



Exposure to School and Classroom Racial Segregation in Charlotte-Mecklenburg High Schools and Students' College Achievement

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Abstract: In this study we investigate Charlotte Mecklenburg Schools (CMS) high school graduates' academic performance in the first year of college and test whether their exposure to racial segregation in high school at both the school and classroom levels affected their college freshman grade point averages. Utilizing administrative data from the Roots of STEM Success Project, we track the CMS class of 2004 from middle school through its first year of education in the University of North Carolina (UNC) system. Our findings show that segregation among schools and among classes within schools compromises college achievement for students of color while offering no significant benefits to white students' college achievement.

Keywords: social structure; segregation; second-generation segregation; achievement; tracking; North Carolina; longitudinal; multilevel modeling

Exposición a segregación en el colegio y en las clases en las escuelas secundarias de Charlotte-Mecklenburg y el rendimiento académico de los estudiantes

Resumen: En este estudio investigamos el rendimiento académico de los graduados de escuelas secundarias de Charlotte Mecklenburg Schools (CMS) en su primer año de universidad y probamos si la exposición a segregación racial durante la escuela secundaria al nivel colegio y clase afecta su promedio de rendimiento académico en la universidad. Utilizando datos administrativos del Roots of STEM Success Project, seguimos a la clase de estudiantes del CMS del 2004 desde la escuela media hasta su primer año de universidad en el sistema universitario de Carolina del Norte (UNC). Nuestros resultados muestran que la segregación entre colegios y entre clase dentro de un colegio deteriora el rendimiento académico en la universidad de los estudiantes de color, mientras al mismo tiempo no ofrece beneficios significativos al rendimiento académico de los estudiantes blancos en la universidad.

Palabras-clave: estructura social; segregación; segregación de segunda generación; rendimiento académico; la división de los alumnos en grupos de acuerdo a su nivel de aptitud; Carolina del Norte; longitudinal; modelos multiniveles

Exposição à segregação racial na escola e na sala de aula nas escolas de ensino médio e as conquistas dos estudantes de faculdade de Charlotte-Mecklenburg

Resumo: Nesse estudo nós investigamos os formandos do ensino secundário das escolas do condado de Mecklenburg em Charlotte (CMS) e o desempenho acadêmico no primeiro ano de faculdade, e testamos para ver se a exposição à segregação racial na escola de ensino secundário, tanto na escola como na sala de aula afetou as notas desses alunos no primeiro ano de faculdade. Utilizando dados administrativos obtidos através do *Roots of STEM Success Project*, nós acompanhamos a classe de 2004 de CMS desde o ensino médio até o primeiro ano de faculdade na Universidade da Carolina do Norte (UNC). Nossos resultados mostram que a segregação entre escolas e entre salas de aula dentro da escola comprometem as conquistas na faculdade para estudantes negros mas não oferecem benefícios significativos em relação à conquistas na faculdade para estudantes brancos.

Palavras-Chave: estrutura social; segregação; segunda geração de segregação; conquista; acompanhamento; Carolina do Norte; longitudinal; modelagem multinível

Exposure to School and Classroom Racial Segregation in Charlotte-Mecklenburg High Schools and Students' College Achievement

If getting into college is the first step in a student's postsecondary educational journey, an academically strong start in college is the second because grades can either expand or limit opportunities for successfully completing a college degree, entering desirable majors and the careers to which they lead, and pursuing graduate programs. Recent breakthroughs on the topic of why some students achieve more than others during their college years point to the poor quality of some college courses (Arum & Roksa, 2011) and the poor quality of some high schools (DiPrete & Buchmann, 2013). While scholars have also investigated the ways in which success in college is influenced by student engagement (Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008), high school achievement (Geiser & Santelices, 2007; Rothstein, 2004), and family background (Buchmann & DiPrete, 2006; Pike & Kuh, 2005), few, if any, prior investigations of success in the first year of college have rigorously examined its relationship to high school segregation.

Assessing the lasting impact of segregation is a critical element in the debates about school assignments, school choice, and equity of opportunities and resources occurring in districts across

the country. Most discourse about school segregation begins and ends with comparisons of K-12 schools' enrollments in terms of race, ethnicity, and socio-economic status (SES). While these studies have shown that segregation by school does have significant implications for student achievement (Borman et al., 2004; Goldsmith, 2004; Rumberger & Palardy, 2005), a growing body of literature shows that segregation within schools, often referred to as "second-generation segregation," also affects student outcomes (Kalogrides & Loeb, 2013; Meier, Stewart, & England, 1989; Mickelson, 2001 & 2015; Tyson, 2011; Welner & Oakes, 1996). These studies point out that even when a school is racially, ethnically, and socio-economically diverse in its overall student body, the individual classrooms in that school may not be. Academic tracking, the practice of offering different sections of the same course at different levels of academic rigor, is one way that a diverse school may be practicing severe educational segregation within its walls (Oakes, 1995, 2005). Civil rights groups are taking notice; in 2014 the American Civil Liberties Union and the Civil Rights Project at UCLA filed a complaint against South Orange Maplewood School District in New Jersey for tracking practices that they argue place black and Latino students in lower track classes even when they qualify for upper track classes and against the preferences of the parents (Kohli, 2014).

The Charlotte-Mecklenburg Schools (CMS) system is no stranger to those debates, and its history is rife with policy shifts that increased or decreased segregation. CMS is an excellent site for investigating cumulative disadvantages from first and second-generation segregation for college achievement because both forms of segregation have operated in the district for decades. CMS was once considered to be among the nation's most successfully desegregated public school systems (Douglas, 1995; Smith, 2004). During the three decades that CMS operated under a mandatory desegregation order (following the *Swann v. Charlotte-Mecklenburg Board of Education* decision in 1971) the district remained a majority white school system that utilized busing to integrate schools. In 2002 it began operating as a unitary school district without mandatory busing and has followed a hybrid of neighborhood school assignments and choice plans in which families can request assignment to any school but rarely attend any school other than their local schools (Godwin, Leland, Baxter, & Southworth, 2006; Mickelson, Smith, & Nelson, 2015; Mickelson, Smith, & Southworth, 2009). Due to shortcomings in the design of the 2002 pupil assignment plan and segregated housing in Charlotte, by 2004 school enrollments exhibited a wide variance in the degree of segregation among CMS high schools; some were majority white, some were majority students of color, and others were racially diverse. As we will show later, in 2004 CMS high schools also varied in terms of how much segregation existed at the classroom level. As of the time of this article's publication, CMS operates 168 schools with wide-ranging levels of segregation. Among them are several highly-segregated schools, including six schools that are at least 60% Hispanic, 29 schools that are at least 60% black, and 31 schools that are at least 60% white (Helms, 2015c). Such conditions make CMS a very useful case for studying the effects of school and classroom segregation on a host of outcomes, including college performance, as we do in this manuscript.

