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The Impact of Student Composition on Academic Achievement in Southern High Schools

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Abstract

A major issue in education over the last 50 years concerns the extent and impact of racial segregation in American schools. Despite the importance of this topic, little empirical research has been conducted on the long-term effects segregation on student achievement. This study investigates this important policy issue by analyzing longitudinal data from over 14,000 students attending more than 900 highs schools in the southern and non-southern regions of the United States between 1988 and 1992. The analysis reveals that the socioeconomic composition of students' high schools has a more powerful effect on how much students learn in high school than their own socioeconomic status, especially in the South. The analysis also found that the powerful effects of socioeconomic composition, at least in the South, are explained by policies and practices that could be addressed through educational reforms. Nonetheless, the analysis also revealed that most of the variability in student achievement is attributable to the characteristics of students and their families, and not the characteristics of their schools. Hence, true equality of educational opportunity can only be achieved by addressing the pronounced disparities in the backgrounds and circumstances of students and their families.

The issue of school segregation came to the forefront of education policy when, in 1954, the U.S. Supreme Court declared that the *de jure* segregation of schools was unconstitutional because it was "inherently unequal" (Orfield, 2001, p. 10). Subsequent litigation and federal legislation, primarily during the 1960s and 1970s, lead to increased racial integration, especially in the South. But over the last 20 years, desegregation policies have been largely abandoned because of political changes and the growing concentration of minorities in urban schools that have provided little room for desegregation to take place. Moreover, civil rights leaders have come to believe that integrating schools is less important than insuring that disadvantaged students receive equitable resources and opportunity to learn regardless of whether they attend segregated schools. This latter strategy is premised on the belief that student composition is less important than school resources and learning opportunities in producing high student achievement.

Because of both political and demographic changes, segregation in America's schools is increasing. In 1998-99 more than two-thirds of all black and Latino students in the U.S. attended predominantly minority schools, a higher percentage than 20 years earlier (Orfield, 2001, Table 9). Although segregation has often been viewed in terms of race, racial segregation is strongly related to socioeconomic segregation. Not only are black and Latino students more likely to be poor themselves, they are also more likely to attend high poverty schools. In 1999, almost one-third of all black and Latino children under the age of 18 were living in poverty, compared to 13 percent of white children (U.S. Department of Education, 2002, Table 21). And in 1993-94, two-thirds of black and Latino students attended high poverty schools (41 percent of students eligible for free or reduced lunch), whereas only 27 percent of white students attended high poverty schools (U.S. Department of Education, 1997, Figure 5). To the extent that both individual poverty and school poverty affect academic achievement, black and Hispanic students are doubly disadvantaged.

While virtually every study has documented the impact of individual socioeconomic status on academic achievement, there is also substantial evidence that the social composition of a school affects student achievement even after taking into account a student's own academic and social background. The Coleman report was the first major national study to demonstrate that a student's achievement is highly related to characteristics of other students in the school (Coleman, et al., 1966). In fact, Coleman claimed that "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, 1967, p. 325). Since the publication of that study, a number of studies using a variety of student achievement measures have confirmed Coleman's observation (for a recent review of this evidence, see Kahlenberg, 2001).

What is less clear from existing research is whether the effects of social composition are related to school resources, such as teacher quality and class size, or other school characteristics that could be improved directly through policy initiatives. If that is the case, then the resegregation of America's schools is not necessarily problematic at least in terms of academic achievement, although it could be in terms of race relations in and out of school. Even though schools with high concentrations of poor and minority students often have fewer resources than other schools, those disparities could be reduced without altering the social composition of schools. However, if the effects of student composition cannot be traced to such alterable school characteristics, then the context of attending a school with a high proportion of minority or poor students may itself be problematic. In that case, resegregation could worsen the already large achievement gap between minority and white students in American schools.

This study investigates this important policy issue by using data from the National Education Longitudinal Survey of 1988 to address the following research questions:

1. Does high school segregation affect student achievement? In other words, does the composition of students in 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 resources and school practices that can be manipulated through policy, or are they due to other factors that cannot be directly altered through policy instruments?
3. Are the causes and consequences of school segregation similar in Southern schools compared to schools in other regions of the United States?

Research Literature

Researchers have long recognized that both the individual background characteristics of students as well as 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 study body is low may have lower achievement outcomes than a student from a similar background attending a school where the average SES of the study body is high.

Despite the importance of social composition on academic achievement, there has been relatively little research on the subject. As Jencks and Mayer 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 (Jencks & Mayer, 1990, p. 178).

Although a number of studies were conducted in the 1970s and 1980s that focused more narrowly on the effects of racial composition and school desegregation on the academic achievement of whites and blacks, most of these focused on short-term effects at the elementary school level (for two recent reviews of this literature see Wells & Crain, 1994; Schofield, 1995). 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. Gamoran, 1996; Morgan & Sorensen, 1999).

In addition to the dearth of focused studies, research on school composition suffers from a number of conceptual and empirical difficulties. First, studies must adequately control for individual background characteristics of students and families in order to identify the unique contribution of school composition to student outcomes. Many studies do control for family background characteristics, such as parental income and education or family socioeconomic status. But far fewer studies control for the prior academic achievement of students, which may overstate the impact of current contextual effects on student achievement

A second, related issue is whether studies control for other, unobserved differences between students and families that could be related to the choice of schools. Without control for so-called selection effects, the impact of social composition on student outcomes could be overstated. For example, if more committed students and families chose to attend certain schools and those qualities were not measured, then other measured characteristics could "capture" some of these effects.

Third, studies must specify the correct level of aggregation in order to adequately detect the effects of social composition or other school-level variables. School-level measures of social composition, for example, may not adequately reflect the experiences of individual students who, because of tracking and ability grouping in schools, may have very different access to school resources and contact with fellow students (Jencks & Mayer, 1990). For example, Summers and Wolfe (1977) clearly demonstrate that social composition and school resources show stronger effects on student learning when measured at the classroom rather than the school level. A related issue is whether aggregate measures are adequately captured by summary statistics such as school-level means rather than other statistics that better capture the distribution of such measures (Glewwe, 1997).

Finally, few studies that investigate the effects of social composition are able to identify what explains those effects. As Jencks and Mayer point 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" (Jencks and Mayer, 1990, p. 115). Because social composition is often correlated with an array of school characteristics, from the quality of teachers to organizational features, 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 so while these studies can often demonstrate that social composition has an independent impact on student outcomes, they do not reveal why. For example, Gamoron's study of student achievement in public magnet, public comprehensive, and private schools demonstrates that social composition helps explain differences among these types of schools, his study does not investigate how or why this occurs.

Given these limitations, what does the research literature reveal? Existing research on the effects of social composition has focused on a number of educational and social outcomes—educational attainment, cognitive skills (test scores), crime, teenage sexual behavior, and labor market success. Several earlier reviews examine how school and community composition affect all these outcomes (Jencks & Mayer, 1990; Schofield, 1995; Wells & Crain, 1994). The present review will focus on one particular outcome at the high school level—academic achievement as measured by test scores.

Three aspects of school social composition have been investigated—racial composition, socioeconomic composition, and academic composition. Of course, these three measures of social composition are highly related. Ethnic minorities are much more likely to come from low-income households. For example, child poverty rates for blacks and Hispanics are more than twice as high as child poverty rates for whites (U.S. Department of Education, 2000, Table 21). And, as pointed out earlier, minorities are more likely to attend schools with high concentrations of minority students, which means they are also more likely to attend high-poverty schools. Finally, minorities generally have lower levels of educational achievement than whites, so their concentrations in high-minority, high-poverty schools also mean that they tend to be surrounded by other, low-performing students.

