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The Effect of Socioeconomic and Racial Diversity on Elementary Student Test Performance

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I. Introduction

"We conclude that in the field of public education the doctrine of 'separate but equal' has no place. Separate educational facilities are inherently unequal."
—Earl Warren, Chief Justice of the U.S. Supreme Court

Despite the compelling evidence provided in the 1954 decision in Brown v. Board of Education, the United States has allowed the pursuit of integration to fade into the margins of political discussion and action at the expense of multiple generations of low-income and minority children. Present-day public schools replicate levels of segregation not seen since 1968 (Orfield et. al. 2014). Additionally, the implementation of the No Child Left Behind Act of 2001 led to an increased emphasis on standardized testing and revealed the achievement discrepancies between students of different racial and socioeconomic backgrounds. Our research reveals that pursuing integration in public schools is not a trade-off between diversity and high standardized testing achievement. Moreover, our analysis suggests that greater student body diversity has positive effects on test scores, even for middle- and high-income white students. Pursuing integration, both racially and socioeconomically, is beneficial for both students and overall school performance.

This paper examines how socioeconomic and racial diversity affects test performance. We hypothesize that increasing diversity, either racial or socioeconomic, results in increased test performance. Past literature shows the many ways in which desegregating classrooms by income and ethnicity results in vast benefits socially and academically for the marginalized students at no expense to the wealthy and Caucasian students, which is expanded on in the literature review. More so, studies have proven that, particularly with race desegregation, white students develop and utilize more critical analysis, creative thinking, and more thoughtful discussions when they are in diverse classrooms, skills that continue to benefit them in the workplace and society for the rest of their lives (Bjorklund et. al. 2001).

Throughout our study, we test racial and socioeconomic diversity separately, which allows us to highlight distinct influences of these variables on the students' scores. We apply the Herfindahl-Hirschmann Index to the race distribution of the schools to create a more comprehensive measure of racial diversity in comparison to existing literature. Our results address the hypothesis in various ways. Racial diversity significantly benefits black, white, and sometimes Hispanic test scores, as well as full-price meal students (those without Free and Reduced Meal, FARM, status). However, we did find that socioeconomic diversity, when controlling for race diversity, is mostly insignificant.

II. Literature Review

Following the landmark decision in Brown vs. Board of Education, the effects of this newfound racial integration in public schools across the country were thoroughly studied. Scholars discovered many important benefits, both long and short term, of attending racially integrated schools. As decades passed and academic achievement gaps between races persisted, educational experts moved to study the benefits of socioeconomic integration as a means of solving the race achievement disparities. Most of the literature measures socioeconomic status and racial composition of public schools in terms of free and reduced meals status, FARM, and percent breakdowns of race/ethnicity for the student body, respectively. The study of diversity as *equal distribution of income brackets and ethnicities*, as our research uses, provides the opportunity to study the effect of diversity on achievement in a more nuanced way.

3.A. The Effects of Race

The long-term effects from racial integration have long been studied, but short-term effects, defined by the effects students experience while they are still in K-12, are far less studied. Short-term effects are important in presenting the valuable returns to investment to public education stakeholders who are often deterred by the immensity and financial implications of such initiatives. In terms of testing achievements, it has been shown that a high percentage of black students in elementary schools has a negative impact on black students' test scores, but was insignificant to white students' test scores (Hanushek 2009). Another study tested race composition and black-white segregation effects on students' achievement on the Florida state test. The researchers found that "integrated" schools, those within 15% of average black enrollment for their district, achieved comparable test results to "white-segregated" schools, those that were greater than 15% below the average black enrollment of their district, suggesting that integration processes did not harm school test achievement (Borman et. al. 2004). Short-term effects are not restricted to test results, however, and extensive research into peer effects has shown benefits for both minority and non-minority students (Wells et al. 2016). All students in racially diverse classrooms receive more equitable exposure to highly qualified instructors, academic resources, advanced courses, and greater school funding. They also experience engaging classroom discussion and fewer occurrences of bullying on account of prejudice or stereotyping. Minority students additionally encounter higher educational and disciplinary expectations from their educators than their counterparts in segregated schools (Wells et al. 2016), and English-learning students better acquire the language when exposed to more fluent English-speaking students (Orfield et. al. 2014; Gandara 2009). Non-minority students receive unique benefits as well, with white students experiencing heightened critical-thinking and problem-solving skills (Wells et al. 2016), greater use of moral-reasoning in identifying discrimination and injustice in cases of exclusion (Siegel 2012), and "cross-cultural competency," the capacity to effectively work with group members of differing ethnic backgrounds due to less prejudice and stereotyping (Siegel 2012).

3.B. The Effects of Socioeconomics

In response to growing societal sensitivities to race-based school assignments, researchers have explored the effectiveness of socioeconomic integration of K-12 public schools. The results of these studies have been mixed. Several studies that used the National Longitudinal Educational Study (NLES) have shown positive correlations between students' scores and the average socioeconomic level, measured by FARM status of their school (Crosnoe 2009; Rumberger 2005). However, other studies have exposed what has been identified as the "frog pond effect," in which low-income students perform worse in middle or high-income schools (Lewis, McMillian, Munk 2014; Crosnoe 2009). The “frog pond effect” is experienced by low-income minority, mostly Hispanic, students who are crowded out of seats in advanced levels of core subjects, such as AP or IB options. These low-income students also experience psychological stressors and social isolation both of which adversely affect their performance. However, their lower achievement is largely attributed to the practice of tracking and crowding-out advanced courses by high-income white and Asian students. For this reason, our study investigates socioeconomic influences on elementary students, a cohort in which tracking, crowding-out, and other harmful educational phenomena will not occur until middle and high school.

Furthermore, scholars have blamed the inadequate metrics of “socioeconomic status” for purported negative effects from integration on low-income students, due to efforts like school income-assignment policies (Orfield, Frankenberg, Siegel-Hawley 2016; Kurlaender, Reardon, Yun 2006). A 2012 recommendation report for the National Center for Education Statistics, NCES, suggested using household income, amongst other parental factors, in place of a student’s FARM status as a more accurate estimation of the student’s financial welfare and poverty status (National Center for Education Statistics 2012). FARM is granted by application-completion, and it is estimated that nearly 20% of students nationwide are eligible but did not apply, mostly comprised of non-English speaking and immigrant families (NCES 2012). Due to these inadequacies with FARM as a metric, our study employs the best available income data, household income quartiles from the surrounding neighborhood of each elementary school, to measure the socioeconomic status of the students. However, we preemptively performed a robustness check using the FARM data to verify the accuracy of our household income quartiles.

3.C. The Combined Effects of Socioeconomics and Race

Because of the individual profound effects of race and socioeconomic status of schools, research has delved further to investigate the correlation and dependence of these statuses, and what it means for students. Results regarding whether socioeconomic or racial composition of a school is more influential on student performance vary across the literature. Some results suggest that socioeconomic status of a school and students is a better predictor of test scores than racial composition (Rumberger, Palardy 2005). In a 2016 study (White et. al. 2016), results indicated that FARM status predicted nearly 41% of variance in ELA scores and 35% of variance of math scores of elementary schools’ standardized testing performance, and the inclusion of percent black and Hispanic were insignificant. Only an interaction of FARM and percent Hispanic resulted in a significant predictor of test score variance. White’s study indicated that percent minority students became individually significant as students progressed through middle and high school, suggesting that racial composition of a school is influential on elementary students *only* in conjunction with socioeconomic status. Despite these findings, poverty and/or socioeconomic status cannot alone explain the achievement gaps between different races (White et. al. 2016; Myers, Kim 2004). Studies have shown that even controlling for school and student income data and other recognized measurements of school quality, that nearly 50% of the variance between black and white test scores is still unpredicted (White 2016; Myers, Kim 2004).

