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Buying equal student achievement opportunities

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BUYING EQUAL STUDENT ACHIEVEMENT OPPORTUNITIES

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Table of Contents

List of Tables

Abstract

The majority of a school system's budget is spent on personnel. In order to use this tremendous amount of money efficiently it is important educators understand the impact different spending priorities, specifically total per-pupil expenditures, teacher salary, principal salary, pupil/teacher ratio, and pupil/support personnel ratio have on student achievement and how these inputs are moderated by a district's population density and wealth. Spending data from all the school divisions in Virginia were examined using public spending data from the Virginia Department of Education, and population density and wealth statistics from the Office of Budget Management, US Census Bureau, and Commonwealth of Virginia Commission on Local Government. Bivariate correlations and linear regression slopes were examined to determine the impact of the main effects and multiple linear regression model building was used to examine how a district's wealth and population density moderate the effects of per-pupil expenditures, teacher salary, principal salary, pupil/teacher ratio and pupil/support personnel ratio. Teacher salary proved significant for both math and reading scores while principal salary was significant for math scores only. None of the other main effects had a significant impact on student achievement. A division's status as "rural" by itself proved to be correlated with both reading and math scores. Additionally, wealth by itself was a statistically and practically significant predictor of student achievement regardless of the measurement used highlighting the problems posed for education by economic inequality. When wealth was measured using either median household income or fiscal stress the correlation with student achievement was twice that of composite index indicating composite index may not be the best wealth measurement for the state to use to

allocate funding in order to level the playing field. Further research is needed to determine how spending effects overall school climate, how the adverse impact of wealth can be overcome, and if making changes to the wealth measurement used will help to overcome the impact of wealth on student achievement.

Introduction

K-12 education in the United States is very expensive, costing $620 billion per year (National Center for Education Statistics, 2016). This large price tag is for an industry that does not produce any tangible product (unlike manufacturing), and yet without it, other industries would be unable to function as they would lack the necessary skilled workers. While education is very expensive, it is a product most people are willing to purchase to ensure an educated population. Since money is not unlimited, it must be spent smartly. Education, unlike manufacturing, does not consume large quantities of natural resources or energy, it is essentially a service provider and people are by far the largest expense. In fact, 80% of the money spent to educate students is spent on salaries and benefits (National Center for Education Statistics, 2016). Given the large price tag associated with personnel, it is important to understand and strategically plan how to spend money on people in order to maximize the student achievement return on the personnel investment.

The ability to prioritize spending to best meet the needs of your school is an important leadership function. Both the theory of transformational leadership (Bass, 1985; Burns, 1978) and the Interstate School Leader's Licensure Consortium (National Policy Board for Education Administration, 2008) have the development and implementation of a vision as cornerstones. According to Kaplan and Norton (1993), considering the financial perspective is a key component of implementing a vision. In describing how to focus your organization with a Balanced Scorecard, they list as a critical step ensuring budgeting meets strategic goals (p. 36) and eliminating investments that do not contribute to the vision (p. 42). With personnel spending as K-12 education's largest single expense, it is an imperative leadership task to examine it to ensure spending supports the overall vision.

In education people are both the input and the output. Educated people are the product or output, and to create that output, a large number of caring, trained teachers and others are needed to perform the labor intensive task of working with and encouraging students to maximize their potential. The largest expense in almost any school system's budget is people, half of whom are teachers. A good superintendent will pay close attention to personnel as it is the largest, most variable portion of the budget and the one that presents the most opportunities for success (Absheir, Harris & Hopson, 2011, p. 8). People are the one indispensable resource in education and a school division that has the right mix of people can maximize their impact on student achievement within the financial constraints of their budget. As education is a people business, a significant part of improving education should be determining how to smartly spend the limited money to get the optimal mix of people to maximize student success. One way to determine how to do this is to study the relationship between spending and student achievement scores. Specifically, this study examines exactly how and under what conditions increased spending on personnel yields practically significant results as this differs based on the unique situation of each district.

The basic framework asserting that spending inputs relate to educational outputs (achievement) is what is known as an "education production function" (Hanushek, 1986). Hanushek (1986) characterizes these as non-experimental, econometric studies that examine each of the inputs effecting student achievement (p. 1148). By following this basic framework, a researcher can examine relationships between spending decisions or inputs and the outputs we refer to as student achievement. This type of research can help the education practitioner to make staffing decisions to ensure the best mix of employees for maximizing student success.

Making the best staffing decisions requires school divisions to understand the specific role each type of employee plays in attaining the desired student achievement results. For example, the teacher undoubtedly has the most direct impact on student success as it is he or she who directly provides instruction to the students. In order to maximize teacher impact, a school division must decide if it makes more sense to have more teachers in order to reduce class size, or if it makes more sense to offer a higher salary to minimize turn-over, improve morale, and recruit and retain the "best and brightest" teachers. While teachers are undeniably the most important employees with the most potential to improve student achievement, they are not the only ones who play an important role in student achievement. Principals provide the school with leadership while instructional aides and other support personnel perform countless other valuable tasks that make schools run smoothly and ensure most of a teacher's time can be spent on instruction. By having the best possible mix of employees a division should be able to obtain the best possible student achievement.

Teachers make up half of the employees in a typical school division and cost a total of $175 billion annually (National Center for Education Statistics, 2016). Divisions can increase or decrease the amount of money they spend on teacher salaries in two different ways. First, by adjusting the quantity of teachers hired. The more teachers a division employs, the more money they must spend. Adjusting this amount, called "pupil or student/teacher ratio," has obvious instructional implications and most, but not all, studies in this area (Jepson & Rivkin, 2009; Krueger 2003; Glass & Smith 1979; Figlio1998) suggest a positive relationship between student/teacher ratio and student achievement.

Second, a division could adjust the amount of money it spends on teachers by adjusting the amount spent on each teacher's salary and benefits. Spending more money on each teacher could theoretically improve morale and allow a specific division to recruit better teachers. Several studies (James, 2011; Figlio, 1998; Macphail-Wilcox & King, 1986) found increasing salaries has a positive impact on student achievement. However, the possible trade-off is the more divisions spend per teacher, the fewer teachers they can afford to employ. Likewise, if a division spends money on small class sizes (lots of teachers) this means there is less to spend on each teacher which may impact quality. It is currently unknown which option is better due to an absence of studies specifically examining both simultaneously.

In a school building the principal is the undisputed leader. It is the principal who is ultimately responsible for everything that happens in the school. Research on the impact of the principal on student achievement shows principals impact student achievement by selecting teachers, providing a focus or vision, and by direct control of curriculum and instructional practices (Brewer, 1992). Principal salary has been shown to be important for getting people to become principals (Norton, 2003) and in improving academic achievement (Brewer, 1992).

While the principal provides valuable leadership, schools also employ support personnel who work behind the scenes to keep everything going smoothly. Support personnel include custodians, bus drivers, food service workers, receptionists, and secretaries and instructional aides. These are individuals without a Department of Education License, often referred to as "para-professionals," who make the duties of teachers and administrators much easier. These are the individuals who either help the school function smoothly and efficiently or who lighten the burden on teachers, theoretically making their job easier. They typically cost a school system one-half of what a teacher costs and so theoretically could be a cost effective way to get things done. Logic dictates hiring more of these employees should improve your school and this is common thinking as 12% of K-12 staff fall into the instructional aide category (National Center for Education Statistics, 2015). However, very little research has been conducted to support the link between support personnel and student achievement. This lack of research makes it unknown if hiring more instructional aides and other support personnel makes sense.

Understanding the overall link between spending on class size, teacher salary, principal salary and support personnel is important, but to truly understand the relationship between spending inputs and achievement one must consider the possibility the relationship may vary depending on the unique characteristics of a school district. For example, a division's status as rural, suburban, or urban has been shown to impact a district's ability to recruit and retain teachers (Greenlee & Brown, 2009; Guarino, Santibanez & Daley, 2006). So, it is important to examine how a division's population density moderates the effect of spending inputs on student achievement outputs. Likewise, the wealth of a school district impacts recruiting, retention, and the need for sound leadership in school settings (Greenlee & Brown, 2009; Charlotte Advocates for Education, 2004; O'Donnell & White, 2003; Payne 2003, 2009). Understanding how the effects of spending inputs on achievement are moderated by wealth and population density is crucial to making the best decisions for each unique school division.

This study explores the relationship between teacher salary, principal salary, student-teacher ratio, and student/support personnel ratio compared to student achievement as measured by reading and math Standards of Learning test scores (SOLs). Examining all of these main effects simultaneously contributes to answering the overall question of which of these inputs is most important in influencing student achievement? In addition to examining the main effects of each of these categories, this study explores how each of these main effects is moderated by a district's wealth and population density. By better understanding this relationship, education practitioners will be able to make the best possible staffing decisions for their specific districts.

Literature Review

Introduction

In conducting this study, I examine the nature of the relationship between the inputs of average individual teacher salary, pupil/teacher ratio, principal salary, per pupil expenditures, pupil/support personnel ratio, and the outputs of student achievement in reading and math as measured by the Virginia Standards of Learning (SOL) tests. In examining these relationships, I establish which of these inputs has a positive impact student achievement. Then I examine whether or not and how spending inputs impact on student achievement changes based on a division's wealth and population density (rural/suburban/urban) composition. In this literature review I discuss relevant literature on each of these main effects and then on the variables that may serve as moderating effects. The following literature review summarizes prior research on the impact of per pupil expenditures, teacher salary, principal salary, and pupil/teacher ratio on student achievement and will provide a rationale for how these effects may be moderated by a district's wealth and population density.

Main Effects

Spending. Much of the literature on effectiveness of school system spending seeks to evaluate effectiveness on the basis of "education production function." An education production function is a formula where the output of student achievement is related to resources or inputs (Macphail-Wilcox & King, 1986, p. 196). Some inputs are things a school can control, such as teachers, facilities, and curriculum. Other inputs consist of environmental factors such as a student's ability, level of family support, or SES and are difficult to control (Hanushek, 1986, p. 1150). So, the education production function is simply a formula to determine what inputs (resources) can provide the desired outputs (student achievement) (Macphail-Wilcox & King, 1986, p. 196).

The concept of the production function originated in business. However, while in business the customer determines the value of a product, in education the student is both the product and the customer (James, 2015, p. 44). This deprives education of the built-in judge businesses enjoy for product quality. Students lack the product knowledge of consumers and while there are private schools, parents lack the same degree of choice as customers searching for traditional products. In present day education, quality is most often determined by test scores. Test scores are used by teachers to evaluate student success, by principals to determine teacher quality, and by the community to judge their local schools. Consequently, test scores are the most convenient output measure for student achievement as the market forces of business do not apply.

Ideally, and as noted by Hedges, Laine, and Greenwald (1994) a production function could be used to predict how spending will impact student learning as measured by test scores and may allow the researcher to identify the most cost-effective ways of running a school division (p. 5). So, a production function allows education decision makers to have some idea what effect their spending decisions (as they select which inputs are important) will have on the output (student achievement). It is this basic premise that researchers use to equate school factors with student achievement.

For the last fifty years, researchers have attempted to link spending inputs with student achievement to determine what, if any impact spending has. Researchers linking school outcomes with spending began in 1966 when congress commissioned the writing of *Equality of Educational Opportunity*, commonly known as *The Coleman Report* (Coleman, 1966). Coleman (1966), examined the status of America's schools with regards to educational quality, and determined the quality of the school does not make much difference in student achievement (p. 22). Coleman's findings asserted most (70%) of student achievement variation is found within the population of a particular school (p. 296) indicating the majority of student achievement is influenced less by schools than by other factors. In fact, he concluded only 10 to 20% of variation can be attributed to schools leading him to conclude school factors are not particularly important (p. 22). If Coleman's work were accepted, there would be little point in striving to improve our schools. Many researchers have since taken issue with Coleman's (1966) findings and common sense suggests how a school spends should have a positive effect on student achievement.

Although within school variation accounts for the majority of variance in student achievement scores, the 10-20% of variance associated with schools may not be trivial. According to Marzano (2001), even a 10% difference in variance is still meaningful as it will result in a typical student scoring 23% higher at the best school than at the worst school (p. 2). Consequently, Coleman's findings can be interpreted differently, that differences between schools are important and do have a meaningful impact on student's lives.

