A District-Level Analysis of the Influence of Socioeconomic Status, Per-Pupil Funding, and Student-to-Teacher Ratio on Academic Performance in Virginia Public Schools

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(ABSTRACT)

It is imperative to identify the structural characteristics that influence academic performance so that we are aware of the impact that policy change has on the educational outcomes of our youth. This study used district-level regression analysis to identify the influence of socioeconomic status, per-pupil funding, and student-to-teacher ratio on the academic performance of students in Virginia's public schools. The data set was created by linking data from the U.S. Census and the Virginia Superintendent's Report. Four assumptions were tested: as median income increases (socioeconomic status), academic performance improves; as per-pupil funding increases, academic performance improves; increases in student-to-teacher ratios lead to poorer academic performance; and when socioeconomic status is controlled, the influence of race upon academic performance is greatly diminished. Previous literature suggests: that a positive correlation exists between socioeconomic status and academic performance; that a negative correlation exists between student-to-teacher ratio and academic performance; that results are mixed regarding the correlation between per-pupil funding and academic performance; and that residual racial effects persist despite the control of socioeconomic status. The regression analysis yielded significant results concerning the socioeconomic status and race variables, results that are presented and discussed in this paper.

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Part 1: Statement of the Problem

The purpose of this study is to determine how differences in socioeconomic status (SES), per-pupil funding (school funding), and student-to-teacher ratio (class size) affect the academic performance of students in Virginia's public schools. Previous research suggests a negative relationship between class size and performance, and a positive relationship between SES and performance. Research results have been mixed concerning school funding and its effect on performance. This study will shed additional light on that third critical area, while also taking a comprehensive look at the aggregate effect of these three factors considered together. While much research has focused on the factors individually, this study seeks to take a comprehensive look at how these three factors can be considered together in policy to substantially increase academic performance.

Basic inquiry into Virginia's annual funding allocation reveals the inequity of Virginia's funding procedures. In Alexandria, for instance, $16,085 is spent per student, whereas the Bedford school district spends $7,011 per student (Virginia 2006). The large gaps in funding between districts are caused by an inadequate equalizing mechanism and laws that allow school districts sole possession over their property tax revenues. Therefore, a poorer school district will inevitably be disadvantaged, helping to perpetuate a negative cycle of disadvantaged youths. Varying levels of property-tax income from district-to-district lead to stark differences in per-pupil spending, which is not helped by the state's "equalizing mechanism" which does little to equalize funding.

James Coleman's 1966 report, "Equality of Educational Opportunity," however controversial, highlighted the role of socioeconomic status in relation to academic performance. In fact, it seems almost self-evident that students who face tougher lives outside of school will have more difficulty inside the classroom. As one of the factors included in this study, I will seek to identify how substantial the role of SES is in relation to academic performance.

The basis for much of the support for smaller class sizes comes from the experimental research conducted in the Wisconsin Student Achievement Guarantee in Education Program (SAGE) and Tennessee Student Teacher Achievement Ratio Program (Project STAR). Concerning the results of Project STAR, Finn and Achilles stated in the Fall 1990 edition of *The American Educational Research Journal* that, "This research leaves no doubt that small classes have an advantage over larger classes in reading and math in early primary grades" (Finn and Achilles 1990:10). These two experimental programs showed strong correlations between students being placed in smaller classes and being farther ahead of their peers academically by the time they finished elementary school.

I have presented a basic summary of the research in the three pertinent areas of SES, school funding, and class size. In the next section, I will expand upon these three topics.

Part 2: Review of the Relevant Literature

2.1 Socioeconomic Status and Academic Performance

When discussing SES, different scholars hold different definitions of the term. Some rely simply on total household income, while others include other variables, such as parental education levels, in a composite index. Besides the widely-used income variable, here are some other variables considered: family and parental educational attainment; total family income; living in poverty; living in a single-parent household; motivation for learning; alcohol/drug use; crime; community/environment; etc. Many scholars posit that the primary factor responsible for academic success is SES (Coleman 1966; Duncan 2005); Hanushek (2001:27) argues that SES, more than any other factor, influences academic performance, and Hanushek and Somers (2001) argue that the focus in the education debate should shift from funding to SES due to more substantial correlations between SES and academic performance than other variables. Critics note that non-SES variables can be influenced by policy, and should be altered due to substantial correlations between non-SES variables and academic performance. This study will not include a composite SES index, but focus on median household income as the SES variable. Further research that expands upon this study should consider a more complex SES variable.

In the 1998 Early Childhood Longitudinal Study (ECLS-K), it was determined that there was a strong correlation between SES and achievement gaps in both math and reading. Blacks scored -.605 standard deviation points relative to the white reference group in math, while Hispanics scored -.709 standard deviation points relative to whites. Reading scores revealed that blacks scored -.389 standard deviation points relative to whites, and Hispanics scored -.445 deviation points relative to whites (Duncan 2005:37). These scores show a significant correlation to SES. According to the ECLS-K─SES index, blacks averaged -.703 standard deviation points relative to whites, while Hispanics averaged -.784 standard deviation points relative to whites (Duncan 2005:37 Figure 1). There was a significant correlation between nonwhite SES disadvantage and academic disadvantage (Duncan 2005). The significance of this study concerns the influence of SES and race upon academic performance. The ECLS-K study yielded results that suggested that, even though SES is one of the largest influences on academic performance, it does not erase the effect of race; when SES is controlled, the researchers still found that non-white students scored lower than their white counterparts. This is important conclusion that I intend to test in this study.

The ECLS-K data also uncovered important facets of everyday life that are affected by SES. For instance, approximately forty-six percent of poor children come from single-parent homes, compared to approximately sixteen percent for nonpoor children. Approximately thirty-one percent of poor children come from homes with few children's books (less than ten) in the household, compared to approximately five percent for nonpoor children. Approximately thirty-seven percent of children in poor families have a mother who dropped out of high school, compared to approximately eight percent for nonpoor children. Approximately thirty-eight percent of poor children come from homes where their mother either has no job or a low-prestige job, compared to approximately eight percent for nonpoor children. These are some of the starkest examples of the disparities between poor and nonpoor households, but they are not the only ones. There are wide gaps between the poor and the nonpoor in many other categories as well, including: low-quality neighborhood; three or more sibling families; residential instability; spanking; low birth-weight; teen mother; maternal depression; etc (Duncan 2005:38). Of these hardships that are listed it is particularly useful when race is considered. Of poor white children, fifty-two percent face one or more of these hardships, compared with eighty-seven percent of poor black children and eighty-one percent of poor Hispanic children. Only four percent of poor white children face four or more of these hardships, compared to twenty-nine percent of poor black children and eighteen percent of poor Hispanic children (Duncan and Magnuson 2005:39).

Some scholars are skeptical of socioeconomic reasons for the unequal performance, as direct correlations can be hard to come by depending upon the research model (Lee 2002). Lee (2002) argues that there was a relationship between the narrowing of the achievement gap relative to the narrowing of the SES gap for blacks and whites from the 1980s until the 1990s, but the stabilization and slow rise of the achievement gap is not followed by any significant change in the SES of blacks and whites in the 1990s. The author goes on to state that other factors are also important, as SES does not explain the entirety of the gap, but that it should not be overlooked as a partial explanation. Grissmer et. al. (1994) argue that the achievement gap narrowed at a faster rate over the last three decades than changes in the structure of minority SES, meaning that a change in class status may not have been the impetus for the narrowed gap. The authors posit that educational policy aided blacks much more than socioeconomic change. Hedges and Nowell (1998), in a critique of Grissmer and his colleagues, argued that they were only partially right, and that correlations between achievement and SES also played an important role.

Kohr (1986) asserted that there was a significant correlation between individual student SES and performance (his SES composite index included parental educational background, total household income, and the amount of reading materials in the home). He was careful to note that other variables are at play as well, including: school-wide SES; teacher quality; and the content of their academic agenda. Kohr found significant correlations between SES and performance, as well as race, and an interaction of race and SES (Kohr 1986:162). Despite his assertion that school-wide SES mattered, Kohr noted that a student in a low SES school could perform better than their peers if their individual SES was higher than their peers. Despite this individual agency, however, there was a negative significant relationship between low-SES schools and performance. Kohr also observed growing inequality: in low SES schools the achievement gap between blacks and whites was wider (Kohr 1986:163). Kohr (1986) concluded that school-wide SES was an important factor in individual student educational outcomes. Cohen, Pettigrew, and Riley (1972) came to the same conclusion, but asserted that school-wide SES was actually more important in most cases than individual SES, suggesting that the resources a school has to offer may mean more than the individual resources a student brings to an academic setting. Reyes and Stanic (1989) assert that, "SES appears to count for less than ten percent of the variance in mathematics achievement when the student is the unit of analysis and considerably more when the school or community is the unit of analysis" (Reyes and Stanic 1989:5).

Xin Mia and Don A. Klingler (2000) assert that, because students are "nested" inside of schools, you must study not only their individual characteristics, but the characteristics of the schools in which they attend. While there is significant support for the assertion that individual SES is the determining factor in school performance (Sammons et. al., 1997, Thomas et. al. 1997), Mia and Klingler contend that the SES of a school can have just as much of an effect (Caldas and Bankston 1997, Ho and Willms 1996). What Mia and Klingler found in their hierarchical linear model was that the mean school-SES had more of an effect on student achievement in reading and writing than individual factors (Mia and Klingler 2000:51). The authors noted that this is indirectly related to funding, as higher SES schools have access to greater resources, and therefore can engage in a variety of education-enhancing activities, such as field trips (Mia and Klingler 2000:52). The indirect relationship was suggested because overall funding by itself was not the answer, but the increased resources that schools were able to employ.

Caldas and Bankston (1997) concluded that school environment has a substantial impact on the achievement of individuals. The authors found that attending school's with populations of high SES students tends to raise the achievement of all students, and that school SES tends to have only a slightly lesser influence than individual SES (Caldas and Bankston 1997). The authors also found that parental educational background and occupational status had more of an impact on achievement than family income alone. The authors note that, "One uncomfortable implication of our research is that framing the issue of school population composition as a question of the disadvantages of homogeneity versus the advantages of diversity, as Coleman has consistently done, may be somewhat oversimplistic" (Caldas and Bankston 1997). The authors note that, regardless of race, students benefit from attending a higher SES school because of the increased amount and variety of resources available to them.

Carlene M. Buchanan (2006) asserts that SES has an effect on attainment, and that attainment then plays a huge role in college entrance and success, and that inequality in the U.S. is increasing (Buchanan 2006:69). This is a startling assertion. What this assumption essentially means is that your chances of receiving a college education are tied directly to one's social class; if inequality is growing in this country we can only assume that fewer and fewer people will have access to higher education. Buchanan asserts that SES, when compared across models, can explain anywhere from fifteen to twenty-four percent of the variance (Buchanan 2006:69). This assertion is startling; could chances of college attendance be based upon your economic resources instead of your intellectual resources?

While many studies connect SES with academic performance (Dossey et. al. 1988, Jones 1984, Johnson 1989, White 1982, Kohr 1986, Reyes and Stanic 1989), some studies suggest that there is also an intersectionality between race and SES, and that a simple social class correlation does not explain the entire problem. Kohr and his colleagues (1989) suggest that as individual SES increases, white students see more gain in academic performance than black students (Kohr et. al. 1989:148), and that a low school-wide SES hurt black students more than whites (Kohr et. al. 1989:149).

Desegregation of schools has been identified by many in the field as key to eliminating the inequality in our schools (Grissmer et. al. 1998). Hanushek (2001) agues that historically the U.S. government's greatest effort to narrow the achievement gap is in desegregation of the schools, although the results are mixed concerning achievement effects. Hanushek illustrates the desegregation movement with data regarding the average percentage of white classmates of minority students: in 1968, 22.3 percent of black student's classmates were white on a national average, a number that increased to 35.1 percent by 1992 (Hanushek, 2001:26). The percentage of blacks in predominantly minority schools fell from seventy-seven percent in 1969 to sixty-three percent in 1987, but then began to rise again, reaching sixty-nine percent by 1997 (Lee 2002:10). Cumulatively this is a sign of progress, although recent trends are troubling. While gains have been made concerning black/white segregation, Hispanic segregation has actually increased over the last three decades (Orfield and Yun, 1999).

Jonathan Kozol (2005) argues that schools in the New York City public school system that were integrated years ago are still as racially segregated as they have ever been; the only difference is now we face social and economic segregation, not forced legal segregation. What does resegregation of our school systems mean? It means that we are allowing overwhelmingly poor and minority neighborhoods to operate with property tax revenues that provide an "inherently unequal" education for their children. Less than a quarter of black and Hispanic students in the U.S. attend schools that are not predominantly minority (Kozol 2005:19). Of the "intensely segregated" (Kozol 2005:20) white schools in our country, only fifteen percent report that more than half their students live in such poverty that they need free or reduced meals. By the same measures, intensely segregated black and Hispanic schools report that eighty-six percent of their students receive this subsidy (Kozol 2005). This information certainly concerns how SES, specifically school-wide SES, affects achievement; but it also brings us to the topic of school funding.

2.2 Per-Pupil Funding and Academic Performance

When we consider poorly funded schools, we must consider all of the facets of education that are affected by school funding: quality of teachers; level of school building disrepair; overcrowding and disproportionately large class sizes; lack of resources and learning tools, such as computers and scientific equipment; lack of proper learning motivation; etc. While funding may not explain the entirety or majority of achievement, it does play a role in the type of education a student receives and at least partially influences achievement.

Jonathan Kozol (1989) asks this question in *Savage Inequalities*: why should a child's place of birth determine the quality of education received? He expanded upon John Coons' assertion that the current property-tax system ensured "that certain participants in the economic race are hobbled at the gate—and hobbled by the public handicapper" (Coons 1970:273). The current system of funding employed by the state of Virginia and many other states creates an advantage for some children relative to others based solely on place of residency. Kozol states that, "Education offered to poor children should be at least as good as that which is provided to the children of the upper-middle class" (1989:207). Coons, Clune III, and Sugarman (1970) pose the question similarly about school funding: what is the justification for this inequality? Isn't the property-tax system based upon an imaginary line that separates one human being from another into abstract school districts, the purpose of which is to decide who gets more per-pupil funding? What is the rationale of this policy? Coons and his colleagues argue that not only does school funding reflect social stratification in our country, but also that it helps to strengthen class distinctions.