The location of CMS in the state of North Carolina is also beneficial for empirical research on education policy. North Carolina was a pioneer in the adoption of accountability policies, which means that there are now two decades of data available on the performance of students on standardized tests. Furthermore, North Carolina provides its residents access to one of the most affordable, comprehensive, diverse, and respected state systems of higher education. The University of North Carolina (UNC) includes highly competitive campuses such as NC State and Chapel Hill, historically black colleges and universities such as Winston-Salem State University, as well as schools in rural settings like Western Carolina and in metropolitan settings like UNC Charlotte. Because about three-fourths of North Carolina's college-bound public school students pursue university

studies in the UNC system (Department of Public Instruction, 2005), connecting high school experiences to college outcomes is easier than it would be in other states.

We use data that come from the Roots of STEM Success Project,¹ an NSF-funded research project which merges data from North Carolina's Department of Public Instruction and from the General Administration of the UNC system to measure a number of outcomes. Briefly, we find that both black and white students do better in college if they have not attended black segregated high schools. We also find that the college GPAs of black freshman are inversely related to the percentage of black students in their high schools' advanced-level classes; that is, the more black students in their high schools' honors classes, the lower their freshman GPAs in college. This finding suggests a negative influence of racially segregated schools and classrooms on college performance among the black undergraduates.

Previous Research

School and Classroom Segregation

Research on the effects of segregation on K-12 educational outcomes stretches back for decades. In the last 20 years or so, the quality of data and statistical methods used in such studies has improved greatly. The most sophisticated and comprehensive studies of school racial compositional effects on outcomes using nationally representative samples report that racial segregation is negatively related to elementary and secondary student achievement in reading and mathematics (Berends & Peñaloza, 2010; Condrón, 2009; Harris, 2006; Johnson, 2011). Investigations utilizing statewide population data in Florida, Texas, California, and North Carolina report similar findings (Borman et al., 2004; Hanushek, Kain, & Rivkin, 2009; Rumberger & Willms, 1992; Sharma, Joyner, & Osment, 2014; Southworth, 2010; Teranishi & Parker, 2010). Still other rigorous studies have meta-analyzed the literature on school racial compositional effects on mathematics and reading outcomes (Bottia, Mickelson, & Larimore, 2014; Mickelson, Bottia, & Lambert, 2013). Taken together, these studies paint a convincing picture of the academic harm in elementary and secondary education that results from concentrating students of color in racially isolated schools.

The few studies that measure the effects of high school characteristics on college achievement show that the racial composition of the high school attended accounts for a significant portion of the black-white college achievement gap, even at different levels of college selectivity (Black, 2012; Fletcher & Tienda, 2010). For example, Massey (2006) found that school segregation experienced between the ages of 6 and 18 was strongly associated with diminished academic performance during college. Johnson (2011) concluded that movements toward racially balanced schools between 1960 and 1990 improved educational attainment and quality of college attended for blacks, but had no effect on whites. Although attending a racially balanced high school seems to be the best context for raising black students' college achievement (Crain & Mahard, 1978), majority-white high schools tend to do a better job at sending black students to college than majority black high schools (Teranishi & Parker, 2010). The work of Yun and Kurlaender (2004) suggests that such effects may be due at least in part to the effects that social context has on educational aspirations.

While most research examines segregation between white and black students, scholars are paying more attention to Latino students, whose population size and degree of segregation have been steadily increasing, particularly in the West (Gándara & Aldana, 2014). Since 1990, CMS has experienced over 1600% growth in Latino student enrollment. Currently, Latinos comprise 18% of CMS students (Charlotte-Mecklenburg Schools, 2015). Changes to the student population across the country have made it even more difficult for districts to achieve racial balance in schools (Fiel, 2013) and require researchers, policymakers, and the public to think about how to define segregation and

diversity (Mickelson, 2014). In the midst of these shifts in population and perspectives, the link between racial isolation and student achievement remains strong (Logan, Minca, & Adar, 2012).

Segregation of students into different schools is only part of the problem, however. Academic tracking is a common practice in American high schools that separates students into different learning environments, but relatively few studies address the nexus of tracking, segregation, and academic outcomes in higher education. The studies that do investigate this issue report that students in racially balanced schools often experience very different opportunities to learn as a result of tracking and thus achieve different educational outcomes. Upper-track classes, typically designated as honors, Advanced Placement, or International Baccalaureate, include broader curricula, better teaching, and more motivated peers than their lower-track counterparts (Gamoran & Mare, 1989; Oakes, 2005; Slavin, 1990). White and more affluent students are more likely to enroll in upper track classes than youth from lower income and disadvantaged families of color (Darity, Castellino, Tyson, Cobb, & McMillen, 2001; Oakes, 1995 & 2005).

The tendency for students of color to take lower-track classes goes beyond what can be explained by initial ability. For example, in racially balanced schools, blacks whose academic achievement and ability are comparable to that of whites are more likely to enroll in lower-track classes (Darity et al, 2001; Mickelson, 2001). Something of a paradox thus results: when schools are racially diverse, academically-promising black students are more likely to be relegated to lower-track classes, while in a segregated black school those same students are more likely to take upper-track classes (Lucas & Berends, 2007; Mickelson 2015; Oakes, 2005; Southworth & Mickelson, 2007).

