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# Contexts Matter: The Relationship Between School Wide Student Demographics and Graduation Rates

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Abstract

*Nearly 60 years after the Supreme Court Decision in Brown, segregation is still an ingrained facet of American public education. This study investigated the extent to which these continued patterns of segregation influenced graduation rates from high school. The study used data provided by the Virginia Department of Education (VDOE) on the 2011 graduating cohorts in 302 public high schools across the state. The results indicate that graduation rates for all students vary significantly as a function of the overall socioeconomic and racial composition of high schools. In addition, low-income students are significantly more likely to graduate in low-poverty high schools and minorities are significantly more likely to graduate in high schools that are not highly segregated by race. Finally, school level demographic variables explain a significant, independent share of the variance in graduation rates among high schools. These results lend weight to policies designed to integrate high schools as a way to equalize educational opportunity.*

# Contexts Matter: The Relationship Between School Wide Student Demographics and Graduation Rates

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## TABLE OF CONTENTS

List of Tables

List of Figures

# I. INTRODUCTION

Lyndon Johnson's "Great Society" was a comprehensive effort by the federal government to address many of the inequities evident in American society. As part of his push, the U.S. Department of Education commissioned a report on the state of educational equality in American led by the sociologist James Coleman. Coleman's seminal1964 report entitled the *Equality of Educational Opportunity* introduced many researchers and policy analysts to the idea that the most important variable in the quality of a school is the characteristics of the students themselves. Through his research, James Coleman came to understand that a student's own background had a significant influence on his or her own achievement. He also realized that the overall composition of school's student body had a significant and independent impact on individual achievement.

For nearly 50 years, researchers have continued to examine this key conclusion of the Coleman Report that who a student goes to school with matters. One reason for this focus is persistent patterns of school segregation in American public education. On average, black and Latino students continue to be isolated from their white peers. The average white student attends a school where 76.6% of their peers are also white. Black and Latino students attend schools where 29.4% and 27.0% of their peers are white, respectively (Orfield, 2009). Put another way, only 7.9% of whites attend a school where between 50 and 100% of their classmates are minorities. This rises to 64.6% for black and 71.8% for Latino students (Orfield, 2009).

This racial segregation is often conflated with economic segregation. In a recent analysis, the correlation between the percentage of Latino students and the percentage of poor students in America's public schools is very high, .71. For black students, this

correlation is lower, but still high at .53. For whites, it is only .07 (Orfield et al., 2012). This is a concern, partly, because segregated schools are more likely to have inferior teachers, higher rates of teacher turnover, fewer educational resources, lower achieving peer groups, and less challenging curriculums (Orfield et al., 2012). The average Latino student attends a school where 63.5% of their peers are low-income, for black students it is slightly higher at 63.8%. White students, on average, attend a school where only 37.0% of their peers are low- income (Orfield et al., 2012).

These patterns of segregation and isolation are even more alarming when considering the fact that black and Latino students continue to lag behind their white peers on various measures of achievement and attainment (Battle & Lewis, 2002, Berends & Penaloza, 2010, Haile & Nguyen, 2008, Orfield, 2009, Rumberger & Palardy, 2005). Similar patterns emerge for low-income students (Rumberger & Palardy, 2005, Caldas & Bankston, 1997, Sirin, 2005, Chiu & Khoo, 2005). Data from the Census Bureau's most recent Current Population Survey also reveal that low-income and black and Hispanic students are also less likely to complete high school. In the years since the Coleman Report, researchers and policy analysts have continued to examine the link between these two facets of American public education; segregation and achievement gaps based on student characteristics. The balance of evidence suggests that they are related and integrated school environments may a necessary first step to eliminate these persistent achievement gaps.

The legal impetus for school desegregation came from the Supreme Court decision in *Brown v. The Board of Education*, but the above statistics reveal we still have a long way to go in creating inclusive school environments. In 2007, the Supreme Court

struck down two voluntary school integration policies in Seattle, Washington and Jefferson County, Kentucky (Armor, 2010). In recent years, lower courts have also released large metropolitan school districts such as Charlotte-Mecklenburg and Nashville from mandatory school desegregation policies implemented in the years after *Brown* (Houck, 2010, Jackson, 2009). Yet, in writing the majority opinion that struck down the integration plans in Seattle and Jefferson County, Justice Kennedy still claimed that desegregating schools constituted a compelling government interest (Armor, 2010). In addition, the U.S. Department of Justice Office of Civil Rights has recently issued recommendations on legally defensible strategies school districts can use to integrate their schools. So further research into the benefits of school integration is essential both because of continued school segregation and a legal climate that will permit the implementation of plans meeting certain criteria.

**Review of Literature**

Recent research indicates that economic disadvantage reaches across generations, but education can play a critical role in helping break the "cycle of poverty." To the extent that segregated schools depress academic achievement and attainment, school integration efforts could promote upward economic mobility for those from underprivileged backgrounds. In the United States, 43% of children born into the bottom quintile of family income remain there as adults and 70% do not make it to even the middle quintile (PEW, 2012). Blacks born into economically disadvantaged families are even less likely to achieve a middle class lifestyle as adults as compared to whites. Fifty-three percent of blacks, but only 33% of whites, born into the bottom two quintiles of family income remain there as adults. In fact, 56% of blacks born into the middle

quintile of family income fall into the bottom two quintiles as adults. Only 32% of whites follow a similar pattern (PEW, 2012). Yet, education can play a critical role in promoting upward economic mobility. Forty-seven percent of children who are born into the bottom quintile of family income remain there as adults, if they do not earn a college degree. Only 10% of children who are born into the same bottom quintile, but earn a college degree, remain there as adults (PEW, 2012).

If education is to help eliminate this "cycle of poverty" it is essential that researchers continue to examine Coleman's finding that peers have an independent influence on individual student achievement. Fortunately, there is extensive research on this issue and it can be broken into several broad categories. The first examines the relationship between the average socioeconomic status of schools' student bodies and individual student achievement. Research indicates that the average socioeconomic status of a school exerts a significant and independent influence on individual student achievement (Sirin, 2005) and that low-income students tend to benefit the most from attending a school with a relatively high average SES (Zimmer & Toma, 2000).

The second category focuses on how the racial composition of a school impacts individual student achievement. Research indicates that the relationship between the average racial composition of a school and student achievement is primarily a function of the correlation between race and socioeconomic status (Saatcioglu, 2010). What little impact that the average racial composition of a school has on individual student achievement is most likely explained by our imperfect measures of socioeconomic status, culturally specific responses to continued patterns of discrimination (Rothstein, 2004),

and a history of widespread racism (Ogbu, 2004). It is also clear that all students benefit from racially integrated environments (Orfield et al., 2012).

The third category of research examines the moderating factors that might explain the relationship between the average socioeconomic or racial composition of schools and individual achievement. These moderating factors include school funding, teacher quality, peer interactions, and parental influences. Research indicates that minority and low-income students, on average, attend schools that are funded at a level below their white and middle class peers (Bifulco, 2005). Teachers of lower quality also typically teach minority and low-income students (Hanushek et al. 2002). In addition, academic norms and expectations vary as a function of students' own socioeconomic status. These norms and expectations are then passed onto peers in a school setting, which can impact individual achievement (Brookover et al. 1978). Finally, parents exert social capital in a school to the benefit of all students. This social capital is correlated to socioeconomic status (Pong, 1998). Interestingly, purposeful school integration strategies could work to eliminate the inequities in these moderating factors since they are all related to student compositional variables.

Finally, there is extensive research on the primary variables of interest in this study, high school graduation and socioeconomic status. Graduation from high school is associated with a variety of private benefits to individuals (Henderson et al. 2011) and public benefits to society as a whole (Psacharopoulos, 2006). This association highlights the importance of looking into the relationship between graduation rates and school level demographic variables. Researchers have primarily measured socioeconomic status by eligibility for Free and Reduced Price Lunch (FRPL). The benefits of using eligibility for

FRPL include that it is associated with academic achievement, nearly all public schools attempt to determine if students are eligible, and it captures a wide range of students likely impacted by growing up in an economically impoverished environment. There are also drawbacks. Many students are incorrectly labeled as eligible or ineligible, it does not take into account other benefits families receive, it is a dichotomous variable, and students are less likely to sign up for the program as they enter secondary school (Harwell & LeBeau, 2010).

Even though the impact of school level student demographics on individual student achievement has been studied extensively, there are two important gaps in the literature that this study addressed. The first is the relative lack of research on how peers impact educational attainment. There is considerable research on the separate concepts of how school level student demographics impact achievement and the benefits of graduating from high school. There is very little research that connects the two and examines the relationship between school composition and graduation rates. This study also examined the concept of "tipping points," which has received relatively little attention in the research literature. "Tipping points" refer to the concentration of low-income and/or racial minorities in a school beyond which the achievement of all students start to suffer. There is some evidence to suggest that no school should serve a student population where more than 40% or 50% come from low-income backgrounds. Yet, this evidence is rather minimal and requires further study.

**Methodology**

This study built on the research that demonstrates the overall composition of a school's student body has a significant, independent influence on individual achievement

through an analysis of graduating cohorts of students in Virginia in 2011. The first research question examined the relationship between mean graduation rates for the 2011 cohorts and measures of the overall socioeconomic and racial composition of high schools. The second research question examined the relationship between mean graduation rates for certain subsets of students in the 2011 cohorts and measures of the overall socioeconomic and racial composition of high schools. The third research question looked at the relative impact of measures of the overall socioeconomic and racial composition of high schools on graduation rates.

This study explored these three research questions through several analyses. Descriptive analyses looked at how mean graduation rates for all students in the 2011 cohorts differed as a function of measures of the overall socioeconomic and racial composition of high schools. Then, the significance of these differences in mean graduation rates for all students in the 2011 cohorts was analyzed. Next, correlations were run between these measures of the overall socioeconomic and racial composition of high schools and mean graduation rates for students in the 2011 cohorts.

Descriptive analyses then looked at how mean graduation rates for certain subsets of students in the 2011 cohorts differed as a function of the overall socioeconomic and racial composition of high schools. Then, the significance of these differences in mean graduation rates for certain subsets of students in the 2011 cohorts were analyzed. Finally, regression analyses looked at how much of the variance is mean graduation rates for the 2011 cohorts could be explained by measures of the overall socioeconomic and racial composition of high schools as compared to other school level variables.

**Findings**

Results from analyses run as part of the first research question indicate that all students are less likely to graduate in high schools with progressively higher concentrations of economically disadvantaged anytime students. These differences in graduation rates by intervals were more likely to be significantly higher in the lowest poverty schools and significantly lower in the highest poverty schools. The correlations examining the relationship between the average percentage of economically disadvantaged anytime students and graduation rates seemed to contradict the patterns listed above. Students in racially diverse high schools are significantly more likely to graduate than those that attend highly segregated ones. The correlations examining the relationship between the average percentage of underrepresented minorities and graduation rates generally support the conclusion listed above.

Analyses run as part of the second research question demonstrate that economically disadvantaged anytime students were more likely to graduate in relatively low-poverty schools. These differences were significant for economically disadvantaged anytime students who attended the lowest poverty schools. Minorities were more likely to graduate in buildings where fewer than 30% of their peers were also black or Hispanic. Significantly lower graduation rates emerged for minorities who attended high schools where more than 50% of their peers were black or Hispanic. The regression analyses run as a part of the third research question indicate that student demographic variables exert a significant, independent impact on graduation rates. In fact, student demographic variables often exert a larger impact on graduation rates than other school level variables thought to influence educational attainment.

**Conclusions and Recommendations**

These results indicate that educational opportunity is not uniformly distributed amongst high schools in Virginia due to the uneven distribution of students by socioeconomic status and race. There are clear benefits for all students in attending relatively low poverty high schools that are racially diverse, but not highly segregated. These findings support policies designed to integrate schools by socioeconomic status and race as a way to provide more equitable educational opportunities. The highly contextual nature of this study makes it difficult to prescribe firm numerical tipping points for the ideal concentration of low-income and minority students in all schools. Yet, it does seem safe to suggest that all students should learn in an environment were fewer than 50% of their peers are low-income and one where there is racial diversity, not segregation. Future research should focus on how school integration policies impact overall graduation rates, school wide student demographics impact academic attainment in general, and the feasibility of implementing race-neutral integration policies as a way of eliminating racial isolation.

# II. REVIEW OF LITERATURE

## Socioeconomic Status and Achievement

In the *Equality of Educational Opportunity* James Coleman was primarily interested in the school experiences of students from different racial and ethnic backgrounds. Yet, race is often conflated with socioeconomic status, especially in 1960's America. In addition, Coleman described the composition of schools' student populations through a series of variables that included numerous measures of socioeconomic status. Therefore, the Coleman Report sparked additional interest in the relationship between socioeconomic status and student achievement.

There certainly have been critics of the Coleman Report. Jencks & Brown (1975) claimed that Coleman et al. (1964) did not sufficiently control for students prior test scores when examining the relationship between a school's average socioeconomic status and achievement. Cain & Watts (1970) leveled their own methodological criticisms, which included Coleman et al.'s (1964) focus on standardized test scores as the sole measure of achievement, the operationalization of socioeconomic status, statistical techniques used to measure the relationship between socioeconomic status and achievement, and the policy changes proposed by the authors. In a review of the research literature surrounding the relationship between school level measures of student demographics and achievement, Jencks & Mayer (1989) stated that there was relatively weak evidence that classmates have an influence on individual student achievement.

Despite these criticisms, more recent, rigorous research lends support to Coleman et al.'s (1964) primary finding that who a child goes to school with matters. "Peer effects" is a term often found in the research literature and it refers to the cumulative

impact of classmates on individual student achievement. Peer effects are typically described through a widely researched school level student characteristic such as SES or race. Peer effects can have positive or negative repercussions, on average, for individual student achievement depending on their concentration within a particular building. For example, most researchers would expect that peer effects would work to depress individual student achievement in a school with a relatively high concentration of low-SES students. The opposite patterns holds true as well. Most researchers would expect that peer effects would work to increase individual student achievement in a school with a relatively low concentration of low-SES students.

**The importance of SES related peer effects.** Rumberger & Palardy (2005) conducted a study of the impacts of peer effects by SES in American high schools. They drew a sample of 14,217 students in 913 high schools using data from the National Education Longitudinal Survey (NELS) of 1988. NELS: 88 contains achievement growth test data for students as they progressed from eight through twelfth grade in mathematics, reading, science, and history. NELS: 88 also contains survey data from students and parents, which were used to create a SES score for each student. This SES score was a composite of parents' income level, parents' education, and parents' occupational prestige. Rumberger & Palardy (2005) then employed hierarchical linear modeling (HLM), which allowed them to control for the influence of individual background characteristics on student achievement when examining the impact of peer effects by SES. HLM is a statistical technique unavailable to James Coleman and, thus, provided the Rumberger & Palardy (2005) study with additional rigor In addition,

Rumberger & Palardy could control for students' prior achievement before they entered high school since NELS: 88 contained eight grade achievement scores.

Rumberger & Palardy (2005) discovered that the average socioeconomic background of a high school's population had just as much impact on individual students' achievement on state standardized tests as their own socioeconomic background. The socioeconomic composition of a high school's student body was the most significant school based characteristic to influence student achievement. Rumberger & Palardy (2005) also ran analyses to measure the impact on achievement growth by moving students from high-poverty to low-poverty high schools. They placed all 913 high schools in their sample along a normal distribution based on their percentage of low SES students. In addition, they ran analyses; which showed that moving students from high-poverty to low-poverty schools would result in academic gains for those students. Rumberger & Palardy (2005) demonstrated that peer effects by SES have a significant impact on individual student achievement in a large, national sample of high school students.

Caldas & Bankston (1997) also demonstrated that the average socioeconomic status of a high school's student population had a nearly equal influence on individual achievement as a student's own socioeconomic background. Caldas & Bankston (1997) examined 42,041 10$^{th}$ grade scores from the 1990 administration of the Louisiana Graduation Exit Examination (GEE). The 10$^{th}$ grade portion of this examination series focuses on mathematics, English language arts, and written composition. The Louisiana Department of Education also collected rich demographic information on students and their families. This demographic information was used to create a student level measure

of SES based on their eligibility for the Federal Free and Reduced Price Lunch Program (FRPL) as well as parental educational and occupational levels. Based on this student level measure of SES, Caldas & Bankston (1997) calculated an average SES score for each high school in Louisiana.

Using a regression model, Caldas & Bankston (1997) discovered that classmates' SES had a significant impact on individual student achievement. This influence of classmates' SES was only slightly smaller than the impact of a student's own SES background. Like in the Rumberger & Palardy (2005) study, these peer effects by SES could influence individual student achievement in either a positive or negative direction. Caldas & Bankston (1997) claim that integrating schools by SES could prove to be a worthwhile policy assuming that student assignments are managed to prevent a concentration of low SES students in a particular building, which could have a detrimental impact on individual student achievement.

Schwartz (2010) also examined the influence of peer effects by SES in Montgomery County, Maryland. Montgomery County has an inclusionary zoning policy, which means that many of its' neighborhoods, and the corresponding elementary schools, are integrated by SES. These integrated buildings are referred to as "green zone" elementary schools and they serve a student population where 20% or less of children are eligible for the federal Free and Reduced Price Meal Program (FARM). The remaining students in Montgomery County live in neighborhoods and attend elementary school with a higher percentage of low-income peers. These elementary schools with a higher concentration of low-income students are known as "red zone" schools and they serve a student population where between 20% and 85% of students are eligible for FARM.

These red zone schools receive supplementary services, which means that per-pupil expenditures are roughly $2,000 greater in the red zone than green zone elementary schools. Schwartz's (2010) study is really a natural experiment analyzing what has a greater impact on the achievement of low-income elementary students, a school that serves a student body with a relatively high average SES or a school with a relatively low average SES and additional per-pupil funding.

Schwartz (2010) discovered that by the end of elementary school, low-income students in green zone schools performed significantly better than low-income students in red zone schools in math and to a lesser extent in reading. In addition, the academic benefits for low-income students in attending a green zone elementary school accrued over time. Conceivably the achievement gap between low and middle income students in green zone schools would continue to shrink if these students attend integrated schools throughout their secondary years. It also demonstrates the inadequacy of additional per-pupil expenditures in overcoming the negative peer effects of attending an elementary school with a high concentration of low-income peers.

Sirin (2005) conducted a meta-analysis of studies published between 1990 and 2000 that focused on the relationship between the average school socioeconomic status of schools and individual student achievement. This meta-analysis included a sample of over 101,157 students in 6,871 schools across 128 school districts. Sirin (2005) discovered that a student's own family background was one of the strongest predictors of his or her academic achievement. Yet, the impact of the average SES of the school a child attends is even stronger. This finding held across numerous settings, urban, suburban, and rural, as well as grade level. It was also apparent among students of

various racial/ethnic backgrounds. Despite the combined breadth of the studies mentioned above, one limitation is particularly evident. The vast majority of studies employ test scores to analyze the relationship between peer effects by SES and student achievement. Educational attainment in the form of graduation rates is a more valuable measure to use when investigating peer effects by SES because of its relationship to a host of life outcomes. These outcomes will be described in more detail later.

**Peer effects and neighborhood impacts.** Another important concept surrounding peer effects by SES is their relative influence on student achievement as compared to other variables. Of particular interest is the extent to which peer effects by SES impact achievement as compared to neighborhood effects. Neighborhood effects refer to the collective sway students' neighborhoods have on their academic success. The importance of neighborhood effects is due partly to the fact that these two variables are often conflated with each other. Schools, especially at the elementary level, generally draw students from surrounding neighborhoods with residents that are generally uniform in their socioeconomic status. Therefore, school populations often reflect the SES characteristics of the neighborhoods in which students live. It is essential that researchers are able to discern whether these two variables exert separate or conflating influences on student achievement. Unfortunately, there is scant research that compares the relative influence of peer effects by SES and neighborhood effects. Yet, emerging research indicates that peer effects by SES seem to make a stronger contribution to student achievement.

Jargowski & El Komi (2011) took advantage of a longitudinal panel dataset of nearly 10 million Texas students created by the Texas Schools Project (TSP). The

researchers focused on 5th through 8th graders who participated in the Texas Assessment of Academic Skills (TAAS) in both reading and math in 1999 and 2000. In addition, this dataset contained demographic information on each student that participated in TAAS. Jargowski & El Komi (2011) also used census tract data from the 2000 Census as a proxy for the neighborhood characteristics of each school's attendance zone.

Jargowski & El Komi (2011) then analyzed the relationship among school level, individual, and neighborhood characteristics to changes in student test scores from 1999 and 2000. To measure school level characteristics, the researchers focused on the percentage of students eligible for FRPL, student turnover, and the average math and reading scores for students in that particular grade. To measure neighborhood level characteristics, the researchers focused on the poverty rate in the school's census tract, the percentage of students in married couple families, and the percentage of adults who are college graduates. Jargowski & El Komi (2011) discovered a consistent negative correlation between students' math scores and neighborhood poverty, although this was not statistically significant and the same pattern was not found for reading. They also found that the average math and reading scores of a student's peers did have a statistically significant relationship to their own scores on the TAAS.

Finally, Jargowski & El Komi (2011) created a regression model, which included all the school level, individual, and neighborhood characteristics. Neighborhood characteristics explained virtually none of the variance in student test scores. School level characteristics, in particular peer test scores, explained a large degree of the variance in individual student test scores. Jargowski & El Komi's (2011) research does indicate that neighborhood poverty rates do have some influence on student test scores.

Yet, a student's peers have a much greater impact on his or her own achievement on the TAAS.

As part of her study on Montgomery County, Schwartz (2010) also examined the academic impact of growing up in neighborhoods with different levels of overall poverty. The relative affluence of Montgomery County means that Schwartz (2010) was only able to compare the academic achievement of public housing students living in very low poverty neighborhoods, 0%-5% poverty rate, with those living in low poverty neighborhoods, 5%-28% poverty rate. Public housing students who lived in very low poverty neighborhoods demonstrated a modest increase in math and a smaller increase in reading than their peers who lived in low poverty neighborhoods. These increases due to neighborhood were above and beyond the math and reading improvements these students experienced due to their elementary school. At the same time, the effect size of living in a very low poverty neighborhood, as compared to a low poverty neighborhood, was only half that of attending school with different poverty rates.

These conclusions indicate both neighborhood effects and school level peer effects by SES have an impact on student achievement. In other words, peer effects by SES are not simply a function of cumulative neighborhood effects; they both have a distinct influence on student achievement. At the same time, research indicates that school level peer effects by SES have a stronger relationship with student achievement than neighborhood effects. This is an important point, in part, because school administrators can take advantage of peer effects by SES through policies solely focused on redesigning student assignment plans.

**Who benefits from peer effects.** An important concept in the literature is the extent to which peer effects by SES impact students from different socioeconomic backgrounds. Researchers have put forth several potential theories. It may be that peer effects by SES have a significant influence on the achievement of all students, but this impact is stronger for students from low SES backgrounds than those from high SES backgrounds. This theory is in accordance with the concept of 'diminishing returns' (Chiu & Khoo, 2005), where those students most in need benefit the greatest from improvements in their educational environment. If this theory is true, school integration efforts by socioeconomic status could benefit all students and work to reduce to achievement gap between low SES and high SES students.

Another possible theory is that peer effects by SES have a significant influence on the achievement of all students, but this impact is stronger for students from high SES backgrounds than low SES backgrounds. If this theory is true, school integration efforts by socioeconomic status could benefit all students and at the same time, work to increase the achievement gap between low SES and high SES students. A third option is that peer effects by SES benefit all students relatively equally. In this case, school integration efforts by SES would raise the achievement of all students, although it would not reduce the achievement gap between low SES and high SES students. A final possible theory is that the impact of peer effects by SES is a zero sum game. According to this theory, any academic benefits to low SES students of an integrated school environment would be equally offset by losses to high SES students. If the influence of peer effects by SES is a zero sum game, then school integration efforts by SES would have no overall academic

benefits, although it would work to reduce achievement gaps between these two groups of students.

Most research indicates that peer effects by SES have a significant impact on all students, but that this influence is greater for students from low SES backgrounds than high SES backgrounds (Chiu & Khoo 2005, Coleman 1964, Jargowsky & El Komi 2011, Schwartz 2010, and Zimmer & Toma 2000). Zimmer & Toma (2000) utilized data from the International Association for the Evaluation of Educational Achievement (IEA), which administered a cross-national mathematics exam to students in twenty countries, including the United States. This study also contained a survey, which gathered students' demographic information. This allowed the researchers to create a measure of each student's SES based on their parents' education level and occupation status. From this dataset, Zimmer & Toma (2000) were also able to group students' scores and demographic information based on the classroom in which they were educated.

Zimmer & Toma (2000) used a fixed effects model to examine the relationship between the education level of students' classmates and scores on the mathematics exam. They discovered that all students perform better on this mathematics exam in classrooms where a relatively high percentage of their peers had parents who had at least graduated from secondary school. Yet, this peer effect by SES was even more beneficial to the low SES students than the high. Evidence from studies such as this lends weight to the argument that school integration by SES is an effective school policy since all students will benefit, but especially those most at-risk for lower academic achievement.

Yet, there are other studies that indicate that the influence of peer effects by SES is more likely a zero sum game (Caldas & Bankston 1997, Mayer 2002, and Rumberger

& Palardy 2005). Mayer (2002) examined the impacts of school segregation by SES through census tract data contained in the Public Use Micro Sample (PUMS) of 1970, 1980, and 1990. Census tracts are used as proxies for school attendance zones and thus, provide a sense of the economic segregation between schools. Mayer (2002) used household income to calculate the level of segregation between census tracts in all 50 states. In addition, Mayer (2002) drew on data from the Panel Study of Income Dynamics (PSID), which contains longitudinal survey data on demographic information and educational attainment for students from 14 until 23.

Mayer (2002) concluded that increases in economic segregation between census tracts had little impact on overall educational attainment. This is because such increases did improve the educational attainment for high income students, while at the same time depressing educational attainment for low- income students. The benefits of increased segregation to high-income students were off-set by decreased educational attainment for low-income students. Results from studies such as Mayer's (2002) indicate that school integration efforts based on students' SES could reduce the educational attainment gap between low and high income students but do little to improve overall educational attainment. In this case, school integration efforts would probably find little political traction since it pits the interests of high SES families against low SES families.

Finally, some researchers find that peer effects by SES impact all students relatively equally (Perry & McConney 2003). Perry & McConney (2003) utilized data from the Australian administration of the Programme for International Student Assessment (PISA), which assesses students in mathematics, reading, science, and problem solving. One advantage of PISA is that it employs a complex measure of SES,

which includes measures of parental education and occupation, families' cultural capital, and financial resources. Perry & McConney (2003) divided schools into quintiles based on their average SES. Students were also divided into quintiles based on their own SES. This allowed Perry & McConney to evaluate how students from different SES backgrounds fared on the PISA in relation to their school's average SES.

Perry & McConney (2003) demonstrate that all students, regardless of their own SES background, benefited fairly equally from attending schools with a progressively higher average SES. This pattern held for all four subjects assessed on the PISA. This research also indicates that policies aimed at integrating schools by SES would be a worthy goal since all students would benefits from peer effects by SES. These policies should garner strong political support since it benefits families in a variety of different constituencies. There is room for debate in the policy world about the benefits of integrating schools by SES, but the balance of research supports the idea that integrated environments would help all students. Yet, further research is still necessary in order to gather evidence that will provide a more definitive answer of who benefits from school integration by SES.

**Tipping Points and SES Integration.** A related concept in the research literature is the issue of a "tipping point." The term tipping point refers to a concentration of economically disadvantaged students in a school beyond which the average educational achievement or attainment of all children suffers due to peer effects by SES. Imagine a hypothetical situation in which a school serves a student population where everyone comes from high SES backgrounds. Conceivably, all students in that building would benefit from peer effects by SES. Now, imagine a hypothetical situation in which

a school serves a student population where everyone comes from low SES backgrounds. Potentially, all students in that building would suffer from peer effects by SES. There may be an ideal ratio of high and low SES students in a building such that both groups of students benefit from peer effects by SES. Unfortunately, current evidence does not provide strong guidance as to where this tipping point may lie.