Another reason that studies provide mixed results on the significance of race and socioeconomics is the various ways in which they are measured. As mentioned previously, most education research has employed FARM as a financial proxy and individual race breakdowns as the race proxy. More recent literature supports using diversity indices, specifically the Herfindahl-Hirschman Index, as socioeconomic and race indices instead. A 2011 research project conducted by Jennifer Clayton explored the role of diversity in elementary schools using a diversity index to measure racial composition rather than individual percentage breakdowns (Clayton 2011). Her results contrasted those of White's research, as hers indicated that racial diversity was not only significant in elementary school, but was a better predictor of scores for Hispanic and white reading tests, and white and black math tests than the poverty level of the school. Furthermore, Clayton provided additional results to the literature on the opposite impacts on Hispanic students, observing that their scores were better in higher poverty and high-minority schools, noting that this relationship is likely attributed to the additional resources and teacher training to aide Spanish-speaking students found in such schools where they comprise a majority of the student body.

Another study that utilized a diversity index is a 2001 analysis of the results of classroom diversity on undergraduate engineering students (Bjorklund et. al. 2001). Instead of test results, an Ohio State University research group observed overall educational indicators and found that more diverse classrooms yielded significant advancements in problem-solving and "group skill development," or the ability to cooperatively and effectively work in a group. These improvements were shown in classes that were approximately one-third non-white. The research group utilized an index to measure diversity in the classrooms, weighing compositions of different race students.

Literature that uses diversity indices expose the non-linear relationship between race composition and academic achievements that simple race percentage breakdowns and binary variables skew or neglect (Borman 2004). Studies that simply measure percent composition of these student cohorts overlook the diminishing returns to achievement as cohorts soar above 50% of the student body. The literature also highlights the significance of equal distribution versus a continuous addition of minority students to majority-white schools. Our use of race and income diversity indices joins our research with that of Clayton and the Ohio State University research group in the nuanced investigation of diversity's impact on students.

Previous literature has shown that although race and socioeconomic status of individuals are often correlated, implementing a school assignment system only addressing one status will not eradicate segregation of the other status, as was seen with the most recent income-based assignment policies. Literature has also shown mixed results on which is more important to test performance, race or socioeconomics, and has left unanswered the feasibility of accurately measuring these statuses distinctly. Our research will add to existing literature that claims race diversity and status is more significant to school-age students than socioeconomics. It will also add to studies on the unique effects Hispanic students experience from diversity. However, this study will deviate from existing research by examining the simultaneous effects of racial *and* socioeconomic diversity, using indices rather than percentages. Also, by examining elementary students, our study will provide greater purity on the effects of diversity without the added factors of practices like course tracking, pay-to-play extracurricular activities, and other school variables that further disadvantage students in middle and high school.

III. Data

To test our hypothesis of the effect of diversity on test scores, we collected school level data on test scores, race, income, and school characteristics. Our data came from four sources: the South Carolina Department of Education, the National Center for Educational Statistics, 2010 U.S. Census data, and proprietary data provided by Environmental Systems Research Institute, ESRI, a geographic information agency. Our data from ESRI is manipulated in arcGIS, a geographic information system, to estimate local income data for each school. The summary statistics for all variables may be found in the Appendix, in Table 1.

4. A. Test Scores

Data for our dependent variable came from the South Carolina Department of Education. We used online reports that detailed test score breakdowns by race, FARM status, and an aggregated student mean category (hereafter referred to as ASM) for public elementary schools in South Carolina. Summary statistics for test scores may be found in the Appendix, in Table 2.

4.B. Income Diversity

Income Diversity[1]: This variable was calculated in GIS using 2010 Census income data. We overlaid this data on a map of all elementary schools and created a four-mile buffer[2]. In this buffer, we pulled in population weighted income data to create an estimated income profile for the buffer. The census data that we used had income data broken down into ten unique brackets. To condense this data, we combined the brackets to create four income quartiles. Using these quartiles, we calculated Herfindahl-Hirschmann indices for each buffer zone. This variable controls for income diversity in the neighborhood around the school. Diversity is measured as an index from 0 to 1, with 0 hypothetically representing a totally equal distribution of income divided into infinite sections in the neighborhood and 1 being no diversity, such as a neighborhood comprised completely of households in one income quartile. Realistically, however, our index ranges from .25 to 1. As the HHI index was originally designed to measure market concentration, and our income “market” has at most four categories, it is impossible for our income diversity index to be below 0.25. Because 1 is least diverse and .25 is most diverse, a negative coefficient in the regression results shows that increased diversity has a positive effect on scores. We predict that the coefficients on the diversity variables be less than zero. It is also one of our main variables of interest, along with racial diversity. Throughout the analysis, this variable will be referred to as “HHI Income.”

4.C. Racial Diversity

We calculated a measure of racial diversity from NCES race data. The race data gathered from the NCES databases break down the racial composition of a school into seven race categories for every year and every grade. These race categories include white, black, Hispanic, Asian or Pacific Islander, Hawaiian, American Indian or Alaskan Native, and Two or More Races. This data was used to construct a racial HHI by squaring the proportions of students in each category and summing the squares. We repeated this process for every grade of interest at every school in our dataset. Thus, we were able to observe the effects of racial diversity, as measured by the probability that any two randomly selected students would belong to different race categories. Like HHI Income, this variable never achieves a value of 0 as there are a limited number of race categories and also the racial composition of South Carolina is not conducive to perfect racial equality. Like income diversity, a negative coefficient on this variable means that increased racial diversity has a positive effect on test scores. Throughout the analysis, this variable will be referred to as "HHI Race."

4.D. Student Race Percentage Breakdowns

These variables control for the racial breakdown of a school using the NCES data that was used to calculate our racial diversity variable. These variables include percent white, percent black, percent Hispanic, and percent Asian. The mean percent white is 57%, the mean percent black is 31%, and the mean percent Hispanic is 5% with Asian at 2%. There are schools in South Carolina with 100% black and 100% white populations, thought Hispanic and Asian never reach the majority of a school. The inclusion of these racial percentages allow us to control for compositional effects, as they are different than diversity effects. The diversity index, as calculated above, only accounts for diversity as measured by the likelihood that any two randomly selected students would be from differing groups. With diversity effects alone, an index value could have endless variations of race distribution. For example, an index of .3 could indicate a school with 40% black, 50% white, 10% Asian, or a school with 40% Hispanic, 50% Asian, and 10% white; there is no distinction. When the racial composition percentages are added, we can differentiate between schools that have identical indices, but vastly different study body race distributions. More generally, we can explore the differences between schools with different race breakdowns and similar race HHIs such as the different implications for a school that is highly segregated with white students versus a school that is segregated with black students.

4.E. Free and Reduced Lunch

This variable is a measure of the percentage of students in the school that are eligible for free or reduced lunch. The data for this variable was acquired from the South Carolina Department of Education in their lunch program data. It is different from HHI income diversity because while the percent of free and reduced lunch students captures the level of poverty in a school, it does not capture the level of income diversity in the school area and is therefore non-confounding. It allows us to observe the effect of and control for the estimated level of poverty in a school.

