of school characteristics: composition, structure, resources, and processes. The first three characteristics are often referred to as school inputs, while school process variables measure how those inputs are actually used in the educational process (Rumberger & Palardy, 2004a). A complete list of variables is provided in Appendix Table 1.

ANALYSIS

Because students in the NELS data sample are nested within classrooms and schools, hierarchical linear modeling (HLM) was used in this study. HLM was developed to address problems specific to nested or multilevel data (Dempster, Laird, & Rubin, 1977; Raudenbush & Bryk, 2002). It is especially suited for investigations of contextual effects because it allows researchers to disentangle the compositional or group-level effects of student background characteristics from the individual effects. We can do this using HLM by first estimating an individual-level model of student achievement. We then use these results to estimate an adjusted mean achievement level for each school that accounts for differences in the background characteristics of students. Finally, we estimate a school-level model to determine the effects of social composition and other school characteristics on differences in adjusted mean outcomes across schools.

For this study, we tested a series of models with different predictor variables specified at three levels. Level 1 models growth in test scores over time nested within students and schools; level 2 models the effects of individual background characteristics on the level one growth parameters of students nested within schools; and level 3 models the effects of school-level variables on mean achievement differences between schools after controlling for differences in the background characteristics of students in the schools (see the Technical Appendix for more detail).[16]

FINDINGS: RICH AND POOR SCHOOLS: SEPARATE AND UNEQUAL

In order to determine whether the social composition of schools impacts student achievement, it is first necessary to break down student achievement into the portion that varies between students and the portion that varies between schools. We did this by estimating the average initial achievement of students in 8^{th} grade and the average achievement growth between the 8^{th} and 12^{th} grades for each test score, as well as the variability in those estimates between students and schools (see Appendix Table 2). Because this study focuses on what students learn during high school, we highlight the findings pertaining to achievement growth rather than initial achievement.[17]

First, we examine the average achievement growth for each subject test and for a composite score across the entire sample of schools, shown in bold in Figure 1. This comparison is facilitated because the NELS tests were standardized on the same metric (a mean of 50 and a standard deviation of 10 in the 10^{th} grade). The results show substantial differences across subject areas in average achievement growth rates between grades 8 and 12. The largest growth rates were in history (9.2 points), while the smallest growth rates were in reading (6.2 points). Math and science, as well as the composite score, were in between.[18]

But these averages mask considerable variability in achievement growth among students and schools across all subject areas. The variability is greater among students than among schools, as one might expect. For example, student achievement growth in mathematics ranges from a low of 1.7 points (about one fifth of the average for the population) to a high of 15.9 points (almost twice the average). In other words, some students are learning almost 10 times as much math in high school as other students! At the school level, the average growth rate in mathematics ranges from a low of 5.5 points to a high of 12.1 points. In other words, in some high schools

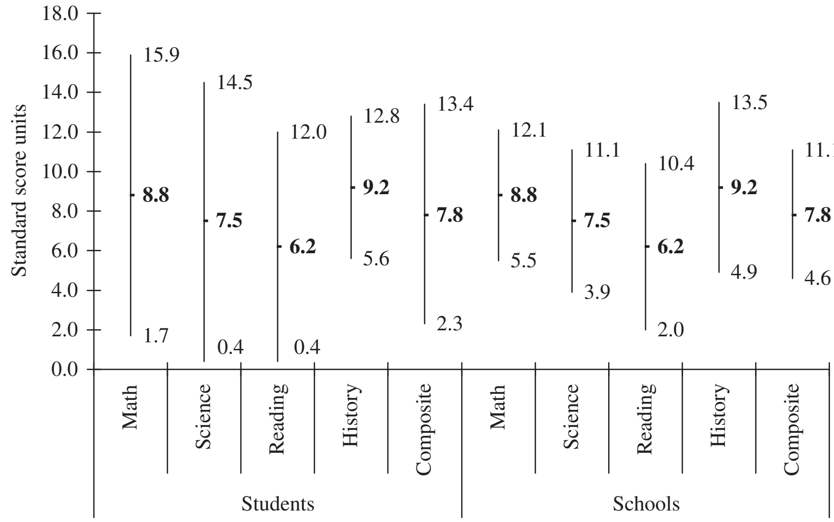

Figure 1. Mean (in bold) and range of plausible values for achievement growth during 4 years of high school among students and schools, by test score.

Note: Range of plausible values represent the 95% range of expected values based on assumption of normality for variance estimates shown in Appendix Table 2 and calculated using the formula in Raudenbush and Bryk (2002), p. 71.

students learn, on average, more than twice as much math as students in other high schools. Differences in average reading score gains among high schools ranges from a low of 2 points to more than 10 points, a fivefold increase. These results suggest that where students attend high school has a great deal to do with how much they learn, although these estimates do not account for the background characteristics of students that most likely influence these differences and the degree to which gains can and are made.

The extent to which high schools contribute to student learning can further be illustrated by calculating the proportion of the total variability in achievement growth attributable to students and the total attributable to schools. The results presented in Figure 2 demonstrate that between 40% and 80% of the variability in achievement growth is related to differences among students, and between 20% and 60% is due to differences among the schools they attend.[19] The variability in achievement growth attributable to schools ranges from a low of 20% in reading and math to a high of 60% in history. The composite score, an average of all four tests, suggests that about 25% of the variability in achievement growth can be attributed to schools.

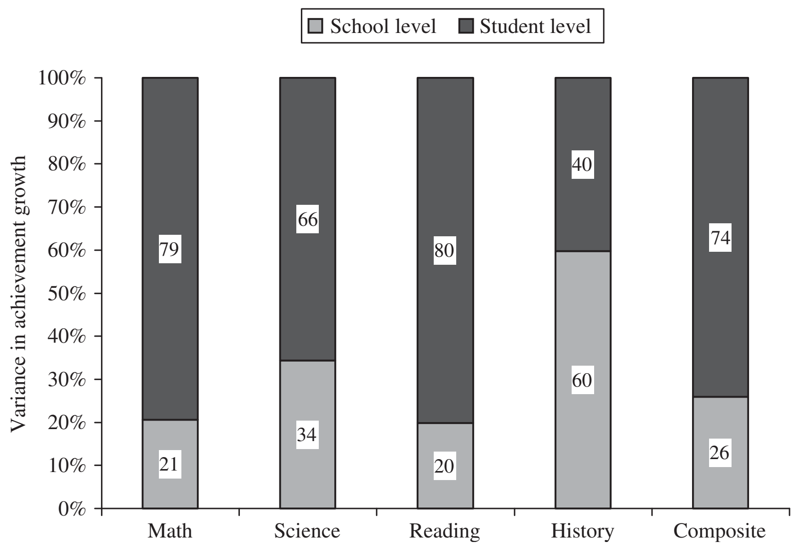

Figure 2. Percent of variance in achievement growth during 4 years of high school at student and school levels, by test score.
Note: Based on values from Appendix Table 2.

Thus, even if differences among schools were completely eliminated, there would still be considerable variability in achievement growth among students and a limit to how much inequality in student outcomes can be eliminated through school reforms versus social policies that address inequalities in student and family circumstances that affect student learning.[21]

DISENTANGLING THE EFFECTS OF STUDENTS AND SCHOOL SES

Although considerable variability in student achievement exists at the school level, not all this variability is due to the characteristics of schools. Some of the variability is due to the differences in the characteristics of students attending schools and the effects of those characteristics on achievement no matter where students attend school. That is, most students from advantaged backgrounds can be expected to do well in school regardless of the school they attend. As a result, schools with more advantaged students will have higher average achievement levels than schools with less advantaged students independent of any school-level effect.

In order to estimate more accurately, then, the contribution of schools to the growth in student achievement during high school, it is necessary to adjust for the effects of student background characteristics and prior achievement before entering high school.[22] These estimated effects (see Appendix Table 3) show that a number of student characteristics predict both initial achievement and achievement growth during high school.[23] Students with stronger academic backgrounds—for example, higher grades, not retained, and aspirations to a 4-year college—had higher initial achievement levels and higher growth rates than other students. Students from higher social class backgrounds had higher initial achievement levels and higher achievement growth rates than students from lower social class backgrounds, even after controlling for academic background. Controlling for both academic and social class background, minority students had significantly lower initial achievement than White students prior to entering high school, but not always lower achievement growth rates.[24] Across all subject areas, Blacks had lower achievement growth rates than Whites, and Asians had higher achievement growth rates than Whites. Meanwhile, Hispanic students had similar growth rates as Whites.[25]

Altogether, differences in the background characteristics and prior schooling of students account for almost three fourths of the variability in initial achievement among high schools (see Appendix Table 3). Because initial achievement was assessed at the end of eighth grade, before most students had entered high school, it makes sense that this variability in initial achievement is due largely to student characteristics and elementary and middle school experiences and not the characteristics of their high schools. In contrast, the student characteristics included in our model account for less than a third of the variability in achievement growth, on average, among schools in all subjects except science. The remaining variability is most likely due to the characteristics of the schools that students attend.