Based on their review of only three studies, Jencks and Mayer (1990) concluded that "a high school's mean SES has a negligible impact on how much the average student learners in high school" (p. 144), although they note that one recent study at the time (Byrk & Driscoll, 1988) did find that high school SES did impact 12th grade math scores. Yet they did acknowledge some differential effects: (1) a school's mean SES may have more effect on black students than white students, although more research using longitudinal data would need to verify this claim, and (2) blacks would probably benefit from attending predominantly white schools in the north, but there is no evidence about the impact in the South.

Since these reviews, a number of studies have demonstrated that both racial and socioeconomic composition have a relatively strong effect on student achievement in high school. Cross-sectional studies, in general, have tended to demonstrate consistently strong effects of both racial and socioeconomic composition (Caldes & Bankston, 1997, 1998; Rumberger & Willms, 1992). But as we pointed out earlier, these studies are less compelling because they do not control for academic achievement of students when they first enroll in school. Therefore, we will focus the remainder of our review on longitudinal studies that control for prior achievement.

Two earlier studies were based on High School and Beyond, a large national longitudinal study of 25,000 sophomores and seniors in 1980. One study found little effect of either racial or socioeconomic composition on 12th grade test scores in five subject areas after controlling for 10th grade test scores (Gamoran, 1996). But another study, based on the same data, found very strong effects of school SES on a summary measure of test score gains even after controlling for 10th grade achievement and school resources, but no effect for racial composition (Chubb & Moe, 1990).[1]

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

A number of recent studies have been based on the National Education Longitudinal Study of 1988, a longitudinal study of 25,000 eighth graders. None of these studies focused specifically on social composition, so it is often difficult to determine the effects of social composition on academic achievement. Gamoran (1996), for example, examined the effects of school academic climate on 10th grade test scores in public magnet, public comprehensive, and Catholic high schools after controlling for 8th grade achievement. He found that, collectively, 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 student achievement, but he didn't report the size or significance of the three individual measures. Lee, Smith, and Croninger (1997) and Lee and Smith (1997) also used NELS data to study the effects of school organization and school size on changes in student achievement during high school. Two measures of social composition were used in these two studies—the mean SES of students in the school and high-minority schools (schools with 40 percent or more Black and Hispanic students). However, the models that were used and the results that were reported make it impossible to disentangle the individual and contextual effects of SES, so these studies are unable to reveal whether SES composition, by itself, matters. The first study used a two-segment growth model to investigate organizational reforms on math and science achievement in high schools and found a large and statistically significant effect of SES composition on mathematics achievement growth between grades 8 and 10 and between grades 10 and 12 even after controlling for structural practices, but there was no significant effect on achievement growth in science. The second study examined the impact of school size on gains in math and reading achievement between 8th and 12th grades, found that high minority schools had significantly higher gains in math achievement than low minority schools (after controlling for differences in gender, minority status, ability, and SES), but there was no effect of minority composition on reading achievement. One final study based on NELS data examined the effects of teacher characteristics and classroom practices on 10^{th} grade math scores after controlling for 8^{th} grade math scores (Goldhaber & Brewer, 1997). Of the three social composition variables included in the study—percent White students in the school, percent students from single-parent families, and percent minority students in the classroom—only the latter shows a small negative effect on student outcomes.

Overall, existing research, although limited, suggests that social composition has a significant impact on student achievement. The effect is stronger in cross-sectional studies that do not control for prior achievement, but even in longitudinal studies that do control for prior achievement, it appears that the social composition of students in the school or classroom may affect how much students' learn in high school. Two measures of school composition have been shown to effect learning—racial composition and socioeconomic composition.

But 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 the effects of social composition on student achievement. The first suggests that the effects of social composition are directly related to the influence of peers. Jencks and Mayer (1990) suggest the effects of peers can either be positive or negative—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. Kahlenberg (2001) reviews 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). Another study found evidence of ethnic and social inequality to 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). One organizational feature of high schools may be highly influenced by social composition—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; Welner & Oakes, 1996).

In summary, existing research suggests that both the racial and ethnic composition of schools can impact educational achievement. However, few studies have investigated the causal mechanisms between social composition and educational achievement. Yet this relationship is important to investigate because it suggests different policy responses. If segregation is related to school resources and practices, then its adverse effects could be addressed through policies designed to reallocate resources and promote school reform. But if it is related to the effects of peers, then its adverse effects can only be addressed through policies designed to desegregate schools.

Methods

Data

Data for this study come from the base year, first and second follow-up panels from The National Education Longitudinal Survey of 1988 (NELS:88). NELS:88, which was designed and funded by the National Center for Educational Statistics (NCES), used a stratified two-stage probability sampling procedure to select a nationally representative sample of 1988 eighth graders. During the first stage 1052 public and private U. S. middle schools were chosen. Then from within each selected school approximately 23 students on average were chosen for a total of nearly 25,000 students. A school questionnaire administered to the principal of each school, a teacher questionnaire administered to about five teachers per school who taught courses to the sampled students, and a parent questionnaire administered to the parents of the sampled students were also collected. Subsequent follow-ups, one in 1990 and one in 1992, attempted to follow a sub-sample of the original sample through their high school years. In addition, each follow-up was "freshened" with 500 and 1,500 new students respectively in order to provide a nationally representative sample of 10th and 12th grade students.

This study used 14,217 student cases with valid questionnaires from all three survey years who attended 913 high schools.[2] Respondents without high school IDs, those that did not have base year test scores, and those who did not attend a school with at least 5 students in the

[2] 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., Gamoran, 1996). The program that we used to conduct this study, HLM, does not allow weighting at level two (students) or three (schools) in three-level models. Nonetheless, we did investigate the representativeness of our sample by comparing the sub-sample of urban and rural schools (639) with a weighted sample of urban and rural schools from the High School Effectiveness Study, a sub-sample of schools from NELS that was designed to provide a probability sample of 10th grade or high schools (Scott, et al., 1996). Compared to the weighted HSES sample, the schools in our sub-sample were more likely to be public (76 versus 54 percent for HSES0, urban (44 versus 35 percent), larger than 1000 students (63 versus 48 percent), low (0-25 percent) minority (66 versus 42 percent), and high (51-100 percent) poverty (7 versus 6 percent). Based on these comparisons we conclude that our sample is fairly representative of U.S. high schools.

sample were deleted. The later was necessary to assure reasonable reliability estimates of 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.[3] We analyzed both the entire sample of high schools and two sub-samples: 325 high schools located in the 17 southern and border states and 588 high schools located in other regions of the country.

Variables

The dependent variable used in this study was mean composite of four standardized achievement test scores in math, science, reading, and social science that were administered in the spring of 1988, 1990, and, 1992 when most students were enrolled in grade 8, 10, and 12, respectively. For each test, NELS developed a pool of questions, which 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 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.

