

FISCAL EFFORT AND EDUCATIONAL EFFICIENCY IN VIRGINIA DURING THE
2012-2013 ACADEMIC YEAR

by

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Dedication

This is dedicated to my wife, Monique, whose encouragement and support made this possible.

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List of Abbreviations

Local Composite Index	LCI
Educational Efficiency	EE
Fiscal Effort	FE
Virginia Department of Education	VDOE
Modified Quadriform Analysis	MQA

Abstract

FISCAL EFFORT AND EDUCATIONAL EFFICIENCY IN VIRGINIA DURING THE 2012-2013 ACADEMIC YEAR

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This study examines fiscal effort and educational efficiency in Virginia's school divisions during the 2012-2013 academic year. This analysis considers multiple educational inputs and outputs, as well as school division spending behaviors and community characteristics. The disparity of fiscal effort amongst local school divisions in Virginia is analyzed. This measure is combined with an educational efficiency metric that identifies school divisions that are maximizing their educational outputs relative to their fiscal inputs. These metrics are examined in an attempt to find commonalities amongst school divisions with similar levels of fiscal effort and educational efficiency in order to identify exemplars that can shape future fiscal policy and funding methods. Results show that there is great disparity among school divisions in Virginia in terms of their fiscal effort, and that these differences are not systematically related to such metrics as poverty rate, geographic location, or wealth, suggesting that differences are largely related to local

policy and decision making choice related to spending. Analyses show, further, that school divisions that are most efficient in their spending chose to devote greater proportions of their resources on factors that relate to teachers and teaching directly. Findings suggest that research on fiscal effort may be a fruitful path for further research, and measures of efficiency promise to reveal important patterns that have implications for research and policy at the state and local levels.

Chapter One

In the current economic climate, and given the foreseeable future of fiscal constraints in public school education, it is essential for school divisions to be able to make informed decisions about school funding that best meet the needs of their students, employees, and the community. School leaders and decision makers will need to consider the anticipated impact of inputs such as funding, human capital, and infrastructure and their effect on the key output of student achievement. Additionally, reflection will need to occur that examines the predicted outcomes compared to actual outcomes as well as the various short-term and long-term effects of funding-related decisions.

As leaders of public sector organizations, decision makers in school systems are called on to be good stewards of public resources. In the current era of declining resources it is imperative to examine the impact of various expenditures relative to outcomes produced, with an eye on the opportunity cost of each decision. Particularly when the size of the fiscal pie stagnates or even shrinks, it is critical to understand how that pie is divided and to what extent spending decisions bear fruit.

At first glance, there seems to be a simple answer to this dilemma. *Schools need more money. With more money, students will do better. More money is always better.* But research has shown that it is not that simple. There is over thirty years of research that either agrees with this sentiment or completely refutes it (Hanushek, 1986; Jackson,

Johnson & Perisco, 2014), depending on the study. Both sides of this argument often have statistically significant empirical evidence to support their case. To further complicate the spending issue, school leaders need to ensure that the manner in which they are spending their funds is equitable and cost-effective.

One of the primary challenges faced by policy makers who are interested in an efficient and equitable school finance system is determining the actual cost of an adequate education for all students. Assuming that this can be accurately determined, it is imperative that there are reliable methods to measure the effectiveness of the resources that are being allocated to local education funding. Production functions, the costing-out method, the cost-function estimation technique, and return-on-investment methods all attempt to account for price difference and the demands of different groups of students, and measure efficiency of school division spending. Additionally, because of the nature of the accounting procedures in education, it is often very difficult to determine accurate costs for specific programs (Levin & McEwan, 2001).

Regardless of these difficulties, decision makers must be able to determine if the allocated funds are having the intended impact and are being effectively and efficiently utilized. School leaders must decide which inputs are valued and should be allocated funds and they also must establish methods that determine the success and value of a program's outputs (Lewis, 1990). Researchers and school leaders struggle with both of these equally important parts of cost-effectiveness.

This research attempts to approach this challenge from a different perspective and utilizes two measures to explore the impact of school resources on the educational

outputs of school divisions. This study investigates the levels of fiscal effort (FE) and educational efficiency (EE) in Virginia's school divisions during the 2012-2013 academic year. Because of the complexity of this type of analysis, multiple educational inputs and outputs, as well as alterable and unalterable factors, are examined in an attempt to find commonalities amongst school divisions with similar levels of fiscal effort and educational efficiency (Calzini, 2011). The relative nature of this type of analysis can provide policy makers with a basic method to compare the productivity of school divisions (Houck, Rolle & He, 2010). The findings of this type of examination are desirable because the common practices of highly efficient school divisions can then be used to guide and shape future fiscal policy and funding methods.

There is an existing body of research that examined the efficiency of spending decisions in many educational settings (e.g., Indiana, Texas, Georgia, Virginia) and developed an initial understanding of common characteristics amongst efficient school divisions (Anderson, 1996; Calzini, 2011; Hickrod, 1989, 1990; Houck, Rolle & He, 2010; Rolle, 2000; Stevens, 2006). Additionally, there have been several studies on the state and national level that investigate fiscal effort and its impact on specific educational outputs such as graduation rates (Cedo, 2014; Johnson, 2014).

The inclusion of educational efficiency measures in this study will allow school divisions to be identified that make appropriate progress relative to the financial support they receive as well as identify those divisions that do more with less. By including fiscal effort in this study, the relative importance localities place on education can be

investigated. Combining the fiscal effort and educational efficiency measures will allow exemplar school divisions to be identified.

There is something to be learned about student achievement from the way the school divisions in Virginia choose to utilize their funding. Because funding is at such a premium in these difficult financial times, specific and targeted decisions are being made about how to allocate limited budgets. This research attempts to identify these intentional decisions and explore their generalizability in school divisions throughout Virginia.

Purpose

This research explores educational funding decisions by local school divisions to determine if they produce results that, when combined with an appropriate level of fiscal effort by a locality, are effective and efficient in a relative sense (Houck, Rolle & He, 2010). Fiscal effort is a measure of a locality's fiscal commitment to education that is calculated with a ratio between total school division expenditures and local resources and wealth. This measure can be an indicator of how much education is a driver of a locality's fiscal policy and how it is allocated when compared to other school divisions in Virginia. Additionally, it will investigate if there are specific factors associated with school divisions that have high levels of fiscal effort or educational efficiency and if there are any possible correlations between a school division's fiscal effort and educational efficiency.

This study attempts to identify commonalties and specific characteristics of school divisions in Virginia that balance fiscal effort and educational efficiency with high

levels of student achievement. The following research questions are addressed in this study:

1. What is the level of disparity in fiscal effort (FE) at the school division level in Virginia during the 2012-2013 academic year?
2. What is the educational efficiency (EE) of school divisions in Virginia during the 2012-2013 academic year?
3. What commonalties in resource allocation are displayed between school divisions with similar levels of educational efficiency?
4. Is there a correlation between fiscal effort and educational efficiency in Virginia school divisions during the 2012-2013 academic year?

Significance

The intended audience for this research is school board members, superintendents, division-level leaders, local tax authorities, and state-level policy makers. The relative nature of this analysis can provide policy makers with a basic method to compare the productivity of school divisions (Houck, Rolle & He, 2010). This research will also be of value for policy makers because it will identify divisions that are highly effective *and* have high returns on investment and it will pinpoint what spending behaviors and characteristics contributed to getting them to that level. These exemplar divisions can be the starting point for the creation of responsible and successful fiscal policies in these difficult financial times. Additionally, the levels of educational efficiency and fiscal effort used in this financial analysis can help determine strengths and weaknesses in the state funding policies as well as identify local spending outliers. The fiscal policy of these

exemplar divisions can be models of what to do in the future or warnings of mistakes that should not be repeated.

This study will add to the growing body of research that uses a relative approach to determine educational productivity. It will complement previous research that has been conducted in Texas, Indiana, Georgia, and Virginia (Calzini, 2011; Houck, Rolle & He, 2010; Rolle, 2000; Stevens, 2006). It will provide a more recent analysis of achievement data in Virginia through the lens of educational efficiency. This study will be the first to examine the possible relationship between local fiscal effort and school division productivity in Virginia.

The findings from this study have implications for local school division leaders as well as local and state policy makers. *Fiscal Effort* is an important measure for the local taxing authorities to monitor as they decide how to allocate a locality's fiscal capacity. It is also an important measure for local school boards and superintendents to monitor so they can properly advocate for increased funding for their school division.

The findings revealed by the educational efficiency measures used in this study have several practical implications. In the immediate future, inefficient school divisions can improve their efficiency by altering specific local spending decisions. Over time, state policy makers could consider some of the efficiency indicators when updating the Local Composite Index and the Standards of Quality.

Methodology Overview

The analyses in this study will utilize two measures, with the school division serving as the unit of analysis. The first measure, fiscal effort, compares local wealth to

educational expenditures. Wealth is measured using a composite of a division's property value, gross income, and taxable sales (Owings & Kaplan, 2006; VDOE, 2015). The specific weights of each of these local wealth indicators and the manner in which they are compared to educational expenditures are detailed in Chapter 3.

The second measure that is analyzed in this study is educational efficiency as determined through modified quadriform analysis (MQA). MQA is a method that allows the relative efficiency of a school division to be determined using educational inputs and outputs (Houck, Rolle & He, 2010). This method uses two regressions, one for educational inputs and one for educational outputs. The residuals of these regressions are classified into one of four MQA dimensions: efficient, effective, inefficient, or ineffective (Anderson, 1996; Rolle, 2000; Stevens, 2006). Analysis of variance and regression analysis are then utilized to find common characteristics amongst efficient and effective school divisions. Measuring efficiency in education is a much more complicated task than in the private sector because of the lack of products or outputs that are easy to measure (Anderson, 1996). The modified quadriform is an effective tool because it allows the relationships between educational inputs and outputs to be analyzed.

This study will seek to inform school leaders and policy makers about the challenges divisions in Virginia have balancing funding levels with effective fiscal practices. In the next section, the relevant literature and extant research will be examined. This review of the literature will examine the historical and current context of school funding and the challenges and successes in this area. This research intends to explore if school funding decisions produce results that, when combined with an appropriate level

of fiscal effort by a locality, are achieved in a relatively efficient manner (Houck, Rolle & He, 2010). Additionally, it will be important to investigate if there are specific factors associated with school divisions that have high levels of fiscal effort or educational efficiency and if there are any possible correlations between a school division's fiscal effort and educational efficiency.

Operational Definitions

For the purposes of this research, the following definitions will be used for key terms and topics. Specific details about how these terms will be measured are included.

Achievement: Student performance on standardized tests and other assessments. There are numerous ways to measure student achievement besides standards-based assessments, but the metrics used in this research incorporate student performance on Virginia Standards of Learning (SOL) assessments.

Alterable Factors: Areas and characteristics such as class-sizes, teacher salaries, and instructional expenditures that can be controlled by a school division (Calzini, 2011).

Educational Efficiency: The level of productivity a school division receives from the money they spend. In this study, efficiency will be measured using a modified quadriform analysis that will examine educational inputs and outputs as well as alterable and unalterable school factors. Educational efficiency will be measured relative to other divisions throughout Virginia (Anderson, 1996; Hickrod, 1989, 1990; Houck, Rolle & He, 2010 Rolle, 2000; Stevens, 2006).

Fiscal Effort: A comparison of a division's educational expenditures to their overall ability to pay and local wealth. Fiscal effort (FE) is represented by the

formula $FE = SE/LWpP$, where SE represents school division expenditures during a fiscal year and $LWpP$ is a measure of local wealth per pupil, a composite of a division's property value, gross income, and taxable sales that is divided by the school division's Average Daily Membership (Owings & Kaplan, 2006; VDOE, 2015).

School division (or just "division"): The state of Virginia uses the term "division" to refer to the local education agency, often called "school system" or "school district" in other states. The school division serves as the unit of analysis in this study.

Unalterable Factors: Characteristics such as demographics, poverty, and diversity that cannot be willingly changed by a school division (Calzini, 2011; Houck, Rolle & He, 2010).

Chapter Two

This study explores the relationship between the fiscal decisions made by a school division and the impact of those decisions on the achievement of its students. This relationship is investigated through the lenses of fiscal effort and educational efficiency and the study attempts to identify commonalities amongst school divisions that combine high levels of student achievement with educational efficiency. In the following sections, I present a review of the literature on the impact of resources on student achievement, equitable funding methods, measuring effectiveness in education, school funding in Virginia, fiscal effort, and educational efficiency. This chapter will conclude with the conceptual framework that supports this study. The literature related to these topics will provide a context for the challenges that exist in the areas of efficient school funding, what is already known, and what topics require further investigation.