But what explains this remaining variability in student learning? Can any of the variability be attributed to the compositional effects of students, as Coleman suggested more than 35 years ago? To investigate this issue, we created a series of school-level compositional variables from the student-level background variables and added them to the earlier models. For example, in addition to each student's individual SES, we added a variable in the statistical model that measured the mean SES of the student's school in order to determine if the school effect of SES predicts student achievement above and beyond a student's individual SES. Because these compositional variables are correlated, including all of them in the model allowed us to determine their independent effects.[26] We also included variables for other school inputs—the structural characteristics of schools and school resources—in the same model in order to identify the unique effects of the compositional variables independent of other school inputs.[27] The estimated parameters of the final input model for each outcome measure are shown in Appendix Table 5.

What we found was that only one compositional variable—school SES—had a significant effect on student learning during high school. That is, both students' own socioeconomic status and the average socioeconomic status of the students in their schools contribute to their achievement growth during high school. One way to illustrate the relative importance of these two factors is by computing the change in achievement growth associated with a change in student and school SES measured in standard deviations of each variable. These expressions, known as "effect sizes," provide a common metric that allows comparisons between different outcomes and between different studies (Cohen, 1988). The effect sizes for student and school SES for each test score are shown in Figure 3.[28]

The results show that effect sizes for school SES are almost as large overall and even larger in certain subject areas than the effect sizes for student SES. For example, in the composite measure of student learning, students with a 1 standard deviation higher value of SES had average achievement growth rates that were .13 of a standard deviation higher, net of other student factors that also predict achievement growth rates. In addition, students attending high schools with a 1 standard deviation higher value of school SES had achievement growth rates that were .11 of a standard deviation higher, net of other school inputs that predict achievement growth rates. Effect sizes for both student SES and school SES varied by subject area; they were largest in science and smallest in reading. In three subjects—science, reading, and history—the SES of a student's school had a stronger impact on achievement growth than their own SES.

Is the magnitude of these effects meaningful and statistically significant? Although effect sizes in this range may be considered small (Cohen, 1988) for large populations, as in the case of this study, they may be considered substantial (Mosteller, 1995). Another way to view the magnitude of these effects is to contrast them with what some observers consider to be a highly successful school reform program—the Tennessee class size reduction experiment—which produced 4-year effect sizes of .25 (Finn & Achilles, 1999). In other words, students who attended schools with a 1 standard deviation higher value of mean SES improved their achievement growth rates on the composite test as much as might be expected from almost 2 years of class size reduction![29] Clearly, there is a sizable benefit from attending a high-SES school. But as we show below, the benefit of attending a high-SES school is even greater than these results suggest.

In addition to school SES, we also found that a number of structural features of high schools, such as school size and sector, predict achievement growth, although none of the resource variables had a significant effect.[30] In some cases, similar variables predict student achievement in several academic subjects, while in other cases they do not. For example, students attending Catholic schools had higher achievement growth in mathematics than stu-

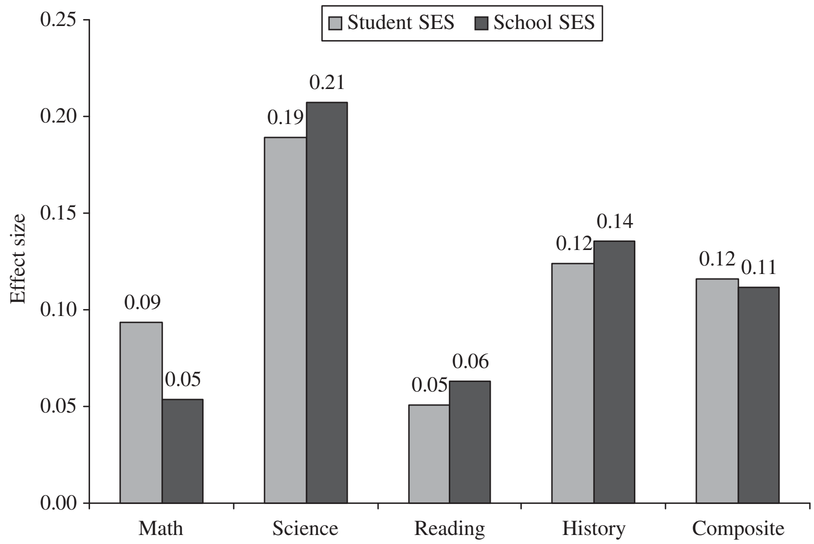

Figure 3. Effect sizes of individual and school SES on achievement growth, by test score.
Note: Effect size represents the change in the outcome variable (expressed in student-level standard-deviation units shown in Appendix Table 2) associated with a one standard deviation change in the predictor variable (shown in Appendix Table 1). Effect sizes computed from parameter estimates based on school composition model that controls for other background and school composition variables as shown in Appendix Table 4.

dents attending public comprehensive schools, but they did not have significantly higher achievement growth in any other subject.[31] Students attending private schools had significantly higher achievement growth in reading and math compared with students attending comprehensive public schools, but not in science and history. In contrast, students attending large (1,201 to 1,800 students) and extra large (more than 1,800 students) public schools had higher achievement growth in all subjects except history.

EXPLAINING THE EFFECTS OF SCHOOL SES

Why does the SES of a school's student body matter? Is it related to the school policies and practices (alterable features of schools), to the characteristics of students themselves, which are sometimes referred to as peer effects (e.g., Hanushek, Kain, Markman, & Rivkin, 2003; Rivkin, 2001), or to the relationship between the two? *Our results suggest that the reason school SES matters is that it is related to a number of school processes that predict achieve-*

ment growth. In other words, school SES may indirectly affect achievement growth in high school by influencing what is available in certain schools in terms of processes and opportunities.

In the case of the composite measure of achievement, four school process variables were significant:

1. Teachers' expectations about students' ability to learn
2. The average hours of homework that students completed per week
3. The average number of advanced (college prep) courses taken by students in the school
4. The percentage of students who reported feeling unsafe at school

Thus, students in schools in which teachers have high expectations and students complete more homework, take more advanced classes, and feel safe, have higher academic growth than students in schools without these characteristics. That academic effort (homework and advanced coursework) improves student learning underscores the importance of a school's academic climate (Lee & Smith, 1999; Phillips, 1997; Shouse, 1997). Yet school safety is also important. Finally, teachers' expectations about students' ability affects learning, even after controlling for students' academic effort, which underscores the importance of teacher efficacy and sense of responsibility for student learning.[32] Other variables, such as teacher collegiality, supportive leadership, and shared decision making, which are the focus of popular reform efforts, were found to have no direct impact on student achievement.[33]

In fact, the four school process variables listed above explain all the estimated effects of socioeconomic composition on achievement growth in all subjects except science. That is, the estimated coefficients for school SES became nonsignificant in the final model, which means that there were no independent effects of school SES after controlling for this set of school-level predictors. In science, however, the coefficient for school SES remains positive and significant even after controlling for these variables. Despite their utility, these models only explain about 40% of the variance in achievement growth in math, science, reading, and the composite test score, and only about 15% of the variance in history.[34]

ESTIMATING THE IMPACT OF ATTENDING A DIFFERENT SCHOOL

Although the preceding analysis was able to demonstrate that the effects of school SES on student learning could be explained by a number of school policies and practices, statistically significant differences in achievement growth rates remained even after controlling for these school policies and practices. As a result, we may have underestimated the impact of attending schools with different student body characteristics. To investigate this issue further, we analyzed the sample of schools based on their status as low-, middle-, and high-SES groups based on the mean SES of each school. Comparing the three groups of schools reveals that they not only differ with respect to student and school SES, but that they also differ with respect to other student characteristics, such as prior achievement (middle school grades), family characteristics (coming from nontraditional families), and college aspirations (see Appendix Table 1). But perhaps the biggest difference besides SES is in racial composition. Low-SES high schools were 62% minority, while high-SES high schools were 84% White. Even the middle class schools were only 20% minority.

Not surprisingly, student achievement varies as well. Estimates from our final statistical model (see Appendix Table 6) reveal that the initial achievement level of students in high-SES high schools is about 8 points higher (on the composite test measure) than the initial achievement level of students in low-SES high schools, which corresponds to the average amount learned by all students during high school (see Figure 1). This means that students entering low-SES schools are about 4 years behind students who enter high-SES schools. It also means that at the end of 4 years of high school, students in low-SES high schools have lower achievement levels, on average, than students in high-SES high schools had before they started high school! Because the statistical model used to generate these estimates holds constant a number of the characteristics that affect student learning (e.g., family structure, retention), actual differences between low- and high-SES schools are no doubt greater in "real life" when these characteristics come into play.[35]

The results also suggest that the effects of some student background characteristics operate similarly in all three groups of schools, while others do not. For instance, Asians have higher growth rates than Whites in middle- and high-SES schools, but not in low-SES schools. Blacks have lower achievement growth than Whites in low- and middle-SES schools, but similar growth rates in high-SES schools (although they only represent 3% of the students in high-SES schools). The most consistent finding is that prior achievement, as measured by middle school grades, is an important predictor of high school learning in all three groups of schools, albeit more so in high-SES high schools than low-SES high schools. Student SES remains an important predictor of high school learning even within middle- and high-SES schools. But, interestingly, it is not a significant predictor of achievement growth in low-SES schools, which suggests that such schools have more uniform (and some might say, equitable) effects on students no matter what their background. In contrast, retention has a negative effect on student learning in low- and middle-SES schools but has no significant effect on learning in high-SES schools.