The crux of much of Jonathan Kozol's work deals with an important issue: is it fundamentally unconstitutional to deliver separate educations to students based upon SES and geography? Kozol asserts that "The Supreme Court decision in *Brown* v. *Board of Education. . .* in which the court had found that segregated education was unconstitutional because it was "inherently unequal," did not seem to have changed very much for children in the schools I saw," (Kozol 1989:3) and that "What seems unmistakable, but, oddly enough, is rarely said in public settings nowadays, is that the nation, for all practice and intent, has turned its back upon the moral implications, if not yet the legal ramifications, of the *Brown* decision." (Kozol 1989:4).

Some research suggests that a variable as simple as a positive learning environment can have substantial impact on academic outcomes, as my discussion of Lee (1998) will reveal later. Hearing of the learning environments in some of our country's poorest school districts, however, it is hard to imagine how any learning could take place at all. Kozol describes the poor urban schools he visited as "extraordinarily unhappy places" that reminded him of "garrisons" and "outposts" which he thought looked as if they came from "foreign nations" (Kozol 1989:85). Kozol describes schools in the worst neighborhoods, with doors guarded and police roaming through the halls monitoring the children. The outside windows were often covered with bars. Kozol noted that "in Boston, the press referred to areas like these as 'death zones'" (Kozol 1989:5); "I often wondered why we would agree to let our children go to school in places where no politician, school board president, or business CEO would dream of working," Kozol questioned (Kozol 1989:5). In East St. Louis, one of the most disastrously poor regions he visited, the nicest buildings were the City Hall (which contains the jail), the local brothel, and the funeral parlors (Kozol 1989:16). Kozol notices schools in New York without a single classroom window (Kozol 1989:87). According to the New York Times, blackboards in Morris High School in the South Bronx are so badly damaged that teachers are hesitant to let children use them in fear that they will cut themselves. The problems do not end there: paint chips off of the walls can be seen all over the floor; water rushes down one stairwell like a waterfall after it rains; one classroom is off-limits due to a huge hole in the floor; and music room chairs have to be strategically placed to avoid falling ceiling tiles (Kozol 1989:99). This, the poorest congressional district in the U.S., is described by Kozol as a "landscape of hopelessness" (Kozol 1989:100). Kozol visits Morris High a year later, after much attention was given to the conditions at the school, and it is largely unchanged. One-time funding allotments or periods of brief media attention will not fix these problems.

Aside from the learning environment itself, teachers have little physical resources with which to teach their students. Vocational classes, which would at the very least help children acquire valuable skills for a possible future career, do not have the equipment necessary. The science labs are "30 to 50 years outdated" (Kozol 1989:27). Ignoring what some might deem "luxuries," even the basic necessities for science, like water, are unable to be obtained. There is no heating and no air conditioning (Kozol 1989:27-29). Kozol claims that the little equipment the school does possess is so old and dilapidated that faculty are pressured not to use it, as to preserve it (Kozol 1989:29). Classes go without books for entire grading periods, and when books are acquired they are damaged and outdated. In Chicago, some schools are forced to place impossible rations on their paper and pencil supplies (Kozol 1989:67). Irl Solomon, a graduate from Brandies University and popular history teacher at a school Kozol visited states that "I have done without so much for so long that, if I were assigned to a suburban school, I'm not sure I'd recognize what they are doing. We are utterly cut off" (Kozol 1989:29). It is hard to believe that Solomon's students are receiving an education equal to the suburban children he references.

Local property taxes make up the bulk of public school funding. In the U.S., federal funding makes up about six percent of yearly expenditures (Kozol 1989:56). The rest is paid for by local and state funds, with local funds normally at least twice that of state funds. Local districts decide how high their property taxes will be, which leads to peculiar situations. East St. Louis, considered one of the worst places in the U.S. to reside—it is so bad that it is often compared to a poor undeveloped country—is so poor and so in debt, yet has one of the highest property-tax rates in the state of Illinois in order to fund public services (Kozol 1989:8). Poorer districts often charge a higher property tax (sometimes considerably higher) than their wealthy counterparts, and yet fall well below the funding of those wealthy districts, due to an extreme difference in property value.

Table 1: Highest versus Lowest Spending Comparison in Virginia, 2005

Highest-Spending School Districts in the State of Virginia	*Per-Pupil Spending*	*Lowest-Spending School Districts in the State of Virginia*	*Per-Pupil Spending*
Alexandria	$16,085	Chesterfield	$7,274
Falls Church	$15,909	King George	$7,142
Arlington	$15,877	Pittsylvania	$7,170
Charlottesville	$12,846	Bedford	$7,011

(Source: 2006 Virginia Superintendent's Annual Report)

With Alexandria spending $16,085 per student and Bedford spending $7,011 (Table 1), the inequality in funding is glaringly apparent. Despite the obvious difference, the inequity is actually much deeper than a first glance would have you believe. Not only can Bedford afford half of what Alexandria spends, but places like Bedford often spend much more on non-teaching related expenditures than wealthier districts. Building maintenance expenditures can occupy twice as much space in a poor district's budget due to older buildings that are left in disrepair. What this means is poorer districts are often in even worse shape than they appear because they have even less money to spend on teaching-related expenditures. With property taxes sometimes reaching levels twice as high as other districts, it is clear that inequitable funding, and much larger percentages of funding spent out of the classroom, leave poorer districts in a tough situation. Future research would be wise to construct funding variables based solely upon money spent on instruction.

Consider the cumulative effect of funding in a single classroom. If one district spends roughly $7,000 per student, and one district spends roughly $16,000, that is more than double the spending. But consider this: a classroom of thirty students in the poorer district spends $210,000 per classroom based upon these numbers, and the wealthier district spends $480,000. When analyzed in terms of total classroom funding, such as this example, the difference is astounding. Considering that in the year 2006, a first time teacher with a Masters degree earned roughly $45,000-$48,000 in some Northern Virginia school districts, you are talking about a difference in funding of more than five highly qualified teachers' salaries (and of course, Northern Virginia pays well relative to other Virginia school districts).

The funding inequity forces some schools in poorer districts to fail in competition with wealthier districts for the best teachers, and can often result in a considerable number of sub-par educators. At Public School 79 in New York City, Kozol points out, the principal claims to have to hire the "tenth-best" teachers, which he says, "I thank God they are still breathing" (Kozol 1989:84). Underperforming children in the worst districts need the best teachers to help them overcome disadvantage. . . but instead they receive the worst (Kozol 1989:85). Education experts often cite extraordinary teachers as the best tool to combat and narrow the achievement gap between performing and underperforming children; unfortunately, hiring these teachers with half of the funding is nothing more than a fantasy for most of the poorer districts (Kozol 1989:213).

Public policy analysts often argue that you cannot raise average scores by increasing funding, therefore it is of no use fighting the equalization battle. This ignores the fact that although you may not raise scores universally, you are ignoring the group of truly gifted students, however large or small, that will be left behind if they are not allowed to enroll in the necessary courses to compete with their wealthier counterparts. Dr. Lillian Parks, superintendant of East St. Louis schools, says that, "Gifted children are everywhere in East St. Louis, but their gifts are lost to poverty and turmoil and the damage done by knowing they are written off by their society. Many of these children have no sense of something they belong to. They have no feeling of belonging to America" (Kozol 1989:33). The handful of students that can compete despite their environment cannot keep up with their wealthier counterparts if they are forced to attend inferior schools without the necessary college preparatory programs. Without advanced courses to bolster their academic résumé to the level of their wealthier counterparts, such as AP programs, these students are at a disadvantage despite their tremendous résumés. Not only will gifted children in these poor districts face incredible economic obstacles when trying to attend college, but they may fail simply because their school district wasn't able to provide the necessary classes.

If funding levels do not matter, why do richer districts fight so hard to protect their advantage? Justice Thurgood Marshall, commenting on a school funding court case, asked this question: "[If] financing variations are so insignificant. . . it is difficult to understand why a number of our country's wealthiest school districts nevertheless zealously pursued its cause before this court" (Kozol 1989:219). Marshall also observed that local control is often used as an excuse to justify inequality (Kozol 1989:219). Marshall asserted that poor districts have no control over the quality of education that they provide, because it is tied to their wealth, something that they do not have and do not control. Therefore, when critics argue that losing control of local funding means losing local control over local education, Marshall posits that the only control lost is by those that have wealth to begin with (Kozol 1989:219-220).

Proponents of equalized school funding stress that increased educational opportunities, better schools, and better quality teachers will undoubtedly help students (Greenwald, Hedges, and Laine 1996, Hedges and Greenwald 1996, Hedges, Laine and Greenwald 1994). Elliott (1998) concluded that school funding has an indirect effect on student achievement due to the quality of teachers a district is able to hire (Elliott 1998:223). The author also notes that students are given more "opportunities to learn" (OTL) in wealthier school districts, which also affects academic performance. Elliott definition of OTL: ability for schools to hire more educated and experienced teachers; school districts employing smaller class sizes; greater use of technology such as science equipment and computers; etc. Expenditures are significantly related to most OTL measures (Elliott 1998:233). Elliott also found a direct positive correlation between the experience and education of teachers and the academic performance of students in their classes. This is a noteworthy conclusion in support of better funding for poorer districts in competition for qualified teachers.

There is considerable scholarship suggesting a direct correlation between level of school funding and academic performance. Some scholars suggest that there is a positive significant correlation between expenditures and test scores (Greenwald 1996:34). In Elliott's study (1998), she found that school expenditures were "significantly related to higher achievement" (Elliott 1998:232). A small but significant effect results when an additional $1,000 is spent in a classroom: Elliott observed increased achievement, causing mean achievement to rise by .20 points from the 8th grade to the 10th grade. Elliott cites some methodological problems with this variable due to studying it on the district-wide level, and thinks an evaluation at the school level would yield even larger results (Elliott 1998).

Significant scholarly work focuses on the fact that less money is spent on the poor children in our country. One indicator of poverty within a school building is how many students qualify for a free lunch. As Elliott (1998) points out, “Less money is spent in schools where more students qualify for free lunches” (Elliott 1998:233). When one district has more money to spend than another, the wealthier district has more policy options. One of those options is smaller class sizes (Greenwald, Hedges, and Laine 1996, Hedges and Greenwald 1996, Hedges, Laine and Greenwald 1994), and issue I will deal with later in next section of this paper.

Wenglinsky contends that, although it is an indirect link, there is a correlation between educational funding and academic achievement. What the author proposes is that, while there is not a perfect correlation between funding and achievement, there is a correlation between the amount of money a school spends and the gap between the highest performing and lowest performing students within schools. Wenglinsky notes that, when analyzing the funding problem, one must distinguish between different types of funding, not simply depend upon aggregate spending. Aggregate spending calculations leave out how much is spent on instruction, building maintenance, administrative costs, etc. Some types of funding matter, the author asserts, and some do not. He also notes that a dollar in one region does not buy nearly as much as a dollar in another region. One thousand dollars per student in one rural district in Alabama, for instance, may buy you considerably more than $1,000 in an urban district like New York City. The author notes that, not only do lower-SES students go to poorer schools, but they receive an inferior education within that school than their higher-SES and better-performing peers. The author found that, as students grew older, schools became less likely to be able to lessen the impact of their SES. Therefore, the best opportunity for schools to lessen the impact of SES may be at the elementary school level (K-5). The author found that spending did help the achievement of the elementary school students, but that spending only had indirect effects as the children grew older and entered middle school and high school. He also found that, with fourth graders, class size had a positive impact on performance, a relationship that again virtually disappears by the time the children reach twelfth grade. He confirmed that while instructional spending had a positive effect on performance, administrative spending did not. The author found that, when schools do not have the funds necessary, students depend much more upon their previous knowledge, and therefore the gap between low SES and high SES, and low-performing and high-performing students, widens in poorly-funded schools. The author noted these conclusions: the earlier a child receives resources the better their chances later in their academic career; the bulk of funds should go to instruction; and that equalized funding for all schools means less within-school performance gaps (Wenglinsky, 1998). The last conclusion, less intraschool gaps, is based upon the premise that when a school has sufficient resources, it can focus attention upon low-performing students. When a school does not have sufficient resources, it may not have the remedial programs or the personnel to focus the necessary energy towards closing achievement gaps.

In Hanushek's (1997) meta-analysis of funding research, he found that of the 163 studies that measured funding and achievement, twenty-seven percent found significant positive correlations, seven percent found significant negative correlations, and sixty-six percent found no significant relationships. Hanushek concluded that "There is no strong or consistent relationship between school resources and student performance" (Hanushek 1997:148). Hedges, who has consistently debated Hanushek about the positive correlation between funding and achievement, analyzed the same data with different standards. The scholar found that forty-four percent of cases showed significant positive correlations, three percent showed significant negative correlations, and fifty-three percent yielded no significance (Greenwald, Hedges, and Laine, 1996). Hedges and his colleagues used different criteria than Hanushek, and noted that, in the twenty-seven studies that they analyzed using what they deemed proper criteria, there was positive significance between spending and performance.

The Coleman Report, considered a groundbreaking yet controversial study on educational achievement, contended that when SES and student background information is controlled, there is no significant link between spending and achievement. When a group of scholars went back and reanalyzed Coleman's data, however, they found that there was a relationship between spending and African-American achievement in the South (Wenglinsky 1998:270). Even with the overall conclusion that SES and background information were the real determining factors in a student's success, Coleman's data revealed that spending mattered and the simplified SES explanations were not the only conclusions to be drawn.

Critics of increased school funding and equalized funding note that resources do not necessarily determine the quality of education, but how those resources are allocated. Hanushek (1989, 1991, 1994, 1996) argues that a direct correlation between funding and performance does not exist due to differing success rates with resource allocation. His conclusions are scathing as they relate to poorer districts, and strike a particularly paternalistic tone: because poorer districts supposedly make unwise decisions with their funding, we shouldn't give them anymore then we must (or are legally forced to give). This is a seemingly flawed and paternalistic argument.