Impact of Resources

It seems intuitive that more money is the simple answer to the question of how to improve overall school performance. By this logic, a good school can get better or a struggling school can improve with additional funding (Wyckoff, 1992). As obvious as this seems, there is a significant body of research that has demonstrated that a relationship between additional funding and improved achievement does not exist (Hanushek, 1986; Jackson, Johnson & Perisco, 2014). On its own, increased funding does

not appear to guarantee improved student achievement (Hanushek, 1986). This line of research argues that schools do not need more money; they just need to spend the money they do have in the right way (Hanushek, 1997). An underperforming school that suffers from poor instruction and incompetent leadership cannot improve by simply increasing the budget, raising teacher salaries, and buying brand new laptops. The behaviors of the school, teachers and staff must change before any amount of money will make a difference. On the other hand, money may be helpful in creating some needed changes, or more money may serve to attract more qualified personnel; there is conflicting evidence that suggests that additional funding does benefit student academic achievement as well as lifetime outcomes (Jackson et al., 2014). Complicating matters further, school leaders must also consider the levels of equity in their funding decisions. There are numerous high-performing schools or divisions, that when compared to their counterparts are either overfunded or underfunded (Boser, 2014). The same can be found for low-performing divisions.

When researching school performance in California, Wu (2013) discovered that student achievement at the school level was very sensitive to several variables, including the impact of school resources such as class-size, teacher experience, and access to technology. A recent study of school funding within school divisions shows that there is often very little attention paid to how resources are allocated to individual schools (Rubenstein, Schwartz, Stiefel & Amor, 2007). This study identified that although schools with a high percentage of poor students often receive more funding, teachers with less experience and lower salaries typically staff them. This illustrates, in a small way,

the complexity associated with attempting to determine the influence of fiscal resources on school outcomes.

Jimenez-Castellanos (2010) conducted a mixed-methods review of this relationship and found a positive correlation between achievement and resources such as higher teacher salaries and new schools. But he also highlights that there is a significant disparity in the ethnic groups that receive these additional benefits with white students having significantly more access to these resources than English language learners, Latinos, and low-income students. School expenditures have also been found to influence graduation rates and the persistence rate of first-year college students (Webber & Ehrenberg, 2010).

Funding Equity

It is important to understand the mechanisms that determine how much funding a school division receives. Scholars studying funding allocations often assert that “demography is destiny,” that where a child lives determines whether that child attends a school that receives sufficient funding to provide an adequate education. This raises the question: Is there an accurate and practical way to determine if students are receiving reasonably equitable levels of funding, regardless of where they live (Wu, 2013)?

Another key question in this debate is if all funding should be based on equal expenditures per student or be based on the needs (poverty, language, special education) of a specific student population (Iatarola & Stiefel, 2003)?

The primary unit of analysis for much of the available research on equity in school finance has been at the state level. Wyckoff (1992) found that over a seven-year

period between 1980 and 1987, the equality of instructional expenditures by states had an increased level of equity as compared to previous time periods. This study used instructional expenditures as the primary metric of equity. It also utilized several school finance measures including coefficients of variations, Gini coefficients, and the Theil coefficient. Several researchers then began to move their analysis to the division and school level. Roy (2003) explored an overhaul of the school financing system in Michigan during the mid-1990's and found after a greater level of state control was implemented and inter-division spending disparities were decreased, student achievement in the poorest school divisions increased on state assessments, but this increase was not seen on nationwide assessments such as the NAEP.

Iatarola and Stiefel (2003) discussed the predictable finding in their analyses that schools that educate needier and non-white students have less access to school resources and score lower on assessments. An additional study analyzed the inter-division equity in Virginia and found that there is a relationship between available resources and a school division's socioeconomic characteristics, as well as a relationship between school resources and student achievement (Unnever, Kerckhoff & Robinson, 2000).

Education Costs and Effectiveness

One of the primary challenges faced by policy makers that are interested in an efficient and equitable school finance system is determining the actual cost of an adequate education for all students. One approach to determine the appropriate amount of spending is the costing-out method, which solicits inputs from consultants on the resources needed to provide a basic education for all students. Hanushek (2005) states

that one of the main shortcomings of the costing-out system, besides the conflict of interest that is often created by utilizing consultants who are also service providers for the school systems, is that the costing-out exercise “purports to provide something that cannot currently be provided: a scientific assessment of what spending is needed to bring about dramatic improvements in student performance” (p. 73).

An alternative to the costing-out method is the cost-function estimation technique, which attempts to correct for price differences, the demands of different groups of students, and the efficiency of division spending (Costrell, Hanushek & Loeb, 2007). Although it takes a more scientific approach to determining the cost of adequate schooling and avoids the potentially biased estimates of the costing-out method, cost-function estimation still does not prove to be a reliable tool. After controlling for numerous variables, there is still a great deal of variation across divisions in their outcomes for students (Costrell et al., 2007).

The final piece of this fiscal puzzle is determining the effectiveness of spending patterns enacted by schools and divisions. School leaders must decide which inputs are valued and should be allocated funds and they also must establish methods that determine the success and value of a program’s outputs (Lewis, 1990). Researchers and school leaders struggle with both of these equally important parts of cost-effectiveness. Because of the nature of the accounting procedures in education, it is often very difficult to determine accurate costs for specific programs (Levin & McEwan, 2001). Regardless of these difficulties, decision makers must be able to determine if the allocated funds are having an impact and are being effectively and efficiently utilized.

School Funding in Virginia

The Commonwealth of Virginia utilizes a financial equity model that was created to attempt to determine a school division's fiscal capacity to support Virginia's Standards of Quality (SOQ) for education. The Local Composite Index (LCI) was established and codified in 1974 as part of Virginia's Foundation Program. The LCI calculates a division's ability to financially support the SOQ by measuring the number of enrolled students, the value of property in the division, the adjusted gross income of the residents, and the taxable retail sales in the division (Virginia Department of Education, 2012).

The Local Composite Index is a necessary instrument at the state and local level in Virginia to encourage equitable learning environments for all students, but further research is required to verify its effectiveness as a reliable equity tool. During the time period it has been in effect, the LCI has been volatile in its calculations of fiscal capacity and involved in a precipitous drop in fiscal equity between 2003 and 2005 (Driscoll & Salmon, 2008). Between 2003 and 2005, the Virginia state government provided 755 million dollars in additional funding to local education agencies that was intended to supplement the existing funding. Due to limited oversight, many localities used this additional funding as "local tax relief" and decreased their local contribution to the school division (Driscoll & Salmon, 2008). Because the additional state funds were not used consistently throughout Virginia, the level of inequity drastically increased. Hence, it is important to examine the degree to which use of the LCI affects equitable funding as a valued outcome.

When examining the Local Composite Index for any predictable effects on student achievement, it is important to study its creation in historical context as well as to consider the similarities and differences it has with other equity models nationwide. Many school finance systems are aging structures that require numerous changes to align them with the current state of school reform (Odden & Clune, 1998). The necessity for changes to school finance structures has been happening at the same time as a shift from an emphasis on equity and adequacy of *minimums* and *basic skills* in public schools, to the new equity and adequacy of *excellence* in education and *proficiency outcomes for all children and at all schools* (Verstegen & Driscoll, 2008). Further research could continue to determine what the funding should purchase in terms of teacher characteristics, curriculum, class size, and technology (Verstegen & King, 1998).

Research in this area can benefit scholars by providing empirical evidence to determine the effectiveness of financial equity models to impact student achievement. Any evidence that is found could then be used to support specific theories in areas such as school finance, school reform, learning environment design, and many others. For practical purposes, this empirical evidence could also have broad implications for the actions and decisions of school leaders and policy makers at the local, state, and federal level when they attempt to determine the best use of the limited funds that are available.

Research that examines school finance policies should also consider the support of local and state taxpayers who provide the fiscal resources that these policies distribute. Despite annual local property tax increases in the state of New York between 2003-2010, voters approved 91.9% of proposed school division budgets (Silverman, 2011). Is this

high approval rate an indicator of an electorate that is uninformed on school issues and indifferent to tax increases or one that is well versed in the intricacies of school finance and is heavily in favor of additional funds for the school system? What would research of this nature look like in the Commonwealth of Virginia where divisions are funded by county legislatures and what is the voting public's level of knowledge, or even level of awareness, about the Local Composite Index?

Verstegen and Salmon (1991) state that the "primary objective of an equitable school finance system is to break the linkage between local fiscal capacity and revenue, thus providing equal educational opportunity for all children" (p. 427). Even during 2003-2005, a time of fiscal surplus in Virginia education spending, this goal of equity was not achieved and most localities that accepted the additional state funds reduced their school-related expenditures, or at best, maintained the level of their current school budget (Driscoll & Salmon, 2008).

With the Local Composite Index in place, there are still severe school funding disparities throughout Virginia and although the current economic climate will not make solving education funding problems easy, it will force school leaders and policy makers to find the most efficient way to operate and disperse funds in the most cost-effective manner (Salmon, 2010). Driscoll and Salmon (2008) suggest that the problem with Virginia's fiscal equity program, which includes the LCI, is the actual equalization formula that is used and the required adjusted local expenditure per pupil, which the formula calculates, has, over time, "fallen well below the funding levels provided by nearly all school divisions" (p. 260).

Fiscal Effort

Because the level of educational funding provided by the state continues to decline in Virginia (JLARC, 2015), the degree to which schools are supported at the local level can be a key determining factor for the educational opportunities that students can access. Owings and Kaplan (2013) have developed a measure of fiscal effort (FE) that can be applied at the local level. Fiscal effort is represented by the formula $FE = R/TB$, where R represents a locality's educational expenditures and TB is a measure of local wealth that could consist of a division's property value, gross income, taxable sales, or other metrics. It measures how much a locality spends on education in relation to its total capacity. Fiscal effort can be an important indicator of what a community or its policy makers value. The amount of fiscal effort directed towards schools is an effective way to compare the commitment to education in communities with vastly different levels of local wealth (Owings & Kaplan, 2013).

There are two recent studies that utilized this measure of fiscal effort and investigated the potential relationship between local fiscal effort and educational outcomes. A longitudinal study on graduation rates did not find a strong relationship with fiscal effort at the state level alone, but it did find that sustained fiscal effort over time positively impacts graduation rates (Cedo, 2014). An examination at the division level in Virginia found that fiscal effort was not a sole predictor and that certain demographic variables had a larger impact on graduation rates (Johnson, 2014).

In this study, Fiscal Effort will serve as a relative measure that will be used to describe the disparity of local wealth that is allocated to educational resources in the

localities throughout Virginia. This measure will be a valuable metric to combine with the educational efficiency ratings to determine the relative importance of education and productivity of the school divisions throughout Virginia.

Educational Efficiency

Due to the aforementioned challenges with cost-effectiveness and return-on-investment research, many scholars have turned to a measure of educational efficiency that utilizes the modified quadriform as an analytic tool to identify, in a relative sense, the balance a school division strikes between educational inputs and outputs. The earliest evidence of this methodology has been identified in the work of Anderson (1996). His efficiency analysis of urban and rural school divisions built on the work of Hickrod (1989) and developed the two stage modified quadriform approach. In stage one, the school divisions are grouped into efficiency categories and in stage two, specific characteristics are identified that distinguish efficient and inefficient school divisions (Anderson, 1996).

The work of Rolle (2000) and Stevens (2006) continued the use of the modified quadriform to investigate school division efficiency in Indiana and Texas. In Indiana, a large number of efficient school divisions were identified and significant relationships were found between school resources and educational outcomes (Rolle, 2000). Nearly a third of the school divisions in Texas were categorized as efficient and student-teacher ratios were found to be a reliable predictor of positive educational outcomes (Stevens, 2006).

A recent analysis of school division efficiency in Georgia provides a refined use of the modified quadriform that builds on all of the previous research in this field (Houck, Rolle & He, 2010). This study was able to categorize efficient and inefficient schools as well as identify commonalities amongst similar school divisions. A major contribution of this study was its investigation of school division persistence. It attempted to identify school divisions that demonstrated consistent educational efficiency across multiple educational outputs.

All of the studies that utilize the modified quadriform methodology categorize school divisions into four categories. As reflected in Figure 1, the four school division dimensions include *efficient*, *inefficient*, *effective*, and *ineffective* school divisions (Anderson, 1996).

1. *Efficient* school divisions produce higher than expected outcomes with lower than expected expenditures.
2. *Inefficient* school divisions produce lower than expected outcomes with higher than expected expenditures.
3. *Effective* school divisions produce higher than expected outcomes with higher than expected expenditures
4. *Ineffective* school divisions produce lower than expected outcomes with lower than expected expenditures.