But the question that relates back to the central issue of segregation in this article is, How would students perform if they attended schools with different socioeconomic compositions? To answer this question, we performed a series of simulations. We used the mean values of SES and grades for students attending low-SES high schools to represent the characteristics of a disadvantaged student. Similarly, we used the mean values on the same variables for students in middle-SES high schools to represent an average student and the mean values for students in high-SES high schools to represent an advantaged student. All other student characteristics, such as aspirations and family type, were assumed to be the same across all three groups, which suggests that actual differences in the estimated achievement among the groups are greater than we assumed. But the purpose of the exercise was simply to determine how student learning could be altered by attending a different school, so the specific characteristics of students in the three groups is less important than holding those characteristics constant across school settings. Using these characteristics and the estimated parameters from our statistical models, we then estimated the achievement growth for disadvantaged, average, and advantaged White and Black students attending low-, middle-, and high-SES schools.

The results, shown in Figure 4, confirm our earlier findings: Where students attend school has a major impact on how much they learn. In fact, school characteristics account for more of the differences in student learning during high school than student background characteristics, and this is especially true for students attending high-SES schools. For example, the difference in achievement growth between advantaged and disadvantaged White students in middle-SES schools is 1.1 points (8.5 vs. 7.4), whereas the difference between a disadvantaged White student attending a high- and a middle-SES school is 1.5 points (8.9 vs. 7.4). For Blacks, the differences are even greater; the difference between advantaged and disadvantaged Black students in middle-SES schools is 1.1 points (7.5 vs. 6.4), whereas the difference between a disadvantaged Black student attending a high- and a middle-SES school is 1.9 points (8.3 vs. 6.4).[36] Interestingly, differences in achievement growth related to student background characteristics are less pronounced in low-SES high schools than in high-SES high schools, in part because middle school grades are a more powerful predictor of student learning in high-SES high schools than in low-SES high schools, as noted earlier. Thus, low-SES schools tend to be more homogenous in their effects on student learning.

The results can also be used to show what would happen if students were redistributed among low-, middle-, and high-SES schools, assuming that nothing else about the schools changed, an assumption we relax below. First, moving students from low-SES to middle-SES schools appears to have little potential impact on their achievement. For example, the achievement

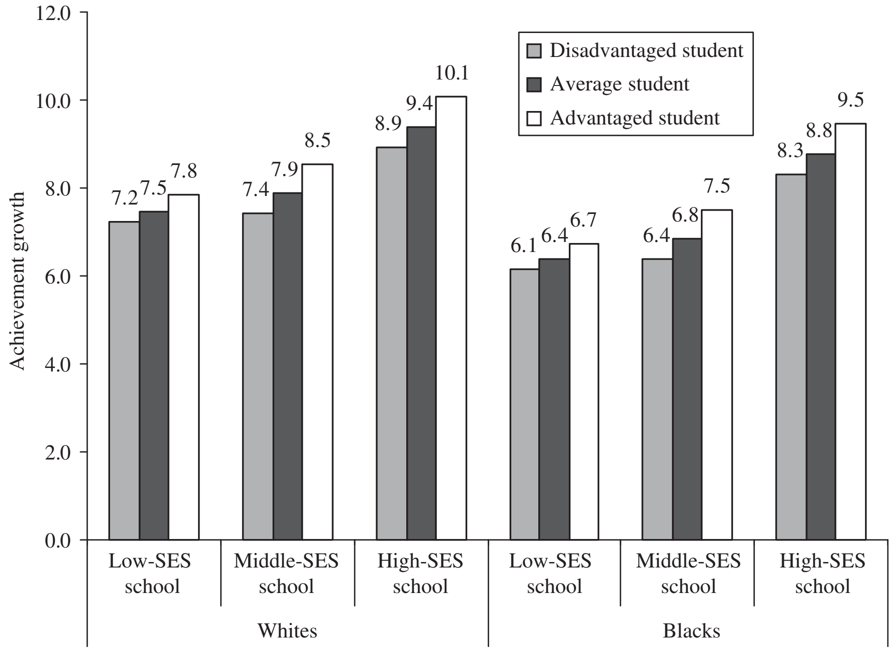

Figure 4. Estimated achievement growth during 4 years of high school for disadvantaged, average, and advantaged White and Black students in low-, middle-, and high-SES high schools.

Note: Estimates based on mean values of student SES and grades from Appendix Table 1 and coefficients for those variables from Appendix Table 7.

growth of a disadvantaged Black student would likely increase by .3 points, or about 2 months of learning; the achievement growth of an average Black student would increase by .4 points, and the achievement growth of an advantaged Black student would increase by .8 points. Whites would experience similar small improvements. Second, much greater impact would occur by moving students to high-SES, or affluent, schools. For example, the achievement of an average Black student would increase by 2 points, or about 1 full year of learning. Whites would also experience substantial improvements, but less than Blacks (1.5 points for an average White student vs. 2 points for an average Black student).

Although moving small numbers of students from middle- to high-SES schools would have little impact on the social composition and the advantages that they enjoy, any large-scale integration of high-SES schools would effectively lower their SES composition and could lower their achievement advantage relative to middle-class schools by altering the school processes that make them so successful (e.g., lowering teacher expectations). If this occurred (an issue we discuss below), the achievement advantages enjoyed by White students in high-SES schools could decline, whereas the potential benefits to Black students in moving to high-SES schools would be less than the present simulations suggest. In the extreme and unlikely case that all low-SES and all high-SES schools were integrated and consequently transformed into middle-class schools, the present analysis suggests that gains in achievement to predominantly minority students moving from low-SES to middle-class schools would be less than the declines in achievement of White students moving from high-SES to middle-class schools. This suggests that integration would lower the achievement gap between Whites and Blacks, but it could also lower overall achievement levels.

CONCLUSIONS

The results of this study confirm a widely held belief of many parents: that whom you go to school with matters. But what appears to matter most is the socioeconomic, not the racial, composition of schools. In our study, all students—whatever their race, social class, or academic background—who attended high schools with other students from high social class backgrounds learned more, on average, than students who attended high schools with other students from low social class backgrounds. While students' own social class backgrounds were related to their achievement, so too were the average social class backgrounds of all the students in their school. In fact, the effects of school SES were almost as large, and sometimes much larger, than the effects of student SES on achievement growth in the four academic subjects we examined—mathematics, science, reading, and history—as well as a composite achievement measure. The results of this study also confirm the original conclusions of the Coleman report.

The importance of school SES was further highlighted by estimating changes in student learning that could be achieved by redistributing students among schools. These simulations further substantiated that school SES is a more important predictor of student achievement than individual SES. In addition, schools influenced the achievement of students from all backgrounds. Although this finding challenges an important finding in the Coleman report that Whites were less affected by the quality of their schools than were minority students (Coleman et al., 1966), other researchers have also found that social composition has at least as strong, and in some cases, a stronger, impact on advantaged students as disadvantaged ones (e.g., Byrk & Driscoll, 1988; Hanushek et al., 2002; Willms, 1986).

This study also investigated why socioeconomic composition matters by exploring three possible explanatory factors: structural features of schools, school resources, and school processes (policies and practices). Two of these factors—structural features of schools and school resources—did not account for the effects of school SES. This suggests that policy efforts designed to alter school structures or redistribute resources will most likely not be effective at reducing the advantages associated with attending more affluent schools. In fact, two popular structural changes—to shift more students into private schools via tuition vouchers and creating more small schools in urban districts—may have little or no impact because schools characterized as "private" or "small" had little or no significant impact on student learning in some subjects after controlling for the individual and aggregate effects of student background characteristics. Further educational resources—at least the ones we were able to measure—had no discernable effects on student learning, so equalizing educational resources would do little to equalize educational outcomes.[37]

However, the third factor—school policies and practices, namely teacher expectations and the academic climate—did account for the effects of school SES in the first part of our analysis. *That is, after controlling for the effects of school policies and practices, the socioeconomic composition had no significant impact on student learning*. This was the case in all subjects except science, where controlling for these factors reduced, but did not eliminate, the significant impact of school SES on achievement growth.

What do these findings suggest about the need to desegregate America's schools? The findings from the first part of our analysis (based on the entire sample of high schools) suggests that desegregation may not be necessary *if* it were possible to alter those policies and practices that are associated with schools' socioeconomic composition. For example, two of these policies and practices—the amount of homework that students do and the amount of rigorous academic courses they take—could, in theory, be altered by improving the academic climate of schools (e.g., Cook et al., 1999). School safety could also be improved by school policies and practices (e.g., Wishnick & Wishnick, 1996). Whether teacher expectations can be altered is less clear, as is the extent to which teachers with low expectations for their students will increase homework and academic rigor. Existing research suggests that teacher efficacy, particularly teachers' beliefs about students' ability to learn, is less amenable to reform efforts (Newman et al., 1989; Ross, 1995).[38] Furthermore, there is no reason to believe that the academic rigor of a school can be disconnected from teacher expectations and improved in a technical manner absent of the normative and political changes that would be needed to affect teacher attitudes about students (see Oakes, Wells, Jones, & Datnow, 1997). Nonetheless, reviews of so-called "comprehensive school reforms" that alter school organization and instructional practices show that they can significantly improve student achievement even among high-poverty schools (Borman et al., 2003).[39]

Some observers believe, however, that desegregation, particularly socioeconomic integration, is the only way to achieve equal educational opportunity for all children (Kahlenberg, 2001; Orfield, 2001; Ryan, 1999). These researchers have noted that schools tend to respond to the demands and political clout of their constituents; thus, parents and students with the power to demand more challenging curriculum and command high expectations have schools with different ‘‘school cultures’’ and ‘‘academic presses’’ than less powerful and influential families (see Brantlinger, 2003; Oakes et al., 1997; Wells & Serna, 1996). Thus, poor students who enroll in schools with a majority of such powerful families are more likely to be in schools that offer challenging college-prep curriculum and where teachers have overall high expectations (see Wells & Crain, 1997). These researchers also cite a history in which we learn that as long as students are segregated along class and race lines in American schools, it is unlikely that there will be sufficient political will to equalize educational opportunity.