If we assume school quality matters, it raises the question as to what specific school spending characteristics are most important. The evidence suggests simply spending alone does not have an impact on student achievement but that spending intelligently might. Hanushek (1986) conducted a meta-analysis of 147 spending studies and concluded that spending alone is not directly related to a student's performance (pp. 1159-1167). More recent studies also support Hanushek's findings. For example, a study comparing spending amongst EU countries found some countries spend a lot of money and get student achievement scores lower than those countries spending much less money (Agasisti, 2014). In addition, Schanchter (2010) compared per pupil spending across the country and found that while in New York it costs an average of $17,173 per year to educate a student, Utah is able to educate a student for just $5,765 (p. 40). Utah does this with large class sizes, limited technology, few administrators and few instructional specialists (p. 42). Despite spending considerably less, Utah's schools perform better as measured by their major city graduation rates ranging between 85% and 92% compared with New York's rates of 48% to 56% (p. 51). This indicates good results can perhaps be achieved without spending a lot of money. However, the culture, wealth and demographics of New York versus Utah are substantially different and probably play a role in the need to spend money to get results. Additionally, as each state develops their own curriculum and graduation requirements, comparing New York to Utah is not an even comparison.

In order to determine how well individual U.S. school districts do with efficiency, Boser (2014) conducted a study of 2,397 school districts that controlled for student environmental factors and found only 37% of the districts in the top one-third for spending also overlapped with the top one-third for achievement (p. 25). This would seem to indicate a weak or no link between spending and student achievement and therefore support the idea that spending by itself does not guarantee results, meaning districts must spend intelligently in addition to spending large amounts. While there is a large body of research refuting a link between spending and instruction, not all researchers are in agreement in this area. While Hanushek's (1986) research pointed to the need to spend smartly instead of just more, some researchers disagree with this conclusion on spending. Hedges et al. (1994) re-examined the same data used by Hanushek (1986) but with a different statistical method, magnitude analysis and combined significance testing instead of vote counting, and came to the opposite conclusion finding a positive correlation between resources and student achievement. However, Hanushek (1994) has called these findings into question noting Hedges et al. (1994) eliminated studies that did not find significance and did not note a direction for their insignificant findings. Given the existing evidence, I predict the large, diverse sample of districts across an entire state to yield similar results to those found by Agasisti

(2014), Boser (2014), and Schanchter (2010). Consequently, I do not predict spending to have an impact on student achievement.

H_1: There is no relationship between per-pupil spending and student achievement as measured by reading and math SOL scores.

Teacher salary. If schools are able to impact the student in any way, it is through the work of the teacher as it is the teacher who has by far the most direct contact with the students. The ability of a teacher has been shown to have a consistent impact on student achievement. Students with the most effective teachers have been shown to improve while even talented students with ineffective teachers will struggle to improve (Wright, Horn & Saunders, 1997, p. 63). In fact, Wright et al. (1997) examined 13 factors thought to influence student achievement and found teacher quality to have the largest effect size of any of these factors. Rockoff (2004) also found teacher quality to have a significant, but smaller positive impact on student achievement and found the most experienced teachers often performed the best (p. 247). This indicates high quality teachers do make a difference. If a division is fortunate enough to employ all high quality teachers, they will get better student achievement scores than districts with low quality teachers. Likewise, if a district is only able to employ ineffective teachers, they will post less favorable results.

Just like in a business transaction, the hiring and salaries of teachers can be conceptualized as a supply/demand transaction (Guarino, et al. 2006, p. 174). They explain demand as the number of teaching positions that need to be filled and supply as the number of qualified teachers who will work for the offered compensation.

Consequently, the way to increase a division's supply is to increase the offered compensation until the supply increases and balances with the demand.

Schools compete with one-another to attract and retain the best teachers. Often teachers start their career at whatever school has an opening before moving to a school they truly view as favorable for a myriad of reasons, one of which is salary. Ingersoll (2001) found 47% of teachers who left one school for another cited salary as a reason. This indicates a teacher may start their career wherever they can find a position. As they gain experience, they are no longer willing to work for what they see as an inadequate salary and seek higher wages in another district. Supporting this notion is the finding of Allen (2005) who reviewed 28 studies on teacher salary and found increasing salaries has a positive impact on retention (p. 92).

School divisions that offer the highest salaries can attract teachers from the best colleges and universities. Figlio (2002) built on the link between teacher quality and strength of a teacher's undergraduate institution (Ehrenburg & Brewer, 1994) by using a teacher's undergraduate institution as a proxy for teacher quality and found a statistically significant positive relationship between higher salaries and a district's ability to attract quality teachers (Figlio, 2002, p. 697). This indicates students from the best colleges have the luxury of seeking the school districts with the best salaries as they have more options compared to students from schools with lesser reputations. Lankford, Loeb and Wycoff (2002) in a study using NY State personnel data, found teachers who were more qualified, as determined by the selectivity of their college and their success on the state teaching exams, were more likely to switch schools or school districts than less qualified teachers. This suggests if a district fails to have a sufficiently attractive salary scale, they risk losing their best teachers, who have more options to move to other districts.

Research clearly indicates there is a need to offer competitive salaries in order to compete for teachers with other districts. An extension of this logic is the idea that districts with the best compensation will be able to attract the best teachers and will therefore have the highest test scores. For example, Houck, Rolle and He (2010), studied the efficiency of school districts in Georgia and determined greater productivity to be correlated with higher teacher salaries (p. 352). Additionally, Macphail-Wilcox and King (1986), in a meta-analysis, found salary is correlated with student performance and suggest this is because higher salaries allow districts to attract teachers with higher verbal abilities which have been shown to indicate teacher quality (p. 207). In a more direct link to student achievement, Figlio (1998) found if starting teacher salaries are raised by 10% one can expect a 1.3% increase in 10^{th} grade student achievement scores (p. 247). James (2011) came to a similar conclusion finding the total cost spent on teachers to be the only measurable input to have an impact on student achievement (p. 7). Together, this evidence suggests that divisions that pay better can also attract better teachers, building the case for raising teachers' salaries.

Not all researchers found a positive relationship between teacher salary and achievement. Galchus (1994) found as overall salaries went up, teacher quality went down. He hypothesized this was because administrators, to keep their overall teacher costs low, are selecting cheaper employees at the bottom of the pay scale. For this reason, it is important for a researcher to look at average salary paid by a division rather than just looking at select points on the division's salary scale as was done by Galchus (1994).

The research makes it clear a competitive salary is necessary for a division to recruit and retain the best quality teachers. School divisions compete for the best employees with each other and with the greater job market. School districts who fail to offer a competitive salary will be left behind by better paying districts. Consequently, I propose the following hypothesis:

H_2: There is a positive relationship between teacher salary and student achievement as measured by a school division's reading and math SOL scores.

Principal salary. Principals are ultimately responsible for everything that happens at their school. When a school performs poorly, principals are often replaced. According to the Interstate School Leadership Licensure Consortium, Principals are charged with facilitating a shared vision, ensuring student learning, safe and effective school management, and collaborating with the community (National Policy Board for Education Administration, 2008). Because of these large responsibilities, principals are typically given a larger salary than teachers. There is a large range of principal salaries, and compared to research on teacher salaries, little research has been done to link them with student achievement. However, existing literature does seem to indicate principal quality has an impact on student achievement.

Principals can influence student achievement by creating a school culture focused on tailoring professional development, evaluations, and faculty meetings towards addressing issues relating to student achievement. Additionally, the policies set by principals can influence the practice of teachers and therefore student achievement

(Dhuey & Smith, 2014, p. 638). Evidence that the principal matters can be found by studying the changes that occur when a principal leaves his or her post and is replaced by a new principal. Miller (2011) found principals matter when it comes to student achievement as was evidenced by a downturn in student academic performance when there is a transition between principals (p. 71). This does not directly indicate a difference between the best and worst principals, but does show the principal has an impact on student achievement.

Principals impact student achievement through the method and quality of leadership they provide to schools. Shatzer, Caldarella, Hallam and Brown (2013) conducted a study of principal leadership styles at 37 elementary schools and determined those who display "Instructional" leadership styles have a larger impact on student achievement than those who displayed a transformational style (p. 10). This indicates the principal's leadership traits/style do matter to students and teachers. The impact principals have has also been measured by following the most effective principals as they move from school to school. Dhuey and Smith (2014) examined the relationship between schools and principals in British Columbia. They identified effective and ineffective principals as they transferred from one school to another and observed the impact they had at their new school. They also found principals can influence test scores in both reading and math (p. 661). They found an improvement in principal quality of one standard deviation results in an increase of 0.29 standard deviations in math and 0.41 in reading (p. 661). In addition to impacting test scores, the best principals hire the best teachers through their knowledge of the hiring process and have the greatest impact on discipline and attendance (Rice, 2010). This indicates a principal can have a meaningful impact on student achievement. Experienced principals usually cost more money as salary scales demand more experienced administrators make more money than novice administrators. Consequently, experience matters and a division will likely have to pay for it.

As high salaries are often needed to draw the best administrators, low salaries in a division can prevent teachers from aspiring to become administrators. While administrators usually make more money than teachers, this extra money is often offset by the extra hours they must work minimizing the financial gain (Norton, 2003, p. 52). However, the financial gain is important when a division is seeking quality principals and their salaries can have an impact on student achievement. Brewer (1992) noted principals are especially important because they have power over teacher selection, can provide a school-wide focus, and can exert control over curriculum. Brewer (1992) examined longitudinal data collected from a sample of students at 1,100 different high schools and concluded if one raises a principal's salary compared to that of a teacher by just 5%, it will result in a 20% gain in student achievement scores (p. 288). This would seem to indicate raising principal salary is an effective way to improve student achievement. While less conclusive, Menshah, Schoderbek and Sahay (2013), in a statewide study of administrator salaries across the state of New Jersey, did not find a statistically significant relationship between administrative salaries and student test scores. However, they did find a weak positive relationship when using a dynamic panel estimator with Gaussian Mixture Modeling (p. 15). They describe their results as "ambiguous" and do not base any conclusions on their findings. Given the strong research rationale for a principal's leadership role being important and given all of the empirical studies are either positive or at worst inconclusive, I expect to find a positive relationship between principal salary and student achievement. Consequently, I put forth the following hypotheses:

H_3: Principal salary is significantly related to student achievement as measured by a school division's reading and math SOL scores.

Class size. Class size is one of the largest drivers of the cost of education, and a small increase or decrease can have a large budgetary impact. Koshal and Manjulika (1998) found in higher education that a one student increase in class size nationally would translate into over $1 million in savings at public colleges and over $2 million at private colleges (p. 276). This demonstrates the financial gain that can be achieved by increasing class size. But, what is the gain for student achievement by reducing class size?

Class size is often used to indicate school quality because it is indicative of the amount of personal attention each student receives (Miles, 2011, p. l 45). The thought being, smaller classes lead to more individual attention and therefore better learning. However, the consensus on small class sizes equaling school quality is far from unanimous. In fact, class size was one of the factors Coleman (1966) found did not impact student achievement. Hanushek (1986), in a meta-analysis of studies on class size examined 112 estimates and found only nine showed small classes improved student achievement while fourteen showed a negative effect on student achievement (p. 1161). Krueger (2003) reexamined Hanushek's data and found if Hanushek had given all studies equal weight instead of the individual estimates within the studies there would be an overall positive relationship between smaller classes and student achievement (p. F60). In a meta-analysis of 300 studies, Glass and Smith (1979) found a strong relationship between class size and student achievement regardless of subjects or student ability. They did find the relationship was the strongest at the upper grades, but that it existed at all levels of K-12 education (p. 15). A meta-analysis conducted by Shin and Chung (2009) noted the state of confusion surrounding class size literature and attempted to sort it out by examining 17 recent studies on class size reduction. They concluded small classes perform better than large classes by 0.20 standard deviations (p.15). Similar results were found by Wenglinsky (1997) who analyzed National Assessment of Educational Progress (NAEP) data and found smaller class sizes do have an impact on student achievement (p. 233).

Additionally, large scale studies have consistently shown a positive relationship between class size and student achievement. In the 1990's California instituted a reform to change the average class size of a K-3 class from 30 students to 20 students (Jepson & Rivkin, 2009, p. 247). The results of this program showed reducing class size to be effective for all segments of the population (p. 247). Additionally, Figlio (1998) found in a study of 10th graders increasing the ratio of students to teachers by 10% results in an average 1.4% drop in student achievement (p. 147).

Tennessee, like California, conducted a large-scale study on class size reduction. This study, known as Student Teacher Achievement Ratio (STAR) examined 330 Tennessee K-3 classrooms. Groups consisted of one control and two treatment groups. The treatment group consisted of a group with small classes and a group with classes the same size as the control groups but with an aide in addition to the teacher. The study found significant gains with Cohen's d effect sizes from .13 to .27 for the group with the smaller classes (Mosteller, 1995). Hanushek (1999) challenged these results asserting many students switched between the control and treatment groups throughout the study (p. 153).