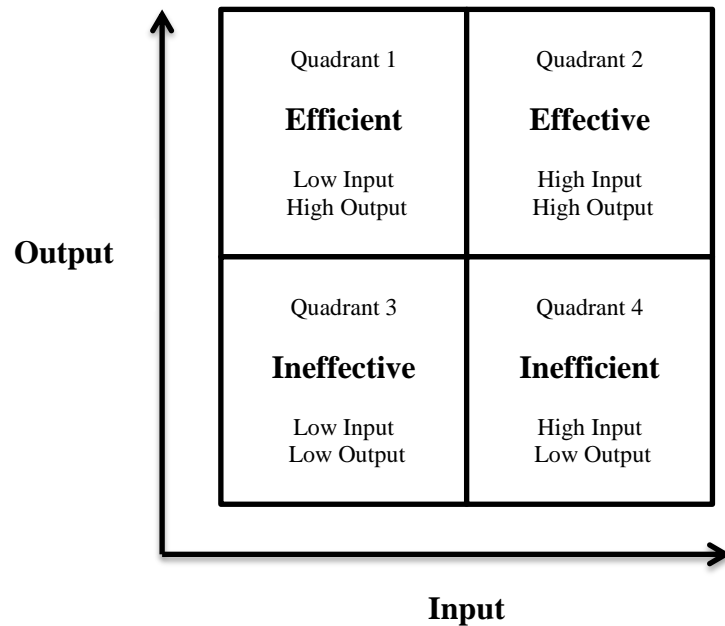


Figure 1. The modified quadriform and efficiency dimensions. Adapted from Houck, Rolle & He (2010).

Modified Quadriform Analysis is a method that allows the relative efficiency of a school division to be determined using educational inputs and outputs (Houck, Rolle & He, 2010). Measuring efficiency in education is a much more complicated task than in the private sector because of the lack of products or outputs that are easy to measure (Anderson, 1996). The modified quadriform is an effective tool because it allows the relationships between educational inputs and outputs to be analyzed.

Conceptual Framework

This chapter shows that the impact on student achievement must be considered when school divisions are making decisions about how to allocate their limited financial resources. In the framework established for this study, school resources, funding equity, educational effectiveness, fiscal effort, and educational efficiency are all factors that must be considered by school divisions when they are making these important decisions.

The genesis for this entire study was the very large question of how school divisions are impacted by the manner in which they wish to allocate their fiscal resources. As this study developed, four specific topics were explored. First, it was important to investigate the existing research related to the specific impact of funding on overall school productivity. Second, the concept of fiscal effort, or how much a locality allocates to education, is a valuable measure that should be compared throughout Virginia. Third, there must be a measure that determines the efficiency and overall effectiveness and success of a school division.

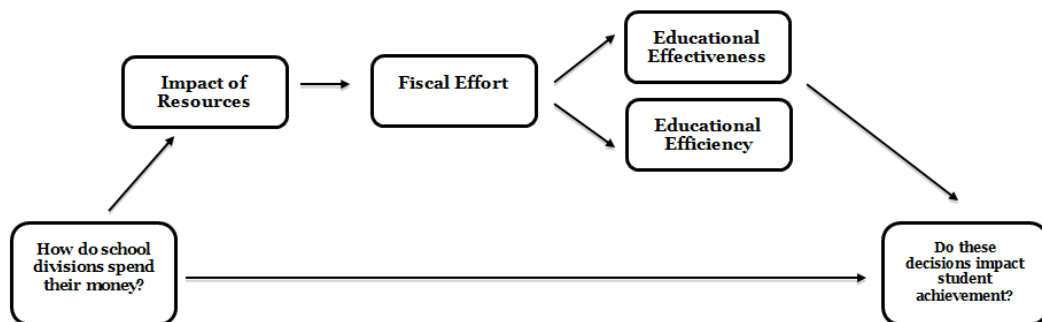


Figure 2. Conceptual framework.

The efficiency and effectiveness components of this framework are combined to develop a measure that balances fiscal resources with educational outputs. This culminating measure of educational efficiency can begin to explore the initial question of how a school division's overall success is impacted by the manner in which they wish to allocate their fiscal resources. Figure 2 represents this framework in a graphic format.

Summary

This study seeks to inform school leaders and policy makers about the challenges school divisions in Virginia have balancing funding levels with efficient fiscal practices. In the next section, the study design will be discussed as a way to identify school divisions that have found a way to achieve this balance and what steps were required to attain this success. This research explores if these decisions produce results that, when combined with an appropriate level of fiscal effort by a locality, are effective and efficient in a relative sense (Houck, Rolle & He, 2010). Additionally, it investigates if there are specific factors associated with school divisions that have high levels of fiscal effort or educational efficiency and if there are any possible correlations between a school division's fiscal effort and educational efficiency. Often, the focus of school divisions is overall performance, but it is increasingly becoming more important to find a way to achieve high levels of performance in the most efficient way possible.

Chapter Three

As mentioned at the outset of this dissertation, this study focuses on the connection between student achievement and the manner in which the school divisions in Virginia choose to utilize their funding. Because funding is at such a premium in these difficult financial times, decisions are being made about how to allocate these limited budgets. This research explores if these decisions produce results that, when combined with an appropriate level of fiscal effort by a locality, are effective and efficient in a relative sense (Houck, Rolle & He, 2010). Additionally, it attempts to identify specific factors associated with school divisions that have high levels of fiscal effort or educational efficiency and if there are any possible correlations between a school division's fiscal effort and educational efficiency.

This study identifies commonalities and specific characteristics of school divisions in Virginia that balance fiscal effort and educational efficiency with high levels of student achievement. The following specific research questions are addressed:

1. What is the level of disparity in fiscal effort (FE) at the school division level in Virginia during the 2012-2013 academic year?
2. What is the educational efficiency (EE) of school divisions in Virginia during the 2012-2013 academic year?

3. What commonalties in resource allocation are displayed between school divisions with similar levels of educational efficiency?
4. Is there a correlation between fiscal effort and educational efficiency in Virginia school divisions during the 2012-2013 academic year?

Research Design

To address these research questions, this study employs a non-experimental, ex-post-facto analysis. This includes an examination of local fiscal effort as well as educational inputs and outputs from school divisions in the state of Virginia during the 2012-2013 academic year.

The analyses in this study utilizes two measures, with the local school division serving as the unit of analysis. The first measure is fiscal effort (FE), which is represented by the following equation.

$$FE = \frac{SE}{LWpP} \quad (1)$$

SE represents school division expenditures during a fiscal year and *LWpP* is a measure of local wealth per pupil and utilizes a composite of a division's property value, gross income, and taxable sales that is divided by the school division's Average Daily Membership (Owings & Kaplan, 2006; VDOE, 2015). The specific weights of each of these local wealth indicators and the manner in which they are compared to educational expenditures are detailed later in this chapter.

The second measure that is analyzed in this study is educational efficiency as determined through modified quadriform analysis (MQA). MQA is a method that allows the relative efficiency of school divisions to be determined using educational inputs and outputs in two stages (Houck, Rolle & He, 2010). In the first stage, this method uses two regressions. One regression measures educational inputs and the other one measures educational outputs. When compared against the actual inputs and outputs, the residuals of these regressions are plotted on the quadriform to sort school divisions into one of four categories (Anderson, 1996; Rolle, 2000, Stevens, 2006). In the second stage, analysis of variance and regression analysis are then utilized to find common characteristics amongst school divisions that are in the same efficiency categories.

Analytic Approach to Research Questions

The first research question, “what is the level of disparity in fiscal effort (FE) at the school division level in Virginia during the 2012-2013 academic year?” was studied with the statistics of *range* and *restricted range* (Odden & Piccus, 2004). *Range* is a univariate measure of the difference between the highest and lowest levels of local fiscal effort. *Restricted range* is a similar measure that attempts to minimize the impact of outliers by limiting the distribution at the 5th and 95th percentiles (Barton, 2013; Brownson, 2002).

The second research question, “what is the educational efficiency (EE) of school divisions in Virginia during the 2012-2013 academic year?” was studied with the modified quadriform which classified school divisions into one of four educational efficiency dimensions. The modified quadriform uses regression residuals to categorize

school divisions as efficient, effective, ineffective, and inefficient across five educational outputs.

The third research question, “what commonalties in resource allocation are displayed between school divisions with similar levels of educational efficiency?” was addressed using regression analysis and analysis of variance (ANOVA). This methodology investigated the impact of the factors that can be influenced by the decisions of the local school leaders and policy makers.

The fourth research question, “is there a correlation between fiscal effort and educational efficiency in Virginia school divisions during the 2012-2013 academic year?” was studied with a bivariate correlation to measure the relationship between educational efficiency and local fiscal effort (Johnson, 2014).

Table 1 presents the evidence and methodology used in this study, as well as the expected outcomes for each of the research questions that this study addresses. Range is a suitable tool for the first research question because the Fiscal Effort analysis is a relative measure. Range allows us to describe the consistency or disparity of Fiscal Effort across all 132 school divisions in the state. The extant modified quadriform research supports the use of regression analysis and ANOVA (Anderson, 1996; Calzini, 2011; Hickrod, 1989, 1990; Houck, Rolle & He, 2010 Rolle, 2000; Stevens, 2006). The early research that incorporated the modified quadriform utilized discriminant analysis in the second stage, but recent studies have favored ANOVA (Anderson, 1996; Houck, Rolle & He, 2010).

Table 1

Evidence and Methodology for Research Questions

Evidence	Analysis	Outcomes
Q1.What is the level of disparity in fiscal effort (FE) at the school division level in Virginia during the 2012-2013 academic year?		
School expenditures, property value, adjusted gross income, taxable sales	range, restricted range	A relative statistical measure for how much value a locality places on educational expenditures
Q2. What is the educational efficiency (EE) of school divisions in Virginia during the 2012-2013 academic year?		
Alterable and unalterable school division characteristics, student achievement data	Modified quadriform analysis	School divisions will be categorized into one of the four educational efficiency categories that include efficient, inefficient, effective, and ineffective.
Q3. What commonalties in resource allocation are displayed between school divisions with similar levels of educational efficiency?		
Alterable and unalterable school division characteristics	Analysis of variance	Commonalties amongst efficient and effective school divisions
Q4. Is there a correlation between fiscal effort and educational efficiency in Virginia school divisions during the 2012-2013 academic year?		
Fiscal effort level, educational efficiency output residuals	Bivariate correlation	The strength of the relationship between fiscal effort and educational efficiency output residuals.

Data Sources

For this study, financial and student achievement data from 132 school divisions in Virginia during the 2012-2013 academic year was analyzed for fiscal effort and

educational efficiency. When this study was designed, this was the most recent year all of the necessary data required for this analysis were available. It is also an important year in Virginia, because this was the first year that Virginia qualified for a waiver from the US Department of Education of the Annual Yearly Progress (AYP) requirements of the Elementary and Secondary Education Act (ESEA).

There are more than 132 divisions in Virginia but the financial and academic data for school divisions with joint-operating agreements (Bedford City and Bedford County; Fairfax City and Fairfax County; Emporia and Greensville County; and Williamsburg and James City County) are reported under the fiscal agent division only (i.e., the joint operating agreement implies that there is one budget for the combined divisions). Bedford County, Fairfax County, Greensville County and Williamsburg are the fiscal agents for the aforementioned divisions (VDOE, 2015).

Financial data assembled for this study includes publicly-available evidence on spending patterns of Virginia school divisions. The most recent available information was used in this study, acknowledging that there is some lag time in the release of data from the Virginia Department of Education. This is a significant factor for the data related to the Local Composite Index. Data were collected from the State Department of Education as well as the Virginia Department of Taxation and the U.S. Census Bureau.

Fiscal Effort

Fiscal effort (FE), is represented by Equation 1, where SE represents school division expenditures during a fiscal year and $LWpP$ is a measure of local wealth per pupil and utilizes a composite of a division's adjusted property value, adjusted gross

income, and adjusted taxable sales that is divided by the school division's Average Daily Membership (Owings & Kaplan, 2006; VDOE, 2015).

$$FE = \frac{SE}{LWpP} \quad (1)$$

This measure demonstrates how much a locality spends on education per student in relation to its total capacity. Fiscal effort can be an important indicator of what a community or its policy makers value. The amount of fiscal effort directed towards schools is an effective way to compare the commitment to education in communities with vastly different levels of local wealth or size (Owings & Kaplan, 2013).