Prominent education policy experts have provided their perspective on the concept of a tipping point, despite the rather weak evidence to support their claim. Richard Rothstein (2004) believes that a cap of about 40% should be placed on the number of students in a school from low SES backgrounds. This is the cap on the percentage of students eligible for FRPL Wake County Public Schools placed on its' schools in 2000 (Kahlenberg, 20001). Wake County Public Schools is the 16th largest in the nation and their implementation of a school integration policy based on student SES lends practical significance to research on this concept of a tipping point. Richard Kahlenberg (2001), another author who has written extensively about economic integration, believes that the percentage of low SES students in any school should be below 50%. It can be argued that the Federal Government provides some guidance on this issue since Title I Funds are only available to provide school-wide programs in buildings where more than 40% of students come from low-income families (W.C. Riddle, personal communication, April 1st, 2012).

Unfortunately, research specifically focused on the concept of a tipping point is rare, but indirect evidence does come from several sources. Employees from the National Center for Education Statistics published a report focused on the condition of urban education in the United States. An important by-product of this research it that it

indicates that educational achievement and attainment is typically depressed in schools that serve a student population where more than 40% of students are living in poverty. Poverty, in this study, was based on Census Bureau estimates.

One strength of this research is that the authors examined the relationship between concentrations of poverty in schools against several measures of student achievement and attainment. The authors first looked at the achievement data of 8th graders from the National Education Longitudinal Study of 1988 (NELS: 88) and the performance of these same students in 10th grade when they participated in the High School & Beyond (HS&B) Study. Students were assessed on math and reading and their scores placed along a normal distribution. 8th graders who attended school with poverty concentrations between 0% and 5% scored on average a 53. This drops to a 51 for those in schools with between 6% and 20% poverty, 49 in schools with between 21% and 40% poverty and 45 in schools with over 40% poverty. A nearly identical pattern emerges for 10th graders. Note the greater drop in scores, once the poverty concentration of a school exceeds 40%.

The authors then examined the on time graduation rates, graduating within four years of starting high school, for students using data from the HS&B Study mentioned previously. Eighty-five percent of sophomores in schools with between 0% and 5% of students living in poverty graduated on time. This drops to 82% in schools with poverty concentrations between 6% and 20%, 80% in schools with poverty concentrations between 21% and 40%, and 73% in schools with over 40% poverty. Unfortunately, the disadvantages associated with attending high school with a high concentration of peers living in poverty carries over into post-secondary educational opportunities. Using data from the National Longitudinal Survey of Youth (NLSY), the authors discovered an

association between students who earned a bachelor's degree and the poverty concentration in their high school. 36% of high school students in schools with a poverty concentration between 0% and 5% went on to earn a bachelor's degree. This drops to 25% in schools with between 6% and 20% of students living in poverty, 20% in schools with poverty concentrations between 21% and 40%, and 17% in schools with over 40% poverty.

Similar patterns emerge for the relationship between economic outcomes and the percentage of students labeled as "disadvantaged" by school administrators in the HS&B Study. There is a sharp decrease in the percentage of students employed or attending school full time that also attended high school with a disadvantaged concentration over 40%. In addition, there is a sharp increase in the percentage of adults who are unemployed and living in poverty that also attended a high school with a disadvantaged concentration over 40%. The NCES study demonstrates that concentrations of poverty or disadvantage in a school beyond 40% is associated with a sharp decrease in educational achievement and attainment as well as a host of later economic outcomes. This evidence lends support to the idea that a low-income student population of 40% is a tipping point.

Other research indicates that the tipping point for the concentration of economically disadvantaged students might be lower. Orland (1990) pulled data from the Sustaining Effects Study (SES), which included demographic information on a nationally representative sample of elementary school students between the years 1976 and 1979. The Sustaining Effects Study also includes achievement data in the form of results from two standardized tests, the Comprehensive Test of Basic Skills and the Practical Achievement Scale. Finally, Orland (1990) used data from the 1980 Census to analyze

the poverty concentrations within elementary schools. There is a sharp increase in the percentage of all students, poor and non-poor alike, that score below the 25% percentile on the two standardized assessments once the poverty concentration in an elementary school exceeds 24%. Orland (1990) then ran a multivariate analysis to control for student backgrounds variables to isolate the peer effect by SES. Even while controlling for numerous demographic variables, peer effects by SES still explained a greater share of the variance in scores on the standardized tests once the poverty concentration in a school increased beyond 24%.

In Schwartz's (2010) research low poverty schools were those where between 0% and 20% of students were eligible for FARM and moderate poverty schools were those where between 20% and 85% of students were eligible for FARM. The academic benefits of attending an economically integrated school, for low-income students, diminished as the percentage of children in a building eligible for FARM rose. The greatest benefit was for low-income students who attended a school where 20% or less of students were eligible for FARM, with lesser benefits when that percentage rose to 30%. Beyond 30%, there did not seem to be any academic benefits.

The collective weight of these studies does seem to indicate there is a tipping point for the concentration of economically disadvantaged students in a school. Yet, the evidence for exactly where this tipping point lies is still up for debate. In addition, the most prominent research around this idea of a tipping point is relatively old. Orland's study is from 1990 and the NCES report is from 1996. Schwartz's (2010) study is the most recent, yet it had a limited sample size, which makes a comparison between low and high poverty schools difficult. Thus, there is a real need for further research into the

concept of tipping points because the literature is quite sparse. The results from such research could also be used to help school district officials design assignment plans to leverage peer effects to improve student achievement and attainment.

**Summary points.** Several important trends emerge from the research on peer effects by SES. The first is that the average SES of students in a school exerts a significant and independent influence on individual achievement. Evidence of this independence is seen in the separate, and lesser, impact of neighborhood effects on student achievement. The weight of research indicates that low SES students benefit to a greater extent than high SES students from these peer effects, although this is not yet conclusive. There is also an important gap in the research literature when it comes to evidence of tipping points.

This study will attempt to find evidence of a tipping point using a measure of educational attainment not often found in the research literature, graduation rates. Part of this study will focus on the relationship between the percentage of economically disadvantaged students in Virginia's high schools and their graduation rates. The expectation is that peer effects by SES will work to significantly increase graduation rates in low poverty schools and significantly decrease graduation rates in high poverty schools. Finding this tipping point is important in order to leverage the positive impacts of peer effects by SES for all students and thus maximize the number of high school graduates in Virginia. In an ideal scenario, all high school students would benefit, and no one would be adversely impacted, from the impacts of peer effects by SES. Conceivably, the statewide graduation rate would then increase since all students reap the advantages of peer effects by SES.

**Race and Achievement**

Similar to socioeconomic status, the racial composition of a student's classmates exerts an independent influence on his or her achievement. The close connection between race and socioeconomic status in American society appears to be the primary reason for this influence. Lee & Burkman (2002) provide evidence that racial gaps in achievement are primarily explained by differences in socioeconomic status through an analysis of data collected by the federal government that evaluated the vocabulary and mathematics development of students as they began kindergarten in 1998. In their study, Lee & Burkman (2002) normalized the reading performance of black students against those of whites. Therefore, on average, white students scored at the 50$^{th}$ percentile on the reading skills assessment and black students scored at the 36$^{th}$ percentile.

Lee & Burkman (2002) also divided students into one of five quintiles based on a measure of their socioeconomic status, which included family income, parental education, and parental occupation status. Most of the achievement gap in reading skills between black and white students was eliminated when students were compared within each quintile group. The reading skills gap between black and white students in the lowest fifth was only three points, five points in second fifth, four points in middle fifth, four points in the fourth fifth, and twelve points in the highest fifth.

A similar pattern emerged for the scores on the mathematics skills assessment, which were also normalized to the performance of whites. On average, white students scored at 50$^{th}$ percentile, while black students scored at the 27$^{th}$ percentile. Yet, most of this apparent gap was eliminated when students' scores were analyzed within each quintile group. In the lowest fifth the mathematics skills gap was only seven points, eight

points in the second fifth, fourteen points in the middle fifth, seventeen points in the fourth fifth, and twenty-four points in the highest fifth. Lee & Burkman's (2002) research indicates that race is primarily a proxy for socioeconomic status. Thus, evidence that the overall racial composition of a school exerts an influence on individual student achievement is mostly a function of peer effects by SES.

Berends & Penaloza (2010) also found that apparent achievement gaps based on race were primarily a function of socioeconomic factors. This lends further weight to the argument that the racial composition of schools, by itself, does little to influence individual student achievement. Berends & Penaloza (2010) examined the mathematics achievement of four cohorts of high school seniors over the course of thirty years. This thirty-year span included information on the senior classes of 1972, 1982, 1992, and 2004. Using data from the Longitudinal Studies program at the National Center for Education Statistics, they discovered that overall gaps were decreasing between the mathematics achievement of white and black/Hispanic students. This was principally a result of improvements in the family background characteristics of Hispanic and black students relative to whites. From 1972 through 2004 black and Hispanic parents were becoming better educated, had occupations with higher social statuses, and were earning more, all relative to whites.

Unfortunately, high schools in the United States became increasingly segregated by race between the years 1972 and 2004 (Berends & Penaloza, 2010). This segregation acted as a counter-balance to the overall decrease in math achievement gaps between white and Hispanic/black students. Despite their improving situation, Hispanics and blacks were still overrepresented in the lower ends of the measure of socioeconomic

status. This increasing segregation meant that blacks and Hispanics were more likely to attend school with a higher concentration of peers from low socioeconomic backgrounds and, thus, suffer from peer effects by SES. So even though overall achievement gaps decreased, the segregated racial compositions of students' high school worked to partially offset these gains. Berends & Penaloza (2010) predicted that black and Hispanic students should have been expected to score even higher relative to whites had earlier trends in school integration from the 1960's continued.

Saatcioglu (2010) also found evidence that the racial composition of schools impact individual student achievement primarily as a function of its association with the average SES of a school. Saatcioglu (2010) examined Cleveland's transitions from a segregated school district in the late 1970's through stably integrated schools in the 1980's and eventual resegregation in the 1990's. Saatgioclu (2010) focused on four cohorts of students who attended Cleveland's schools during different periods of these transitions. The first cohort did not attend integrated schools until late into their high school career and so they experienced nominal levels of school integration. The second cohort experienced segregation through most of middle school after which they attended integrated schools. The third cohort spent their entire school careers in integrated environments. The fourth cohort went to elementary and middle school in integrated environments but they experienced a gradual resegregation of students during high school.

Saatgioclu (2010) then examined dropout rates for various racial groups within these cohorts. There was a distinct decrease in dropout rates between the first and second cohorts as the latter group experienced greater degrees of integration. Cohort three had

the lowest dropout rate, as those students were able to attend integrated schools from Kindergarten through 12th grade. Finally, there was an increase in dropout rates for the last cohort as Cleveland slowly resegregated during their secondary school years. Interestingly, white students also benefited from integrated school environments in a way similar to minorities, just to a lesser degree. The primary explanation for these varying dropout rates was the changes in school composition that accompanied integration. Integrated schools were less likely to have high concentrations of student poverty, non-traditional families, students who come from neighborhood with high rates of neighborhood personal crime, high percentages of students who where very mobile, or serve a large student body. The studies by Lee & Burkman (2002), Berends & Penaloza (2010), and Saatcioglu (2010) indicate that race very closely serves as a proxy for socioeconomic status. Therefore, any apparent impact of the racial composition of schools on individual student achievement is primarily an example of peer effects by SES.

**The apparent persistence of achievement gaps based on race.** Some researchers appear to find evidence of achievement gaps based on race, even when controlling for student SES and other school compositional factors. If the conclusions these researchers draw are accurate, then the average racial composition of a school may exert an independent influence on individual student achievement. Southworth (2010) followed a cohort of North Carolina students as they progressed from fourth through eight grades, examining their scores on the North Carolina reading and math End of Grade (EOG) achievement tests. Southworth (2010) divided schools into categories

based on the percentage of white and minority students as well as their concentration of students eligible for FRPL.

Individual student test scores tended to change as a function of adjustments in the average racial and economic composition of the student body in the school that they attended. As expected, there was a negative correlation between test scores and the percentage of students eligible for FRPL. There was also a negative correlation between test scores and the percentage of minorities in a school. This second correlation was evident even after Southworth (2010) controlled for the percentage of students eligible for FRPL in a school. Socioeconomic status was measured using eligibility for FRPL and parental education level. Based on the Southworth (2010) study it appears that higher concentrations of minority students are correlated with lower individual test scores.

Bankston & Caldas (1996) came to a similar conclusion after examining the relationship between the level of segregation in students' high schools and their scores on the Louisiana Graduation Exit Examination (GEE). There was a negative relationship between the percentage of African-Americans in a school and individual scores on the GEE. This influence of the average racial composition of a school on student achievement was apparent even when controlling for students SES. SES was measured using students' eligibility for FRPL, parental education level, and parental occupation level. African-Americans in Louisiana scored significantly lower on the GEE than their white peers because African Americans were much more likely to attend school in a segregated setting alongside high percentages of classmates of the same race. In fact,

white students who attended high school in these predominately African-American high schools also scored worse than would be expected in a more integrated setting.

So what accounts for the impact of the racial composition of schools on individual achievement even while controlling for average school level SES? Richard Rothstein (2004) explains that the impact of the racial composition of schools is the result of several circumstances, which are primarily outside the control of the student. Rothstein's (2004) book principally focuses on detailing the black-white achievement gap, although the conclusions highlighted here could apply to members of various minority groups. The first circumstance is that researchers do not have a perfect measure or measures for describing the socioeconomic status of a student and thus, the average SES of a school. This most likely accounts for the large majority of difference in achievement and attainment seen between students with similar socioeconomic statuses but different racial backgrounds. Even while controlling for factors such as family income, parental education level, parental occupation status, etc. there are almost certainly other variables that help explain the connection between the average socioeconomic status of a school and individual student achievement. These additional variables to describe socioeconomic status could include total family assets, parental expectations for educational attainment, and family income in the critical first five years of a child's life, etc. These measures can be very expensive and time consuming to collect. This means that researchers often include other measures, that are easier to collect, but most likely to leave out some of the features of socioeconomic status in their descriptions of student composition at the school level.

The second circumstance revolves around continued discrimination in schools and the labor market. Rothstein (2004) states that black students do not study as hard and are more likely to be disruptive in class as compared to whites with similar family incomes. These behaviors are likely a function of lower teacher expectations for black students as well as a pattern of blacks not being able to translate educational attainment into labor market success, on par with whites, due to discrimination. The third circumstance Rothstein (2004) and Ogbu (2004) cite an oppositional culture many blacks hold towards majority-institutions such as public schools. Again, this oppositional culture must be understood within a historical context of widespread racism where blacks often maintained a sense of self-dignity and pride by withholding respect from majority-institutions. Rothstein (2004) believes the apparent influence of the average racial composition of a school on individual student achievement is explained mostly by our imperfect measures of socioeconomic status. At the same time, there is an independent influence on achievement associated with school racial composition due to behaviors connected with continued discrimination in our schools and labor markets as well as a historically rooted oppositional culture.

**Differential benefits.** Similar to SES, there is a question of who benefits from stably integrated school environments by race. One line of research proposes that the overall racial composition of a school has differential impacts based on the race and/or abilities of the individual student. These interaction effects help to provide a clearer picture of the relationship between racial composition at the school level and individual achievement. Hanushek et al. (2002) followed three cohorts of 5$^{th}$ graders in Texas through their middle school years. According to the authors, the advantage of looking at

5th graders is each of them experienced a "structural" shift when they moved onto 6th grade. Conceivably, the impact of the overall racial composition of a school would be greater in 6th grade since the transition from elementary to middle school involved significant changes in peer relationships.

Hanushek et al. (2002) discovered a negative relationship between the percentage of black students in a school and the achievement of black students. This negative impact of higher black enrollments seemed to have the greatest impact on the achievement of higher ability black students. Lower ability black students seemed unaffected by the percentage of black peers in their school. Hanushek et al. (2002) make the argument that the achievement of higher ability black students is pushed towards the median, which has repercussions for their later educational attainment and prospects in the workforce. Hanushek et al. (2002) offer two possible theories for the relationship between the overall black student composition in a school and the achievement of high ability black students. Both theories are related to the previous discussion of Rothstein's (2004) work. The first is black students actively discourage academic achievement among fellow black peers, although Hanushek et al. (2002) do not place this in a historical context. The second is that teachers hold lower expectations for black achievement overall, which is more likely to inhibit the achievement of high ability black students.

White students seemed to be much less impacted by the percentage of black students in their school. There was an inverse relationship between the percentage of black students in a school and the achievement of low ability whites, although this relationship was not significant. The percentage of Hispanic students had a positive impact on the achievement of white and black students, although this was not a

significant relationship. The key point is that by looking at these interaction effects, Hanushek et al. (2002) provide a clearer picture of how school racial composition influences individual students' achievement with different background characteristics.

Lee (2007) also found evidence of these interaction effects between the average school racial composition and the race/ethnicity of individual students. Lee (2007) relied on data from the Add Health study, which collects student and school level information from a representative sample of 7th through 12th graders. It also administers a Picture Vocabulary Test (AHPVT), which formed the basis for the operationalization of student achievement in this study. Lee (2007) discovered that increases in the proportion of black students in a school have a negative impact on the achievement of black peers. There was no relationship between the percentage of black students in a school and white and Hispanic achievement.

The percentage of Hispanics in a school had no relationship to black or Hispanic achievement. White achievement increased as the proportion of Hispanic students in a school rose. White, black, and Hispanic students all had higher achievement as the percentage of white students in a school increased. Again, Lee (2007) discovered interaction effects between school racial composition and the achievement of individual students.

A related line of research examines how immigration status might moderate this relationship between the average racial composition of a school and individual achievement. Ryabov & Van Hook (2007) focused on the correlation between school level minority composition, adolescent Latino student achievement, and generation status. They used scores from the AHPVT and overall grade point average (GPA) to

measure student achievement. School level minority composition did not have an impact on AHPVT scores for Latino students, but it did influence overall GPA. There was a negative relationship between school level minority concentration and GPA for foreign-born Latinos, but not for those born in the United States. Ryabov & Van Hook (2007) speculated that this may be due, at least in part, to the theory that Latino students are slower to assimilate linguistically when educated in schools with peers from similar racial/ethnic backgrounds. This is an academic concern since most instruction occurs in English.

**Summary points.** An extensive body of research demonstrates that the relationship between the average racial composition of a school and student achievement is primarily a function of the correlation between race and socioeconomic status. When studies do find an impact of the average racial composition of a school on individual student achievement this is most likely due to our imperfect measures of socioeconomic status as well as culturally specific responses to continued patterns of discrimination and a history of widespread racism. Like socioeconomic status, research on the impacts of the racial composition of schools has focused mainly on achievement as measured by standardized test scores. There is a need for research to examine the relationship between school level compositional variables and attainment in the form of graduation rates. Graduating from high school is associated with a host of positive life outcomes, which will be described in further detail later in the literature review. Many researchers have also examined how the average racial composition of a school impacts individual student achievement based on that child's own racial/ethnic background. While a valid line of research, it seems clear that all students benefit from a racially integrated environment.

There are also clear benefits to all students learning in racially integrated environments. In an Amici Curiae brief to the Supreme Court before the *Parents v. Seattle School District* and *Meredith v. Jefferson County* case, a group of social scientists summarized key findings from the research literature about the benefits to all students of a racially integrated school environment. These include more developed critical thinking skills, higher academic achievement, greater cross-racial understanding, and improved life outcomes. Orfield, Kucsera, and Siegel-Hawley (2012) developed similar conclusions in a recent review of the literature on the benefits of racially integrated schools. These include the ability to work with and make friends with students from a variety of backgrounds, being less likely to hold racial stereotypes, greater academic achievement and attainment for minorities, and a desire to seek out integrated work, educational, and residential settings later in life. Certainly it is more difficult to create racially integrated schools in the aftermath of the Supreme Court decision in this case. Yet, Armor & O'Neill (2010) illustrate strategies that are available to school district officials. Therefore, this study will examine the impact of racial composition on attainment because there is evidence of its academic importance as well as the continued feasibility of integrating schools by race.

**Moderating Factors**

**School and district level resources.** Many researchers have examined the moderating factors that might explain how the average race or SES of a school exerts an influence on individual student achievement. One line of research focuses on financial resources, which can vary greatly by district and school. The United States has a relatively decentralized formula of school finance, at least compared to other large,

OECD (Organisation for Economic Co-operation and Development) nations (Zhang et al., 2011). State and local governments are primarily responsible for raising the revenues needed to fund school districts. One consequence of this system of school finance is that there is a limited role for the federal government to play in reducing funding disparities between individual districts.

A strong argument can be made that funding inequities, at any significant level, are unacceptable in a relatively wealthy, industrialized nation. To make matters worse, there is strong evidence that these funding inequities are correlated with the characteristics of students within certain districts and/or states. Bifulco (2005) focused on the financial disparities between school districts as a function of the racial composition of their student bodies. Bifulco (2005) examined figures from the Common Core Data (CCD), Census of Government School System Finance Files (F33 files), and Small Area Income and Poverty Estimates to examine funding disparities in 10,168 districts across 43 states. This dataset included approximately 88% of all public school students and 95% of black public school students in 2002. Nominal per-pupil expenditures are greater in the average black student's school district than the average white student's. Yet, the average black student goes to school in a district with 30% higher costs than the average white student. The higher nominal per-pupil expenditures in the average black student's school district are not great enough to cover these additional costs.

These higher costs in the average black student's district are due to several factors. The average black student is more than two and a half as times as likely to attend school in a large school district. This means that the district is subject to

diseconomies of scale. The average black student is also much more likely to attend school with a high percentage of low-income peers, who require additional educational resources. The average black student also lives in a school district with significantly higher teacher costs than the average white student.

Bifulco (2005) suggests that the average black student's school district needs to increase per-pupil expenditures by a rate of between 3% and 16% in order to provide equal opportunities for academic achievement. Bifulco (2005) believes that these funding disparities could be eliminated by increases in state aid for the education of low-income students or greater racial and economic integration at the school level. School integration could be the more financially efficient option since Bifulco's (2005) suggestion for increasing state aid for the education of low-income students is generally much higher than current levels.

In an analysis of funding disparities based on student race, Lee (2012) contends that minority students would need substantial increases in per-pupil expenditures in order for all students to meet basic proficiency standards on the 8$^{th}$ Grade Mathematics sub-section of the NAEP. Black and Hispanic students would need additional per-pupil expenditures of $736 and $916 respectively, while white students would only need an increase of $437. These findings expand on Bifulco's (2005) assertion that black students attend school in relatively resource poor environments and both researchers contend resource disparities are contributing to the achievement gaps between white and minority students.

Baker & Green (2005) came to a similar conclusion when examining disparities in per-pupil expenditures as a function of the racial composition of school districts. Unlike

Bifulco (2005), Baker & Green (2005) did not calculate additional financial burdens borne by school districts that serve high percentage of black students. Yet Baker & Green (2005) examined the relationship between per-pupil expenditures and the percentage of black students in a school district as well as per-pupil expenditures and the overall share of minorities. In their analysis, average per-pupil expenditures in fifteen states showed a negative relationship with the overall percentage of minority students in a district. For these fifteen states, the same relationship held for average per-pupil expenditures and the percentage of black students in a district.

Bifulco's (2005) and Baker & Green's (2005) research demonstrates that race and per-pupil expenditures are closely linked. Unfortunately, there is also evidence that many states employ a regressive school finance system. Baker & Welner (2010) define a regressive school finance system as one where the per-pupil expenditures of a school district are positively correlated with overall district wealth. On the other hand, Baker & Welner (2010) define progressive school finance systems as those that are designed so that there is a negative relationship between the wealth of a school district and per-pupil expenditures. Progressive school finance systems are desirable because they demonstrate a commitment on the part of a state to offset the limited revenue raising capacity of low-wealth districts and provide supplemental support for the education of low-income students.

Nationwide, Baker & Welner (2010) discovered that school district funding continues to remain positively correlated with overall district wealth. In other words, the majority of states employ regressive school finance system. Fortunately, there are a few states such as Alaska, Utah, New Jersey, Minnesota, and Ohio that actually implement a

rather progressive school finance system. Yet, the weight of evidence suggests that current systems of school finance do not provide minority and low-income students with equitable access to resources. The previous studies painted a broad picture of state and district level funding. The next section focuses in on one particular type of school resource; teachers.

**Teacher labor markets.** Many researchers argue that teacher quality is the most important in-school resource that influences student achievement (Darling-Hammond 2004, Clotfelter et al. 2005, and Lankford et al. 2002). In fact, Lee (2012) contends that increasing the percentage of in-field teachers of minority students would go a long way in reducing their achievement gap with white students on the 8th Grade NAEP. A central finding from research on teacher labor markets is that teacher quality varies greatly as a function of a school's student body. Lankford et al. (2002) evaluated teachers in New York State across a variety of categories including experience, degree attainment, competitiveness of the college from which they obtained their degree, whether or not they were certified to teach in their assignment, and scores on the New York State Teaching Certificate Exams. These exams act as a gateway into the teaching profession in New York.

Non-white, low-income, and Limited English Proficient (LEP) students are much more likely to have teachers of lower quality and experience high degrees of teacher turnover in their schools. This situation is the result of teachers transferring out of schools with high percentages of minority, low-income, and LEP students into those with smaller numbers of students from all three sub-groups. The authors believe that the current salary structure does little to alleviate the sorting of teachers by student

characteristics. There is little variation in teacher salaries between school districts and virtually none within districts. This gives teachers little incentive to remain in schools where the teaching environment is perceived to be more difficult. Interestingly, purposeful school integration may eliminate some of this teacher sorting since all schools within a district or region are similar in regards to salient student characteristics.

Hanushek et al. (2002) discovered a similar pattern in their analysis of teacher labor markets in Texas. The researchers took advantage of a database compiled by the University of Texas-Dallas (UTD) Texas Schools Projects in collaboration with the Texas Education Agency (TEA). This database contains matched panel data sets on several variables related to student and teacher characteristics. There is strong evidence that teachers who transfer between schools or districts within Texas favor buildings that consist of higher-achieving students who are less likely to be minority and come from low-income backgrounds. Teachers generally transfer into schools that contain 2 percent fewer black students, 4.4 percent fewer Hispanic students, and 6 percent fewer students eligible for Free and Reduced Price Lunch as compared to their previous school.

This pattern holds for teachers who transfer from urban to suburban districts and those who transfer to different schools within the same urban district. Teachers who transfer to new schools within urban districts tend to be more experienced. The result is that minority, low-income, and lower achieving students are less likely to have experienced teachers. The authors suggest that only substantial increases in salary would offset this general pattern of transfers to schools with greater white, middle class, and higher achieving student populations. As an example, less experienced female teachers would require salary increases in the 25 to 40 percent range in order to continue teaching

in schools that have a relatively high-minority, FRPL eligible, and low achieving student populations. Again, school integration efforts might alleviate the need for additional compensation since all schools within a district or region would serve a similar student population.

Jackson (2009) found further evidence that teachers distribute themselves according to student attributes in an analysis of the Charlotte-Mecklenburg, N.C. Public Schools in the years before and after a court ordered desegregation plan was removed. Jackson (2009) gathered data on the changes in school demographics, test scores, as well as measures of teacher quality before and after the busing program ended at the start of the 2002-2003 school year from the National Center for Education Statistics (NCES) and the North Carolina Education Research Data Center (NCERDC). Teachers knew the busing plan was coming to an end, which meant they had the opportunity to apply for positions in other buildings within the school system before any actual changes in student demographics occurred. Thus, Jackson (2009) took advantage of this natural experiment to analyze the process of teacher sorting in a school district that transformed from one that was integrated by race to one with high levels of *de facto* segregation.

Jackson (2009) discovered that an inflow of black students into a school corresponded to a departure of teachers highly ranked on several measures of teacher quality. These measures included years of experience, scores on teacher certification exams, and value-added models that estimated the impact of individual teachers on reading and math scores. Schools with an inflow of black students were more likely to lose both high quality white and black teachers. Jackson (2009) suggests that teacher sorting is primarily a result of preferences associated student characteristics related to

race, such as previous achievement or socioeconomic status. Jackson estimated (2009) that this drop in teacher quality in majority black schools potentially contributed to 3.3% of the black-white achievement gap in math and 7.5% in reading in Charlotte-Mecklenburg.