Although many studies of high school effectiveness using NELS data have used on only one or two achievement tests, particularly mathematics (e.g., Morgan & Sorenseen, 1999; Carbonaro, 1998; Lee & Smith, 1997; Lee, Smith, and Croninger, 1997), we decided to use all four tests for two reasons. First, because students are required to learn and schools are required

[3] Requiring two years of test data instead of three not only increased the overall sample size and the within-school sample size (mean of 16 students per school) for our study, but also made the sample more representative since students who transferred or dropped out of 10^{th} were less likely to be tested in 12^{th} grade (see Morgan and

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 achievement outcomes, which suggests that studies that rely on a single test could reach erroneous or incomplete conclusions about effective schools. For example, Gamoran (1996) found that while mathematics achievement was significantly higher in Catholic schools than other private or public schools after controlling for the individual and context effects of student background characteristics, but there was no significant advantage in the other three academic subjects.[4]

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 of students in order to yield more accurate estimates of school effects on student achievement. A large number of variables were constructed to measure several types of school characteristics: resources, structure, and processes. These characteristics are often associated with school composition, but could be altered through policies and practices without altering the social composition of schools. A complete list of variables is provided in Appendix Table 1.

Statistical Techniques

Since students in the NELS:88 data sample are nested within classrooms and schools, hierarchical linear modeling (HLM) was used in this study. HLM has been developed in the past ten years to deal with problems specific to nested/multilevel data sets including aggregation bias,

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Sorenseen, 1999, Table 1) and these students were more likely to be minority and come from low-income households. Approximately one-quarter of our sample had only two test scores.

[4] Jencks and Mayer (1990) also report that the affects of social composition seem to vary by subject area.

misestimation of errors, and the unit of analysis problem (Raudenbush & Bryk, 2002). In investigations of contextual effects, aggregation bias is more than just a statistical nuisance as it is with most analyses of nested data. Investigations of contextual effects seek to model aggregation bias. That is, studies of contextual effects are attempting to examine the degree to which between-school differences in contexts influence student achievement outcomes after controlling for individual differences associated with student background characteristics. HLM is especially suited to this problem since it first estimates an individual level model that examines the variance in student outcomes, then estimates a school level model which examines the variance of mean school outcomes across schools using favorable, Baysian estimation techniques (Dempster, Laird, & Rubin, 1977; Raudenbush & Bryk, 2002).

In this study we used an individual growth trajectory approach to modeling student growth in cognitive test scores. HLM is well suited for models using individual growth trajectory since the growth is conceptualized as nested within each student over a period of time. Thus the HLM model of individual growth trajectories will include models specified at three levels: level one models growth in test scores over time nested within students and schools; level two models the effects individual background characteristics on the level one growth parameters of students nested within schools, and level three models the effects of school level variables on mean achievement differences between schools after controlling for differences in the intake or background characteristics of students in the schools.[5] A detailed specification of the models is presented in the statistical appendix.

[5] An alternative approach is to use a simpler two level HLM model which uses twelfth grade student test scores as the dependent measure, controlling for previous student achievement at level one and school effects at level two. The two level model, while not miss-specified, incurs higher errors in estimating change in achievement than the growth model. The growth model, with three data points, estimates a regression line for each student while the two level HLM approach utilizes only two data points in estimating achievement gains, which increases errors of estimation. In sum, the three level growth models use all of the data available *and* a more precise estimation procedure, which together yields a superior estimate of change compared to the two level difference score approach.

Results

The first model estimated achievement and achievement growth without any predictor variables. The model provides estimates of the average initial achievement of students in the 8th grade, prior to entering high school, and average achievement growth between the 8th and 12th grades for each sample of students as well as the variability in those estimates between students and schools. The estimated parameters from the model for the total sample, the Southern sample, and the other regions sample are shown in Appendix Table 2. Below we highlight the most important findings.

Figure 1 shows the average initial achievement and achievement growth rates for students in Southern schools and those in other regions of the country. Both initial average achievement and achievement growth rates are lower for students attending schools in the South compared to other regions of the country. The difference in initial achievement is about 1.5 points, which is equivalent to about two-thirds of an academic year in student learning.[6] In other words, students attending southern schools enter high school about two-thirds of a grade level behind their peers in other parts of the country. By the end of high school, the gap has widened to 2.1 points, or about one full academic year.

But these averages mask considerable variability in achievement and achievement growth rates among students and schools. This variability can be illustrated by calculating a range of plausible values for both averages based on the estimated student-level and school-level variances from the model. The results, presented in Table 1, show that there is considerable variation in achievement and achievement growth rates among students and schools both in the South and in other regions of the country. The variability is greater among students than among

[6] A difference of 1.5 points represents about 19 percent of the average growth rate of 7.85 points for the national sample, which translates into about 6.8 months of the 36 months students attend high school.

schools, as one might expect. Because high schools should not be accountable for achievement levels of the students before they arrive, but should be accountable for the how much students learn while they are there, it is more important to focus on the achievement growth rates rather than initial achievement.[7] Differences in achievement growth among schools is considerable, ranging from a low of 4.2 points to a high of 10.7 points in the South, and ranging from a low of 4.8 points to a high of 11.3 points in other regions. In other words, students in some high schools learn more than twice as much as students in other high schools. This suggests that where students attend school has a great deal to do with how much they learn during high school.

The extent to which high schools contribute to student learning can further illustrated by calculating the proportion of the total variability in initial achievement and achievement growth attributable to students and to schools. The results, presented in Figure 2, show that about three-quarters of the variability in both achievement and achievement growth is related to due to differences among students and about one-quarter due to differences among the schools that they attend.[8] Thus, even if differences among schools were completely eliminated, there would still be considerable variability in achievement levels among students. These figures provide an upper bound of how much inequality in student outcomes could ever be eliminated through school reforms alone rather than reforms in social policy that address inequalities in student and family circumstances that contribute to student learning.

Although 25 percent of the variability in student achievement is 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

[7] In our data, these two measures are moderately correlated (.46 in Southern schools, .45 in non-Southern schools). In other words schools with higher initial achievement also have higher achievement growth.

characteristics on achievement no matter where students attend school. In other words, 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 achievement levels than schools with less advantaged students. In order to provide a better picture of schools' contribution to student achievement, it is important to account for the effects of student background characteristics.

This can be done through a statistical model that controls for differences for student background characteristics. We estimated such a model for each sample of schools. The results, presented in Appendix Table 3, show that a number of background characteristics explain both initial achievement differences among students entering high school as well as differences in achievement growth during high school. Students from higher social class backgrounds had higher initial achievement levels and higher achievement growth rates than students from lower social class backgrounds. Students with stronger academic backgrounds—higher grades, lower incidences of misbehavior, not retained, and aspirations to a four-year college—also had higher initial achievement levels and higher growth rates than other students. Controlling for academic and social class background, minority and female students had much lower initial achievement and lower achievement growth rates, with the exception of Asian students, who had much high achievement growth rates than students from other ethnic backgrounds, including whites. Students who dropped out of school between the 10th and 12th grades had lower achievement levels in 8th grade and lower achievement growth rates between grades 8 and 12 (which is to be expected considering they were not in school at least part of the time).

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[8] A recent international study of student achievement by the OECD found that, on average, differences between schools accounts for 36 percent of the average between-student variation in reading literacy of 15 year-olds among the 26 countries that participated in the study, including 35 percent for the United States (OECD, 2001, p. 60).