But is there the political and individual will to integrate schools? The political will to integrate schools has been replaced by the widespread belief among both conservatives and liberals that rigorous standards, accountability, and market mechanisms (e.g., choice) can improve the performance of all schools no matter what their social composition (Peterson & West, 2004). This belief is buttressed by lack of legal authority to promote and enforce involuntary integration through busing, which ended with a 1991 Supreme Court decision (*Board of Education of Oklahoma v. Dowell*, 1991) that freed school districts from addressing past discrimination and even allowed increased segregation (e.g., assigning students to neighborhood schools) ‘‘as long as such actions were not intentionally discriminatory’’ (Frankenberg et al., 2003, p. 19).

Individual will also appears to be lacking. Although Whites’ attitudes toward school integration are generally favorable (see Bobo, 2001), such attitudes do not usually translate into action.[40] In particular, Whites who feel advantaged by a system of segregated schools are unlikely to willingly give up or share their privileged position. Case studies of magnet school programs and other efforts to promote equity in school districts document the difficulty of integrating schools and equalizing opportunity, especially along social class lines (e.g., Brantlinger, 2003; Metz, 2003; Smrekar & Goldring, 1999).[41] As Brantlinger observed in her insightful case study of a Midwestern school district, ‘‘When he [the superintendent] tried to increase equity and curricular access, those who benefited from segregation and advantage—affluent parents, students, and teachers—promptly rose in protest’’ (p. 149). Moreover, even if between-school segregation was eliminated or greatly reduced, it would not necessarily reduce within-school segregation in learning opportunities and friendship patterns (Michelson, 2001; Moody, 2001; Oakes & Guiton, 1995; Oakes et al., 1997; Wells & Oakes, 1996; Yonezawa, Wells, & Serna, 2002).

Furthermore, integration is insufficient to equalize educational opportunity. As Coleman first observed, and as this and other studies have confirmed, most of the variability in student achievement overall, as opposed to achievement growth during high school, is associated with students (and their families and communities), not the schools they attend. Therefore, to achieve true equality of opportunity will require addressing the pervasive inequalities found in family and community resources (Armor, 2003; Rothstein, 2004). The challenge of improving educational opportunity in the United States was clearly stated by Coleman (1967) more than 35 years ago:

> In some part, the difficulties and complexity of any solution derived from the premise that our society is committed to overcoming, not merely inequalities in the distribution of educational *resources* (classroom teachers, libraries, etc.), but inequalities in the opportunity for educational *achievemen*t [italics in original]. This is a task far more ambitious than has even been attempted by any society: — not just to offer, in a passive way, equal access to educational resources, but to provide an educational environment that will free a child's potentialities for learning from the inequalities imposed upon him by the accident of birth into one or another home and social environment. (pp. 20–21)

In a society that is becoming more and more stratified along social class lines, this challenge is far more formidable today than ever before.

TECHNICAL APPENDIX

A series of models were developed and tested to identify both student-level and school-level variables that influenced gains in achievement test scores between the 8^{th} and 12^{th} grades. The first step was to specify a level 1 growth model as follows:

$$Y_{tij} = \pi_{0ij} + \pi_{1ij}a_{tij} + e_{tij}, \tag{1}$$

where Y_{tij} is the theta score for a single subject test or composite of four subject tests at time t of person i attending high school j; π_{0ij} is the intercept parameter, true theta score of person i upon entering high school j; π_{1ij} is the slope parameter, theta growth rate for person i during high school j; a_{tij} represents time t for person i in high school j; and e_{tij} is the random effect for person i in school j. For this study, time was specified as three values (0, .5, 1) corresponding to achievement values for 8^{th}, 10^{th}, and 12^{th} grades. As a result, the growth parameter, π_{1ij}, represents the estimated growth rate or total amount of learning for a student between grades 8 and 12, or the entire 4 years of high school.

After specifying the level 1 growth model, a series of level 2 and level 3 models were tested. The first model was an unconditional model that did not introduce predictor variables in any of the level 2 or level 3 models. This model allows one to examine the overall or grand mean values for both initial achievement and achievement growth rates for the entire sample of students. It also produces estimates of the variance in these parameters at the individual (level 2) and school (level 3), which can be used to compute the proportion of variance in these parameters that exists at the individual and school levels (known as the intraclass correlation).

The next step was to specify a level 2 or student model, which functions primarily as a control for the effects of individual background characteristics on achievement growth. The idea was to try to equalize any education background differences that may exist among students as they entered high school. Three types of background characteristics were included in the student model: demographic characteristics (minority group, SES, nontraditional family, siblings who dropped out; measured in 10^{th} grade), academic background (grades, college aspirations, and retention; all measured in 8^{th} grade) and peers who dropped out (measured in 10^{th} grade). We also included variables indicating whether the student subsequently dropped out or transferred schools between grades 10 and 12. We then specified the following student-level model:

$$\pi_{1ij} = \beta_{10j} + \beta_{11j}X_{1ij} + \ldots + \beta_{1pj}X_{pij} + r_{1ij} \tag{2}$$

where π_{1ij} is the growth parameter of student i in school j as specified in level 1, β_{10j} is the mean test score growth in school j, and β_{11j} through β_{1pj} are the estimated effects of the student-level predictors on growth rates within each school, and r_{1ij} is the error term.[42] All the continuous measures were centered on the grand mean for the entire sample of students while all the other (dummy) variables were not centered. As a result, the intercept term, β_{10j}, represents the adjusted mean achievement growth for each school, or the mean achievement growth for each school assuming that it enrolled the same types of students—that is, students absent any of the dummy variables (i.e., White males from traditional families who did not have college aspirations, who had never been retained, and who remained at the same high school between 1990 and 1992) who had average characteristics on all other variables.

The level 3 model, an intercept-and-slopes-as-outcomes model, is designed to examine whether between-school variance in mean growth rates in test scores can be attributed to measured school characteristics. A series of level 3 models were estimated. The first introduced a set of contextual variables that represented school-level averages of the individual characteristics used in the student model. The second introduced a set of structural characteristics of schools: location, school size, and school control (Catholic and private), including whether the school was a public magnet school. School structure variables are considered to be components of schools that teachers and school administrators have little or no control over. The third introduced a set of resource variables. The final model introduced a set of process variables. The models were estimated sequentially by first incorporating all the variables in the group in the model but only retaining the significant ones ($p \leq .10$) prior to introducing the variables from the subsequent groups. The purpose of this model building is to determine the extent to which resource, structure, and process variables can explain the compositional effects. The final level 3 model was

$$\beta_{10j} = \gamma_{100} + \gamma_{101} W_{1j} + \ldots + \gamma_{10q} W_{qj} + u_{10j} \tag{3}$$

where β_{10j} is the mean test score growth in school j, γ_{100} is the overall sample mean of student test score growth, γ_{101} to γ_{10q} are the estimated effects of the school-level variables on the mean test score growth, and u_{10j} is the residual at school j.

Appendix Table 1. Variable definitions and descriptive statistics for samples

Variable Name	Total Mean (SD)	Low SES Mean (SD)	Medium SES Mean (SD)	High SES Mean (SD)	Description and (NELS variables)
Level 1 N (N = 39,287)	**39,287**	**4,488**	**28,200**	**6,599**	
Math test	50.31 (10.28)	44.23 (8.87)	49.62 (9.77)	57.40 (9.47)	(BY2XMTH, F12XMTH, and F22XMTH)
Science test	50.00 (10.27)	44.11 (8.79)	49.54 (9.91)	55.94 (9.80)	(BY2XSTH, F12XSTH, and F22XSTH)
Reading test	50.13 (10.15)	44.67 (8.87)	49.60 (9.82)	56.12 (9.53)	(BY2XRTH, F12XRTH, and F22XRTH)
History test	49.81 (10.19)	44.51 (9.56)	49.29 (9.87)	55.63 (9.29)	(BY2XHTH, F12XHTH, and F22XHTH)
Test composite	50.06 (9.27)	44.38 (7.95)	49.51 (8.84)	56.27 (8.50)	Mean of math, science, reading, history tests
Time	0.46 (0.40)	0.45 (0.40)	0.46 (0.40)	0.46 (0.40)	Time (0 = 8^{th}; 0.5 = 10^{th}; 1 = 12^{th})
Level 2 N (N = 14,217)	**14,217**	**1,640**	**10,198**	**2,379**	
Asian	0.06 (0.24)	0.05 (0.22)	0.05 (0.23)	0.09 (0.29)	(F1RACE = 1)
Black	0.09 (0.29)	0.21 (0.41)	0.08 (0.28)	0.03 (0.18)	(F1RACE = 2)
Hispanic	0.11 (0.31)	0.33 (0.47)	0.09 (0.29)	0.04 (0.19)	(F1RACE = 3)