Houck (2010) conducted another natural experiment of teacher sorting in the Metropolitan Nashville Public Schools (MNPS) as it was released from unitary status and transitioned to a neighborhood schools student assignment policy starting in 1999 and running through 2004. In a similar fashion to Montgomery County, Maryland, Nashville provided compensatory funds to schools that contained a high percentage of poor and minority students. These funds were used for decreased student/teacher ratios, teacher in service trainings, longer school years, and additional programs for students. Conceivably, these compensatory programs would help to create a more positive working environment and work to offset at least some of the teacher sorting patterns seen in the Lankford et al. (2002), Hanushek et al. (2002) and Jackson (2009) research. Unfortunately, the same patterns emerged. Poor and minority students were more likely to have non-tenured teachers, a proxy for experience.

Houck's (2010) focus on teacher experience is important since Darling-Hammond (2000) suggests teachers are least effective during their first five years in the classroom. Achievement for poor and minority students might suffer if they are more likely to be taught by relatively novice teachers. Clotfelter et al. (2005) focused on this distribution of novice teachers by the race in North Carolina. They discovered that districts with high percentages of black students also contain disproportionate shares of novice teachers even while controlling for characteristics such as the percentage of students eligible for

free and reduced price lunch, size of the district, and district location. A partial explanation for this distribution is the fact that black students are over-represented in remedial or standard tracks and under-represented in advanced tracks. Novice teachers are more likely to teach these remedial or standard courses while more experienced teachers are more likely to teach these advanced courses. This distribution of teachers might reflect the personal preferences of more experienced practitioners as well as the relative influence of white parents in pressuring administrators to place more veteran teachers in these advanced courses.

Taken together, the research on finance disparities supports Zhang et. al's (2011) basic contention that the decentralized nature of school finance in the United States leads to inequities in per-pupil expenditures between states and districts. From a social justice perspective, the truly detrimental finding is that these disparities are related to the composition of school districts such that those students most in need of resource intensive school environments are the least likely to get them. Districts and schools with high percentages of poor and minority students are also much less likely to retain high-quality teachers, an important determinant of student achievement. It is apparent that teachers tend to gravitate towards schools and districts with fewer minority and poor students and those with higher overall student achievement. It may be that schools and districts are less likely to be able to provide the amount of additional compensation that might keep high-quality teachers in high-minority and poor schools due to the finance disparities highlighted above.

**Peer interactions.** The type and quality of peer interactions is likely another moderating factor between the racial and SES composition of schools and student

achievement. A basic contention is that students learn norms, expectations, and behaviors related to academic achievement from their peers. This learning takes place within the context of various peer interactions and can influence individual students in a positive or negative way. There is evidence to suggest that students' expectations and norms for academic behaviors and achievement vary as a function of their own socioeconomic status. These expectations and norms are then passed onto to other students in a school. Therefore, one reason low-income students tend to achieve more in predominately middle class schools is because, on average, they are exposed to more positive attitudes and behaviors related to academic achievement from their relatively advantaged peers.

In an early study of elementary schools, Brookover et al. (1978) discovered that school climate variables moderated the relationship between average achievement and the socioeconomic composition of a school's student body. School climate variables consist of the norms and expectations for behavior in an academic setting. In the case of schools, norms and expectations are communicated to students by adults as well as perceived and held by the students themselves. Brookover et al. (1978) analyzed school climate through a series of questionnaires given to students in a random sample of elementary schools across Michigan. In addition, the researchers collected data on student characteristics and overall achievement on the Michigan Assessment Program from the Michigan Department of Education.

In a regression analysis of mean achievement, the researchers first added the climate variables, which explained a large share of the variance. They then added the racial composition of the school, which added very little to the explained variance. A

similar pattern emerged for socioeconomic status when the school climate variables were first added to the regression analyses. School climate variables predicted a larger share of the variance in mean achievement between schools than the average socioeconomic status of the student body.

School climate variables were highly correlated with the composition of the student body. Low-income and high-minority schools were more likely to score lower on the various measures of school climate. The opposite pattern also held true since high-income and low-minority schools were more likely to score higher on the various measures of school climate. Yet, changes in student composition absent increases on the various measures of school climate did not guarantee higher mean achievement. Therefore, changes in student composition did not always determine school climate although, as mentioned above, these two variables were highly correlated. This study suggests that the relationship between student compositional variables and mean achievement is moderated by a school's academic climate.

Davis-Kean (2005) describes how students learn the sorts of academic norms and expectations mentioned in the Brookover et al. (1978) study as a function of their socioeconomic status. Davis-Kean (2005) relied on data from the 1997 Child Development Supplement of the Panel Study of Income Dynamics (PSID-CDS), which included information on families' socioeconomic status, parent-child interactions, parents' expectations for their children's education, as well as scores on the Woodcock-Johnson-Revised Tests of Achievement. Families' socioeconomic status was measured by parents' level of education, income, and the number of children in the home. Parents' expectations for their children's educational achievement were based on the amount of

schooling they expected their child to complete. Finally, parents were interviewed on three aspects of their home environment; reading behaviors, parent-child play, and parental warmth.

Parents' education showed a positive correlation to student scores on the Woodcock-Johnson-Revised Tests of Achievement. Using a structural equation model (SEM), Davis-Kean (2005) was able to demonstrate that parents' education is related to achievement scores indirectly through their expectations for their children's educational attainment, reading behaviors in the home, and warmth. This demonstrates that parents pass on academic expectations and behaviors to their children as a function of their own socioeconomic status. On average, children of parents with higher levels of education come to school from a more academically supportive environment than children of parents with lower levels of education. The Brookover et al. (1978) and Davis-Kean (2005) research demonstrates students hold different norms and expectations related to academic achievement depending on their socioeconomic status.

Other research has demonstrated how these norms and expectations for academic achievement are passed on to peers in a school setting. Ryan (2001) found that the influence of peer groups helped to moderate the decline in GPA that students, on average, experienced while moving from sixth through seventh grade. Ryan (2001) surveyed a group of seventh graders in an ethnically and economically diverse urban middle school. These students were surveyed at the end of their sixth grade year, their last year in elementary school, and the end of their seventh grade year, their first year in middle school. As part of the survey, Ryan (2001) asked students to develop a list of their closest friends in school. From these lists, Ryan (2001) developed numerous peer groups

within the building. These peer groups refer to an individual's small, relatively intimate group of friends who interact with each other on a regular basis.

On average, students' GPAs declined from the end of sixth grade through the end of seventh grade and they reported lower motivation for schoolwork during this time. Yet, the influence of peer groups helped to moderate this decline. Students who associated with higher achieving peers experienced less of a decline in GPA and motivation than those students who associated with lower achieving peers. This pattern developed even when the researcher controlled for selection biases in the regression analyses. Ryan (2001) hypothesized that socialization within peer groups accounts for their influence on individual achievement. This socialization consists of frequent interactions, shared experiences, and the exchanging of information. Ryan (2001) demonstrates that close peers have a significant influence on individual attitudes and behaviors towards school.

Mounts & Steinberg (1995) came to a similar conclusion when they surveyed a sample of 9$^{th}$ through 11$^{th}$ graders from California and Wisconsin in the fall and spring semesters. The researchers selected a sub-sample of 1,000 students who were present for both administrations of the survey and used those results for their analyses. The survey asked students a series of questions related to adolescent life, including a list of their five closest friends. The key finding is that friends' GPAs were highly predictive of individual students' GPAs even after controlling for selection biases. In addition, individual students' GPAs became more similar to their friends' over time, suggesting that this influence is cumulative at the high school level.

Molloy et al. (2011) focused on a wider variety of possible peer influences on

academic outcomes than either Ryan (2001) or Mounts & Steinberg (1995). Molloy et al. (2011) looked at the relative influence of reciprocated friendships, interaction dyads, and shared group memberships on measures of academic engagement before and after the transition to middle school in the fifth and seventh grades. Academic engagement consists of both academic self-concept and academic effort. These two variables were operationalized as enthusiastic and focused involvement in academic activities and they manifest themselves in behaviors such as effort and active class participation. Friendships were defined as mutual, liking relationships that are characterized by an increasing importance placed on sharing, disclosure, trust, loyalty, and emotional support in early adolescence. Interaction dyads are peers who share frequent interactions and are an important setting for children to acquire competencies, learn social skills, and develop sets of beliefs and behaviors. Shared group membership consists of social groups of three or more students that become a source for individual identity, resources, and positive feelings of belonging and being liked. These three forms of social interactions are distinct, but also often overlap.

The students all came from a small, working class school district in central Pennsylvania. While the students were overwhelmingly white, the socioeconomic make up of the sample is similar to other rural communities across the U.S. The results indicate that socialization processes influence individual student academic engagement across all three types of peer groups. Friendships appear to have the strongest influence on academic effort, but interaction dyads and social groups also have a significant influence on academic engagement. Peer group influences appear to be stronger in

seventh than fifth grade, which is consistent with prior research that indicates adolescents are more susceptible to contextual impacts.

Ryan (2001) and Molloy et al. (2011) suggest that socialization processes are the medium through which peers influence individual academic outcomes. Harris (2010) conducted a meta-analysis of research on how peers influence academic outcomes and developed a "group-based contagion" theory from the available evidence. This theory has three major characteristics. The first is that individuals follow the lead of their classmates, especially those classmates who belong to a similar group. This group might be based on a shared racial background, but can consist of any number of characteristics. The second characteristic of group-based contagion theory states that disadvantaged peers, minorities and those from low–income backgrounds, benefit academically from advantaged peers to a greater extent than fellow advantaged peers.

The third characteristic is that peers influence the quality of school resources, which moderates the relationship between average student composition variables and individual achievement. This assertion is in line with the research that suggests that the amount and quality of district and school level resources often vary as a function of the composition of students themselves. Group-based contagion theory also points to academic benefits of providing a setting where students from low-socioeconomic backgrounds can interact with peers from relatively high-socioeconomic backgrounds. Unfortunately, for many students from low SES backgrounds, this sort of interaction is less likely to occur because they are forced to attend school with high concentrations of like peers.

**Parental influences.** Another line of research finds evidence that parental involvement in schools and the social capital that they wield helps to moderate the relationship between the average socioeconomic status of a school's student body and achievement. Social capital can be described as the "density and consistency of educationally-focused relationships that exist among parents, children, and schools" (Teachman, 1997). There is evidence of social capital in such formal organizations such as the PTA or Booster Clubs as well as more informal communication between groups of parents and school officials. Pong (1998) found that school level averages on a measure of social capital moderated the relationship between the average socioeconomic status of students and individual 10th Grade achievement scores.

Pong (1998) utilized the National Education Longitudinal Study (NELS) to collect data on student demographics and achievement scores on math and reading exams. Pong (1998) also collected data on the percentage of single parents in a school. This school level demographic variable, the percentage of single parents, is positively correlated with the percentage of students who are eligible for FRPL and who are minorities. Therefore, the percentage of single parents became a proxy for school level SES. The NELS datasets also included students' survey responses about their parents' social capital. These questions revolved around parents' participation in school and relationships with acquaintances outside of school.

Pong (1998) discovered a negative correlation between the proportion of single parents in a school and scores on the NELS math and reading exams. Pong (1998) found that the school level measures of parents' social capital moderated this relationship between single parenthood and achievement. This pattern was evident even after

controlling for the percentage of minorities in a school, the percentage of student eligible for FRPL, school location, school type, and school size. Thus, single parents were less likely to exercise social capital, which in turn, was associated with lower average achievement test scores for all students in a school, not just their own children.

Goddard (2003) also found that the average social capital exercised in a school moderated the relationship between school level measures of student socioeconomic status and individual test scores on the Metropolitan Achievement Test. This study focused on 45 elementary schools in a large urban school district in the Midwest. Goddard (2003) collected school level demographic and achievement from the central administrative office of the school district. Goddard (2003) also administered a survey to school faculty that asked a series of questions aimed at discerning the average level of social capital exercised by parents and community members in a school. The social capital questions focused on three broad topics; the relational networks that connect parents and community members and facilitate student learning, trusting relationships among students and parents, and norms that support student learning. Goddard (2003) also created a variable to describe the average socioeconomic status of a school as measured by the percentage of students eligible for FRPL.

There was a significant, negative correlation between school level measures of social capital and student socioeconomic status. In an analysis of variance, both the average socioeconomic status of students in a school and the average social capital exercised by parents and community members explained a unique proportion of the variance in student scores on the Metropolitan Achievement Test. Goddard (2003) also developed a multilevel analysis, which showed that school level social capital, not SES,

significantly predicted which students would pass the achievement test. Goddard's (2003) and Pong's (2008) research demonstrates that the average social capital exercised in a school is correlated with school level socioeconomic status. In Goddard's (2003) study school level measures of social capital were negatively correlated with SES as measured by the percentage of students eligible for FRPL. In Pong's (1998) study the percentage of single mothers in a school was correlated with two measures of SES, the proportion of students eligible for FRPL and who were minorities. In both cases, the average social capital available to a school moderated the relationship between school level measures of SES and achievement.

**Summary points.** There are several lines of research that examine the moderating factors between school level demographics and individual student achievement. Minority and low-income students are more likely to attend schools that are funded significantly below their white and middle class peers. These funding inequities are partly the result of the United States' decentralized school finance processes. In addition, minority and low-income students are more likely to be taught by lower quality teachers, which can work to depress academic achievement. There is also evidence to suggest that academic norms and expectations vary as a function of student's socioeconomic class. Students pass these norms and expectations onto their peers, which have a significant influence on individual student achievement. Finally, the average social capital, which is correlated to socioeconomic status, exercised in a school can work to the academic benefit of all students in that building.

The research surrounding these moderating factors lends weight to the argument that school integration will work to the benefit of all students. Integrated schools will be

places where minority and low-income students experience the same resource rich educational environments as their white and middle class peers. Purposeful integration will help to ensure that financial inequities and teacher quality are not a function of student compositional factors. Integrated schools will also make it more likely that all students benefit from positive peer influences and parents' social capital, which will increase average academic engagement and achievement.

**Variables of Interest**

This study focuses primarily on two variables, high school graduation rates and socioeconomic status. Graduation from high school is an important area of focus because of its correlation to numerous private and public benefits. Private benefits are enjoyed by the individual and include qualities such as increased income or participation in the labor market. Public benefits have a positive impact on society at large and include variables such as decreased crime rates or increased tax revenues. The weight of research indicates that graduating from high school conveys numerous private benefits on individuals as well as public benefits to society at large.

**Private benefits.** The Organisation for Economic Co-operation and Development (OECD) produces a yearly report, Education at a Glance, on the state of education in participating nations. This report is important because it provides rich descriptive data on the relationship between educational attainment and numerous private and public benefits in the United States. The OECD often breaks data into gender and age variables that, while not ideal for this research, still provides a concise picture of the state of education. As of 2009, individuals with a high school diploma were much more likely to be employed in the United States as compared to those did not complete their secondary

education. 72.9% of males and 64.8% of females who had graduated from high school were employed full time as compared to 62.2% of males and 41.5% of females who did not complete their secondary education. Written another way, the unemployment rate was11.5% for males and 7.7% for females with a high school diploma. The unemployment rate was 15.9% for males and 14.6% for females who did not complete their secondary education.

Levin et al. (2007) provide additional support to the idea that high school graduation conveys private benefits to individuals. Using slightly older data from the 2003-2004 Current Population Survey (CPS), Levin et al. (2007) also found that employment rates were much higher for high school graduates as compared to high school dropouts. As one example, 66% of black male high school graduates were employed as compared to 49% of black males who dropped out of high school. They also discovered that high school graduates have higher average yearly incomes. For example, white females who have graduated earn on average $16,500 a year. This drops to $7,800 for white females who dropped out of high school.

There is some evidence to suggest that the private benefits of higher levels of education have increased in recent years. Henderson et al. (2011) examined Decennial Census Data from 1940 through 2000 as well as the American Community Survey (ACS) of 2005. Henderson et al. (2011) confirmed earlier findings that higher levels of education increased individual earnings. The researchers calculated a rate of return to education, which determined the average increase in salary for each additional year of education. This rate of return to education has increased in the past 15 years, which lends significance to research that examines high school graduation rates. High School

Graduation also opens to the door to post-secondary educational opportunities. As Henderson et al.'s (2011) research indicates, these additional years of education have financial benefits.

Henderson et al. (2011) also claim that the private benefits of education are heterogeneous across different racial groups in the United States. Black workers typically have a higher rate of return to education than whites. In 1950 black workers experienced a 1.4% greater rate of return to education as compared to white workers. This rate of return remained essentially the same until 2005, when it increased to 4%. Henderson et al. (2011) believe a partial explanation for this differential rate of return to education lies in the relatively advantaged economic situation of white workers as compared to blacks. Since whites are disproportionately advantaged, higher levels of education is more likely an expectation and thus brings smaller rates of return. The opposite pattern holds for black individuals who are disproportionately disadvantaged. This lends further importance to research on graduation rates since increases in education holds the promise of reducing economic disparities between white and black workers in the United States.

Psacharopoulos (2006) conducted a literature review of studies that examined the private and public benefits of education. Psacharopoulos (2006) highlights some additional private benefits of increased educational attainment. Nonwage remuneration, fringe benefits and working conditions, are greater for those with higher levels of education. More educated individuals also have greater total assets and savings than those with lower levels of education. Finally, increased education also improves life expectancy.

**Public benefits.** There are also numerous public benefits to high school graduation. Levin et al. (2007) examined figures from existing data sources as well as a cohort of individuals who were 20 years old in 2005. In one analysis they looked at the Medical Expenditure Panel Survey (2004) from the U.S. Department of Health and Human Services. High School Graduates enroll in Medicare at about half the rate of dropouts, which reduces governmental health expenditures. This lower enrollment is reflected in reduced predicted public health expenditures for those who graduate from high school in their cohort of 20 year olds. For example, Hispanic males who earn a high school diploma are expected to command $24,800 in public health dollars over the course of their lifetime. This increases to $59,000 for those who dropout of high school.

High School Graduates are also less likely to commit numerous crimes. Levin et al. (2007) examined data from the 2004 Uniform Crime Reports (UCR) collected by the Federal Bureau of Investigation (FBI). High School Dropouts are more likely to commit violent and property crimes as well as drug offenses. High School Graduates are also less likely to receive numerous social services. Using data from 2004 Current Population Survey, Levin et al. (2007) discovered that high school graduates are 40% less likely to receive Temporary Assistance for Needy Families (TANF) and 19% less likely to receive Food Stamps as compared to those who dropout of high school.

Psacharopoulos (2006) estimates that educational attainment contributes to 15% of economic growth in the United States. It appears that much of this correlation is due to the moderating influence of higher worker output related to increases in educational attainment. Psacharopoulos (2006) also discovered that increased levels of educational attainment results in lower per-capita police expenditures, increased charitable donations,

greater educational attainment and scholastic achievement for offspring, lower reliance of income transfers and higher rates of voting. In the OECD report mentioned above, 69.6% of citizens in the United States who graduate from high school vote in national elections as compared to 42.4% of those who do not complete their secondary education.

Psacharopoulos (2006) found a large reduction in tax revenues due to high school dropouts. High School Graduates pay about $60,000 more in state and federal taxes over their lifetime as compared to those who dropout. This results in $192 billion in lost income and tax revenues for each cohort of 18 year olds who never complete their high school education. This $192 billion represented 1.2% of Gross Domestic Product (GDP) in 2005. It is also more expensive to provide health services to high school dropouts. These additional costs averaged $100,000 per student in 2004.

Increased educational attainment in general and high school graduation specifically conveys numerous private and public benefits. High School Graduates are more likely to be employed and earn higher wages in those jobs than those who dropout. High School Graduates are less likely to rely on costly medical and social services, commit various crimes, and are more likely to vote in national elections and pay more in state and federal taxes over their lifetimes. These benefits point to the importance of using graduation rates as an outcome variable in educational research. Such research could inform effective public policy in implementing strategies designed to increase the number of high school graduates.

**Measuring socioeconomic status (SES).** In the landmark study *Equality of Educational Opportunity,* James Coleman was primarily interested in the educational experiences of students from different racial and ethnic backgrounds. A primary finding

was that minority students, due to *de facto* segregation, were much less likely to attend schools with the sorts of resources that facilitate academic achievement, including academically oriented peers. James Coleman also described the composition of schools' student populations through a series of variables that revolved around socioeconomic status. These variables included the education level of their parents, family structures at home, the presence of items in the home associated with economic success, parents' aspirations for their students' education, how often parents supported their children's education, the amount of reading matter in the home, students geographic mobility, behavior issues at school, and the number of dropouts. More recent educational research has often focused on a single variable to describe a student's economic background, eligibility for the Federal Free and Reduced Price Lunch Program (FRPL) (Sirin, 2005).

Using FRPL to describe the socioeconomic status of students has three important advantages. The first is that it is well established in the research literature that student achievement is related to eligibility for this program. As has been demonstrated in previous sections, students who are eligible for the FRPL program are at risk for lower academic achievement. The second is that eligibility for FRPL is a widely collected metric by nearly all public schools across the nation that requires parents to truthfully report their household income, under the threat of criminal prosecution. The third is that eligibility is reserved for those families that make up to 185% of the federal poverty level. This means that a wide range of families can sign up for FRPL so it more accurately reflects the number of students whose achievement is negatively impacted by an impoverished economic background.

Despite these advantages, there are some limitations to using eligibility for FRPL as a measure of socioeconomic status, as highlighted by Harwell & LeBeau (2010). The first is that many students are incorrectly identified as eligible or ineligible for FRPL. Harwell & LeBeau warn that up to 20% of students in a sample could be incorrectly labeled as either eligible or ineligible for the program. The second is that student eligibility is usually based on federal poverty guidelines, which often fail to account for factors that cause additional burdens for families or the numerous in-kind benefits poor families often receive. The third is eligibility for FRPL is a dichotomous variable; a student either is or is not eligible for the program. Therefore, it does not capture the impacts that variations in income within each eligibility category might have on student achievement. The fourth is the students are less likely to participate in the program as they move into secondary school. This makes it more difficult for researchers to get an accurate count of the number of individuals receiving FRPL when the sample consists of high school students. Finally, there is a confounding effect where participation in the FRPL program might actually offset some of the negative academic impacts of living in poverty. This makes it difficult for researchers to assess the true impacts of growing up in a low-income environment on student achievement.

Lubienski & Crane (2010) conducted an analysis of the effectiveness of variables beyond eligibility for FRPL in predicting student achievement. This study relied on data from The Early Childhood Longitudinal Study-Kindergarten Class of 1998-1999 (ECLS-K). A key advantage of this dataset is that parents answered a wide array of interview questions about themselves and their families as their children were starting kindergarten. These interviews responses provide a more detailed picture of students' background

characteristics that might impact achievement. Lubienski & Crane (2010) discovered that the number of children in a household, mother's age at first birth, and children's books at home all helped to predict math and reading achievement in elementary school. Lubienski & Crane (2010) suggest that these measures should be used to supplement collection on FRPL eligibility. Collection of data on these additional variables would serve to reduce or eliminate some of the drawbacks to using eligibility for FRPL as a measure of SES as highlighted by Harwell & LeBeau (2010).

**Summary points.** The goal of this section was to establish the logic in using high school graduation rates as a measure of academic achievement and an analysis of the benefits and drawbacks to using eligibility for FRPL as a measure of socioeconomic status. Graduation from high school is associated with numerous private and public benefits and is a necessary prerequisite for various post-secondary educational opportunities. This connection between graduating from high school and numerous important life outcomes makes it an important variable for educational researchers to focus on as a way of informing sound public policy. There are three key advantages to using eligibility for FRPL as a measure of socioeconomic status. Eligibility for FRPL is associated with lower academic achievement, it is widely collected metric by nearly all public schools, and it captures a wide range of students who are likely hampered by growing up in a low-socioeconomic environment. The drawbacks include the fact that many students are incorrectly labeled as eligible or ineligible for the program, it does not include the potentially numerous in-kind benefits families receive, it is a dichotomous variable, students are less likely to participate in the program as they enter secondary

school, and participation in the program might work to offset some of the negative impacts of living in poverty.

# III. METHODOLOGY

This study built on the research literature that demonstrates the composition of a school's student body exerts a significant, independent influence on individual student achievement. The first research question examined the relationship between mean graduation rates for the 2011 cohorts and measures of the overall socioeconomic and racial composition of high schools. The second research question examined the relationship between mean graduation rates for certain subsets of students in the 2011 cohorts and measures of the overall socioeconomic and racial composition of high schools. The third research question looked at the relative impact of measures of the overall socioeconomic and racial composition of high schools on graduation rates.

This study explored these three research questions through several analyses. Descriptive analyses looked at how mean graduation rates for all students in the 2011 cohorts differed as a function of measures of the overall socioeconomic and racial composition of high schools. Then, the significance of these differences in mean graduation rates for all students in the 2011 cohorts was analyzed. Next, correlations were run between these measures of the overall socioeconomic and racial composition of high schools and mean graduation rates for students in the 2011 cohorts.

Descriptive analyses then looked at how mean graduation rates for certain subsets of students in the 2011 cohorts differed as a function of the overall socioeconomic and racial composition of high schools. Then, the significance of these differences in mean graduation rates for certain subsets of students in the 2011 cohorts were analyzed. Finally, regression analyses looked at how much of the variance is mean graduation rates

for the 2011 cohorts could be explained by measures of the overall socioeconomic and racial composition of high schools as compared to other school level variables.

As a consequence of these analyses, this study also looked at the relatively underdeveloped concept of "tipping points." Policy analysts such as Richard Kahlenberg (2001) and Richard Rothstein (2004) suggest that public school officials should strive to integrate schools such that no more than a certain percentage of low SES students attend any one building. Richard Kahlenberg (2001) believes that no school should serve a student population where more than 50% of students come from low SES backgrounds. Richard Rothstein (2004) believes the figure is closer to 40%. There is little research to support the concept of "tipping points," but it is an area of high importance for those who would hope to craft policies that leverage peer effects for the benefits of all students.

**Data**

Data was gathered from the Virginia Department of Education (VDOE) website. The VDOE has annually published demographic and achievement data on each graduating cohort of high school students since 2008. The VDOE also publishes demographic and Standards of Learning (SOL) achievement data on entire schools as part of two separate, searchable databases. In addition, the VDOE annually uploads a "Report Card" for each school in the state. These report cards contain data on school level measures such as the number and type of school safety infractions, the percentage of students enrolled in AP courses, the percentage of provisionally licensed teachers, and the percentage of teachers with various degrees. This data from the VODE website is available to the general public and is completely anonymous.

302 public, "regular" high schools were part of this study. This excluded all public high schools that are charters, Governor's Schools, or are otherwise tailored to educate certain subsets of high school aged students in Virginia. Governor's Schools attract students across district lines and only grant admission after a competitive application process. This study focused on students in the graduating cohort of 2011. Demographic data was also collected from the cohorts of 2010, 2009, and 2008. This was designed to formulate a more accurate picture of the school level student compositional variables that might have impacted graduation rates for the members of the 2011 cohorts.

**Defining Variables**

Graduation Rates were derived from the Virginia On-Time Graduation Rate. This focus on graduation rates is important for two key reasons. The first is that graduating from high school is associated with a host of positive life outcomes, as detailed in the literature review. To the extent that education should provide practical benefits to students, researchers should be interested in the relationship between graduation rates and school level variables. The second is that graduation rates are an outcome variable less often used in the research literature than achievement tests. It is imperative that researchers come to be a better understanding of the relationship between this particular outcome variable and various school level characteristics.

The Virginia On-Time Graduation Rate creates a cohort of students as they enter ninth grade and then calculates the number of students from that group who earn a Board of Education Approved Diploma four years later. Transfer students are removed from their original high school's cohort count and then added to their receiving school.

Calculating the On-Time Graduation Rate involves taking the total number of graduates in a particular cohort and dividing it by the total number of ninth graders from four years earlier plus transfers in and minus transfers out. There are exceptions made for students who are Limited English Proficient (LEP) or have disabilities that would require they take more than four years to graduate.

The primary alternative measure of graduation rates is the Federal Graduation Indicator, which is used in calculations of Adequate Yearly Progress (AYP). There are two key differences between the Federal Graduation Indicator and the Virginia On-Time Graduation Rate. The Federal Graduation Indicator calculates the percentage of students who graduate within four, five, and six years of entering ninth grade. In addition, the Federal Graduation Indicator only includes those students who graduate with an Advanced Studies or Standard Diploma. This excludes those students in Virginia who graduate with a Modified Standard, Special, or General Achievement Diploma. Modified Standard and Special Diplomas are intended for those students whose disabilities make it unlikely they would meet the requirements for an Advanced Studies or Standard Diploma. General Achievement Diplomas are designed for individuals who are at least 18 years old and who have dropped out of high school. It requires that they complete certain high school courses as well as earn a passing score on the General Educational Development (GED) exam.