A division's annual school expenditure (*SE*) was extracted from the column labeled *Total Cost of Operation Regular Day School* in Table 13 of the 2012-2013 Superintendent's Annual Report (VDOE, 2015). *Total Cost of Operation Regular Day School* is the total amount spent in the categories of *Administration, Instruction, Attendance and Health Services, Pupil Transportation Services, and Operations and Maintenance* in Table 13 of this report.

Local wealth per pupil (*LWpP*) was calculated using data from the *2012-2014 Composite Index of Local Ability to Pay* report that is available from the Virginia Department of Education. This report is used to calculate the Local Composite Indices (LCI) for the 2012-2013 and 2013-2014 academic years, but it is calculated based on financial and revenue data from Fiscal Year 2009 (VDOE, 2015). Although this time lag in financial data could be a potential limitation of this study, every school division in

Virginia is affected by this time lag in an identical manner, which may reduce the impact of this as a limiting factor.

To compute total adjusted local wealth, property value, gross income, and taxable sales for each division were adjusted so the weight of each fiscal indicator aligns with the local wealth weights that are used in Virginia's Local Composite Index. Property value received a weight of 0.5, gross income received a weight of 0.4, and taxable sales received a weight of 0.1. These specific weights allow the adjusted local wealth measure utilized throughout this study to be aligned with the weighted composite of a division's property value, gross income, and taxable sales that comprises the *Indicators of Ability-to-Pay* calculation from the VDOE Local Composite Index (LCI) formula (VDOE, 2015).

The total adjusted local wealth was thus computed as $(.5 \text{ (property value)} + .4 \text{ (gross income)} + .1 \text{ (taxable sales)})$. This value was divided by the Average Daily Membership (ADM) of each school division as reported in the *2012-2014 Composite Index of Local Ability to Pay* (VDOE, 2015) in order to determine a measure of Local Wealth per Pupil (LWpP). Local Wealth per Pupil is reported instead of Total Local Wealth because of the lack of uniformity in school division size throughout Virginia. When LWpP was combined with School Expenditures in the Fiscal Effort formula, it was possible for a greater distinction to be made between affluent, small school divisions and large, low-income divisions.

Educational Efficiency and the Modified Quadriform

The educational efficiency and relative production of Virginia's school divisions were measured with a modified quadriform analysis in two stages (Houck, Rolle & He, 2010). Modified quadriform analysis relies on two regression formulas that predict the funding levels and the educational outputs against a set of unalterable characteristics. The residuals of these two formulas are used to demonstrate educational efficiency across four dimensions (Anderson, 1996; Hickrod, 1989).

As reflected in Figure 1, the four dimensions in this study will include *efficient*, *inefficient*, *effective*, and *ineffective* school divisions (Anderson, 1996).

1. *Efficient* school divisions produce higher than expected outcomes with lower than expected expenditures.
2. *Inefficient* school divisions produce lower than expected outcomes with higher than expected expenditures.
3. *Effective* school divisions produce higher than expected outcomes with higher than expected expenditures
4. *Ineffective* school divisions produce lower than expected outcomes with lower than expected expenditures.

Modified Quadriform Analysis

In stage one of the modified quadriform analysis, two regression formulas were used to examine school division inputs and outputs. The first regression explored the relationship between educational inputs and unalterable school division characteristics (Table 2). The second regression examined the connection between educational outputs

and the same unalterable characteristics from the input regression (Table 3). Alterable characteristics, factors that schools *can* control, will not be included at this point in the analysis in an effort to reduce the error in the results. The extant MQA literature on this is mixed, but the ANOVA analysis in Stage 2 will be able to account for the impact of the factors that are beyond the influence of the local school leaders and policy makers. Each regression formula is represented by

$$Z_i = b_0 + b_1W_{1i} + b_2W_{2i} + \dots + b_nW_{ni} \quad (2)$$

where Z is the predicted value (educational input or output) for each school division and W represents the unalterable characteristics and variables (Anderson, 1996).

Table 2

Educational Input Regression Variables

Type	Source
Dependent Variable	Per-pupil expenditures
Independent Variables	Unalterable Factors: division size median income property wealth per-pupil sales tax per-pupil % of special education students % of poverty community educational attainment

Note. Adapted from “Examining school division efficiency in Georgia,” by E.A. Houck, R.A. Rolle, and J. He, 2010, *Journal of Education Finance*, 35(4), p. 338. Copyright 2010 by ASBO International.

The data for all of the variables in Table 2 were available from the Virginia Department of Education and the Census Bureau. The data for per-pupil expenditures and division size are from the columns labeled *Per-Pupil Expenditure for Operation Regular Day School* and *End-of-Year ADM for Determining Cost Per Pupil* in Table 15 of the 2012-2013 Superintendent's Annual Report. Property wealth per-pupil and sales tax per-pupil were extracted from the *2012-2014 Composite Index of Local Ability to Pay* (VDOE, 2015). The percentage of poverty in each division was determined by using the percentage of students in each school division that receive Free or Reduced Lunch. The data for this figure are from the *2012-2013 Free and Reduced Price Eligibility* report from the VDOE Office of School Nutrition Programs. The percentage of students in each school division that receive Special Education services was calculated using data from the VDOE Custom Report Generator for Students with Disabilities at the end of the 2012-2013 school year and the ADM on Table 13 of the Superintendent's Annual Report for Virginia for FY2013. Median Income and Educational Attainment in each school division were retrieved from the Census Bureau's 2013 American Community Survey (ACS). These figures represented the median annual household income in each school division as well as the percentage of 25 and over residents that have received at least a high school diploma.

Table 3

Educational Output Regression Variables

Type	Source
Dependent Variables	5 th grade Reading SOL pass rate 8 th grade Reading SOL pass rate End of Course Reading SOL pass rate Graduation Rate AP Enrollment
Independent Variables	Unalterable Factors: division size median income property wealth per-pupil sales tax per-pupil % of special education students % of poverty community educational attainment

Note. Adapted from “Examining school division efficiency in Georgia,” by E.A. Houck, R.A. Rolle, and J. He, 2010, *Journal of Education Finance*, 35(4), p. 338. Copyright 2010 by ASBO International.

The Independent Variables in the output regression that are displayed on Table 3 are identical to variables described in Table 2. The 5th grade, 8th Grade, and End of Course (EOC) Reading SOL pass rates for each division in the 2012-2013 academic year were available from the VDOE Division Report Cards. Reading assessment data were selected for use in this study because of two factors. First, longitudinal studies have shown early reading successes or struggles to be predictive of future overall educational performance (Fiester, 2010; Lesnick, Smithgall & Gwynne, 2010). Second, 2012 was the first year students in Virginia were administered a new math assessment that was based

on curriculum standards with an increased level of rigor. The reading assessment with increased rigor had already been in place for multiple years.

The graduation rate variable was represented by the Virginia On-Time Graduation Rate by Division from the VDOE *Class of 2013 Four-Year Cohort Report*. The Virginia On-Time Graduation Rate “expresses the percentage of students in a cohort who earned a Board of Education-approved diploma within four years of entering high school for the first time. Percentages are based on longitudinal student-level data and account for student mobility and retention and promotion patterns” (VDOE, 2015).

The AP Enrollment variable is the percentage of High School Students by Division who took 1 or more AP classes during the 2012-2013 school year. The figure for this data is from the VDOE *Advanced Programs Participation by School Report*. School-level participation in advanced programs is reported annually for students involved in governor’s schools, Advanced Placement, International Baccalaureate or college-level courses. School-level figures from each division were combined to create a division-wide AP participation number. The AP participation figure was divided by the Grade 9-12 Fall Membership figure for each school division to generate the percentage of high school students in each division who were enrolled in 1 or more AP courses during the 2012-2013 school year.

The specific input and output variables (dependent variables in Table 2 and Table 3) that were used in this stage of the modified quadriform analysis were selected based on the extant literature. Specifically, they were modeled on the work in Georgia conducted

by Houck, Rolle and He (2010). The five output variables were selected to provide a comprehensive view of division performance at the elementary and secondary levels.

The two regressions detailed above determined the predicted values for the educational inputs and outputs. These predicted values were subtracted from the actual educational inputs and outputs to determine the residual.

Educational Inputs residual: $Actual_{inputs} - Z_{inputs}$

Educational Outputs residual: $Actual_{outputs} - Z_{outputs}$

The standardized residuals were charted on the quadriform to determine a school division's level of educational efficiency in each of the five educational outputs (5th Grade Reading, 8th Grade Reading, EOC Reading, Graduation Rate, AP Enrollment) that are being investigated in this study. One modified quadriform was created for each of the five educational outputs. As shown in Figure 2, the educational input residuals are plotted along the horizontal axis and the educational output residuals are plotted along the vertical axis in each quadriform.

MQA and Division Commonalities

In stage two of the modified quadriform analysis, the common characteristics of *efficient* and *effective* school divisions were investigated. The existing MQA research recommends discriminant analysis or a combination of analysis of variance (ANOVA) and regression analysis for this stage (Anderson, 1996; Hickrod, 1989; Houck, Rolle &

He, 2010). In order to keep the scope of this study reasonable and to model extant literature, the ANOVA analyses were conducted for school divisions classified in the efficient category as well as for divisions in the efficient and effective categories (Houck, Rolle & He, 2010). Future research could explore the commonalities of school divisions considered to be effective, inefficient, and ineffective, as well as the various combinations of these categories.

This study used a regression analysis to investigate the relationship between school division characteristics and the likelihood that a school division is classified as efficient or effective. This study also performed an analysis of variance on school division outcomes (

Table 3) with significant alterable and unalterable school characteristics (Table 4). These alterable and unalterable characteristics were selected based on models provided by extant literature (Anderson, 1996; Houck, Rolle & He, 2010). ANOVA was conducted for all school divisions that are classified as effective or efficient as compared with all other divisions. The ANOVA results will be presented for each of the five educational outputs.

Table 4

Variables Used in Analysis of Educational Outputs

Type	Source
Dependent Variables	efficient school divisions efficient and effective school divisions inefficient school divisions
Independent Variables	Unalterable Factors: division size median income property wealth per-pupil sales tax per-pupil % of special education students % of poverty

community educational attainment

Alterable Factors:

per-pupil expenditures

local fiscal effort

% of funding from local sources

% of funding from state sources

% of funding from state sales tax

% of funding from federal sources

administrators per 1000 students

teachers per 1000 students

counselors per 1000 students

total instructional positions per 1000 students

teacher-student ratio (K-7)

teacher-student ratio (8-12)

teacher-student ratio (K-12)

teacher salaries

administrator salaries

% of expenditures on instruction

% of expenditures on administration

% of expenditures on attendance and health

% of expenditures on operations and maintenance

% of expenditures on school day operations

% of expenditures on pre-K

% of expenditures on facilities

% of remaining balance

Limitations

Potential limitations of this study include the analysis of a single year of school funding data. Over the last decade, the United States and Virginia have experienced a significant amount of volatility in their economies. A single year analysis may reveal findings that are significant during that year, but are not generalizable over time. Second, there may be policies in place that are unique to specific localities that significantly

influence a division's expenditures and effort level that are unaccounted for using the analysis specified, masking patterns of outcomes or making any attributions related to these patterns difficult to discern. Finally, Virginia's Local Composite Index relies on financial data that is four years old (e.g., the 2012-2014 LCI is based on fiscal data from 2009). Because of this, the current economic realities of localities will not be recognized by this formula that determines the amount of state funding school divisions are allocated. This time-lag in financial information that effects school division funding is a limiting factor, but it is a limitation that is consistent for all school divisions throughout Virginia (Salmon & Alexander, 2014).

Chapter Four

This study has described the necessity for an empirical analysis of the levels of fiscal effort and educational efficiency in the school divisions throughout Virginia. School leaders and policy makers can utilize this data to inform spending practices at the division level and state fiscal policies. This analysis revealed trends in the data as well as connections between school division spending habits and specific educational outcomes. The results of this statistical analysis will also support a discussion in the final chapter of the impact of fiscal effort and educational efficiency on the school divisions in Virginia and the educational experiences that they are able to provide for their students. This chapter presents the findings of the following research questions:

1. What is the level of disparity in fiscal effort (FE) at the school division level in Virginia during the 2012-2013 academic year?
2. What is the educational efficiency (EE) of school divisions in Virginia during the 2012-2013 academic year?
3. What commonalties in resource allocation are displayed between school divisions with similar levels of educational efficiency?
4. Is there a correlation between fiscal effort and educational efficiency in Virginia school divisions during the 2012-2013 academic year?

Findings

Range and restricted range were used to investigate the first research question. The second and third research questions employed the modified quadriform methodology and utilized analysis of variance and regression analysis to interpret the results of the modified quadriforms. The final research question utilized a bivariate correlation to measure the relationship between educational efficiency and local fiscal effort (Johnson, 2014).