Enrolling in upper-track classes does not open all academic doors to black students, however. Regardless of placement, black students report feeling that their unique experiences with parents, counselors, and college admissions create obstacles to their academic achievement that other groups do not face, struggling with their own assumptions about black students' innate abilities, or experiencing lower expectations of teachers based on race (Ferguson, 1998 & 2003; Howard, 2003; Steele & Aronson, 1995). It is hard to have, let alone meet, high expectations for academic performance if both students and teachers hold deeply-held skepticism about how things will ultimately turn out.

If individual black students face these obstacles even occasionally, then concentrating blacks in schools or classrooms—even upper-track classrooms—likely multiplies the obstacles to learning and hinders not only individual student achievement but that of entire classrooms or schools. If a teacher or student believes that black students will not perform well, seeing a classroom full of black students would likely lead teacher and student to doubt the potential of the class as a whole. Furthermore, one of the more enduring explanations for why a segregated black classroom may harm a black students' performance is Fordham and Ogbu's (1986) "acting white hypothesis," which maintains that black students hesitate to exhibit too much interest in academic achievement in front of their black classmates. As Tyson, Darity, and Castellino (2005) point out, the stigmatization of achievement is not unique to one race, and can manifest differently according to schools' particular cultures. There are organization factors at work as well: teacher quality seems to be correlated with racial segregation. Where black students are concentrated, teacher ability and experience is typically lower (Jackson, 2009) and professional collaboration is less common (Stearns, Banerjee, Mickelson, & Moller, 2014).

Schools are not the only mechanism by which students are assigned to particular learning opportunities and settings; tracking also separates students into groups that will receive very different educational experiences, even within the same school. And although segregation by school is viewed by many as a problem, parents, teachers, students, and school officials vigorously defend tracking as the best way to serve high-ability students, to increase rigor in low-scoring schools, or to

tailor educational experiences to the apparent interests and abilities of the individual student (Hallinan, 1994; Loveless, 2009). Research, however, has repeatedly shown that students end up in particular academic tracks as a result of many factors other than ability or interest. Recommendations by teachers and counselors, parental pressure on both students and school officials, prior exposure to segregated schooling, students' desires to be with friends or in a particular classroom, and students' race and SES all can influence track placement. Organizational characteristics of the school itself, including course offerings, seat availability, and the race and SES of the student body also play roles in determining a student's academic track (Jones, Vanfossen, & Ensminger, 1995; Kitsuse & Cicourel, 1963; Lee, Smith, & Croninger, 1997; Riehl, Pallas, & Natriello, 1999; Useem, 1992; Southworth & Mickelson, 2007). These influences converge to create what scholars have come to call second-generation segregation, a phrase that points out that while a particular school may be diverse in terms of race and SES, its classrooms may be highly segregated (Meier, Stewart, & England, 1989). Just as it does between schools, segregation within the schools has a measurable effect on achievement (Card & Rothstein, 2007). Importantly, literature on the influence of second-generation segregation in high school on college achievement is rather scant.

Segregated Education in CMS

The harmful effects of segregation, both across and within schools, have been observed within CMS. Over the past fifty years CMS has used a wide variety of policies that have brought significant change to how students are assigned to schools. Years of mandated busing policies maintained low levels of segregation. More recently, the "choice" plans that replaced mandated busing have resulted in higher levels of segregation in the district. But even during the heyday years of desegregation, CMS high school students were often separated by classrooms along racial lines. As the district crafted its mandated busing plans in the early 1970s, CMS considered the implementation of new and more divergent academic tracks as essential to getting whites to buy into desegregated schools (Mickelson, 2001, 2015; Mickelson & Heath, 1999). In essence, CMS asked affluent whites to go to schools with blacks, but provided them with options for academically superior classes in which they would have very few black classmates.

Within-school segregation continued during the entire period that CMS operated under court-mandated desegregation. In 1977 the segregation within the district's schools was so apparent and systemic that the federal Department of Health, Education and Welfare (HEW) ruled CMS ineligible for a \$922,000 HEW grant it had been awarded (Bradbury, 1977). A few years later, a self-critical internal report to CMS administration identified tracking as re-segregation (Charlotte-Mecklenburg Schools, 1981). As late as 1997, middle and high school mathematics, science, English, and social studies classes continued to be tracked in ways that strongly correlated with students' race and SES backgrounds, even after taking students' prior academic performance into account. The top academic classes were almost entirely white, while the least rigorous classes were disproportionately black, relative to the school's demographic mix. Moreover, black and white students with comparable academic abilities were found in different academic tracks. Blacks were far more likely to be in lower tracks than their similarly able white peers. Because lower track classes characteristically offer less rigorous instruction, a more limited curriculum, and frequently were taught by less highly qualified teachers, the potential academic benefits of the desegregation mandated by the *Swann* decision were compromised—actually subverted—by the pervasive re-segregation of secondary students into racially imbalanced tracked core academic classes (Mickelson, 2001, 2015).

Our study uses the case of the CMS class of 2004 to advance research on the topics of segregation, tracking, and long-term educational outcomes because it links high schools' levels of

school segregation and racially correlated academic tracking to students' college grade point averages, something none of the earlier studies attempted. Although the impact of segregation at both the school and classroom level has been shown to affect short-term academic achievement, we are investigating whether effects carry over into the next level of education.

Research Questions

We set out to answer three research questions prompted by CMS's history of segregation between and within schools. First, do the effects of school racial segregation extend into early college outcomes among students graduating from CMS schools and entering the UNC system? Second, is minority representation in the upper-track classes related to students' first year college achievement? Third, do the levels of within-school segregation due to tracking exacerbate the negative effects of attending a segregated black high school? If they do, then simply making schools diverse will not be enough to ensure equality of educational opportunities. Policies that seek to provide greater equality of opportunities to learn will need to also address segregation resulting from academic tracking practices as they currently exist.