There are three key advantages of the Virginia On-Time Graduation Rate as compared to the Federal Graduation Indicator. The first is that it is a more stringent measure of academic achievement because the expectation is that students will graduate within four years of enrolling in ninth grade. Public schools should push their students to

graduate in four years so that they can productively maximize their early adult years by taking advantage of employment and/or post-secondary educational opportunities. There is also a financial benefit to public schools since they no longer have to pay for the education of individuals who have graduated.

The second advantage is that is the Virginia On-Time Graduation Rate includes all Virginia Board of Education Approved Diplomas. This recognizes the real achievement of students with disabilities who may not have the capacity to earn an Advanced Studies or Standard Diploma. A General Achievement Diploma is only designed to be an option of last resort and students are only counted as "on-time" graduates if they complete the requirements for this diploma within four years. Therefore, school divisions cannot artificially increase their On-Time Graduation Rate by encouraging struggling students to dropout and earn a General Achievement Diploma at a later date.

The third advantage is that the Virginia Department of Education (VDOE) disaggregates Virginia On-Time Graduation Rates by student demographic categories. Under the Federal Graduation Indicator, the VDOE only disaggregates graduation rates by student demographic categories for those high schools that fail to meet the federal graduation benchmarks for AYP. These benchmarks include graduating 80% of students with an Advanced Studies or Standard diploma within four, five, or six years, or reducing the percentage of ninth graders who do not graduate within four years by 10%. Because of the limited number of high schools in Virginia that fail to meet the AYP graduation benchmarks, it is much more efficient and cost-effective to analyze how graduation rates

might vary according to student demographics by using the Virginia On-Time Graduation Rate.

Socioeconomic Status was defined using the VDOE variable "economically disadvantaged anytime." Economically disadvantaged anytime students are at a higher risk of not graduating as compared to their middle and upper income peers in Virginia. In 2011, economically disadvantaged anytime students graduated at a rate of 79.1% as compared to 87.1% of all students. Economically disadvantaged anytime is a dichotomous variable and includes all students who meet at least one of four different criteria at some point during their high school careers. Students are considered economically disadvantaged anytime if they were eligible for the Federal Free and Reduced Price Lunch Program (FRPL), received Temporary Assistance for Needy Families (TANF) benefits, were eligible to receive Medicaid benefits in Virginia, or had been identified as migrant or experiencing homelessness.

The federal government has established the eligibility requirements for FRPL as well as rules for determining whether or not students can be considered migrant or homeless. Students are eligible to receive free school breakfasts and lunches if their family earns up to 130% of the Federal Poverty Guidelines. Students can receive reduced price school breakfasts and lunches if their family earns up to 185% of the Federal Poverty Guidelines. The McKinney-Vento Homeless Assistance Act (Title X, Part C of the No Child Left Behind Act) provides criteria states use to determine if students are considered homeless. The No Child Left Behind Act also stipulates which students can be considered migrant. TANF and Medicaid are Federal programs, although the eligibility requirements for both are established by individual states. The Virginia

Department of Social Services publishes the income eligibility requirements to receive TANF benefits. The Virginia Department of Social Services also publishes the income and non-income eligibility requirements for receiving Medicaid Services.

There are certain benefits to using the variable economically disadvantaged anytime as a measure of socioeconomic status. The first is that is captures a broader number of students likely impacted from growing up in an impoverished economic environment than the widely used metric of FRPL in the research literature. This is due to the fact that students are measured against four different criteria and remain labeled by the state even if they meet the requirements for only a portion of their high school careers. This variable is also easy and cost-effective to collect. Data using this variable was easily downloaded from the VDOE website and did not require additional surveys, interviews, or any collection of personal information.

The VDOE also collects a yearly count of the number of students in each school that are considered economically disadvantaged. A student is considered economically disadvantaged if they meet one of the four criteria for economically disadvantaged anytime listed above. Yet, unlike the designation of economically disadvantaged anytime, a student can be considered economically disadvantaged for one school year only. Their status as economically disadvantaged must then be reevaluated at the start of the next school year (C.W. Bazzichi, personal communication, July 19, 2012). It is important to use the variable economically disadvantaged anytime, as opposed to economically disadvantaged, because the percentage of students labeled as economically disadvantaged tends to drop off in high school. As of the 2010-2011 school year, 59.00% of all black students in Virginia were also labeled as economically disadvantaged as well

as 57.20% of Hispanics and 22.35% of whites. Yet at the high school level, these numbers drop to 49.60% of blacks, 48.58% of Hispanics, and 17.72% of whites. There is research literature to corroborate this phenomenon that high school students are less likely to be labeled as coming from low SES backgrounds (Harwell & LeBeau, 2010).

There is little reason to believe that, on average, students' economic situations suddenly improve in high school. Researchers such as Harwell & LeBeau (2010) suggest that high school students are less likely to sign up for FRPL out of embarrassment. Using the term economically disadvantaged anytime worked to offset some of the decline seen in the use of this label during high school. As an example, 63 twelfth graders at Arcadia High School were labeled as economically disadvantaged during the 2010-2011 school year. At the same time, 93 students in the same graduating cohort met the definition of economically disadvantaged anytime.

There is one important drawback to the variable economically disadvantaged anytime. The Virginia Department of Education only publishes data on the percentage of students who are considered economically disadvantaged anytime for each graduating cohort, not an entire high school. When reporting on general demographic trends or school wide data, the VDOE only uses the term economically disadvantaged (C.W. Bazzichi, personal communication, July 19, 2012). Remember, this study focused on the graduating cohort of 2011. One possible solution to address this drawback would be to simply assume that the percentage of economically disadvantaged anytime students in the 2011 cohort is an accurate measure of the percentage of students who could be labeled economically disadvantaged anytime in the entire high school. Fortunately this is not necessary because the VDOE publishes demographic data on graduating cohorts prior to

2011. Thus, it was possible to calculate an average of the percentage of students labeled economically disadvantaged anytime from the 2011, 2010, 2009, and 2008 cohorts. This average was used as the measure for the percentage of students in each high school who are considered economically disadvantaged anytime by the VDOE.

With a few exceptions, students in the 2011 graduating cohort attended high school in the same building as those from the 2010, 2009, and 2008 graduating cohorts. It was important to gather data on the level of economic disadvantage from these previous cohorts in order to create an accurate picture of the possible peer effects that would have impacted the graduation rates of the various 2011 cohorts. As the 2011 cohort moved onto progressively higher grades in high school, new students entered each building that would compromise future cohorts. Unfortunately, the percentage of students labeled economically disadvantaged anytime is not available for these future cohorts. Using an earlier cohort, prior to 2011, for analysis is not possible either since longitudinal data is not available for cohorts prior to 2008. Calculating this average was the best solution to address the drawback that the VDOE only publishes the percentage of students labeled as economically disadvantaged anytime for graduating cohorts, not entire schools, because it relied on actual demographic data from previous cohorts and only made assumptions about the level of economic disadvantage in future cohorts.

The VDOE categorizes students according to the following racial categories; black, Hispanic, white, Asian, American Indian, Native Hawaiian, as well as two or more races. This study only focused on black, Hispanic, and white students since they comprised over 90% of the high school aged population in the state of Virginia during the academic year of 2010-2011. Blacks and Hispanics were grouped together and were

referred to by the term "underrepresented minorities." Underrepresented minorities graduate at a lower rate than whites in Virginia. Using the Virginia On-Time Graduation Rate, only 80.3% of black and 79.2% of Hispanic students in the 2011 cohorts graduated. This is compared to 89.7% of whites. In addition, researchers often express achievement gaps in terms of average differences among different racial or ethnic groups. Across numerous measures of achievement, blacks and Hispanics continue to lag behind their white peers in the United States (Battle & Lewis, 2002, Berends & Penaloza, 2010, Haile & Nguyen, 2008, Rumberger & Palardy, 2005). Therefore, blacks and Hispanics are referred to as underrepresented minorities because they are less likely to graduate from high school in Virginia and lag behind their white peers on various measures of achievement.

**Other school level variables.** Regression analyses were also used to determine the relative influence of school wide student demographics on graduation rates, as compared to other school level variables. The first set of these variables, scaled reading and writing scores as well as the percentage of students enrolled in at least one Advanced Placement (AP) course were included to determine if school wide student demographics were simply a proxy for student academic ability. Scaled reading and writing scores, were derived from each high school's participation in Virginia's Standards of Learning (SOL) exams. It is was critical to determine if school wide student demographics exerted an independent influence on graduation rates. If so, it would provide justification for policies aimed at the purposeful integration of schools.

Three other variables, the percentage of Limited English Proficient (LEP) students, the percentage of students with disabilities, and the School Safety Ratio, were

included to determine how characteristics of students, beyond demographic variables, might explain some of the variance in graduation rates. LEP students, students with disabilities, and students who are more likely to disrupt the learning environment of others may be less likely to graduate and they might be concentrated in schools with relatively high concentrations of economically disadvantaged anytime and underrepresented minority students. In this scenario, the percentage of LEP students, the percentage of students with disabilities, and the school safety ratio might reduce the amount of variance in graduation rates apparently explained by student demographic variables.

It is also important to include a note about the variable School Safety Infractions, which was used in the regression analyses. School Safety Infractions consist of a variety of student misbehaviors that fall into one of several categories; weapons offenses, offenses against students, offenses against staff, other offenses against persons, alcohol, tobacco, and other drug offenses, property offenses, disorderly or disruptive behavior offenses, technology offenses, and a category termed all other offenses. The assumption is that school safety infractions disrupt the learning environment in some way and possibly explain some of the variance in mean graduation rates for the 2011 cohorts. School level administrators are responsible for coding student misbehaviors into the following categories and then the VDOE publishes this data as part of each school's Report Card. Under No Child Left Behind, the VDOE is also required to identify and make publically known the number of schools in the state that meet the Virginia Board of Education's definition of "Persistently Dangerous Schools."

School level administrators might find it advantageous to either not report some school safety infractions or code relatively dangerous incidents as something more benign. This is certainly a drawback, but no other database of school safety infractions exists in Virginia. This study only calculated a ratio of total school safety infractions with no regard to how individual misbehaviors are categorized. An argument that declares that one type of school safety infraction is more or less disruptive to a school's learning environment is very subjective. Therefore, it was more appropriate to compare high schools based on their overall ratio of school safety infractions and assume that schools with proportionally higher numbers of school safety infractions faced greater disruptions to their learning environment than schools with proportionally lower numbers of school safety infractions.

Finally, four variables were included in the regression analyses to measure teacher quality. These were the percentage of teachers whose highest degree attained is a bachelor's, the percentage of teachers whose highest degree attained is a master's, the percentage of teachers whose highest degree attained is a doctorate, and the percentage of provisionally licensed teachers. As illustrated in the review of literature, teacher quality is a variable that moderates the relationship between student demographics and achievement. It was essential to examine this relationship in Virginia's high schools in order to develop effective policy recommendations. For example, if the measures of teacher quality explained nearly all of the variance in graduation rates, policies aimed at enticing high quality teachers to work in low-income, racially segregated schools might be a more effective way to raise graduation rates than the purposeful integration of schools.

**Analyses**

In order to conduct the analyses, high schools were divided into intervals based on either their average percentage of economically disadvantaged anytime students or percentage of underrepresented minorities (see Tables 1 and 2). These ranges allowed for variability in the data without creating intervals that were so large that they masked important differences between high schools along the variables of interest. A descriptive analysis looked at how the mean graduation rates for the 2011 cohorts varied between intervals created by the average percentage of economically disadvantaged anytime students in high schools. Another descriptive analysis examined how the mean graduation rates for the 2011 cohorts varied between intervals established by the percentage of underrepresented minorities in high schools.

Next, a One-Way Analyses of Variance examined the significance of these differences in mean graduation rates for the 2011 cohorts between intervals established by the average percentage of economically disadvantaged anytime students in high schools. Another One-Way Analysis of Variance looked at the significance of these differences in mean graduation rates for the 2011 cohorts between intervals created by the percentage of underrepresented minorities in high schools. After that, a correlation was run to study the relationship between mean graduation rates for the 2011 cohorts and the average percentage of economically disadvantaged anytime students in high schools. Another correlation was run to look at the relationship between mean graduation rates for the 2011 cohorts and the percentage of underrepresented minorities in high schools.

Table 1

*Percent Ranges in ED Anytime Intervals*

| Interval Number | ED Anytime | *N* |
|---|---|---|
| 1 | 0.0-19.9 | 54 |
| 2 | 20.0-29.9 | 52 |
| 3 | 30.0-39.9 | 39 |
| 4 | 40.0-49.9 | 63 |
| 5 | 50.0-59.9 | 44 |
| 6 | 60.0-64.9 | 23 |
| 7 | 65.0-100.0 | 27 |

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.

Table 2

*Percent Ranges in UM Intervals*

| Interval Number | UM | *N* |
|---|---|---|
| 1 | 0.0-9.9 | 72 |
| 2 | 10.0-19.9 | 52 |
| 3 | 20.0-29.9 | 53 |
| 4 | 30.0-49.9 | 59 |
| 5 | 50.0-69.9 | 41 |
| 6 | 70.0-100.0 | 25 |

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.

Another set of descriptive analyses examined the mean graduation rates for just economically disadvantaged anytime students in the 2011 cohorts between intervals created by the average percentage of economically disadvantaged anytime students in high schools. The final set of descriptive analyses looked at the mean graduation rates just for underrepresented minorities in the 2011 cohorts between intervals created by the percentage of underrepresented minorities in high schools. Next, a One-Way Analysis of Variance was used to examine the significance of these differences in the mean graduation rates for economically disadvantaged anytime students in the 2011 cohorts between intervals created by the average percentage of economically disadvantaged anytime students in high schools. After that, a One-Way Analysis of Variance was used to look at the significance of these differences in the mean graduation rates for underrepresented minorities in the 2011 cohorts between intervals created by the percentage of underrepresented minorities in high schools.

The same series of descriptive and inferential analyses were then conducted when high schools were divided into deciles instead of intervals. These decile ranges and the results of those analyses are found in Appendix A. These results were not included in the results section for two reasons. The first is that the pattern of results by deciles mimicked the pattern of results by intervals and only served to reinforce the essential conclusions presented in the results section. The second is that the results by intervals were seen as more suitable for justifying certain policy recommendations made in the final chapter.

Finally, linear regressions were used to examine how much of the variance in mean graduation rates among high schools could be explained by student demographic characteristics as compared to other school level variables thought to influence academic

attainment. The regressions were run using two distinct modeling procedures. Using one set of modeling procedures, the average percentage of economically disadvantaged anytime students was added along with the following school level variables to examine their relative influence on graduation rates, average scaled scores on Virginia's Standards of Learning (SOL) reading exam, average scaled scores on Virginia's SOL writing exam, the percentage of Limited English Proficient (LEP) students, the percentage of students with disabilities, the percentage of teachers whose highest degree attained is a bachelor's, the percentage of teachers whose highest degree attained is a masters, the percentage of teachers whose highest degree attained is a doctorate, the percentage of provisionally licensed teachers, the percentage of students enrolled in at least one Advanced Placement (AP) course, and the School Safety Ratio. Then, the same process was used with the percentage of underrepresented minorities instead of the average percentage of economically disadvantaged anytime students.

In the second modeling procedure, a correlation matrix was created to determine which school level variables were significantly related to graduation rates. The results of that correlation matrix revealed that all of the school level variables listed above, with the exception of Limited English Proficient (LEP) students, were significantly correlated to graduation rates. Under this second modeling procedure eighteen separate regressions were run. In each regression only two independent variables were compared on their relationship with the dependent variable of graduation rates. In one group of nine regression models the first independent variable was always the average percentage of economically disadvantaged anytime students and the second was a different one of the school level variables significantly correlated to graduation rates. In the other group of

nine regression models the first independent variable was always the percentage of underrepresented minorities and the second was a different one of the school level variables significantly correlated to graduation rates.

It should also be noted that a value of zero was assumed for many high schools along two school level variables, the percentage of Limited English Proficient (LEP) students and the percentage of students enrolled in at least one AP course. These high schools had student counts below ten for each of these following variables and so were not published by the VDOE (C.W. Bazzichi, personal communication, August 13, 2012). This assumption of zero was made for 131 high schools along the LEP variable and 41 high schools along the AP course variable. While not ideal, the other option of removing these schools from the regression analyses would have resulted in a potentially skewed sample.

**Hypotheses**

My first hypothesis was that mean graduation rates for the 2011 cohorts would decline as the average percentage of economically disadvantaged anytime students increases in high schools. My second hypotheses was that mean graduation rates for the 2011 cohorts would decline as the percentage of underrepresented minorities increases in high schools. My third hypothesis was that there would be significant differences in the mean graduation rates for the 2011 cohorts between intervals established by the average percentage of economically disadvantaged students in high schools. Differences would be more likely to be significant at the highest and lowest ends of the interval range. My fourth hypothesis was that there would be significant differences in the mean graduation rates for the 2011 cohorts between intervals established by the percentage of

underrepresented minorities in high schools. Differences would be more likely to be significant at the highest and lowest ends of the interval range.

My fifth hypothesis was that mean graduation rates for economically disadvantaged anytime students in the 2011 cohorts would decline as the average percentage of economically disadvantaged anytime students increases in high schools. My sixth hypothesis was that mean graduation rates for underrepresented minorities in the 2011 cohorts would decrease as the percentage of underrepresented minorities increases in high schools. My seventh hypothesis was that there would be significant differences in the mean graduation rates for economically disadvantaged anytime students in the 2011 cohorts between intervals established by the average percentage of economically disadvantaged anytime students in high schools. Differences would be more likely to be significant at the highest and lowest ends of the interval range. My eighth hypothesis was that there would be significant differences in the mean graduation rates for underrepresented minorities in the 2011 cohorts between intervals established by the percentage of underrepresented minorities in high schools. Differences would be more likely to be significant at the highest and lowest ends of the interval range.

These hypotheses stem from several conclusions drawn from the research literature. There is strong evidence that than low SES and minority students are at a higher risk for lower academic achievement, which could explain a general decline in graduation rates in schools with higher concentrations of these students. There is also considerable overlap between the percentage of underrepresented minorities and economically disadvantaged anytime students in Virginia's public schools, a topic which will be discussed in more detail later. Therefore, it is likely that there will be similar

results from analyses that use either of these student demographic variables. In addition, peer effects by SES tend to increase the academic achievement of all students in low poverty schools and depress them in high poverty schools. Because of these peer effects by SES, it is more likely that significant differences in mean graduation rates will emerge at the higher and lower ends of the interval ranges.

My ninth hypothesis was that the correlation between mean graduation rates for the 2011 cohorts and the average percentage of economically disadvantaged anytime students in high schools would be negative and significantly stronger at progressively higher ends of the interval range. My tenth hypothesis was that the correlation between the mean graduation rates for the 2011 cohorts and the percentage of underrepresented minorities in high schools would be negative and significantly stronger at progressively higher ends of the interval range. My hypotheses about the two correlation analyses stem from the research literature that indicates peer effects by SES tend to increase the academic achievement of all students in low poverty schools and decrease the achievement of all students in high poverty schools. Again, there is also a relatively high overlap between race and poverty in Virginia so it is likely that both correlation analyses will produce similar results. At the same time, research shows that students' own socioeconomic background influences achievement no matter what school they attend. Therefore, it is likely that the relationship between the two school wide student demographic variables and mean graduation rates for the 2011 cohorts will be generally be negative, due to the influence of students' own backgrounds, but also stronger at progressively higher ends of the interval ranges due to peer effects.

An important potential contribution of the One-Way Analyses of Variance and Correlations is to help identify where potential "tipping points" may lie. There may be a point, beyond which, the concentration of economically disadvantaged anytime students and/or underrepresented minorities in high schools significantly depresses the graduation rate for all students. It is important to identify where this tipping point may lie so that those with influence over school policy can craft student assignment strategies designed to avoid this tipping point. Student assignment policies based on avoiding these tipping points could be a potentially important strategy in raising graduation rates for all students in Virginia.

My eleventh hypothesis was that the average percentage of economically disadvantaged anytime students in high schools would explain a significant share of the variance in mean graduation rates for the 2011 cohorts even when paired with other school level variables thought to influence academic attainment. My twelfth hypothesis was that the percentage of underrepresented minorities in high schools would explain a significant share of the variance in mean graduation rates for the 2011 cohorts even when paired with other school level variables thought to influence academic attainment. There is substantial evidence from the research literature that school level student demographics have a significant, independent influence on individual student achievement. Thus, it is likely that the average percentage of economically disadvantaged anytime students and underrepresented minorities will continue to explain a significant share of the variance in mean graduation rates for the 2011 cohorts even when paired with school level variables that are also believed to influence achievement.

It is important to note the overlap between race and SES in Virginia's public schools. As compared to whites, there is a greater overlap between the percentages of underrepresented minorities who are also labeled as economically disadvantaged by the VDOE. In 2010-2011, 49.60% of black and 48.58% of Hispanic high school students were also labeled as economically disadvantaged. This is compared to 17.72% of whites. This overlap might explain much of any relationship between mean graduation rates for the 2011 cohorts and the percentage of underrepresented minorities in high schools. Yet, these were still worthwhile analyses because the overlap is not perfect, which means race might still play a role in influencing mean graduation rates.

**Summary Points**

A primary goal of this section was to connect the research literature with the key variables and analyses that were part of this research. It also provided an explanation for the benefits and drawbacks of each major choice made as part of developing the methodology of this study. This section also explained how the hypotheses grew from key conclusions of the research literature. The hypotheses for this study were the following:

- My first hypothesis was that mean graduation rates for the 2011 cohorts would decline as the average percentage of economically disadvantaged anytime students increases in high schools.
- My second hypotheses was that mean graduation rates for the 2011 cohorts would decline as the percentage of underrepresented minorities increases in high schools.

- My third hypothesis was that there would be significant differences in the mean graduation rates for the 2011 cohorts between intervals established by the average percentage of economically disadvantaged students in high schools. Differences would be more likely to be significant at the highest and lowest ends of the interval range.
- My fourth hypothesis was that there would be significant differences in the mean graduation rates for the 2011 cohorts between intervals established by the percentage of underrepresented minorities in high schools. Differences would be more likely to be significant at the highest and lowest ends of the interval range.
- My fifth hypothesis was that mean graduation rates for economically disadvantaged anytime students in the 2011 cohorts would decline as the average percentage of economically disadvantaged anytime students increases in high schools.
- My sixth hypothesis was that mean graduation rates for underrepresented minorities in the 2011 cohorts would decrease as the percentage of underrepresented minorities increases in high schools.
- My seventh hypothesis was that there would be significant differences in the mean graduation rates for economically disadvantaged anytime students in the 2011 cohorts between intervals established by the average percentage of economically disadvantaged anytime students in high schools. Differences would be more likely to be significant at the highest and lowest ends of the interval range.

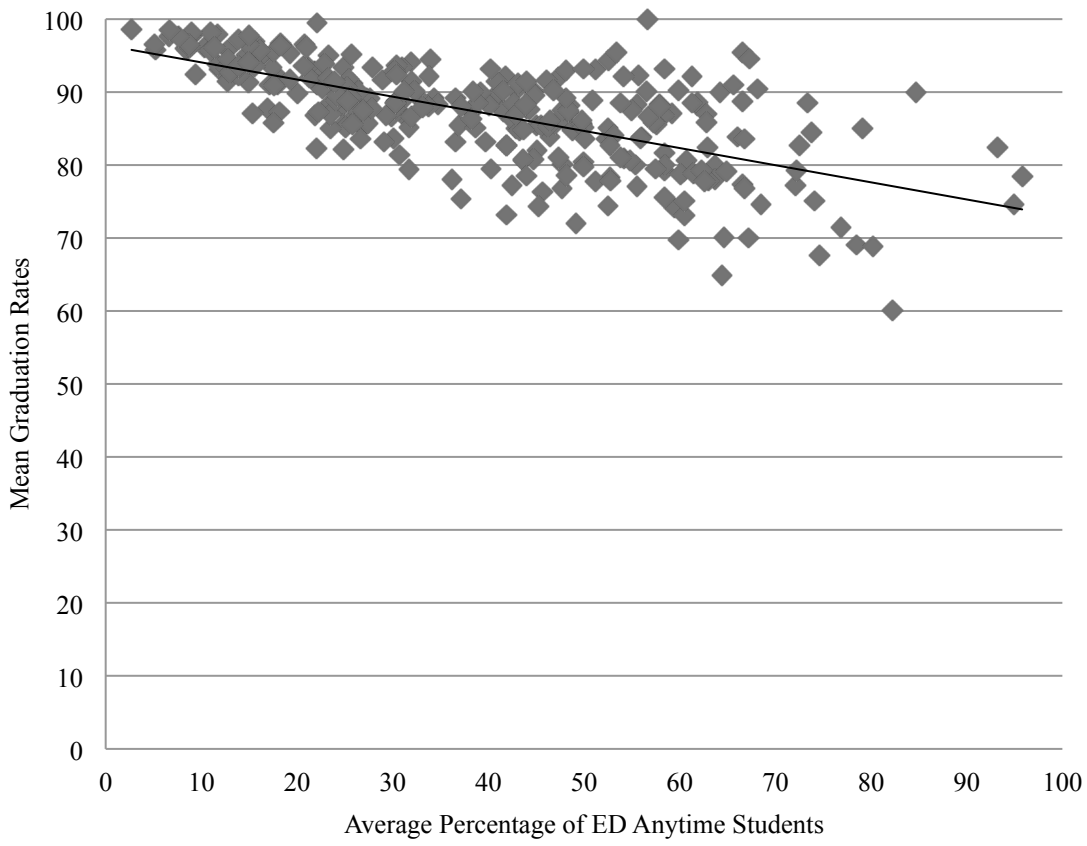
- My eighth hypothesis was that there would be significant differences in the mean graduation rates for underrepresented minorities in the 2011 cohorts between intervals established by the percentage of underrepresented minorities in high schools. Differences would be more likely to be significant at the highest and lowest ends of the interval range.
- My ninth hypothesis was that the correlation between mean graduation rates for the 2011 cohorts and the average percentage of economically disadvantaged anytime students in high schools would be negative and significantly stronger at progressively higher ends of the interval range.
- My tenth hypothesis was that the correlation between the mean graduation rates for the 2011 cohorts and the percentage of underrepresented minorities in high schools would be negative and significantly stronger at progressively higher ends of the interval range.
- My eleventh hypothesis was that the average percentage of economically disadvantaged anytime students in high schools would explain a significant share of the variance in mean graduation rates for the 2011 cohorts even when paired with other school level variables thought to influence academic attainment.
- My twelfth hypothesis was that the percentage of underrepresented minorities in high schools would explain a significant share of the variance in mean graduation rates for the 2011 cohorts even when paired with other school level variables thought to influence academic attainment.

# IV. FINDINGS

## Graduation Rates for All Students

Mean graduation rates for the 2011 cohorts consistently declined as the average percentage of economically disadvantaged anytime students increased in high schools (see Figure 1 and Table 3). The highest graduation rate was in the first interval, the lowest poverty schools, and the lowest graduation rate was in the seventh interval, the highest poverty schools.

Figure 1. Scatterplot of Mean Graduation Rates and the Average Percentage of ED Anytime Students




*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.