Research Question One – Fiscal Effort Disparity

The first research question investigates the level of disparity in fiscal effort (FE) at the school division level in Virginia during the 2012-2013 academic year. An analysis of fiscal effort in school divisions ($n = 132$) throughout Virginia shows a range of 2993.91, with a minimum fiscal effort of 2.06 and a maximum fiscal effort of 2995.97. The mean Fiscal Effort was 212.29 ($SD = 401.28$). Fiscal Effort is a relative measure amongst school divisions in Virginia with higher scores indicating a greater percentage of the overall wealth of a locality being allocated to education. Table 5 displays the Fiscal Effort score for each school division in Virginia in during 2012-2013.

The restricted range of Fiscal Effort is 967.10, with a minimum score of 11.07 and a maximum score of 978.17. The mean Fiscal Effort of the restricted range was 146.28 ($SD=177.81$). Using the 5th (FE = 10.76) and 95th percentiles (FE = 984.22) as the cut point, the restricted range removed 12 school divisions from the 132 that are being analyzed as part of this study. The six school divisions below the fifth percentile that were excluded by the restricted range are some of the smallest in Virginia. The six school

divisions above the 95th percentile that were excluded by the restricted range are some of the state's largest. Although the results at the extremities of the range measure indicate a correlation between Fiscal Effort and division size, this trend does not continue between the 5th and 95th percentiles in the restricted range.

The school expenditures of the division with the highest level of Fiscal Effort is equivalent to 1.8% of the locality's adjusted local wealth. This figure for the division with the lowest level of Fiscal Effort is 0.8%. This was determined by dividing a division's total school expenditures by the division's adjusted local wealth. Total school expenditures is from the column labeled *Total Cost of Operation Regular Day School* in Table 13 of the Superintendent's Annual Report for Virginia for FY2013 (VDOE, 2015). Adjusted local wealth is a measure used throughout this study that utilizes a weighted composite of a division's property value, gross income, and taxable sales in the same manner as the *Indicators of Ability-to-Pay* calculation from the VDOE Local Composite Index (LCI) formula. The exact weights that are used in this study and in the Local Composite Index are detailed in Chapter 3 of this study.

It is a striking finding of this study that using this relative measure, and after controlling for division size by looking at spending and local wealth on a per pupil basis, the divisions at the high end of the Fiscal Effort range are allocating over twice as much of their local fiscal capacity to education as the divisions at the lowest end of the range. Students in the divisions at the lowest end of the fiscal effort range attend schools that are funded by a significantly smaller portion of the local wealth than their counterparts in high fiscal effort divisions. It is not realistic or practical that minimum or maximum

percentages of local wealth should be allocated to educational spending, but it is important to acknowledge the disparity that is currently occurring in Virginia.

These range and restricted range results indicate that there was a high level of disparity in Fiscal Effort (FE) at the school division level in Virginia during the 2012-2013 academic year. As utilized in this study, Fiscal Effort is a relative measure and due to the limited amount of extant literature, there is not an established score that indicates an appropriate level of effort. Additionally, considering the high level of socio-economic diversity, wealth distribution, and cost-of-living variation throughout the state, a disparity in total overall education spending would not be a surprising finding. But, the Fiscal Effort measure used to answer this research question reveals a wide disparity in how much of each locality's total fiscal capacity is allocated to education.

The three school divisions in Table 5 are all of a similar size (approximately 12,000 students) and although they are from different regions of the state, the disparity in fiscal effort is alarming. The specific figures used to calculate fiscal effort are displayed in the table. Out of these three divisions, the wealthiest (Division C) actually has the lowest FE because of the small amount that is being spent (in relation to local wealth) when compared with the other divisions. Division DA has the smallest amount of Local Wealth but its high school expenditures (in relation to local wealth) increases its FE to almost three times that of the wealthier Division C.

Table 5

Fiscal Effort in Three School Divisions of Similar Size

Division	Local Wealth	Division Size	Local Wealth per Pupil	School Expenditures	Fiscal Effort
DA	\$4,763,668,579	12,126	\$392,847	\$146,380,657	372.62
DD	\$5,351,985,535	11,348	\$471,624	\$112,166,411	237.84
C	\$20,118,571,081	11,422	\$1,761,388	\$224,536,099	127.47

The Fiscal Effort level as well as the educational input and output residuals utilized for the second research question are presented in Table 6. The school divisions are ordered according to their Fiscal Effort score. The standardized regression residuals are presented with the Fiscal Effort metric to provide context for the educational efficiency analyses conducted in the second and third research questions. The regression residuals are used to categorize the school divisions within the modified quadriform.

Table 6

Fiscal Effort and Educational Efficiency Input and Output Standardized Regression Residuals by School Division during 2012-2013. School Divisions are Sorted by Fiscal Effort.

Division Name*	Fiscal Effort	Standardized Regression Residuals					
		<i>Financial Input</i>	<i>Grade 5 Reading</i>	<i>Grade 8 Reading</i>	<i>EOC Reading</i>	<i>Graduation Rate</i>	<i>AP Enrollment</i>
AL	2995.97	0.44704	0.32029	0.39278	0.50832	0.12729	-0.96255
CU	2155.15	-1.0475	0.40379	-0.1061	-0.38831	0.11476	-0.59435
DR	1473.33	0.71995	0.37721	0.11554	-0.00424	-0.53017	0.43102
Z	1435.39	-0.60444	0.29916	-0.18416	0.11327	0.02094	-0.19614
BQ	1367.60	0.34205	-0.14588	0.04428	-0.00617	0.67328	1.10312
Y	995.46	-0.58558	-0.71933	0.02999	0.19689	0.39691	-0.57173
BF	978.17	0.02185	0.13014	-0.21993	-1.88467	1.60937	0.50619
CE	876.98	0.34862	-1.36685	-0.88851	-0.54864	-0.15257	0.14611
CF	851.09	0.18149	-0.96511	-1.45301	-0.58071	-1.68852	0.70806
DL	772.13	-0.40000	0.01233	-0.12144	0.13284	0.10388	-0.23178
DK	700.37	-0.43354	-0.82546	-0.70619	-0.13989	-0.34248	1.14885
BC	584.44	-0.72293	0.50290	-1.14083	-0.05515	0.91188	1.14006
CY	457.25	0.29829	-1.75557	-3.23389	-2.15453	-2.72172	-0.07284
CQ	422.98	0.36503	-0.07724	-1.06726	-0.74113	-1.18404	-1.04000
DA	372.62	-0.20462	-1.08783	-0.52764	-3.71011	-2.28643	1.69002
BD	365.45	-0.03701	-0.79957	-0.6514	-1.38231	-0.25846	0.25028
AS	349.94	0.16825	-0.57697	0.26877	0.11213	0.05420	-0.76671
DB	333.07	0.38509	0.56900	2.5031	1.90957	2.13407	-0.69046

Division Name*	Fiscal Effort	Standardized Regression Residuals					
		<i>Financial Input</i>	<i>Grade 5 Reading</i>	<i>Grade 8 Reading</i>	<i>EOC Reading</i>	<i>Graduation Rate</i>	<i>AP Enrollment</i>
DN	318.58	-0.63510	-0.47046	-0.85894	-0.66587	-0.37888	-0.97607
EB	275.50	-0.35428	0.54864	-0.38238	0.01650	0.51764	1.10843
DZ	270.36	0.00893	2.4888	1.05753	1.41295	0.85949	-0.30226
CO	245.44	-0.35351	0.1629	0.34536	0.51879	0.05418	0.19389
AH	244.43	-0.02784	-0.58223	0.77891	-0.42298	-0.86807	0.35573
S	242.24	-0.05389	-0.97847	-0.11051	0.80698	-0.10999	1.56421
DD	237.84	0.47583	1.11224	-0.11786	0.16162	0.68724	0.49924
BV	229.00	0.39943	-0.36563	-1.03177	-1.64760	-0.09156	0.32308
BG	228.76	-0.93528	-0.12004	0.12210	0.22740	0.22696	0.19103
H	223.89	2.39284	-0.49015	0.36900	0.32278	-0.76432	1.39556
BT	210.92	0.11074	-0.37387	-0.83556	-0.65348	-0.90359	0.72986
DQ	202.88	-0.86333	1.86628	0.48352	0.57332	-0.60786	0.42572
AN	198.41	0.25787	-0.98589	-0.62397	-0.52392	0.27377	-0.85112
I	195.47	0.23689	-0.03177	-1.01827	0.31828	1.03995	-0.29158
CT	191.39	-0.18034	1.21975	0.03095	-0.32896	-1.51550	-0.89839
CB	189.75	0.68224	0.48885	0.57092	-0.35581	0.18727	0.47362
B	183.24	1.20371	-0.50120	0.75994	0.24181	0.26698	1.72564
DI	175.36	0.02865	1.26776	0.41491	-0.16841	1.29139	0.26592
DG	170.93	-0.73694	0.59961	1.45803	1.07644	1.08460	-0.62826
DT	167.17	-0.12593	1.07170	0.52167	1.64910	1.67184	0.06916
AF	167.16	-0.87643	0.41728	-0.45058	-0.26157	0.81193	0.19632
BO	158.21	-2.65316	-0.09053	-1.85471	1.15135	1.89667	-1.24649
K	154.62	-0.64747	-0.75849	-0.40549	-0.17711	-0.00384	1.17042

Division Name*	Fiscal Effort	Standardized Regression Residuals					
		<i>Financial Input</i>	<i>Grade 5 Reading</i>	<i>Grade 8 Reading</i>	<i>EOC Reading</i>	<i>Graduation Rate</i>	<i>AP Enrollment</i>
CN	153.93	0.88546	-0.4985	-1.60586	-1.43997	-1.29600	-0.79479
BI	147.83	0.79093	2.74556	1.97735	-1.22454	1.36823	-0.22706
BB	142.19	0.27229	-0.48221	0.51012	0.40925	0.38392	-0.59651
BW	132.79	-0.40479	0.02957	1.09647	-0.41383	-1.10404	0.71287
DH	132.38	0.68332	-0.44844	0.59127	0.38505	1.58232	-0.26799
C	127.47	1.06359	-0.85907	-1.07125	-0.20119	-0.90587	0.20381
DE	123.14	-1.03596	0.56110	-0.62282	0.60969	0.45189	-0.45245
AR	116.90	0.77673	1.00775	3.16976	1.15266	-0.05687	-0.47077
AW	115.62	-0.16466	0.70295	-1.70026	-0.98005	-1.22013	-0.90308
AJ	112.71	0.03018	0.08919	-1.27341	-1.69118	-1.46841	-0.63219
BE	111.28	-1.07288	0.82656	0.27728	0.15061	0.79369	0.23979
CV	110.03	-0.58949	-0.21185	-0.77801	-1.30279	-0.19003	0.40194
DF	109.66	0.64821	1.23168	0.95940	0.55246	-0.03455	-1.51755
F	105.52	-0.24447	1.18982	-0.11694	-0.7292	-0.41339	-0.06753
BX	105.34	0.76082	-1.91974	-0.65077	-0.73756	0.14312	1.56972
D	104.18	1.29012	-0.34196	-0.86025	-0.85761	-0.77461	-0.87059
M	103.79	-0.07223	-0.35798	0.81332	0.40347	0.49430	-0.80729
BJ	100.52	-0.10640	-0.56243	-0.93944	-1.62433	-1.28348	0.05865
U	98.61	0.40952	-0.29165	1.25148	0.40320	1.00933	-0.07624
DS	98.27	-1.19648	0.04915	-1.01832	-0.96673	0.68881	0.01200
DY	97.22	0.32589	0.09152	0.95135	0.54546	0.78179	1.41507
EA	94.87	-0.21409	1.72065	-0.50772	0.25993	-0.54376	-1.07712
A	94.77	-0.46969	-0.52668	0.93434	0.44510	0.12132	-0.55435