Lee (1998) posited that school conditions played an important role in achievement. Over the last three decades, class size has decreased from thirty students to eighteen students in elementary schools and twenty students to fourteen students in secondary schools; over the same period school expenditures increased by sixty percent (Lee, 1998:9). The average level of teachers' education has changed as well; there was a twenty-four percent increase in the prevalence of teachers with Masters degrees during the 1971-1986 time period alone. Those numbers have since slowed and stabilized (Lee, 1998:9). As these factors slowed and leveled off, so has the achievement gap. There are some methodological problems with Lee's class size data, as it does not actually measure regular class size, and includes instructors and personnel who do not teach a daily regular-size class.

Opponents of equalization argue that although equalizing mechanisms do not rid the system of disparities, they provide children with the "minimum" or "foundation" education that they "need," asserting that all children do not need equal education as long as they receive the minimum deemed necessary; Kozol argues against this "foundation" principle of state funding. States have equalizing mechanisms that provide poorer districts with more state and federal money than wealthier districts. There are two problems with this mechanism: state and federal money combined do not account for the majority of a given district's funding (the vast majority of funding comes from local property taxes); and the "foundation" is not equal to the wealthier districts funding level, but considered enough to "provide a 'minimum' or 'basic' education" (Kozol 1989:208; Augenblick et al. 1997). Two major problems with providing minimum education is subjectivity of standards and competitiveness. Kozol (1989) points out that a "minimum" education is nothing more than some tenuous assurance that graduates will be able to secure *a* job. We do not provide the poorest districts' children the opportunity to compete for more desirable and competitive jobs. Furthermore, the definition of "minimum" or "adequate" is subjective, and those people that decide its meaning often have the wealthier districts interests at heart, interests that include maintaining their advantage. They decide what poor children deserve, and what their role in society should be (Kozol 1989:216). It would be an understatement to identify this as a conflict of interest.

Unequal funding, unequal opportunity, and a sense of hopelessness tend to create apathy in lower class students. Murphy (1981) states that there are very real differences not only in the quality of education received by different socioeconomic classes, but the resulting educational aspirations of those classes as well. The answer to this problem seems almost self-evident: although educational and economic background have tremendous influence on school success rates, it is quite clear that children receiving a sub-par education may not feel intensely motivated to move ahead in a system that disadvantages them (Murphy 1981).

One of the most common criticisms of equalized funding is that it does not account for the entire gap. Cook and Evans (2000) argue that three-quarters of the achievement gap lies within schools. While this is important and points to the necessity to look inside our schools to fix the problems, it still illustrates the fact that inequitable funding across school districts helps to reinforce inequality. If equalized funding eliminates a quarter of the gap, Cook and Evans might have trouble explaining why it should not be enacted as policy. If achievement can be bolstered, even in on a small scale, we should address those factors that lay within our sphere of control.

"Surely there is enough for everybody in this country. They [our children] are all quite wonderful and innocent when they are small. We soil them needlessly."

Jonathan Kozol

2.3 Student-to-Teacher Ratio and Academic Performance

As lengthy as the class size debate has been, it has mostly centered in either theory, small experiments with insufficient samples, or flawed models. Most scholarly work that experimented with class size proved insufficient due to research design flaws and insufficient sample size. Critics of these experiments cited short duration and small samples. Recent research suggests that, despite the conclusions of earlier studies, smaller class size is linked to better achievement. This conclusion is particularly true when the class is no larger than thirteen to fifteen students. It also helps economically disadvantaged kids narrow the achievement gap. If instituted at an early age, smaller classes can have a substantial impact according to important and ground-breaking experimental research.

In 1985, the Tennessee legislature funded the STAR class-size experiment. Students were assigned randomly to small (13-17) or regular (22-26) classes, or regular classes with a teacher's aide, upon entering kindergarten. With 6,000 student participants the first year, 12,000 students overall, and 329 classes from seventy-nine schools in forty-six districts, the study did not suffer the small sample size problems of previous studies. It also did not suffer from short duration: the students participated in the experiment for four years, and they were followed after the experiment for at least four more years. The study saw improved student performance during and after they were involved in the experiment relative to their peer reference group. Students had superior test scores, developed better learning habits, and researchers observed fewer in-class behavioral problems. Students in the smaller classes performed better than their counterparts in the other two situations. The study also found that the gains were greater for minorities (two to three times those of whites). It also found that students in smaller classes were promoted to the next grade level at a higher rate (Finn and Achilles 1999:97-99). Not only did the STAR researchers arrive at these highly encouraging conclusions, but subsequent analysis of their data has supported their conclusions (Goldstein and Blatchford 1998) and scholars have generally praised the study (Mosteller 1995, Orlich 1991, Grissmer and Flanagan 1998, Jancks and Phillips 1998). A later experiment, Tennessee's "Project Challenge," replicated the experiment and came to the same conclusions (Achilles, Nye, and Zaharias 1995). In Wisconsin, the SAGE experiment used methods similar to the STAR study and yielded similar results (Maier et. al. 1997), and a similar study was also conducted in Burke County, North Carolina, to similar results (Achilles, Egelson, and Harman 1995). The achievement gap was reduced on every single test in the STAR experiment (Finn and Achilles 1999:100). At the end of kindergarten, students from smaller classes performed better than their peers in the other two learning situations in all subjects, proving to be ahead of their peers academically by approximately a month. After finishing first grade, students from smaller classes found themselves approximately two months ahead of their counterparts, and shockingly, "At the end of fifth grade, small-class students are about half a school year [five months] ahead of [their counterparts] in all subjects" (Finn and Achilles 1999:101). After leaving the experiment and moving on to fourth grade, the students from smaller classes held an advantage over their counterparts. Even in-class behaviors were better for the small-class students, including initiative-taking and overall effort (Finn et. al. 1989).

The SAGE study was a five-year pilot project started during the 1996-1997 school year in certain Wisconsin school districts targeted for their poverty. The project yielded results consistent with the Tennessee STAR project, linking smaller class sizes with better student performance for students in kindergarten through third grade. The SAGE program consisted of thirty experimental schools (with teachers given no more than 12-15 students) and seventeen comparison schools (schools with regular class sizes and similar characteristics to the experimental schools, including SES and student achievement). The measurement for performance was achievement tests administered at the beginning and end each grade level, consisting of evaluation of reading, mathematics, and language arts skills. In all academic areas tested, students attending a SAGE reduced class-size school performed better then their counterparts. Although the achievement gap between black and white students remained, the results concluded that the gap narrowed in SAGE schools, unlike their counterparts. The SAGE results also concluded that average classroom SES had an effect on performance. The teachers involved in the SAGE program filled out questionnaires to help researchers determine the cause of the SAGE program's success. To be sure, they concluded, class size alone does not account for all of the gains in performance. What class size allows is for teachers to have more individual instruction time, more overall time spent on teaching rather than administration or discipline, more frequent involvement from students, more sharing, more discussion, more hands-on activities, and more coverage of academic content (Molnar et. al. 1999:173). Some of the most prized results were less time spent on discipline and more time spent on teaching, and the fact that the more individual attention given to students, the more interaction and back-and-forth questioning and answering that resulted, which led to increased learning. Teachers indicated that they were also able to get to know their students better, which led to better individually-adapted instruction. Many of the teachers noted that their classrooms became tightly-knit units which led to better learning environments. The fact that teachers had more time to spend with individual students one-on-one showed its greatest impact on low-SES students, students with special needs, and poorly achieving students. What this suggests is that class size does in fact greatly influence performance by providing teachers with greater instructional options. The SAGE results indicate that there may be a great need to reduce class sizes to fifteen students or fewer in elementary schools, so that the effects of the SES and the achievement gap can be mitigated for students later in their academic careers (Molnar et. al. 1999).

Hanushek (1999) claims that, "The non-experimental evidence [concerning class-size research] does not suggest that any substantial achievement gains would accrue to general class size reduction policies of the type recently discussed and implemented in various jurisdictions around the United States" and that "Both pupil-teacher ratios and class sizes have fallen over some period of time, without any commensurate improvement in overall student performance" (Hanushek 1999:144). His stance is problematic for various reasons. The STAR and SAGE studies were not concerned with pupil-teacher ratios, but actual individual class size. Stating that actual class size has fallen does nothing to attack the premise of the SAGE and STAR studies, which is that there is a threshold with which performance is enhanced (roughly fifteen students or less). To say that actual class size has fallen means nothing when they have not fallen beyond the threshold for which performance is enhanced. Pupil-to-teacher ratios are flawed (Miles 1995) and are usually deflated misrepresentations of actual class size due to the inclusion in the pupil-to-teacher formula of teachers that do not teach a full class on a daily basis (specialized instructors). Until actual class-sizes, not pupil-teacher ratios, fall below this line (national class sizes average roughly twenty-five students), Hanushek can make no claims as to how consistent the results would be with the experimental data from SAGE and STAR. Hanushek also points to some losses in academic achievement over the course of the last three decades. What he does not do, however, is address the fact that, regardless of fluctuations in students' achievement, STAR and SAGE confirmed that there are ways to narrow the achievement gap, reducing overall educational inequality. Of the STAR results, Hanushek asserts that, "It is not known whether there are larger populations to which [the results] can be generalized" (Hanushek 1999:158). Due to the size of the study (roughly 6,000 students), one finds it hard to follow Hanushek's logic.

The criticism of class size reductions tend to state that the gains are either not large enough or not present at all, and that class size reduction is only influential at the earliest grades. The second assumption seems to be negated by the fact that the STAR study found class size benefits well into middle school. Hanushek (1996, 1997, 1998) disagrees with the influence of class size, stating that, "We have extensive experience with class size reduction and it has NOT worked" (Hanushek 1998:ii). He has been criticized for his methodology, however, as Finn and Achilles note (1999). Some of the methodological concerns with Hanushek's work is that he uses student-to-teacher ratios that account for all of the teaching professionals within a given district and all of the students in a given district, regardless of whether or not those teaching professionals are responsible for a full-size class each day or not (Finn and Achilles 1999). Miles found that there was a ten-student discrepancy between student-to-teacher ratios (13.2 students per teacher) and actual class size (23 students per teacher) in his study of Boston schools (Miles 1995:477). Scholars note that school districts must hire many specialty teachers, such as teachers responsible for bilingual programs and special education, that tend to deflate the student-to-teacher ratios in a given area, leaving deceivingly small classes and skewed ratios (Miles 1995, Lewit and Baker 1997). Aside from methodological concerns, plenty of scholars disagree entirely with Hanushek's premise that no relationship exists between class size and achievement (Hedges, Lane and Greenwald 1994, Krueger 1998, Wenglinsky 1997).

Whether the studies yielded results notable enough to change policy is debatable, although it is difficult to build a case against the STAR and SAGE results due to their incredibly impressive implications. Do we value a five-month or more advantage in academic achievement?

Is it worth the money? These seem like policy questions more than questions of the validity of the study, a study which was met with praise from much of the academic community.

Supporters for class size reduction are numerous. Murnane and Levy (1995) found that smaller classes helped achievement, especially when coupled with other educational reforms. Grogger's (1996) research concerning reductions in pupil-to-teacher ratios showed that, while small, there was indeed a correlation to a narrowing of the achievement gap. This suggests that while many methods do little to narrow the gap individually, in conjunction they may have a rather substantial aggregate impact on the achievement gap (Grogger 1996).

Administrators and educators from poorer districts realize the implications of class size problems. Fiscal cuts in St. Louis, which resulted in terminated employment for 280 teachers, increased class size dramatically, having an "unimaginable impact" on the students, according to the president of the teachers' union (Kozol 1989:24). At a school in East St. Louis, one teacher has 110 students in four classes, but only twenty-six books. The books they did have contained approximately 100 missing pages (Kozol 1989:37). Schools in the wealthiest parts of Chicago, such as New Trier High School, average twenty-four students per class, and fifteen per class for slower learners. Compare that to schools in the poorest parts, which average thirty-six and thirty-nine, respectively (Kozol 1989:65-66). One wealthy school in Chicago reports that its counselors have a load of twenty-four students per counselor—compared to Du Sable, a poor school, whose counselors deal with a load of 420 students per counselor (Kozol 1989:65-66). In Public School 261 in District 10 in New York, there are 930 kids per counselor (Kozol 1989:86) and Kozol notices some classes with as many as thirty-seven students. The disparity in some New York schools is such that poorer districts have classes that average fifty percent to almost eighty percent larger than their wealthier counterparts. Some students in the South Bronx report having over forty children in their classrooms, so many that when all of them attend class some are forced to stand (Kozol 1989:111). The New York Times reported that a high school in Crown Heights, New York, had converted bathrooms, gyms, hallways, and closets into classrooms (although by "conversion" they do not mean that they were actually suitable classrooms—conversion only meant that classes were held there, regardless of whether or not conditions were altered to assure that learning environments were created). It was reported that five children were having class right next to a urinal (Kozol 1989:114).

2.4 Previous Research Relative to This Study

Research concerning the relationship between socioeconomic status and academic performance yields relative agreement on the link between increased socioeconomic status and increases in academic performance. The disagreement within the SES/academic performance debate concerns the importance of individual student SES compared to school-wide SES and community-wide SES. I will address district-level community SES in this study.

Research concerning the relationship between school funding and academic performance is mixed. While multiple scholars have found significant evidence linking increases in school funding to increases in academic performance, some of their work has raised methodological concerns. Those concerns themselves do not assure illegitimacy, but question whether the indicators currently used in funding scholarship truly capture the desired variable. This study will consider district-level per-pupil funding.

Experimental class-size research yields relatively unanimous support for the assumption that lower class-sizes result in improved academic performance. Non-experimental research generally supports this assumption as well, although there are notable critics. The groundbreaking results of the STAR and SAGE experimental studies, however, seem to negate most of this criticism. This study will consider district-level teacher-to-pupil ratios.