While the evidence is far from forming a consensus, most studies and those conducted on the largest scale, indicate smaller classes do have a positive effect on student achievement. Additionally, logic dictates the more attention a teacher can provide to each individual student, the greater the gains. However, the need to hire more teachers to reduce class size could be detrimental as it can cause divisions to forgo quality and hire less qualified teachers to meet their staffing goals (Miles, 2011, p. 45). Still, the bulk of the evidence indicates smaller classes have a positive impact on student achievement and consequently, I propose the following hypothesis.

H_4: The ratio of teachers to students is positively related to student achievement as measured by a division's reading and math SOL scores.

Support personnel. School divisions employ a lot of K-12 personnel in support roles. These are employees who lack a professional license from the Department of Education and are often referred to as "para-professionals." Para-professionals make up 12% of the total number of K-12 employees (National Center for Education Statistics, 2015). Despite the large number of employees in this category, very little research has been done to establish their effectiveness on academic achievement. In fact, only two studies dealing with this topic could be found using Google Scholar. The first, studying just instructional aides concluded instructional aides did not have a significant impact on student achievement (except in the area of K-2 reading) (Gerber, Finn, Achilles & Zaharias, 2001). They examined whether being in a classroom with a teacher's aide had an effect on student achievement by comparing students in classes with an aide for one, two, three, or four years. They found a small significant effect on 2nd and 3rd grade years for students who had only been in a class with an instructional aid for one or two years (p. 133). However, they did not account for the fact that in a lot of schools it is common practice to place the students with the most profound needs in classes with aides as an aide is often used to assist students with learning or behavioral disabilities. This means the classes with an aide are often the classes with the greatest challenges to teaching and learning to begin with and so their results are questionable. Additionally, they did not take into account the overall effect of having a higher density of support personnel in general has on the entire school division.

In addition to the single study directly on instructional aides, there was an experimental study primarily on class size reduction, the Tennessee STAR Project (Mosteller, 1995), which added the inclusion of an instructional aide as an extra variable and found a small Cohen's d effect sizes between .05-.14 depending on which assessment was administered. These results are questionable because a considerable number of students transferred between the control and treatment groups throughout the study (Hanushek, 1999, p. 154). Consequently, there is simply not enough evidence to conclude adding support personnel is or is not beneficial for student achievement.

While there may be an absence of evidence on the effectiveness of support personnel, most school divisions employ them. According to Gerber, Finn, Achilles, and Boyd-Zharia, (2001), the employment of support personnel is based on "common sense" (p. 124). While their role in education is greatly varied, instructional aides are used primarily to reduce "administrative burdens" on teachers and to perform instructional tasks under the supervision of the teacher (p. 124).

School divisions employ other support personnel, such as secretaries and nurses, to help ensure the school runs smoothly. If support staffs are overwhelmed, it will hurt the efficiency of the division as those duties will either go undone or will need to be done by professional staff at a greater expense due to their higher salaries. Despite this line of logic, there is no research establishing a higher number of support personnel per pupil has any impact on student achievement. This leads me to propose the following hypothesis on the impact of support personnel on student achievement:

H_5: There is a positive relationship between the ratio of support personnel and student achievement as measured by a division's performance on reading and math SOL scores.

Largest impact. If all of the main effects discussed above positively affect student achievement this information will still be of limited use to division superintendents as their limited budgets will not allow a meaningful increase in spending in all areas simultaneously. Consequently, all of the main effects of teacher salary, principal salary, class size and pupil/support personnel ratio must be compared to determine which has the largest impact and is therefore the best use of limited resources. I propose the following research question:

RQ: Does teacher salary, principal salary, class size or the ratio of students to support personnel account for the largest share of variance in student achievement as measured by SOL scores?

Supplemental Analysis, Region

The diversity found across an entire state has the potential to minimize the impact of some of the independent variables because what is a competitive salary in a low cost of living area may not be competitive in a high cost of living area. Costs of living vary widely from one school district to another. In some districts, a basic three bedroom house can be purchased for less than $100,000 while in other locations the same house would cost $500,000. Allen (2005), in a review of literature, concluded the acceptability of salaries is determined by how they compare to salaries of others in their area or in nearby school systems (p. 91). This means districts are in competition with one another to offer the best salaries. What is unknown is how much money a district needs to offer to be competitive, or how low they can drop their salaries without having an impact on student achievement.

Because of regional differences and the research of Allen (2005), I suggest a division's average salary may be sufficient to attract high quality teachers if it is better, or at least as good, as those of surrounding divisions. In order to get an accurate picture of how much a district needs to spend on salaries, it will likely be more useful to examine salary across a region than across an entire state. First there should be a greater homogeneity between districts who are neighbors. Second, as neighboring districts are likely in competition with one another, it is reasonable the district with the highest salaries relative to other salaries in a region will get the highest scores. With this in mind, I propose the following hypotheses:

H_6: Spending more on teacher and principal salary and having a smaller student to teacher ratio relative to other divisions in a region will have a larger impact on student achievement than spending relative to the entire state.

Moderating Effects

Knowing how various inputs impact student achievement is useful and may be of some help when superintendents make personnel decisions but what is perhaps more useful is to understand under what conditions particular spending inputs are most or least warranted. For example, I hypothesized a positive overall relationship for teacher salary and student achievement; while this may be true, it may not be true for all situations. Furthermore it may be more important under some situations than others. In order to help make this determination, I examine demographic and economic moderating variables to better understand the conditions that influence the effects of different types of spending on achievement.

This further investigation is crucial when examining inputs such as class size. Based on the majority of the evidence reviewed, I hypothesize smaller class sizes are beneficial. However, there are studies showing little or no benefit to smaller classes. This indicates a one-size fits all approach to examining the intricacies of division spending may be flawed. By examining inputs that serve as moderating effects I hope to discover when smaller class sizes are most important.

Population density. Rural, suburban, and urban districts are different places with different needs. The low population density, lack of amenities, and peaceful open spaces of a rural setting stand in stark contrast to the high density urban landscape. However, both rural and urban districts share the common trait—they are not as desirable a place to live as the suburbs. Suburbs could be viewed as the ideal place to live and are in many respects more attractive to potential employees than either rural or urban districts. Consequently, those divisions operating in rural and urban areas often have more trouble filling their staffing needs.

Teachers often look to teach in a school with a similar background to the one in which they grew-up. Teachers from top colleges are statistically more likely to have grown up in suburbs compared to teachers from urban areas who are more likely to have attended less selective colleges (Jacobs, 2004, p. 140). This would theoretically put non-suburban districts (rural and urban) in a bind as they would have a built-in disadvantage in attracting the best teachers and would have to compensate for this through other hiring and retention incentives such as higher salaries. This points to the idea that some districts may have to pay higher salaries than other districts in order to get the same quality teachers. This would be due to some districts/divisions being more attractive places to live and work than other districts.

Monk (2007) proposed an attractiveness theory to explain the difficulties some districts have in attracting high-quality teachers. In this theory, the overall attractiveness of an area plays a role in determining the salary for which employees are willing to work. This theory explains why a rural school district with a low cost of living may still need to pay a higher salary to attract workers. This makes the case that if a less attractive district fails to pay a sufficient salary, they will have less qualified teachers (p. 162). Monk (2007) also points out teachers typically prefer to teach in an area similar to the one in which they grew up which puts rural districts at a disadvantage as they typically produce fewer college graduates than suburban districts.

Urban schools have a unique set of problems and like their rural counterparts, often struggle to find the best qualified teachers. Jacobs (2007) reports urban students score lower on achievement tests, have higher poverty, unemployment, and crime rates, an eroding tax base, and crowded schools (p. 132-133). Because of these problems, urban areas face some of the same attractiveness challenges as rural schools. Teachers in high poverty urban settings are more likely to lack a degree in the subject they are teaching and are more likely to have struggled to pass the teaching exam (Greenlee & Brown, 2009, p. 96). This creates the unfortunate situation where the neediest students are often served by the least qualified teachers.

Theoretically, areas designated as suburban, but not urban, are more attractive places to work than rural or urban environments. While many of the things that make a district attractive are innate to a district, there are things a district can do to improve their relative attractiveness. Guarinio, et al. (2006), recognize multiple things go into making a district "attractive". They describe what makes a district attractive as a combination of factors including work load, working conditions and compensation. They suggest school divisions can adjust their attractiveness by improving compensation or other work conditions in order to ensure their demand for teachers is met. Divisions can also adjust the demand by changing the size of their typical class (p. 175). This means a division can, with the right incentives, overcome an innate lack of attractiveness.

Research indicates to overcome a lack of attractiveness, divisions may need to, but often do not, adjust their employee compensation. Jimerson (2003) investigated the unique elements of teacher compensation in rural areas and noted rural compensation is usually much lower than urban compensation. This is justified due to what is typically but not always, a lower cost of living. And while rural teachers do typically have lower housing costs, teachers in rural areas often have higher transportation costs as they need a car and will likely drive more miles due to the spread-out nature of rural areas. Additionally, due to a lack of desirability, rural districts may have trouble enticing teachers to move there and so may have to offer higher salaries in order to attract and hire qualified teachers (p. 11).

According to Jacobs (2007), urban schools typically have a harder time hiring teachers than their suburban counterparts (p. 129). In executing recruiting activities, larger and urban school districts have advantages and disadvantages. The larger size of some urban districts allows them to recruit teachers over a wider area. However, they can also have cumbersome bureaucratic systems that prevent them from efficient hiring (p. 133). The recruiting problems of urban districts are especially pronounced when they are seeking math and science teachers. Consequently, it is likely one will find an achievement gap in math scores above what we see in reading.

Figlio (2002) hypothesized that quality teachers may self-select to higher paying districts out of a preference for living in suburbs, where they are more likely to have grown up (as suburbs produce more college graduates), and which also typically pay better (p. 687). So, it is possible the environment of the district, rather than the higher salary is what attracts the best teachers.

Given the different challenges faced by rural and urban districts and the added difficulty of recruiting teachers caused by a lack of attractiveness, rural and urban districts will likely need to pay higher salaries than their suburban counterparts in order to attract quality teachers. The lack of support structures available to students in rural and urban areas will also likely result in more of a benefit in smaller class sizes.

District wealth. Wealthier school districts have advantages over poorer districts. First, they are more likely to have an educated population. Second, they have more resources. Third, they may be more attractive places to live. As was previously noted, rural and urban schools are typically poorer than their suburban counterparts. However, this is not always the case as there are rural resort communities and gentrified urban areas that are anomalies. Consequently wealth and population density are unlikely to perfectly overlap and should be examined separately.

The lower desirability of poorer districts, just like urban and rural districts, presents a challenge in recruiting the best teachers. Divisions located in these places may need to do something else to make their divisions more attractive places to work. Greenlee and Brown (2009), in a survey of 99 teachers in Florida, found salary and benefits to be important in high poverty schools relative to low poverty schools (p. 96). This would indicate high poverty environments are less desirable places to work and therefore require a higher salary to attract quality teachers.

There is a considerable amount of research indicating the unique challenges posed by high-poverty schools require the very best leadership. The research makes it clear the importance of a principal's leadership traits change based on demographics. Charlotte Advocates for Education (2004) studied principals who were successful in high poverty areas and found principals who are successful are self-motivated, visionary leaders, risk takers and problem solvers who provide their teachers with continuous feedback (p. 2). Such a principal is unlikely to be cheap.

Greenlee and Brown (2009) found teachers in high poverty schools place a greater value on working for a strong principal who sets a positive tone and vision than teachers in low poverty schools (p. 105). This indicates the leadership in a high poverty school is more important than in lower poverty schools. Unfortunately, low-income schools are more likely to have principals in their first year or with less experience than higher income schools (Rice, 2010, p. 5). This is bad news for student achievement as according to Rice (2010), citing research of (Clark, Martorell & Rockoff, 2009), a principal's level of experience matters when determining student performance, especially in math (p. 2). This means the schools most in need of an experienced leader are the ones who are most likely to have a principal lacking that crucial experience. This should have an impact on student achievement and an especially strong impact on math.

The literature supports the common belief the principal can impact student achievement. O'Donnell and White (2003) found a significant relationship between student achievement and teacher ratings of principal leadership. However, they found this relationship only existed at schools with a high SES population indicating the wealth of a district may play a role in the importance of a principal's leadership.

Much of the research on what students who live in poverty need indicates forming a relationship with teachers is crucial for their learning (Payne, 2003, 2009). It is much easier to form relationships when class sizes are smaller. Consequently small class sizes should be more important in less affluent settings than in wealthier environments.