Division Name*	Fiscal Effort	Standardized Regression Residuals					
		<i>Financial Input</i>	<i>Grade 5 Reading</i>	<i>Grade 8 Reading</i>	<i>EOC Reading</i>	<i>Graduation Rate</i>	<i>AP Enrollment</i>
CK	92.59	-0.68011	1.06972	0.2299	0.13307	0.59609	-0.08400
T	90.59	-1.24809	0.49217	-0.59336	-1.35577	-0.78405	-0.97109
DX	84.71	2.51182	0.37214	0.75736	0.00001	-0.27791	1.55350
BA	82.14	-0.56767	-0.89208	0.17407	-0.52292	0.49030	0.17145
CR	80.87	-0.53245	-0.03344	-0.39651	0.60749	-1.15739	0.09267
AC	80.72	0.12106	0.81312	0.43048	0.96130	1.00066	-0.48891
BZ	78.09	-1.15052	-1.13707	0.10704	0.33143	0.40501	-0.73540
P	77.67	0.40096	0.17682	-0.11315	1.10817	1.39099	0.01974
BL	77.60	2.41491	3.00274	-1.52663	0.26201	-0.80706	6.54005
CL	77.15	-0.60176	-0.73704	1.11939	0.89690	2.45805	0.24942
W	72.56	1.43327	0.23629	0.11166	1.34339	-0.15156	0.72979
DU	72.29	-0.20277	0.14866	-0.23223	0.83492	-0.31382	-0.60495
AV	71.05	-0.24677	1.81474	1.17226	2.31273	0.91614	-0.27227
X	70.55	2.00053	0.41961	0.40900	-0.24638	-1.41826	1.87413
CJ	69.76	-0.25544	-0.95672	-0.29217	0.21390	-0.76809	-0.63641
N	67.01	-0.19148	-1.35798	0.18425	0.58610	0.12634	-0.33663
AI	65.85	0.33206	-0.32043	-0.66965	-0.41809	-0.76218	0.13786
AP	63.24	-1.21259	0.33645	0.44893	1.01199	0.66216	0.31726
DJ	63.11	0.27602	-0.59345	0.67719	0.46982	-1.96445	0.02108
AZ	60.77	1.23402	0.67520	2.24129	-0.23268	-0.51362	-0.37506
CS	60.13	-0.09920	-0.34213	0.24452	0.34347	0.70608	0.68129
DM	55.61	-0.76071	-0.71657	0.17711	0.21481	0.35969	-0.52659
CM	55.33	-0.74253	-1.17578	0.80011	2.04569	0.91431	-0.14022

Division Name*	Fiscal Effort	Standardized Regression Residuals					
		<i>Financial Input</i>	<i>Grade 5 Reading</i>	<i>Grade 8 Reading</i>	<i>EOC Reading</i>	<i>Graduation Rate</i>	<i>AP Enrollment</i>
AU	54.80	0.07636	0.94369	1.41391	-	-	-0.10665
BR	54.80	-0.76305	-0.41273	-1.02600	0.63588	-0.19000	-0.06862
G	52.48	-0.41982	0.81650	-1.43126	-0.30977	-1.93352	-0.27864
AT	50.57	-0.05487	-1.05222	0.89144	0.97133	0.41690	-0.80691
BM	50.54	-1.56790	-1.02789	0.14749	0.03183	-0.14543	-1.18920
O	48.74	0.49397	-0.35448	0.42965	-1.05908	0.31994	-0.56042
CP	48.49	0.09118	0.39229	0.44714	0.26867	-0.26710	0.49597
CD	45.94	-1.12886	0.55547	-0.88503	-0.73306	-0.85497	-0.51380
Q	44.44	-0.57931	-0.80700	-0.05663	1.18690	1.20196	-0.36343
R	43.84	-0.17306	-1.95280	0.76938	-0.70154	-1.01930	0.64015
CW	43.02	1.26947	0.77516	0.92972	0.03921	1.16840	0.33705
AQ	42.65	-0.06356	-1.46120	-1.01900	-2.58677	-2.09180	-0.86417
BS	41.61	-0.17014	0.29452	0.32298	0.54020	0.80617	0.29497
CI	41.52	-0.67655	1.61612	0.38768	1.44834	0.97881	-1.40531
AD	39.00	0.29832	1.33781	-0.60032	-0.78703	0.11153	-1.01184
DC	38.51	0.03262	-0.54906	-0.71450	-1.03351	-0.99996	-0.56517
AM	37.93	2.76446	0.00748	0.91647	0.41188	0.25695	-0.27405
AY	37.68	-2.31719	0.46042	0.66423	-0.09156	-1.09092	1.22883
AO	35.59	-0.82905	-0.08419	0.89186	0.33910	1.05645	0.55278
AA	34.30	0.24812	0.74385	-0.31541	0.02423	0.88385	-0.22088
DP	34.13	2.98325	0.73859	0.24564	-1.42291	-1.52273	-0.33227
AG	31.86	0.41019	-1.05761	0.46832	0.39567	-1.25457	-0.66070
E	31.21	-1.23531	-0.00808	1.30447	-1.01486	1.09424	1.68495

Division Name*	Fiscal Effort	Standardized Regression Residuals					
		<i>Financial Input</i>	<i>Grade 5 Reading</i>	<i>Grade 8 Reading</i>	<i>EOC Reading</i>	<i>Graduation Rate</i>	<i>AP Enrollment</i>
DV	28.38	2.61576	0.28174	1.54421	1.28141	0.46957	-0.66945
BU	27.86	0.27789	-0.43433	-0.83506	-1.50726	1.59768	0.75937
AK	27.16	-1.72077	0.42012	-0.53874	0.06111	-0.16197	-0.71614
DW	25.39	-0.61892	-0.14676	-0.53011	-0.95365	-0.72103	-0.01539
CG	25.21	0.16656	-0.54079	-1.98765	-0.27261	-0.74209	0.63808
CZ	24.01	0.00640	0.41063	1.71301	0.81022	0.18926	0.63345
CC	23.62	-0.00534	-0.47120	0.26220	1.33896	-0.03407	-0.17059
AX	19.81	0.12674	0.80733	-0.78324	0.44590	-0.55662	-1.09139
L	19.06	0.30253	-2.47740	-1.04292	0.61849	1.17434	-0.74513
BK	15.79	-0.34641	0.68299	1.11127	-0.37382	-0.45868	-0.60908
AE	15.6	-0.35714	1.21221	-0.51411	-0.74388	-0.51637	-0.98292
V	15.1	1.91082	-2.93234	-2.09300	1.98670	0.57401	-0.09484
AB	13.54	0.84492	-1.87530	-1.10264	-1.48608	-1.25062	-0.43984
BY	13.21	-0.46900	-0.70163	0.37485	-0.70868	0.74785	-0.30249
DO	11.19	2.20915	0.69853	-0.24205	0.35757	1.01082	-0.39838
BN	11.07	0.19010	-0.32286	-0.30288	0.67034	0.68960	-1.52672
CH	10.17	-2.75781	0.75921	0.04177	-0.23945	-0.82709	-0.92691
CA	9.76	-1.55444	1.04297	1.99823	2.30261	0.72755	-1.48846
BP	9.54	0.17570	0.19796	0.26702	0.80034	-0.42126	-0.15417
CX	8.52	-0.05530	-1.24424	-0.54277	-0.12714	-0.61892	-0.05184
J	4.68	-0.58121	-1.29108	-0.73700	-0.64136	-1.26343	-0.02371
BH	2.06	-0.24357	1.17949	0.63257	1.12910	1.22308	2.35801

On its own, the variance in how education spending is allocated in Virginia's localities is a significant finding of this study. The significance of this finding increases when an additional factor is considered. High levels of Fiscal Effort variance are not only demonstrated amongst school divisions with different characteristics (size, geography, per capita wealth) and demographics. They are primarily revealed amongst school divisions *with similar* characteristics and demographics. This could indicate that the level of Fiscal Effort is not being determined by factors out of a locality's control (state or federal policy decisions, natural disaster, national recession, etc.), tradition, or the influence of the historical education culture in a locality, but rather, the Fiscal Effort level could vary because of intentional decisions about educational spending made by local policy makers. The specific spending decisions that were made will be discussed later in this chapter.

Research Question Two – Educational Efficiency

The second research question examined the level of educational efficiency in Virginia's school divisions using a modified quadriform analysis. Two regression formulas were used to examine school division inputs and outputs. The first regression explored the relationship between educational inputs and unalterable school division characteristics (Table 2). The second regression examined the connection between educational outputs and the same unalterable characteristics from the input regression (Table 3).

Each educational output is displayed on a modified quadriform (Appendix A). As shown in Figure 2, the educational input standardized residuals were plotted along the

horizontal axis and the educational output standardized residuals were plotted along the vertical axis in each quadriform.

The results of the educational input regression and the five educational output regressions categorized the school divisions into one of the four educational efficiency categories. Table 7 displays the results of the first stage of modified quadriform analysis for each educational output. The table shows the percentage of school divisions in each of the efficiency categories for the five educational outputs. As predicted, the distribution of schools across the four categories has a relatively even distribution.

Table 7

Percentage of School Divisions in Each Dimension Across All Five Educational Outputs.

Educational Output	<i>n</i>	Efficient	Effective	Inefficient	Ineffective
5 th Grade Reading SOL	132	24.24	25.76	27.27	22.73
8th Grade Reading SOL	132	25.00	27.27	25.76	21.97
EOC Reading SOL	131*	25.19	29.77	23.66	21.37
Graduation Rate	131*	24.43	27.48	25.95	22.14
AP Enrollment	131*	20.61	22.14	31.30	25.95

Note: *Lexington City is not included because it is a K-8 school division.
(Houck, Rolle & He, 2010)

Across all five of the educational outputs, there is a relatively even distribution of divisions across the efficiency categories. The smallest percentage of school divisions in one category was 20.61% in the efficient category of AP enrollment and the largest percentage was 31.30% in the inefficient category off AP enrollment.

Tables 8 - 11 display how consistently a division performs across the five educational outputs. This performance consistency, or persistence, is an important measure in identifying consistently excelling or struggling divisions and will help reduce the impact of random variation on the findings (Houck, Rolle & He, 2010). Table 7 displays the percentage (and number) of school divisions that were categorized as efficient in none of the five educational outputs, one of the outputs, two of the outputs, three of the outputs, four of the outputs, or all five of the educational outputs. The data reveal that there were six school divisions in Virginia that were categorized as efficient in all five of the educational outputs.

Table 8

*Percentage of Divisions that Performed Efficiently across All Educational Outputs
(Number of School Divisions in Parentheses)*

Category	0 of 5	1 of 5	2 of 5	3 of 5	4 of 5	5 of 5
Efficient	50.38 (66)	10.69 (14)	12.21 (16)	13.74 (18)	8.40 (11)	4.58 (6)

Note. Lexington City is not included because it is a K-8 school division. Table adapted from Adapted from “Examining school division efficiency in Georgia,” by E.A. Houck, R.A. Rolle, and J. He, 2010, *Journal of Education Finance*, 35(4), p. 343. Copyright 2010 by ASBO International.

Tables 9-11 display the school division consistency across the educational efficiency categories of effective, inefficient, and ineffective. Table 9 shows that three divisions were categorized as effective in all output areas. Table 10 shows the six divisions categorized as inefficient and Table 11 shows that there were five divisions categorized as ineffective across all educational outputs.

Table 9

Percentage of Divisions that Performed Effectively across All Educational Outputs (Number of School Divisions in Parentheses)

Category	0 of 5	1 of 5	2 of 5	3 of 5	4 of 5	5 of 5
Effective	58.02 (76)	6.87 (9)	9.16 (12)	12.98 (17)	10.69 (14)	2.29 (3)*

Table 10

Percentage of Divisions that were Ineffective across All Educational Outputs (Number of School Divisions in Parentheses)

Category	0 of 5	1 of 5	2 of 5	3 of 5	4 of 5	5 of 5
Ineffective	51.15 (67)	8.40 (11)	13.74 (18)	12.21 (16)	10.69 (14)	3.82 (5)

Table 11

Percentage of Divisions that were Inefficient across All Educational Outputs (Number of School Divisions in Parentheses)

Category	0 of 5	1 of 5	2 of 5	3 of 5	4 of 5	5 of 5
Inefficient	55.73 (73)	10.69 (14)	12.98 (17)	9.16 (12)	6.87 (9)	4.58 (6)

These consistently performing school divisions will also be utilized in the second stage of the modified quadriform analysis (ANOVA and regression) when the study investigates the common characteristics of effective and efficient school divisions throughout Virginia. The second stage identifies similar spending behaviors amongst the school divisions that were consistently classified as efficient or effective.

Research Question Three – Spending Commonalities

The third research question investigated the commonalties in resource allocation displayed between school divisions with similar levels of educational efficiency. Utilizing the results of the modified quadriform analysis, the common characteristics of *efficient* and *effective* school divisions was investigated. The existing MQA research recommends discriminant analysis or a combination of analysis of variance (ANOVA) and regression analysis for this stage (Anderson, 1996; Hickrod, 1989; Houck, Rolle & He, 2010). The latter approach was selected for this study.