Table 3

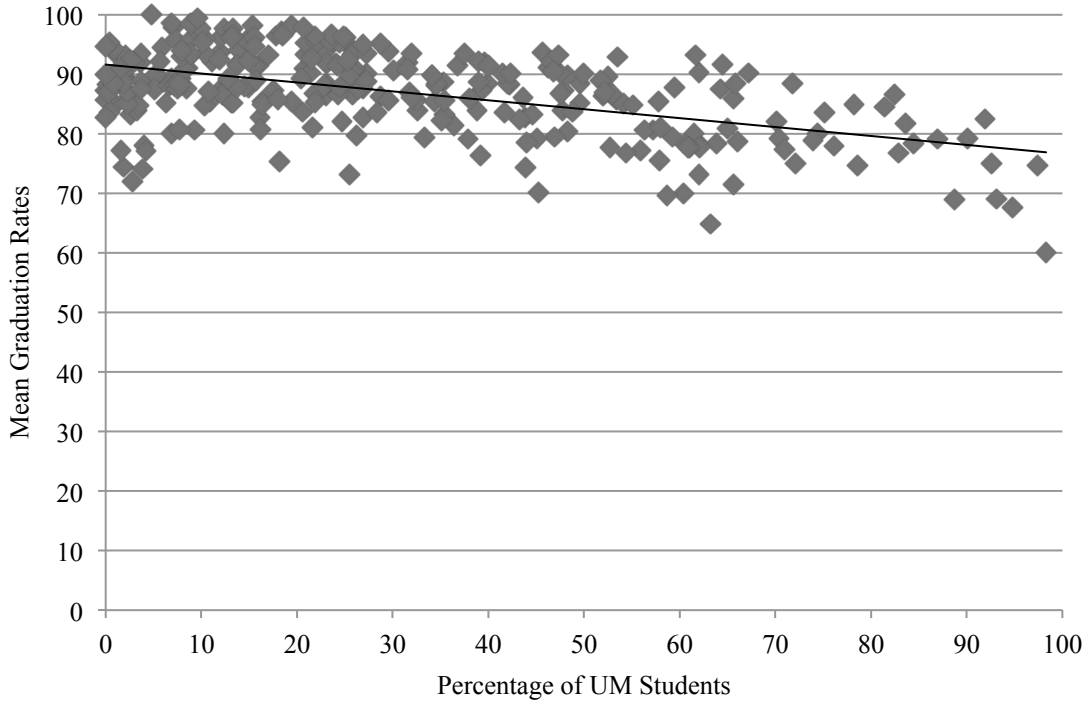
*Mean Graduation Rates by ED Anytime Intervals*

| ED Anytime Interval | Percent Range | Mean Graduation Rate | *N* |
|---|---|---|---|
| 1 | 0.0-19.9 | 94.51 | 54 |
| 2 | 20.0-29.9 | 89.47 | 52 |
| 3 | 30.0-39.9 | 87.64 | 39 |
| 4 | 40.0-49.9 | 85.33 | 63 |
| 5 | 50.0-59.9 | 84.78 | 44 |
| 6 | 60.0-64.9 | 80.59 | 23 |
| 7 | 65.0-100.0 | 80.04 | 27 |

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.

A slightly different pattern emerged when schools were grouped by the percentage of underrepresented minorities that they served (see Figure 2 and Table 4). Mean graduation rates for the 2011 cohorts increased slightly from the first interval to the second, remained relatively stable through the third, and then progressively declined to a low of 77.86% in the sixth interval.

Figure 2. Scatterplot of Mean Graduation Rates and the Percentage of UM Students




*Note.* UM = underrepresented minorities; students identified as black or Hispanic.

Table 4

*Mean Graduation Rates by Underrepresented Minority Intervals*

| UM Interval | Percent Range | Mean Graduation Rate | *N* |
|---|---|---|---|
| 1 | 0.0-9.9 | 88.72 | 72 |
| 2 | 10.0-19.9 | 90.88 | 52 |
| 3 | 20.0-29.9 | 90.10 | 53 |
| 4 | 30.0-49.9 | 86.36 | 59 |
| 5 | 50.0-69.9 | 82.04 | 41 |
| 6 | 70.0-100.0 | 77.86 | 25 |

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.

Using a One-Way Analyses of Variance, there was a main effect for the average percentage of economically disadvantaged anytime students in high schools on mean graduation rates for the 2011 cohorts, $F(6, 295) = 35.22$, $p = .00$. Subsequent Tukey Post Hoc tests revealed that mean graduation rates in the first interval, 0.0-19.9% ED Anytime, were significantly higher than in all others (see Table 5). Graduation rates in the second interval, 20.0-29.9% ED Anytime, were significantly higher than in the fourth, fifth, sixth, and seventh intervals. Graduation rates in intervals six, 60-64.9% ED Anytime, and seven, 65.0-100.0% ED Anytime, tended to be significantly lower as compared all other intervals.

Table 5

*Mean Differences in Graduation Rates by ED Anytime Intervals*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| 1 | - | 5.04* | 6.87* | 9.18* | 9.73* | 13.92* | 14.46* |
| 2 | -5.04* | - | 1.83 | 4.14* | 4.69* | 8.88* | 9.42* |
| 3 | -6.87* | -1.83 | - | 2.30 | 2.86 | 7.05* | 7.59* |
| 4 | -9.18* | -4.14* | -2.30 | - | .56 | 4.75* | 5.29* |
| 5 | -9.73* | -4.69* | -2.86 | -.56 | - | 4.19* | 4.73* |
| 6 | -13.92* | -8.88* | -7.05* | -4.75* | -4.19* | - | .54 |
| 7 | -14.46* | -9.42* | -7.59* | -5.29* | -4.73* | -.54 | - |

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.
* $p < .05$.

There was also a main effect for the overall percentage of underrepresented minorities in high schools on mean graduation rates for the 2011 cohorts, $F(5, 296) = 27.92$, $p = .00$. Subsequent Tukey Post Hoc tests revealed that mean graduation rates in intervals five, 50.0-69.9% UM, and six, 70.0-100.0% UM, were generally significantly lower than in all other intervals (see Table 6). Mean graduation rates in intervals two and three, 10.0-29.9% UM, were significantly higher than in intervals four through six, 30.0-100.0% UM. This result reinforces the pattern seen in the descriptive analyses that the

highest graduation rates were in intervals two and three. This also stands in contrast to ED Anytime, where graduation rates consistently declined at progressively higher intervals.

Table 6

*Mean Differences in Graduation Rates by Underrepresented Minority Intervals*

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | - | -2.16 | -1.38 | 2.36 | 6.68* | 10.85* |
| 2 | 2.16 | - | .78 | 4.52* | 8.84* | 13.02* |
| 3 | 1.38 | -78 | - | 3.74* | 8.06* | 12.24* |
| 4 | -2.36 | -4.52* | -3.74* | - | 4.32* | 8.50* |
| 5 | -6.68* | -8.84* | -8.06* | -4.32* | - | 4.18 |
| 6 | -10.85* | -13.02* | -12.24* | -8.50* | -4.18 | - |

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.
* $p < .05$.

The correlation between the average percentage of economically disadvantaged anytime students in high schools and mean graduation rates for the 2011 cohorts was significant at the first interval, $r(54) = -.55$, $p < .01$, and the second interval, $r(52) = -.41$, $p < .01$ (see Table 7). The correlation between these two variables failed to achieve significance at all other intervals and was consistently negative. The correlation between the percentage of underrepresented minorities in high schools and mean graduation rates

for the 2011 cohorts was significant at the first, $r(72) = .27$, $p < .05$, and sixth intervals, $r(25) = -.58$, $p < .01$ (see Table 8). The correlation between these two variables failed to achieve significance at all other intervals. The relationship was consistently negative, although barely so in the second interval.

Table 7

*Correlation Between Graduation Rates and the Percentage of Students Labeled as Economically Disadvantaged Anytime by Economically Disadvantaged Anytime Intervals*

| ED Anytime Interval | Percent Range | *N* | Pearson Correlation Coefficient |
|---|---|---|---|
| 1 | 0.0-19.9 | 54 | -.55** |
| 2 | 20.0-29.9 | 52 | -.41** |
| 3 | 30.0-39.9 | 39 | -.23 |
| 4 | 40.0-49.9 | 63 | -.13 |
| 5 | 50.0-59.9 | 44 | -.22 |
| 6 | 60.0-64.9 | 23 | -.19 |
| 7 | 65.0-100.0 | 27 | -.30 |

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.
** $p < .01$.

Table 8

*Correlation Between Graduation Rates and the Percentage of Underrepresented Minorities by Underrepresented Minority Intervals*

| UM Interval | Percent Range | *N* | Pearson Correlation Coefficient |
|---|---|---|---|
| 1 | 0.0-9.9 | 72 | .27* |
| 2 | 10.0-19.9 | 52 | -.01 |
| 3 | 20.0-29.9 | 53 | -.17 |
| 4 | 30.0-49.9 | 59 | -.14 |
| 5 | 50.0-69.9 | 41 | -.22 |
| 6 | 70.0-100.0 | 25 | -.58** |

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.
* $p < .05$. ** $p < .01$.

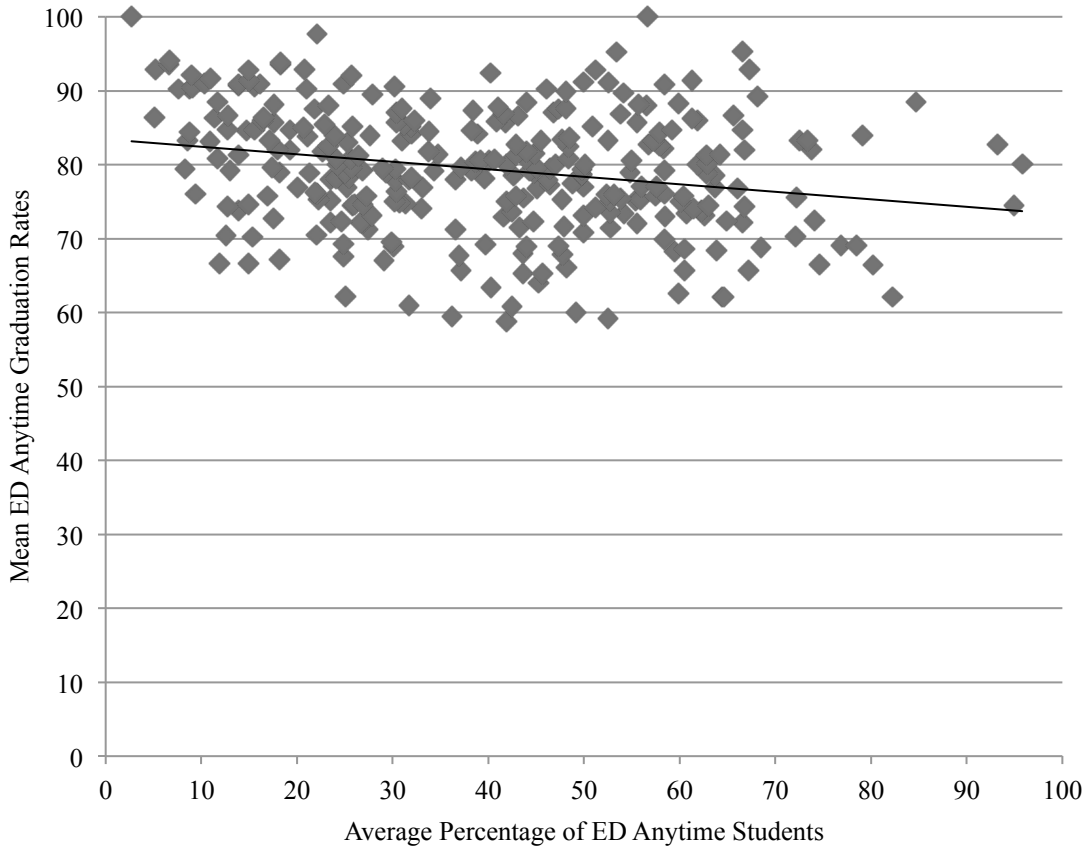
Taken together, these analyses demonstrate that there are clear relationships between student demographics and graduation rates. Graduation rates tended to be significantly higher in the lowest poverty schools and significantly lower in the highest poverty schools. For the UM intervals, graduation rates tended to be significantly lower in the highest minority schools and significantly higher in ones where the percentage of underrepresented minorities ranged from 10.0-29.9%. Generally, the correlations by UM intervals fit this pattern since there was a significant, negative relationship in the highest minority schools, but also a significant, positive relationship in the first interval. These results provide preliminary evidence that purposeful school integration policies designed to eliminate high poverty and high minority high schools might work to increase graduation rates.

The correlations by ED Anytime intervals contradict the established relationship between student demographics and graduation rates. These correlations demonstrate a significant, negative relationship between these two variables only in the lowest poverty schools. A possible explanation is that low-income students graduated at a much lower rate in these low poverty schools, as compared to low-income students in other intervals. In this scenario, peer effects by SES were not strong enough to raise the educational attainment of low-income students. The next section's results by certain subsets of students will help to examine this possible explanation.

**Graduation Rates for Subsets of Students**

Mean graduation rates for students in the 2011 cohorts labeled economically disadvantaged anytime generally declined from the first through fourth interval, 0.0-49.9% ED Anytime (see Figure 3 and Table 9). Graduation rates for economically disadvantaged anytime students then generally leveled off past the fourth interval. This pattern of general decline does not support the explanation that the correlation between the average percentage of economically disadvantaged anytime students and graduation rates was strongest in the lowest poverty schools due to the fact that low-income students were less likely to graduate in these environments.

Figure 3. Scatterplot of Mean ED Anytime Graduation Rates and the Average Percentage of ED Anytime Students




*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime. One high school's 2011 cohort did not contain enough students considered Economically Disadvantaged Anytime above the reportable level established by the Virginia Department of Education.

Table 9

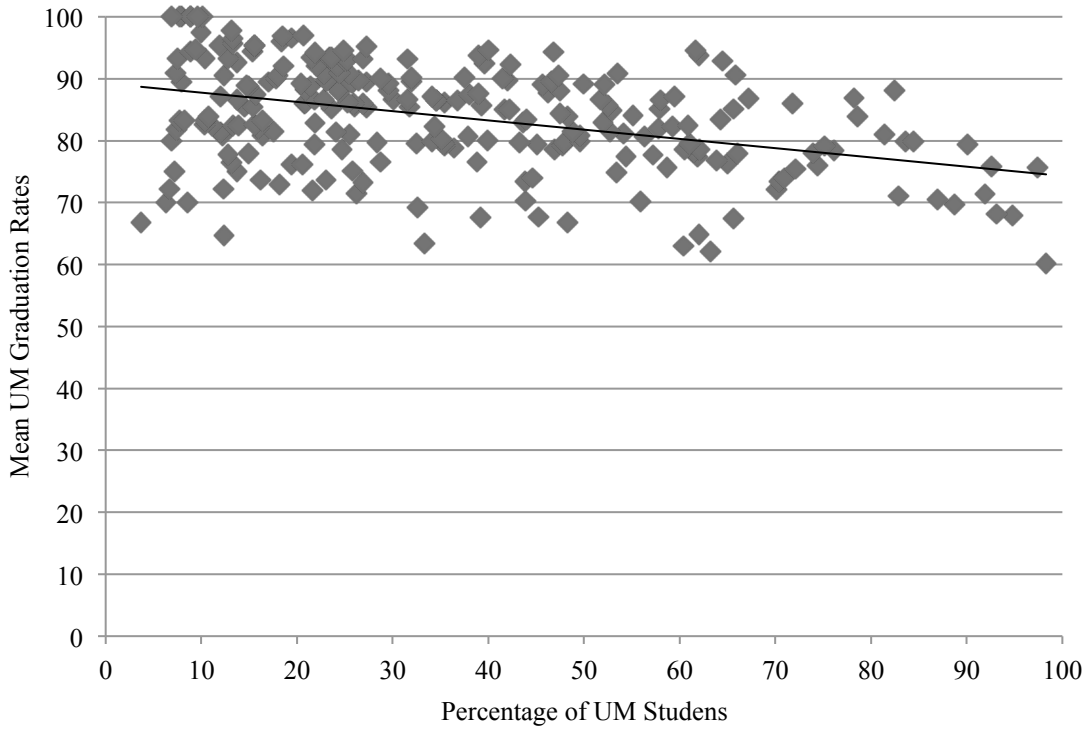
*Mean ED Anytime Graduation Rates by ED Anytime Intervals*

| ED Anytime Interval | Percent Range | ED Anytime Mean Graduation Rate | *N* |
|---|---|---|---|
| 1 | 0.0-19.9 | 84.15 | 53[a] |
| 2 | 20.0-29.9 | 79.06 | 52 |
| 3 | 30.0-39.9 | 78.55 | 39 |
| 4 | 40.0-49.9 | 77.67 | 63 |
| 5 | 50.0-59.9 | 80.16 | 44 |
| 6 | 60.0-64.9 | 75.64 | 23 |
| 7 | 65.0-100.0 | 77.74 | 27 |

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.
[a] One high school's 2011 cohort did not contain enough students considered Economically Disadvantaged Anytime above the reportable level established by the Virginia Department of Education.

A somewhat different pattern emerged when examining the mean graduation rates for underrepresented minorities in the 2011 cohorts as a function the overall percentage of underrepresented minorities in high schools (see Figure 4 and Table 10). Mean graduation rates for underrepresented minorities declined slightly through the first three intervals, 0.0-29.9% UM. Starting in the fourth interval, graduation rates then declined more dramatically to a low of 76.07% in the sixth interval.

Figure 4. Scatterplot of Mean UM Graduation Rates and the Percentage of UM Students




*Note.* UM = underrepresented minorities; students identified as black or Hispanic. 56 high schools' 2011 graduating cohorts did not contain black and/or Hispanic students above the reportable level established by the Virginia Department of Education.

Table 10

*Mean Underrepresented Minority Graduation Rates by Underrepresented Minority Intervals*

| UM Interval | Percent Range | Mean Graduation Rate | *N* |
|---|---|---|---|
| 1 | 0.0-9.9 | 87.26 | 20[a] |
| 2 | 10.0-19.9 | 86.43 | 49[a] |
| 3 | 20.0-29.9 | 86.63 | 52[a] |
| 4 | 30.0-49.9 | 83.05 | 59 |
| 5 | 50.0-69.9 | 81.11 | 41 |
| 6 | 70.0-100.0 | 76.07 | 25 |

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.
[a] 56 high schools' 2011 graduating cohorts did not contain black and/or Hispanic students above the reportable level established by the Virginia Department of Education.

Using a One-Way Analysis of Variance, there was a main effect for the average percentage of economically disadvantaged anytime students in high schools on mean graduation rates for economically disadvantaged anytime students in the 2011 cohorts, $F(6, 294) = 4.88$, $p = .00$. Subsequent Tukey Post Hoc tests revealed that the mean graduation rate for economically disadvantaged anytime students in the 2011 cohorts was significantly higher in interval one, 0.0-19.9% ED Anytime, as compared to all other intervals, with the exception of the fifth (see Table 11). This demonstrates that low-income students were significantly more likely to graduate in low poverty schools.

Table 11

*Mean Differences in ED Anytime Graduation Rates by ED Anytime Intervals*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| 1 | - | 5.09* | 5.59* | 6.47* | 3.98 | 8.50* | 6.41* |
| 2 | -.5.09* | - | .51 | 1.39 | -1.10 | 3.42 | 1.32 |
| 3 | -5.59* | -.51 | - | .88 | -1.61 | 2.91 | .81 |
| 4 | -6.47* | -1.39 | -.88 | - | -2.49 | 2.03 | -.07 |
| 5 | -3.98 | 1.10 | 1.61 | 2.49 | - | 4.52 | 2.42 |
| 6 | -8.50* | -3.42 | -2.91 | -2.03 | -4.52 | - | -2.10 |
| 7 | -6.41* | -1.32 | -.81 | .07 | -2.42 | 2.10 | - |

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.
* $p < .05$.

Using a One-Way Analysis of Variance, there was a main effect for the percentage of underrepresented minorities in high schools on mean graduation rates for underrepresented minorities in the 2011 cohorts, $F(5, 240) = 9.27$, $p = .00$. Subsequent Tukey Post Hoc tests revealed significant differences only appeared when comparing mean graduation rates in intervals five and six against other intervals (see Table 12). Mean graduation rates in interval six, 70.0-100.0% UM, were significantly lower than in intervals one, two, three, and four. Mean graduation rates in interval five, 50.0-69.9% UM, were significantly lower than in intervals one, two, and three.

Table 12

*Mean Differences in Underrepresented Minority Graduation Rates by Underrepresented Minority Intervals*

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | - | .82 | .63 | 4.21 | 6.14* | 11.18* |
| 2 | -.82 | - | -.19 | 3.38 | 5.32* | 10.36* |
| 3 | -.63 | .19 | - | 3.58 | 5.51* | 10.55* |
| 4 | -4.21 | -3.38 | -3.58 | - | 1.94 | 6.98* |
| 5 | -6.14* | -5.32* | -5.51* | -1.94 | - | 5.04 |
| 6 | -11.18* | -10.36* | -10.55* | -6.98* | -5.04 | - |

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.
* $p < .05$.

The results in this section demonstrate that students who come from low-income backgrounds are significantly more likely to graduate in low poverty high schools. This supports the idea that assigning low-income students to low poverty high schools could work to increase their graduation rates. The results also indicate that minority students are significantly less likely to graduate in highly segregated environments where the majority of their classmates are also black or Hispanic. Both analyses suggest a tipping point, beyond which, the graduation rates for low-income and minority students starts to decline. A more thorough discussion will follow in the final chapter, but it should be

noted that this is a highly contextual study and it is difficult to draw firm numerical cutoffs for these tipping points based on this single analysis.

These results also eliminate one possible explanation for the significant, negative correlation between graduation rates and the average percentage of economically disadvantaged anytime students in the first two intervals. Economically disadvantaged anytime students do graduate at a significantly higher rate in the first interval, so it appears that peer effects by SES work to raise their educational attainment. Another possibility is that the presence of low-income students in low poverty schools works to decrease graduation rates for students from relatively advantaged educational backgrounds. Yet, these same low poverty high schools tend to have significantly higher overall graduation rates, so this possibility does not seem likely. This question of what explains the negative correlation between graduation rates and the average percentage of economically disadvantaged anytime students will be explored in further detail in the next chapter.

The analyses in the previous two sections were also run when schools were divided into deciles (see Appendix A). While valuable, the results of these analyses simply serve to reinforce the primary conclusions presented here. In addition, the analyses conducted when schools were divided into intervals provided the most valuable information for policy recommendations dealing with student assignments.

**Relative Impact of Student Demographics**

Employing a series of linear regressions models, the average percentage of economically disadvantaged anytime students in high schools consistently predicted a greater share of the variance in mean graduation rates than average reading scores,

average writing scores, the percentage of students with disabilities, the percentage of teachers whose highest degree attained is a bachelors, the percentage of teachers whose highest degree attained is a masters, the percentage of teachers whose highest degree attained is a doctorate, the percentage of provisionally licensed teachers, the percentage of students enrolled in at least one AP course, and the school safety ratio (see Table 13). Although, the average percentage of economically disadvantaged anytime students only predicted a slightly greater share of the variance in mean graduation rates than average reading scores. The average percentage of economically disadvantaged anytime students in high schools predicted different shares of the variance in mean graduation rates depending on the school level variable it was paired with in the linear regression model. Yet, the beta scores for economically disadvantaged anytime were always negative and significant at $p < .01$.

Table 13

*Linear Regression Models Predicting Graduation Rates From The Percentage of Students Labeled As Economically Disadvantaged Anytime as Compared to Several School Level Variables*

| Predictor Variables | B | Std. Error | Beta | t | Sig. |
|---|---|---|---|---|---|
| Model 1 | | | | | |
| ED Anytime | -.13 | .02 | -.37 | -5.49 | .00 |
| Average Reading Scores[a] | .12 | .02 | .36 | 5.40 | .00 |
| Model 2 | | | | | |
| ED Anytime | -.19 | .02 | -.53 | -8.94 | .00 |
| Average Writing Scores[a] | .05 | .02 | .19 | 3.26 | .00 |
| Model 3 | | | | | |
| ED Anytime | -.24 | .02 | -.68 | -13.39 | .00 |
| Percentage of Students with Disabilities | .08 | .09 | .05 | .97 | .33 |
| Model 4 | | | | | |
| ED Anytime | -.23 | .02 | -.63 | -13.60 | .00 |
| Percentage of Teachers-Bachelors | -.04 | .03 | -.07 | -1.40 | .16 |
| Model 5 | | | | | |
| ED Anytime | -.23 | .02 | -.65 | -13.53 | .00 |
| Percentage of Teachers-Masters | .02 | .03 | .03 | .67 | .51 |
| Model 6 | | | | | |
| ED Anytime | -.23 | .02 | -.65 | -14.70 | .00 |
| Percentage of Teachers-Doctorate | .29 | .23 | .06 | 1.24 | .22 |
| Model 7 | | | | | |
| ED Anytime | -.23 | .02 | -.64 | -13.84 | .00 |
| Percentage of Provisionally Licensed Teachers | -.08 | .07 | -.05 | -1.10 | .27 |
| Model 8 | | | | | |
| ED Anytime | -.22 | .02 | -.63 | -11.90 | .00 |
| Percentage of Students Enrolled in AP Courses | .03 | .03 | .06 | 1.04 | .30 |
| Model 9 | | | | | |
| ED Anytime | -.22 | .02 | -.62 | -13.48 | .00 |
| School Safety Ratio | .09 | .03 | .12 | 2.7 | .01 |

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.
LEP = students identified as Limited English Proficient. AP = Advanced Placement Courses.
[a] Average Reading and Writing Scores are Scaled Averages derived from each high school's participation in the Virginia Standards of Learning (SOL) Assessment Program.
** $p < .01$.

The average percentage of economically disadvantaged students also predicted a significant share of the variance in mean graduation rates when compared with the other school level variables listed above, plus the percentage of Limited English Proficient (LEP) students, in a single linear regression model (see Table 14). In this model, only the percentage of teachers whose highest degree attained is a bachelor's and the percentage of teachers who highest degree attained is a master's predicted a greater share of the variance in mean graduation rates than the average percentage of economically disadvantaged anytime students. Beta scores for both of the teacher variables were negative, in addition to economically disadvantaged anytime.

Table 14

*Linear Regression Model Predicting Graduation Rates From The Percentage of Students Labeled As Economically Disadvantaged Anytime with other School Level Variables*

| Predictor Variables | B | Std. Error | Beta | t | Sig. |
|---|---|---|---|---|---|
| Constant | 83.97 | 17.62 | | 4.77 | .00 |
| ED Anytime | -.15 | .03 | -.42 | -5.44 | .00 |
| Average Reading Scores[a] | .12 | .03 | .36 | 4.23 | .00 |
| Average Writing Scores[a] | .00 | .02 | .00 | .03 | .98 |
| Percentage of LEP Students | -.02 | .05 | -.02 | -.34 | .73 |
| Percentage of Students with Disabilities | .13 | .09 | .08 | 1.52 | .13 |
| Percentage of Teachers-Bachelors | -.51 | .13 | -.89 | -3.96 | .00 |
| Percentage of Teachers-Masters | -.49 | .13 | -.84 | -3.73 | .00 |
| Percentage of Teachers-Doctorate | -.52 | .28 | -.10 | -1.85 | .07 |
| Percentage of Provisionally Licensed Teachers | -.09 | .07 | -.06 | -1.33 | .19 |
| Percentage of Students Enrolled in AP Courses | -.02 | .03 | -.03 | -.60 | .55 |
| School Safety Ratio | .07 | .04 | .09 | 1.82 | .07 |

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.
LEP = students identified as Limited English Proficient. AP = Advanced Placement Courses.
[a] Average Reading and Writing Scores are Scaled Averages derived from each high school's participation in the Virginia Standards of Learning (SOL) Assessment Program.
** $p < .01$.

Employing a series of linear regressions, the average percentage of underrepresented minorities always predicted a significant share of the variance in mean graduation rates when paired with the school level variables of average reading scores, average writing scores, the percentage of students with disabilities, the percentage of teachers whose highest degree attained is a bachelors, the percentage of teachers whose highest degree attained is a masters, the percentage of teachers whose highest degree attained is a doctorate, the percentage of provisionally licensed teachers, the percentage of students enrolled in at least one AP course, and the school safety ratio (see Table 15). The percentage of underrepresented minorities in high schools predicted different shares of the variance in mean graduation rates depending on the school level variable it was paired with in the linear regression model. Yet, the beta scores for underrepresented minorities were always negative and significant at $p < .01$.