Figure 3 illustrates achievement differences among racial groups in Southern and non-Southern schools for male students. The charts show that average achievement levels are lower for all racial groups in Southern schools compared to schools in other regions of the United States even after controlling for other characteristics of students that affect achievement, such as socioeconomic status, family type, and academic background. The charts also show that the achievement gap between black and white students and between Hispanic and whites students is sizeable when students enter high school and, in the case of blacks, widens over the four years of high school. These patterns are similar in both Southern and non-Southern high schools. The pattern is different for Asian students—they begin high school somewhat behind white students, but exceed them by the end of 12th grade, especially in Southern high schools.

Differences in the background characteristics of students account for almost three-fourths of the initial variability among schools in initial achievement levels and more than one-fourth of the initial variability among schools in achievement growth (see Appendix Table 3). Since the initial achievement levels were assessed before entering high school, it makes sense that most of its variability is not related to the high schools that students attend but rather their own background characteristics. In contrast, most of the variability in achievement growth cannot be attributed to the background characteristics of students (at least all the ones that we have included in our model), so it is most likely due to the characteristics of the schools that students attend.

But what explains this variability? 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 estimated another model that built on the previous one by adding a series of school-level compositional variables related to each of the student-level background variables in the previous model. For example, in addition to the each student's socioeconomic status (SES), we added a variable that measured the mean SES of the student's school. That way, we can determine if the compositional or school effect of SES predicts student achievement above and beyond a student's own SES. Of course many of these variables are correlated with each other. For example, it is well documented that the racial composition of schools is highly correlated with school poverty—students in highly segregated schools are also much more likely be in a predominantly poor school (Orfield, forthcoming, p. 12). As illustrated in Figure 4, our data show the same relationship. But by entering all the variables in our model, we can determine which variables independently contribute to student achievement.

The estimated parameters for achievement growth from a "reduced" model that only retained the significant compositional predictors for the total, South, and non-South samples are shown in Appendix Table 4. Of course the effects of school SES and other compositional variables are not net of other school factors that may also predict achievement growth rates, which we investigate below. Nonetheless, these estimates provide an indication of the overall or gross effects of student composition.

The results show that both a student's own socioeconomic status and the average socioeconomic status of his or her school contribute to their achievement growth. 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 where the changes are expressed in standard deviations of each respective variable. These expressions are known as effect sizes (Cohen, 1988). One of the benefits of using effect sizes is that it allows comparisons between different sets of data and different studies through the use of a common metric. Furthermore, in our study, the outcome variable, achievement growth, as two standard deviations, one associated with students and one associated with schools. The effect sizes for student and school SES for both Southern and non-Southern schools are shown in Figure 5.

The results show that effect sizes for school SES are much larger than the effect sizes for student SES in both Southern and non-Southern schools.[9] For example, students outside the South from families with a one standard deviation higher value of SES have average achievement growth rates that are .11 standard deviation higher, net of other student factors that also predict achievement growth rates. In contrast, students attending high schools with a one standard deviation higher value of school SES have achievement growth rates that are .29 of a standard deviation higher. In other words, the effects of school SES are more than twice as large as the effects of student SES.[10] These differences are even larger for students in Southern schools. In the South, students from families with a one standard deviation higher value of SES have average achievement growth rates that are .09 standard deviation higher, almost the same effect as students in other regions of the country. In contrast, students attending high schools with a one standard deviation higher value of school SES have achievement growth rates that close to half standard deviation higher, more than four times as great! Effect sizes such as these, for large populations, are considered substantial (Mosteller, 1995). Another way to view the magnitude of these effects is to contrast them with what many people consider to be a highly successful school reform program—the Tennessee class size reduction experiment—that produced four-year effect sizes of .25 (Finn & Achilles, 1999). In other words, students who attended schools in the South with a one-standard deviation higher value of mean SES improved their achievement growth rates as much as might be expected from 8 years of class size

[9] The OCED study found that in most OECD countries, the effects of school SES outweigh the effects of individual SES, with the effects of school SES about twice the effects of individual SES in the United States (OECD, 2001, p. 199).

reduction! Clearly there is a tremendous benefit from attending a high SES school, especially for students in the South.

But why does the SES of a school's student body matter? To investigate this, we estimated still another model that included a large number of additional school-level predictors that measured structural features of schools, resources, and school processes (see the complete list of variables in Appendix Table 1). The estimated parameters of this final model for the total, Southern, and non-Southern sample of schools are shown in Appendix Table 5.

The results reveal that a number of structure, resource, and process variables predict student achievement independent of other variables in the model. Interestingly, in many cases different variables predict achievement in Southern and non-Southern schools. For example, a number of structural variables—such as Catholic, private, and public magnet schools--predict achievement growth in non-Southern schools, but not in Southern schools. Controlling for other factors, urban schools both in the South and in other regions of the U.S. have higher achievement than suburban schools, while rural schools have higher achievement than suburban schools in non-Southern schools, but lower achievement in Southern schools. With respect to resources, higher student-teacher ratios are associated with lower achievement growth outside of the South, while excellent teachers (as reported by the school principal) are associated with lower achievement in Southern schools, but not schools in other regions. In the South, a number of indicators of school processes were significant predictors of achievement growth: the average number of math courses taken by students in the school, the average hours of homework that students completed per week, the quality of teachers as reported by students and the percentage of students in the academic track all contributed positively to achievement growth, while the

[10] Even if we compare the gross effects of student SES with the gross effects of school SES by excluding all other variables from the model, the effect sizes are almost identical and still substantial--.28 and .27, respectively.

percentage of students reported feeling unsafe at school contributed negatively to achievement growth. Outside of the Southern, none of the predictors for school processes were significant.

After controlling for the final set of school-level predictors, the effect size of school (mean) SES in Southern high schools is greatly reduced—from an initial value of .49 to a final value of .06. In other words, altering the characteristics of Southern high schools could virtually eliminate all of the powerful compositional effects of SES found in those schools. In contrast, very little of the compositional effects of school SES outside of the South can be explained and hence altered by the explanatory variables included in our models.

A final issue that we investigated is whether the compositional effects vary among types of students. In other words, do the effects of school SES help or hinder the achievement growth of some students, but not others? To address this question, we re-estimated the student model reported in Appendix Table 3 to determine whether the effects of SES or minority status varied significantly among schools in each sample. We only found that the effects of one predictor, Hispanic, varied significantly among schools in both the South and in other regions of the country. As reported in Appendix Table 3, the effect of Hispanic is not significantly different than zero. In other words, even though Hispanics have significantly lower initial achievement levels than whites, their achievement growth, on average, does not differ from that of whites after controlling for other individual characteristics. But the achievement gap in growth rates between whites and Hispanics does vary among schools. We then investigated whether student composition variables could explain these differences. In the Southern sample, compositional variables did predict the size of the white-Hispanic achievement gap, but in the non-South sample they did not. In the Southern sample, the gap in achievement growth between whites and Hispanics was higher in high-SES high schools than in low-SES high schools. So even though high-SES high schools have higher achievement growth overall, as reported earlier, Hispanic students in Southern high schools do not benefit from the compositional effect. This could be due to increased within-school segregation in higher SES schools (Michaelson, 2001), although it is not clear why this would occur for Hispanics and not blacks.

Conclusions

The results of this study confirm a widely held belief of many parents—that who you go to school with matters. Students who attend high schools with students from high social class backgrounds learn more than students who attend high schools with other students from low social class backgrounds. In other words, while students' own social class background is related to their own achievement, so too is the social class background of their peers. These results were found both in Southern and non-Southern schools, although the effects of social composition were higher in Southern than non-Southern schools. The results of this study confirm those from earlier studies (e.g, Chubb & Moe, 1990) as well as the original conclusions of the Coleman report.