4.F. Urban Status

This variable was created from data gathered from the South Carolina Department of Education online databases. Urban status is assigned at the county level. It is a binary classification based on population density for urban status for all schools in South Carolina.

4.G. School and Teacher Quality Variables

Data for these variables were gathered from the South Carolina Department of Education's online Elementary School Fact File databases. These variables control for teacher and school effects that may influence test scores outside of income and racial diversity, including things such as dollars spent per pupil and percent of teachers with advanced degrees. These variables operate at the school level and are considered constant across grades. Therefore, though other variables are unique to a specific grade level, these variables are constant across grade levels for a particular school.

IV. Empirical Model

Our testable model is regressing student test scores on index measures of racial and income diversity while controlling for school and neighborhood effects. As such our regression model is below as formula [1]:

$$\text{Test Scores} = \beta_0 + \beta_1 \text{HHI Income} + \beta_2 \text{HHI Race} + \beta_3 \text{Racial Composition Controls} + \beta_4 \text{Area Income Controls} + \beta_5 \text{School Quality Controls} + \beta_6 \text{Teacher Quality Controls} + \mu \quad [1]$$

Regressions are run by grade, by race, and by subject. Therefore, our data is at the average of a particular race in a particular grade on a particular test, with observations at the school level. The SCPASS scores are not reported as individual level data; the scores are aggregates of student lunch status and race within each grade. For example, each regression is run using a specific grade and specific cohort combination as the dependent variable, such as 3rd grade Hispanic, then another for 4th grade Hispanic, and so on.

5.A. Formation of the Finalized Regression Model

When thinking critically about the two independent variables of interest, HHI Income and HHI Race, we hypothesize that both variables have non-constant degrees of impact on our dependent variable. To capture this, two interaction terms were included in our regression, seen in regression [1.1]:

$$\text{Test Scores} = \beta_0 + \beta_1 \text{HHI Income} + \beta_2 \text{HHI Race} + \beta_3 \text{HHI Income} * Q1 + \beta_4 \text{HHI Race} * \text{Percent White} + \beta_5 \text{Racial Composition Controls} + \beta_6 \text{Area Income Controls} + \beta_7 \text{School Quality Controls} + \beta_8 \text{Teacher Quality Controls} + \mu \quad [1.1]$$

The first interaction variable consists of the product of our HHI income variable and the percentage of the population that made $20,000 or less, denoted in the above model as β_3 *HHI Income * Q1*. The other interaction variable included the HHI Race variable and the percentage of white students in a particular grade, denoted as β_4 *HHI Race * Percent White*. Theoretically, it is expected that the effect of racial diversity on SCPASS scores will vary depending on the racial breakdown of a grade. For example, a school with 70% white students and 30% black students has the same HHI as a school with 70% black students and 30% white students. However, we argue that the racial breakdown of these two schools affects scores differently. Therefore, these interaction terms allow the impact of racial diversity to have different effects on the dependent variable of interest. The reasoning for including an interaction term for HHI Income and an income quartile is the same; socioeconomic diversity has varying impacts on SCPASS scores depending on what exactly the breakdown of incomes is.

Despite the importance of including these interaction terms in our regression, the coefficients attached to the terms are difficult to interpret. Because changing the percentage of white students also changes the HHI, it is harder to interpret the coefficient on the interaction terms by themselves. Still, both interactions were included in an F-test with their individual HHI variables to determine whether each pair of variables had joint significance.

5.B. First Robustness Check of GIS Income Data

Without reported school zone boundaries, we used a four-mile buffer zone instead as a proxy for income diversity in elementary schools. To verify the accuracy of the income diversity we collected, we conducted a robustness check by analyzing the difference between the GIS data and the reported racial breakdowns for 3rd, 4th, and 5th graders in each elementary school from the NCES. If the race data that is collected from GIS is close to the NCES school reported race data, then the strength and accuracy of our HHI Income variable would be confirmed—our buffers include many of the students that do actually attend the school associated with that buffer. To do this, GIS was used again to get a racial breakdown of each school under the assumption that the school zone was equal to the four-mile buffer. Next, census tract demographic data was layered onto the existing map. Using the same weighting methods that were previously used to create the HHI Income variable, the number of black, white, Asian, and Hispanic children aged 5-9 were collected for each buffer. Although the age range that we used does not exactly line up with the average ages of students in the 3rd-5th grade, this was the buffer that had the most overlap with our other data.

The next step was to create mirror variables with the new GIS race data—percent white, percent black, percent Asian, and percent Hispanic for each grade for each school. To check how closely the NCES and GIS data matched, we subtracted the percentages from one another (i.e. percent white from the GIS data minus the percent white from the NCES data) and then took the absolute value. To aggregate all of the variables that examined the differences between the GIS and NCES data, we created one variable that averaged all of the “difference” variables.

5.C. Second Robustness check of GIS Income Data

Next, we ran a regression, including only those observations in which our difference variable was equal to or less than .1. By doing this, we only included data points in which the average difference between the percentage race categories from the GIS and NCES data was 10 percentage points or less.

The regression results supported our decision to use the GIS buffers as school attendance zones. In the restricted regression, the number of observations was 1500, around 63% of the total number of observations in our main regression. This shows that the majority of schools do not have grossly different race breakdowns when using the GIS data versus the school reported NCES data. It is impossible to know exactly what amount of variation to expect when using GIS data instead individual level income data, but the robustness check using race data leads us to include the HHI Income variable in our regression to capture income diversity.

After checking to make sure that our HHI Income variable was an appropriate proxy variable, we checked the validity of including it in our regression. Previous literature uses FARM to take into account income differences. However, theoretically we do not believe that FARM is a good measure of income diversity. To see if HHI Income was appropriate to include in our final regressions, we ran the regression with and without HHI Income and included FARM both times. Examining the results showed us that in the absence of HHI Income, the p-value associated with the coefficient on the FARM variable increased, suggesting that it picked up on some of the income effect that would otherwise be captured by the HHI Income variable. The coefficients on the other variables in the regression did not vary much in the size, sign, or significance compared to the coefficients when the regression with HHI Income was run.

By completing these robustness checks, HHI Income is included in all regressions and captures income diversity to the best of our ability.

V. Results

The following section will provide a breakdown of notable patterns of significance that arose from our regressions. The results will be organized first by test subject—English, Mathematics, Social Studies, and Science. Within each test subject, the regression results are organized by the I. effect of socioeconomic diversity, the HHI Income variable; II. the effect of racial diversity, the HHI Race variable; and concluded with III. the race achievement prediction outcomes for that subject. Appendix Table 4 includes condensed regression results of our variables of interest, HHI Race and HHI Income.

6.A. Explaining Race Achievement Predictions:

In order to analyze the complexity presented by our use of diversity indices, as well as compositional measures, we create six hypothesized student body race compositions. With these compositions, referred to as “race achievement predictions” for the remainder of analysis, we studied:

1) A 10% increase in white percentage,
2) A 10% decrease in white percentage,
3) A 10% increase in black percentage,
4) A 10% decrease in black percentage from the South Carolina mean student body racial composition,
5) A hypothetical racial distribution of a South Carolina school with 90% white students,
6) The effect of a 90% white school decreasing to 80% white students
7) A hypothetical racial distribution of a South Carolina school with 90% black students, and
8) The effect of a 90% white school decreasing to 80% black students.

These examples are drawn from the real mean racial distribution of elementary students in South Carolina public schools, expanded on in Table 3.1 below. The race achievement predictions allow us to forecast the expected results if South Carolina schools with these demographics choose to pursue diversification policies. For example, comparisons between 6) and 7) show us how students from a majority-white segregated school would perform differently if their administration chose to decrease the white population and include more minority students.