Appendix Table 1. (Continued)

Variable Name	Total Mean (SD)	Low SES Mean (SD)	Medium SES Mean (SD)	High SES Mean (SD)	Description and (NELS variables)
Native	0.01 (0.08)	0.02 (0.12)	0.01 (0.10)	0.00 (0.05)	(F1RACE = 5)
SES	0.04 (0.81)	– 0.72 (0.69)	– 0.04 (0.98)	0.90 (0.59)	Composite of family income, parents' educational, and occupational prestige (F1SES)
Nontraditional family	0.33 (0.47)	0.41 (0.49)	0.35 (0.47)	0.21 (0.41)	Does not live with both mother and father (F1S92A≠1or F1S92D≠1)
Grades 6–8	3.01 (0.72)	2.82 (0.73)	2.98 (0.72)	3.25 (0.61)	GPA composite (BYGRAD)
College aspirations 8th	0.71 (0.46)	0.55 (0.50)	0.68 (0.47)	0.92 (0.27)	Planned to earn at least a 4-year degree (BYS45 = 5 or 6)
Friends dropped out 10th	0.21 (0.41)	0.35 (0.48)	0.22 (0.41)	0.08 (0.28)	Close friend(s) who dropped out of school (F1S69 = 1, 2, or 3)
Retained 8th	0.16 (0.37)	0.26 (0.44)	0.16 (0.36)	0.10 (0.31)	Ever held back a grade in school as reported by student (BYS74 = 2) or parent (BYP44 = 1).
Transfer	0.06 (0.24)	0.07 (0.26)	0.06 (0.24)	0.06 (0.23)	Transferred schools between 10th and 12th grade (F2F1SCFG = 1)
Dropout	0.07 (0.25)	0.13 (0.34)	0.07 (0.26)	0.02 (0.12)	Dropped out at any time (F2DOSTAT = 3 or 5)
Level 3 N	**913**	**121**	**641**	**151**	
Composition					
Mean SES	0.01 (0.52)	– 0.74 (0.19)	– 0.05 (0.28)	0.89 (0.24)	Mean of student variable, SES
Proportion minority	0.24 (0.29)	0.62 (0.34)	0.20 (0.25)	0.08 (0.14)	Mean of dummy variable indicating Black and Hispanic student (F1RACE = 2 or 3)
Proportion nontraditional families	0.34 (0.17)	0.43 (0.21)	0.35 (0.15)	0.21 (0.12)	Mean of student variable, nontraditional family
Mean eighth-grade grades	2.98 (0.30)	2.76 (0.27)	2.96 (0.27)	3.23 (0.26)	Mean of student variable, grades 6–8
Proportion college aspirations	0.64 (0.18)	0.47 (0.14)	0.62 (0.15)	0.85 (0.11)	Mean of student variable, college aspirations 8th

Appendix Table 1. (Continued)

Variable Name	Total Mean (SD)	Low SES Mean (SD)	Medium SES Mean (SD)	High SES Mean (SD)	Description and (NELS variables)
Proportion friends dropped out 10th	0.22 (0.17)	0.35 (0.19)	0.23 (0.15)	0.09 (0.13)	Mean of student variable, friends dropped out 10th
Proportion retained grades 1–8	0.16 (0.12)	0.25 (0.15)	0.15 (0.11)	0.10 (0.09)	Mean of student variable, retained 8th
Structure					
Catholic	0.07 (0.25)	0.01 (0.09)	0.06 (0.24)	0.13 (0.33)	(G10CTRL1 = 2)
Private	0.08 (0.27)	0.00 (0.00)	0.02 (0.12)	0.42 (0.50)	(G10CTRL1 = 3–5)
Magnet	0.05 (0.22)	0.16 (0.37)	0.04 (0.19)	0.01 (0.08)	(F1C4AB = 1)
Small	0.23 (0.42)	0.14 (0.35)	0.23 (0.42)	0.30 (0.46)	School enrollment = 0–600 (F1C2)
Large	0.28 (0.45)	0.26 (0.44)	0.30 (0.46)	0.20 (0.40)	School enrollment = 1,201–1,800 (F1C2)
Extra large	0.13 (0.33)	0.23 (0.42)	0.12 (0.32)	0.10 (0.30)	School enrollment = 1,801+(F1C2)
Urban	0.31 (0.46)	0.42 (0.50)	0.26 (0.44)	0.42 (0.50)	School located in urban setting (F1URBAN = 1)
Rural	0.30 (0.46)	0.34 (0.48)	0.35 (0.48)	0.05 (0.22)	School located in rural setting (F1URBAN = 2)
Resources					
Student–teacher ratio	16.39 (5.71)	17.61 (3.97)	16.69 (5.90)	14.11 (5.50)	(F1SCENRL/F1C35)
Mean salary	29172 (4793)	29504 (4298)	28999 (4605)	29642 (5830)	Mean teacher salary (F1C42A+F1C42B)/2)
Subject certified	0.84 (0.27)	0.84 (0.26)	0.87 (0.24)	0.70 (0.34)	Proportion of teachers certified to teach in their teaching subject area (depending on their teaching area, one of F1T3_8A-D = 1)
Teacher experience	0.84 (0.24)	0.80 (0.25)	0.84 (0.23)	0.84 (0.24)	Proportion of teachers with 4+ years of secondary-level teaching experience (F1T3_4B = 2–9)
Standard credential	0.83 (0.27)	0.83 (0.26)	0.86 (0.24)	0.68 (0.35)	Proportion of teachers who have a standard teaching credential (F1T3_7 = 1)

Appendix Table 1. (Continued)

Variable Name	Total Mean (SD)	Low SES Mean (SD)	Medium SES Mean (SD)	High SES Mean (SD)	Description and (NELS variables)
BA in teaching area	0.42 (0.17)	0.40 (0.19)	0.42 (0.17)	0.45 (0.18)	Proportion of teachers with at least a BA in their primary teaching subject (depending on their teaching area, one of F1T310B2-E2 = 1)
Super teacher	0.36 (0.18)	0.84 (0.26)	0.37 (0.17)	0.31 (0.20)	BA in subject area, 4+ years of experience, and standard credential
Process					
Parent involvement	2.42 (0.21)	2.43 (0.18)	2.46 (0.19)	2.24 (0.23)	Proportion of parents who agree or strongly agree that they have adequate say in school policy (F2P42M = 1 or 2)
Discipline fair	0.63 (0.15)	0.59 (0.16)	0.63 (0.15)	0.67 (0.16)	Mean of dummy variable indicating student agrees the discipline is fair at the school (F1S7D = 1 or 2)
Homework time	4.61 (2.05)	3.59 (1.25)	4.19 (1.51)	7.20 (2.51)	Mean number of hours spent on homework per week (F1S36A2)
Teaching quality	0.00 (0.39)	− 0.03 (0.38)	0.07 (0.33)	− 0.28 (0.50)	Standardized principal component
Teacher community	− 0.01 (0.69)	− 0.15 (0.70)	− 0.05 (0.66)	0.28 (0.71)	Standardized principal component
Teacher control	− 0.01 (0.72)	− 0.32 (0.66)	− 0.05 (0.70)	0.38 (0.71)	Standardized principal component
Teacher curriculum coordination	− 0.01 (0.60)	− 0.11 (0.56)	− 0.02 (0.59)	0.91 (0.63)	Standardized principal component
Principal leadership	0.01 (0.74)	− 0.06 (0.71)	− 0.05 (0.76)	0.20 (0.63)	Standardized prin cipal component
Teacher efficacy	0.01 (0.60)	0.07 (0.65)	− 0.04 (0.66)	0.16 (0.59)	Standardized principal component
Teacher expectations	− 0.01 (0.65)	− 0.36 (0.54)	− 0.09 (0.59)	0.60 (0.62)	Standardized principal component
Poor learning environment	11.90 (2.54)	3.03 (3.20)	11.94 (2.37)	10.84 (2.24)	Principal rating of school learning environment based physical conflicts, gang activity, drug use, etc. (composite of F1C95D, E, F, G, J, K, L, M)

Appendix Table 1. (Continued)

Variable Name	Total Mean (SD)	Low SES Mean (SD)	Medium SES Mean (SD)	High SES Mean (SD)	Description and (NELS variables)
Academic track	0.33 (0.22)	0.23 (0.15)	0.32 (0.20)	0.50 (0.27)	Proportion of students in academic track (F1HSPROG = 2)
Class disruptions	0.00 (0.36)	– 0.14 (0.31)	– 0.04 (0.31)	0.29 (0.41)	Standardized principal component
Unsafe	0.08 (0.08)	0.13 (0.10)	0.08 (0.08)	0.03 (0.05)	Proportion of students who report they feel unsafe at school (F1S7M = 1 or 2)
NAEP composite	13.76 (2.27)	12.20 (2.16)	13.46 (1.87)	16.33 (1.96)	Number of NAEP units in math, science, English, and social science earned in H.S. (F2ral1_C+al2_C+geo_C, tri_C+pre_C+cal_C+bio_C+che_C+phy_C+soc_C+his_C

Appendix Table 2. Principal component descriptions, path loadings, and variance explained