But unlike earlier studies, this study also attempted to discover why socioeconomic composition matters. The study explored three possible causal mechanisms—school structure, school resources, and school processes (policies and practices). These mechanisms, except for school control (Catholic, Private) and location (urban, suburban, rural), can be manipulated through policies without attempting to alter the existing socioeconomic segregation of America's schools. In Southern high schools, these mechanisms accounted for all of the effects of socioeconomic composition. That is, after controlling for differences in school structure, resources, and policies in Southern high schools, socioeconomic composition had little impact on student learning. But that was not the case outside of the South.

The results of this study have clear policy conclusions. Because socioeconomic segregation has powerful effects on student learning, any policies that promote segregation or fail to reduce it will help perpetuate inequalities in achievement among students. In the South at least, it appears that the effects of socioeconomic segregation may be able to be overcome through reforms that alter school policies and practices. But reforms may not be able to overcome the effects of socioeconomic segregation elsewhere. Moreover, since most of the variability in student achievement is attributable to the characteristics of students and their families, and not the characteristics of their schools, true equality of educational opportunity can only be achieved by addressing the pronounced disparities in the backgrounds and circumstances of students and their families

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Figure 1
Average achievement grades 8-12, South and other regions

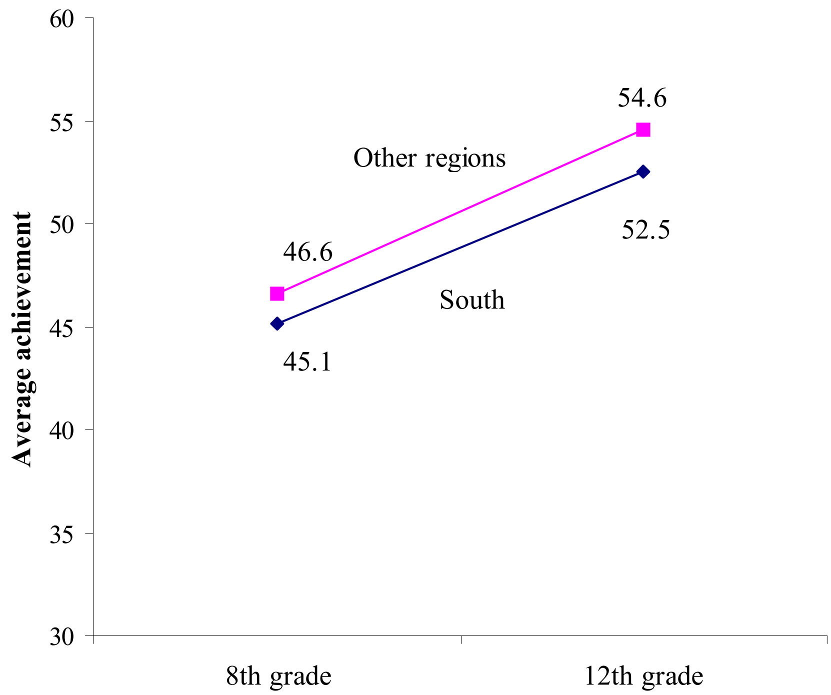


Table 1
Range of plausible values for achievement and achievement growth rates among students and schools, South and other regions

	South	Other regions
Achievement grade 8		
Students	32.8 – 57.3	34.1 – 59.1
Schools	37.6 – 52.5	39.2 – 53.0
Achievement growth grades 8-12		
Students	2.0 – 12.9	2.4 – 13.7
Schools	4.2 – 10.7	4.8 – 11.3

NOTE: Figures represent the 95% range of expected values based on assumption of normality for variance estimates shown in Appendix Table 1 and calculated using the formula presented in Raudenbush & Bryk (2002), p. 71.

Figure 2

Percent of variance in average initial achievement grade 8 and achievement growth grades 8-12 at student and school levels, South and other regions

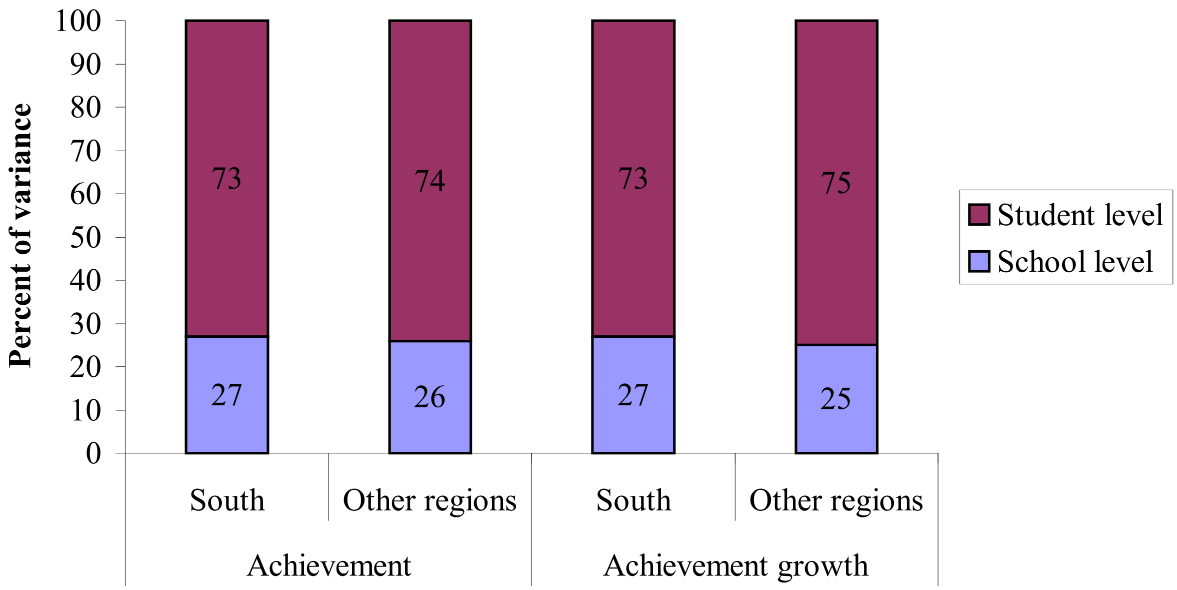
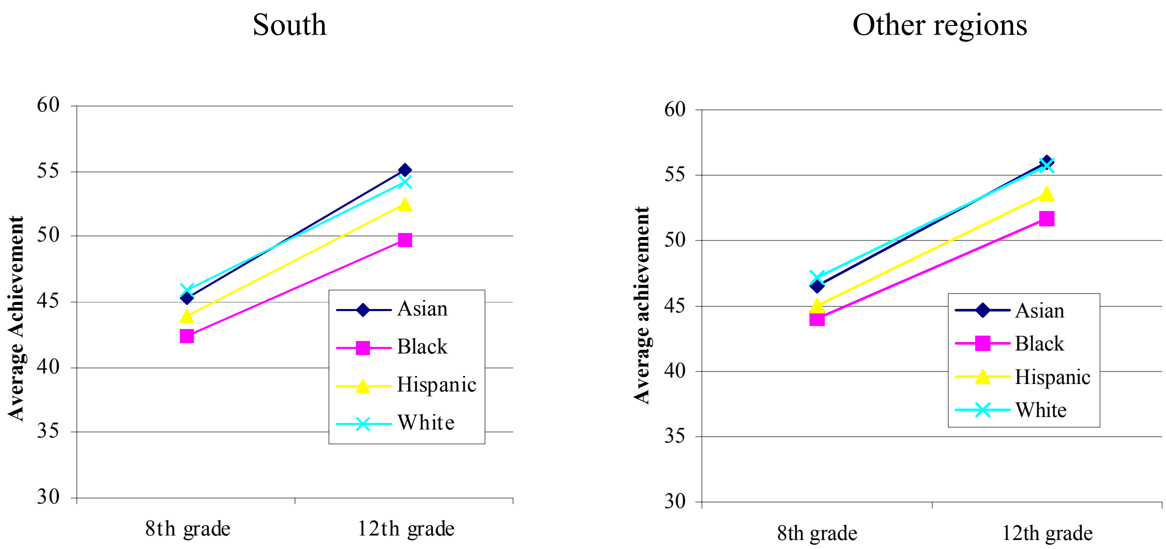