Research Design

We investigate the three research questions using a unique longitudinal dataset that follows one complete cohort of CMS students from middle school through high school and into the UNC system for college. Our models include variables at the individual, high school and college levels that theoretically are expected to have strong associations with students' freshman GPA, our study's dependent variable. The dependent variable in our analyses is student GPA in the first year of college. Our main independent variables are measures of concentrations of black students in schools and in classrooms. Although the populations of Latino and Asian students in CMS schools are now growing rapidly, this study focuses on blacks and whites because they remain the largest racial groups in CMS and historically the issue of segregation in CMS was litigated and policies were made on the basis of black and non-black students (the category into which whites and all other groups were lumped). Moreover, CMS's 2004 graduates entering the UNC system were overwhelmingly black or white. The following sections describe the subjects as well as the individual, high school, and college level variables we use in our models.

Population

The dataset comes from the larger Roots of STEM Success Project described briefly above and contains the population of 2004 North Carolina high school seniors who matriculated into one of the 16 campuses² of the University of North Carolina university system. By the time this particular cohort entered high school, CMS had dismantled its mandated busing program and assigned students to schools largely by neighborhood and partially through choice options, each of which contributed to increased levels of school segregation (Godwin, Leland, Baxter, & Southworth, 2006). This class's experiences are therefore ideal for research on the relationship between racial isolation and achievement. The fact that this dataset follows students from middle school through university studies makes it unique but it is limited to a single cohort of students. CMS graduates who attended community colleges, private North Carolina colleges, or colleges outside North Carolina are also not part of the study's sample. The 1,440 students in our dataset all graduated from 14 of the 21 CMS high schools operating in 2004. We excluded students attending seven alternative and charter schools in the area to avoid comparisons of schools whose enrollments, cultures, and

organizations were inherently different and administered separately from traditional neighborhood schools in CMS.

Variables

Our main independent variable is freshman GPA in college, calculated by dividing the total number of quality points by the total number of credit hours attempted in the first year of college. Several independent variables are also measured at the student level, such as gender, race (a dummy variable indicating black versus non-black), first-generation college student, free or reduced lunch, Pell Grant recipient (a need-based scholarship), and previous academic achievement (a total of the student's middle school standardized test scores). An additional student-level independent variable is academic track, which is measured by the proportion of state-assessed courses the student took at the honors, Advanced Placement, or International Baccalaureate level. For this particular cohort, those courses included physical science, physics, biology, chemistry, algebra I, geometry, algebra II, US history, English I, and economics, legal, and political systems (a course known simply as "ELP").

The school-level variables in our models are the variables of greatest interest in this study. The first, high school racial segregation, classifies schools into three categories, including segregated black schools, diverse schools, and segregated white schools. The reasoning behind the designations is explained later on in the paper. Classroom racial segregation is the second school level variable and it measures the proportion of students in advanced math and science classes (including honors, AP, or IB) at the school who are black. This variable provides a sense of "who's in the room" when the highest achieving students in the school meet for class and higher values mean more black students are present in advanced classes. The third variable, within school racial segregation, links the two variables described above. Quite simply, it is the difference between the proportion of students in the school who are black and the proportion of students in the advanced math and science classes who are black. In the case of this variable, a higher value means that advanced classes have fewer black students, relative to the proportion of black students in the school. Again, more details about this calculation appear later on in this section. We use a fourth school level variable to account for the academic climate of the high school attended. The value for each school in this variable is the proportion of students in the high school enrolled in advanced classes.

The sole college-level variable in our models is the competitiveness of the campus attended and is a three-category measure (highly competitive, competitive, less competitive) based on the average SAT scores and grade point averages (GPAs) of the students in our dataset who attended each of the campuses. Colleges with students who on average had high school GPAs lower than 3.0 and median SATs under 500 belong to the lowest competitiveness category (eight colleges belonged to this category). Colleges whose students, on average, had GPAs between 3.0 and 4.0, and median SATs over 500 but under 570 were categorized as medium competitiveness (four colleges belonged to this category). And finally, colleges whose students, on average, had GPAs over 4.0 and SATs of over 570 were those colleges with high competitiveness (two colleges belonged to this category).

We employ additional variables to obtain information about the schools in this study. While these variables were not included in the main analytical models (Table 4), we used their data to perform a descriptive analysis of the schools in tables appearing later (Table 3). The variable Total EOG refers to the average total score in the middle school reading and math tests of students entering each high school who went on to attend one of the UNC system schools. We calculated this average for each school's black students, white students, and both groups combined. Another school-level variable reflects the average college freshman GPA earned by the students from each high school who went on to a UNC system college or university. Again, we calculated averages for blacks, whites, and blacks and whites.

These measures enable us to compare the academic backgrounds of the students before they entered high schools and after they exited their high schools (first year of college) to see how achievement gaps might narrow or widen at different schools. For example, by looking at academic achievement in eighth grade we control for how well or poorly prepared students were when they entered high schools. The gaps between white and black students offer insight into the quality of high school preparation students received, and whether a high school helped close (or increased) academic gaps between racial categories of students. Table 1 presents the descriptive statistics for the variables employed in our models.

Table 1
Variable Descriptives

Variable	N	Mean	Std Dev	Min	Max
Individual Level Variables					
Freshman GPA	1440	2.691	.849	0	4.198
Gender	1440	.441	.497	0	1
Student is black	1440	.316	.465	0	1
Student is white	1440	.684	.465	0	1
Proportion of advanced classes taken	1440	.477	.298	0	1
Total EOG score	1440	349.666	15.081	299	392
Received Pell grant in 2005	1440	.182	.386	0	1
Received free/reduced lunch in 7 th grade	1440	.095	.293	0	1
First generation college student	1440	.084	.277	0	1
High School Level Variables					
Proportion of students in advanced classes	14	.066	.028	0.030	0.110
High school racial composition (based on % black)	14	.929	.829	0	2
0=segregated black	5	.357			
1=diverse	5	.357			
2=segregated white	4	.286			
Proportion black in advanced math and science classes	14	.276	.219	0.029	0.758
Difference between proportion black and proportion black in advanced classes	14	.181	.079	0.071	0.352
College Level Variables					
Competitiveness of the university campus enrolled	14	1.571	.756	1	3
1= (median HS GPA < 3 and median both SATs<500)	8	.571			
2= (median HS GPA >=3 & <4 and median both SATs>500 and <=570)	4	.286			
3= (median HS GPA > 4 and median both SATs>570)	2	.143			

Note: Table by authors using data from the Roots of STEM Success project

Operationalizing Measures of Segregation

Our analysis requires us to compare different degrees of segregation by school, segregation by academic track, and segregation by academic track relative to the racial composition of the school. To calculate these measures we employed data on classrooms, denoted (i), and schools, denoted (j).