It is clear from the literature high poverty districts need the best leadership and teachers but have an attractiveness problem that inhibits their ability to recruit the best employees. Improved salary is one thing that could compensate for a lack of attractiveness and higher salaries should result in better teachers and better student achievement at high poverty schools. Additionally, the challenges of poverty should make small classes more important in less wealthy environments than in more wealthy environments. With this in mind I will examine how wealth moderates the effect of teacher salary, principal salary, and class size using three different measurements of wealth. The first, median household income, is an indicator of the wealth of the average resident of a district. The second, the composite index score, shows the overall amount of wealth existing in a district. The third, fiscal stress, represents the funding a district could realistically raise through an increase in taxes.

Summary of Moderation Hypotheses

Population density (hypotheses H_{1a}-H_{4a}). The relationship between the main effect variables (per-pupil spending, teacher and principal salary, and pupil/teacher ratio) on student achievement scores will be stronger in rural and urban schools than in suburban schools.

Wealth (hypotheses H_{1b}-H_{4b}). The relationship between the main effect variables (per-pupil spending, teacher and principal salary, and pupil/teacher ratio) on student achievement scores will be stronger in poorer districts than in wealthier districts.

Table 1
Table of moderation hypotheses.

Moderator	Per-Pupil Spending	Teacher Salary	Principal Salary	Pupil/Teacher Ratio
Rural/Suburban/ Urban	H_{1a}	H_{2a}	H_{3a}	H_{4a}
Wealth	H_{2a}	H_{2b}	H_{3b}	H_{4b}

Method

The participants in this study were composed of the 132 school divisions operated by counties and cities in Virginia. According to membership (enrollment) numbers they vary widely in size from Highland County with 185 students to Fairfax County with 182,157 students (VDOE, 2015b). Additionally, Virginia's school divisions serve a mixture of affluent areas, and areas where poverty is prevalent. Some divisions serve suburban areas while others serve rural or urban areas. Regardless of the population or geographic location, each school system follows a similar curriculum as is prescribed by the Virginia Standards of Learning and their corresponding SOL tests.

Each school division has its own school board and makes its own decisions within parameters set by the Virginia Standards of Quality. Each school system is led by a superintendent who is supervised by a school board that is either directly elected or is appointed by the legislative body in that district. School boards and their superintendents have a significant amount of discretion when determining how their money is spent. However, no school division has an unlimited amount of money and so it must be spent in such a manner as to get the best possible student learning outcomes.

Main Effect Measures

All main effect measures were collected from The Superintendent's Annual Report (VDOE, 2015a). This is a series of annual reports sent to the Virginia Department of Education from the individual school divisions containing statistics on all elements of the division's operation. All of the main effect measurements were extrapolated from this source. The data is published in 19 separate tables and is made available to the public on the Department of Education website (http://www.pen.k12.va.us/statistics_reports/supts_annual_report/2014_15/index.shtml).

Per-pupil expenditures. Different school systems spend vastly different amounts of money, even on a per-pupil level. For example, at the low end the medium sized King George County (4288 students), spends only an average of $8,740 per student annually. At the other extreme, the very small Highland County spends an average of

$19,728 per student per year. The median per-pupil expenditure is $10,672.50. All per-pupil spending estimates are expressed in dollars and are reported in units of $10,000.

Teacher salary. Teacher salary varies widely across Virginia. At the low end of the range, Tazwell County pays teachers an average of $37,035 per year while, at the high end, Arlington pays teachers an average of $74,534 per year. The median teacher salary across Virginia school divisions is $47,575.24. These numbers are an average salary in dollars paid to teachers in each division. Consequently this number is driven by two factors; first, the salary scale for PK-12 teachers adapted by each division which is based largely on experience and second, where the teachers in the division fall on that scale. Teacher salary is reported in units of $10,000.

Principal salary. Principal salary varies even more widely than teacher salary. The average principal salaries range from Buena Vista City at $46,597 to Arlington which pays principals an average of $143,205 (VDOE, 2015a). The median average principal's salary in Virginia is $84,287.31. Principal salary is reported in units of $10,000.

Pupil/teacher ratio. The pupil/teacher ratio is simply the number of students per teacher in a school system. This number is reported by school divisions to the Virginia Department of Education and includes all types of teachers, both classroom teachers and teachers in supporting roles. Classroom teachers are those teachers at any grade who are responsible for a classroom of students. Teachers in supporting roles may pull out small groups of students for remediation or provide other professional services such as librarian. It is not a perfect measure of class size, but is a good measure of the amount of individual attention from professional staff available to students. The numbers reported represent the number of students per teacher and range from 6.90 to 16.67 with a median of 12.16.

Pupil/support personnel ratio. Unlike with teachers who are all lumped into one category, school divisions report the number of support personnel they employ broken down by category. Those personnel falling into the Department of Education's categories of "instruction" and "administration, attendance and health" categories are the ones most likely to have an impact on instruction. This is because they have a direct role working with students and assisting the teachers who provide the instruction by performing tasks which allow the teachers to better focus on instruction. The numbers of personnel in these categories were summed and divided into the total number of students in a division in order to obtain an overall pupil/support personnel ratio. This ratio indicates the number of students per one support person and varies widely across the state ranging from 8.95 to 179.6 with a median of 56.73.

Moderator Measures

Interactions were computed for each of the main effect variables with the moderating variables indicating a division's population density and wealth as measured by both median household income and Department of Education Composite Index. This created new variables representing the interaction between the main effects and these specific moderators.

Population Density.

Urban. The U.S. Census Bureau defines an area to be "Urban" if it has a population greater than 50,000 and a population density of at least 1000 people per square mile. Virginia has five areas that meet the definition of "Urban". Areas with an urban designation are the Northern Virginia area around Washington D.C, Richmond, the Hampton Roads/Norfolk area, Lynchburg, and Roanoke. Districts falling into one of these five "urban" zones were classified as urban.

Suburban. The U.S. Office of Management and Budget, using this data, provides "metropolitan" designations to areas. To be classified as "metro" an area must have a core urban area (at least 50,000 people) and be economically intertwined with the urban area (USDA, n.d.). Areas defined as "metro" but not as "urban" are hypothetically very attractive as they provide easy access to the amenities of city life without the crowds and negative traits associated with urban areas. Approximately half of the districts in Virginia are designated as "metro" which indicates a reasonable proximity to one of the five urban areas. That said many of the metro areas have a rural feeling and a low population density. However, given their proximity to an urban center, they are still arguably more desirable than the rural counties that lack such proximity (USDA, n.d.). I classified those districts which fall into an area designated as "metro" as "suburban".

Rural. A district is designated as "rural" if it lacks the population density of a core area of at least 50,000 and fewer than 1000 people per square mile and it is not economically intertwined with a core urban area. Fifty-three districts in Virginia meet these criteria and were designated as "rural".

In order to use multiple linear regression (MLR) with this as a categorical variable, I created two new dummy coded variables labeled "rural" and "urban" such that suburban is the reference group. For the new variable "rural", rural districts were coded as "1" and non-rural districts were coded as "0". For "urban", urban districts were coded as "1" and non-urban districts coded with "0". As each hypothesis was tested, the data was examined to see if a district's classification changed the nature of the relationship between the main effect variables and student achievement.

Wealth. In order to determine how the wealth of a district impacts its need to spend money on personnel, I used three different measurements of a district's wealth. The first, the composite index, measures the total wealth available to a division in the form of potential tax revenue. The second measure is median household income which measures the individual wealth of residents within a district. The third measure, fiscal stress, represents the funding a district could realistically raise through an increase in taxes.

Composite index. The composite index represents the percentage of local versus state funding a division must pay. It is calculated using a weighted formula where property values count for 50%, gross income for 40%, and taxable sales for 10%. The Virginia Department of Education adjusts the composite index to ensure the state pays no more, than 45% of total education funding based on minimum funding requirements established by DOE for the entire state. This figure is expressed as the percentage of a school division's funding that must come from local sources. This ranges from 18% for the poorest districts to 80% for the wealthiest districts. The median district must raise 36% of funds from local sources. As it takes several things into account, it is an excellent indicator of the total amount of wealth that exists in a district but not of the personal wealth of the residents.

Median household income. In order to account for the wealth of individuals residing in a particular district, I used the median household income numbers for each district as computed by the U.S. Census Bureau. The median household income numbers provide insight into the socioeconomic condition of the residents. This additional measurement is useful as it is possible for a district to have a healthy tax base (due to high property values caused by a resort, attraction or large business) but still have a high number of citizens with a low income. Median household income numbers are available from the U.S. Census Bureau. The wealthiest district has a median household income of $123,996, the poorest $27,746 while the median district has a median household income of $47,673.50. Median household income numbers are reported in units of $10,000.

Fiscal stress. As neither composite index nor median household income are perfect measures of a district's wealth (James Regimbal, personal communication, December 6, 2016), I added the Fiscal Stress Index as prepared by the Commonwealth of Virginia Commission on Local Government (2016). The index, centered at 100, equally weights per capita revenue capacity (the amount that could be raised if residents were taxed at the state average), revenue effort (the ratio of actual taxes compared to capacity) and median household income (p. 2). This measurement is different as it combines factors and includes the amount of revenue a locality is already accessing thus indicating the additional funding that could be realistically raised through additional taxes.

Region. The Virginia Department of Education divides districts into eight different geographic regions (VDOE, 2016). In order to assess the impact of the individual main effects relative to the other districts in a region, I computed an average for each region for each of the main effects. I then computed the difference between the region average and the numbers for each district to show how each school division compares to other districts within the same region.

Outcome Measures

Student Achievement. Reading and math Standards of Learning (SOL) test scores serve as indicators of student achievement and as the dependent variables for this study. These scores represent the percentage of students who earned a minimum passing score (400) on the tests. The tests themselves are criterion referenced and are on a scale of 0-600 with a score of 400 representing passing. For most tests, a score of 400 indicates students answered slightly more than half of the questions correctly. Reading and math scores were selected as the dependent variables because it is these scores by which a school system is judged under No Child Left Behind. This data is available from The Virginia Department of Education School System Report Cards. The 2014-2015 school year was used as this is the most recent year for which there is data (VDOE 2015a).

Procedure

The main effects of the independent variables, per pupil expenditures (H_1), average teacher salary (H_2), average principal salary (H_3), pupil/teacher ratio (H_4), and pupil support/personnel ratio (H_5) were tested using SPSS by estimating bivariate correlation coefficients with the reading and math SOL scores across school divisions. Examining these correlations allowed me to tell which main effects are related to reading and math scores and if the relationship was positive or negative. Further information concerning the significance of the main effects was obtained by using single linear regression to obtain slopes for each of the main effect variables on both reading and math scores. Once independent variables with positive correlations were identified, they were placed in on a MLR model which was tested to determine which independent variable accounts for the largest share of variance (RQ).

In order to assess the importance of a division's spending relative to other divisions in their region (H_6), main effects within region were examined by computing a new term for the main effects average teacher salary, average principal salary and pupil/teacher ratio showing each division's distance from the region average. Bivariate correlations were computed for each of the main effects with math and reading scores to show the importance of each of the different spending inputs within a region.

The moderating effects of a district's population density (H_{1a}-H_{4a}), and a district's wealth (H_{1b}-H_{4b}) on reading and math SOL scores were tested for each main effect using MLR model building (Hypothesis H_{1a}-H_{4a} and H_{1b}-H_{4b}).

Before the model could be built, interaction terms were computed by multiplying each centered main effect variable (per-pupil expenditures, average teacher salary, average principal salary, and pupil/teacher ratio) by the moderating variables. For population density, dummy coded terms "urban" and "rural" were used. For wealth, I computed three sets of terms. The first computed term used centered composite index, the second used centered median household income, and the third term used fiscal stress as a proxies for wealth. This process provided terms representing the interactions between the moderator and main effect variables.

A series of separate MLR models was tested to evaluate each hypothesis containing the main effects of centered independent and moderating variables, and their interaction terms. For example, in order to test H_{1a} dealing with the moderating effect of population density between per-pupil expenditures and student achievement, three MLR models were tested for both the math and reading independent variables. The first model contains just the main effect for per-pupil expenditures. The second model added the moderating variables, “rural” and “urban” (representing “population density”). The third model added the computed interaction terms between per-pupil expenditures and urban and rural density dummy codes. By examining the R^2 change and corresponding *p* value I was able to tell how much variance each component added. Similar separate models containing each of the main effect, moderating variables, and interaction terms were tested to evaluate all of the hypotheses for both the reading and math independent variables. Hypothesis H_{1b}-H_{4b} were tested separately using composite index, median household income, and fiscal stress as proxies for wealth. Testing these models indicated which interactions were significant and how much incremental variance each model predicted.

Results

Descriptive statistics shown in Table 2 indicate that while there are large differences between school divisions in principal salary, median household income, and pupil/support personnel ratio, the other differences between divisions as indicated by standard deviations, are fairly small. This is especially true for pupil/teacher ratio and for both dependent variables (reading and math scores).