Figure 3

Average achievement grades 8-12 by race, South and other regions



Note: Figures computed from estimates in Appendix Table 3 that control for other demographic, background, and peer effects.

Figure 3

Correlation between percent minority and mean SES of high schools, South and other regions

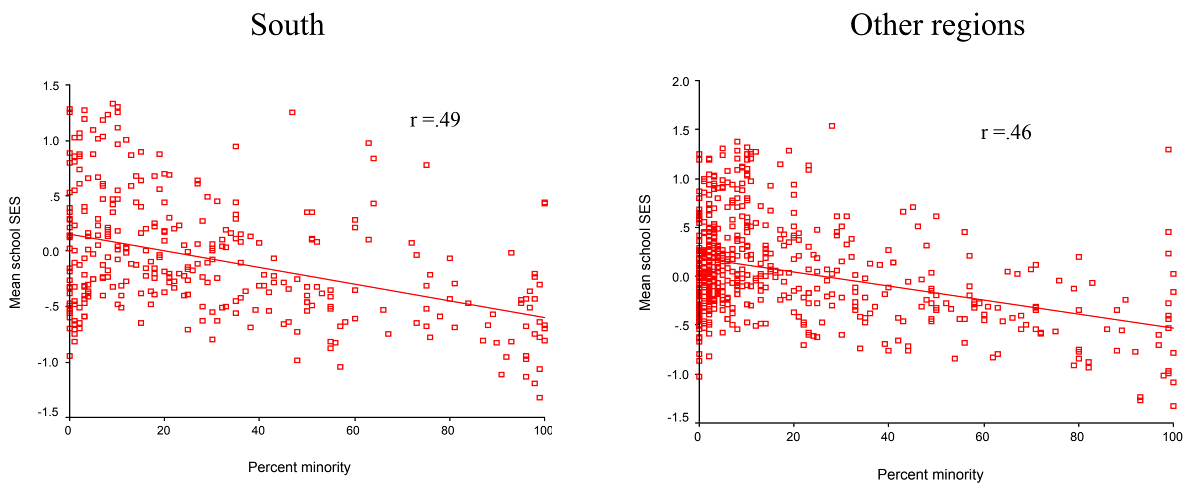
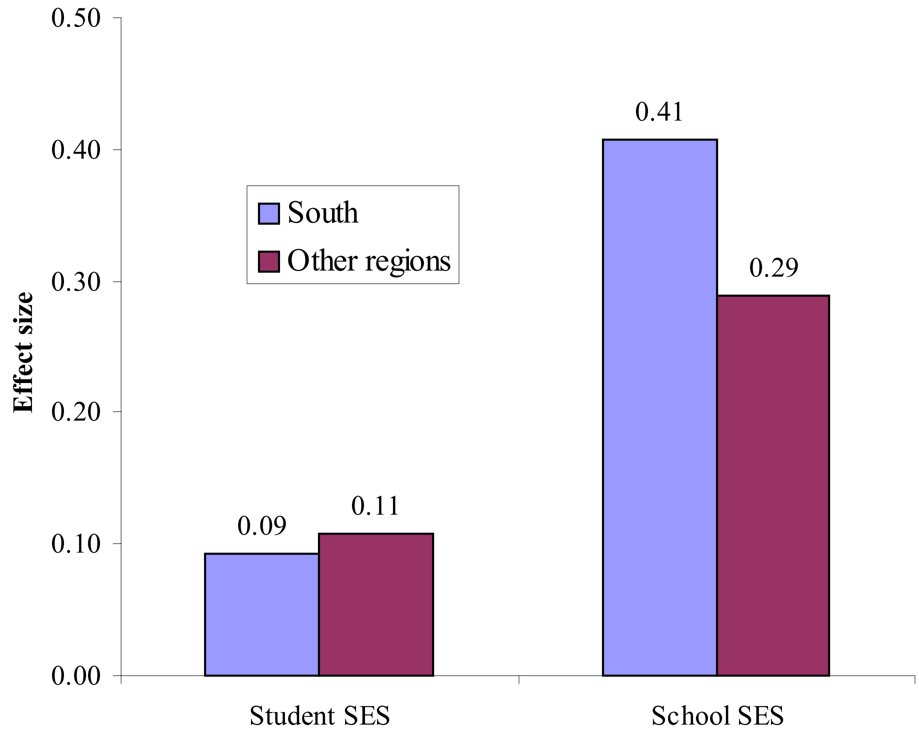


Figure 4
Effects size of individual and school SES on achievement growth, South and other regions



NOTE: Effect size represents the effect of a one-standard deviation change in the predictor variables on a one-standard deviation change in the outcome variable. Effect sizes for individual SES based on student-level standard deviation in achievement growth as shown in Appendix Table 2; effect sizes for school SES based on school-level standard deviation in achievement growth. 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.

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 8th and 12th grades. The first step was to specify a level-one growth model as follows:

$$Y_{tij} = \pi_{0ij} + \pi_{1ij}a_{tij} + e_{tij}, \qquad (1)$$

where Y_{tij} is the composite theta score 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_{ij} 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 8th, 10th, and 12th 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 four years of high school.

After specifying the level-one growth model, a series of level-two and level-three models were tested. The first model was a "null" model that did not introduce predictor variables in any of the level-two or level-three 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 estimates of the variance in these parameters at the individual (level two) and school (level three), which can be used to compute the proportion of variance in these parameters that exists at the individual and school levels (known as the intra-class correlation).

The next step was to specify a level-two 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 (female, minority group, SES, nontraditional family, siblings who dropped out—measured in 10^{th} grade), academic background (grades, misbehavior, college aspirations, and retention—all measured in 8^{th} grade) and peers (peers commitment to school 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:

$$\pi_{1ij} = \beta_{10j} + \beta_{11j} X_{1ij} + \ldots \quad + \beta_{1pj} X_{pij} + r_{1ij} \qquad (2)$$

where π_{1ij} is the growth parameter of student i in school j as specified in level one, β_{10j} is the mean test score growth in school j, and β_{11j} through β_{1qj} are the estimated effects of the student-level predictors on growth rates within each school, and r_{1ij} is the error term.[11] All the continuous measures were centered around 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, 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-three 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-three models were estimated. The first introduced a series of contextual variables that represented school-level averages of the individual characteristics used in the student model. The second introduced a series 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 series of resource variables. The final model introduced a series 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 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-three model was:

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

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.