Table 15

*Linear Regression Models Predicting Graduation Rates From The Percentage of Underrepresented Minorities as Compared to Several School Level Variables*

| Predictor Variables | B | Std. Error | Beta | t | Sig. |
|---|---|---|---|---|---|
| Model 1 | | | | | |
| UM | -.07 | .01 | -.26 | -5.28 | .00 |
| Average Reading Scores[a] | .17 | .02 | .53 | 10.79 | .00 |
| Model 2 | | | | | |
| UM | -.11 | .01 | -.37 | -7.79 | .00 |
| Average Writing Scores[a] | .11 | .01 | .41 | 8.70 | .00 |
| Model 3 | | | | | |
| UM | -.14 | .01 | -.48 | -9.74 | .00 |
| Percentage of Students with Disabilities | -.33 | .08 | -.20 | -4.00 | .00 |
| Model 4 | | | | | |
| UM | -.17 | .01 | -.60 | -13.47 | .00 |
| Percentage of Teachers-Bachelors | -.23 | .03 | -.40 | -9.06 | .00 |
| Model 5 | | | | | |
| UM | -.16 | .01 | -.57 | -12.80 | .00 |
| Percentage of Teachers-Masters | .21 | .03 | .37 | 8.22 | .00 |
| Model 6 | | | | | |
| UM | -.16 | .01 | -.56 | -11.84 | .00 |
| Percentage of Teachers-Doctorate | 1.32 | .25 | .25 | 5.27 | .00 |
| Model 7 | | | | | |
| UM | -.14 | .01 | -.49 | -9.65 | .00 |
| Percentage of Provisionally Licensed Teachers | -.20 | .08 | -.13 | -2.65 | .01 |
| Model 8 | | | | | |
| UM | -.14 | .01 | -.51 | -11.50 | .00 |
| Percentage of Students Enrolled in AP Courses | .22 | .03 | .38 | 8.69 | .00 |
| Model 9 | | | | | |
| UM | -.14 | .01 | -.48 | -9.8 | .00 |
| School Safety Ratio | .17 | .04 | .23 | 4.66 | .00 |

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.
LEP = students identified as Limited English Proficient. AP = Advanced Placement Courses.
[a] Average Reading and Writing Scores are Scaled Averages derived from each high school's participation in the Virginia Standards of Learning (SOL) Assessment Program.
** $p < .01$.

The percentage of underrepresented minorities also predicted a significant share of the variance in mean graduation rates when compared with the other school level variables listed above, plus the percentage of Limited English Proficient (LEP) students, in a single linear regression model (see Table 16). In this model, the percentage of underrepresented minorities predicted a greater share of the variance in mean graduation rates than any of the other school level variables with the exceptions of the percentage of teachers whose highest degree attained is a bachelors and the percentage of teachers whose highest degree attained is a masters. Yet, the percentage of underrepresented minorities only predicted a slightly larger share of the variance in graduation rates than average reading scores. In addition, the beta score for reading scores was positive while the beta scores for the percentage of underrepresented minorities and the two teacher variables were negative.

Table 16

*Linear Regression Model Predicting Graduation Rates From The Percentage of Underrepresented Minorities with other School Level Variables*

| Predictor Variables | B | Std. Error | Beta | t | Sig. |
|---|---|---|---|---|---|
| Constant | 74.90 | 15.85 | | 4.73 | .00 |
| UM | -.11 | .02 | -.38 | -6.80 | .00 |
| Average Reading Scores[a] | .11 | .03 | .35 | 4.31 | .00 |
| Average Writing Scores[a] | .00 | .02 | .01 | .17 | .87 |
| Percentage of LEP Students | -.01 | .05 | -.02 | -.32 | .75 |
| Percentage of Students with Disabilities | -.01 | .08 | -.00 | -.09 | .93 |
| Percentage of Teachers-Bachelors | -.48 | .13 | -.84 | -3.83 | .00 |
| Percentage of Teachers-Masters | -.37 | .13 | -.63 | -2.92 | .00 |
| Percentage of Teachers-Doctorate | -.26 | .28 | -.05 | -.95 | .35 |
| Percentage of Provisionally Licensed Teachers | -.04 | .07 | -.02 | -.52 | .61 |
| Percentage of Students Enrolled in AP Courses | .06 | .03 | .10 | 1.79 | .07 |
| School Safety Ratio | .01 | .04 | .02 | .33 | .74 |

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.
LEP = students identified as Limited English Proficient. AP = Advanced Placement Courses.
[a] Average Reading and Writing Scores are Scaled Averages derived from each high school's participation in the Virginia Standards of Learning (SOL) Assessment Program.
** $p < .01$.

Scatterplots were also created as another way to visually represent the relationship between student demographics, other school level variables, and graduation rates. These scatterplots were developed using Many Eyes, an online program created by IBM. Scatterplots created in Many Eyes can incorporate three variables. The circumference of the "bubbles" on these scatterplots represents the concentration of that variable in each high school. In the scatterplots developed for this study, overall graduation rates are always on the Y-Axis. In half of the scatterplots, the percentage of economically disadvantaged anytime students are on the X-Axis and in the other half it is the percentage of underrepresented minorities. The third variable is always one of the school level variables used in the regression analyses, with the exception of LEP students, and is represented by the size of the circumference of the bubbles. These scatterplots are contained in Appendix B. The most relevant scatterplots demonstrate how higher reading scores are concentrated in high schools with relatively low percentages of economically disadvantaged anytime students and racially diverse student bodies.

The results from these regression analyses indicate that the percentage of economically disadvantaged anytime students and underrepresented minorities explain a significant and independent share of the variance in graduation rates. In addition the beta scores for both variables were consistently negative. Of the two, the average percentage of economically disadvantaged anytime students tended to predict a greater share of the variance in mean graduation rates than the overall percentage of underrepresented minorities. In a separate linear regression model examining the influence of only the average percentage of economically disadvantaged anytime students and underrepresented minorities on graduation rates, ED Anytime had a beta score of -.53 and

UM had a beta score of -.28. Both beta scores were significant at $p < .01$. The results of these regressions lends evidence to the idea that the purposeful integration of schools by student demographic characteristics could work to equalize educational opportunities for all students since they explain a significant and independent share of the variance in graduation rates.

# V. CONCLUSIONS AND RECOMMENDATIONS

## Graduation Rates for All Students

The first research question examined the relationship between mean graduation rates for the 2011 cohorts and measures of the overall socioeconomic and racial composition of high schools. There was a distinct pattern where students were less likely to graduate in high schools with progressively higher concentrations of economically disadvantaged anytime students. These differences in graduation rates by intervals were more likely to be significantly higher in the lowest poverty schools, 0-29.9% ED Anytime, and significantly lower in the highest poverty schools, 60.0-100% ED Anytime. These findings support my first hypothesis that mean graduation rates for the 2011 cohorts would decline as the average percentage of economically disadvantaged anytime students increases in high schools. They also support my third hypothesis that there would be significant differences in the mean graduation rates for the 2011 cohorts between intervals established by the average percentage of economically disadvantaged anytime students in high schools. Differences would be more likely to be significant at the highest and lowest ends of the interval range.

The results of the correlation between graduation rates and the average percentage of economically disadvantaged anytime students in high schools seem to contradict the patterns seen above. The correlation between these two variables was consistently negative, but only significant in the first two intervals, the lowest poverty schools. One possible explanation for the significant, negative correlations in the first two intervals is that low-income students graduated at lower rates in low poverty schools. Yet,

subsequent analyses done as part of the second research questions demonstrated that this was not the case.

Another possible explanation is that middle and upper income students graduated at lower rates in low poverty schools. This does not seem very likely since low poverty schools tended to have the highest graduation rates and they, by definition, contained mostly middle and upper income students. Unfortunately, the analyses in this study do not provide a definitive answer for this potential explanation or for these correlations in general. These correlations by economically disadvantaged intervals only lend partial support to the ninth hypothesis that the correlation between mean graduation rates for the 2011 cohorts and the average percentage of economically disadvantaged anytime students in high schools would be negative and significantly stronger at progressively higher ends of the interval range. A limitation of this study is that graduation rates were not examined for middle and upper income students as a function of overall school student demographics. The results from such analyses might provide a compelling explanation for why correlations between graduation rates and the average percentage of economically disadvantaged anytime students were only significant in the lowest poverty schools.

When looking at the results from the analyses by UM intervals, graduation rates did not immediately decline in schools with progressively higher concentrations of minority students. There was actually a slight increase in graduation rates in high schools from the first interval, 0.0-9.9% UM, to the second and third intervals, 10.0-29.9% UM. Graduation rates then consistently declined past underrepresented minority concentrations of 29.9%. These results partially support the second hypothesis that mean

graduation rates for the 2011 cohorts would decline as the percentage of underrepresented minorities increases in high schools. The pattern was not as linear as predicted.

The results from the One-Way Analysis of Variance indicate that graduation rates tend to be significantly lower in the fifth and sixth intervals where the percentage of underrepresented minorities exceeds 50%. Graduation rates also tended to be significantly higher in the second and third intervals where the percentage of underrepresented minorities ranged from 10.0-29.9%. These results provide partial support for my fourth hypothesis that there would be significant differences in the mean graduation rates for the 2011 cohorts between intervals established by the percentage of underrepresented minorities in high schools. Differences would be more likely to be significant at the highest and lowest ends of the interval range. The results indicate that there are academic benefits for all students in attending a diverse high school, but also drawbacks in attending a highly segregated one.

The correlations by UM intervals generally support this pattern since there was a significant, negative relationship between graduation rates and the percentage of underrepresented minorities in the sixth interval, 70.0-100.0% UM. The correlation between these two variables was actually positive and significant in the first interval, 0-9.9% UM. This positive correlation is indicative of the fact that the percentage of underrepresented minorities in high schools is only related to a real decline in graduation rates past the third interval. In the remaining intervals, the correlations were negative, although barely so in the second interval. These results from the correlational analysis lend partial support to my tenth hypothesis that the correlation between mean graduation rates for the 2011 cohorts and the percentage of underrepresented minorities in high

schools would be negative and significantly stronger at progressively higher ends of the interval range. The strongest correlation was found in the highest interval, but the relationship was significant and positive in the first. In addition, the negative relationships found in other intervals failed to achieve statistical significance.

The analyses used to explore the first research question demonstrate that there are clear relationships between student demographics and graduation rates. All students generally appear to benefit from attending high school in relatively low poverty and racially diverse environments. These findings indicate that efforts to integrate schools, by socioeconomic status and race, would increase graduation rates for students who are currently educated in highly segregated environments. This would work to equalize educational opportunity since all students would attend high school in a setting where the demographics of their peers tended to increase academic attainment.

It is possible that integrating all schools would not have an overall positive impact on graduation rates since there would be a subsequent decline in the number of very low poverty high schools. Yet, as illustrated in the literature review, the weight of education research indicates that all students would benefit from peer effects by SES in which a majority of students come from middle or upper income backgrounds. Therefore, it is most likely that school integration policies would work to raise graduation rates for low-income and racial minorities, without any academic harm for those from relatively advantaged backgrounds. In addition, public schools should strive serve the best interests of all students, regardless of background. This means that all students deserve to be educated in an integrated setting where there are equitable opportunities for success.

**Graduation Rates for Subsets of Students**

The second research question examined the relationship between mean graduation rates for certain subsets of students in the 2011 cohorts and measures of the overall socioeconomic and racial composition of high schools. Low-income students certainly benefited from attending low poverty high schools. Graduation rates for students labeled as economically disadvantaged anytime generally declined from the first through the fourth intervals, 0.0-49.9% ED Anytime. Taken as a whole, graduation rates then tended to level off. These results generally support my fifth hypothesis that mean graduation rates for economically disadvantaged anytime students in the 2011 cohorts would decline as the average percentage of economically disadvantaged anytime students increases in high schools.

The results from the One-Way Analysis of Variance largely fit this pattern since low-income students were significantly more likely to graduate in the lowest poverty schools, 0.0-19.9% ED Anytime. There were no other significant differences, although this is still a relatively large range of high schools in which low-income students are more likely to graduate. The results of this One-Analysis of Variance lend partial support to my seventh hypothesis that there would be significant differences in the mean graduation rates for economically disadvantaged anytime students in the 2011 cohorts between intervals established by the average percentage of economically disadvantaged anytime students in high schools. Differences would be more likely to be significant at the highest and lowest ends of the interval range. Again, the only significant difference in graduation rates occurred in the lowest poverty schools.

When looking at UM Intervals, minorities were more likely to graduate in high schools where between 0.0-29.9% of their peers were also black or Hispanic as compared to setting where 30.0% or more of their peers were also black or Hispanic. This 0.0-29.9% range encompassed the first three intervals. There was a slight decline in graduation rates for underrepresented minorities through this 0.0-29.9% UM range, but a much larger decline started in the fourth interval, 30.0-49.9% UM, and carried on through the fifth and sixth intervals, 50.0-100.0% UM. This lends partial support to my sixth hypothesis that mean graduation rates for underrepresented minorities in the 2011 cohorts would decrease as the percentage of underrepresented minorities increases in high schools. Graduation rates were fairly stable through the third interval, before starting a more dramatic decline.

The results from the One-Way Analysis of Variance demonstrate that minorities are typically less likely to graduate in highly segregated high schools where between 50.0-100.0% of their peers are also black or Hispanic. This lends partial support to my eighth hypothesis that there would be significant differences in the mean graduation rates for underrepresented minorities in the 2011 cohorts between intervals established by the percentage of underrepresented minorities in high schools. Differences would be more likely to be significant at the highest and lowest ends of the interval range. Differences in graduation rates were significantly lower in the most highly segregated high schools, but differences were also generally significantly higher all the way through interval four.

The results from the analyses done as part of the second research question demonstrate that low-income students are significantly more likely to graduate in low poverty high schools. Minorities are also significantly less likely to graduate in a highly

segregated environment. These results lend further support to policies aimed at integrating schools by socioeconomic status and race, such that, low-income or minority students have the opportunity to learn in environments where the demographics of their peers work to increase their chances of graduating. A limitation of this study is that it only categorized students as either economically disadvantaged anytime or not and as either an underrepresented minority or not. This eliminates the possibility of examining more nuanced research questions that categorize students along more than one variable. For example, underrepresented minorities might only be more likely to graduate in diverse high schools where a high percentage of their black or Hispanic peers come from middle or upper income families.

A recent brief issued by the American Educational Research Association in support of the University of Texas at Austin's affirmative action admission policy, sheds some light on why ensuring diverse learning environments for minorities is so important. The AERA's brief explores the issue of "critical mass" and how it impacts the academic success of minorities. Specifically, a critical mass of fellow minorities in an academic institution helps to protect an individual student against stereotyping, stereotype threat, and discrimination. These benefits of a critical mass of fellow minorities all work to increase achievement. In the context of this study, it may be that diverse student bodies work to protect underrepresented minorities against threats to graduating from high school. This provides further evidence that ensuring diversity by both class and race would be an important element in effective school integration policies.

**Relative Impact of Student Demographics on Graduation Rates**

The third research question looked at the relative impact of measures of the overall socioeconomic and racial composition of high schools on graduation rates. Both the average percentage of economically disadvantaged anytime students and underrepresented minorities in high schools explained a significant and independent share of the variance on graduation rates. This is evident despite the inclusion of various other school level variables thought to influence educational attainment. In addition the beta scores for both variables were consistently negative. This independence shows that student demographic characteristics are not simply a proxy indicator for other school level variables that might influence graduation rates. These results support my eleventh and twelfth hypotheses that the average percentage of economically disadvantaged anytime students and underrepresented minorities would explain a significant share of the variance in mean graduation rates for the 2011 cohorts even when paired with other school level variables thought to influence academic attainment.

The independent, significant influence student demographics have on graduation rates provides further evidence that policies aimed at integrating schools by class and race could work to equalize educational opportunities for all students in Virginia. This would also be a potentially powerful policy level since these student demographic characteristics often explained a greater share of the variance in graduation rates than the other school level variables. Of the two, the average percentage of economically disadvantaged anytime students explained a greater share of the variance in graduation rates than the percentage of underrepresented minorities. Yet, it is still logical to assume

that integrating schools along both these variables would have a greater positive impact on graduation rates than one alone.

**Future Directions for Research**

The first two suggestions for future research may well be examined in tandem, how does integration at the high school level by socioeconomic status and race impact graduation rates for middle and upper income students and how would integration impact overall graduation rates. The weight of evidence from the research literature suggests that in an integrated school setting the graduation rates for middle and upper income students would either decline slightly or not at all (Chiu & Khoo 2005, Coleman 1964, Jargowsky & El Komi 2011, Schwartz 2010, and Zimmer & Toma 2000). Yet, there is some evidence that in an integrated school setting any gains in achievement for low-income students would be offset by declines for middle and upper income students (Caldas & Bankston 1997, Mayer 2002, and Rumberger & Palardy 2005). Further research is necessary to lend additional support to either of these two competing theories.

Only one of the studies listed in the previous paragraph (Mayer, 2002) used educational attainment, as opposed to achievement scores, as the outcome measure. Therefore, it is very important that researchers continue to examine how student demographics impact educational attainment in addition to achievement. Another important area of future research is how effective implementing race neutral policies will be on creating racially diverse schools. Nationally, there is high collinearity between race and socioeconomic status, but they certainly do not overlap perfectly. In addition, the division of school districts along geographic boundaries would almost certainly make it more difficult to create an integrated school environment for all students. The impetus

for such research stems from the current legal environment created by the Supreme Court Decisions in *Parents v. Seattle School District* and *Meredith v. Jefferson County*. This research would be highly contextual, but could provide a practical guide for states and school districts as they plan future integration efforts. Such research could also provide legal cover for districts that determine that they must consider the race of individual students in order to eliminate racial isolation.

Results from the two regression models indicate that there are numerous school level variables, beyond student demographics, that explain some of the variance in mean graduation rates among high schools. This would indicate that policies designed to increase graduation rates should not focus solely on manipulating student assignments. Numerous policies aimed at addressing a variety of these school level variables would almost certainly be the most effective. For example, reading scores consistently predicted a significant share of the variance in graduation rates. The potential positive impact of integrating schools along both race and socioeconomic status would most likely to be greater if paired with policies designed to increase reading ability before and during high school.

This study looked at Virginia as whole, but decisions about how to integrate schools would have to be made at the local and regional level. This study provides justification for integrating schools by race and socioeconomic status, but further research is needed to provide guidance to local school divisions on the potential impacts of various inter- and intra-district solutions. In addition, research on the local level can provide guidance on how best to design these potential solutions.

**Future Directions for Policy**

The results from this study indicate that manipulating student assignment policies such that all high schools in Virginia serve a proportionate share of economically disadvantaged anytime students and underrepresented minorities would work to equalize educational opportunity. Unfortunately, students who attend highly segregated schools are less likely to benefit from resource rich environments, higher quality teachers, more academically oriented peers, and more influential parental networks. In addition, integrated schools help to develop critical thinking skills, foster higher academic achievement, greater cross-racial understanding, and the ability to work with and become friends with people from a variety of backgrounds. Manipulating student assignment policies to integrate all schools is not only good policy, but it is also a moral imperative since public education should strive to provide all students with similar opportunities for success.

The purposeful integration of high schools would work to raise the graduation rates for those students most in danger of dropping out, economically disadvantaged anytime students and underrepresented minorities. As stated in the methodology section 87.1% of all students in the 2011 cohort graduated from high school as compared to 79.1% of students who were labeled as economically disadvantaged anytime. At the same time 89.7% of white students graduated as compared to 80.3% of black and 79.2% of Hispanics. Unfortunately, these low-income and minority students are more likely to attend high school with a relatively high percentage of like peers. For these students, integrated high schools would help to raise graduation rates, which conveys numerous private and public benefits. High school graduates are more likely to be employed, earn

higher wages, experience greater levels of nonwage remuneration, fringe benefits, and live longer. They are also less likely to use various social services, commit numerous types of crimes and have children who drop out. They also contribute more to society through increased tax revenues and a greater likelihood of voting.

An important consideration is what impact, if any, integrating all schools to reflect the socioeconomic and racial diversity of the state as a whole would have on overall graduation rates. It may be that any increase in graduation rates for those students who would have attended high schools that serve relatively high concentrations of low-income and minority students would be accompanied by a subsequent decline in graduation rates for those students who would have attended high schools that serve relatively low concentrations of low-income and minority students. While this study did not specifically examine this possibility, an important conclusion from the research literature is the idea that integration would most likely work to boost overall graduation rates. In a hypothetical situation where all high schools in Virginia served a representative sample of the entire student population, graduation rates for middle and upper income students and whites would likely either not decline at all or to a smaller degree so as to not offset the gains made by low-income and minority students. Integration would then work to both equalize educational opportunity and increase overall graduation rates.

**Tipping points.** Another goal of this study was to examine the concept of tipping points. It appears that all students would benefit from attending high school where a majority of their peers were from middle or upper income families. It would also appear that school divisions should strive to ensure that no high school contains a "majority-

minority" student population. A few results from the analyses are particularly relevant for this discussion about tipping points. The first is that graduation rates for all students were generally significantly higher in schools that served a student population between 0-29.9% economically disadvantaged anytime and generally significantly lower in schools that served a student population between 60.0-100.0% economically disadvantaged anytime. The second is that low-income students were significantly more likely to graduate in schools where between 0.0-19.9% of their peers were labeled as economically disadvantaged anytime.

The third is that graduation rates for all students were typically significantly higher in schools that served a student population where between 10.0-29.9% of all students were minorities and typically significantly lower in schools where more than 50% of students were minorities. The fourth is minorities were typically significantly more likely to graduate in high schools where fewer than 50% of students were also minorities. Based on these results, it could be argued that high schools should all serve a population where between 10% and 30% of students are minorities and fewer than 30% come from low-income backgrounds. In addition, low-income students should be integrated into high schools with fewer than 30% of like peers.

Yet, this focus on fixed tipping points is probably short sighted because of two important limitations of this study. The first is that this study focused on just a single outcome, graduation rates. While this was designed to address a gap in the research literature, the results from this study may not be applicable to other measures of attainment or measures of achievement. In addition, this study focused on a single state. These two facts make the results very context specific and so it is very difficult to pin

down specific tipping points for socioeconomic status and race, which may be useless for a different outcome measure or in a different state. Therefore, it is more appropriate to suggest that school divisions in Virginia strive to integrate high schools such that no building serves a low-income population beyond 50%. In addition, school divisions should work to ensure that all schools are racially diverse, but none are highly segregated by race.

Policies aimed at integrating schools along the parameters listed above can generally be divided into intra- and inter-district options (Mantil et al., 2012). The most direct intradistrict policy is to simply redraw attendance zone boundaries such that all schools serve a diverse student body. This has worked in some school districts like LaCrosse, Wisconsin, but might not always be feasible in other divisions due to widespread residential segregation (Kahlenberg, 2001). School districts such as Jefferson County, Kentucky or Cambridge, Massachusetts have implement a managed choice or parental controlled choice policy (Mantil et al., 2012). This gives parents the choice of choosing schools outside of their neighborhood attendance zone and district officials ensure that student demographic characteristics fall within established ranges. District officials can also weight admissions to magnet schools as a way to ensure diverse student bodies or make decisions on students transfers with an eye to diversity (Mantil et al, 2012).

For many school divisions integration along the parameters suggested above is not possible using only intradistrict strategies. Fortunately, there are examples of interdistrict integration policies in school divisions across the United States. Many segregated school districts have consolidated with neighboring divisions as a way to

create a student population from which integrated schools can be created. Prominent examples of this include Wake and Jefferson County Public Schools. Wake County Public Schools were created after the consolidation of the City of Raleigh Public Schools with the surrounding county of Wake, N.C. Jefferson County Public Schools were created after the consolidation of the City of Louisville with the surrounding county of Jefferson, Kentucky.

Absent consolidation, there are numerous cases where entire metropolitan areas have developed voluntary integration policies designed to reduce socioeconomic and racial isolation in urban school districts. Since 1999, the city of Omaha has leveraged school choice mechanisms and magnet schools to ensure that participating schools in the greater metropolitan area serve a student population where no more than 40% of students are eligible for Free and Reduced Priced Lunch (Mantil et al., 2012). Boston METCO's program allows mostly minority students residing in Boston to attend school in one of thirty-seven suburban districts. Compensatory funds follow these students as a way to entice participation from suburban districts. These sorts of voluntary policies designed to increase racial integration across a metropolitan region are also used in Rochester, St. Louis, Indianapolis, East Palo Alto, and San Diego (Mantil et al., 2012).

These interdistrict and intradistrict integration policies would likely be particularly successful in Virginia. Mantil, Perkins, and Aberger (2012) conducted an analysis of the viability of policies to increase socioeconomic integration across six different states. Virginia is relatively unique in that many school districts of concentrated poverty happen to border relatively affluent divisions. In their study, Mantil et al. (2012) defined high-poverty schools as those that serve a FRPL population over 40%. Based on

this definition, Mantil et al. (2012) project that intradistrict and interdistrict integration policies could reduce the number of high-poverty schools in Virginia by 60%, the highest in their sample.

The policy recommendations listed above were formulated with the idea that integrating schools along socioeconomic and racial lines are equally feasible. Unfortunately, using race as an individual identifier when assigning students to schools has become more difficult since the Supreme Court Decision in *Parents v. Seattle School District* and *Meredith v. Jefferson County.* The U.S. Department of Justice, Civil Rights Division and the U.S. Department of Education, Office of Civil Rights recently published a guidance letter to educational institutions about options for creating integrated schools in light of the 2006 Supreme Court Decision. This guidance letter provides advice for school districts that want to purposefully work to integrate their schools as a tool to raise student achievement. The U.S. Departments of Justice and Education emphasize that school districts must first implement integration policies that do not consider the individual race of the student. A potential solution is to examine racial composition at the neighborhood level from Census tract data to use in student assignments. If such policies still result in racial isolation only then can districts consider the individual race of students. While more difficult than before the 2006 Supreme Court decision, implementing student assignment policies designed to achieve racial integration is still a legally defensible strategy.

**Summary Points**

The study lends evidence to one of the central conclusions of the Coleman Report, who you go to school with matters. When examining graduation rates, all students

benefit from attending relatively low poverty and racially diverse high schools. As a corollary, highly segregated, whether by race or socioeconomic status, high schools tend to depress graduation rates. Similarly, low-income students profit from attending high school where a high percentage of their peers come from middle and upper income backgrounds. Minorities are least likely to graduate in highly segregated schools by race. In addition, overall measures of the socioeconomic and racial composition of high schools exert an independent, significant influence on graduation rates. In fact, school wide student demographics are one of the strongest predictors of graduation rates.

Research must continue on the impacts of school wide demographics on individual achievement because of its direction connections to policy and the potential integrated schools have for improving student outcomes. In the future, researchers must continue to examine how integration efforts impact overall measures of achievement or attainment, not just for certain subsets of students. In addition, research must continue of how student demographics impact academic attainment, as opposed to achievement. Unfortunately, very little research has focused on this important concept. Finally, as long as the courts favor race neutral plans for integration, research should continue to examine how effective they are at achieving the goal of racially integrated schools.

These findings support policies aimed at integrating schools by both socioeconomic status and race. To the extent that public schools should serve the best interests of all students, this sort of integration is essential. There is also evidence from this study and the research literature to suggest that such integration would work to raise graduation rates for those most likely to drop out in Virginia, low-income and minority students, without changing graduation rates for those from more advantaged

backgrounds. The public and private benefits of raising graduation rates as a result of integrating high schools could be tremendous.

Integration can be a contentious process and conjure up unpleasant memories of anti-busing protests and white flight to the suburbs. Yet there are examples of school divisions that have worked to integrate their schools on a voluntary basis with decades long records of success. In addition, integration efforts can be coupled with policies that entice parents such as school choice mechanisms and specialized magnet school programs. The executive branch has also provided approval for voluntary integration efforts through their guidance letter from The U.S. Department of Justice, Civil Rights Division and the U.S. Department of Education, Office of Civil Rights.

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## APPEDNIX A

Table 17

*Percent Ranges in Student Demographic Characteristics by Decile*

| Decile Number | ED Anytime | UM |
|---|---|---|
| 1 | 0.0-13.9 | 0-2.6 |
| 2 | 14.7-21.3 | 2.8-7.7 |
| 3 | 21.8-25.8 | 7.8-12.8 |
| 4 | 25.8-31.7 | 13.1-18.4 |
| 5 | 31.7-40.6 | 18.5-24.4 |
| 6 | 40.9-45.2 | 24.4-31.6 |
| 7 | 45.5-50.1 | 31.8-41.7 |
| 8 | 50.9-57.6 | 42.0-52.1 |
| 9 | 57.9-63.7 | 52.5-64.3 |
| 10 | 63.8-95.8 | 64.5-98.3 |

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime. UM = underrepresented minorities; students identified as black or Hispanic.