In this study I seek to address two important gaps in current research: the relationship between funding and academic performance and the aggregate effect of all three variables on academic performance. The funding debate is muddled and I find it important to contribute since it has very serious implications for educational outcomes and future life-chances for students. The more important gap, however, concerns the aggregate effect of all three variables. Not only has there been a dearth of research that considers these three variables collectively and the amount of variance they cause, but very little has been revealed about how the variables affect one another when considered in the same model. If one variable reveals a significant relationship when considered alone in a bivariate relationship, but reveals a virtually non-existent relationship once other variables enter a regression model, then the debate is altered in a very substantial manner.

Part 3: Formation of Objectives

3.1 Nominal Definitions

Dependent Variable 1: Percentage of students proficient on the third-grade English SOL Test.

Dependent Variable 2: Percentage of students advanced on the third-grade English SOL Test.

Dependent Variable 3: Percentage of students proficient on the third-grade Mathematics SOL Test.

Dependent Variable 4: Percentage of students advanced on the third-grade Mathematics SOL Test.

Dependent Variable 5: Percentage of students proficient on the eighth-grade English SOL Test.

Dependent Variable 6: Percentage of students advanced on the eighth-grade English SOL Test.

Dependent Variable 7: Percentage of students proficient on the eighth-grade Mathematics SOL Test.

Dependent Variable 8: Percentage of students advanced on the eighth-grade Mathematics SOL Test.

Unit of Analysis: School district (county or city).

Independent Variable 1: socioeconomic status (district average of median total household-income)

Independent Variable 2: per-pupil funding (average for district)

Independent Variable 3: student-to-teacher ratio (average for school district)

Independent Variable 4: percentage of citizens within a district who self-identify as African American.

Control Variable: SES (to determine if the influence of race decreases once SES is controlled, and determine if discussing race is actually misleading since SES is more of an influence – the single SES variable will be interpreted as both an independent variable and a control for the race variable).

Population/Scope Conditions: The population is all (*N* = 128) of the city and county public school districts in the state of Virginia that had sufficient data (as reported by the Virginia Superintendent's Report and the U.S. Census). The conclusions yielded from this study should generally hold true for other districts in other states as well, although important limitations are noted later in this paper.

3.2 Hypotheses

Hypothesis 1: socioeconomic status will be positively correlated with the academic-performance variables.

Hypothesis 2: school funding will be positively correlated with the academic-performance variables.

Hypothesis 3: average class size will be negatively correlated with the academic-performance variables.

Hypothesis 4: when SES is controlled, the influence of race upon the academic performance variables will decrease compared to the bivariate relationships.

Hypothesis 5: the effects of the independent variables will be greater for the advanced variables versus the proficient variables.

Hypothesis 6: the effects of all of the independent variables will be greater at the eight grade level relative to the third grade level.

Part 4: Description of Methods

4.1 Research Plan

I constructed one data set from two data sources. The first data source is the U.S. Census' collection of city and county profiles for the state of Virginia. This data source provides the following variables for this study: SES (median total household income for every city and county in Virginia); and race (percentage of African American residents for every city and county in Virginia). The second data source is the 2005-2006 Virginia Superintendent's Annual Report. This data source provides the following variables for this study: the academic performance variables (percentages of proficient passing and percentages of advanced passing on the Virginia SOL tests for grades three and eight in all of Virginia's counties and cities in math and reading); funding (per-pupil funding for all cities and counties in Virginia); class-size (pupil-to-teacher ratios for all Virginia cities and counties). The Virginia Superintendent's Report is public data available via the internet on the Virginia Department of Education's website; the Virginia city and county profiles are publicly available data on the U.S. Census' website.

Each Virginia school-district had the following information when entered into multiple regression analysis: amount of school funding per pupil in their district (funding indicator); median household-income (SES indicator); pupil-to-teacher ratio (class size indicator); percentages of students who passed at the proficient level and passed at the advanced level, respectively, on the math and reading SOL tests for grades three and eight (academic performance indicators); and percentages of African American residents (race indicator). Using multiple regression analysis, I determined the correlations and standardized coefficients that exist between the SES, funding, class size, and race indicators (independent variables) and performance on the SOL tests (dependent variable).

4.2 Multiple Regression Analysis

The purpose of using multiple regression analysis is to determine how much variance in academic performance can be explained by the models, and the relative contribution of each variable in the model. A standard multiple regression analysis was conducted using SPSS software. I explored the relationship between academic performance (categorized as eight continuous dependent variables) and four continuous independent variables (SES, class size, race, and funding). Each independent variable was entered into a multiple regression model with the dependent variable to determine the individual relative effect of each variable and the aggregate effect of the variables and the predictive ability of these variables when considered together. The results showed support for a select number of hypotheses.

There were eight separate models: Model One included the four independent variables with the dependent variable, “English Three Proficient”; Model Two included the four independent variables with the dependent variable, “English Three Advanced”; Model Three included the four independent variables with the dependent variable, “Math Three Proficient”; Model Four included the four independent variables with the dependent variable, “Math Three Advanced”; Model Five included the four independent variables with the dependent variable, “English Eight Proficient”; Model Six included the four independent variables with the dependent variable, “English Eight Advanced”; Model Seven included the four independent variables with the dependent variable, “Math Eight Proficient”; and Model Eight included the four independent variables with the dependent variable, “Math Eight Advanced.”

My sample size included 128 Virginia school districts (some districts had to be excluded due to insufficient data, although almost every district was included). Multiple regression analysis can suffer greatly from small sample-sizes, an issue I considered in accordance with Tabachnick and Fidell’s (2001) formula concerning sample sizes.

Tabachnick and Fidell’s (2001:117) formula for calculating desired sample size:

$$N > 50 + 8\mathrm{m}$$

(m = number of independent variables)

With a total of four independent variables, my suggested *N*, according to this formula, should be no less than 82 subjects. My sample (128 districts) met this requirement.

The variables were coded as follows:

Median income is a continuous variable measuring the average total household income for the residents in each district in dollars.

School funding is a continuous variable measuring the average per-pupil spending in each district in dollars.

Student-to-teacher ratio is a continuous variable measuring the average amount of students per instructor in each district measured in number of students.

Percentage African American is a continuous variable measuring the percent of residents who self identify as African American within each district measured in percentage on a 100% scale.

All of the academic performance variables are percentages on a 100% scale.

The results of the multiple regression models were analyzed for their effect coefficients, explained variance, and significance. Correlations and coefficients were deemed significant if they yielded a significance level less than .05 (less than .01 and less than .001 were also documented). The Adjusted R-Square value was used to explain how much of the variance is explained by each model. The results yielded in the ANOVA table determined the significance of the overall model, with the significance deemed valid if $< .05$. Relationships were considered very weak (and almost unnoteworthy) if less than .1, of low strength if between .1 and .299, of medium strength if between .3 and .499, and of large strength if between .5 and .7. Relationships greater than .7 would have been deemed questionable and required further post-analysis testing.

The beta standardized coefficient determined the influence of each variable and the direction of each relationship (positive meaning that increasing the independent variable leads to an increase in academic performance, and negative meaning that an increase in the independent variable leads to a decrease in academic performance).

One control variable was considered in the discussion (SES). The reason for selecting SES as a control variable is related to my inclusion of race in the models. As stated in the hypotheses section, I am interested in determining the effect of race once SES is controlled, with the hypothesis that the influence of race will decrease in the model once SES is controlled relative to the bivariate relationships (the single SES variable is interpreted as both an independent variable and a control variable for race).

4.3 Explanation of Variables

Here is a list of the variables included in the models (under the actual names used in the model) followed by a brief explanation of each variable:

- MedianIncome: This independent variable is the median total household income in a given school district. This is the SES variable.
- SchoolFunding: This independent variable is the average per-pupil funding within a given school district. This is the school funding variable.
- ClassSize3 and ClassSize8: These independent variables are the student-to-teacher ratios for the third and eighth grade classes, respectively, within a given school district. This is the student-to-teacher ratio variable.
- PercentageAfricanAmerican: This independent variable is the percentage of the population that self-reports as African American within a given school district. This is the race variable.

- English3Proficient and English3Advanced: These dependent variables are the percentages of third grade students who score above the proficiency and advanced thresholds, respectively, on the English SOL Test. These are academic performance variables.
- Math3Proficient and Math3Advanced: These dependent variables are the percentages of third grade students who score above the proficiency and advanced thresholds, respectively, on the Math SOL Test. These are academic performance variables.
- English8Proficient and English8Advanced: These dependent variables are the percentages of eighth grade students who score above the proficiency and advanced thresholds, respectively, on the English SOL Test. These are academic performance variables.
- Math8Proficient and Math8Advanced: These dependent variables are the percentages of eighth grade students who score above the proficiency and advanced thresholds, respectively, on the Math SOL Test. These are academic performance variables.

Table 2: Models 1-4

	M1	*M2*	*M3*	*M4*
Variables				
Median Income Standardized Coefficient (VIF, Tolerance)	-0.146 (1.775, .563)	0.211 * (1.775, .563)	-0.314 ** (1.775, .563)	0.265 ** (1.775, .563)
Per-Pupil Spending Standardized Coefficient (VIF, Tolerance)	-0.011 (1.261, .793)	-0.119 (1.261, .783)	-0.021 (1.261, .793)	-0.083 (1.261, .793)
Student-to-Teacher Ratio Standardized Coefficient (VIF, Tolerance)	0.100 (1.708, .585)	0.020 (1.708, .585)	0.085 (1.708, .585)	-0.003 (1.708, .585)
Percentage African American Standardized Coefficient (VIF, Tolerance)	0.098 (1.334, .750)	-0.449 *** (1.334, .750)	0.434 *** (1.334, .750)	-0.557 *** (1.334, .750)
Model Details				
All Variables Entered	Yes	Yes	Yes	Yes
***N* = 128**	Yes	Yes	Yes	Yes
Adjusted R^2	0.006	0.290	0.323	0.443
Standard Error	5.356	6.296	5.217	7.502
Model Significance Level	0.314	0.000	0.000	0.000
Multicollinearity Problems	No	No	No	No

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

Abbreviations as follows: English Proficiency - Grade Three (*M1*); English Advanced - Grade Three (*M2*); Math Proficiency - Grade Three (*M3*); Math Advanced - Grade Three (*M4*).

Table 3: Models 5-8

	M5		*M6*		*M7*		*M8*	
Variables								
Median Income Standardized Coefficient (VIF, Tolerance)	0.044	(1.197, .836)	0.227 *	(1.197, .836)	-0.056	(1.197, .836)	0.243 **	(1.197, .836)
Per-Pupil Spending Standardized Coefficient (VIF, Tolerance)	-0.276 **	(1.330, .752)	0.054	(1.330, .752)	-0.157	(1.330, .752)	-0.114	(1.330, .752)
Student-to-Teacher Ratio Standardized Coefficient (VIF, Tolerance)	-0.049	(1.299, .770)	0.049	(1.299, .770)	-0.025	(1.299, .770)	-0.085	(1.299, .770)
Percentage African American Standardized Coefficient (VIF, Tolerance)	-0.042	(1.101, .908)	-0.369 ***	(1.101, .908)	-0.064	(1.101, .908)	-0.266 **	(1.101, .908)
Model Details								
All Variables Entered	Yes		Yes		Yes		Yes	
N **= 128**	Yes		Yes		Yes		Yes	
Adjusted R^2	0.040		0.213		0.003		0.129	
Standard Error	6.303		7.600		7.595		10.597	
Model Significance Level	0.062		0.000		0.366		0.000	
Multicollinearity Problems	No		No		No		No	

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

Abbreviations as follows: English Proficiency - Grade Eight (*M5*); English Advanced - Grade Eight (*M6*); Math Proficiency - Grade Eight (*M7*); Math Advanced - Grade Eight (*M8*).

5.1 Model One: English Proficiency – Grade Three

Model One tests the relationship between the independent variables median income, per-pupil spending, student-to-teacher ratio, and percentage African American within a school district, and the dependent variable percentage of students proficient on the grade three English SOL Test. This model yielded a significance of .314, exceeding the significance threshold of .05, deeming the results from Model One unreliable (Table 2, Table 9).

5.2 Model Two: English Advanced – Grade Three

Model Two (Table 2) tests the relationship between the independent variables median income, per-pupil spending, student-to-teacher ratio, and percentage African American within a school district, and the dependent variable percentage of students advanced on the grade three English SOL Test. The purpose of this model is to determine the effect that an increase in the level of an independent variable will have on the level of the dependent variable.

• <u>Descriptive Statistics</u>

A review of the Descriptive Statistics table reveals that all 128 districts were included in the analysis (Table 2).

• <u>Correlations</u>

A review of the Correlations table (Table 11) reveals the direction, strength, and significance of the relationships between the different variables. I will review the significant relationships (significance less than .05).

All districts were included in this analysis (*N:* 128).

Median income was significantly correlated with every variable. Median income yielded a positive coefficient of .301 in relation to advanced English SOL scores. This means that income was positively associated with academic achievement, and the relationship is of medium strength (absolute value greater than .299). Median income yielded a positive coefficient of .185

in relation to school funding. This means that income is positively associated with school funding, and the relationship is of low strength (absolute value less than .3). Median income yielded a positive coefficient of .477 in relation to class size. This means income is positively associated with class size, and the relationship is of medium strength (absolute value greater than .299).

School funding was significantly correlated with every variable. School funding yielded a negative coefficient of -.149 in relation to advanced English SOL scores. This means that school funding is negatively associated with academic performance, and the relationship is of low strength (absolute value less than .3). School funding was negatively correlated with class size (-.157). This means that school funding was negatively associated with class size, and this relationship is of low strength (absolute value less than .3).

Class size was significantly correlated with median income, school funding, and percentage African American.

Percentage African American was significantly correlated with every variable. Percentage African American yielded a negative coefficient of -.511 in relation to advanced English SOL scores. This means that an increase in the African American population was negatively associated with academic achievement, and the relationship was strong (absolute value greater than .5). Percentage African American yielded a negative coefficient of -.229 I n relation to median income. This means that an increase in the African American population was negatively associated with median income, and the relationship was of low strength (absolute value less than .299). Percentage African American yielded a positive coefficient of .148 in relation to school funding. This means that an increase in the African American population was positively associated with school funding, and the relationship was of low strength (absolute value less than .3). Percentage African American yielded a positive coefficient of .180 in relation to class size. This means that an increase in the African American population was positively associated with class size, and the relationship was of low strength (absolute value less than .3).