In 2004, CMS was about 44% black. We follow the longstanding practice of other policy researchers (Card, Mas, & Rothstein, 2008) studying racial composition effects and based our categorization of a school as segregated or desegregated on the percentage black rather than percentage white students in the school. Since the earliest days of implementing *Swann*, CMS board pupil assignment policy aimed to keep the black enrollment at every school within 15% of the system-wide black enrollment. This bandwidth was the standard adopted by Judge Robert Potter in his 1999 ruling in the reactivated *Swann* case. The +/-15% bandwidth standard was then used by subsequent studies of CMS that categorize schools as segregated-white, segregated-black, and racially-balanced. For these reasons we employ it in our study. Proportion black is defined as:

$$PB_j = B_j/S_j$$

PB_j stands for proportion black at school j , B_j is the number of black students at school j , and S_j is the total number of students at school j . Based on the longstanding +/-15% bandwidth practice described above and the fact that CMS was about 44% black at the time, we define school level categories of racial segregation as:

- 1) Segregated-black school enrollments are over 59% black,
- 2) Segregated-white school enrollments are less than 29% black,
- 3) Diverse schools have enrollments with between 30% and 58% black students.

At the classroom level we included the continuous measure of proportion of students in advanced math and science classes in that high school who were black. Proportion black in advanced math and science classes is defined as:

$$PBadv_{ij} = Badv_{ij}/Sadv_{ij}$$

$PBadv_{ij}$ stands for the proportion of black students in advanced math and science classes i at school j , $Badv_{ij}$ is the number of black students at advanced math and science classes i at school j , and $Sadv_{ij}$ is the total number of students at advanced math and science classes i at school j .

We also included the difference between the proportion black students at the high school level and the proportion black students in the advanced math and science classes of each school to measure the within school segregation. With this variable, a higher value represents a greater disparity between the representation of black students in the school and black students in the honors classes. Within school racial segregation is defined as:

$$WRS_j = PB_j - PBadv_j$$

To calculate all of the previously discussed measures we utilized data from schools and classrooms in the school year 2003-2004 when the majority of the students in our sample attended the twelfth grade. The patterns of segregation reflect the transition away from school integration policies and toward those of predominantly neighborhood-based assignment.

Analytic Strategy

Students in this study are clustered in their CMS high schools and later in their UNC campuses, so we employed a multilevel regression model that includes random effects for high schools and college campuses to examine students' freshman GPA in 2005. This approach allows us to examine the effects of school and college characteristics that impact college students' freshman GPAs, taking into consideration the fact that certain groups of students attended the same high schools and the same college campuses, which may have their own influences on achievement independent of high school and classroom racial composition and the various individual characteristics known to influence academic performance. Due to the small number of high schools in our samples, we sometimes had difficulty running the models with the random effects. In these cases we employed the Huber-White adjustment of standard errors to account for heteroscedasticity and found similar results with both methodologies.

We ran models first with the categorical between-school measure of segregation for the entire sample of students and for subsamples of white and black students. We then ran models with the continuous classroom segregation measure again for the full sample of students and for the subsamples of white and black students. Lastly we ran models including the between school measure of segregation plus the within school measure of segregation (defined as the difference between proportion black at a school and the proportion black in advanced math and science classes at that school).

Below is the linear equation of the multi-level model estimating predicted freshman GPA by student, secondary school, and college characteristics:

$$FrGPA_{i(jk)} = \beta_o + \sum_{p=1}^p \pi_p x_{pi} + \sum_{p=1}^p \lambda_p w_{pj} + \sum_{p=1}^p \beta_p z_{pk} + e_{i(jk)} + \mu_{1j} + \nu_{1k}$$

The outcome variable is a continuous variable that indicates students' freshman GPA for student i who attended high school j and college k , $FrGPA_{i(jk)}$. Students' estimated GPA is a function of student variables, x_{pi} , high school variables, w_{pj} , and college variables, z_{pk} . The models also include a between-student error term $e_{i(jk)}$, a random component for high schools, μ_{1j} , and another random component for college campus, ν_{1k} . School and college level variables are centered at the grand mean.

Findings

As mentioned earlier, in 2004 CMS high schools manifested many degrees of segregation. The number of schools that were segregated increased after the district became unitary in 2002. To provide an example of the consequences of moving away from direct desegregation policies, Table 2 shows the schools and their categories from year 2000 to 2003 organized by degree of racial segregation. In the year 2000, 10 of the high schools in the CMS district were diverse, three were segregated black, and one was segregated white. Three years later, the distribution changed enormously as nine of the schools were segregated (five were segregated black and four segregated white) while only five of them remained diverse. Table 2 also lists the percentages of students enrolled in the school in the 2003-2004 school year who were black.

Table 2
CMS High Schools by Racial Composition Category (Diverse, Segregated Black, Segregated White) and Availability of Advanced Math and Science Courses, 2000-2004