Pearson correlations shown in Table 3 indicate, as one would expect, a very high correlation between reading and math scores indicating most divisions perform at similar levels in both areas of student achievement. A division’s status as rural was also found to be a significant predictor of student achievement. The correlations with the largest practical implications are the strong correlations between any of the three measures of wealth and most of the other studied variables. For example, median household income is significantly correlated with every other variable except for pupil/support personnel. In fact, median household income and fiscal stress are more highly correlated with reading and math than any of the other variables including composite index indicating the powerful role wealth plays in all things related to education.

Main Effects (H_1-H_5)

Bivariate correlation results for Hypotheses 1-5 are shown in Table 3. Regression results for these hypotheses are shown in Table 4.

Per-Pupil Expenditures (H_1). The correlations between per-pupil expenditures and student achievement as measured by SOL scores proved to be non-significant for both math and reading. Consequently, we can accept H_1 that there is no relationship between per-pupil expenditures and student achievement as measured by SOL scores.

Teacher Salary (H_2). The correlation between a division's average teacher salary and student achievement as measured by SOL scores is significant for both math and for reading. Consequently we can accept H_2 and conclude there is a positive relationship between a division's spending on teacher salary and SOL scores. While the R^2 values indicating teacher salary accounts for 5.7% of the variance in math SOL scores and 4.8% in reading SOL scores is meaningful and indicates the best performing divisions also pay the best, a large salary increase alone would be an impractical way of raising SOL scores. An examination of the regression slopes (See Table 4) indicates for a 1 percentage point improvement in average SOL pass rates average individual teacher salaries would have to increase by over $300,000 for math and over $400,000 for reading. Consequently, while the correlation is statistically significant, the increase in salaries needed to impact a division's SOL scores is not practical.

Principal Salary (H_3). Results indicate the correlation between the average salary a school division pays to a principal and SOL scores is small but statistically significant for math but not for reading. These findings partially support H_3. As with teacher salary, the impact of principal salary is statistically significant with 4.8% of the variance in math scores being attributable to principal salary. However, a 1 point increase in average math SOL pass rates would require a $1 million increase in principal salary. So, while the best performing divisions do pay the best, raising salaries alone is unlikely to have a large impact.

Pupil/Teacher Ratio (H_4). Results indicate the correlation between pupil teacher ratio and student achievement is non-significant for both math and for reading. This either indicates class size is unimportant or, as indicated by a small standard deviation, there is very little practical difference in the class sizes across the state. Consequently there is no evidence of a significant relationship between class size and student achievement and so we are unable to reject the null and accept $H_{4.}$

Support ratio (H_5). An examination of the bivariate correlations shown in table 3 between the pupil/support personnel and student achievement indicates no significant relationship exists for either math or for reading. The evidence indicates no significant relationship exists between the pupil/support personnel ratio and student achievement and so we are unable to reject the null and accept H_5.

Largest impact (RQ). In order to determine which predictor accounts for the largest share of variance in SOL scores, MLR model building was used to compare the impact of average teacher salary, average principal salary, pupil/teacher ratio and total support ratio. Assumptions for multicollinearity were met with all VIF statistics less than

4. Results shown in Table 5 indicate the only predictor to account for a significant portion of variance is teacher salary which is significant for both math and reading. When other predictors are added they do not make a significant contribution to the variance. Furthermore, an examination of semi-partial correlations indicates that, controlling for all other predictors in the model, teacher salary accounts for 1% of the unique variance in math and 2% of unique variance in reading while the next largest (not statistically significant) is total support ratio at only .5% for math and principal salary at .1% for reading. Consequently teacher salary is the only independent variable to make a meaningful contribution to variance on student achievement. However, the slopes were extremely small such that for a 1 percentage point gain in SOL pass rates teacher salaries would need to increase by $366,703 for math and $437,254 for reading, adjusting for the effects of other predictors in the model. Average teacher salary accounts for the largest and only statistically significant share of variance, but raising teacher salaries alone is unlikely to have much of an impact on student achievement scores. So, the overall answer to the research question is average teacher salary has the largest impact on student achievement.

Supplemental Analysis: Main Effects within Region (H_6)

In order to determine the effects of a division's average teacher salary, average principal salary, and pupil/teacher ratio on student achievement compared to other divisions in a region, regional averages were computed and the differences found were used to create new terms indicating each division's standing relative to the regional average. Bivariate correlations, reported in Table 6, for teacher salary, principal salary, and pupil/teacher ratio were computed within region and compared to those computed with state-wide data. H_6 stated the correlations would be greater within region than across the entire state. An examination of the bivariate correlations revealed no practical difference between correlations within region and those across the entire state. Consequently, we are unable to reject the null and accept H_6 as offering a higher salary than neighboring districts is by itself insufficient to raise student achievement.

Summary of H_1-H_6 and Largest Impact (RQ)

Results for H_1-H_6 and RQ are reported in Tables 3-6. As was expected, per-pupil expenditures was not correlated with student achievement. Teacher salary proved to be a statistically significant predictor of student achievement (H_2), but the practical significance associated with the effect was trivial. Principal salary exhibited a statistically significant relationship with math but not with reading scores (H_3), but the practical significance of the effect was again trivial. Pupil/teacher ratio had no impact on student achievement (H_4). Pupil/support personnel ratio also had no impact on student achievement (H_5). No differences were found when comparing the main effect variables within region to those from across the entire state (H_6).

Population Density (H_{1a}-H_{4a})

In order to determine the moderating role of population density on the relationship between each of the aforementioned main effect spending variables (per-pupil expenditures [H_{1a}], teacher salary [H_{2a}], principal salary [H_{3a}], and pupil/teacher ratio [H_{4a}]) and student achievement scores, I used a model building approach with MLR. In the first model I entered the centered main effect variable (e.g., per-pupil expenditures). In the second model I added the dummy coded “urban” and “rural” terms. In the third model I added the main effect variable’s interaction with each dummy coded population density term. This process was repeated for 1) all four main effect spending variables and 2) both the reading and math independent variables. Results are reported in Tables 7-10.

Table 7 shows the model building results for per-pupil expenditures. Per-pupil expenditures was not related to student achievement. However, a district's status as rural was a significant predictor of both math and reading scores, indicating rural school divisions scored significantly lower than non-urban school divisions. Neither of the interaction terms including per-pupil expenditures and the population density dummy coded terms were statistically significant, lending no support to H_{1a}.

Table 8 shows the model building results for teacher salary. While teacher salary by itself is a significant predictor of student achievement, when you consider teacher salary's interactions with "urban" and "rural" teacher salary is no longer significant. In the third model, when the interactions between teacher salary and "urban" and "rural" are added, "rural" becomes a significant predictor of student achievement for both reading and math and "urban" becomes a significant predictor for reading. Given the lack of significance of the interaction terms, we are unable to accept H_{2a}.

Table 9 shows the model building results for principal salary. While principal salary by itself was related to student achievement for math, in the third model when the interactions are considered it loses its significance. Principal salary does not have a significant impact on reading scores. When the third model is considered both the terms "rural" and "urban" become significant for reading. However, none of the interaction terms were significant for either reading or math giving no support to $H_{3a.}$

Table 10 shows the model building results for pupil/teacher ratio on population density. Pupil teacher ratio was not related to student achievement. The term "urban" was not related to student achievement but the term "rural" was related to both reading and math. Interaction terms were not significant for either reading or math giving no support to H_{4a}.

Summary of H_{1a}-H_{4a} Findings

After testing the moderating effect of a district's population density as determined by a district's position as either rural, suburban, or urban, I can conclude population density does not play either a practically or statistically significant role in moderating the effects of per-pupil expenditures, teacher salary, principal salary, or pupil/teacher ratio on student achievement. This indicates a district's population density does not drive the need to spend money on personnel with respect to student achievement. While rural and urban districts obviously have unique sets of challenges, greater spending among district's in rural or urban settings does not differentially affect student achievement scores. However, this does not mean rural and urban districts do not have challenges above those of their suburban counterparts. Controlling for all other variables in the final models, the "rural" dummy code main effect showed a fairly consistent statistically significant, negative effect (see Tables 7-10), indicating students in rural areas often do not perform as well as those in suburban areas. While none of the hypotheses concerning the moderating effect of population density on student achievement (H_{1a}-H_{4a}) were supported, rural divisions clearly did not perform as well as others.

Wealth (H_{1b}-H_{4b})

Composite index, median household income, and fiscal stress were used as different measures to represent the wealth of a district. When these three wealth indicators are examined as predictor variables instead of as moderators, all three show a strong correlation with both reading and math scores (see Table 3). Fiscal stress, the wealth indicator with the strongest correlation, accounts for 21% of the variance in math and 25% of the variance in reading.

In order the test for the moderating effect of wealth on the relationship between each of the aforementioned main effect spending variables (per-pupil expenditures [H_{1b}], teacher salary [H_{2b}], principal salary [H_{3b}], and pupil/teacher ratio [H_{4b}]) and student achievement scores, I used a model building approach with MLR similar to that used above to test H_{1a}- H_{4a}. Again, I entered the main effect of each separate spending variable in the first model (e.g., per-pupil expenditures). In the second model I added the main effect for the wealth indicator. Finally, in the third model I added the interaction between the spending variable and wealth indicator to test the moderating effect. As was the case for testing H_{1a}- H_{4a}, above, this process was repeated here for 1) all four main effect spending variables and 2) both the reading and math independent variables. In addition, I operationalized "wealth" in three different ways (i.e., composite index, median household income, and fiscal stress), meaning I tested each set of models separately using each of these measures of wealth.

Per-pupil expenditures (H_{1b}). Tables 11-13 show the model building results for per-pupil expenditures. Per-pupil expenditures was not related to student achievement. A district's wealth, whether measured by composite index, median household income, or fiscal stress was related to student achievement in both reading and math indicating the powerful role wealth plays as predictor of student achievement. When, in Table 11, a district's wealth as measured by composite index is considered, per-pupil expenditure becomes significant. This was not the case when wealth is measured with either median household income or fiscal stress. Still, none of the interactions were significant for either reading or math lending no support to H_{1b}.

Teacher Salary (H_{2b}). Tables 14-16 show the model building results for teacher salary. Teacher salary was related to student achievement. When controlling for teacher salary, the composite index measure of wealth was not a significant predictor of student achievement (Table 14). However, both median household income and fiscal stress (Tables 15-16) were significant predictors for both reading and math scores when controlling for teacher salary. When the interaction terms were considered, teacher salary only had a significant effect to on reading and then only when using median household income as a predictor of wealth. None of the interaction terms for teacher salary and wealth were significant lending no support to H_{2b}.

Average Principal Salary (H_{3b}). Tables 17-19 show the model building results for principal salary. Principal salary by itself was related to math, but not reading SOL scores. Principal salary continues to have a significant effect on student achievement in math when adding the interactions between principal salary and composite index. It no longer has a significant effect on math when measuring wealth with either median household income or fiscal stress. While principal salary by itself was not related to student achievement in reading, it becomes significant when the interaction term with median household income was added. However, regardless of the measurement used for wealth, none of the interaction terms were significant giving little support to H_{3b}.

Pupil/Teacher Ratio (H_{4b}). Tables 20-22 show the model building results for pupil/teacher ratio. Pupil/teacher ratio was not related to student achievement. While wealth, as measured by either composite index, median household income or fiscal stress is related to student achievement in both math and reading, none of the interaction terms were significant. Consequently, there is no support for H4b.

Summary of H_{1b}-H_{4b} Findings

I found no evidence that school division spending on any of the four spending inputs, per-pupil expenditures, average teacher salary, average principal salary or pupil/teacher ratio differed based on the wealth of a district whether measured by composite index, median household income, or fiscal stress. Thus there is no support for H_{1b}-H_{4b}. Furthermore, after examining the impact wealth has when combined with the main effect variables per-pupil expenditures, average teacher salary, average principal salary, and pupil/teacher ratio is clear it is a district's wealth and not the main effect spending variables that primarily impact student achievement. The significance of the impact of teacher salary on student achievement disappears when you control for wealth with either composite index of fiscal stress and it disappears for math when controlled with median household income. Furthermore, the significance "average principal salary" shows as a predictor of math scores goes away when controlling for wealth by any measure. In summary, wealth is a consistent barrier to student achievement and there is no evidence any of the tested variables are in a position to change that.