• Variables Entered/Removed

A review of the Variables Entered/Removed table reveals that all of the desired variables were entered into the regression model, and that the variables were categorized correctly as either independent or dependent (Table 2).

• Model Summary/ANOVA

The Model Summary table reveals that the model explained 29% of the variance in the dependent variable (Adjusted R-Square of .290). The ANOVA table reveals a significance level of .000, meaning the model is significant (significance less than .05) (Table 2, Table 12).

• Coefficients

Refer to Table 2 and Table 13.

Median income (significance of .036) and percentage African American (significance of .000) both yielded significant standardized coefficients (significance less than .05). School funding and class size were not significant.

Median income yielded a positive standardized coefficient of .211. This means that an increase in income was positively associated with academic performance. The relationship was of low strength (absolute value less than .299).

Percentage African American yielded a negative standardized coefficient of -.449. This means than an increase in the African American population was negatively associated with academic performance. The relationship was of medium strength (absolute value greater than .299).

• Multicollinearity

The Coefficients table yielded Tolerance levels and Variance Inflation Factors (VIF) well within the range of assurance that multicollinearity was not an issue. A Tolerance level of less than .1 or a VIF of more than 10 would indicate problems with multicollinearity. This was not an issue in this model (Table 2, Table 13).

5.3 Model Three: Math Proficiency – Grade Three

Model Three (Table 2) tests the relationship between the independent variables median income, per-pupil spending, student-to-teacher ratio, and percentage African American within a school district, and the dependent variable percentage of students proficient on the grade three Math SOL Test. The purpose of this model is to determine the effect that an increase in the level of an independent variable will have on the level of the dependent variable.

• Descriptive Statistics

A review of the Descriptive Statistics table reveals that all 128 districts were included in the analysis (Table 2).

• Correlations

A review of the Correlations table (Table 14) reveals the direction, strength, and significance of the relationships between the different variables. I will review the significant relationships (significance less than .05).

Median income was significantly correlated with every variable. Median income negatively correlated with math three proficiency (-.376). This means that an increase in income was negatively associated with academic performance. This relationship was of medium strength (absolute value greater than .3). Median income positively correlated with school funding (.185).

This means that an increase in income was positively associated with school funding. The relationship was of low strength (absolute value less than .3). Median income was positively correlated with class size (.477). This means that an increase in income was positively associated with class size. This relationship was of medium strength (absolute value greater than .299).

School funding was significantly correlated with median income, class size, and percentage African American. School funding was negatively correlated with class size (-.157). This means that an increase in school funding was negatively associated with class size. This relationship was of low strength (absolute value less than .3).

Class size was significantly correlated with median income, school funding, and percentage African American.

Percentage African American was significantly correlated with every variable. Percentage African American was positively correlated with math three proficiency (.518). This means that an increase in the population of African Americans was positively associated with academic performance. This positive correlation is anomalous compared to the other dependent variables. The relationship was of large strength (absolute value greater than .5). Percentage African American was negatively correlated with median income (-.229). This means that an increase in the African American population was negatively associated with income. This relationship was of low strength (absolute value less than .3). Percentage African American was positively correlated with school funding (.148). This means that an increase in the African American population was positively associated with school funding. The relationship was of low strength (absolute value less than .3). Percentage African American was positively correlated with class size (.180). This means that an increase in the African American population was positively associated with class size. This relationship was of low strength (absolute value less than .3).

• Variables Entered/Removed

A review of the Variables Entered/Removed table reveals that all of the desired variables were entered into the regression model, and that the variables were categorized correctly as either independent or dependent (Table 2).

• Model Summary/ANOVA

The Model Summary table reveals that the model explained 32.3% of the variance in the dependent variable (Adjusted R-Square of .323). The ANOVA table reveals a significance level of .000, meaning the model is significant (significance less than .05) (Table 15).

• Coefficients

Refer to Table 2 and Table 16.

Median income (significance of .002) and percentage African American (significance of .000) yielded significant coefficients; school funding (significance of .802) and class size (significance of .372) were not significant coefficients (significance level greater than .05).

Median income yielded a negative standardized coefficient (-.314). This means that an increase in income was negatively associated with academic performance. The relationship was of medium strength (absolute value greater than .299).

Percentage African American yielded a positive standardized coefficient (.434). This means that an increase in the African American population as positively associated with academic performance. This relationship was of medium strength (absolute value greater than .299).

• Multicollinearity

The Coefficients table yielded Tolerance levels and Variance Inflation Factors (VIF) well within the range of assurance that multicollinearity was not an issue. A Tolerance level of less than .1 or a VIF of more than 10 would indicate problems with multicollinearity. This was not an issue in this model (Table 2, Table 16).

5.4 Model Four: Math Advanced – Grade Three

Model Four (Table 2) tests the relationship between the independent variables median income, per-pupil spending, student-to-teacher ratio, and percentage African American within a school district, and the dependent variable percentage of students advanced on the grade three Math SOL Test. The purpose of this model is to determine the effect that an increase in the level of an independent variable will have on the level of the dependent variable.

• Descriptive Statistics

A review of the Descriptive Statistics table reveals that all 128 districts were included in the analysis (Table 2).

• Correlations

A review of the Correlations table (Table 17) reveals the direction, strength, and significance of the relationships between the different variables. I will review the significant relationships (significance less than .05).

Median income was significantly correlated with every variable. Median income was positively correlated with math three advanced (.376). This means that an increase in income was positively associated with performance. This relationship was of medium strength (absolute value greater than .299). Median income was positively correlated with school funding (.185). This means that an increase in income was positively associated with school funding. This relationship was of low strength (absolute value less than .3). Median income was positively correlated with class size (.477). This means that an increase in income was positively associated with class size. This relationship was of medium strength (absolute value greater than .299).

School funding was significantly correlated with median income, class size, and percentage African American. School funding was positively correlated with class size (.039). This means that an increase in school funding was positively associated with class size. This relationship was of low strength (absolute value less than .3), and can be classified as very weak (absolute value less than .1).

Class size was significantly correlated with median income, school funding, and percentage African American.

Percentage African American was significantly correlated with every variable. Percentage African American was negatively correlated with math three advanced (-.631). This means that an increase in the African American population was negatively associated with academic performance. This relationship was of large strength (absolute value greater than .499). Percentage African American was negatively correlated with median income (-.229). This means that an increase in the African American population was negatively associated with median income. This relationship was of low strength (absolute value less than .3). Percentage African American was positively correlated with school funding (.148). This means that an increase in the African American population was positively associated with school funding. This relationship was of low strength (absolute value less than .3). Percentage African American was positively correlated with class size (.180). This means that an increase in the African American population was positively associated with class size. This relationship was of low strength (absolute value less than .3).

• Variables Entered/Removed

A review of the Variables Entered/Removed table reveals that all of the desired variables were entered into the regression model, and that the variables were categorized correctly as either independent or dependent (Table 2).

• Model Summary/ANOVA

The Model Summary table reveals that the model explained 44.3% of the variance in the dependent variable (Adjusted R-Square of .443). The ANOVA table reveals a significance level of .000, meaning the model is significant (significance less than .05) (Table 2, Table 18).

• Coefficients

Refer to Table 2 and Table 19.

Median income (significance of .003) and percentage African American (significance of .000) yielded significant coefficients; school funding (significance of .265) and class size (significance of .975) were not significant (significance of greater than .05).

Median income yielded a positive standardized coefficient of .265. This means that an increase in median income was positively associated with academic performance. This relationship was of low strength (absolute value less than .3).

Percentage African American yielded a negative standardized coefficient of -.557. This means that an increase in the African American population was negatively associated with academic performance. This relationship was of large strength (absolute value greater than .499).

• Multicollinearity

The Coefficients table yielded Tolerance levels and Variance Inflation Factors (VIF) well within the range of assurance that multicollinearity was not an issue. A Tolerance level of less than .1 or a VIF of more than 10 would indicate problems with multicollinearity. This was not an issue in this model (Table 2, Table 19).

5.5 Model Five: English Proficiency – Grade Eight

Model Five tests the relationship between the independent variables median income, per-pupil spending, student-to-teacher ratio, and percentage African American within a school district, and the dependent variable percentage of students proficient on the grade eight English SOL Test. This model yielded a significance of .062, exceeding the significance threshold of .05, deeming the results from Model Five unreliable (Table 3, Table 21).

5.6 Model Six: English Advanced – Grade Eight

Model Six (Table 3) tests the relationship between the independent variables median income, per-pupil spending, student-to-teacher ratio, and percentage African American within a school district, and the dependent variable percentage of students advanced on the grade eight English SOL Test. The purpose of this model is to determine the effect that an increase in the level of an independent variable will have on the level of the dependent variable.

• <u>Descriptive Statistics</u>

A review of the Descriptive Statistics table reveals that all 128 districts were included in the analysis (Table 3).

• <u>Correlations</u>

A review of the Correlations table (Table 23) reveals the direction, strength, and significance of the relationships between the different variables. I will review the significant relationships (significance less than .05).

Median income was correlated significantly with every variable. Median income positively correlated with English eight advanced (.330). This means that an increase in income was positively associated with academic performance. This relationship was of medium strength (absolute value greater than .299). Median income positively correlated with school funding (.185). This means that an increase in income was positively associated with school funding. This relationship was of low strength (absolute value less than .3). Median income positively correlated with class size (.182). This means that an increase in income was positively associated with class size. This relationship was of low strength (absolute value less than .3).

School funding was significantly correlated with median income, class size, and percentage African American. School funding negatively correlated with class size (-.400). This means that an increase in school funding was negatively associated with class size. This relationship was of medium strength (absolute value greater than .299).

Class size significantly correlated with median income, school funding, and percentage African American.

Percentage African American significantly correlated with every variable. Percentage African American negatively correlated with English eight advanced (-.421). This means that an increase in the African American community was negatively associated with academic performance. This relationship was of medium strength (absolute value greater than .299). Percentage African American negatively correlated with median income (-.229). This means that an increase in the African American population was negatively associated with median income. This relationship is of low strength (absolute value less than .3). Percentage African American positively correlated with school funding (.148). This means that an increase in the African American community was positively associated with school funding. This relationship was of low strength (absolute value less than .3). Percentage African American negatively correlated with class size (-.168). This means that an increase in the African American community was negatively associated with class size. This relationship was of low strength (absolute value less than .3).

• Variables Entered/Removed

A review of the Variables Entered/Removed table reveals that all of the desired variables were entered into the regression model, and that the variables were categorized correctly as either independent or dependent (Table 3).

• Model Summary/ANOVA

The Model Summary table reveals that the model explained 21.3% of the variance in the dependent variable (Adjusted R-Square of .213). The ANOVA table reveals a significance level of .000, meaning the model is significant (significance less than .05) (Table 3, Table 24).

• Coefficients

Refer to Table 3 and Table 25.

Median income (significance of .010) and percentage African American (significance of .000) yielded significant coefficients; school funding (significance of .552) and class size (significance of .588) were not significant (significance greater than .05).

Median income yielded a positive standardized coefficient of .227. This means that an increase in income was positively associated with academic performance. This relationship was of low strength (absolute value less than .3).

Percentage African American yielded a negative standardized coefficient of -.369. This means that an increase in the African American community was negatively associated with academic performance. This relationship was of medium strength (absolute value greater than .299).

• <u>Multicollinearity</u>

The Coefficients table yielded Tolerance levels and Variance Inflation Factors (VIF) well within the range of assurance that multicollinearity was not an issue. A Tolerance level of less than .1 or a VIF of more than 10 would indicate problems with multicollinearity. This was not an issue in this model (Table 3, Table 25).

5.7 Model Seven: Math Proficiency – Grade Eight

Model Seven tests the relationship between the independent variables median income, per-pupil spending, student-to-teacher ratio, and percentage African American within a school district, and the dependent variable percentage of students proficient on the grade eight Math SOL Test. This model yielded a significance of .366, exceeding the significance threshold of .05, deeming the results from Model Seven unreliable (Table 3, Table 27).

5.8 Model Eight: Math Advanced – Grade Eight

Model Eight (Table 3) tests the relationship between the independent variables median income, per-pupil spending, student-to-teacher ratio, and percentage African American within a school district, and the dependent variable percentage of students advanced on the grade eight Math SOL Test. The purpose of this model is to determine the effect that an increase in the level of an independent variable will have on the level of the dependent variable.

• <u>Descriptive Statistics</u>

A review of the Descriptive Statistics table reveals that all 128 districts were included in the analysis (Table 3).

• <u>Correlations</u>

A review of the Correlations table (Table 29) reveals the direction, strength, and significance of the relationships between the different variables. I will review the significant relationships (significance less than .05).

Median income was significantly correlated with every variable. Median income positively correlated with math eight advanced (.268). This means that an increase in income was positively associated with academic performance. This relationship was of low strength (absolute value less than .3). Median income positively correlated with school funding (.185). This means that an increase in income was positively associated with school funding. This relationship was of low strength (absolute value less than .3). Median income positively correlated with class size (.182). This means that an increase in income was positively associated with class size. This relationship was of low strength (absolute value less than .3).

School funding was significantly correlated with median income, class size, and percentage African American. School funding was negatively correlated with class size (-.400). This means that an increase in school funding was negatively associated with class size. This relationship was of medium strength (absolute value greater than .299).

Class size was significantly correlated with median income, school funding, and percentage African American.

Percentage African American significantly correlated with every variable. Percentage African American negatively correlated with math eight advanced (-.325). This means that an increase in the African American population was negatively associated with academic performance. This relationship was of medium strength (absolute value greater than .299). Percentage African American negatively correlated with median income (-.229). This means that an increase in the African American population was negatively associated with median income. This relationship was of low strength (absolute value less than .3). Percentage African American positively correlated with school funding (.148). This means that an increase in the African American community was positively associated with school funding. Percentage African

American was negatively correlated with class size (-.168). This means that an increase in the African American population was negatively associated with class size. This relationship was of low strength (absolute value less than .3).