Table 3.1: Race Percentage Distributions for Predicted Test Achievement Tables

	South Carolina Mean Values	**1) Increase White from Mean**	**2) Decrease White from Mean**	**3) Increase Black from Mean**	**4) Decrease Black from Mean**	**5) Majority White**	**6) Decreased Majority White**	**7) Majority Black**	**8) Decreased Majority Black**
White	57%	67%	47%	51%	69%	90%	80%	6%	14%
Black	31%	23%	43%	41%	21%	4%	12%	90%	80%
Asian	2%	1%	1%	1%	1%	1%	1%	0%	0%
Hispanic	5%	6%	6%	4%	6%	2%	4%	2%	4%
Hawaiian	1%	0%	0%	0%	0%	0%	0%	0%	0%
American Indian	1%	0%	0%	0%	0%	0%	0%	0%	0%
Two or More Races	3%	3%	3%	3%	3%	3%	3%	2%	2%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

The outcomes are expanded on in their respective areas below.

6.B. English Language Arts:

Referring to the regression results, socioeconomic diversity, denoted with the HHI Income variable, shows little significance in English Language Arts, abbreviated ELA, test scores across the grades and various student cohorts. However, HHI Income is attributed with a significant 14-point decrease in 3rd grade Asian ELA test scores with every 0.01 increase of the socioeconomic diversity index.

Unlike the effects of socioeconomic diversity, racial diversity, denoted with the HHI race variable, produces highly consistent effects to the various student cohorts. Race diversity increases ELA test scores for Paid lunch, black, and white students across all three grades. Paid lunch students gained 4-5 points per 0.01 index increase in race diversity, where black and white students gained 1-2 and 11 points respectively. Adversely, race diversity is responsible for decreases in ELA scores for subsidized lunch, Hispanic, and Asian students, but by less than two points for any of the three negatively affected student cohorts. Again, the adverse implications for Asian students appear. The additional adverse effect on Hispanic students is attributed to the lack of supplementary faculty and teacher training for English-as-a-Second-Language concerns. Hispanic students receive these additional language resources mostly in schools where they comprise the majority of the student body, which would be considered non-diverse schools. The negative effect on subsidized lunch students reflects the negative effect on Hispanic students, who comprise a significant portion of the low-income students in South Carolina.

6.C ELA and Race Predictions

Table 3.2: ELA Race Prediction Results

ELA	Increase White by 10%			Decrease White by 10%			Increase Black by 10%			Decrease Black by 10%			90% to 80% White Composition			90% to 80% Black Composition		
Grade	3rd	4th	5th	3rd	4th	5th	3rd	4th	5th	3rd	4th	5th	3rd	4th	5th	3th	4th	5th
ASM	0.08	0.64	2.24	-4.01	-2.53	0.95	-3.08	-1.81	1	0.43	0.96	2.3	-0.78	-1.56	0.92	-0.42	0.66	0.04
Asian	-31.5	-33	-26.8	-36.8	-39.2	-39.8	-36.8	-38.9	-40.6	-31.23	-32.32	-25.82	7.8	2.06	7.85	-18.99	-15.29	-12.17
Black	-84.3	-82.3	-77.6	66.06	60.34	61.17	51.84	47.35	49.19	-111.7	-108.9	-103.5	256.1	252.7	244.6	-12.05	-15.06	-15.49
Hispanic	0.5	7.03	9.18	2.57	-1.31	-1.25	-36.4	-38.9	-40.1	-2.74	5.74	7.88	95.24	75.11	81.25	19.34	25.71	19.51
White	-6.23	-6.04	-8.59	-19.3	-19.3	-18.1	-14.2	-14.4	-14.8	-8.94	-8.52	-11.17	15.04	6.79	7.82	198.8	198.4	205.8

For the aggregated student mean, ASM, test scores, 10% increases in white students resulted in between 0-2 point increases on the ELA test for the ASM score. Subsequently, a 10% decrease in white students resulted in 1-4 point decreases of the ASM ELA test score. Manipulations of the black student percentage indicated mixed effects for 10% increases and minor increases in score, from 1-2 points, for a 10% decrease in black students.

For Asian students' ELA scores, every 10% fluctuation in either direction of white and black percentages resulted in a lower score than the score associated with the mean race composition of South Carolina schools. Regression results show that one of the few positive effects on Asian scores is the increase of Asian students in their school, and in all race achievement predictions hypothetical distributions, the Asian percentage is decreased. This explains why Asian students' predictions continually show decreases in scores. However, decreasing majority white schools' white composition, comparing hypotheticals 5) and 6), add 2-8 points on Asian ELA scores. In contrast, decreasing white distributions, comparing hypotheticals 7) and 8), results in 12 to 16-point decreases for Asian students.

For black students' ELA scores, 10% increase in white students and 10% decreases in black students always produced worse test scores than those of the mean S.C. race composition hypothetical. These fluctuations parallel each other because the hypothetical with a 10% decrease in black students redistributed the other races to reflect a 13% increase in white students from the mean. In opposition, a 10% decrease in white students and a 10% increase in black students both increased the scores for black students. For example, the third grade comparison shows a nearly 66-point increase for black students as a result of a 10% decrease of white students.

White students' ELA scores reflected the effects on Asian students' scores. All fluctuations of white and black students caused decreases to the white students' ELA test score when compared to the score of the mean race composition, but to varying degrees. The effect of a 10% increase of white students on white test scores was negative, but about one-third of the point decrease from the 10% decrease of white students on white test scores. For example, in third grade, the 10% white student increase caused a 6-point decrease, but the 10% white student decrease caused a 19-point decrease. Although these results expose a negative effect from increasing minority students on white students' test achievement, the exponential increase in ELA test scores for black students comes at an expense of only a fraction of those points lost for white students; often resulting in an overall increase in test achievement at the school-level.

Hispanic students' ELA scores are affected by the black and white fluctuations unlike any other cohort. Both the increase and decrease of 10% white students either did not affect their scores or resulted in a 1 to 2-point increase from the mean race composition score. Contrarily, both the increase and decrease of 10% black students resulted in decreases to Hispanic ELA test scores, with the 10% black increase causing nearly 40-point losses. It is important to note that, at the mean, Hispanic students only comprised 5% of the student body and only changed by 1% variation for all five hypotheticals. More so, it was only in the hypothetical 10% increase of black students that the Hispanic percentage decreased, resulting in the significant loss to their ELA score. These results mirror the same adverse effect that HHI Race had, stemming from the same issue of English non-proficiency resources.

VI. Mathematics

Sporadic instances of socioeconomic diversity significance do occur, with a minor 1.1-point decrease in the 5th grade ASM score. Subsidized and Paid Lunch students experience positive effects from increased diversity, with upwards of a 7-point increase for 3rd grade Subsidized students' scores and 11 to 16-point increase in 3rd and 5th grade Paid Lunch students. However, when socioeconomic diversity is tested on the scores categorized by students' race, socioeconomic diversity is never statistically significant.

Similar to the ELA results, racial diversity shows significant effects on elementary students in our study. The 3rd grade ASM scores show a minor .1-point decrease from increased racial diversity, followed by another minor score decrease in Subsidized students' scores. However, these negligible coefficients are significantly outweighed by the extensive benefits. For example, Paid Lunch students increase over 4-points across all grades when you increase racial diversity by .01 on the diversity index. These positive benefits are reiterated in the racially categorized scores as well, with 4th grade black, Hispanic, and White students experiencing 1 to 11-point score increases in Mathematics, and Asian students experiencing no statistical effect from the increased diversity.