Discussion

This study examines the effects of personnel related spending inputs (per-pupil expenditures, average teacher salary, average principal salary, pupil teacher ratio, and pupil/support personnel ratio) on student achievement as measured by reading and math

SOL scores. This study builds on the existing literature to examine whether or not a district's region, population density, (rural, suburban, urban), and wealth (as measured by composite index, median household income, and fiscal stress) moderate the effects of spending inputs on student achievement. Teacher salary and principal salary were the only main effect spending variables to demonstrate a significant relationship with student achievement. Considering a district's region had no effect of the effects of spending units on student achievement, nor did the relationship between spending inputs and student achievement differ as a function of district population density or wealth. While all of the interactions were non-significant, the effects of one set of control variables—that is, indicators of wealth (i.e., composite index, median household income, and fiscal stress)—showed the strongest effects on student achievement when treated as a main effect indicating SOL scores are higher in wealthier parts of the state than in poorer parts of the state. I will discuss potential explanations for and implications of the failure to support the stated hypotheses as it was a districts wealth and not overall per-pupil expenditures, any of the personnel related inputs, or any of the wealth or population density interactions that had the largest impact on student achievement.

Per-pupil Expenditures

Findings support the work of Coleman (1966), Hanushek (1986), Agasisti (2014) and Schanchter, (2010) who found spending alone is insufficient to raise student achievement. However, these findings should not be used as an excuse to cut or to not provide funding. First, all districts have unique needs and may be spending the right amount to meet their needs and cutting funding could have disastrous consequences. Second, the largest predictor of student achievement is wealth and as such, it will likely take money to fix this problem. While there is nothing in this study's results that proves an increase in spending will help the poorest districts, 40 out of the 50 poorest districts spend below the state mean. This makes it difficult to rule out spending more money as a solution for the problems faced by the poorest districts as the lack of poor districts with above average spending makes this like an experimental study with no treatment group. What these results do indicate is an across the board spending increase for all districts regardless of wealth will likely be meaningless unless leaders carefully examine both their needs related to inequality and other specific needs and carefully target spending towards solving those problems. Further spending research should look at spending on specific issues and measure the success of that spending. For example, does spending targeted on improving literacy in the earlier grades over time yield positive results across all grades? Is it an effective use of money to have larger overall classes but to provide more direct instruction to the most at risk students? An examination of these kinds of spending issues is needed to learn more about the intricacies of effective spending.

Effects of Specific Types of Personnel Spending Inputs

Teacher salary had the largest impact on student achievement of any of the personnel spending variables. Moreover, average teacher salary was the only personnel spending type to significantly predict both math and reading student achievement scores. This indicates that students in better paying districts perform better. However, the flat slope indicates that teacher salaries would need to be raised highly unrealistic amounts to meaningfully impact student achievement. That is, to increase a school division's SOL test pass rates by 1% a 1000% salary increase would be required. This estimate was much weaker than the relationship found by Figlio (1998) who found a 10% increase in starting salary should result in a 1.3% increase in student achievement (p. 247). However, this is not a direct comparison as Figlio's (1998) study examined starting salary instead of looking at the average paid compensation as was done in this study. Nonetheless, these findings appear strongly counter to those put forth by Figlio. Average principal salary was statistically significant for reading but not for math. As with teacher salary the effect size for the reading scores was tiny with a slope so flat as to render it practically insignificant and the impact of principal salary goes away when you control for wealth.

Guarino et al. (2006) suggested teacher hiring and salaries were a supply/demand transaction with supply equaling the number of teachers who are willing to work for the offered compensation and demand as the number of open positions. Using Guarino et al.'s characterization, my findings could simply suggest the teacher supply is actually adequate to meet the current demands in Virginia. Moreover, my findings suggest that districts are generally paying a salary (to teachers and principals) that is sufficient to meet their staffing needs with qualified applicants in keeping with other traits that make a school district a desirable place to work.

Ingesoll (2001) noted teacher salary was a reason teachers cited for transferring from one district to another. However, it was not the only reason for either teacher or principal transfers. It is possible when a teacher or principal leaves one school division for another they see a salary increase as an added bonus rather than as the driver of their decision. Salary may just be a single item in the larger picture of school climate which includes support from administrators, student discipline and involvement in decision making (Ingersoll, 2001, p. 525). In this scenario a teacher or principal may be content with a lower salary as long as other workplace factors are satisfactory. It is also possible as teachers and principals leave one district for another they are replaced with reasonably qualified teachers and principals resulting in a practically minimal effect on student achievement. This is especially likely, because according to Ingersoll (2001), teacher turnover is highest amongst the least experienced teachers (p. 502) meaning divisions may be swapping one inexperienced teacher for another sparing them the impact that would be felt from a loss of the most experienced teachers. Additionally, as long as turnover rates are fairly low, it is unlikely to have a large impact on overall numbers.

In a surprise that runs counter to the common sense argument that the more teachers, the more individual attention and therefore the higher student achievement, pupil/teacher ratio was not found to be related to with student achievement. This could indicate most of Virginia's schools are operating in a sweet spot of pupil/teacher ratio, or that there is little practical difference in most of the class sizes. The range of average pupil/teacher ratio in Virginia is a minimum of 6.90 and a maximum of 16.67 with a mean of 12.12. However, the standard deviation is extremely small, 1.51 indicating most divisions have similar pupil/teacher ratios. This close distribution of pupil/teacher ratios could explain the results as while there may be a practical difference between a class of 15 and a class of 30, it is unlikely there is much of a difference between a class of 12 and one of 14.

At first glance these results would seem to support the work of Coleman (1966) and Haunushek (1986) and refute the experimental studies of Jepson and Rivkin (2009) and Mosteller (1995). However, the real world difference in class sizes in this study is much smaller than the experimental designs which used 20 students for a small class and

30 students for a large class. This could explain why the results of this study were non-significant as the class sizes were all so similar as to make little practical difference.

The impact of support personnel on student achievement was found to be non-significant. Unlike the case of pupil/teacher ratio, this is not for a lack of meaningful differences between school divisions, as the range was considerable with a minimum of 8.95 and a maximum of 179.08 support personnel per pupil with a standard deviation of 18.94. However, this may simply imply that most school divisions have employed the appropriate number of support personnel, in proportion to their enrollment numbers, to meet their needs based on factors not considered in this study. In other words, while there is a need to maintain a fairly standard pupil/teacher ratio, regardless of other factors, the need to employ support personnel fluctuates widely based on factors not yet determined. Further research is needed to determine under what conditions higher ratios of support personnel are needed or could be beneficial.

Returning to the issue of the personnel spending type with the largest impact, I conclude that if there is a single budgetary item that has both a large and meaningful impact on student achievement, it has not yet been found. I recommend research on spending focus on two areas. First, research should study the 20% of school division budgets that is not directly related to personnel as the results of this study indicate neither overall spending applied evenly and without regard for other economic factors, nor spending on specific personnel categories is an effective lever for moving student achievement numbers. Second, it is possible personnel constitutes something of a “fixed cost” in education. Leaders, while able to make slight adjustments, may feel any large decreases in their personnel spending would not allow them to complete their basic tasks.

So, if personnel costs are largely fixed, future research may focus on the effects of increases in spending in non-personnel categories, such that the ratio of spending on personnel to non-personnel drops from 80%/20% to 70%/30% or even less. Second, researchers may examine how the specific distribution of teachers impacts achievement. Given limited budgetary resources, I might suggest that getting the right number of employees in the right places may have important effects. For example, it may that smaller class sizes are more important in high-need elementary classrooms than in high school classrooms. Finally, I suggest that the lack of strong main effects of any of the four personnel spending indicates that Virginia's schools are currently operating in a "sweet spot" based on their district's needs, which decision makers have established over time. It may be time to change the discussion away from "how can increased spending positively impact student achievement?" to "to what extent could decreased spending negatively impact student achievement?" The latter is the question posing greater concern for educational decision makers today, as budget crises carry unknown and potentially substantial risks.

Regional Differences

Perhaps the largest surprise in this study was the lack of practical significance of personnel spending differences within regions. While it seems like a reasonable assumption that teachers and others are attracted to the school division with the best pay and the need to compete with other districts is an often cited reason for raising salary, there is little evidence salary or spending relative to other divisions in a region actually has an impact on student achievement. These findings do not necessarily refute those of Allen (2005) as the offered salaries may all still be acceptable in light of other things that create overall working conditions. Ingersoll (2001) noted 47% of teachers who switch schools cited salary as a reason, but it may not be the only reason that is driving their decision to switch districts.

These findings open up several possibilities. First, it is possible an otherwise content teacher may stay where they are even if the salary is lower than that of neighboring districts and while salary is a factor in teacher's decisions to switch districts, it is not the overriding one. Second, it could be when a teacher leaves to go to another school division (due to any reason) they are replaced by equally competent teachers as experienced teachers are unlikely to be the ones leaving in large enough numbers to make a significant difference. If this is the case it would explain how salary could influence retention as was asserted by Ingersoll (2001) but not impact student achievement. If we assume teacher quality matters, this study indicates the best teachers do not necessarily gravitate towards the districts with the best pay, or if they do, interview/hiring processes may lack the efficiency needed to separate the best teachers from the mediocre ones. Third, if we accept Monk's (2007) attractiveness theory, then we might assume that most districts may be cognizant of the wages being offered by their neighbors in the region and offer salaries that are competitive in light of the other elements that make a district attractive. Thus, making decisions to transfer within-region more dependent on the other attractiveness other attributes.

Wealth

While wealth was not initially intended as a main effect variable because it lies outside of the control of a district's leadership, it clearly has the largest impact on student achievement of any of the studied variables. In fact, the correlation between wealth and student achievement when measured by composite index was equal to that of teacher salary. However, when wealth is measured by either median household income or fiscal stress, the correlation doubles making wealth, as predicted by median household income or fiscal stress, by far the largest predictor of student achievement. Unfortunately, while a district's wealth has the largest impact on a child's education the wealth of a district is largely outside the control of division's leadership.

Composite index is currently the measurement of wealth used by the state of Virginia to determine the amount of state funding each school division receives. The intent is for state aide to level the playing field and minimize the disadvantages experienced by the poorest districts relative to their wealthier counterparts. Presently, the success of this is limited as the poorest districts are still spending less money per pupil than the state average. While wealth is clearly the most important predictor of student achievement, composite index may not be effectively serving its intended purpose in measuring wealth and fairly distributing state funding. Wealth, if measured by either median household income or fiscal stress exhibits twice the correlation with student achievement as it does when measured by composite index. While a slightly lower correlation for composite index may be expected as it is the current formula used to level the playing field, the magnitude of its difference compared to median household income and fiscal stress indicates many students are left behind under the current funding system. If the goal behind the current sliding scale for the amount of state funding a district receives is to even the playing field, it is not successful as the least wealthy divisions exhibit the lowest student achievement. Consequently, it may be time to revisit

Virginia's funding formula in order to ensure it is serving its intended purpose of providing all children with an equal opportunity for education.

Moderating Effects

These findings do not support the moderating effect of either population density or wealth. However, both produced main effects on student achievement, indicating that divisions in rural and urban and less wealthy areas score lower on student achievement than divisions in suburban and wealthy divisions. These main effects are consistent with prior research on population density by Greenlee & Brown (2009), Jacobs (2007), Jimerson (2007), and Monk (2007), who noted the disadvantages faced by rural and urban districts and of Charlotte Advocates for Education (2004), Clark Martorell and Rockoff (2009), Greenlee and Brown (2009), O'Donnell and White (2003), and Payne (2003, 2009) who noted the disadvantages faced by less affluent districts.

Limitations

While this study takes a comprehensive look at personnel spending, it does have some limitations. First, only a single measure, SOL test scores was used to measure student achievement. While this is a standardized measure selected because it is the most important measure for Virginia's educators, it is only a single measure and the small standard deviation of scores indicates most divisions have managed to attain comparable proficiencies.

Second, this study measures personnel spending as it currently is and not how it would be impacted by changes. If educational leaders have correctly adjusted spending to meet the local needs of their divisions, then we could expect all divisions to get similar results thus not providing us with insight into what would happen if a district experienced either a substantive increase in spending, or what is more likely, substantive spending cuts. The practical implications of this knowledge would be useful to educational leaders to help them advocate for level or increased funding and to help them plan intelligently if cuts are unavoidable.

Future Directions

While teacher salary was a significant predictor of student achievement, the lack of significant interactions between wealth or population density and teacher salary indicates the need to pay teachers a higher salary does not vary based on a district's wealth or population density. Correlations within region were nearly identical to those across the state indicating paying higher salaries relative to the region also does not result in higher student achievement. However, teacher salary is by itself, a significant predictor of student achievement. Future research is needed to determine exactly how salary plays a role in attracting the best teachers or if it is not a large factor, as is suggested by the minimal slope teacher salary exhibited in Table 4, what does attract the best teachers to the best schools?

The lack of difference between within region correlations and those from across the state makes it possible that either the interview/hiring process lacks the effectiveness needed to identify the best teachers or that salary is only one element of a larger set of working conditions that make a person want to work in a particular division. Further research on both hiring and on the importance of salary as a part of working conditions could help explain the reason correlations with in region were no different than those across the state.