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

APPENDIX TABLE 1
Variable definitions and descriptive statistics

Variable Name	South		Other regions		Description and (NELS:88 variables)
	Mean	SD	Mean	SD	
Level-1	**(N=13,976)**		**(N=25,311)**		
Test composite	48.93	9.19	50.69	9.26	Mean of math, reading, science, and history test scores grades 8, 10, and 12 (BY2XRTH-F22XHTH)
Time	0.46	0.40	0.46	0.40	Time (0=8th ; 0.5=10th ; 1=12th)
Level-2	**(N=5,042)**		**(N=9,175)**		
Female	0.51	0.50	0.51	0.50	Indicator for female gender (F1SEX = 2)
Asian	0.04	0.19	0.07	0.26	(F1RACE = 1)
Black	0.17	0.37	0.05	0.21	(F1RACE = 2)
Hispanic	0.12	0.32	0.11	0.31	(F1RACE = 3)
Native	0.01	0.08	0.01	0.11	(F1RACE = 5)
SES	-0.04	0.85	0.08	0.78	Composite of family income, parents' educational and occupational prestige (F1SES)
Nontraditional family	0.37	0.48	0.31	0.46	Does not live with both birth parents (F1S92A or F1S92D ≠ 1)
Grades 6th-8th	3.02	0.70	3.00	0.72	GPA composite (BYGRAD)
Misbehavior 8th	-0.10	0.90	-0.12	0.90	Factor score (BYS55A, BYS55E, BYS55F)
College Aspirations 8th	0.70	0.46	0.71	0.46	Planned to earn at least a 4-year degree (BYS45 = 5 or 6)
Friend dropped	0.26	0.44	0.19	0.39	Friend(s) dropped out of school (F2S69A)
Retained 8th	0.20	0.40	0.14	0.35	Heldback prior to 9th grade (F1N22 = 2)
Transfer	0.07	0.25	0.06	0.24	Transferred schools between 10th and 12th grade (F2F1SCFG = 1)
Dropout	0.08	0.28	0.06	0.24	Dropped out at any time (F2DOSTAT=3 or 5)
Level-3	**(N=325)**		**(N=588)**		
Composition					
Mean SES	-0.07	0.55	0.06	0.50	Mean of SES of students (F1SES)
Percent minority	30.17	30.20	18.22	25.59	Proportion of Black and Hispanic students (mean of F1RACE = 2 or 3)
Proportion from nontraditional families	0.38	0.16	0.31	0.17	Proportion of students who do not live in household with birth mother and father (F1S92A = 2 and/or F1S92A = 2)
Mean College Aspirations	0.62	0.19	0.65	0.18	Mean for planned to earn at least a 4-year degree (BYS45 = 5 or 6)
Mean 8th grade misbehavior	-0.05	0.33	-0.10	0.30	Mean factor score (BYS55A, BYS55E, BYS55F)
Mean 8th grade grades	2.99	0.29	2.97	0.30	Mean GPA grades 6-8 (BYGRADS)
Mean Peers	0.01	0.29	0.00	0.32	**Mean factor score**
Percent Friend	0.27	0.18	0.19	0.15	Percent of students with friend(s) who dropped out

Dropout					(F2S69A)
Percent Sibling Dropout	0.14	0.12	0.12	0.11	Percent of students with sibling(s) who dropped out (F2S96K)
Percent Free Lunch	21.97	23.25	15.28	19.10	Percent of students receiving free lunch program (F1S30A)
Proportion retained grades 1-8	0.19	0.13	0.14	0.11	Proportion of students retained in grades 1-8 reported by parent or student (BYS74, BYP44)
Structure					
Small	0.18	0.39	0.25	0.44	School enrollment = 0-600 (F1C2)
Large	0.26	0.44	0.29	0.45	School enrollment = 1201-1800 (F1C2)
Extra large	0.17	0.38	0.11	0.31	School enrollment = 1801+ (F1C2)
Urban	0.32	0.47	0.30	0.46	School located in urban setting (F1URBAN = 1)
Rural	0.36	0.48	0.27	0.44	School located in rural setting (F1URBAN = 2)
Catholic	0.04	0.20	0.08	0.27	(NOMSEC = 2)
Private	0.08	0.28	0.08	0.27	(NOMSEC = 3)
Magnet	0.05	0.21	0.05	0.22	Ever enrolled in magnet program (F2S13)
Resource					
Student-teacher ratio	16.64	5.04	16.25	6.05	(F1SCENRL/F1C35)
Proportion excellent teachers	0.33	0.19	0.34	0.21	Proportion of teachers rated excellent by principal (F1C92D)
Prop. teachers w/ advanced degrees	0.52	0.20	0.54	0.22	Proportion of teachers with advanced degrees ((F1C44C + F1C44D)/F1C35)
Mean salary	27541	4075	30074	4924	Mean teacher salary (F1C42A + F1C42B)/2)
Process					
Discipline fair	0.62	0.15	0.64	0.15	Proportion of students who agree the discipline is fair at the school (F1S7D=1 or 2)
Homework time	4.17	1.88	4.85	2.10	Mean number of hours spent on homework per week (F1S36A2)
Teaching quality	-0.02	0.39	0.01	0.39	Standardized principal component of five student questions of teacher quality (F1S7G, H, I, J, L, and F1S66)
Parent involvement	2.44	0.20	2.41	0.22	Proportion of parents who agree or strongly agree that they have adequate say in school policy (F2P42M = 1 or 2)
Teacher responsibility for learning	-0.01	0.59	0.01	0.61	Standardized Principal component for teacher responsibility for student learning (F1T4_1D, E, F, I, F1T4_2J, N, F1T4_5A-F)*
Academic track	0.32	0.22	0.34	0.23	Proportion of students in academic track (F1HSPROG = 2)
Class disruptions	-0.06	0.35	0.03	0.36	Standardized principal component for classroom disruptions (F1S7F, N, O, and K)
Unsafe	0.09	0.09	0.07	0.08	Proportion of students who report they feel unsafe at school (F1S7M=1 or 2)
NAEP Math	2.65	0.66	2.67	0.64	Number of NAEP math units in H.S.
NAEP Science	2.00	0.56	2.04	0.55	Number of NAEP science units in H.S.

*See Lee, Smith, & Croninger (1997) for details.