High School	Category 2000	Category 2001	Category 2002	Category 2003	% white in school 2003-04	% black in school 2003-04	% black in advanced math & science classes 2003-04	Gap between % black at school and % black in advanced classes 2003-04
Providence	Seg. White	Seg. White	Seg. White	Seg. White	81.40	10.10	2.95	7.15
South Meck	Div.	Seg. White	Seg. White	Seg. White	65.34	17.28	6.70	10.59
North Meck	Div.	Seg. White	Seg. White	Div.	66.78	25.56	8.97	16.58
Butler	Div.	Div.	Seg. White	Seg. White	72.46	21.24	12.22	9.02
Myers Park	Div.	Div.	Div.	Seg. White	64.79	24.88	6.96	17.91
East Meck	Div.	Div.	Div.	Div.	43.82	43.52	16.01	27.51
Independence	Div.	Div.	Div.	Div.	36.42	51.12	32.89	18.23
Olympic	Div.	Div.	Div.	Div.	40.01	41.38	22.37	19.02
Northwest Vance	Div.	Div.	Div.	Seg. Black	41.08	54.95	19.78	35.16
Harding	Div.	Seg. Black	Seg. Black	Seg. Black	26.14	59.14	33.80	25.34
West Meck	Div.	Seg. Black	Seg. Black	Seg. Black	18.95	71.40	48.33	23.07
Garinger	Seg. Black	Seg. Black	Seg. Black	Seg. Black	25.39	61.68	41.18	20.50
West Charlotte	Seg. Black	Seg. Black	Seg. Black	Seg. Black	11.09	67.94	58.32	9.63
	Seg. Black	Seg. Black	Seg. Black	Seg. Black	2.36	90.16	75.78	14.38

Note: Table by authors using data from the Roots of STEM Success project.

Table 2 also presents the percentages of students in the advanced math and science classes that same year who were black, providing a measure of the level of segregation associated with academic tracking in each school. The last column shows the difference between a school’s overall percentage black and upper-track percentage black, providing an estimation of the second-generation segregation present at each school. Examples of this important distinction can be seen by examining Myers Park and Butler high schools. While the student body at each of those two schools is roughly 25% black, the gap in representation of black students between the student body and the advanced classes at Myers Park is twice as large as it is at Butler. In none of the 14 high schools is the percentage of black students in the advanced classes reflective of their representation in the

school's overall student body. Although the usual lower academic preparation of black students might help explain these numbers, this is yet another classic instance of the second-generation segregation that has been present in CMS since it began to implement *Swann* (Charlotte-Mecklenburg Schools, 1981; Mickelson, 2001, 2015).

Table 3

High School Racial Category, College GPA, and Black-White (B-W) Achievement Gaps in Middle School

High School	2004 High School Category	Middle School B-W EOG Test Score Gap	B-W Freshman GPA Gap	Middle School Average EOG Score	Average Freshman College GPA
West Meck	Seg. Black	-25.8	-.08	344	2.21
West Charlotte	Seg. Black	-22.2	-.59	334	2.25
Providence	Seg. White	-20.9	-.44	356	2.92
Harding	Seg. Black	-18.7	-.08	344	2.51
Independence	Diverse	-18.4	-.40	348	2.65
Butler	Seg. White	-16.7	-.37	350	2.84
Northwest	Diverse	-16.6	-.58	344	2.57
East Meck	Diverse	-15.7	-.20	352	2.74
North Meck	Diverse	-15.3	-.19	354	2.80
Vance	Seg. Black	-13.9	-.53	350	2.72
Myers Park	Seg. White	-13.2	-.16	356	2.89
South Meck	Seg. White	-13.1	-.13	352	2.77
Olympic	Diverse	-10.3	.19	332	2.41
Garinger	Seg. Black	-4.6	-.09	338	2.13

Note: Highlighting indicates schools with the largest B-W test score gaps (Columns 3 and 4) and lowest average achievement (Columns 5 and 6).

A cohort of students may enter their freshman year of high school with a black-white achievement gap already firmly established in middle school and before. Within our dataset, cohorts that enter a given high school with an achievement gap in middle school test scores tend to have similar gaps in their college grade point averages, with a few exceptions. Table 3 sorts the high schools in our dataset by the size of the black-white achievement gap among the college-bound students as measured by scores on North Carolina's End-of-Grade (EOG) standardized tests for middle school students. To facilitate interpretation of this table, we highlight cells with relatively larger black-white achievement gaps and lower average achievement. For example, Table 3 shows that black and white college freshmen who attended West Charlotte High, a segregated black school, had the second-largest EOG test score gap (-22.2 points) of all the schools in the sample and the largest gap in terms of college GPA (-.59). Another segregated black school, Garinger High, had the cohort's smallest achievement gap between black and white students entering high school (-4.6) and the third-smallest after high school (-.09). Not all schools are so consistent, however. West Mecklenburg High stands out as a school in which the cohort had the largest gap in EOG scores (-25.8) but the smallest gap in college GPA (-.08). The cohort of students at Vance started with a moderate-size gap (fifth smallest at -13.9 points) but ended up with the third largest in terms of freshman college GPA (-.53).

With only a few exceptions, however, the schools with the largest test score gaps also tend to be schools with the lowest test scores, and therefore a narrowing of gaps does not necessarily mean

that achievement increased in the years leading up to college. For example, although West Mecklenburg and Harding appear successful at closing the black-white achievement gap for their students, the college GPAs for graduates of those schools were still in the bottom half of the distribution of college performance. The students from Vance, who ended up with a wider gap, had one of the higher average college GPAs. Racial composition and achievement are highly correlated; all of the segregated white schools were in the top half of average EOG scores as well as the top half of the average college GPA distribution and none of the school cohorts moved from the bottom half of EOG achievement to the top half of college GPAs. These results of the middle school to high school to college performance comparisons support the notion that segregation is associated with lower academic achievement.

Our multivariate statistical analysis, to which we now turn, extends this investigation to control for various factors and identify causes of differences in achievement. Our multilevel models seek to understand how individual background, secondary school characteristics, and college factors contribute to college freshmen grades. To better isolate the relationship between high school racial segregation and freshman GPA we controlled for the academic atmosphere at each school by including a variable for the proportion of students in the high school in an advanced placement/college track. Also, to control for possible GPA inflation we include a university level measure of the competitiveness of the campus the student attended based on the average SAT scores and grade point averages of the students in our dataset who attended each of the campuses. The results of our multilevel analyses, presented in Table 4, indicate that segregation at both the high school and the classroom level due to tracking harms academic outcomes in college.