• Variables Entered/Removed

A review of the Variables Entered/Removed table reveals that all of the desired variables were entered into the regression model, and that the variables were categorized correctly as either independent or dependent (Table 3).

• Model Summary/ANOVA

The Model Summary table reveals that the model explained 12.9% of the variance in the dependent variable (Adjusted R-Square of .129). The ANOVA table reveals a significance level of .000, meaning the model is significant (significance less than .05) (Table 3, Table 30).

• Coefficients

Refer to Table 3 and Table 31.

Median income (significance of .008) and percentage African American (significance of .003) yielded significant coefficients; school funding (significance of .235) and class size (significance of .372) were not significant (significance greater than .05).

Median income yielded a positive standardized coefficient of .243. This means that an increase in income was positively associated with academic performance. This relationship was of low strength (absolute value less than .3).

Percentage African American yielded a negative standardized coefficient of -.266. This means that an increase in the African American community was negatively associated with academic performance. This relationship was of low strength (absolute value less than .3)

• Multicollinearity

The Coefficients table yielded Tolerance levels and Variance Inflation Factors (VIF) well within the range of assurance that multicollinearity was not an issue. A Tolerance level of less than .1 or a VIF of more than 10 would indicate problems with multicollinearity. This was not an issue in this model (Table 3, Table 31).

Part 6: Discussion

6.1 Race and Socioeconomic Status

Race and SES were the only variables to yield significant results in the regression analysis. Both variables proved to have substantial and persistent effects at all levels.

Table 4: Race and SES Correlation and Regression Comparison

	Race Correlation	SES Correlation	Race Regression	SES Regression
Variables				
English 3 Advanced	-0.511	0.301	-0.449	0.211
Math 3 Proficient	0.518	-0.376	0.434	-0.314
Math 3 Advanced	-0.631	0.376	-0.557	0.265
English 8 Advanced	-0.421	0.330	-0.369	0.227
Math 8 Advanced	-0.325	0.268	-0.266	0.243

In the regression models, race yielded a low-strength relationship with the academic performance variable math 8 advanced (-.266). Race yielded medium strength relationships with the academic performance variables English 3 advanced (-.449), math 3 proficient (.434), and English 8 advanced (-.369). Race yielded a large-strength relationship with the academic performance variable math 3 advanced (-.557). With the exception of the anomalous math 3 proficient relationship, race had a persistent negative effect on academic performance.

In the regression models, SES yielded low-strength relationships with the academic performance variables English 3 advanced (.211), math 3 advanced (.265), English 8 advanced (.227), and math 8 advanced (.243). SES yielded a medium-strength relationship with the academic performance variable math 3 proficient (-.314). With the exception of the anomalous math 3 proficient relationship, SES had a persistent positive effect on academic performance.

Table 4 highlights the effect that SES had as a control variable relative to race. When we analyze the bivariate relationship between race and academic performance, and then compare those to the relationships in the regression models with SES as a control variable, the effect of race decreases (decrease from -.511 to -.449, from .518 to .434, from -.631 to -.557, from -.421 to -.369, and from -.325 to -.266, respectively). Previous literature suggests that once SES is controlled, there are still residual negative racial effects. This study supports those findings. While the presence of SES as a control variable decreases the influence of race, it does not completely remove its influence.

6.2 "Hobbled at the Gate"

The regression results suggest that minorities and low-SES students are disadvantaged upon entering public schools relative to other students in the competition for advanced scores. The third grade advanced English and math variables both indicated that race and SES have major implications. Race yielded a negative coefficient of -.557 relative to math three advanced, while SES yielded a positive coefficient of .265 relative to math three advanced. Race yielded a negative coefficient of -.449 in relation to English three advanced, while SES yielded a positive coefficient of .211 relative to English three advanced. These results suggest that as early as third grade, students are hampered by obstacles associated with low SES status and discriminatory racial disadvantage.

6.3 Increasing Effect over Time?

Previous literature suggests that the effects of disadvantages associated with lower SES as well as the discriminatory disadvantages associated with occupying a minority status such as African American may increase over time. This study did not support that conclusion. Race had a smaller effect on the eighth grade math advanced dependent variable than the third grade math advanced dependent variable (-.266 and -.557, respectively), while SES remained relatively constant (eighth grade: .243, third grade: .265). Race had a smaller effect on the eighth grade English advanced dependent variable than the third grade English advanced dependent variable (-.369 and -.449, respectively), while SES remained relatively constant (eighth grade: .227, third grade: .211).

The English proficiency models at both third and eighth grade were not significant, and the math proficiency model at the eighth grade level was not significant, resulting in no comparison for those two sets of models.

6.4 School Funding and Class Size

School funding and class size did not yield any significant results when entered into regression models. They also did not yield any significance when tested for bivariate relationships with the academic performance variables in the correlation tables. This suggests that a district-level analysis fails to find any significant connection between the variables.

6.5 Discussion of Hypotheses

6.5.1 Hypothesis 1

SES will be positively correlated with academic performance

This hypothesis was supported in Model Two, Model Four, Model Six, and Model Eight. Model Three. Model One, Model Five, and Model Seven produced nonsignificant results.

6.5.2 Hypothesis 2

School funding will be positively correlated with academic performance

School funding did not produce any significant results.

6.5.3 Hypothesis 3

Class size will be negatively correlated with academic performance

Class size did not produce any significant results.

6.5.4 Hypothesis 4

The effects of race will decrease once SES is controlled

This hypothesis was supported in Model Two, Model Three, Model Four, Model Six, and Model Eight (it should be noted that racial variance remained). Model One, Model Five, and Model Seven produced nonsignificant results.

6.5.5 Hypothesis 5

The effects of the independent variables will be greater in the advanced models compared to the proficient models

Only one of the four proficient models produced significant results; this hypothesis could not be supported or rejected given the lack of results.

6.5.6 Hypothesis 6

The effects of the independent variables will be greater for the eighth grade models relative to the third grade models

The results did not support this hypothesis.

Part 7: Conclusion, Limitations, and Future Research

This study yielded little support for the per-pupil funding/academic performance relationship, as well as the student-to-teacher ratio/academic performance relationship. This study yielded relatively strong support for the SES/academic performance relationship and race/academic performance relationship. The results were consistent with previous literature concerning SES and race, inconsistent with previous experimental research concerning class size, and consistent with some research concerning the lack of influence per-pupil funding has on academic performance (although per-pupil funding research has not returned a strong verdict supporting or rejecting the relationship).

The results of this study suggest that the socioeconomic background of students plays a major role in their chances of succeeding in school. They also suggest that there is much room for improvement in research design. Considerable racial effects remained after SES was controlled, suggesting that there are hidden variables not being considered. Future research should consider using a much more in-depth race variable including many more racial identifications in addition to the African American variable.

Future research should also consider the inherently flawed nature of the student-to-teacher ratio. As noted in this paper, this ratio included all instructors in a given district, despite the fact that a considerable amount of instructors are not responsible for a full-sized class on a daily basis.

Future research should also seek to identify how much funding is actually spent in the classroom, as opposed to capital outlays and administration costs. Previous research suggests that there may be a link between funding and academic performance, but that the link exists when one considers instructional spending.

A hierarchical linear model (HLM) would be an important addition to this study. With HLM analysis, one could research effects at multiple levels: individual; school, district; and even the state level. One considerable limitation of this study was its focus on the district-level. Gaining access to individual-level statistics and including them in a HLM analysis with district-level statistics would yield much stronger and more reliable results.

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Appendices

Appendix A: Data Set

Table 5: Partial County Data Set (Accomack-Floyd)

DIVNAME	EN3PROF	EN3ADV	MA3PROF	MA3ADV	EN8PROF	EN8ADV	MA8PROF	MA8ADV	FUNDING	INCOME	CLASS3	CLASS8	BLACK
Accomack County	53	30	47	47	50	23	43	30	$8,882	$31,256	178	11.9	28.90%
Albemarle County	42	45	31	57	42	44	33	56	$10,113	$55,118	182	9.5	9.60%
Alleghany County	47	41	45	49	54	36	42	33	$8,847	$38,489	184	11.7	5.50%
Amelia County	52	36	35	57	54	23	47	31	$7,680	$45,008	260	8.9	23.30%
Amherst County	41	44	39	48	51	24	42	34	$7,562	$38,881	176	9.8	19.60%
Appomattox County	43	51	35	61	51	15	47	34	$7,367	$38,080	192	10.4	21.60%
Arlington County	45	42	32	60	48	27	38	33	$15,877	$66,626	199	9.2	8.70%
Augusta County	44	41	38	51	51	24	37	37	$7,704	$47,089	184	12	3.90%
Bath County	58	30	50	40	60	20	49	35	$11,675	$38,145	176	9.9	8.10%
Bedford County	47	35	40	50	53	33	43	40	$7,348	$48,518	184	9.9	6.30%
Bland County	53	35	39	47	45	30	45	32	$8,082	$34,001	181	9.9	4.40%
Botetourt County	45	45	35	61	54	28	42	42	$8,290	$53,211	186	8.5	4.30%
Brunswick County	47	23	45	30	57	14	42	25	$9,606	$31,224	149	7.8	56.00%
Buchanan County	42	33	37	53	52	24	30	47	$9,140	$25,549	147	10.5	3.20%
Buckingham County	51	31	43	43	51	17	48	32	$8,356	$31,606	174	9	37.30%
Campbell County	46	36	36	55	50	30	39	43	$7,507	$40,058	178	8.3	15.20%
Caroline County	49	27	43	43	56	17	47	16	$7,680	$44,212	207	11.9	29.20%
Carroll County	48	37	38	53	60	17	51	24	$7,825	$32,812	124	11.3	0.70%
Charles City County	41	28	46	22	58	11	40	4	$12,673	$44,387	173	9	46.40%
Charlotte County	47	47	39	54	60	35	44	37	$7,706	$30,688	191	12.5	31.00%
Chesterfield County	44	42	35	57	58	23	42	38	$7,274	$63,931	226	13	21.10%
Clarke County	40	45	24	67	51	28	39	41	$8,143	$56,839	164	12.8	6.20%
Craig County	45	43	53	41	68	5	30	22	$7,752	$39,826	191	12.3	0.60%
Culpeper County	42	41	32	57	51	25	38	43	$7,974	$52,707	209	10.7	15.80%
Cumberland County	38	29	43	40	61	20	49	26	$9,041	$34,492	183	9.2	34.10%
Dickenson County	49	35	40	48	51	27	27	53	$8,658	$26,480	147	10.3	0.60%
Dinwiddie County	45	40	37	58	52	21	39	38	$8,009	$44,269	168	10	32.00%
Essex County	40	23	46	38	52	22	44	17	$8,557	$38,770	163	13.6	38.50%
Fairfax County	46	40	31	60	46	38	30	53	$10,919	$83,880	283	11.3	9.60%
Fauquier County	37	48	39	52	48	30	43	26	$9,128	$70,652	213	9.5	8.80%
Floyd County	46	41	28	64	60	19	56	31	$8,030	$36,400	168	13	1.90%

Table 5: Partial County Data Set (Fluvanna-Northampton)

DIVNAME	EN3PROF	EN3ADV	MA3PROF	MA3ADV	EN8PROF	EN8ADV	MA8PROF	MA8ADV	FUNDING	INCOME	CLASS3
Fluvanna County	43	34	42	39	49	28	51	14	$7,898	$53,082	19.2
Franklin County	48	43	35	59	50	38	50	34	$7,899	$40,758	18.1
Frederick County	44	40	41	48	58	20	49	27	$8,957	$55,084	18.9
Giles County	45	44	39	52	55	21	48	19	$7,840	$37,241	17.8
Gloucester County	45	40	38	53	50	37	40	41	$8,218	$48,780	19.3
Goochland County	44	48	34	63	57	31	48	42	$8,951	$84,389	15.9
Grayson County	48	35	41	47	41	20	58	18	$8,140	$30,280	18.6
Greene County	48	32	38	51	48	23	41	19	$8,738	$51,221	17.5
Greenesville County	53	21	47	35	53	18	51	4	$9,980	$30,878	22.9
Halifax County	40	34	43	41	52	24	48	29	$9,152	$31,030	17.3
Hanover County	38	49	34	59	52	33	41	48	$7,431	$87,979	20.7
Henrico County	41	44	37	54	50	31	38	39	$7,890	$53,009	22.8
Henry County	47	34	45	48	51	22	48	23	$7,790	$32,044	21.6
Highland County	58	17	29	47	84	20	72	18	$11,307	$32,852	13.2
Isle Of Wight County	48	39	41	52	55	27	54	30	$8,295	$51,424	20.1
King And Queen County	40	31	42	47	42	20	38	23	$11,979	$37,738	12.7
King George County	44	38	38	47	49	27	38	27	$7,142	$81,088	18.8
King William County	51	27	38	48	43	28	27	38	$8,855	$55,004	21.4
Lancaster County	38	34	41	48	55	29	40	40	$9,117	$38,484	17.3
Lee County	49	42	41	58	53	28	38	48	$9,307	$28,108	13.6
Loudoun County	38	49	31	61	51	32	37	48	$11,142	$94,225	22.5
Louisa County	48	31	38	52	51	23	45	39	$8,348	$44,728	20.9
Lunenburg County	44	30	39	37	51	25	32	43	$8,524	$29,724	19.6
Madison County	38	48	43	48	41	31	38	33	$8,538	$42,948	18.3
Mathews County	58	23	39	48	40	50	48	29	$8,345	$48,088	16.4
Mecklenburg County	48	42	41	54	58	23	40	37	$7,780	$31,789	18.6
Middlesex County	49	33	51	34	65	20	70	11	$8,384	$40,807	19.5
Montgomery County	38	47	38	50	48	33	38	14	$8,180	$35,319	17.1
Nelson County	50	38	39	52	54	21	58	28	$9,453	$40,000	16.8
New Kent County	49	39	50	41	54	27	49	31	$7,780	$81,001	22.2
Northampton County	45	28	42	43	47	38	45	35	$10,298	$31,847	19.7