APPENDIX TABLE 2
Parameter Estimates for Unconditional Model

	National	South	Other regions
Mean			
Achievement—Grade 8	46.044	45.053	46.594
Achievement growth—Grades 8-12	7.850	7.481	8.056
Parameter variance			
Within students (level-1)	6.696	6.657	6.718
Between students (level-2)			
Achievement—Grade 8	39.917	38.783	40.550
Achievement growth—Grades 8-12	8.046	7.707	8.230
SD	2.837	2.776	2.869
Between schools (level-3)			
Achievement—Grade 8	14.685	14.048	14.140
Achievement growth—Grades 8-12	2.818	2.811	2.701
SD	1.679	1.677	1.644
Percent of variance between schools			
Achievement—Grade 8	26.9	26.6	25.9
Achievement growth—Grades 8-12	25.9	26.7	24.7
Reliability			
Level-1			
Achievement—Grade 8	.872	.870	.874
Achievement growth—Grades 8-12	.317	.312	.320
Level-2			
Achievement—Grade 8	.814	.811	.807
Achievement growth—Grades 8-12	.606	.609	.595

† = significant at α=0.10; * = significant at α=0.05; ** = significant at α=0.01

APPENDIX TABLE 3
Parameter Estimates for Student Model

	National	South	Other regions
Mean Achievement—Grade 8			
Intercept	46.720**	45.896**	47.177**
Female	-1.234**	-1.153**	-1.284**
Asian	-0.614**	-0.624	-0.657**
Black	-3.414**	-3.558**	-3.131**
Hispanic	-2.092**	-1.953**	-2.136**
Native	-2.395**	-3.309**	-2.111**
SES	1.864**	1.785**	1.910**
Non-traditional family	0.209*	0.259	0.202
GPA grades 6-8	4.000**	3.490**	4.282**
College aspirations grade 8	1.682**	1.902**	1.536**
Misbehavior grade 8	-0.418**	-0.394**	-0.430**
Retained grades 1-8	-2.359**	-2.207**	-2.455**
Had dropout friends	-0.596**	-0.461**	-0.678**
Transferred grades 10-12	-0.258	-0.027	-0.369
Dropped out grades 10-12	-0.668**	-0.981**	-0.470
Mean Achievement growth—Grades 8-12			
Intercept	8.491**	8.309**	8.589**
Female	-0.830**	-0.854**	-0.821**
Asian	1.054**	1.545**	0.866**
Black	-0.988**	-0.947**	-0.972**
Hispanic	0.035	0.209	-0.051
Native	-0.057	-0.548	0.086
SES	0.527**	0.504**	0.551**
Non-traditional family	-0.206*	-0.119	-0.253*
GPA grades 6-8	0.773**	0.685**	0.813**
College aspirations grade 8	0.305**	0.192	0.363**
Misbehavior grade 8	-0.133*	-0.111	-0.149
Retained grades 1-8	-1.056**	-1.148**	-0.995**
Had dropout friends	-0.419**	-0.266	-0.520**
Transferred grades 10-12	-0.126	-0.128	-0.108
Dropped out grades 10-12	-1.020**	-1.168**	-0.923**
Parameter variance			
Within students (level-1)	6.701	6.665	6.722
Between students (level-2)			
Achievement—Grade 8	22.605**	22.735**	22.423**
Achievement growth—Grades 8-12	6.641**	6.278**	6.818**
Between schools (level-3)			
Achievement—Grade 8	3.862**	3.647**	3.719**
Achievement growth—Grades 8-12	1.968**	1.942**	1.941**
Percent of variance between schools explained			
Achievement—Grade 8		72.5	73.7
Achievement growth—Grades 8-12		30.9	28.1

† = significant at $\alpha=0.10$; * = significant at $\alpha=0.05$; ** = significant at $\alpha=0.01$

APPENDIX TABLE 4
Parameter Estimates for School Composition Model

	National	South	Other regions
Mean Achievement growth—Grades 8-12			
Intercept	8.543**	8.376**	8.644**
Mean SES	1.088**	1.241**	0.950**
Mean Grades	-0.325	-0.865*	0.069
Percent minority students	0.690*	0.752†	0.815*
Female	-0.834**	-0.875**	-0.818**
Asian	0.997**	1.491**	0.801**
Black	-1.087**	-1.077**	-1.106**
Hispanic	-0.031	0.187*	-0.156
Native	-0.124	-0.656	0.020
SES	0.359**	0.305**	0.396**
Non-traditional family	-0.216*	-0.128	-0.263*
GPA grades 6-8	0.798**	0.752**	0.811**
College aspirations grade 8	0.278*	0.164	0.338*
Misbehavior grade 8	-0.133*	-0.100	-0.150
Retained grades 1-8	-1.072**	-1.178**	-1.002**
Had dropout friends	-0.393**	-0.223	-0.505**
Transferred grades 10-12	-0.151	-0.206	-0.102
Dropped out grades 10-12	-1.028**	-1.167**	-0.934**
Parameter variance			
Within students (level-1)	6.703	6.666	6.724
Between students (level-2)			
Achievement—Grade 8	22.525**	22.682**	22.321**
Achievement growth—Grades 8-12	6.626**	6.276**	6.798**
Between schools (level-3)			
Achievement—Grade 8	2.662**	2.295**	2.645**
Achievement growth—Grades 8-12	1.804**	1.690**	1.808**
Percent of variance between schools explained			
Achievement—Grade 8	81.87	83.66	81.29
Achievement growth—Grades 8-12	35.98	39.88	33.06

† = significant at α=0.10; * = significant at α=0.05; ** = significant at α=0.01
NOTE: Estimates for initial achievement are not shown.

APPENDIX TABLE 5
Parameter Estimates for Final Model

	National	South	Other regions
Intercept	8.568**	8.399**	8.658**
School-level predictors			
Composition			
Mean SES	0.354	-0.132	0.510†
Mean Grades	-0.866**	-1.632**	-0.437
Percent minority students	0.252	0.434	0.231
Structure			
Catholic	0.281	-0.274	0.468
Private	0.338	0.014	0.506
Magnet	0.458	-0.488	0.892*
Rural	0.098	-0.496*	0.419*
Urban	0.107	0.041	0.072
Small	-0.077	-0.035	-0.105
Large	0.408**	0.209	0.490**
Extra Large	0.584*	0.460	0.559†
Resource			
Student-teacher ratio	-0.017†	0.008	-0.019†
Teacher Excellence	-0.764**	-1.078*	-0.422
Process			
NAEP Math	0.278*	0.688**	0.033
Homework Time	0.160**	0.232**	0.108†
Teacher Quality	-0.099	0.597*	-0.479*
Academic Track	-0.195	1.154*	-0.461
Unsafe	-2.798**	-3.159*	-2.732**
Student-level predictors			
Female	-0.834**	-0.863**	-0.814**
Asian	0.889**	1.384**	0.748**
Black	-1.000**	-0.906**	-1.061**
Hispanic	-0.138	-0.121	-0.188
Native	-0.083	-0.603	0.049
SES	0.362**	0.314**	0.399**
Non-traditional family	-0.209*	-0.129	-0.258*
GPA grades 6-8	0.811**	0.760**	0.821**
College aspirations grade 8	0.261*	0.116	0.333*
Misbehavior grade 8	-0.121†	-0.099	-0.133†
Retained grades 1-8	-1.065**	-1.175**	-1.011**
Had dropout friends	-0.381**	-0.218	-0.488**
Transferred grades 10-12	-0.136	-0.187	-0.104
Dropped out grades 10-12	-1.015**	-1.138**	-0.940**

Parameter variance			
Within students (level-1)	6.701	6.669	6.721
Between students (level-2)			
Achievement—Grade 8	22.523**	22.688**	22.322**
Achievement growth—Grades 8-12	6.624**	6.220**	6.820**
Between schools (level-3)			
Achievement—Grade 8	2.106**	1.641**	2.010**
Achievement growth—Grades 8-12	1.616**	1.286**	1.582**
Percent of variance between schools explained			
Achievement—Grade 8	85.66	88.32	85.79
Achievement growth—Grades 8-12	42.65	54.25	41.43

† = significant at $\alpha=0.10$; * = significant at $\alpha=0.05$; ** = significant at $\alpha=0.01$

NOTE: Estimates for initial achievement are not shown.