A district's status as "rural" was consistently found to have a negative impact on student achievement. Future research is needed to determine specifically what elements of a division's status as rural are having a negative impact on student achievement. From there, research should focus on what kinds of programs can mitigate those effects to help students in rural districts perform as well as their non-rural peers.

This study took a fairly broad look at personnel from the perspective of finding the optimum mix. Future research should examine the impact of different personnel allocations with in the schools. For example, there may be an advantage in having elementary classes as small as 10 while high school classes of 30 may be fine. Previous experimental design studies on class size that have found a positive relationship between class size and student achievement (Figlio, 1998, Jepson & Rivkin, 2009, Mosteller, 1995) all either examined a narrow grade level or had potential problems caused by students switching between control and treatment groups. Future research should use a large sample of data from divisions nationally and break down average class size per grade level in order to determine if smaller classes are or are not more advantageous for some grade levels than others.

Given the lack of impact found by spending inputs in this study, it is possible personnel costs are somewhat fixed and districts are unable to meaningfully reduce their current personnel costs without the perception of catastrophe. Future research should examine budgets across many school systems in order to identify what costs are variable (based on some divisions being able to do without various line-items) and which costs are fixed (based on all divisions spending at comparable levels). Once identified, the impact of those variable costs can be measured against student achievement to determine how adjusting those costs impacts student achievement.

Finally and most importantly, this study highlights that nothing currently in place is solving the problems posed by economic inequality. Consequently, something must be tried and measured to remedy the fact that a district's wealth is the largest predictor of student achievement. While in a perfect world, a significant increase in state funding would be applied to poorer districts to see if an increase in spending could affect the problems posed by inequality, a more practical solution is to identify the specific problems caused by inequality and design specific programs to target those problems and measure their impact.

Conclusion

As the majority of any school system's budget is spent on personnel, this study examined the effects of specific personnel spending inputs on student achievement within the context of wealth, population density, and region. Findings indicated the only inputs with a significant impact on student achievement were principal and teacher salary. These finding did not vary whether examined relative to a regional average or across the entire state indicating it is not crucial for school division leaders to outspend their neighbors. Furthermore, none of the interactions between the main spending inputs and population density or wealth were significant indicating wealth and population density do not serve as moderators for the studied spending inputs. However, a division's status as rural, and to a greater extent the wealth of a district do serve as predictors of student achievement. While per-pupil expenditures as an input were not correlated with student achievement the poorest districts are spending less than the state average making it unknown how additional spending could help the poorest districts overcome the effects of inequality. Given the overwhelming impact a district's wealth has on test scores, it is a problem state education leaders need to address.

The current funding formula needs to be changed in order to provide equal educational opportunities to students from less affluent backgrounds. This is not currently the case as wealth exhibits the strongest correlation with student achievement. Theoretically, state funding should serve to level the playing field and offset the ill effects of low-wealth on student achievement. This is not currently the case as the poorest districts spend less money per-pupil than the state average. Fixing this problem will require our state leaders to re-think the way state funds are distributed. The way wealth is measured is the place to start this conversation as median household income and fiscal stress exhibit twice the correlation with student achievement as composite index indicating many students are left behind under the current system. A starting point for designing a new system may be the fiscal stress index as it indicates the amount of additional revenue a locality is capable of raising thus identifying districts that could offset a drop in state funding by raising additional money and those who lack the capability to raise any additional money. By implementing a different formula for determining funding, we may be able to take steps to mitigate the impact of wealth on student achievement thus allowing all students to have equal student achievement opportunities.

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Appendix Tables 2-22

Table 2
Table of Descriptive Statistics

	M	*SD*
Per Pupil Expenditures	1.12	.20
Average Teacher Salary	4.82	6.43
Average Principal Salary	8.62	1.50
Pupil Teacher Ratio	12.12	1.51
Pupil/Support Personnel Ratio	57.07	18.94
Composite Index	.39	.15
Median Household Income	5.27	1.90
Fiscal Stress	99.99	3.64
Reading Scores	.77	.07
Math Scores	.77	.07

Note: N=132, Per pupil expenditures, average teacher salary, average principal salary, and median household income are expressed in units of $10,000.

Table 3.

Table of Pearson correlations for all research variables.

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Math Score												
2. Reading Score	.86*		.									
3. Per Pupil Expenditures	.05	.02										
4. Teacher Salary	.24*	.22*	.50*									
5. Principal Salary	.22*	.16	.38*	.85*								
6. Pupil/Teacher Ratio	.06	.10	-.55*	.29*	.27*							
7. Pupil/Support Personnel Ratio	.08	.05	-.38*	.07	.09	.53*						
8. Urban	-.02	-.08	.20*	.43*	.40*	.14	.04					
9. Rural	-.19*	-.18*	-.07	-.44*	-.50*	-.24	-.09	-.35*				
10. Composite Index	.24*	.21*	.68*	.48*	.40*	-.31*	-.29*	.07	-.12			
11. Median Household Income	.40*	.45*	.24*	.74*	.75*	.33*	.11	.28*	-.46*	.48*		
12. Fiscal Stress	-.46*	-.50*	-.37*	-.49*	.47*	.00	.07	.08	.19*	-.71*	-.75*	

*Note: N=132, *P<.05*

Table 4

Simple linear regression slopes for per-pupil expenditures (PPE), average teacher salary (ATS), average principal salary (APS), pupil/teacher ratio (PTR) and pupil/support personnel ratio (PSPR).

	Math				Reading			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
PPE	.02	.03	.54	.59	.01	.03	.19	.85
ATS	.03	.01	2.77	.01*	.02	.01	2.57	.01*
APS	.01	.00	2.67	.01*	.01	.00	1.88	.06
PTR	.00	.00	.66	.51	.00	.00	1.12	.27
PSPR	.00	.00	.89	.38	.00	.00	.54	.59

*Note. *p<.05, PPE, ATS, and APS are in units of $10,000.*

Table 5

MLR Regression Results for Average Teacher Salary (ATS), Average Principal Salary (APS), Pupil/Teacher Ratio (PTR) and Pupil/Support Personnel Ratio (PSPR) on Math (a) and Reading (b) Scores

	Model 1a				Model 2a				Model 3a				Model 4a			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
ATS	.03	.01	2.77	.01*	.02	.02	1.01	.28	.02	.02	1.01	.28	.02	.02	1.17	.24
APS					.00	.01	.43	.67	.00	.01	.44	.66	.00	.01	.40	.69
PTR									.00	.00	-.14	.89	.00	.01	-.60	.55
PSPR													.00	.00	.90	.37
R^2		.06				.06				.06				.06		
F for R^2 Change		7.68				.19				.02				.82		

	Model 1b				Model 2b				Model 3b				Model 4b			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
ATS	.02	.04	2.53	.01*	.03	.02	1.73	.09	.03	.02	1.67	.10	.03	.02	1.67	.09
APS					.00	.01	-.48	.64	.00	.01	-.50	.62	.00	.01	-.50	.62
PTR									.00	.00	.46	.65	.00	.01	.29	.77
PSPR													.00	.00	.19	.85
R^2		.05				.05				.05				.05		
F for R^2 Change		6.38				.23				.21				.04		

*Note: N=132, *p<.05, ATS and APS are expressed in units of $10,000.*

Table 6

Table of Pearson Correlations

	State-Wide		Within Region	
Variable	Math	Reading	Math	Reading
Per Pupil Expenditures	.05	.01		
Average Teacher Salary	.24*	.22*	.21*	.24*
Average Principal Salary	.22*	.16	.21*	.18*
Pupil Teacher Ratio	.06	.10	.01	.08
Pupil/Support Personnel Ratio	.08	.05		
Composite Index	.24*	.21*		
Median Household Income	.40*	.45*		
Fiscal Stress	.46*	.50*		
Rural	-.19*	-18*		
Urban	-.02	-.08		

*Note: N=132, *p<.05*

Table 7

MLR Regression Results for Population Density as a Moderator of Per-Pupil Expenditure (PPE) on Math (a) and Reading (b) Scores

	Model 1a				Model 2a				Model 3a			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
PPE	.02	.00	.54	.59	.02	.03	.62	.54	-.02	.05	-.29	.77
Urban					-.02	.02	-1.19	.24	-.03	.02	-.13	.18
Rural					-.03	.01	-2.40	.02*	-.03	.01	-.23	.02*
Interaction Rural X PPE									.04	.08	.48	.63
Interaction Urban X PPE									.08	.08	1.00	.32
R^2		.00				.04				.05		
F for R^2 Change		.29				2.96				.50		

	Model 1b				Model 2b				Model 3b			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
PPE	.01	.03	.19	.85	.01	.03	.40	.69	-.04	.05	-.75	.45
Urban					-.03	.02	1.80	.07	-.04	.02	-2.19	.03*
Rural					-.03	.01	-2.60	.01*	-.03	.01	-2.58	.01*
Interaction Rural X PPE									.03	.07	.46	.65
Interaction Urban X PPE									.13	.07	1.80	.07
R^2		.00				.06*				.08		
F for R^2 Change		.04				3.94*				1.71		

*Note: N=132, *p<.05, PPE is expressed in units of $10,000.*

Table 8

MLR Regression Results for Population Density as a Moderator of Average Teacher Salary (ATS) on Math (a) and Reading (b) Scores

	Model 1a				Model 2a				Model 3a			
Variable	*b*	*Se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
Teacher Salary	.03	.01	2.77	.01*	.03	.01	2.55	.01	.01	.00	.81	.42
Urban					-.02	.01	-1.40	.16	-.02	.02	-1.17	.25
Rural					-.04	.02	-1.90	.06	-.05	.02	-2.17	.03*
Interaction Urban X ATS									.03	.02	1.17	.24
Interaction Rural X ATS									.02	.03	.66	.51
R^2		.06				.09				.10		
F for R^2 Change		7.68				2.39				.72		

	Model 1b				Model 2b				Model 3b			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
Teacher Salary	.02	.01	2.53	.01*	2.67	.01	2.56	.01*	.02	.02	1.26	.21
Urban					-.02	.01	-1.65	.10	-.03	.02	-2.04	.04*
Rural					-.05	.02	-2.58	.01*	-.06	.02	-2.93	.00*
Interaction Urban X ATS									.03	.02	1.11	.27
Interaction Rural X ATS									-.02	.03	-.63	.53
R^2		.05				.10				.12		
F for R^2 Change		6.38				4.00				1.20		

*Note: N=132, *p<.05, ATS is expressed in units of $10,000.*

Table 9

MLR Regression Results for Population Density as a Moderator of Average Principal Salary (APS) on Math (a) and Reading (b) Scores

	Model 1a				Model 2a				Model 3a			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
Average Principal Salary	.01	.00	2.57	.01*	.01	.01	2.11	.04*	.01	.01	1.12	.26
Urban					-.32	.02	-1.64	.10	-.04	.02	-1.63	.11
Rural					-.02	.02	-1.31	.19	-.02	.02	-1.26	.21
Inter. Urban X APS									.01	.01	.42	.67
Inter. Rural X APS									.00	.01	.06	.95
R^2		.05				.08				.08		
F for R^2 Change		6.62				1.87				.01		

	Model 1b				Model 2b				Model 3b			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
Average Principal Salary	.01	.00	1.88	.06	.01	.01	1.50	.14	.01	.01	1.39	.17
Urban					-.04	.02	-2.14	.03*	-.05	.02	-2.27	.03*
Rural					-.02	.01	-1.76	.08	-.04	.02	-2.42	.02*
Inter. Urban X APS									.00	.01	.35	.73
Inter. Rural X APS									-.02	.01	-1.54	.13
R^2		.03				.07				.10		
F for R^2 Change		3.51				3.26				1.72		

*Note: N=132, *p<.05, APS is expressed in $10,000 units.*

Table 10

MLR Regression Results for Population Density as a Moderator of Pupil/Teacher Ratio (PTR) on Math (a) and Reading (b) Scores

	Model 1a				Model 2a				Model 3a			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
PTR	.00	.00	.66	.51	.00	.00	.24	.81	.00	.01	.11	.91
Urban					-.02	.02	-1.10	.27	-.02	.02	-1.12	.27
Rural					.03	.01	-2.30	.02*	-.03	.01	-2.28	.03*
Interaction Rural X PTR									.00	.01	.25	.81
Interaction Urban X PTR									.00	.01	-.03	.98
R^2		.00				.44				.44		
F for R^2 Change		.44				2.77				.04		