7.A. Mathematics and Race Predictions

Table 3.3: Mathematic Race Prediction Results

Math	Increase White by 10%			Decrease White by 10%			Increase Black by 10%			Decrease Black by 10%			90% to 80% White Composition			90% to 80% Black Composition		
Grade	3rd	4th	5th	3rd	4th	5th	3rd	4th	5th	3rd	4th	5th	3rd	4th	5th	3th	4th	5th
ASM	0.19	0.65	2.2	-4.76	-3.79	0.32	-3.85	-3.22	0.14	0.61	1.05	2.26	-0.85	-1.03	1.7	0.75	1.46	0.23
Asian	-32.4	-34.2	-27.2	-39.2	-40.6	-40.5	-39.2	-40.3	-41.4	-32.03	-33.54	-26.18	8.38	2.28	7.71	-16.9	-16.04	-12.48
Black	-81.5	-80.9	-77	63.72	58.81	61.75	49.99	45.87	49.49	-108.2	-107.4	-102.7	249.7	255.1	242.6	-10.57	-14.19	-13.13
Hispanic	1.25	6.91	7.99	2.63	-0.12	-1.51	-35.6	-39	-41	-1.96	5.4	6.69	95.05	78.14	80.67	19.22	26.64	19.33
White	-6.24	-7.7	-8.77	-18.2	-19.6	-18.6	-13.7	-14.9	-15.5	-8.91	-10.04	-11.34	14.3	6.9	-221.5	194.4	200.5	204

Given that South Carolina is predominantly composed of white and black individuals, when a school experiences a 10% decrease of one of the cohorts it experiences a near 10% increase in the other. This exchanging brings about the paired effects we see throughout the prediction tables.

For example, ASM scores show negligible increases, by less than half a point, when South Carolina schools at the average mean increase their white distribution by 10%, and when they decrease their black students by 10%. Yet, when the white percentage is decreased by 10%, and when the black percentage is decreased by 10%, ASM scores show 3-4-point decreases in 3rd and 4th grade. When 90% White student schools lower their white composition, ASM scores show overall there are minor decreases, 1-point and less, to the schools' scores in 3rd and 4th grade. However, reducing the black composition in majority black schools results in about 1-point increases to the mathematic test scores across grades.

Asian students experienced substantial decreases to their scores, upwards of 40-points, when the average mean race distributions were increased or decreased for white or black students. Their scores fluctuated identically to the ELA predictions from lowering race compositions in highly segregated schools.

Black students face an incredible disadvantage in math from increasing white by 10% and decreasing black by 10% from the S.C. mean, with tremendous decreases from 80-100 points across grades. These results are consistent with the regression results, showing that black elementary students are the primary benefactors from increased racial diversity in comparison to the other races. Black students reflect Asian students' predictions in the hypotheticals 5) to 6) and 7) to 8), however, their increases from lowering white students' percentage soars over 200 points, and their decreases to lowering black students' percentage from a black segregated school are a mere 10-14-points in comparison.

Hispanic students overall experience minimal point fluctuations in mathematics of under 5 points in hypotheticals 1) to 4) except in increasing black students by 10%, which results in nearly 40 point decreases. Hispanic students significantly benefit from decreasing white students in a white segregated school, with upwards of 95 point increases in mathematics across grades. The decrease of black students in black segregated schools, hypothetical 7) to 8), only resulted in increased of about 20 points to Hispanic math scores.

White students experience the most modest fluctuations in hypotheticals 1) to 4) amongst all race groups. Like Asian students, their math scores decrease in any way the S.C. mean is changed in 1) to 4), never exceeding a 20-point decrease. In hypotheticals 5) to 6), when white students are reduced in a white segregated school, white students experience minimal increase to their scores in 3rd and 4th grade, but an exponential decrease of over 200 points in 5th grade. This 200-point fluctuation continues on in hypothetical 7) to 8), when black students are decreased, in which white students gain 200 points across grades.

VII. Science

Mirroring results in ELA and Mathematics scores, income diversity has less of an effect on science test scores than does racial diversity. Third and fifth grade Paid and Subsidized students all benefit from increased income diversity, ranging from 14 to 25 additional points on their science SCPASS scores with only a .01 index increase in income diversity. Amongst the scores categorized by race, HHI Income is only statistically significant for 3rd grade white students, with a meager 5-point increase.

Concerning racial diversity, when categorized by students' lunch status, only 4th grade Paid and Subsidized students are significantly affected by racial diversity. Yet, as previously seen in the other subjects, black and white students both benefit from increased racial diversity. Deterring from other subjects, however, Hispanic students' scores are negatively affected by increased racial diversity, but only by a maximum of 3.5 points.

8.A. Science and Race Achievement Predictions

Table 3.4: Science Race Prediction Results

Science	Increase White by 10%			Decrease White by 10%			Increase Black by 10%			Decrease Black by 10%			90% to 80% White Composition			90% to 80% Black Composition		
Grade	3rd	4th	5th	3rd	4th	5th	3rd	4th	5th	3rd	4th	5th	3rd	4th	5th	3th	4th	5th
ASM	0.38	1.25	0.39	-0.45	-2.8	-0.33	-0.63	-2.15	-0.97	0.62	1.72	0.49	-4.31	-3.05	-1.57	7.81	1.99	7.74
Asian	-1.04	-32.6	-0.6	-3.07	-38.4	-2.03	-2.62	-38.2	-1.73	-0.88	-31.97	-0.52	0.42	1.62	1.13	-2.69	-14.49	-2.61
Black	-113	-79.1	-109	122.3	58.14	121.7	98.52	45.4	101.3	-144.2	-105.1	-139.2	186	249.6	175	28.6	-14.4	16.45
Hispanic	16.27	6.82	17.07	1.06	-0.12	-1.37	-21.4	-37.7	-23.5	17.91	5.28	19.18	21.3	77.2	18.17	7.7	25.39	5.59
White	32.96	-7.11	32.8	-65.5	-18.3	-83.9	-40.6	-13.6	-54.5	35.29	-9.29	37.02	55.94	4.24	49.06	111.5	196.1	99.5

ASM regression results show that each grade performs better in a white majority school than a school with 10% less white students and proportionate changes to the other races, in hypothetical 1). However, students do better in a decreased black majority school than they do in a black majority school, in hypothetical 2). In addition, they do better when the percentage of whites is increased from the mean and when the percentage of blacks is decreased from the mean.

Asian students, again, experience decreases to their science scores in hypotheticals 1) to 4). Likewise, they experience minimal point increases when white students are decreased in white segregated schools, from hypotheticals 5) to 6), and decreases when the black composition is reduced, in hypotheticals 7) to 8).

Black students generally perform better with more diversity in majority schools and more black students than the South Carolina mean provides. All grades of black students score higher in schools with 80% white students rather than 90% white students, in hypotheticals 5) to 6). In schools with 90% black students, 3^{rd} and 5^{th} grade black students test better in science when their composition drops to 80% of the student body, in hypotheticals 7) to 8). In regards to South Carolina's mean student body race distribution, we find that black students achieve higher science scores when white students are decreased from the mean and black students are increased from the mean. Therefore, black students generally perform better in more diverse schools. Hispanic students achieve higher science scores by increasing white students and decreasing black students from the mean, in hypotheticals 1) to 4). Across all grades, Hispanic students perform better in schools that begin as 90% white students or 90% black students and become more racially diverse. When dealing with variation from the South Carolina mean, Hispanic students tend to perform better with an increase in the percentage of white students and decrease in the percentage of black students. However, 3^{rd} grade Hispanic students also benefit from decreasing the percentage of white students from the mean.