Table 6: Partial County Data Set (Northumberland-York)

DIVNAME	EN3PROF	EN3ADV	MA3PROF	MA3ADV	EN8PROF	EN8ADV	MA8PROF	MA8ADV	FUNDING	INCOME	CLASS3
Northumberland County	48	35	40	57	51	28	42	30	$8,831	$40,139	22.5
Nottoway County	40	51	43	52	44	43	51	32	$8,513	$32,179	16.9
Orange County	45	28	43	39	50	32	51	22	$7,951	$49,082	20.6
Page County	47	38	40	51	50	21	48	27	$7,468	$35,720	17.2
Patrick County	50	34	44	45	58	24	51	27	$7,889	$30,805	14.6
Pittsylvania County	48	38	38	52	62	15	48	24	$7,170	$37,328	20.4
Powhatan County	45	42	39	51	57	29	44	39	$8,248	$60,884	20.3
Prince Edward County	43	43	43	41	45	21	37	20	$8,524	$30,719	20.3
Prince George County	48	40	40	50	52	23	57	23	$7,529	$50,849	19.5
Prince William County	49	35	35	58	50	30	38	43	$8,872	$75,302	20.4
Pulaski County	45	35	43	45	48	24	49	23	$7,583	$38,409	15.9
Rappahannock County	41	35	33	51	37	47	49	18	$10,078	$53,062	14.3
Richmond County	52	21	53	27	48	32	40	54	$8,514	$34,347	16.4
Roanoke County	45	43	37	54	59	27	32	60	$8,008	$52,577	17.5
Rockbridge County	45	32	38	48	50	24	43	24	$8,755	$40,081	15.9
Rockingham County	41	47	37	57	48	38	33	49	$8,003	$45,238	17.9
Russell County	38	47	30	67	54	23	37	31	$7,670	$29,845	14.2
Scott County	39	53	27	69	57	27	58	27	$7,928	$31,450	13.7
Shenandoah County	48	41	31	60	59	20	48	35	$8,672	$43,893	23.4
Smyth County	47	33	41	48	53	24	42	30	$7,840	$32,659	15.2
Southampton County	48	33	44	45	59	15	50	9	$8,593	$38,487	16.3
Spotsylvania County	43	38	41	44	51	30	47	28	$7,797	$67,722	22.4
Stafford County	42	38	38	52	62	22	42	41	$8,127	$78,498	21.6
Surry County	60	32	60	28	51	23	41	28	$11,899	$39,489	16.8
Sussex County	47	11	53	18	37	14	41	23	$11,821	$30,721	15.5
Tazewell County	45	38	41	49	50	23	45	18	$7,571	$30,578	19.3
Warren County	47	38	38	52	55	22	58	24	$7,388	$49,193	21.8
Washington County	39	45	40	49	48	28	47	27	$7,758	$38,725	20.4
Westmoreland County	52	31	45	39	42	11	27	3	$7,890	$37,888	20.8
Wise County	43	48	38	57	50	18	42	38	$8,118	$30,203	17.6
Wythe County	38	43	44	45	50	30	39	32	$8,012	$35,121	15.5
York County	38	54	32	63	52	33	39	45	$8,145	$68,310	21.6

Table 7: Complete City Data Set

DIVNAME	EN3PROF	EN3ADV	MA3PROF	MA3ADV	EN8PROF	EN8ADV	MA8PROF	MA8ADV	FUNDING	INCOME	CLASS3
Alexandria City	43	38	39	48	46	23	35	25	10,085	$80,715	17.8
Bristol City	40	39	38	45	46	27	45	30	8,828	$29,818	18.9
Buena Vista City	54	34	54	37	50	31	44	32	8,175	$34,982	18.2
Charlottesville City	34	41	39	45	39	21	31	24	12,846	$31,246	13.9
Colonial Heights City	49	42	38	52	57	11	44	30	9,385	$48,184	18.9
Covington City	31	49	32	53	60	29	51	28	11,688	$32,822	14.3
Danville City	52	31	51	35	52	22	34	25	8,398	$27,904	15.3
Falls Church City	40	52	23	75	38	49	42	48	15,909	$82,908	17.3
Franklin City	46	23	42	29	38	11	45	18	9,928	$33,291	17.4
Fredericksburg City	31	33	41	38	47	25	27	4	11,248	$37,408	17.4
Galax City	37	47	33	64	51	28	41	20	7,511	$30,138	17
Hampton City	48	29	46	39	62	14	48	28	8,501	$40,938	19.8
Harrisonburg City	49	31	38	47	53	22	34	46	9,874	$31,585	18.1
Hopewell City	50	32	54	34	58	17	41	44	8,865	$34,422	17.7
Lexington City	28	64	32	66	35	51	43	43	8,438	$33,190	14.5
Lynchburg City	48	39	39	52	44	32	44	28	8,824	$32,997	20.2
Manassas City	51	32	44	47	43	25	35	13	10,759	$62,753	22.2
Manassas Park City	53	38	41	51	50	28	48	24	10,458	$64,753	19.9
Martinsville City	53	23	45	35	55	18	33	28	8,939	$28,270	17.7
Newport News City	46	38	49	38	53	18	38	30	8,885	$39,574	18.7
Norfolk City	49	28	49	38	55	20	44	28	8,543	$33,777	20
Norton City	47	40	51	40	48	18	38	37	9,452	$28,144	17.1
Petersburg City	42	22	46	28	33	8	35	18	9,084	$29,419	18.7
Poquoson City	42	47	38	61	51	38	51	34	7,458	$70,478	20.4
Portsmouth City	44	34	49	38	48	12	38	14	8,472	$35,782	20.8
Radford City	43	38	39	50	42	45	47	39	7,927	$27,585	15.1
Richmond City	47	31	45	40	46	13	42	20	10,995	$32,547	17.4
Roanoke City	45	31	41	44	52	20	41	21	9,184	$32,807	17.8
Salem City	45	46	35	62	55	38	48	42	8,888	$41,517	17.1
Staunton City	48	32	39	58	52	28	48	37	9,254	$35,417	17.2
Suffolk City	47	30	52	32	57	15	51	19	8,125	$49,038	19.1
Virginia Beach City	47	42	37	54	53	29	48	35	8,741	$51,843	18.5
Waynesboro City	47	38	39	50	41	25	40	37	8,418	$35,455	17
Winchester City	48	34	42	48	45	28	37	20	10,541	$39,142	19.2

Appendix B: Models

Table 8: Model One Bivariate Correlations

Correlations

		English3 Proficient	Median Income	School Funding	ClassSize3	Percentage African American
Pearson Correlation	English3Proficient	1.000	-.122	-.039	.049	.147
	MedianIncome	-.122	1.000	.185	.477	-.229
	SchoolFunding	-.039	.185	1.000	-.157	.148
	ClassSize3	.049	.477	-.157	1.000	.180
	PercentageAfrican American	.147	-.229	.148	.180	1.000
Sig. (1-tailed)	English3Proficient	.	.084	.332	.290	.048
	MedianIncome	.084	.	.018	.000	.005
	SchoolFunding	.332	.018	.	.039	.048
	ClassSize3	.290	.000	.039	.	.021
	PercentageAfrican American	.048	.005	.048	.021	.
N	English3Proficient	128	128	128	128	128
	MedianIncome	128	128	128	128	128
	SchoolFunding	128	128	128	128	128
	ClassSize3	128	128	128	128	128
	PercentageAfrican American	128	128	128	128	128

Table 9: Model One Analysis of Variance

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	137.753	4	34.438	1.200	.314[a]
	Residual	3528.966	123	28.691		
	Total	3666.719	127			

a. Predictors: (Constant), PercentageAfricanAmerican, SchoolFunding, ClassSize3, MedianIncome

b. Dependent Variable: English3Proficient

Table 10: Model One Regression Coefficients

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	43.752	4.737		9.236	.000		
	MedianIncome	.000	.000	-.146	-1.236	.219	.563	1.775
	SchoolFunding	.000	.000	-.011	-.106	.916	.793	1.261
	ClassSize3	.198	.229	.100	.863	.390	.585	1.708
	PercentageAfrican American	.032	.033	.098	.955	.341	.750	1.334

a. Dependent Variable: English3Proficient

Table 11: Model Two Bivariate Correlations

Correlations

		English3 Advanced	Median Income	School Funding	ClassSize3	Percentage African American
Pearson Correlation	English3Advanced	1.000	.301	-.149	.058	-.511
	MedianIncome	.301	1.000	.185	.477	-.229
	SchoolFunding	-.149	.185	1.000	-.157	.148
	ClassSize3	.058	.477	-.157	1.000	.180
	PercentageAfrican American	-.511	-.229	.148	.180	1.000
Sig. (1-tailed)	English3Advanced	.	.000	.046	.256	.000
	MedianIncome	.000	.	.018	.000	.005
	SchoolFunding	.046	.018	.	.039	.048
	ClassSize3	.256	.000	.039	.	.021
	PercentageAfrican American	.000	.005	.048	.021	.
N	English3Advanced	128	128	128	128	128
	MedianIncome	128	128	128	128	128
	SchoolFunding	128	128	128	128	128
	ClassSize3	128	128	128	128	128
	PercentageAfrican American	128	128	128	128	128

Table 12: Model Two Analysis of Variance

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2698.084	4	674.521	13.942	.000[a]
	Residual	5950.791	123	48.380		
	Total	8648.875	127			

a. Predictors: (Constant), PercentageAfricanAmerican, SchoolFunding, ClassSize3, MedianIncome

b. Dependent Variable: English3Advanced

Table 13: Model Two Regression Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	40.232	6.151		6.541	.000		
	MedianIncome	.000	.000	.211	2.119	.036	.563	1.775
	SchoolFunding	-.001	.000	-.119	-1.419	.159	.793	1.261
	ClassSize3	.060	.298	.020	.202	.840	.585	1.708
	PercentageAfrican American	-.224	.043	-.449	-5.195	.000	.750	1.334

a. Dependent Variable: English3Advanced

Table 14: Model Three Bivariate Correlations

Correlations

		Math3 Proficient	Median Income	School Funding	ClassSize3	Percentage African American
Pearson Correlation	Math3Proficient	1.000	-.376	-.028	.017	.518
	MedianIncome	-.376	1.000	.185	.477	-.229
	SchoolFunding	-.028	.185	1.000	-.157	.148
	ClassSize3	.017	.477	-.157	1.000	.180
	PercentageAfrican American	.518	-.229	.148	.180	1.000
Sig. (1-tailed)	Math3Proficient	.	.000	.377	.424	.000
	MedianIncome	.000	.	.018	.000	.005
	SchoolFunding	.377	.018	.	.039	.048
	ClassSize3	.424	.000	.039	.	.021
	PercentageAfrican American	.000	.005	.048	.021	.
N	Math3Proficient	128	128	128	128	128
	MedianIncome	128	128	128	128	128
	SchoolFunding	128	128	128	128	128
	ClassSize3	128	128	128	128	128
	PercentageAfrican American	128	128	128	128	128

Table 15: Model Three Analysis of Variance

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1761.374	4	440.344	16.176	.000[a]
	Residual	3348.305	123	27.222		
	Total	5109.680	127			

a. Predictors: (Constant), PercentageAfricanAmerican, SchoolFunding, ClassSize3, MedianIncome

b. Dependent Variable: Math3Proficient

Table 16: Model Three Regression Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	40.171	4.614		8.706	.000		
	MedianIncome	.000	.000	-.314	-3.226	.002	.563	1.775
	SchoolFunding	.000	.000	-.021	-.251	.802	.793	1.261
	ClassSize3	.200	.223	.085	.896	.372	.585	1.708
	PercentageAfrican American	.167	.032	.434	5.146	.000	.750	1.334

a. Dependent Variable: Math3Proficient

Table 17: Model Four Bivariate Correlations

Correlations

		Math3 Advanced	Median Income	School Funding	ClassSize3	Percentage African American
Pearson Correlation	Math3Advanced	1.000	.376	-.116	.037	-.631
	MedianIncome	.376	1.000	.185	.477	-.229
	SchoolFunding	-.116	.185	1.000	-.157	.148
	ClassSize3	.037	.477	-.157	1.000	.180
	PercentageAfrican American	-.631	-.229	.148	.180	1.000
Sig. (1-tailed)	Math3Advanced	.	.000	.096	.341	.000
	MedianIncome	.000	.	.018	.000	.005
	SchoolFunding	.096	.018	.	.039	.048
	ClassSize3	.341	.000	.039	.	.021
	PercentageAfrican American	.000	.005	.048	.021	.
N	Math3Advanced	128	128	128	128	128
	MedianIncome	128	128	128	128	128
	SchoolFunding	128	128	128	128	128
	ClassSize3	128	128	128	128	128
	PercentageAfrican American	128	128	128	128	128

Table 18: Model Four Analysis of Variance

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5919.520	4	1479.880	26.294	.000[a]
	Residual	6922.722	123	56.282		
	Total	12842.242	127			

a. Predictors: (Constant), PercentageAfricanAmerican, SchoolFunding, ClassSize3, MedianIncome

b. Dependent Variable: Math3Advanced

Table 19: Model Four Regression Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	51.330	6.634		7.737	.000		
	MedianIncome	.000	.000	.265	3.009	.003	.563	1.775
	SchoolFunding	-.001	.000	-.083	-1.120	.265	.793	1.261
	ClassSize3	-.010	.321	-.003	-.032	.975	.585	1.708
	PercentageAfrican American	-.339	.047	-.557	-7.288	.000	.750	1.334

a. Dependent Variable: Math3Advanced

Table 20: Model Five Bivariate Correlations

Correlations

		English8 Proficient	Median Income	School Funding	ClassSize8	Percentage African American
Pearson Correlation	English8Proficient	1.000	-.007	-.255	.077	-.084
	MedianIncome	-.007	1.000	.185	.182	-.229
	SchoolFunding	-.255	.185	1.000	-.400	.148
	ClassSize8	.077	.182	-.400	1.000	-.168
	PercentageAfrican American	-.084	-.229	.148	-.168	1.000
Sig. (1-tailed)	English8Proficient	.	.470	.002	.194	.172
	MedianIncome	.470	.	.018	.020	.005
	SchoolFunding	.002	.018	.	.000	.048
	ClassSize8	.194	.020	.000	.	.029
	PercentageAfrican American	.172	.005	.048	.029	.
N	English8Proficient	128	128	128	128	128
	MedianIncome	128	128	128	128	128
	SchoolFunding	128	128	128	128	128
	ClassSize8	128	128	128	128	128
	PercentageAfrican American	128	128	128	128	128