Factor and Items Labels	Item Descriptions	Item Loadings
Teaching Quality	***4-point Likert scale (1 = strongly agree, 4 = strongly disagree)***	
F1S7G	TEACHERS ARE INTERESTED IN STUDENT	0.702
F1S7H	WHEN R WORKS HARD TEACHERS PRAISE EFFORT	0.789
F1S7I	IN CLASS OFTEN FEEL PUT DOWN BY TEACHERS	0.681
F1S7J	IN CLASS OFTEN FEEL PUT DOWN BY TEACHERS (reverse coded)	0.591
F1S7L	TEACHERS EXPECT R TO SUCCEED IN SCHOOL	0.747
F1S66	TEACHERS EXPECT R TO SUCCEED AT SCHOOL	0.697
Variance Explained		49.5%

Appendix Table 2. (Continued)

Factor and Items Labels	Item Descriptions	Item Loadings
Teacher Efficacy	***6-point Likert scale (1 = strongly disagree, 6 = strongly disagree)***	
F1T4_5A	CAN GET THROUGH TO MOST DIFFICULT STUDENTS	0.666
F1T4_5B	T RESPONSIBLE FOR KEEPING STUDENTS FROM DROPPING OUT	0.622
F1T4_5C	CHANGE APPROACH IF STUDENTS NOT DOING WELL	0.626
F1T4_5D	DIFFERENT METHODS CAN AFFECT ACHIEVEMENT	0.730
F1T4_5E	LITTLE I CAN DO TO ENSURE HIGH ACHIEVEMENT (reverse coded)	0.610
F1T4_5F	R MAKING DIFFERENCE IN STUDENTS' LIVES	0.595
F1T4_11F	CREATE LESSONS STUDENTS WILL ENJOY LEARNING	0.516
Variance Explained		39.3%
Teacher Expectations	***6-point Likert scale (1 = strongly disagree, 6 = strongly disagree)***	
F1T4_1D	SUCCESS/FAILURE DUE TO FACTORS BEYOND ME	0.569
F1T4_1E	STUDENT MISBEHAVIOR INTERFERES W/ TEACHING	0.678
F1T4_1I	STUDENTS INCAPABLE OF LEARNING MATERIAL	0.631
F1T4_2J	FEEL WASTE OF TIME TO DO BEST AT TEACHNG	0.648
F1T4_2N	STUDENTS' ATTITUDES REDUCE ACADEMIC SUCCESS	0.755
Variance Explained		43.4%
Class Disruptions	***4-point Likert scale (1 = strongly agree, 4 = strongly disagree)***	
F1S7F	OTHER STUDENTS OFTEN DISRUPT CLASS	0.673
F1S7K	OFTEN FEEL PUT DOWN BY STUDENTS IN CLASS	0.501
F1S7N	DISRUPTIONS IMPEDE R'S LEARNING	0.712
F1S7O	MISBEHAVING STUDENTS OFTEN GET AWAY WITH IT	0.696
Variance Explained		42.4%
Teacher Community	***6-point Likert scale (1 = strongly disagree, 6 = strongly disagree)***	
F1T4_1B	CAN COUNT ON STAFF MEMBERS TO HELP OUT	0.741
F1T4_1C	COLLEAGUES SHARE BELIEFS ABOUT MISSION	0.720
F1T4_2E	GREAT DEAL COOPERATIVE EFFORT AMONG STAFF	0.846
F1T4_2F	BROAD AGREEMENT AMONG FACULTY ABOUT MISSION	0.771
F1T4_2H	SCHOOL SEEMS LIKE A BIG FAMILY	0.753
Variance Explained		58.9%

Appendix Table 2. (Continued)

Factor and Items Labels	Item Descriptions	Item Loadings
Teacher Control	***5-point Likert scale (1 = no influence, 5 = great deal of influence)***	
F1T4_9A	TEACHERS INFLUENCE OVER DISCIPLINE POLICY	0.767
F1T4_9B	TEACHERS INFLUENCE OVER IN-SERVICE PROGRAMS	0.714
F1T4_9C	INFLUENCE GROUPING STUDENTS BY ABILITY	0.774
F1T4_9D	INFLUENCE OVER ESTABLISHING CURRICULUM	0.748
Variance Explained		56.4%
Teacher Curriculum Coordination	***6-point Likert scale (1 = strongly disagree, 6 = strongly disagree)***	
F1T4_1A	COORDINATE COURSE CONTENT W/ DEPT. TEACHERS	0.783
F1T4_1N	COORDINATE CONTENT W/ TEACHERS OUTSIDE DEPT.	0.666
F1T4_2P	FAMILIAR W/ CONTENT TAUGHT BY DEPT. TEACHERS	0.657
Variance Explained		49.6%
Principal Leadership	***6-point Likert scale (1 = strongly disagree, 6 = strongly disagree)***	
F1T4_1F	PRINCIPAL POOR AT GETTING RESOURCES (reverse coded)	0.711
F1T4_1G	PRINCIPAL DEALS WITH OUTSIDE PRESSURES	0.669
F1T4_1H	PRINCIPAL MAKES PLANS & CARRIES THEM OUT	0.798
F1T4_1J	GOALS/PRIORITIES FOR THE SCHOOL ARE CLEAR	0.709
F1T4_1L	STAFF MEMBERS RECOGNIZED FOR JOB WELL DONE	0.644
F1T4_1O	PRINCIPAL KNOWS WHAT KIND OF SCHOOL HE/SHE WANTS	0.848
F1T4_1P	ADMINISTRATION KNOWS PROBLEMS FACED BY STAFF	0.756
F1T4_2I	PRINCIPAL LETS STAFF KNOW WHAT'S EXPECTED	0.861
F1T4_2K	PRINCIPAL IS INTERESTED IN INNOVATION	0.778
F1T4_2M	PRINCIPAL CONSULTS STAFF BEFORE DECISIONS	0.723
Variance Explained		56.6%

Note: All variables were coded on 4–6 Likert-type scales. Factor loadings were computed using the all cases from the F2 sample of NELS with a valid F1sch_id ($N = 19{,}392$).

Appendix Table 3. Parameter estimates for unconditional model

	Math	Science	Reading	History	Composite
Mean					
Initial achievement	45.878**	46.087**	46.982**	45.243**	46.044**
Achievement growth	8.765**	7.504**	6.174**	9.183**	7.850**
Parameter variance					
Within students (level 1)	8.191	22.437	17.632	21.542	6.696
Between students (level 2)					
Initial achievement	49.862**	38.850**	48.069**	42.505**	39.917**
Achievement growth	13.059**	8.625**	13.435**	3.287**	8.046**
Between schools (level 3)					
Initial achievement	19.063**	14.704**	13.042**	16.017**	14.685**
Achievement growth	3.390**	4.512**	3.306**	4.889**	2.818**
Percent variance between schools					
Initial achievement	27.7	27.5	21.3	27.4	26.9
Achievement growth	20.6	34.4	19.8	59.8	25.9
Reliability					
Within students (level 1)					
Initial achievement	.875	.665	.758	.694	.872
Achievement growth	.378	.134	.231	.059	.317
Between students (level 2)					
Initial achievement	.821	.777	.741	.783	.814
Achievement growth	.578	.497	.448	.548	.606
Correlation—Achievement/Growth					
Between students (level 2)	.340	.757	.428	.688	.511
Between schools (level 3)	.387	.468	.404	−.017	.470

**$p < .01$.

Appendix Table 4. Parameter estimates for student model

	Math	Science	Reading	History	Composite
Mean					
Initial achievement					
Intercept	46.102**	46.368**	47.054**	45.118**	46.157**
Asian	0.865**	−0.931**	−1.511**	−0.776**	−0.591**
Black	−3.813**	−4.080**	−3.124**	−3.028**	−3.507**
Hispanic	−2.066**	−2.392**	−1.958**	−2.101**	−2.097**
Native	−2.373**	−2.967**	−2.383**	−2.533**	−2.519**
SES	1.838**	1.836**	2.031**	2.029**	1.910**
Nontraditional family	0.106	−0.024	0.356**	0.178	0.155
GPA grades 6–8	4.446**	3.566**	4.151**	3.924**	4.029**
College aspirations grade 8	1.603**	1.604**	1.671**	1.853**	1.678**
Retained grades 1–8	−2.661**	−1.539**	−2.841**	−1.876**	−2.224**
Had dropout friends	−0.834**	−0.819**	−0.695**	−0.801**	−0.774**
Transferred grades 10–12	−0.350	−0.590*	−0.105	−0.294	−0.329
Dropped out grades 10–12	−0.834**	−1.165**	−0.421†	−0.661**	−0.822**
Achievement growth					
Intercept	8.742**	8.131**	6.127**	9.476**	8.106**
Asian	0.921**	0.751*	1.224**	1.286**	1.065**

Appendix Table 4. (Continued)

	Math	Science	Reading	History	Composite
Black	−0.495*	−2.175**	−1.053**	−0.503†	−1.065**
Hispanic	0.172	−0.661**	0.035	0.727**	0.037
Native	0.036	0.133	−0.451	0.052	−0.121
SES	0.547**	0.957**	0.421**	0.445**	0.566**
Nontraditional family	−0.216*	−0.177	−0.129	−0.421**	−0.226*
GPA grades 6–8	1.086**	0.749**	0.779**	0.374**	0.749**
College aspirations grade 8	0.665**	−0.017	0.555**	−0.025	0.283**
Retained grades 1–8	−1.336**	−0.696**	−1.214**	−0.362†	−0.948**
Had dropout friends	−0.635**	−0.723**	−0.328*	−0.276	−0.512**
Transferred grades 10–12	0.141	0.080	0.265	−0.901**	−0.165
Dropped out grades 10–12	−0.635**	−0.627^{t}	−0.468	−2.016**	−1.101**
Parameter variance					
Within students (level 1)	8.215	22.446	17.630	21.496	6.696
Between students (level 2)					
Initial achievement	29.884	22.446	30.096	26.128	22.959
Achievement growth	10.914	7.149	12.237	2.855	6.816
Between schools (level-3)					
Initial achievement	6.059	4.560	3.313	5.490	3.894
Achievement growth	2.458	2.872	2.563	4.420	1.971
Percent of variance between schools explained by model					
Initial achievement	68.2	69.0	74.6	65.7	73.5
Achievement growth	27.5	36.3	22.5	9.6	30.1

†$p < .10$; *$p < .05$; **$p < .01$.