White students incur mixed effects to their science scores from fluctuations in race distribution. White students always gain test points in a reduced white majority school or a reduced black majority schools as opposed to a white majority or black majority school, seen in hypotheticals 5) to 8). However, unlike the trends in other subjects, white students perform better from an increase in white, 1), and decrease in black, 4), only in 3^{rd} and 5^{th} grade, with a decrease to scores in 4^{th} grade. When white students are decreased by 10% and black students increased by 10%, as with hypotheticals 2) and 3), white students revert back to their patterns from ELA and math and experience a consistent decrease in scores, ranging from 13 to 80 points across grades.

VIII. Social Studies

The regression results for science and social studies often trend quite closely. It is possible that science and social studies track each other closely and are different from math and language arts because of classroom effects. While math and ELA are often practiced and encouraged at home through reading time and summer and supplemental workbooks, science and social studies are infrequently augmented at home, and additionally receive less emphasis in school test preparation. Therefore, it is possible that science and social studies are the clearest indicators of classroom effects, as they are least likely to be influenced by outside factors.

The pattern of irregular and minimal influence of socioeconomic diversity is repeated in social studies test scores' regressions. Subsidized and Paid students, similar to science regression results, experience increased test scores upwards of 20 points in grades 3 and 5. Yet, when scores are categorized by race, the only statistically significant effect is a minor 5-point decrease on 5^{th} grade black students' scores. As previously seen, the influence of socioeconomic diversity is only evident when students are categorized by their own socioeconomic means.

In terms of racial diversity, the ASM results show a small and negative effect on 4th grade social studies and a small and positive effect on 5th grade. Deterring from prior trends, Subsidized students experience an opposite effect than that of Paid students, experiencing a negative effect from racial diversity versus a positive effect on Paid lunch students. Black and white students are positively affected by racial diversity in social studies, a pattern that follows across all test subjects. In contrast, Hispanic students are disadvantaged by increased racial diversity, similar to the effect seen in science test scores.

9.A. Social Studies and Race Achievement Predictions

Table 3.5: Social Studies Race Prediction Results

Social Studies	Increase White by 10%			Decrease White by 10%			Increase Black by 10%			Decrease Black by 10%			90% to 80% White Composition			90% to 80% Black Composition		
Grade	3rd	4th	5th	3rd	4th	5th	3rd	4th	5th	3rd	4th	5th	3rd	4th	5th	3th	4th	5th
ASM	0.02	0.32	-2.19	-1.66	-3.53	1.09	-1.57	-3.02	-0.57	0.4	0.78	-2.34	-5.77	-2.56	-2.3	8.06	-0.17	8.26
Asian	-4.82	-16.2	-0.61	-7.1	-39.7	-1.41	-6.81	-37.9	-1.16	-4.85	-14.05	-0.55	4.42	2.4	0.47	-3.46	-21.66	-2.1
Black	-117	-82.4	-122	121.8	58.84	124.5	100.3	45.78	102.5	-148.1	-109.3	-153	182	259.1	174.1	24.46	-15.75	22.96
Hispanic	21.28	6.77	19.77	-10.5	-1.21	3.47	-30.6	-39.9	-20.2	23.65	5.28	21.66	33.27	79.11	20.07	-0.34	26.37	8.26
White	41.73	-7.43	39.61	-73.2	-20.1	-83.2	-45.6	-15.2	-52.4	44.99	-9.54	44.13	62.72	4.51	53.13	109.5	198.8	93.2

ASM scores show mixed results in hypotheticals 1)-4) that vary across grades. However, for ASM scores, the schools experience 2-5-point decreases in social studies scores consistently when white segregated schools go from 90% to 80% white, hypotheticals 5) to 6). The opposite is true for black segregated schools that become more diverse; ASM scores increase, except an insignificant .1-point decrease in 4th grade.

Asian students continue to exhibit the consistent pattern of disadvantage when deterring from the S.C. mean. This again highlights the extreme disadvantage they face when percent Asian students in their school is decreased, which occurs in all hypothetical instances.

Black students' social studies scores mirror the patterns seen in science score predictions, continuing to perform better in decreased white and increased black student schools.

Hispanic students' social studies scores, as well, mirror the science score patterns mostly. They stray from the trend only in hypothetical 2), with a 10-point decrease for 3rd graders who experience 10% less white students from the S.C. mean, and in hypothetical 7) to 8), with a minor .3-point decrease for 3rd graders in a school that becomes 80% black.

White students' social studies score predictions also replicate that of science score predictions.

IX. Additional Findings

Our research lends insight into the significance and effects from measurements of school and teacher quality on students' test scores. Analysis on effective educational tools and allocation of funding is vast and heterogeneous.

10.A. Student Factors

An increase in the percentage of students that were suspended results in upwards of 2 to 3-point increase in black students' ELA and math test scores in 3rd and 4th Grade. We hypothesize that this relationship is likely due to the absence of disruptive children from the classroom, allowing the rest of the students to experience more uninterrupted instructional time.

The attendance rate increases test scores by 1 to 3-points for all subjects and all grades in the ASM test scores regressions. However, in the by-race regressions, 3rd and 4th grade Asian students experience point decreases of nearly 10-points in all subjects. Similar to the main results, Asian students are affected uniquely by quality variables in comparison to the rest of the students. The only student factors that significantly affect Asian scores are the percentage suspended and the attendance rates. 4th grade Hispanic and 5th grade white students experience 5 to 9-point increases on their science scores from increased attendance.

10.2. School Factors

An interesting positive correlation between high quality and accessibility of arts programs and science test scores emerges, with 3rd grade black students, 4th grade Asian students, and 5th grade Hispanic students experiencing nearly 20-point increases due to an increase in arts opportunities.

The variable for years of the same principal results in uniform positive significance at the ASM and by-race levels, mostly in science and social studies. We infer that this relationship suggests that long-term principals make additional investments in non-core subjects compared to new principals who may prioritize achievement in core subjects to prove their competency.

The variables controlling for budget allocation produce curious conclusions. *Dollars per student* uniformly produce negative, albeit miniscule, effects on students' test scores. Coefficients never surpass -.009, but were all significant at the 1% level. In contrast, *percent of budget spent on "instruction*," including any resources utilized for educational portions of the school day only, is positively significant for all races, grade levels, and tests, except Hispanic students in which it is insignificant. The dichotomy between *dollars per student* and *percent of budget on instruction* suggests that it is not the dollar amount, but the **proportion** of dollars allocated to student education that matters more. We hypothesize that these two variables likely both result in higher funding per pupil, but it suggests that there is not a hypothetical dollar-per-pupil floor, under which students have no hope.

10.C. Teacher Factors

The last of the quality measures includes teacher factors, such as percentage with advanced degrees, their retention rates, and salaries. However, this variable results in negative effects to students' test scores, especially in science and social studies, at all grades for black and white students. This relationship is abstract; we infer that this may negatively correlate because the advanced degree teachers are predominantly hired in math and ELA, requiring more outside-of-classroom study time than their social studies and science counterparts.

The positive significance associated with teacher retention rates suggests that efforts to encourage teachers' durations at the same school will yield guaranteed benefits. ASM scores show increases of about .3 points in all subjects with increased percent of teachers retained, and by-race scores exposing nearly 3-point increases for black and white students in science and social studies.