Table 21: Model Five Analysis of Variance

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	367.048	4	91.762	2.310	.062[a]
	Residual	4886.170	123	39.725		
	Total	5253.219	127			

a. Predictors: (Constant), PercentageAfricanAmerican, SchoolFunding, MedianIncome, ClassSize8

b. Dependent Variable: English8Proficient

Table 22: Model Five Regression Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	61.933	6.009		10.306	.000		
	MedianIncome	.000	.000	.044	.460	.646	.836	1.197
	SchoolFunding	-.001	.000	-.276	-2.754	.007	.752	1.330
	ClassSize8	-.174	.356	-.049	-.490	.625	.770	1.299
	PercentageAfrican American	-.016	.036	-.042	-.457	.649	.908	1.101

a. Dependent Variable: English8Proficient

Table 23: Model Six Bivariate Correlations

Correlations

		English8 Advanced	Median Income	School Funding	ClassSize8	Percentage African American
Pearson Correlation	English8Advanced	1.000	.330	.022	.130	-.421
	MedianIncome	.330	1.000	.185	.182	-.229
	SchoolFunding	.022	.185	1.000	-.400	.148
	ClassSize8	.130	.182	-.400	1.000	-.168
	PercentageAfrican American	-.421	-.229	.148	-.168	1.000
Sig. (1-tailed)	English8Advanced	.	.000	.402	.071	.000
	MedianIncome	.000	.	.018	.020	.005
	SchoolFunding	.402	.018	.	.000	.048
	ClassSize8	.071	.020	.000	.	.029
	PercentageAfrican American	.000	.005	.048	.029	.
N	English8Advanced	128	128	128	128	128
	MedianIncome	128	128	128	128	128
	SchoolFunding	128	128	128	128	128
	ClassSize8	128	128	128	128	128
	PercentageAfrican American	128	128	128	128	128

Table 24: Model Six Analysis Of Variance

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2214.898	4	553.725	9.587	.000[a]
	Residual	7104.071	123	57.757		
	Total	9318.969	127			

a. Predictors: (Constant), PercentageAfricanAmerican, SchoolFunding, MedianIncome, ClassSize8

b. Dependent Variable: English8Advanced

Table 25: Model Six Regression Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	17.817	7.246		2.459	.015		
	MedianIncome	.000	.000	.227	2.631	.010	.836	1.197
	SchoolFunding	.000	.000	.054	.597	.552	.752	1.330
	ClassSize8	.233	.429	.049	.543	.588	.770	1.299
	PercentageAfrican American	-.191	.043	-.369	-4.466	.000	.908	1.101

a. Dependent Variable: English8Advanced

Table 26: Model Seven Bivariate Correlations

Correlations

		Math8 Proficient	Median Income	School Funding	ClassSize8	Percentage African American
Pearson Correlation	Math8Proficient	1.000	-.075	-.168	.039	-.071
	MedianIncome	-.075	1.000	.185	.182	-.229
	SchoolFunding	-.168	.185	1.000	-.400	.148
	ClassSize8	.039	.182	-.400	1.000	-.168
	PercentageAfrican American	-.071	-.229	.148	-.168	1.000
Sig. (1-tailed)	Math8Proficient	.	.200	.029	.331	.214
	MedianIncome	.200	.	.018	.020	.005
	SchoolFunding	.029	.018	.	.000	.048
	ClassSize8	.331	.020	.000	.	.029
	PercentageAfrican American	.214	.005	.048	.029	.
N	Math8Proficient	128	128	128	128	128
	MedianIncome	128	128	128	128	128
	SchoolFunding	128	128	128	128	128
	ClassSize8	128	128	128	128	128
	PercentageAfrican American	128	128	128	128	128

Table 27: Model Seven Analysis of Variance

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	251.012	4	62.753	1.088	.366[a]
	Residual	7095.918	123	57.690		
	Total	7346.930	127			

a. Predictors: (Constant), PercentageAfricanAmerican, SchoolFunding, MedianIncome, ClassSize8

b. Dependent Variable: Math8Proficient

Table 28: Model Seven Regression Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	52.518	7.242		7.252	.000		
	MedianIncome	.000	.000	-.056	-.578	.564	.836	1.197
	SchoolFunding	-.001	.000	-.157	-1.541	.126	.752	1.330
	ClassSize8	-.104	.429	-.025	-.243	.808	.770	1.299
	PercentageAfrican American	-.030	.043	-.064	-.692	.491	.908	1.101

a. Dependent Variable: Math8Proficient

Table 29: Model Eight Bivariate Correlations

Correlations

		Math8 Advanced	Median Income	School Funding	ClassSize8	Percentage African American
Pearson Correlation	Math8Advanced	1.000	.268	-.075	.050	-.325
	MedianIncome	.268	1.000	.185	.182	-.229
	SchoolFunding	-.075	.185	1.000	-.400	.148
	ClassSize8	.050	.182	-.400	1.000	-.168
	PercentageAfrican American	-.325	-.229	.148	-.168	1.000
Sig. (1-tailed)	Math8Advanced	.	.001	.202	.287	.000
	MedianIncome	.001	.	.018	.020	.005
	SchoolFunding	.202	.018	.	.000	.048
	ClassSize8	.287	.020	.000	.	.029
	PercentageAfrican American	.000	.005	.048	.029	.
N	Math8Advanced	128	128	128	128	128
	MedianIncome	128	128	128	128	128
	SchoolFunding	128	128	128	128	128
	ClassSize8	128	128	128	128	128
	PercentageAfrican American	128	128	128	128	128

Table 30: Model Eight Analysis of Variance

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2553.383	4	638.346	5.685	.000[a]
	Residual	13812.047	123	112.293		
	Total	16365.430	127			

a. Predictors: (Constant), PercentageAfricanAmerican, SchoolFunding, MedianIncome, ClassSize8

b. Dependent Variable: Math8Advanced

Table 31: Model Eight Regression Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	38.166	10.104		3.777	.000		
	MedianIncome	.000	.000	.243	2.685	.008	.836	1.197
	SchoolFunding	-.001	.001	-.114	-1.194	.235	.752	1.330
	ClassSize8	-.536	.599	-.085	-.895	.372	.770	1.299
	PercentageAfrican American	-.183	.060	-.266	-3.065	.003	.908	1.101

a. Dependent Variable: Math8Advanced

Table 32: Model Information (Models 1-4)

	M1	*M2*	*M3*	*M4*
Variables				
Median Income Standardized Coefficient (VIF, Tolerance)	-0.146 (1.775, .563)	0.211 * (1.775, .563)	-0.314 ** (1.775, .563)	0.265 ** (1.775, .563)
Per-Pupil Spending Standardized Coefficient (VIF, Tolerance)	-0.011 (1.261, .793)	-0.119 (1.261, .783)	-0.021 (1.261, .793)	-0.083 (1.261, .793)
Student-to-Teacher Ratio Standardized Coefficient (VIF, Tolerance)	0.100 (1.708, .585)	0.020 (1.708, .585)	0.085 (1.708, .585)	-0.003 (1.708, .585)
Percentage African American Standardized Coefficient (VIF, Tolerance)	0.098 (1.334, .750)	-0.449 *** (1.334, .750)	0.434 *** (1.334, .750)	-0.557 *** (1.334, .750)
Model Details				
All Variables Entered	Yes	Yes	Yes	Yes
N = 128	Yes	Yes	Yes	Yes
Adjusted R^2	0.006	0.290	0.323	0.443
Standard Error	5.356	6.296	5.217	7.502
Model Significance Level	0.314	0.000	0.000	0.000
Multicollinearity Problems	No	No	No	No

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

Abbreviations as follows: English Proficiency - Grade Three (*M1*); English Advanced - Grade Three (*M2*); Math Proficiency - Grade Three (*M3*); Math Advanced - Grade Three (*M4*).

Table 33: Model Information (Models 5-8)

	M5	*M6*	*M7*	*M8*
Variables				
Median Income Standardized Coefficient (VIF, Tolerance)	0.044 (1.197, .836)	0.227 * (1.197, .836)	-0.056 (1.197, .836)	0.243 ** (1.197, .836)
Per-Pupil Spending Standardized Coefficient (VIF, Tolerance)	-0.276 ** (1.330, .752)	0.054 (1.330, .752)	-0.157 (1.330, .752)	-0.114 (1.330, .752)
Student-to-Teacher Ratio Standardized Coefficient (VIF, Tolerance)	-0.049 (1.299, .770)	0.049 (1.299, .770)	-0.025 (1.299, .770)	-0.085 (1.299, .770)
Percentage African American Standardized Coefficient (VIF, Tolerance)	-0.042 (1.101, .908)	-0.369 *** (1.101, .908)	-0.064 (1.101, .908)	-0.266 ** (1.101, .908)
Model Details				
All Variables Entered	Yes	Yes	Yes	Yes
N = 128	Yes	Yes	Yes	Yes
Adjusted R^2	0.040	0.213	0.003	0.129
Standard Error	6.303	7.600	7.595	10.597
Model Significance Level	0.062	0.000	0.366	0.000
Multicollinearity Problems	No	No	No	No

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

Abbreviations as follows: English Proficiency - Grade Eight (*M5*); English Advanced - Grade Eight (*M6*); Math Proficiency - Grade Eight (*M7*); Math Advanced - Grade Eight (*M8*).

Table 34: Additional Information for Models 1-4

	Model 1	Model 2	Model 3	Model 4
Descriptive Statistics				
Mean - Dependent Variable	45.20	37.09	40.10	48.38
Mean - Median Income	$42,995.00	$42,995.00	$42,995.00	$42,995.00
Mean - School Funding	$8,899.46	$8,899.46	$8,899.46	$8,899.46
Mean - Class Size	18.086	18.086	18.086	18.086
Mean - % African American	19.09%	19.09%	19.09%	19.09%
Std. Deviation - Dependent Variable	5.3730	8.2520	6.3430	10.0560
Std. Deviation - Income	$13,892.108	$13,892.108	$13,892.108	$13,892.108
Std. Deviation - Funding	$1,638.815	$1,638.815	$1,638.815	$1,638.815
Std. Deviation - Class Size	2.7109	2.7109	2.7109	2.7109
Std. Deviation - % African American	16.512453%	16.512453%	16.512453%	16.512453%
All Districts Included? (N =128)	Yes	Yes	Yes	Yes
Variables Entered/Removed				
All Variables Entered?	Yes	Yes	Yes	Yes
Variables Correctly Categorized?	Yes	Yes	Yes	Yes
Model Summary				
R	0.194	0.559	0.587	0.679
R-Square	0.038	0.312	0.345	0.461
Adjusted R-Square	0.006	0.290	0.323	0.443
Std. Error of Estimate	5.356	6.956	5.217	7.502
ANOVA				
F	1.200	13.942	16.176	26.294
Significance	0.314	0.000	0.000	0.000

Table 35: Additional Information for Models 5-8

	Model 5	Model 6	Model 7	Model 8
Descriptive Statistics				
Mean - Dependent Variable	50.92	25.27	42.98	30.27
Mean - Median Income	$42,995.00	$42,995.00	$42,995.00	$42,995.00
Mean - School Funding	$8,899.46	$8,899.46	$8,899.46	$8,899.46
Mean - Class Size	11.041	11.041	11.041	11.041
Mean - % African American	19.09%	19.09%	19.09%	19.09%
Std. Deviation - Dependent Variable	6.4310	8.5660	7.6060	11.3520
Std. Deviation - Income	$13,892.108	$13,892.108	$13,892.108	$13,892.108
Std. Deviation - Funding	$1,638.815	$1,638.815	$1,638.815	$1,638.815
Std. Deviation - Class Size	1.7903	1.7903	1.7903	1.7903
Std. Deviation - % African American	16.512453%	16.512453%	16.512453%	16.512453%
All Districts Included? (N =128)	Yes	Yes	Yes	Yes
Variables Entered/Removed				
All Variables Entered?	Yes	Yes	Yes	Yes
Variables Correctly Categorized?	Yes	Yes	Yes	Yes
Model Summary				
R	0.264	0.488	0.185	0.395
R-Square	0.070	0.238	0.034	0.156
Adjusted R-Square	0.040	0.213	0.003	0.129
Std. Error of Estimate	6.303	7.600	7.595	10.597
ANOVA				
F	2.310	9.587	1.088	5.685
Significance	0.062	0.000	0.366	0.000

Appendix C: Institutional Review Board Exempt Approval Letter

VirginiaTech

Office of Research Compliance
Carmen T. Green, IRB Administrator
2000 Kraft Drive, Suite 2000 (0497)
Blacksburg, Virginia 24061
540/231-4358 Fax 540/231-0959
e-mail ctgreen@vt.edu
www.irb.vt.edu
FWA00000572(expires 5/20/2010)
IRB # is IRB00000667

DATE: April 8, 2008

MEMORANDUM

TO: Terry Kershaw
Lawrence Eppard

FROM: Carmen Green

SUBJECT: **IRB Exempt Approval:** "A District-Level Analysis of the Influence of Socioeconomic Status, Per-Pupil Spending, and Student-to-Teacher Ratios on Academic Performance in Virginia Public Schools" , IRB # 08-225

I have reviewed your request to the IRB for exemption for the above referenced project. The research falls within the exempt status. Approval is granted effective as of April 8, 2008.

As an investigator of human subjects, your responsibilities include the following:

1. Report promptly proposed changes in the research protocol. The proposed changes must not be initiated without IRB review and approval, except where necessary to eliminate apparent immediate hazards to the subjects.

2. Report promptly to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

cc: File

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Institutional Review Board - Exempt Approval Letter