Table 18

*Mean Graduation Rates by ED Anytime Deciles*

| ED Anytime Decile | Mean Graduation Rate | *N* |
|---|---|---|
| 1 | 95.69 | 30 |
| 2 | 93.14 | 30 |
| 3 | 89.53 | 30 |
| 4 | 88.03 | 30 |
| 5 | 87.51 | 30 |
| 6 | 85.39 | 30 |
| 7 | 84.94 | 30 |
| 8 | 85.31 | 30 |
| 9 | 82.17 | 30 |
| 10 | 79.48 | 32 |

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.

Table 19

*Mean Graduation Rates by Underrepresented Minority Deciles*

| UM Decile | Mean Graduation Rate | *N* |
|---|---|---|
| 1 | 87.96 | 30 |
| 2 | 87.78 | 30 |
| 3 | 91.63 | 30 |
| 4 | 90.51 | 30 |
| 5 | 91.67 | 30 |
| 6 | 89.19 | 30 |
| 7 | 86.75 | 30 |
| 8 | 85.73 | 30 |
| 9 | 80.81 | 30 |
| 10 | 79.18 | 32 |

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.

Table 20

*Mean Differences in Graduation Rates by ED Anytime Deciles*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | 2.55 | 6.16* | 7.66* | 8.18* | 10.30* | 10.75* | 10.38* | 13.52* | 16.21* |
| 2 | -2.55 | - | 3.61 | 5.11* | 5.63* | 7.75* | 8.20* | 7.83* | 10.97* | 13.66* |
| 3 | -6.16* | -3.61 | - | 1.50 | 2.02 | 4.13 | 4.59* | 4.22 | 7.35* | 10.04* |
| 4 | -7.66* | -5.11* | -1.50 | - | .52 | 2.64 | 3.09 | 2.72 | 5.86* | 8.55* |
| 5 | -8.18* | -5.63* | -2.02 | -.52 | - | 2.11 | 2.57 | 2.20 | 5.33* | 8.02* |
| 6 | -10.30* | -7.75* | -4.13 | -2.64 | -2.11 | - | .46 | .09 | 3.22 | 5.91* |
| 7 | -10.75* | -8.20* | -4.59* | -3.09 | -2.57 | -.46 | - | -.37 | 2.76 | 5.45* |
| 8 | -10.38* | -7.83* | -4.22 | -2.72 | -2.20 | -.09 | .37 | - | 3.13 | 5.82* |
| 9 | -13.52* | -10.97* | -7.35* | -5.86* | -5.33* | -3.22 | -2.76 | -3.13 | - | 2.69 |
| 10 | -16.21* | -13.66* | -10.04* | -8.55* | -8.02* | -5.91* | -5.45* | -5.82* | -2.69 | - |

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.
* $p < .05$.

Table 21

*Mean Differences in Graduation Rates by Underrepresented Minority Deciles*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | .18 | -3.67 | -2.55 | -3.71 | -1.23 | 1.21 | 2.23 | 7.15* | 8.78* |
| 2 | -.18 | - | -3.85 | -2.73 | -3.89 | -1.41 | 1.03 | 2.05 | 6.97* | 8.60* |
| 3 | 3.67 | 3.85 | - | 1.12 | -.04 | 2.44 | 4.88* | 5.90* | 10.82* | 12.45* |
| 4 | 2.55 | 2.73 | -1.12 | - | -1.16 | 1.32 | 3.76 | 4.78* | 9.70* | 11.33* |
| 5 | 3.71 | 3.89 | .04 | 1.16 | - | 2.48 | 4.92* | 5.94* | 10.86* | 12.49* |
| 6 | 1.23 | 1.41 | -2.44 | -1.32 | -2.48 | - | 2.45 | 3.47 | 8.39* | 10.01* |
| 7 | -1.21 | -1.03 | -4.88* | -3.76 | -4.92* | -2.45 | - | 1.02 | 5.94* | 7.56* |
| 8 | -2.23 | -2.05 | -5.90* | -4.78* | -5.94* | -3.47 | -1.02 | - | 4.92* | 6.54* |
| 9 | -7.15* | -6.97* | -10.82* | -9.70* | -10.86* | -8.39* | -5.94* | -4.92* | - | 1.62 |
| 10 | -8.78* | -8.60* | -12.45* | -11.33* | -12.49* | -10.01* | -7.56* | -6.54* | -1.62 | - |

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.
* $p < .05$.

Table 22

*Correlation Between Graduation Rates and the Percentage of Students Labeled as Economically Disadvantaged Anytime by Economically Disadvantaged Anytime Deciles*

| ED Anytime Decile | *N* | Pearson Correlation Coefficient |
|---|---|---|
| 1 | 30 | -.60** |
| 2 | 30 | -.05 |
| 3 | 30 | -.14 |
| 4 | 30 | -.02 |
| 5 | 30 | -.26 |
| 6 | 30 | -.21 |
| 7 | 30 | -.07 |
| 8 | 30 | .11 |
| 9 | 30 | -.10 |
| 10 | 32 | -.19 |

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.
** $p < .01$.

Table 23

*Correlation Between Graduation Rates and the Percentage of Underrepresented Minorities by Underrepresented Minority Deciles*

| UM Decile | *N* | Pearson Correlation Coefficient |
|---|---|---|
| 1 | 30 | -.13 |
| 2 | 30 | .29 |
| 3 | 30 | -.20 |
| 4 | 30 | -.25 |
| 5 | 30 | -.10 |
| 6 | 30 | .09 |
| 7 | 30 | .06 |
| 8 | 30 | .22 |
| 9 | 30 | -.31 |
| 10 | 32 | -.59** |

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.
** $p < .01$.

Table 24

*Mean ED Anytime Graduation Rates by ED Anytime Deciles*

| ED Anytime Decile | ED Anytime Mean Graduation Rate | *N* |
|---|---|---|
| 1 | 85.29 | 29[a] |
| 2 | 83.14 | 30 |
| 3 | 79.19 | 30 |
| 4 | 77.84 | 30 |
| 5 | 78.69 | 30 |
| 6 | 76.83 | 30 |
| 7 | 78.39 | 30 |
| 8 | 80.60 | 30 |
| 9 | 77.83 | 30 |
| 10 | 76.42 | 32 |

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.
[a] One high school did not contain enough students considered Economically Disadvantaged Anytime for 2011 Graduating Cohort above the reportable level established by the Virginia Department of Education.

Table 25

*Mean Underrepresented Minority Graduation Rates by Underrepresented Minority Deciles*

| UM Decile | Mean Graduation Rate | *N* |
|---|---|---|
| 1 | [a] | 0[a] |
| 2 | 83.02 | 11[a] |
| 3 | 87.92 | 25[a] |
| 4 | 86.46 | 29[a] |
| 5 | 87.52 | 30 |
| 6 | 86.45 | 29[a] |
| 7 | 83.39 | 30 |
| 8 | 82.64 | 30 |
| 9 | 80.03 | 30 |
| 10 | 77.47 | 32 |

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.
[a] Not all 2011 graduating cohorts contained black and/or Hispanic students above the reportable level established by the Virginia Department of Education.

Table 26

*Mean Differences in ED Anytime Graduation Rates by ED Anytime Deciles*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | - | 2.15 | 6.10 | 7.45* | 6.60* | 8.46* | 6.90* | 4.69 | 7.45* | 8.87* |
| 2 | -2.15 | - | 3.95 | 5.30 | 4.45 | 6.31 | 4.75 | 2.54 | 5.30 | 6.72* |
| 3 | -6.10 | -3.95 | - | 1.35 | .50 | 2.36 | .80 | -1.41 | 1.36 | 2.77 |
| 4 | -7.45* | -5.30 | -1.35 | - | -.85 | 1.01 | -.55 | -2.76 | .01 | 1.42 |
| 5 | -6.60* | -4.45 | -.50 | .85 | - | 1.86 | .30 | -1.91 | .85 | 2.27 |
| 6 | -8.46* | -6.31 | -2.36 | -1.01 | -1.86 | - | -1.56 | -3.77 | -1.01 | .41 |
| 7 | -6.90* | -4.75 | -.80 | .55 | -.30 | 1.56 | - | -2.21 | .55 | 1.97 |
| 8 | -4.69 | -2.54 | 1.41 | 2.76 | 1.91 | 3.77 | 2.21 | - | 2.76 | 4.18 |
| 9 | -7.45* | -5.30 | -1.36 | -.01 | -.85 | 1.01 | -.55 | -2.76 | - | 1.42 |
| 10 | -8.87* | -6.72* | -2.77 | -1.42 | -2.27 | -.41 | -1.97 | -4.18 | -1.42 | - |

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.
* $p < .05$.

Table 27

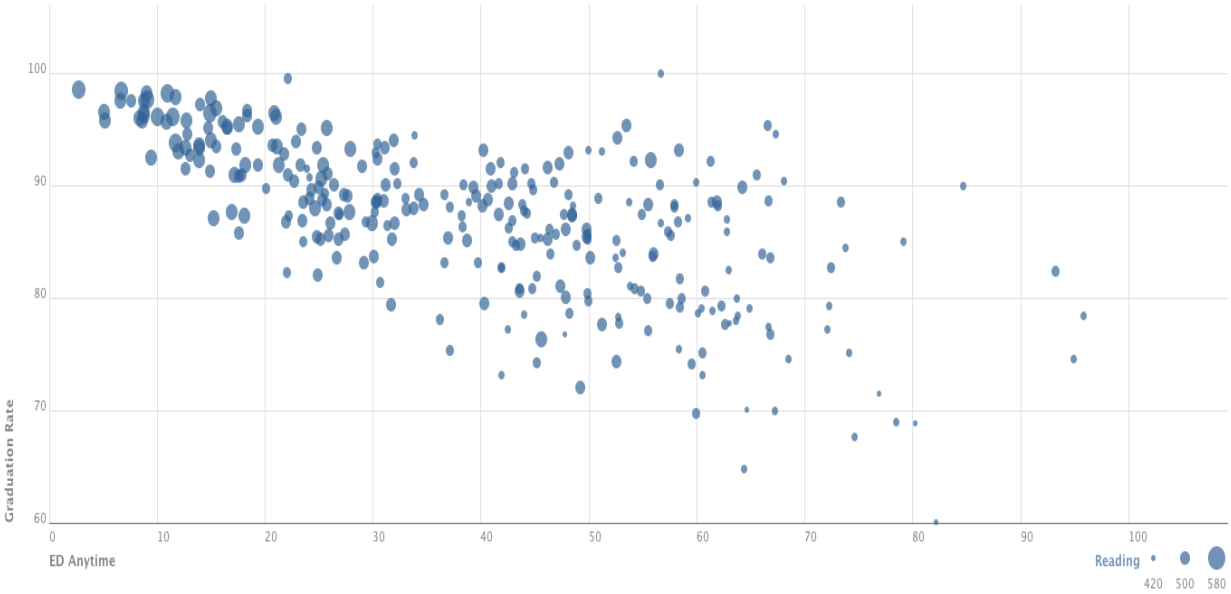
*Mean Differences in Underrepresented Minority Graduation Rates by Underrepresented Minority Deciles*

| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| 2 | - | -4.90 | -3.45 | -4.51 | -3.43 | -.38 | .38 | 2.99 | 5.55 |
| 3 | 4.90 | - | 1.46 | .40 | 1.47 | 4.53 | 5.28 | 7.89* | 10.45* |
| 4 | 3.45 | -1.46 | - | -1.06 | .02 | 3.07 | 3.83 | 6.44* | 9.00* |
| 5 | 4.51 | -.40 | 1.06 | - | 1.08 | 4.13 | 4.89 | 7.50* | 10.06* |
| 6 | 3.43 | -1.47 | -.02 | -1.08 | - | 3.05 | 3.81 | 6.42* | 8.98* |
| 7 | .38 | -4.53 | -3.07 | -4.13 | -3.05 | - | .76 | 3.37 | 5.93 |
| 8 | -.38 | -5.28 | -3.83 | -4.89 | -3.81 | -.76 | - | 2.61 | 5.17 |
| 9 | -2.99 | -7.89* | -6.44* | -7.50* | -6.42* | -3.37 | -2.61 | - | 2.56 |
| 10 | -5.55 | -10.45* | -9.00* | -10.06* | -8.98* | -5.93 | -5.17 | -2.56 | - |

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.
* $p < .05$.

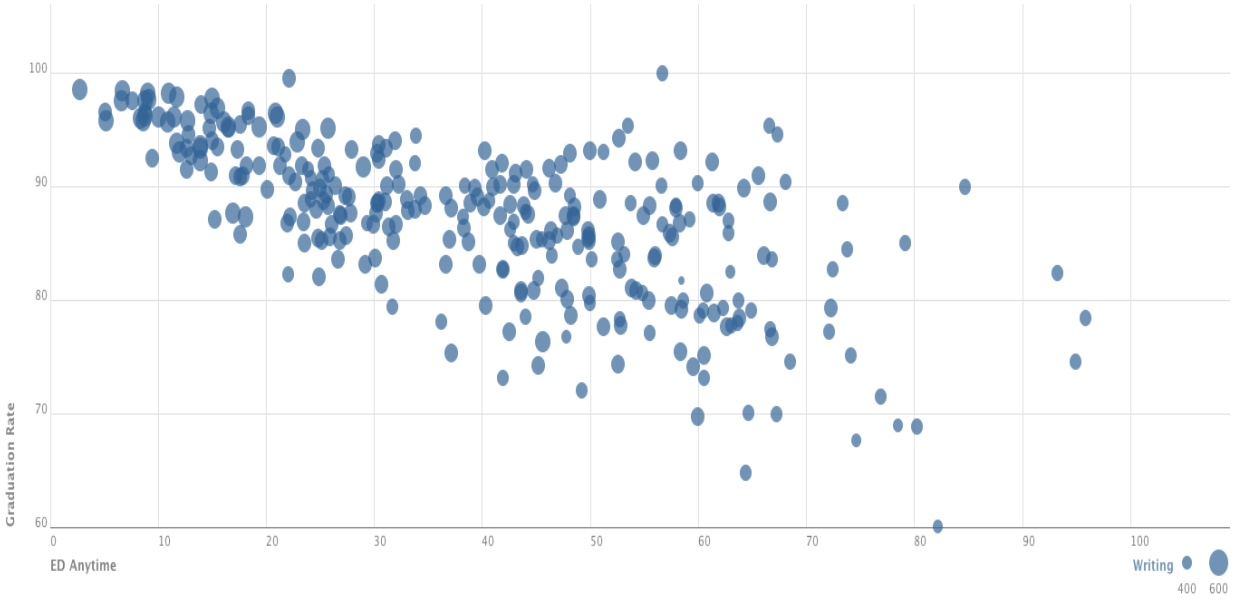
# APPENDIX B

Figure 5. Scatterplot of Mean Graduation Rates, the Average Percentage of ED Anytime Students, and Reading Scores[a]



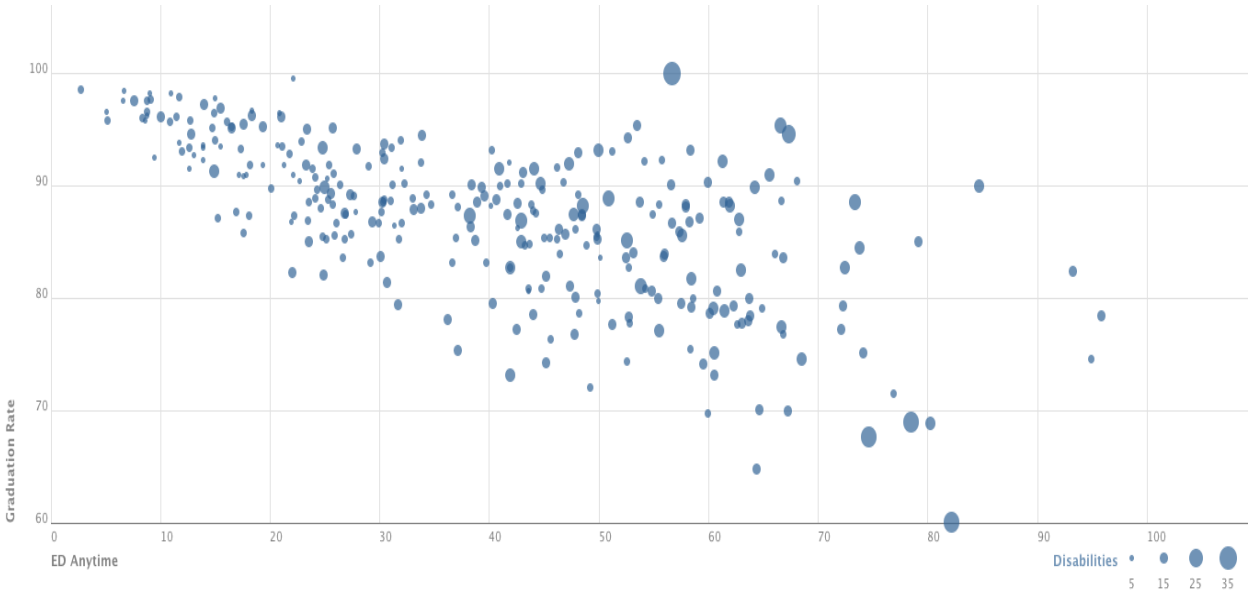

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.
[a] Average Reading Scores are Scaled Averages derived from each high school's participation in the Virginia Standards of Learning (SOL) Assessment Program.

Figure 6. Scatterplot of Mean Graduation Rates, the Average Percentage of ED Anytime Students, and Writing Scores[a]



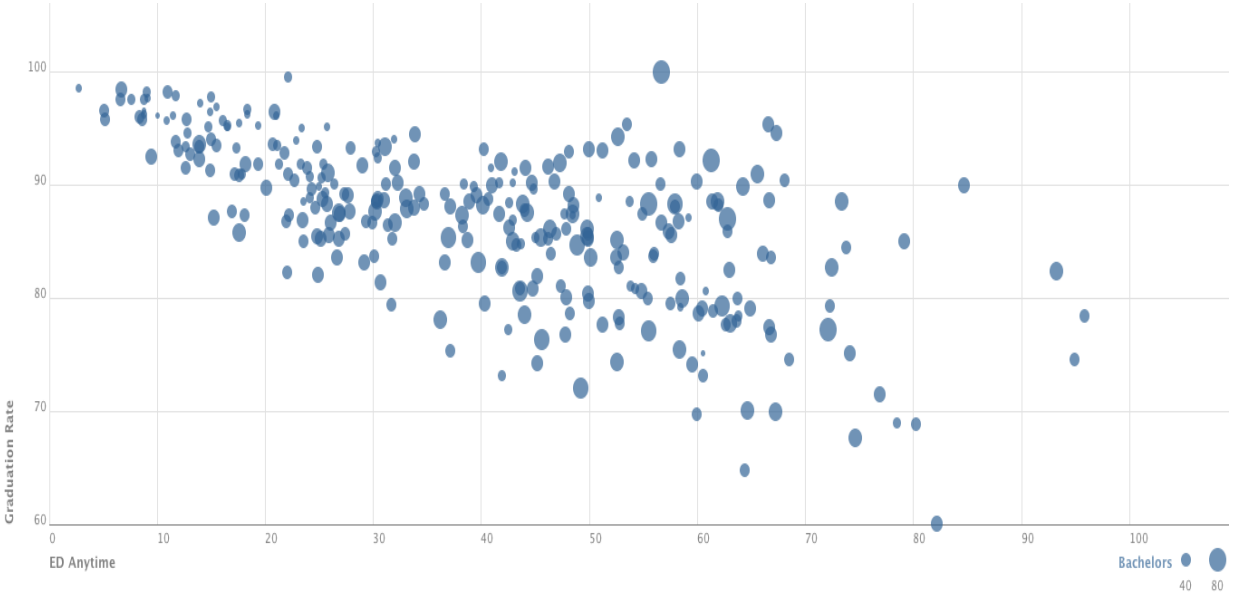

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.
[a] Average Writing Scores are Scaled Averages derived from each high school's participation in the Virginia Standards of Learning (SOL) Assessment Program.

Figure 7. Scatterplot of Mean Graduation Rates, the Average Percentage of ED Anytime Students, and the Percentage of Students with Disabilities



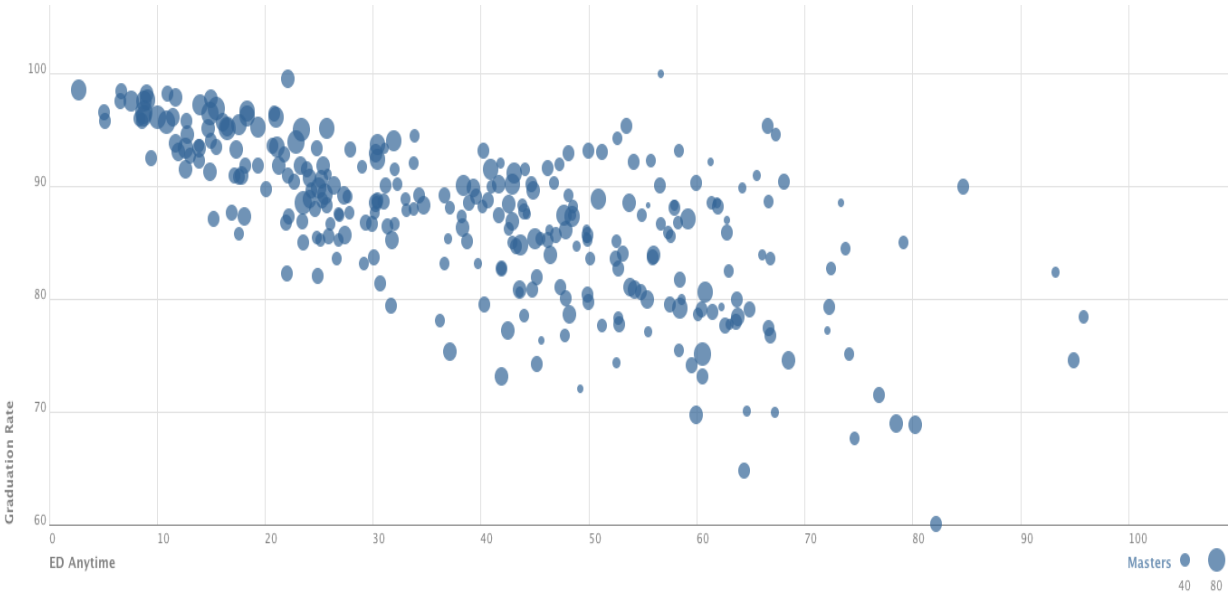

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.

Figure 8. Scatterplot of Mean Graduation Rates, the Average Percentage of ED Anytime Students, and the Percentage of Teachers with a Bachelor's



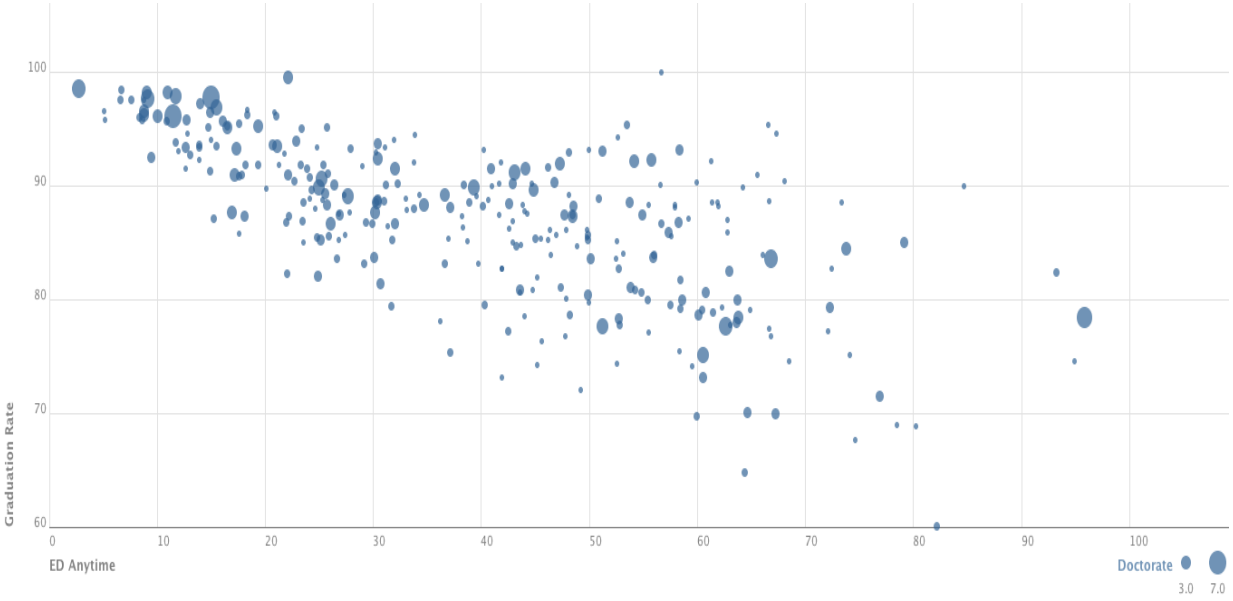

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.

Figure 9. Scatterplot of Mean Graduation Rates, the Average Percentage of ED Anytime Students, and the Percentage of Teachers with a Master's



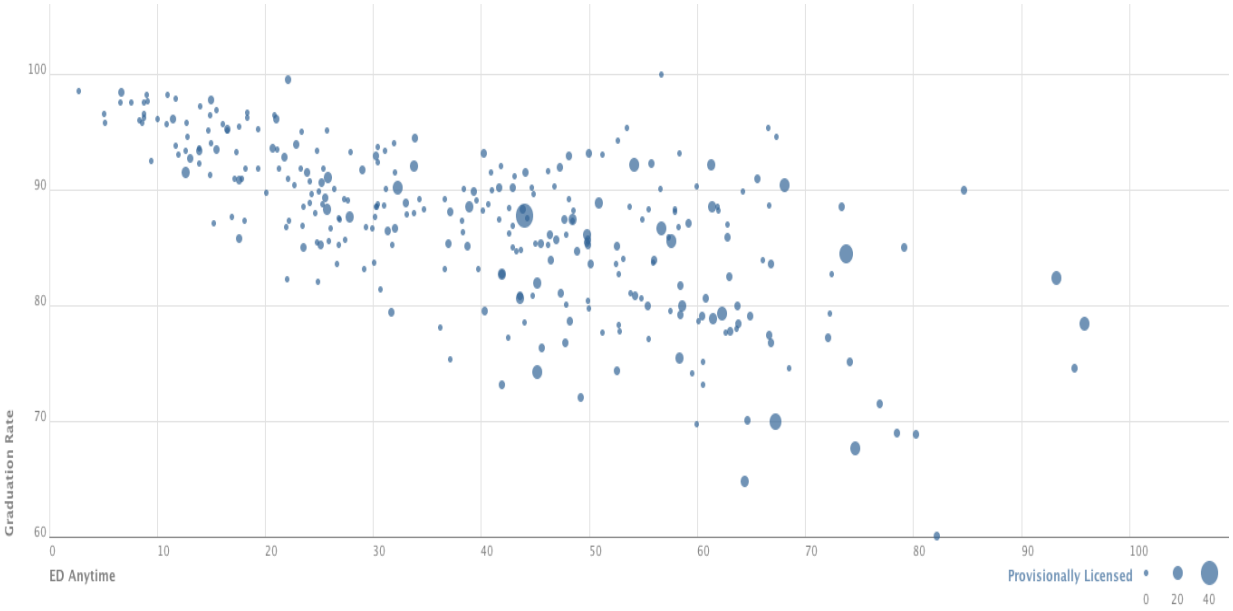

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.