Overall, these observations point to some initiatives education policymakers may pursue with surety. Incentivizing principal and teacher retention has been proven over and over again to benefit students' test achievement. However, it is necessary to also be weary of negative effects from tenured educators on Hispanic students. More so, we have found that lower-income schools should not assume a life-sentenced financial handicap for their students; moving existing resources into instruction-specific investments, regardless of the size of the budget, will reflect better achievement for their students.

X. Conclusion

In closing, this research highlights pivotal information to guide pioneers in the educational field to make the most effective and beneficial changes to public schools across the state. Our results showed that race diversity overwhelmingly affects elementary students' test performance. Socioeconomic diversity showed insignificant results when the HHI race was also controlled, suggesting that racial integration is the larger concern in terms of influence on students. The data confirms that pursuing test performance and student body integration does not come to a trade-off; schools can receive positive outcomes in test scores while increasing diversity.

There were a few limitations to our research that prevented full analysis on the effects of diversity:

Firstly, there is no publicly available income data at the school or student level nor a uniform resource for attendance zones. The South Carolina Department of Education only offered a Poverty Index and the percent FARM, which were inefficient measures of socioeconomic diversity, and attendance zones were sparsely available and spread across the dozens of districts individual websites. The use of neighborhood income data extrapolated into predicted attendance zones left ample room for error.

Secondly, there was not enough data to develop a narrative for the unique effects on Asian students. They experienced negative effects from diversity and were not influenced by any school or teacher quality metric. We predict that discrepancies could have emerged from having separate Asian categories for the test scores between 2008-2011 and 2012-2014 due to a change in the ethnicity question on the SCPASS test, or because "Asian" comprises of both immigrant and native-born Asians, who would have different influences in a school.

Thirdly, there was no distinction for English proficiency in Hispanic students. South Carolina, in particular, has a large population of Hispanic families, and language barriers would overwhelmingly explain why Hispanics do better in schools with a large composition of other Hispanic students. It would be interesting to analyze whether there are contrasting results for

English-proficient Hispanics that mirror the benefits that both black and white Students experienced.

Despite these limitations, our findings show compelling support for schools to increase diversity. Although there are mostly insignificant effects from socioeconomic diversity, our results show that diversifying socioeconomic status of majority white schools, at or above 90% white students, benefits all races across all subjects. The benefits from increasing racial diversity, however, are much more substantial and show positive influences on black, white and Hispanic test scores across nearly all subjects and grades. Given the high correlation between race and socioeconomic status, it is inferred that the racial diversity variable absorbed much of the positive influence of socioeconomic diversity, as well. Although Asian students do not experience benefits, they are rarely disadvantaged by the increased diversity that greatly improves the test achievement for the rest of their peers. Overall, the race achievement predictions provide evidence for breaking apart largely segregated schools in order to adjust their race distribution to resemble the South Carolina average mean distribution more closely, as students in general performed better towards the mean. We understand that our research does not effectively capture all of the benefits of racial and socioeconomic diversity inside and outside of the classroom. We are unable to explain variations across grades. More so, the aforementioned "peer effects" offer a different angle in support of racial and socioeconomic diversity. However, as our results show, some of these peer effects that stem from having a diverse classroom manifest themselves in higher test scores.

Overwhelmingly, our study exposes numerous benefits for South Carolina students, school administrators, and other education stakeholders alike that arise from increased diversity.

XI. Appendix

Table 1: Observation and Variable Summary Data
**Summary data includes all collected data; count amounts vary due to inconsistent reporting by schools. We only included schools that had reported data for all of these statistics. Each regression contained about 2,200 observations due to our contingency.*

	Count	Mean	Standard Dev.	Min	Max
HHI Race					
3rd Gr.	3977	59.08	18.17	27.51	100
4th Gr.	3953	59.5	18.25	27.25	100
5th Gr.	3902	59.97	18.42	26.8	100
Race					
% American Indian Students 3rd Gr.	3977	0.34	1.29	0	33.33
% American Indian Students 4th Gr.	3953	0.31	1.13	0	21.43
% American Indian Students 5th Gr.	3902	0.3	1.12	0	20.2
% Asian Students 3rd Gr.	3977	1.28	2	0	25
% Asian Students 4th Gr.	3953	1.26	2.94	0	100
% Asian Students 5th Gr.	3902	1.14	1.9	0	25
% Hispanic Students 3rd Gr.	3977	6.69	8.76	0	100
% Hispanic Students 4th Gr.	3953	6.29	8.25	0	74.29
% Hispanic Students 5th Gr.	3902	6.01	8.11	0	100
% Black Students 3rd Gr.	3977	39.72	29.31	0	100
% Black Students 4th Gr.	3953	40.04	29.41	0	100
% Black Students 5th Gr.	3902	40.82	29.65	0	100
% White Students 3rd Gr.	3977	50.16	28.48	0	100
--- % White Students 4th Gr.	3953	50.39	28.52	0	100
% White Students 5th Gr.	3902	50.1	28.72	0	100
% Haw aiian Students 3rd Gr.	2249	0.09	0.35	0	3.85
% Haw aiian Students 4th Gr.	2232	0.1	0.4	0	6.25
% Haw aiian Students 5th Gr.	2200	0.08	0.35	0	5.56
% 2 or more races Students 3rd Gr.	2249	3.1	3.97	0	100
% 2 or more races Students 4th Gr.	2232	2.93	2.9	0	50
% 2 or more races Students 5th Gr.	2200	2.8	2.74	0	33.33
Income Distribution					
% Pop. Under $20,000	5550	23.98	8.38	5.63	49.89
% Pop. Betw een $20,000 - $40,000	5550	23.8	4.48	10.02	41.32
% Pop. Betw een $40,000-$75,000	5550	27.08	3.92	10.37	38.85
% Pop. Over $75,000	5550	25.14	9.71	6.98	61.24
School Quality					
% Students w ith FARM	7265	62.63	22.33	0	101
Urban	5678	0.67	0.47	0	1
% Teacher Vacancies over 9 w eeks	4096	0.3	1.96	0	69
Rating of Arts Opportunities (1-4)	4100	2.99	0.43	1	4
Years of Same Principal	4097	5.69	5.2	0	55
% Student Body Suspended	4095	0.25	1.11	0	30.6
% Students Who Attended PreK	3711	97.68	8.29	0	100
% Non-Retention	4106	1.81	1.97	0	42.7
% Days of Student Attendance	4107	96.3	0.92	90.3	99.9
% Identified as Gifted & Talented	3527	11.55	9.18	0	100
% Student Body w ith Disabilities	3528	9.49	6.6	0	100
% Older than Avg. Age for Grade	3527	1.42	2.18	0	44.7
% Teachers w ith Advanced	4104	60.61	11.81	0	100
% Teachers w ith Elementary Tenure	4104	81.84	12.47	0	100
% Classes Not Taught by HQ	4105	1.81	5.23	0	100
% Teachers' Return Rate	3921	86.64	6.46	47.2	100
Dollars Spent per Student	4048	7790.3	2793.76	2979	89276
% Budget Spent on Teachers'	4048	64.39	6.77	18.9	93.7
% Budget Spent on Instruction	4046	67.81	6.14	24	91