Models 1 through 3 examine the relationships among school-level segregation and freshman GPA for the full sample of respondents and then separately for blacks and whites. Likewise, models 4 through 6 examine the relationships among classroom-level segregation and freshmen GPA for the full sample of respondents and then separately for blacks and whites. Model 7 examines both school and classroom segregation effects for the entire sample. It also estimates how the effect of classroom segregation on college achievement differs at various levels of school segregation. In each of the seven models our findings indicate that all students who attended a segregated black high school performed worse in their freshman year of college than they would have if they attended a diverse or segregated white high school (which serves as the reference category). While the effect is statistically significant for both black and white students, the magnitude of it is twice as strong for black students (-.242) as it is for white students (-.118).

The findings in models 5 and 6 suggest that attending schools with higher percentages of black students in upper track classrooms is negatively associated with black students' freshman GPA (-.598), but has no significant association with white students' freshman GPA. Taking that line of inquiry further, model 7 reveals statistically significant positive relationship between classroom segregation and college achievement (2.428) for students who attended segregated black high schools but not for those who attended diverse or segregated white high schools.

Table 4
Effects from Multi-level Estimations of Freshman GPA for Roots Sample, by Race

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	Entire Sample	Black Students	White Students	Entire Sample	Black Students	White Students	Entire Sample
Intercept	-1.373 (1.121)	-1.560 (1.201)	-1.538 (1.240)	-1.213 (1.091)	-1.354 (1.267)	-1.458 (1.212)	-1.180 (1.109)
Male	-.331*** (0.049)	-.168* (0.073)	-.386*** (0.048)	-.330*** (0.049)	-.171* (0.070)	-.386*** (0.048)	-.329*** (0.048)
Black	-.109 (0.078)			-.103 (0.081)			-.106 (0.080)
Seg. black school	-.148*** (0.046)	-.242*** (0.062)	-.118* (0.050)				-.167* (0.079)
Diverse school	-.059 (0.044)	-.200** (0.078)	-.041 (0.045)				.027 (0.071)
Proportion black in adv. classes				-.455** (0.176)	-.598*** (0.196)	-.346 (0.295)	
Proportion honors classes taken	.072 (0.106)	.198 (0.148)	.011 (-.121)	.096 (0.109)	.240 (0.157)	.023 (0.127)	.091 (0.095)
Total EOG score	.012*** (0.003)	.012*** (0.003)	.012*** (-.003)	.012*** (0.003)	.012*** (0.003)	.012*** (0.003)	.011*** (0.003)
Received Pell Grant	-.092* (-0.040)	-.138 (0.085)	-.019 (-.059)	-.086* (0.040)	-.124 (0.083)	-.016 (0.055)	-.085* (0.042)
Received FRL in 7th	-.026 (0.064)	.046 (0.058)	-.341 (-.250)	-.029 (0.062)	.036 (0.056)	-.339 (0.250)	-.022 (0.060)
1 st gen. college student	-.025 (0.050)	-.012 (0.070)	-.040 (-.072)	-.026 (0.050)	.003 (0.066)	-.048 (0.071)	-.029 (0.046)
Proportion adv. at high school	.078 (0.631)	1.958 (1.496)	-.260 (-.875)	-.179 (0.909)	.823 (1.275)	-.363 (1.211)	-.208 (0.770)
Campus competitiveness	.071 (0.056)	.067 (0.082)	.135** (-.048)	.063 (0.056)	.060 (0.085)	.131* (0.052)	.071 (0.058)
Gap btw black at HS and black in advanced classes							-.839 (1.071)
Gap btw black at HS and black in advanced classes* Seg. Black School							2.428* (1.375)
Gap btw black at HS and black in adv. classes* Diverse School							-.209 (1.520)
<i>N</i>	1440	460	990	1440	460	990	1440

Note: Secondary school level characteristics were grand mean centered. The *N* for each model is rounded to the nearest 10 to preserve anonymity of subjects.

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

Our findings show that the harm done by concentrating racial minorities in schools cannot be undone by recruiting those racially-isolated students into advanced-level classes. At segregated-black high schools, the greater the gap between the percentage black in the school and the percentage black in advanced track classrooms, the better the students from those high schools do in their freshman year of college. In other words, a student in a predominantly black high school will do better if the advanced classes have fewer black students. This could be an indication of the lower levels of quality of the classes in these segregated-black schools compared to classes in other schools, the characteristics of their teachers or other students, the school's climate of expectations, or a combination of these factors associated with learning environments that have large percentages of racial minorities, all of which are associated with lower educational outcomes. Through one or perhaps all of these mechanisms, concentrating black students in a school or in college-preparatory tracks has damaging effects on their college achievement.

Discussion

Our findings reflect the harm done to all CMS students who matriculate to a UNC campus, but particularly to blacks, when racial minorities are concentrated in segregated schools and classrooms. The harms are apparent even with a sample size limited to a single cohort of students from a single school district. In the results of this study black students who are concentrated in majority-black schools perform worse with regard to the grades they earn in the first year of college compared to black students attending diverse or majority-white schools. And when those black students are concentrated in advanced classes as well, the benefit in achievement that is typically associated with upper-track learning opportunities weakens. This last finding is troubling because one popular strategy for improving outcomes at schools with high concentrations of minorities is to increase the academic rigor by providing more upper-track classes. But our results indicate that if those upper-level classes have high concentrations of students of color, overall achievement suffers.

Exactly why increased numbers of blacks in an advanced level classroom is negatively related to outcomes takes us back to the debate over what causes the black-white achievement gap generally. Researchers have offered an array of explanations. Fordham and Ogbu (1986) suggest that racial identity and peer relationships intersect in ways for black students that are different from whites' experiences, but other scholars argue that stigmatization of success in the classroom is more universal (Tyson, Darity, & Castellino, 2005). Alternatively, blacks in advanced level classes may have had fewer opportunities to learn in their earlier school experiences relative to whites; thus black students' weaker skill set may undermine their performance in advanced classes (Hallinan & Sørensen, 1977), thus causing a classroom to spend more time on remedial lessons and less on more advanced content. The analysis of middle school EOG scores in Table 3 supports this explanation because with only one exception, segregated black high schools had students with the lowest EOG scores. Moreover, lower expectations for a class full of black students may lead teachers to reduce the rigor that an advanced class may otherwise have (Ferguson, 1998). Additionally, the higher incidence of poverty among black families that has been shown to keep black students out of higher tracks may also be related to why students are likely to perform worse on the occasions that they do enroll in those classes (Howells, 2001). Another likely factor, however, is that CMS teachers working in racially isolated schools are less experienced, less likely to have advanced degrees, and more likely to be teaching out-of-field (Jackson, 2009). Finally, racially isolated schools with a majority of students of color are less likely to have collaborative professional teacher cultures that provide the instructional and curricular support that is especially valuable to teachers working in them (Stearns, Banerjee, Moller, & Mickelson, 2014). Any of these reasons could explain why we find that high

concentrations of students of color in classes—even those with upper-track labels—are associated with weaker academic outcomes among college freshmen.