Appendix Table 5. Parameter estimates for input model

	Math	Science	Reading	History	Composite
Mean					
Intercept	8.800**	8.184**	6.251**	9.528**	8.163**
Student background					
SES	0.418**	0.686**	0.231*	0.277*	0.407**
School composition					
Mean SES	0.371*	1.171**	0.446*	0.473†	0.609**
School structure					
Catholic school	1.085**	−0.028	0.497	0.406	0.488†
Other private school	0.781*	0.175	1.534**	0.654	0.856**
Magnet	0.035	0.669	1.010*	1.116*	0.667*
Small	−0.183	0.264	−0.093	−0.054	0.004
Large	0.204†	0.500*	0.609**	0.362	0.405**
Extra large	0.395*	0.702*	0.800**	0.115	0.471*
Parameter variance					
Within students (level 1)	8.215	22.444	17.628	21.504	6.697
Between students (level 2)					
Initial achievement	29.797**	24.557**	30.001**	26.039**	22.884**
Achievement growth	10.906**	7.121**	12.230**	2.819**	6.797**

Appendix Table 5. (Continued)

	Math	Science	Reading	History	Composite
Between schools (level 3)					
Initial achievement	3.730**	3.553**	2.256**	4.504**	2.608**
Achievement growth	2.309**	2.605**	2.224**	4.260**	1.773**
Percent of variance between schools explained by model					
Initial achievement	80.4	75.8	82.7	71.9	82.2
Achievement growth	31.9	42.3	32.7	12.9	37.1

†$p<.10$; *$p<.05$; **$p<.01$.

NOTE: Model includes the same student-level predictors as in Table 3 and the same set of predictors for initial achievement.

Appendix Table 6. Parameter estimates for final model

	Math	Science	Reading	History	Composite
Mean					
Intercept	8.787**	8.173**	6.230**	9.530**	8.152**
Composition					
Mean SES	−0.349	0.748**	−0.220	0.096	−0.008
Structure					
Catholic school	0.768*	−0.161	0.253	−0.082	0.208
Other private school	0.384	−0.018	1.269**	−0.196	0.504
Magnet	−0.123	0.601	0.887*	0.964*	0.539†
Small	−0.233	0.201	−0.163	0.050	−0.050
Large	0.271	0.537*	0.673**	0.391	0.456**
Extra large	0.521*	0.794**	0.960**	0.123	0.569**
Process					
Teacher expectations	0.161	0.270†	0.183	0.178	0.218†
Homework time	0.130**	0.061	0.126*	0.141*	0.115**
NAEP composite	0.117**	0.033	0.073	0.097†	0.082*
Unsafe	−2.753**	−2.022†	−3.548**	−0.238	−2.261**
Parameter variance					
Within students (level 1)	8.213	22.440	17.625	21.500	6.695
Between students (level 2)					
Initial achievement	29.791**	24.551**	30.006**	26.038**	22.880**
Achievement growth	10.923**	7.127**	12.224**	2.852**	6.807**
Between schools (level 3)					
Initial achievement	3.357**	3.279**	2.077**	4.280**	2.371**
Achievement growth	2.152**	2.554**	2.110**	4.144**	1.671**
Percent of variance between schools explained by model					
Initial achievement	82.4	77.7	84.1	73.3	83.9
Achievement growth	36.5	43.4	36.2	15.2	40.7

†$p<.10$; *$p<.05$; **$p<.01$.

NOTE: Model includes the same student-level predictors as in Table 3 and the same set of predictors for initial achievement.

Appendix Table 7. Parameter estimates for student models in low-, middle-, and high-SES schools

	Low SES	Medium SES	High SES
Mean			
Initial Achievement			
Intercept	42.257**	45.764**	50.041**
Asian	− 0.928	− 0.678*	− 0.343
Black	− 3.350**	− 3.549**	− 2.759**
Hispanic	− 1.841**	− 2.037**	− 1.731**
Native	− 3.885**	− 2.047**	− 5.108**
SES	1.421**	1.648**	1.779**
Nontraditional family	0.241	0.136	0.237
GPA grades 6–8	2.674**	4.047**	5.152**
College aspirations grade 8	1.864**	1.651**	2.172**
Retained grades 1–8	− 2.154**	− 2.373**	− 1.792**
Had dropout friends	− 0.462†	− 0.725**	− 1.282**
Transferred grades 10–12	0.026	− 0.381	− 0.088
Dropped out grades 10–12	− 1.036**	− 0.865**	− 0.474
Achievement growth			
Intercept	7.240**	7.879**	10.088**
Asian	0.302	0.945**	1.568**
Black	− 1.102**	− 1.034**	− 0.627
Hispanic	0.470	− 0.182	− 0.165
Native	− 0.430	− 0.386	1.863
SES	0.213	0.492**	0.431*
Nontraditional family	− 0.171	− 0.237*	− 0.203
GPA grades 6–8	0.579**	0.707**	1.084**
College aspirations grade 8	0.326	0.320**	− 0.300
Retained grades 1–8	− 1.181**	− 1.019**	− 0.420
Had dropout friends	− 0.117	− 0.543**	− 0.690
Transferred grades 10–12	− 0.744	0.095	− 0.748
Dropped out grades 10–12	− 1.295**	− 1.093**	− 0.848
Parameter variance			
Within students (level 1)	6.713	6.774	6.327
Between students (level 2)			
Initial achievement	20.897**	23.638**	19.822**
Achievement growth	3.281**	7.358**	6.677**
Between schools (level 3)			
Initial achievement	2.686**	2.929**	4.433**
Achievement growth	1.026**	1.993**	1.679**

†$p < .10$; *$p < .05$; **$p < .01$.

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Notes

1 In particular, in its decision in *Milliken v. Bradley*, 418 U.S. 717 (1974), the Supreme Court excluded suburban schools from urban schools desegregation plans.

2 For example, the National Urban League (2001), the nation's oldest community-based movement for African Americans, issued a blueprint shortly after President Bush's 2001 inauguration on what his administration should do to eradicate the educational disparities between Blacks and Whites. The recommendations included increasing resources and accountability but said nothing of the issue of segregation.

3 The New York State appeals court dismissed the Rochester suit cited earlier (Wright, 2002).

4 In a reanalysis of the 1965 Equality of Educational Opportunity (EEO) survey data used by Coleman, Jencks, and Mayer (1990) found that the correlation between the proportion of White students and the proportion of students owning an encyclopedia (the only measure of school SES in the survey) was .40 for White ninth graders and .49 for Black ninth graders attending Northern high schools. In an analysis of 913 high schools from the National Educational Longitudinal Survey (NELS), Rumberger and Palardy (in press, Figure 4) found that the correlation between percent minority and mean SES was .49 in Southern high schools and .46 in Northern high schools.

5 This was based on the finding that school characteristics explained a greater amount of variance in achievement among Blacks and ethnic minorities than among Whites.

6 Wells and Crain (1994) reviewed the literature on the long-term impact of attending desegregated schools on Blacks.

7 Other recent studies have examined the impact of social composition on elementary and middle school achievement (e.g., Hanushek, Kain, & Rivkin, 2002; Hoxby, 2000).

8 Cross-sectional studies in general have tended to demonstrate consistently strong effects of both racial and socioeconomic composition (see, e.g., Borman et al., 2004; Caldes & Bankston, 1997, 1998; Rumberger & Willms, 1992). A recent international study of high school achievement found that, in the United States, the effects of school SES on student achievement were about twice as large as the effects of individual SES (Organisation for Economic Cooperation and Development, 2001, p. 199).

9 See Bryk and Lee (1992) for a detailed critique of the methodology used in this study.

10 The study did find that school quality, as measured by average test score gains of White students, had a strong significant effect. Although the study controlled for other measures of school quality, such as pupil/teacher ratio, it remains unclear what specific qualities of schools accounted for the findings—in particular, whether they represented peer effects or other qualities of schools.

11 Quality of schools is measured by between-school differences in student achievement after controlling for race, gender, and parental education.