	Model 1b				Model 2b				Model 3b			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
PTR	.00	.00	1.12	.27	.00	.00	.77	.44	.01	.01	.99	.33
Urban					-.03	.02	-1.84	.07	-.03	.02	-1.55	.12
Rural					-.03	.01	-2.42	.02*	-.03	.01	-2.39	.02*
Interaction Rural X PTR									-.01	.01	-.66	.51
Interaction Urban X PTR									-.00	.01	-.42	.68
R^2		.01				.06				.07		
F for R^2 Change		1.25				3.55				.25		

*Note: N=132, *p<.05*

Table 11

MLR Regression Results for Composite Index (CI) as a Moderator of Per-Pupil Expenditure (PPE) on Math (a) and Reading (b) Scores

	Model 1a				Model 2a				Model 3a			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
PPE	.02	.03	.54	.59	-.08	.04	-1.86	.07	-.12	.05	1.40	.03*
Composite Index					.19	.06	3.35	.00*	.17	.06	3.04	.00*
Interaction CI X PPE									.19	.16	-1.52	.25
R^2		.00				.08				.09		
F for R^2 Change		.29		.59		11.25*		.00*		1.35		.14

	Model 1b				Model 2b				Model 3b			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
PPE	.01	.03	.19	.85	-.08	.04	-1.99	.05*	-.13	.05	-2.74	.02*
Composite Index					.16	.05	3.15	.00*	.14	.05	2.70	.01*
Interaction CI X PPE									.28	.15	1.88	.06
R^2		.00				.07				.10		
F for R^2 Change		.04				9.94*				3.55		

*Note: N=132, *p<.05, PPE is in units of $10,000*

Table 12

MLR Regression Results for Median Household Income as a Moderator of Per-Pupil Expenditure on Math (a) and Reading (b) Scores

	Model 1a				Model 2a				Model 3a			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
PPE	.02	.03	.54	.59	-.02	.03	-.63	.53	-.02	.03	-.49	.62
Median Household Income					-.02	.00	4.92	.00*	.02	.00	4.65	.00*
Interaction MHI X PPE									-3.37	.01	-.31	.76
R^2		.00				.16				.16		
F for R^2 Change		.29				24.23				.06		

	Model 1b				Model 2b				Model 3b			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
PPE	.01	.03	.19	.85	-.03	.03	-1.22	.22	-.04	.03	-1.34	.18
MHI					.02	.00	5.20	.00*	.02	.00	5.20	.00*
Interaction MHI X PPE									.01	.01	.59	.55
R^2		.00				.21				.21		
F for R^2 Change		.04				35.65				.35		

*Note: N=132, *p<.0, PPE is in units of $10,000*

Table 13

MLR Regression Results for Fiscal Stress as a Moderator of Per-Pupil Expenditure on Math (a) and Reading (b) Score.

	Model 1				Model 2				Model 3			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
PPE	.02	.03	.54	.59	-.05	.03	-1.68	.10	.22	.62	.35	.73
Fiscal Stress					-.01	.00	-6.12	.00*	-.01	.00	-5.68	.00*
Int. Fiscal Stress X PPE									.00	.01	-.43	.67
R^2		.00				.23				.29		
F for R^2 Change		.29				37.49				.19		

	Model 1				Model 2				Model 3			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
PPE	.01	.03	.19	.85	-.06	.03	-2.37	.02*	-.07	.55	1.25	.21
Fiscal Stress					-.01	.00	-7.05	.00*	-.01	.00	-6.31	.00*
Int. Fiscal Stress X PPE									-.01	.01	-1.37	.17
R^2		.00				.28				.29		
F for R^2 Change		.04				49.65				1.89		

*Note: N=132, *p<.05, PPE is in units of $10,000*

Table 14

MLR Regression Results for Composite Index (CI) as a Moderator of Average Teacher Salary (ATS) on Math (a) and Reading (b) Scores.

	Model 1a				Model 2a				Model 3a			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
Average Teacher Salary	.03	.01	2.77	.01*	.02	.01	1.62	.12	.03	.00	1.88	.06
Composite Index					.08	.05	1.70	.09	.09	.05	1.85	.07
Int. CI X ATS									-.05	.05	-.97	.34
R^2		.06				.08				.08		
F for R^2 Change		7.68				2.88				.19		

	Model 1b				Model 2b				Model 3b			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*Se*	*t*	*p*
Average Teacher Salary	.02	.01	2.53	.01*	.02	.01	1.55	.12	.01	.01	1.13	.26
Composite Index					.06	.04	1.39	.17	.06	.04	1.25	.22
Int. CI X Teach. Salary									.02	.04	.56	.58
R^2		.05				.06				.07		
F for R^2 Change		6.38				1.92				.88		

*Note: N=132, *p<.05, Average Teacher Salary is in units of $10,000.*

Table 15

MLR Regression Results for Median Household Income (MHI) as a Moderator of Average Teacher Salary on Math (a) and Reading (b) Scores

	Model 1a				Model 2a				Model 3a			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
Average Teacher Salary	.03	.01	2.77	.01*	-.02	.01	1.08	.28	.01	.02	-.68	.50
MHI					.02	.01	4.10	.00*	.02	.01	4.25	.00*
Int. MHI X ATS									.00	.00	-1.11	.27
R^2		.06				.17				.17		
F for R^2 Change		7.68				16.86				1.11		

	Model 1b				Model 2b				Model 3b			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*Se*	*t*	*p*
Average Teacher Salary	.02	.01	2.53	.01*	-.03	.01	-2.28	.02*	-.03	.01	-2.10	.04*
MHI					.02	.00	5.61	.00*	.02	.00	5.39	.00*
Int. MHI X ATS									.00	.00	-.14	.89
R^2		.05				.23				.23		
F for R^2 Change		6.38				31.48				.01		

*Note: N=132, *p<.05, Average Teacher Salary is in units of $10,000.*

Table 16

MLR Regression Results for Fiscal Stress (FS) as a Moderator of Average Teacher Salary (TS) on Math (a) and Reading (b) Scores

	Model 1a				Model 2a				Model 3a			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
Average Teacher Salary	.03	.01	2.77	.01*	.00	.01	.18	.86	-.02	.19	-1.07	.29
Fiscal Stress					-.01	.00	-5.02	.00*	-.01	.00	-5.14	.00*
Int. FS X TS									.00	.00	1.08	.28
R^2		.06				.21				.22		
F for R^2 Change		7.68				25.23				1.16		

	Model 1b				Model 2b				Model 3b			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
Average Teacher Salary	.02	.01	2.53	.01*	.00	.01	-3.90	.69	.04	.17	.25	.81
Fiscal Stress					-.01	.00	-5.87	.00*	-.01	.00	-5.72	.00*
Int. FS X TS									.00	.00	-.27	.79
R^2		.05				.25				.25		
F for R^2 Change		6.38				34.43				.07		

*Note: N=132, *p<.05, Average Teacher Salary is in $10,000 units.*

Table 17

MLR Regression Results for Composite Index (CI) as a Moderator of Average Principal Salary (APS) on Math (a) and Reading (b) Scores

	Model 1a				Model 2a				Model 3a			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
Average Principal Salary	.01	.00	2.57	.01*	.01	.01	1.59	.11	.01	.01	2.00	.05*
Composite Index					.09	.05	1.95	.05*	.01	.05	2.11	.04*
Int. CI X APS									-.03	.02	-1.42	.16
R^2		.05				.08				.09		
F for R^2 Change		6.62				3.81				2.00		

	Model 1b				Model 2b				Model 3b			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
Average Principal Salary	.01	.00	1.88	.06	.00	.00	.09	.32	.00	.01	.81	.42
Composite Index					.08	.04	.17	.07	.07	.04	1.77	.08
Int. CI X APS									.01	.02	.31	.76
R^2		.03				.05				.05		
F for R^2 Change		3.52				3.31				.10		

*Note: N=132, *P<.05, Average Principal Salary is in $10,000 units.*

Table 18

MLR Regression Results for Median Household Income (MHI) as a Moderator of Average Principal Salary (APS) on Math (a) and Reading (b) Scores

	Model 1a				Model 2a				Model 3a			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
APS	.01	.00	2.57	.01*	-.01	.01	-1.47	.15	-.01	.01	-1.18	.26
MHI					.02	.01	4.37	.00*	.02	.01	4.50	.00*
Int. MHI X APS									-.00	.00	-1.12	.26
R^2		.05				.17				.18		
F for R^2 Change		6.62				19.11				1.26		

	Model 1b				Model 2b				Model 3b			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
APS	.01	.00	1.88	.06	-.01	.01	-3.55	.00*	-.02	.01	-3.47	.00*
MHI					.02	.00	6.63	.00*	.03	.00	6.20	.00*
Int. MHI X APS									.00	.00	.11	.91
R^2		.03				.27				.27		
F for R^2 Change		3.51				43.94				.01		

*Note: N=132, *p<.05, Average Principal Salary is in $10,000 units.*

Table 19

MLR Regression Results for Fiscal Stress (FS) as a Moderator of Average Principal Salary (APS) on Math (a) and Reading (b) Scores

	Model 1a				Model 2a				Model 3a			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
APS	.01	.00	2.57	.01*	.00	.00	.04	.97	-.08	.03	-1.03	.31
Fiscal Stress					-.01	.00	-5.14	.00*	-.01	.00	-5.23	.00*
Int. FS X APS									.00	.00	1.03	.30
R^2		.05				.21				.22		
F for R^2 Change		6.62				26.39				1.07		

	Model 1b				Model 2b				Model 3b			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
APS	.01	.00	1.88	.06	.00	.00	-1.10	.28	.05	.07	.77	.44
Fiscal Stress					0.01	.00	-6.27	.00*	-.01	.00	-6.11	.00*
Int. FS X APS									.00	.00	-.84	.40
R^2		.03				.25				.26		
F for R^2 Change		3.51				39.30				.70		

*Note: N=132, *p<.05, Average Principal Salary is in $10,000 units.*

Table 20

MLR Regression Results for Composite Index (CI) as a Moderator of Pupil/Teacher Ratio (PTR) on Math (a) and Reading (b) Scores

	Model 1a				Model 2a				Model 3a			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
PTR	.00	.00	.66	.51	.01	.00	1.65	.10	.01	.00	1.58	.12
Composite Index					.14	.04	3.21	.00*	.14	.05	2.79	.01*
Int. CI X PTR									.00	.03	.13	.90
R^2		.00				.08				.08		
F for R^2 Change		.44				10.30				.09		

	Model 1b				Model 2b				Model 3b			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
PTR	.00	.00	1.12	.27	.01	.00	2.00	.05*	.01	.00	1.83	.07
Composite Index					.12	.04	2.96	.00*	.13	.05	2.88	.01*
Int. CI X PTR									.02	.02	.69	.50
R^2		.01				.07				.07		
F for R^2 Change		1.25				8.76				.11		

*Note: N=132, *p<.05*

Table 21

MLR Regression Results for Median Household Income (MHI) as a Moderator of Pupil/Teacher Ratio (PTR) on Math (a) and Reading (b) Scores

	Model 1a				Model 2a				Model 3a			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
PTR	.00	.00	.66	.51	.00	.00	-.95	.34	.00	.00	-.83	.39
MHI					.02	.00	4.97	.00*	.02	.00	4.97	.00*
Int. MHI X PTR									.00	.00	-.43	.67
R^2		.00				.16				.16		
F for R^2 Change		.44				24.65				.19		

	Model 1b				Model 2b				Model 3b			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
PTR	.00	.00	1.12	.27	.00	.00	-.54	.59	.00	.00	-.50	.62
MHI					.02	.00	5.64	.00*	.02	.00	5.67	.00*
Int. MHI X PTR									.00	.00	-.74	.46
R^2		.01				.21				.21		
F for R^2 Change		1.25				31.86				.55		

*Note: N=132, *p<.05, Median Household Income is in $10,000 units*

Table 22

MLR Regression Results for Fiscal Stress (FS) as a Moderator of Pupil/Teacher Ratio (PTR) on Math (a) and Reading (b) Scores

	Model 1a				Model 2a				Model 3a			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*
PTR	.00	.00	.66	.51	.00	.00	.76	.45	.03	.12	.25	.80
Fiscal Stress					0.01	.00	-.46	.00*	-.01	.00	-5.62	.00*
Int. FS X PTR									.00	.00	-23	.82
R^2		.00				.21				.21		
F for R^2 Change		.44				34.48				.05		

	Model 1b				Model 2b				Model 3b			
Variable	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*p*	*b*	*se*	*t*	*P*
PTR	.00	.00	1.12	.27	.00	.00	1.30	.59	.06	.10	.54	.59
Fiscal Stress					0.01	.00	-6.55	.00*	-.01	.00	-6.35	.00*
Int. FS X PTR									-.00	.00	-.49	.62
R^2		.01				.26				.26		
F for R^2 Change		1.25				42.85				.24		

*Note: N=132, *p<.05*