Although the connection between school and classroom composition and student achievement seems clear, CMS is doing little to foster diverse schools and classrooms. Moreover, in 2013, CMS considered a citizens' task force proposal for a school that would exclusively serve black students not for just a few years, but from kindergarten through twelfth grade (Helms, 2013). It has been a long time since Charlotte has seen such an extreme form of intentional school racial segregation.

Some stakeholders hold the position that black students benefit from seeing other black students in their upper-level classes because it helps them to feel that they belong in those more rigorous classes (Tyson, 2011). That claim may indeed be true for some students. But as this study shows, any benefits of seeing fellow blacks in advanced classes are outweighed by the negative consequences that accompany attending a racially isolated class or a racially isolated school. Research on the inverse relationship between teacher quality and school racial or poverty composition offers insights into this problem (Jackson, 2009; Lankford, Loeb, & Wyckoff, 2002), and labeling classes with large numbers of black students as honors or Advanced Placement won't erase those obstacles. The structural conditions and opportunities to learn that the students experience before they arrive in the honors class and the expectations and skills held by peers and teachers are arguably much more important for their achievement.

For political reasons, desegregating schools or dismantling academic tracking may be unattractive options for CMS and other school districts. Indeed, the CMS School Board recently announced that although increasing school socio-economic diversity is one of its priorities for the forthcoming pupil assignment plan, the board will not attempt to address racial segregation through drastic re-zoning of school boundaries (Helms, 2015a). The announcement comes at a time of year when many CMS parents look to alternative educational opportunities such as charter schools, which have grown in number ever since the state legislature removed a statewide cap on their numbers. Increased magnet school options may be the CMS Board's approach to balancing the priority of diversity with the reality of school choice. At the same time, efforts continue to mitigate the challenges posed by segregated schooling in CMS, such as in the 50-million dollar Project LIFT endeavor, without measurable success (Helms, 2015b).

This study suffers from several design and sample issues that limit the interpretations and conclusions that we can draw from its findings. The first limitation arises from the selection bias introduced by the study's restriction to CMS graduates who attended UNC campuses. We can say nothing about CMS college-bound students who attended non-UNC campuses and we cannot say anything about CMS graduates who did not attend higher education. Second, our study says nothing about students who dropped out of CMS prior to graduating. The third limitation arises from findings based on a single school system's matriculates in a single year. We acknowledge these design features limit any conclusions we can legitimately draw from our findings.

Conclusion

The recent history of CMS reflects changes that have been going on throughout the nation. A few decades ago, the district made equity and diversity a top priority; in fact, the district's stated goal was to become the premier integrated urban school district in the nation (Smith, 2004). Success was measured by how balanced schools were in terms of race as well as by how well students performed on standardized tests, graduation rates, and college performance. Coupled with the end of court-ordered desegregation, the arrival of school choice, standards, and accountability

supplanted the emphasis on equity with market-driven reforms in which students take tests, scores get posted, and families choose their preferred schools, assuming they have the information, means, and flexibility to actually pursue their preferred options (Smith, 2004; Smith & Mickelson, 2000).

Once the district stopped assigning students to schools to keep them diverse, the slow trend toward re-segregation that began a decade earlier accelerated (Mickelson, Smith, & Nelson, 2015). Ironically, the re-segregation of schools has contributed to the very thing that accountability policies were intended to avert: lower student performance. As this study shows, policies that concentrate black students into schools and classrooms separate from their other race peers are contributing to the persistence of the achievement gaps between white and black students in measureable ways. As the district becomes increasingly diverse in terms of race and ethnicity as current trends suggest it will, and if reformers are serious about raising student performance, addressing educational segregation would be a good place to start. Without attention to school and classroom racial, ethnic, and SES composition, long-term outcomes such as college performance will continue to reflect the racial stratification of opportunities to learn and student achievement that desegregation policies were intended to eliminate.

The larger issue raised by our findings is the weaker school quality associated with segregated black schools and classrooms. So long as first- and second-generation segregation persist in public schools, we are likely to continue to see race gaps in college performance irrespective of the myriad programs and policies implemented to close these gaps. Regardless of the mechanism at work, the evidence in this study suggests that school assignments that concentrate black students in highly segregated schools and/or classes, even classes with upper-track labels, place them at a disadvantage. A system of school assignments and course offerings that keeps both schools and classrooms diverse would be an important step toward closing the racial achievement gap in CMS and later when graduates matriculate to UNC system campuses. Because of the school system's historic role in desegregation, the findings from our case study are suggestive of policy implications beyond CMS.

Notes

1. STEM is an abbreviation for Science, Technology, Engineering, and Mathematics. The Roots of STEM Success Project directed by Elizabeth Stearns, Roslyn Arlin Mickelson, Melissa Dancy, and Stephanie Moller examines the disparate pathways and antecedents for women and minorities pursuing the STEM fields in North Carolina. This work was supported by the NSF Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP) [Grant Number DUE-0969286]. All errors and interpretations are those of the authors.

2. The 16 degree-granting campuses in the University of North Carolina system include Appalachian State, Eastern Carolina, Elizabeth City State, Fayetteville State, North Carolina A&T, North Carolina Central, North Carolina State University, UNC Asheville, UNC Chapel Hill, UNC Charlotte, UNC Greensboro, UNC Pembroke, UNC School of the Arts, UNC Wilmington, Western Carolina, and Winston-Salem State.

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