The relationship between school division outcomes and alterable and unalterable school characteristics is investigated using ANOVA. This type of analysis is conducted for all school divisions that are classified as effective and efficient as compared with all other divisions as well as efficient divisions compared with all others. The ANOVA results are presented for each of the five educational outputs. Table 12 displays descriptive statistics for the variables that were used to investigate commonalities amongst school divisions in the same efficiency categories.

The analysis of variance (Table 13) for the efficient and effective school divisions versus all others did not reveal any variables that were significantly different in more than one educational output. Across the five educational outputs for efficient and effective divisions, seven variables were found to be significantly different, but none of the variables appeared in more than one educational output. Additionally, no variables were found to be significant for the outputs of Grade 5 Reading and Grade 8 Reading. This was still true after standardizing the predictors and adjusting for skewness.

Table 12

Descriptive Statistics for Variables Used in ANOVA Analyses

Variable Name	<i>n</i>	<i>Min</i>	<i>Max</i>	<i>M</i>	<i>SD</i>
Median Income	132	28116	122238	52259	18743
Educ. Attainment Perc.	132	.68	.97	.83	.06
Property Value/Pupil	132	176176	4.20E+06	922215	660363
Retail Sales Tax/Pupil	132	13134	258225	64700	46226
Per Pupil Expenditures	132	8580	19825	10807	1998
Division Size	132	2045	180307	9545	20189
Poverty/Percentage	132	.07	.81	.48	.16
Special Education/Percentage	132	.07	.21	.13	.03
Fiscal Effort	132	2.06	2995.97	212.20	401.28
Local Funding/Perc.	132	.17	.85	.41	.15
State Funding/Perc	132	.08	.63	.40	.12
Sales Tax Funding/Perc	132	.04	.12	.09	.01
Federal Funding/Perc	132	.02	.23	.10	.04
Administrators/P1K	132	2.64	9.77	4.03	.91
Teachers/P1K	132	60.25	136.73	81.28	11.17

Counselors/P1K	132	2.14	9.28	4.85	1.10
Total Instructional/P1K	132	74.21	184.73	110.08	15.40
Teacher Ratio/K-7	132	7.89	17.31	12.74	1.92
Teacher Ratio/8-12	132	5.24	17.70	11.41	1.99
Teacher Ratio/K-12	132	7.10	16.70	12.07	1.54
Administrator Salary	132	54548	141478	83835	14587
Teacher Salary	132	36427	74582	47162	6300
Perc. Of Cost_Admin.	132	.01	.09	.03	.01
Perc. Of Cost_Instuc.	132	.39	.77	.64	.07
Perc. Of Cost_Health	132	0.00	.04	.02	.01
Perc. Of Cost_Operat.	132	.05	.22	.09	.02
Perc. of Cost_Tot. Schl. Day	132	.50	.96	.83	.09
Perc. Of Cost_Pr.eK	132	0.00	.04	.01	.01
Perc. Of Cost_Facilities	132	0.00	.39	.02	.06
Perc. Of Cost_Debt	132	0.00	.23	.03	.04
Perc. Of Cost_Balance	132	0.00	.42	.05	.06

Table 13

Analysis of Variance Between Efficient and Effective Divisions and All Other Divisions

Variable	EOC Reading				Graduation Perc.				AP Enrollment			
	<u>E&E</u>	<u>Not</u>	<u>Sig</u>	η^2	<u>E&E</u>	<u>Not</u>	<u>Sig</u>	η^2	<u>E&E</u>	<u>Not</u>	<u>Sig</u>	η^2
Perc. of Cost – Balance	.057	.037	*	.03								
Federal Funding Perc.					.092	.106	*	.03				
Perc. of Cost - Admin.					.029	.036	**	.03				
Admin. Per 1K									3.812	4.201	**	.04
Total Instructional Per 1K									107.45	112.024	*	.02
Avg. Salary – Admin.									86433.98	82075.83	*	.02
Perc. of Cost - Instruction									.658	.632	**	.03

Note. * $p < .10$. ** $p < .05$.; Table adapted from Adapted from “Examining school division efficiency in Georgia,” by E.A. Houck, R.A. Rolle, and J. He, 2010, *Journal of Education Finance*, 35(4), p. 348. Copyright 2010 by ASBO International.

One possible cause for the limited number of significant variables in this ANOVA is that when the categories of efficient and effective schools are combined, in most educational outputs, more than half of the school divisions in Virginia are included. Although there were limited significant variables in this portion on the analysis, the few that did surface are all related to the level of investment and spending on instruction and staffing resources.

The analysis of variance for efficient school divisions versus all others revealed several significant variables (Table 14). There were six variables that were significantly different across *all five* educational outputs and one variable that was significant across four of the five educational outputs. The significant variables were Total Expenditures per Pupil, Percentage of Funding from State Tax, Teachers per 1000 students, Total Instructional Positions per 1000 students, Student to Teacher Ratio in Grades 8 – 12, Student to Teacher Ratio Across all Grade Levels, and Counselors per 1000 students (four out of five outputs).

Table 14

Analysis of Variance Between Efficient Divisions and All Other Divisions

Variables	Gr. 5 Reading				Gr. 8 Reading				EOC Reading				Graduation Perc				AP Enrollment			
	<u>E</u>	<u>Not</u>	<u>Sig</u>	<u>η^2</u>	<u>E</u>	<u>Not</u>	<u>Sig</u>	<u>η^2</u>	<u>E</u>	<u>Not</u>	<u>Sig</u>	<u>η^2</u>	<u>E</u>	<u>Not</u>	<u>Sig</u>	<u>η^2</u>	<u>E</u>	<u>Not</u>	<u>Sig</u>	<u>η^2</u>
Total PP	9670	11201	**	.11	9888	11151	*	.08	9885	11221	**	.09	9837	11197	*	.09	9671	11151	**	.10
Local Perc																	.358	.429	*	.04
State Perc	.431	.383	*	.03													.445	.382	*	.05
State Tax Perc	.099	.089	*	.10	.098	.090	*	.06	.098	.090	*	.06	.099	.090	*	.06	.103	.089	**	.16
Admin P1k	3.71	4.14	*	.04																
Teacher P1k	75.65	83.23	*	.09	77.71	82.62	*	.04	77.24	82.88	*	.05	76.92	82.82	*	.06	76.48	82.54	*	.05
Couns P1k	4.42	5.00	*	.05	4.49	4.98	*	.04	4.47	5.023	*	.05	4.39	5.04	*	.07				
Total P1k	102.14	112.84	**	.09	105.68	111.73	*	.03	105.46	112.02	*	.04	105.78	111.69	*	.03	104.14	111.75	*	.04
Ratio K7	13.34	12.53	*	.03													13.48	12.55	*	.04
Ratio 812	12.60	11.00	**	.12	12.16	11.13	*	.05	12.11	11.12	*	.05	12.22	11.11	*	.06	12.24	11.17	*	.05
Ratio Avg	12.97	11.76	**	.12	12.56	11.89	*	.04	12.59	11.87	*	.05	12.69	11.85	*	.06	12.86	11.86	*	.07
Perc. of Cost – Admin.									.028	.034	*	.03								

Note. * $p < .05$. ** $p < .01$.; Table adapted from Adapted from “Examining school division efficiency in Georgia,” by E.A. Houck, R.A. Rolle, and J. He, 2010, *Journal of Education Finance*, 35(4), p. 350. Copyright 2010 by ASBO International.

Six of the seven variables that were significant in the ANOVA can be categorized as instructional spending. Specifically, they are expenditures that directly impact students and affect the ability to deliver instruction and support students on a daily basis. Five of these instructional variables (Teachers per 1000 students, Total Instructional Positions per 1000 students, Student to Teacher Ratio in Grades 8 – 12, Student to Teacher Ratio Across all Grade Levels, and Counselors per 1000 students) indicate that efficient school divisions allocate more of their fiscal resources to instructional and support positions, as well as lower student to teacher ratios. It may be possible that similar spending decisions are being made by school divisions categorized as effective, but the financial cost it requires to implement these decisions outweighs the positive impact for the purposes of this study.

Another significant finding from the analysis of variance is that six of the seven variables are directly controlled at the local level. Total Expenditures per Pupil, Teachers per 1000 students, Total Instructional Positions per 1000 students, Student to Teacher Ratio in Grades 8 – 12, Student to Teacher Ratio Across all Grade Levels, and Counselors per 1000 students are alterable by local school divisions. Virginia's Standards of Quality (SOQ) establish minimum levels or guidelines in some of these areas, but localities can autonomously increase funding in these areas if they feel it will benefit their divisions and students.

The only consistently significant variable that is not within the control of local school divisions is the funding that they receive from the state in the form of state retail

sales and use tax. Virginia returns 1.125 percent of the revenue collected through the five percent state sales and use tax to localities to support public education, which was approximately \$1.2 billion during the 2013 fiscal year (VDOE, 2015). These funds are allocated to local divisions based on estimates of the school-age population in each division from the Weldon Cooper Center for Public Service at the University of Virginia as required by the *Code of Virginia*. It is extremely significant that this funding source was identified by the ANOVA because the state sales and use tax is not impacted by the local composite index and a local division's ability to pay. Rather, it is distributed on the basis of the school age population and subtracted from the total basic aid cost (Dickey, 2013). This may indicate an advantage for larger school divisions due to the economy of scale and other issues that are impacted by overall size.

Research Question Four – Fiscal Effort and Educational Efficiency

The fourth research question investigates connections between fiscal effort and educational efficiency in Virginia school divisions during the 2012-2013 academic year. The significant correlations between the fiscal effort scores and regression residuals for each of the educational outputs are revealed in Table 15. Statistically significant correlations are seen between fiscal effort and 8th grade and high school reading SOL assessments as well as AP enrollment. A strong correlation was found between high levels of fiscal effort and sixty percent of the educational output variables. While this does not indicate causality, the spending commonalities that were discussed previously in this chapter can be considered reasonably logical choices for school divisions trying to make fiscal decisions using a lens of educational efficiency.

Table 15

Correlation between Fiscal Effort and Educational Outputs

	Gr. 5 Reading	Gr. 8 Reading	EOC Reading	Graduation Perc.	AP Enrollment
Fiscal Effort	.162	.211*	.189*	.056	.371**

Note. * $p < .05$; ** $p < .01$

Summary

This chapter presented methodical results related to the fiscal effort and educational efficiency in school divisions throughout Virginia. The results reveal a high level of fiscal effort disparity throughout the state. Using this as a relative measure, it was found that the divisions at the high end of the fiscal effort range are allocating over twice as much of their local fiscal capacity to education as the divisions at the lowest end of the range. Additionally, it was found that high levels of fiscal effort variance are not only demonstrated amongst school divisions with different characteristics (size, geography, per capita wealth) and demographics. They are primarily revealed amongst school divisions with similar characteristics and demographics

The educational efficiency analyses investigated the impacts of the level of fiscal effort and isolated several statistically significant indicators of a division's efficiency. Several commonalities amongst school divisions with similar levels of efficiency have been identified. The analysis of variance for efficient school divisions versus all others revealed several variables that were significant across all five educational outputs. Six of

the seven variables that were significant in the ANOVA can be categorized as instructional spending. Specifically, they are expenditures that are controlled at the local division level, directly impact students, and affect the ability to deliver instruction and support students on a daily basis.

Chapter Five

This study explores the possibility that educational funding decisions produce results that, when combined with an appropriate level of fiscal effort by a locality, are effective and efficient in a relative sense (Houck, Rolle & He, 2010). If this is true, this means that a school division is striking an appropriate balance between the fiscal resources that are spent and the educational outputs and achievements that are produced. Additionally, it investigates if there are specific factors associated with school divisions that have high levels of fiscal effort or educational efficiency and if there are any possible correlations between a school division's fiscal effort and educational efficiency.

This study achieves its purposes through a statistical analysis of the educational inputs and outputs for each of the school divisions in Virginia that included descriptive statistics, regression, ANOVA, and modified quadriform analyses. This chapter examines the results of research questions for practical and research implications. These findings can benefit researchers, school division leaders, as well as local and state policy makers.

This study investigated commonalties and specific characteristics of school divisions in Virginia that balance fiscal effort and educational efficiency with high levels of student achievement through the following specific research questions:

1. What is the level of disparity in fiscal effort (FE) at the school division level in Virginia during the 2012-2013 academic year?

2. What is the educational efficiency (EE) of school divisions in Virginia during the 2012-2013 academic year?
3. What commonalities in resource allocation are displayed between school divisions with similar levels of educational efficiency?
4. Is there a correlation between fiscal effort and educational efficiency in Virginia school divisions during the 2012-2013 academic year?