Table 2: SCASS Summary Scores:
Aggregated Scores (ASM) by Grade by Subject

	Count	Mean	Standard Dev.	Min	Max
ASM Students Aggregated Means					
ASM 3rd Grade ELA	3374	637.1468	73.6074	0	738.5
ASM 3rd Grade Math	3374	619.5468	70.53114	0	701.1
ASM 3rd Grade Science	3374	592.3951	104.2574	0	692.4
ASM 3rd Grade Social Studies	3374	615.0723	108.1326	0	739.8
ASM 4th Grade ELA	3356	625.6435	75.97704	0	722.1
ASM 4th Grade Math	3356	630.8589	77.80761	0	766.3
ASM 4th Grade Science	3356	614.6218	75.60253	0	719.1
ASM 4th Grade Social Studies	3356	633.3608	78.3973	0	748.1
ASM 5th Grade ELA	3321	625.6507	91.13318	0	742.6
ASM 5th Grade Math	3321	622.5504	91.53576	0	729.6
ASM 5th Grade Science	3321	598.3524	123.6121	0	734.8
ASM 5th Grade Social Studies	3321	601.8413	124.6344	0	727.3

Table 4: Condensed Regression Results

ELA	All			Asian			Black			Hispanic			White			Subsidized Lunch			Paid Lunch		
	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5
HHI Income	-0.369	-0.402	0.127	14.43**	7.737	1.189	1.150	4.180	-1.922	-1.215	0.417	2.309	-0.570	-1.377	1.550	-7.500*	-0.686	-2.591	-11.72***	-3.979	-17.16***
	(-0.047)	(-0.057)	-0.011	-0.296	-0.175	-0.029	-0.012	-0.044	(-0.021)	(-0.012)	-0.004	-0.024	(-0.006)	(-0.015)	-0.017	(-0.247)	(-0.024)	(-0.092)	(-0.106)	(-0.038)	(-0.159)
HHI Race	0.120	0.031	0.049	1.572***	1.951***	0.126	-2.204***	-1.840***	-1.787	1.441***	1.245**	1.777	-10.94***	-10.97***	-11.430	0.477**	0.729***	0.304	-4.730***	-5.002***	-4.640***
	-0.109	-0.031	-0.029	-0.206	-0.272	-0.020	(-0.161)	(-0.135)	(-0.135)	-0.090	-0.081	-0.116	(-0.798)	(-0.810)	(-0.837)	-0.115	-0.184	-0.077	(-0.309)	(-0.340)	(-0.305)

Math	All			Asian			Black			Hispanic			White			Subsidized Lunch			Paid Lunch		
	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5
HHI Income	-0.046	0.428	1.117**	-2.415	2.020	-2.911	1.952	4.756	-1.500	-1.285	-0.152	2.330	-0.624	-0.503	2.262	-6.983*	0.286	-1.851	-11.09***	-3.643	-15.89***
	(-0.005)	-0.048	-0.087	(-0.055)	-0.044	(-0.071)	-0.021	-0.051	(-0.017)	(-0.013)	(-0.002)	-0.024	(-0.007)	(-0.006)	-0.025	(-0.247)	-0.010	(-0.066)	(-0.103)	(-0.0346)	(-0.149)
HHI Race	0.0851**	0.042	0.020	1.264	1.146	1.287	-2.175	-1.770***	-1.921	1.439	1.229**	1.783	-10.710	-11.12***	-11.300	0.358*	0.724***	0.220	-4.513***	-4.809***	-4.516***
	-0.070	-0.033	-0.011	-0.136	-0.117	-0.141	(-0.164)	(-0.130)	(-0.147)	-0.092	-0.078	-0.116	(-0.803)	(-0.815)	(-0.829)	-0.093	-0.185	-0.056	(-0.304)	(-0.324)	(-0.299)

Science	All			Asian			Black			Hispanic			White			Subsidized Lunch			Paid Lunch		
	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5
HHI Income	-0.514	-0.115	-0.349	1.672	2.023	-0.916	-2.454	4.397	4.384	0.695	0.044	3.432	-4.594*	-0.844	1.033	-24.45***	-0.129	-14.25**	-25.79***	-4.303	-22.01***
	(-0.017)	(-0.013)	(-0.011)	-0.189	-0.047	(-0.105)	(-0.021)	-0.048	-0.039	-0.011	0.000	-0.059	(-0.043)	(-0.010)	-0.010	(-0.407)	(-0.005)	(-0.218)	(-0.209)	(-0.042)	(-0.177)
HHI Race	-0.435	-0.020	-0.392	0.207	1.035	0.193	-7.626***	-1.719***	-7.017***	1.378***	1.227**	1.575***	-3.587***	-10.91***	-2.522***	-0.504	0.705***	-0.091	-1.016	-4.673***	-0.014
	(-0.101)	(-0.017)	(-0.086)	-0.110	-0.111	-0.099	(-0.473)	(-0.130)	(-0.426)	-0.141	-0.080	-0.169	(-0.229)	(-0.820)	(-0.154)	(-0.061)	-0.184	(-0.01)	(-0.0596)	(-0.323)	(-0.001)

Social Studies	All			Asian			Black			Hispanic			White			Subsidized Lunch			Paid Lunch		
	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5
HHI Income	0.470	0.110	0.732	2.982	2.054	3.046	-2.626	4.827	1.127	5.462*	-0.032	2.548	-3.881	-0.683	0.751	-22.18***	0.083	-13.39**	-22.08***	-3.849	-22.49***
	-0.015	-0.012	-0.022	-0.168	-0.046	-0.202	(-0.022)	-0.051	-0.010	-0.083	(-0.00)	-0.044	(-0.035)	(-0.008)	-0.007	(-0.340)	-0.003	(-0.200)	(-0.172)	(-0.037)	(-0.180)
HHI Race	-0.442	0.105**	-0.521*	0.453	1.141	0.382	-7.647***	-1.703***	-7.870***	2.405***	1.288**	1.436***	-2.962***	-11.02***	-1.979***	-0.540	0.768***	0.181	-0.016	-4.814***	0.259
	(-0.101)	-0.078	(-0.111)	-0.120	-0.117	-0.113	(-0.451)	(-0.124)	(-0.470)	-0.235	-0.081	-0.153	(-0.182)	(-0.807)	(-0.120)	(-0.060)	-0.195	-0.020	(-0.001)	(-0.325)	-0.015

XII. References

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XIII. Endnotes

[1] Collecting the Income Diversity Observations: Geographical Information System (GIS) Utilization: Without individual level data, we had to find another way to capture the socioeconomic diversity at the school level. Due to the absence of individual student income data, we utilized surrounding neighborhood income statistics to develop the income diversity variable. To do this, GIS was used to create a map of all of the elementary schools in South Carolina. After talking to a representative from the SC Department of Education, we were informed that the average school attendance zone has a radius of four miles. Therefore, we created a circle, or "buffer", around each of the schools on our map in lieu of the actual attendance zones, which were not available. Next, 2010 census block data from NHSGIS, another data source, was layered onto our map. Using GIS, we determined the geographic centroid of each block and associated the corresponding number of households with it. Then, income data for each census block group was joined to the appropriate geography. After finishing our layered map, complete with census block groups, household numbers, and income quartile data, we still had to find a way to create data for each elementary school buffer zone. Because a single buffer encompassed multiple block groups (or portions thereof), block centroids were used to population weight household income. Data from individual blocks was used to plot the household distribution within each block group. For example, the buffer zone for School A contains ten block centroids. The number of households associated with each centroid was multiplied by the corresponding household income. Then, those values were added together and divided by the total number of households contained by the buffer. This resulted in a weighted income for each buffer.