Figure 10. Scatterplot of Mean Graduation Rates, the Average Percentage of ED Anytime Students, and the Percentage of Teachers with a Doctorate



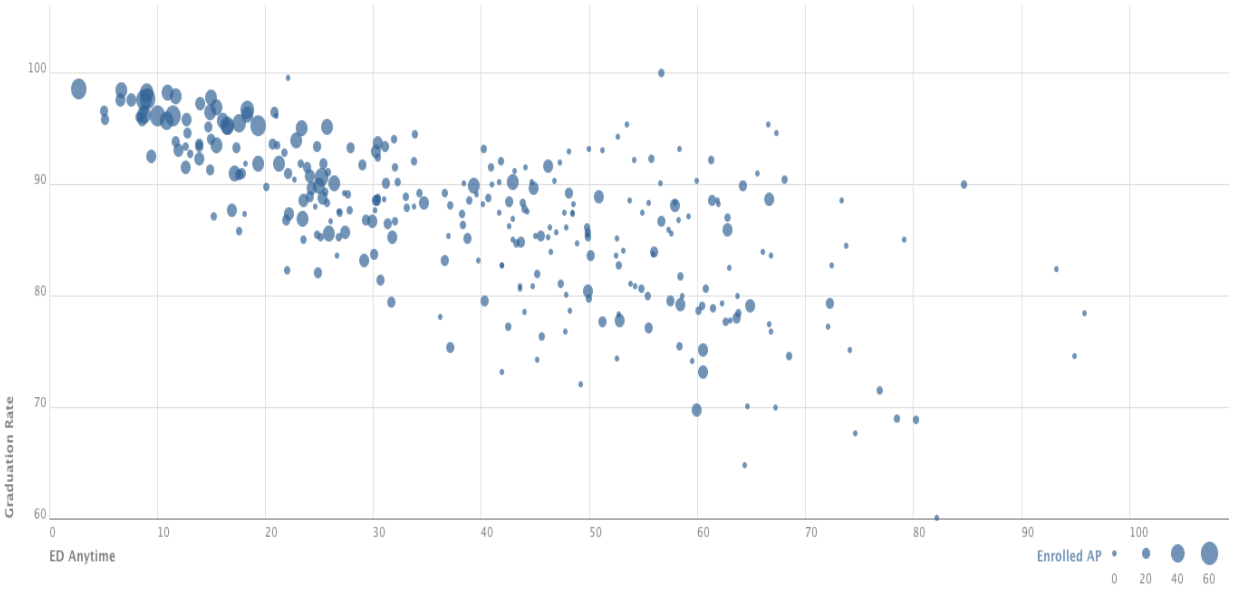

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.

Figure 11. Scatterplot of Mean Graduation Rates, the Average Percentage of ED Anytime Students, and the Percentage of Provisionally Licensed Teachers



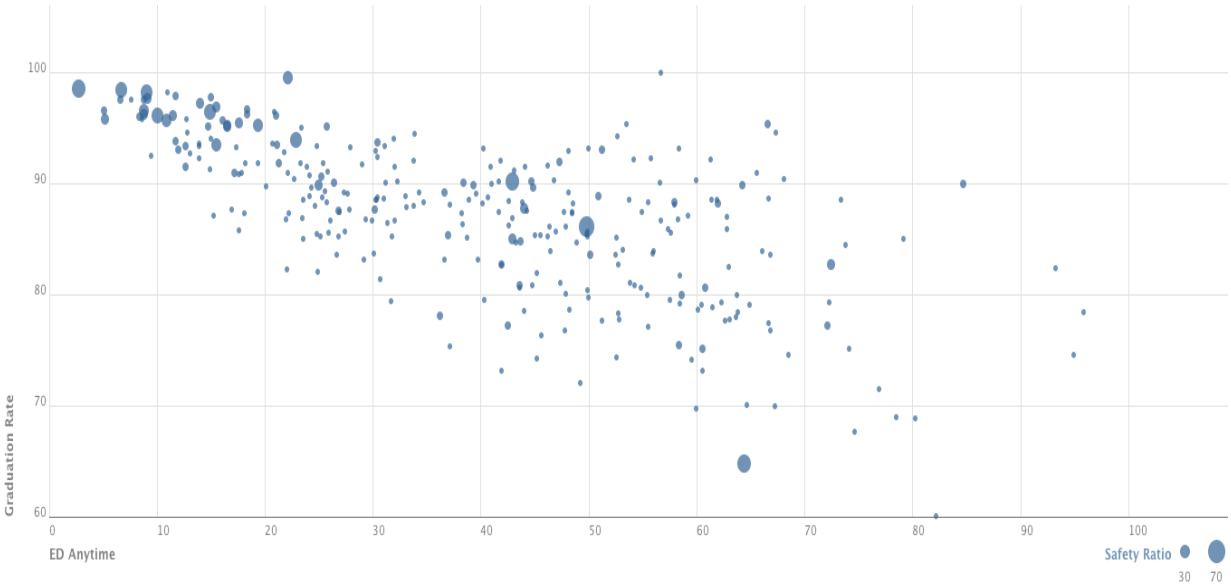

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime.

Figure 12. Scatterplot of Mean Graduation Rates, the Average Percentage of ED Anytime Students, and the Percentage of AP Students



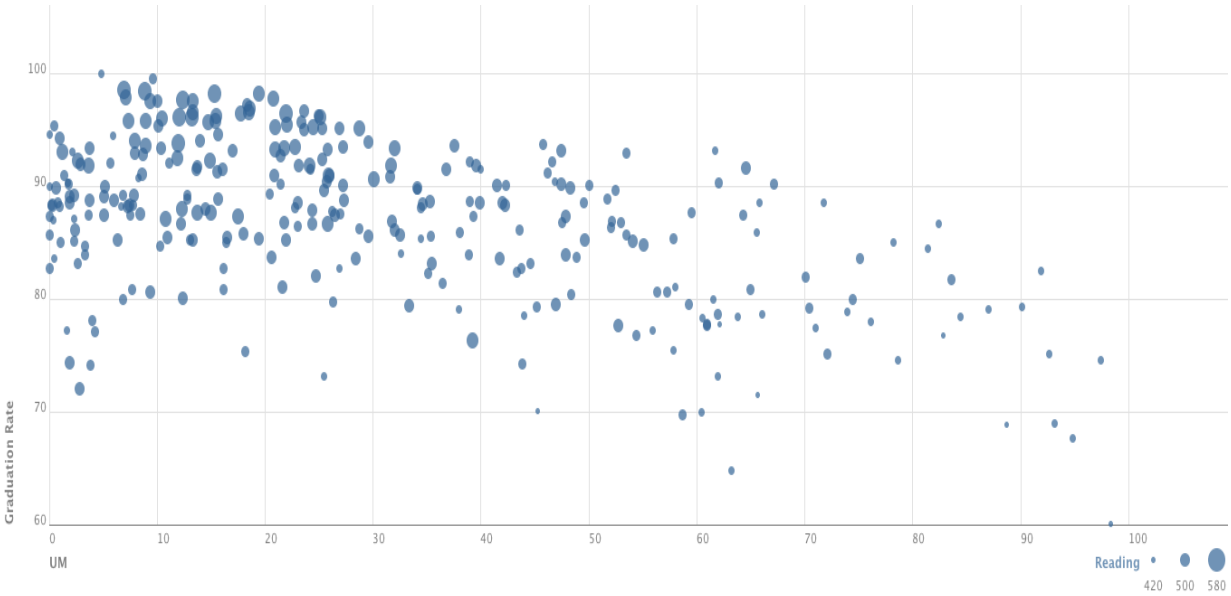

*Note.* ED Anytime = students identified as Economically Disadvantaged Anytime. AP = Advanced Placement Courses.

Figure 13. Scatterplot of Mean Graduation Rates, the Average Percentage of ED Anytime Students, and the School Safety Ratio



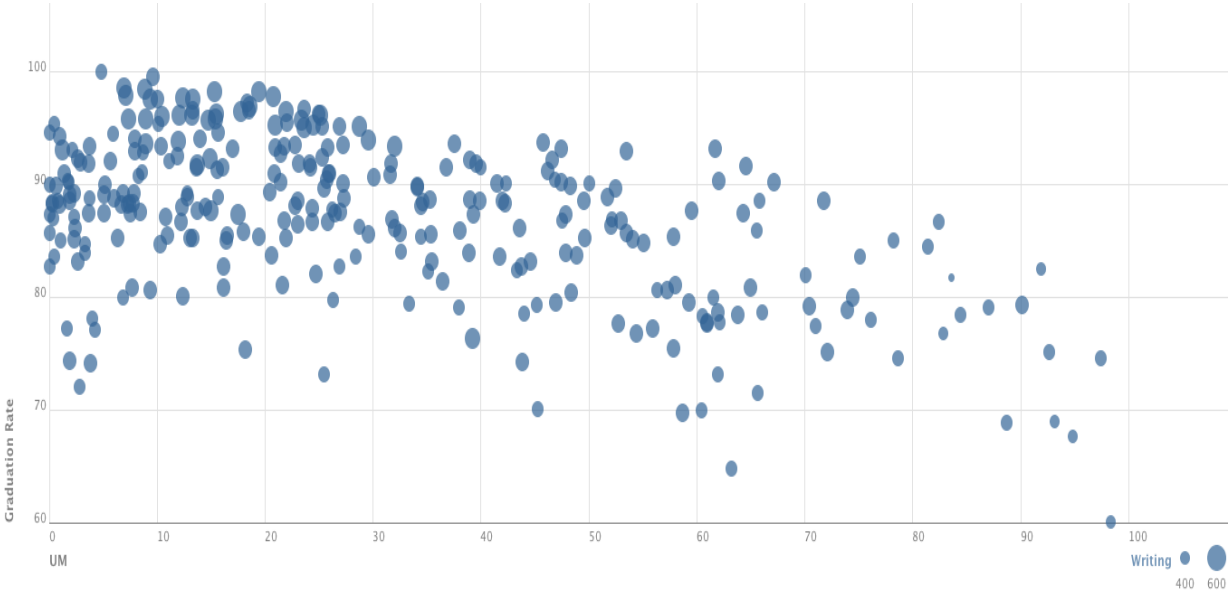

ED Anytime = students identified as Economically Disadvantaged Anytime.

Figure 14. Scatterplot of Mean Graduation Rates, the Percentage of Underrepresented Minorities, and Reading Scores[a]



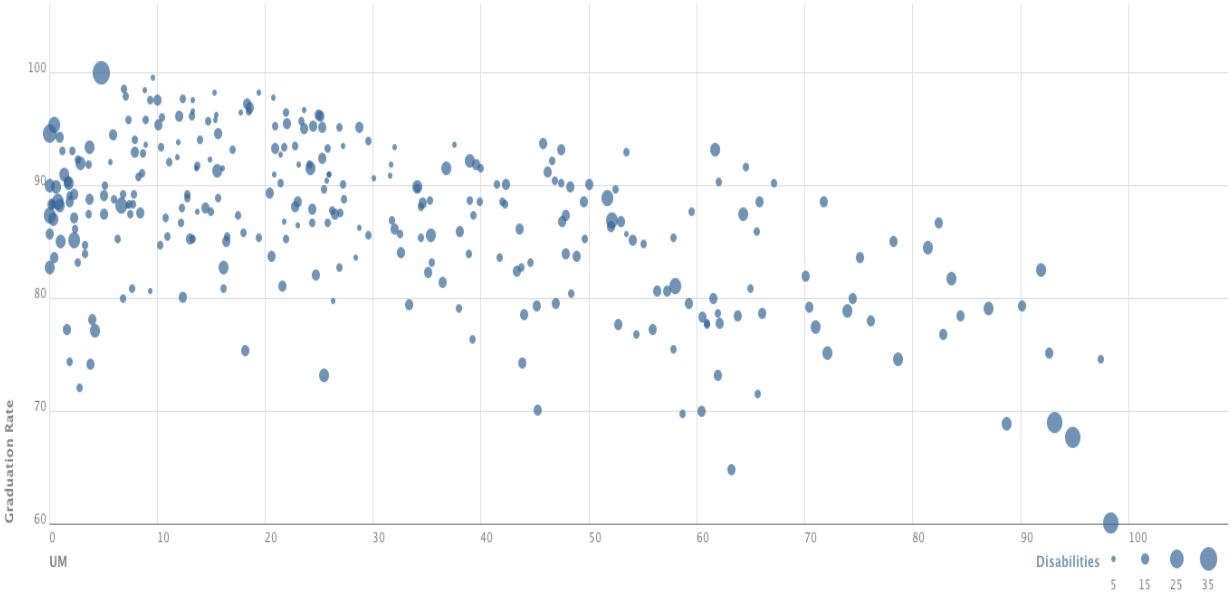

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.
[a] Average Reading Scores are Scaled Averages derived from each high school's participation in the Virginia Standards of Learning (SOL) Assessment Program.

Figure 15. Scatterplot of Mean Graduation Rates, the Percentage of Underrepresented Minorities, and Writing Scores[a]



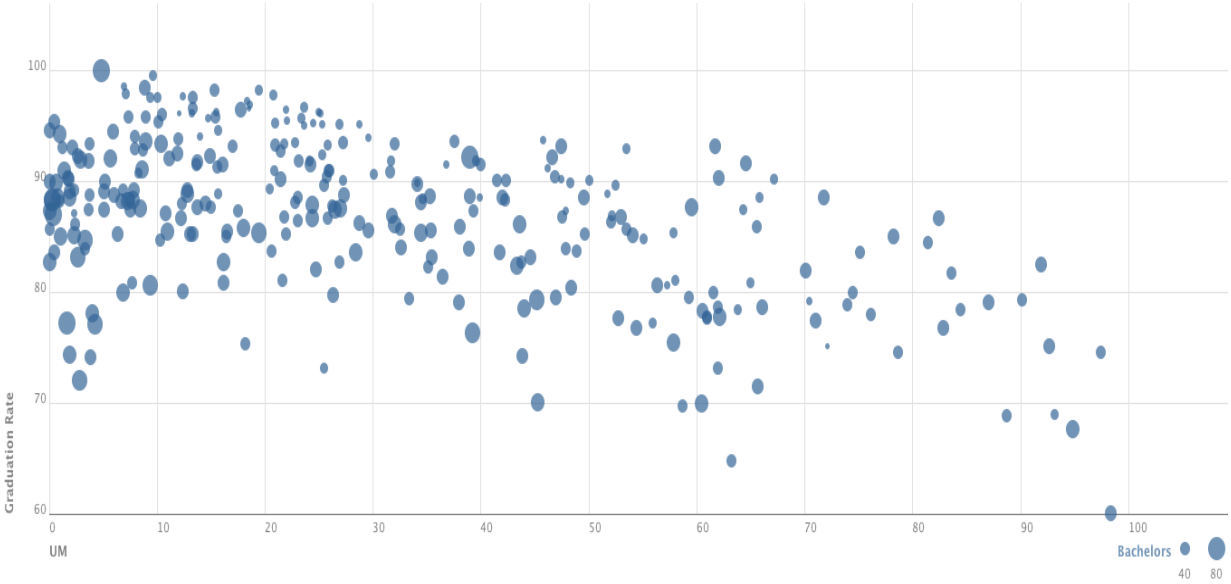

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.
[a] Average Reading Scores are Scaled Averages derived from each high school's participation in the Virginia Standards of Learning (SOL) Assessment Program.

Figure 16. Scatterplot of Mean Graduation Rates, the Percentage of Underrepresented Minorities, and the Percentage of Students with Disabilities



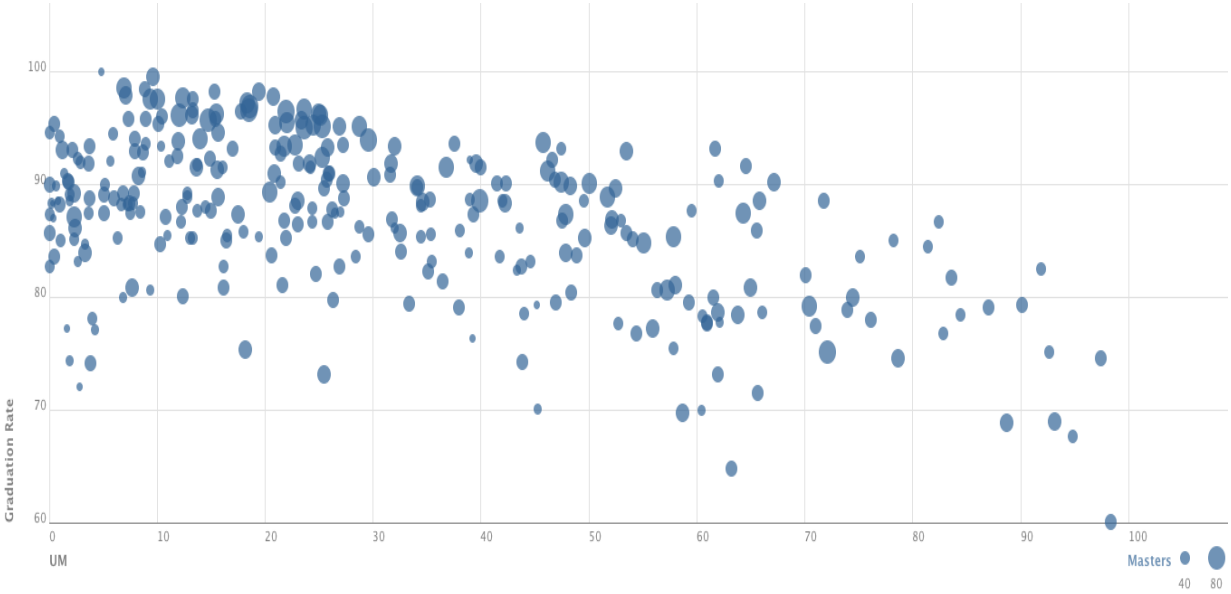

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.

Figure 17. Scatterplot of Mean Graduation Rates, the Percentage of Underrepresented Minorities, and the Percentage of Teachers with a Bachelor's



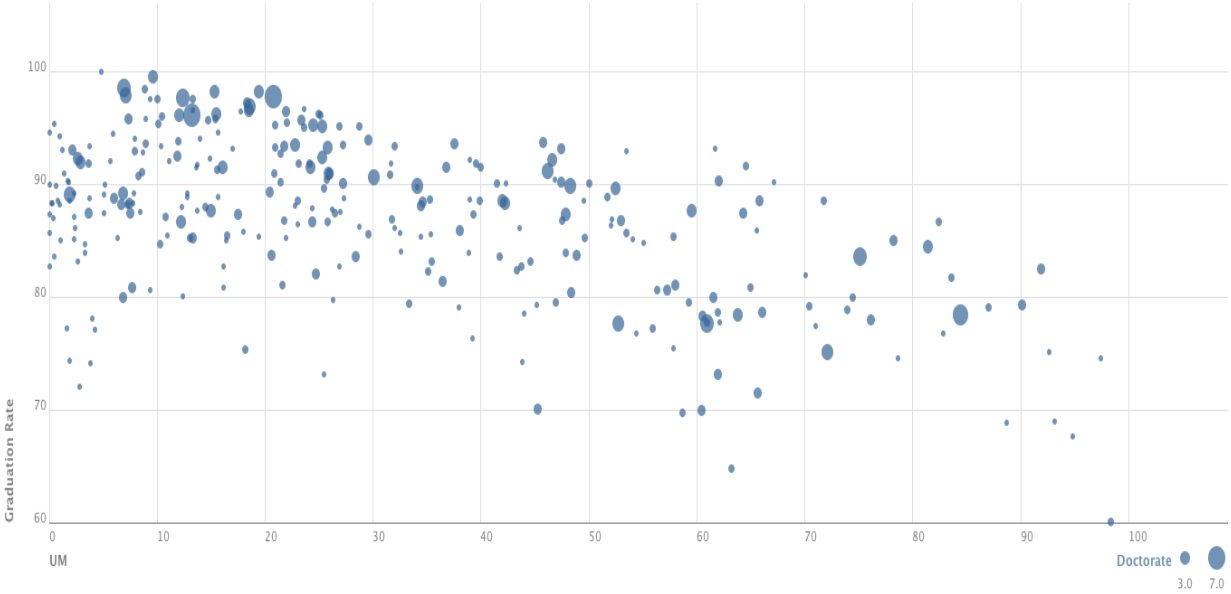

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.

Figure 18. Scatterplot of Mean Graduation Rates, the Percentage of Underrepresented Minorities, and the Percentage of Teachers with a Master's



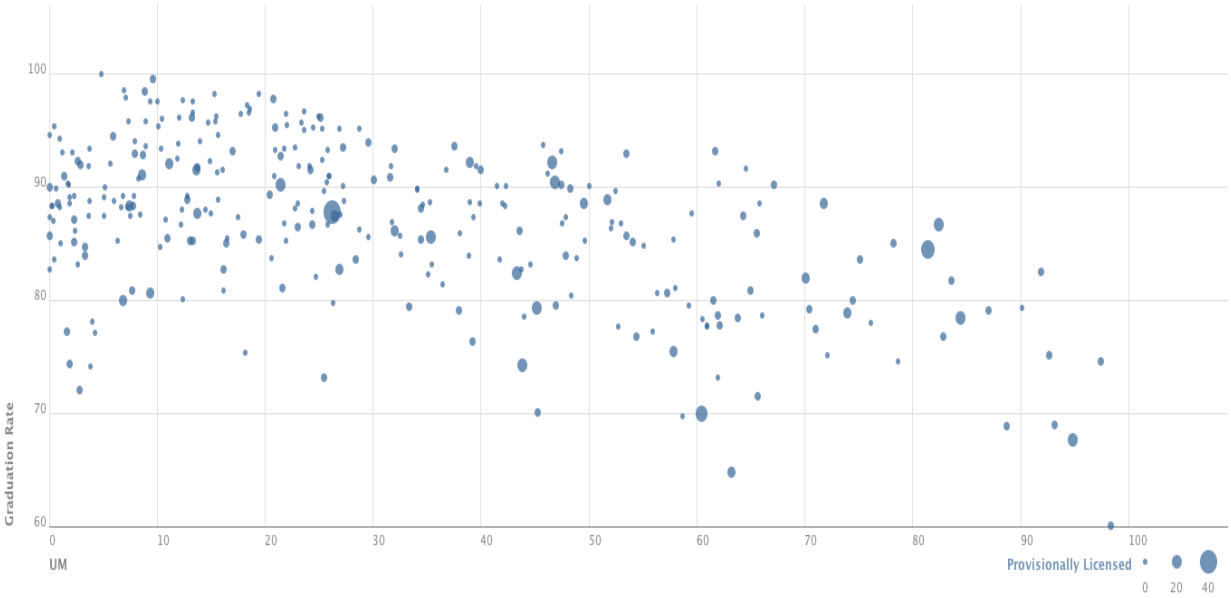

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.

Figure 19. Scatterplot of Mean Graduation Rates, the Percentage of Underrepresented Minorities, and the Percentage of Teachers with a Doctorate



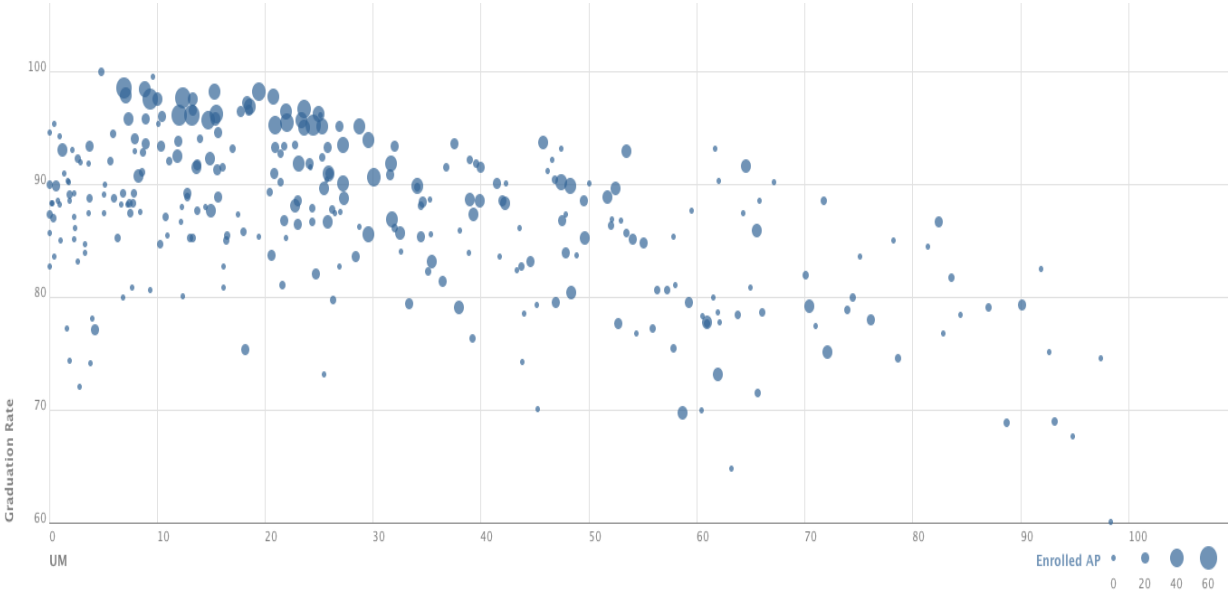

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.

Figure 20. Scatterplot of Mean Graduation Rates, the Percentage of Underrepresented Minorities, and the Percentage of Provisionally Licensed Teachers



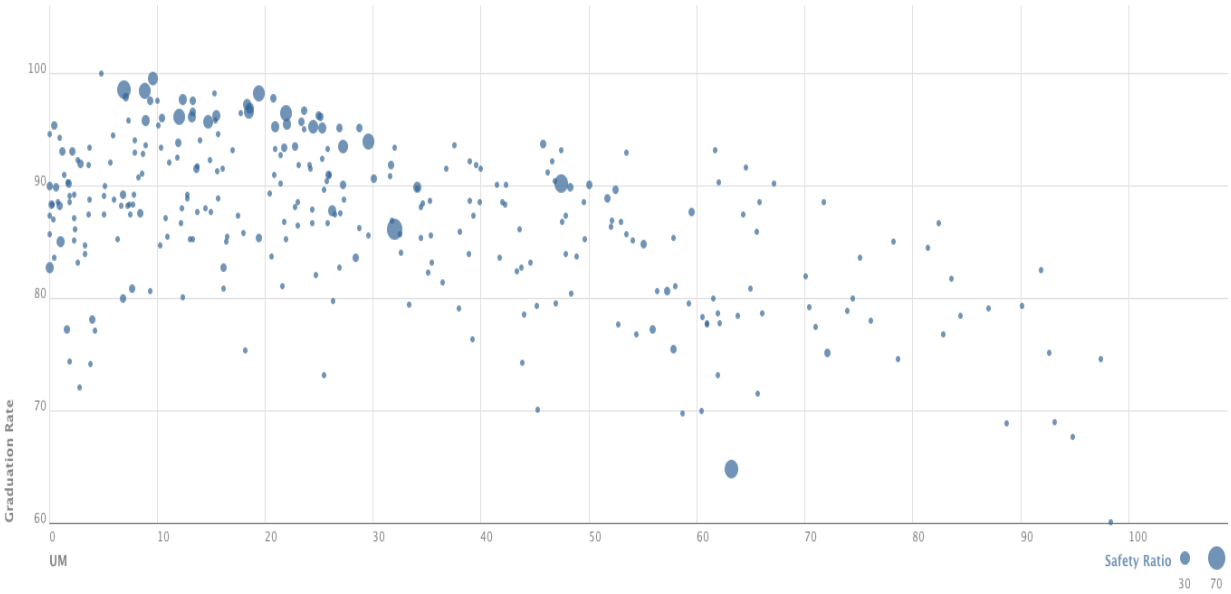

*Note.* UM = underrepresented minorities; students identified as black or Hispanic.

Figure 21. Scatterplot of Mean Graduation Rates, the Percentage of Underrepresented Minorities, and the Percentage of AP Students




*Note.* UM = underrepresented minorities; students identified as black or Hispanic. AP = Advanced Placement Courses.

Figure 22. Scatterplot of Mean Graduation Rates, the Percentage of Underrepresented Minorities, and the School Safety Ratio




*Note.* UM = underrepresented minorities; students identified as black or Hispanic.

# VITA

Philip Andrew Riddle was born May 26, 1982 in Fairfax County, Virginia, and is an American citizen. He graduated from Yorktown High School in Arlington, Virginia in 2000. He received his Bachelor of Arts in Psychology from the University of Virginia, Charlottesville, Virginia in 2005. He received his Masters of Teaching from the University of Virginia, Charlottesville, Virginia in 2005. He subsequently taught in the Arlington County Public Schools system for one year. He then worked in the Henrico County Public Schools system for six years. He received his Education Specialist Degree in Administration and Supervision from the University of Virginia, Richmond Campus in 2009