12 The sample was restricted to respondents with valid school IDs in 1990, who had valid test scores in 1988 and 1990, and who attended schools with at least five respondents. The latter was necessary to assure reasonable reliability estimates of the within-school parameter

estimates. Students had to have test data from at least two questionnaire years in order to specify individual linear growth models for each of them. The high schools attended by NELS students do not constitute a representative sample of schools, and NCES never constructed any school-level weights to compensate for this fact. Some researchers who have used these data for high school effectiveness studies have constructed their own weights (e.g., Lee, Smith, & Croninger, 1997; Morgan & Sorensen, 1999), while other researchers have not (e.g., Carbonaro & Gamoran, 2002; Gamoran, 1996). The HLM software that we used to conduct this study does not allow weighting at level 2 (students) or 3 (schools) in three-level models. Based on comparisons between the school sample (see Appendix Table 1) and characteristics of all public and private schools in the United States from the 1987–1988 Schools and Staffing Survey (the year closest to the NELS study), our school sample also appears to be representative. First, the proportion of private schools in the sample is .15, which is similar to the national proportion of .11 (Ancarrow & Gerald, 1990, Table 1). Second, 31% of the sample schools are located in urban areas and 30% in rural areas, compared with 32% in urban areas and 35% in rural areas nationally (Henke, Choy, Geis, & Broughman, 1996, Table 1.1). Third, the mean student/teacher ratio in the sample is 16.4, which compares favorably with the national mean of 17.1 (Table 1.2). Finally, the proportion of minority students in the sample is .24, which is similar to the national proportion of .28 (Table 1.3).

13 Low-SES schools were at least 1 standard deviation below the sample mean, while high-SES schools were at least 1 standard deviation above the sample mean. Because school SES (like student SES) is normally distributed, most schools were classified as middle SES, meaning that the school SES was within 1 standard deviation of the sample mean.

14 For each subject test, NELS developed a pool of questions that were put on a common vertical scale using Item Response Theory methods. In math, for example, three tests of varying difficulty were developed from a pool of 81 questions and administered to students based on their level of math skill. The probability of a correct answer on each item, summed over the total 81-item pool, were transformed to a *t*-scale standardized on 10^{th}-grade scores (mean of 50, SD of 10). Similar methods were used to construct the achievement tests for science, reading, and social science. These *t*-score transformed data in all four subjects were used to construct our composite measure of academic achievement.

15 For example, Gamoran (1996) found that although mathematics achievement was significantly higher in Catholic schools than in other private or public schools after controlling for the individual and context effects of student background characteristics, there was no significant advantage in the other three academic subjects. Jencks and Mayer (1990) also reported that the effects of social composition seem to vary by subject area.

16 An alternative approach is to use a simpler two-level HLM model that uses 12^{th}-grade student test scores as the dependent measure, controlling for previous student achievement at level 1 and school effects at level 2. The two-level model, although not misspecified, incurs higher errors in estimating change in achievement than the growth model (Rogosa, Brand, & Zimowski, 1982). The growth model, with three data points, estimates a regression line for each student, while the two-level HLM approach uses only two data points in estimating achievement gains, which increases errors of estimation. In sum, the three-level growth models use all the data available *and* a more precise estimation procedure, which together yield a superior estimate of change compared with the two-level difference score approach.

17 As shown in Appendix Table 2, these two measures are moderately correlated (the correlation coefficients range from –.017 to .757, but tend to be moderate on average) at both the student and school levels. In other words, both students and schools with higher initial achievement also have higher achievement growth.

18 Although the reliability of the achievement growth rates are much lower than the reliability of initial achievement, this is consistent with virtually all random-slope models. More-

over, as Raudenbush and Bryk (2002) pointed out, only when level 1 reliabilities fall below .05 do problems of estimation arise.

19 A recent international study of student achievement by the Organisation for Economic Co-operation and Development (OECD, 2001) found that, on average, differences between schools account for 36% of the average between-student variation in reading literacy (status not growth) of 15-year-olds among the 26 countries that participated in the study, including 35% for the United States.

20 The large value for history may be due in part to the low estimated reliability for student achievement growth. See Appendix Table 2.

21 Others have also argued that school reform alone cannot eliminate the achievement gap (see Armor, 2003; Coleman, 1967; Rothstein, 2004).

22 All the background variables measure characteristics of students prior to entering high school except three: having dropout friends, dropping out between 10^{th} and 12^{th} grades, and changing schools between the 10^{th} and 12^{th} grades. All three may be endogenous—that is, influenced by their high schools—a subject that we explore in another paper (Rumberger & Palardy, 2004b). In the present study, controlling for the latter two factors provides estimates for achievement growth during high school for students who remain in the same school for 4 years.

23 As we mentioned earlier, these estimates are for students who remained enrolled in the same school for all 4 years, and therefore do not consider ethnic differences in dropout rates. Yet dropout rates from 10^{th} grade for ethnic minorities tend to be similar or even lower than for Whites after controlling for family and academic background (see Lee & Burkam, 2003; Rumberger & Larson, 1998; Rumberger & Palardy, 2004b).

24 The lower initial achievement of minorities could be the result of attending lower-quality elementary and middle schools.

25 We acknowledge that these general racial and ethnic categories do not capture the large variations within these categories (for some accounts of those variations, see Rumbaut & Portes, 2001).

26 We entered each compositional variable in the model for composite test scores and found that only mean (school) SES had a significant effect. We then estimated that same model for the other test score equations.

27 We used a similar procedure for estimating the effects of the structural and resource variables (see the complete list of variables in Appendix Table 1). Each variable (or sets of similar variables) in the group was entered into the model for composite test scores one at a time, and only the significant variables were retained before introducing the next variable in the group. The reduced model for each group of variables was then estimated for the other test score outcomes.

28 Because the outcome variable in our study, achievement growth, has two standard deviations associated with it—one for students and one for schools—we estimated effect sizes using the standard deviation in achievement growth at the student level.

29 The results are also comparable with the average benefit associated with comprehensive school reform models (Borman, Hewes, Overman, & Brown, 2003).

30 As others have pointed out (e.g., Rowan, Correnti, & Miller, 2002), NELS and other national data sets are not well designed to measure the effects of teachers and teaching on student achievement.

31 However, before controlling for process variables, students attending Catholic schools had significantly higher achievement growth in composite test scores, suggesting that the process variables mediated the Catholic school effect. This was also the case for the effects of attending other private and public magnet schools.

32 While Lee et al. (1997) developed a single measure of what they call ‘‘teacher responsibility for learning,’’ we developed two separate constructs of teacher efficacy based both on

the theoretical (e.g., Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998; Tschannen-Moran & Woolfolk Hoy, 2001) and empirical literature (e.g., Lee, Dedrick, & Smith, 1991; Newman, Rutter, & Smith, 1989): teachers' perceptions of their teaching effectiveness (personal teaching efficacy) and teachers' perceptions of students' ability to learn (general teaching efficacy). Because teachers in NELS were sampled based on their teaching of NELS students and their subject area, teacher sample sizes were small, and therefore, teacher effects were likely underestimated.

33 In their review of the literature and empirical analysis, Miller and Rowan (2003) also found little relationship between these factors and student achievement.

34 The small amount of variance explained for history could be due to the low reliability of the student-level achievement growth rate.

35 Estimates from the unconditional model that do not control for effects of other student characteristics (not shown) confirm this. The initial achievement level of students in high-SES schools was more than 11 points higher than students in low-SES schools, which is substantially higher than the average 4-year achievement growth rate of less than 7 points for students in low-SES schools.

36 This finding is consistent with the NAEP results that we cited earlier showing that poor fourth grade students have higher test scores in low-poverty schools than nonpoor students in high-poverty schools (U.S. Department of Education, 2002).

37 As shown in Appendix Table 1, differences in resources—particularly the credentials and experience of teachers—among low-, middle-, and high-SES schools were small, while differences in teacher expectations (which we label a process variable because it is influenced by the organization) were large.

38 Newman, Rutter, and Smith (1989) found that both teacher efficacy and teacher expectations were influenced by the racial composition of the school, net of other factors. Moreover, although teacher efficacy was influenced by several organizational characteristics of schools, teacher expectations were not. In her account of reform efforts in two Southern middle schools, Lipman (1998) noted, ''For White teachers, in particular, speculative judgments about African American students' personal lives influenced expectations about their capabilities and potential and justified deficit explanations for academic failure'' (p. 77).

39 Interestingly, their meta-analysis of 29 widely implemented school reform models found that, on average, these reforms improved student achievement about one eighth of a standard deviation, almost exactly the effect size we found for school SES in our study.

40 As Schneider and Buckley (2002) pointed out in their review of the literature, ''In short, research based on surveys tends to find that parents of all races and social class say that they prefer schools that have good teachers and high test scores. And very few admit to being concerned by the race or by class composition of the student body. However, these *stated preferences* are often not congruent with *revealed preferences* documented by studies of behavior, which show a much greater role of race and class in the actual choices made by parents'' (p. 9).

41 In their study of magnet school programs in Cincinnati and St. Louis, Smrekar and Goldring (1999) found ''that the impressive racial balance in magnets is not matched with socioeconomic balance between magnet and nonmagnet schools'' (p. 113). In her study of three magnet schools in a large Midwestern school district, Metz (2003) found that ''parents in the city developed increased power at every level. The set of magnets had to be designed to appeal to them. . . . Parents of a race which was particularly needed at school were specially courted; this almost always meant whites'' (p. 34).

42 In order to produce unbiased estimates, the same set of predictors was used as controls for initial achievement (π_{0ij}).

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