The three significant findings of this study are: 1) there is a high level of fiscal effort disparity amongst Virginia's school divisions; 2) school divisions that were categorized as educationally efficient are relatively dissimilar; and 3) school divisions with high levels of educational efficiency make intentional decisions that allocate additional funding to instructional positions or resources that directly impact students. The following chapter discusses the answers to each research question utilizing the results reported in chapter four of this study.

Fiscal Effort Disparity

The results for the first research question indicate that there was a high level of disparity in Fiscal Effort (FE) at the school division level in Virginia during the 2012-2013 academic year. This high level of disparity is also seen when a restricted range measure is analyzed. As utilized in this study, Fiscal Effort is a relative measure and due to the limited amount of extant literature, there is not an established score that indicates an appropriate level of effort. Considering the high level of socio-economic diversity, wealth distribution, and cost-of-living variation throughout the state, a disparity in total

overall education spending would not be a surprising finding. However, the Fiscal Effort measure used to answer this research question reveals a wide disparity in how much of a locality's total fiscal *capacity* is allocated to education.

On its own, the variance in how education spending is allocated in Virginia's localities is a significant finding of this study. The significance of this finding increases when an additional factor is considered. High levels of Fiscal Effort variance are not only demonstrated amongst school divisions with different characteristics (size, geography, per capita wealth) and demographics. They are also revealed amongst school divisions with *similar* characteristics and demographics. Table 16 displays the relevant descriptive statistics for fiscal effort. Tables 17-19 show the disparate fiscal effort levels of school divisions with similar geography, similar levels of local wealth, and similar levels of poverty.

Table 16

Descriptive Statistics for Fiscal Effort

Variable	<i>n</i>	<i>Min</i>	<i>Max</i>	<i>M</i>	<i>SD</i>
Fiscal Effort	132	2.06	2993.91	212.29	401.28

Table 17

Fiscal Effort Ratings for School Divisions from the Central Virginia Region

School Division	Region*	Fiscal Effort
DO	Central Virginia	11.19
V	Central Virginia	15.10
AX	Central Virginia	19.81
DP	Central Virginia	34.13
CD	Central Virginia	45.94
AC	Central Virginia	80.72
CR	Central Virginia	80.87
AJ	Central Virginia	112.71
BI	Central Virginia	147.83
CN	Central Virginia	153.93
CT	Central Virginia	191.39
BD	Central Virginia	365.45
CY	Central Virginia	457.25
BF	Central Virginia	978.17
Z	Central Virginia	1435.39

Note. *VDOE region codes are used to determine geography.

Table 18

Fiscal Effort Ratings for School Divisions with Adjusted Local Wealth between 3B - 4B.

School Division	Adjusted Local Wealth	Fiscal Effort
AX	\$3,075,609,082	19.81
BR	\$3,972,741,443	54.80
X	\$3,185,243,036	70.55
AF	\$3,094,350,137	167.16
DT	\$3,028,021,285	167.17
BT	\$3,351,812,290	210.92

Table 19

Fiscal Effort Ratings for School Divisions with Poverty Rate between 25% - 30%.

School Division	Poverty Percentage	Fiscal Effort
AT	25.85%	19.81
BS	26.06%	772.13
AE	26.36%	28.38
AV	26.42%	333.07
CO	26.71%	2995.97
BQ	27.28%	183.24
S	29.56%	63.24

These data reveals that there is not simply a correlation between division size or local wealth and high levels of fiscal effort. School divisions with similar characteristics (geography, local wealth, poverty) have a wide a range of fiscal effort levels. There may be individual divisions that have unique circumstances that increase or decrease their individual fiscal effort in a particular year, but the state-wide disparity in the data indicates a systemic issue. This could mean that the level of Fiscal Effort is not being determined by factors out of a locality's control (state or federal policy decisions, natural disaster, national recession, etc.), but rather, the Fiscal Effort level is varied because of intentional decisions about educational spending made by local policy makers. The specific spending decisions that were made will be discussed later in this chapter.

Consistently Efficient School Divisions

In order to answer the second research question, the residuals of the educational input regression and the five educational output regressions categorized the school divisions into one of the four education efficiency categories (Table 7). Across all five of the educational outputs, there is a relatively even distribution of divisions across the efficiency categories. Across all outputs, the smallest percentage of school divisions was 20.61 in the efficient category of AP enrollment and the largest percentage was 31.30 in the inefficient category of AP enrollment.

Tables 8 - 11 indicate the consistency of division performance across all five of the educational outputs. This performance consistency, or persistence, is an important measure in identifying consistently excelling or struggling divisions and will help reduce the impact of random variation on the findings (Houck, Rolle & He, 2010). Table 7

displays the percentage (and number) of school divisions that were categorized as efficient in none of the five educational outputs, one of the outputs, two of the outputs, three of the outputs, four of the outputs, or all five of the educational outputs. The data reveals that there were six school divisions in Virginia that were categorized as efficient in all five of the educational outputs. There were also 11 school divisions that were categorized as efficient in four out of the five output areas for a total of 17 highly efficient school districts. Additionally, three divisions were categorized as effective in all output areas, five divisions were categorized as ineffective, and six divisions were categorized as inefficient across all educational outputs.

Of particular note are these consistently efficient school divisions categorized as efficient in four or more educational outputs (Table 8). It is a significant finding of this study that these 17 school divisions would not be considered similar in terms of size, geographic location, or basic demographics. High levels of educational efficiency is not simply an achievement that is reached by school divisions located in a certain area of Virginia or with specific demographics. This school division diversity is displayed in Tables 20 – 22.

Table 20 displays the educational efficiency ratings across all five outputs of all 17 school divisions considered to be highly efficient. Six school divisions were efficient in every educational output and the remaining eleven divisions were efficient in four out of five educational outputs. The rating in the non-efficient category is indicated in Table 20.

Table 20

Educational Efficiency Ratings for Highly Efficient School Divisions

School Division	Grade 3 Reading	Grade 8 Reading	EOC Reading	AP Enrollment	Graduation Rate
AP*	-	-	-	-	-
BE*	-	-	-	-	-
BH*	-	-	-	-	-
BS*	-	-	-	-	-
CO*	-	-	-	-	-
DT*	-	-	-	-	-
AO	ineffective	-	-	-	-
AV	-	-	-	-	ineffective
BG	ineffective	-	-	-	-
CA	-	-	-	-	ineffective
CI	-	-	-	-	ineffective
CK	-	-	-	-	ineffective
CL	ineffective	-	-	-	-
CS	ineffective	-	-	-	-
DG	-	-	-	-	ineffective
DQ	-	-	-	ineffective	-
EB	-	ineffective	-	-	-

Note. *Efficient in all five educational outputs. School divisions are in the efficient category unless another category is indicated.

Table 21 presents three descriptive characteristics for the consistently efficient divisions. Division size, locale description, and the geographic region are shown for each school division. The National Center for Education Statistics locale codes and the VDOE

region codes were used in this table. The relative diversity of the divisions identified as consistently efficient, again indicate that efficiency is caused by intentional decisions rather than division characteristics.

Table 21

Descriptive Characteristics for Highly Efficient School Divisions

School Division	Size by Students	Type**	Geography***
AP*	3743	Large Suburb	Valley
BE*	18338	Rural Distant	Central Virginia
BH*	7427	Rural Fringe	Western Virginia
BS*	1562	Rural Fringe	Southside
CO*	9230	Rural Distant	Western Virginia
DT*	7352	Rural Distant	Southwest
AO	2026	Rural Fringe	Western Virginia
AV	1325	Distant Town	Southwest
BG	49871	Distant Town	Central Virginia
CA	1182	Rural Distant	Northern Neck
CI	881	Remote Town	Southwest
CK	5179	Rural Distant	Northern Virginia
CL	3591	Rural Distant	Northern Virginia
CS	2282	Remote Town	Southside
DG	3890	Rural Remote	Southwest
DQ	6397	Rural Fringe	Southwest
EB	12409	Large Suburb	Tidewater

Note. *Efficient in all five educational outputs. **NCES locale codes are used to determine division type. ***VDOE region codes are used to determine geography.

Table 22 includes further evidence that the divisions that are identified as consistently efficient are a diverse group. Local wealth, the educational attainment of its citizens, or special education and poverty rates do not serve as reliable predictors of educational efficiency. In this table, the median income and educational attainment data

are from the Census Bureau's 2013 American Community Survey (ACS). The Median Annual Household Income is listed for each school division. The educational attainment figure is the percentage of 25 and over residents that have received at least a high school diploma. The property wealth and tax revenue data are extracted from VDOE's 2012-2014 Local Composite Index and displayed as a per pupil figure. The special education and poverty percentages are also from VDOE. The percentage of students in each school division that receive Free or Reduced Lunch is from the 2012-2013 Free and Reduced Price Eligibility report produced by the VDOE Office of School Nutrition Programs. The percentage of students in each school division that receive Special Education services is calculated using the VDOE Custom Report Generator for Students with Disabilities at the end of the 2012-2013 school year and the ADM at the end of the year on Table 13 of the Superintendent's Annual Report for Virginia for FY2013. The specific decisions, which will be discussed later in this chapter, made by school division leaders seem to have a greater chance of increasing the likelihood of educational efficiency.

Table 22

Unalterable School Division Characteristics

School Division	Median Income	Property Wealth per/pupil	Sales Tax Revenue per/pupil	Special Education	Poverty	Educational Attainment
AP*	\$68,288	\$936,692	\$24,603	13.60%	29.56%	85.51%
BE*	\$75,070	\$750,488	\$79,697	12.66%	20.19%	92.06%
BH*	\$34,984	\$473,279	\$48,498	13.00%	64.75%	77.03%
BS*	\$35,237	\$640,457	\$24,463	13.58%	68.39%	69.05%
CO*	\$42,143	\$515,011	\$17,561	13.76%	53.62%	79.06%
DT*	\$41,897	\$712,635	\$84,194	15.20%	45.75%	83.18%
AO	\$44,618	\$904,470	\$29,235	13.84%	45.94%	81.41%
AV	\$30,325	\$363,873	\$143,684	10.29%	66.94%	75.84%
BG	\$61,048	\$733,338	\$94,804	11.61%	37.13%	90.11%
CA	\$53,309	\$2,334,799	\$68,445	11.56%	47.45%	88.97%
CI	\$39,416	\$285,268	\$194,101	13.51%	54.50%	81.35%
CK	\$60,287	\$838,446	\$38,178	9.07%	45.65%	84.97%
CL	\$42,906	\$731,424	\$44,492	12.11%	52.67%	75.55%
CS	\$37,436	\$772,479	\$128,774	13.07%	69.51%	79.47%
DG	\$38,355	\$316,191	\$33,112	16.55%	57.83%	74.86%
DQ	\$35,693	\$447,164	\$85,130	14.95%	51.06%	77.02%
EB	\$82,073	\$759,493	\$73,239	9.72%	20.38%	94.91%

Note. *Effective in all categories.

Table 21 and Table 22 reveal a fairly even distribution across all of the considered characteristics and unalterable factors amongst the high efficient school divisions. This type of distribution suggests that the variables that may cause these school divisions to be categorized together could have more to do with intentional decisions of some type by local school leaders rather than the causal influence of school division characteristics or unalterable factors. Spending commonalities amongst efficient and effective school

divisions will be detailed below in the discussion of the third and fourth research questions.

Spending Commonalities

The third research question investigated the commonalties in resource allocation displayed between school divisions with similar levels of educational efficiency. It is a significant finding of this study that school divisions with high levels of educational efficiency make intentional decisions that allocate additional funding to instructional positions that directly impact students. The relationship between school division outcomes and alterable school division factors was analyzed using ANOVA for all five educational outputs. This type of analysis was conducted for all school divisions that are classified as effective and efficient as compared with all other divisions (Table 12). It was also conducted for only efficient school divisions compared with all others (Table 13).

Results showed strong patterns of significant predictors for the analysis related to efficient school divisions. Six of the seven variables that were significant in the ANOVA can be categorized as instructional spending. Specifically, they are expenditures that directly impact students and affect the ability to deliver instruction and support students on a daily basis. There are large bodies of research that support either the value or the insignificance of lower class-sizes and this study was not designed to support either one of those positions (Hanushek, Mayer, & Peterson, 1999; Krueger, 1997). But, the findings in this study may indicate that smaller class sizes are an efficient way to increase educational outputs. When a school division is required to make difficult decisions about where to allocate its limited resources, these findings indicate that the greatest return on

investment will be seen when the funding is dedicated to instructional positions that directly impact students.

Another significant finding from the analysis of variance is that six of the seven variables are directly controlled at the local level. Total Expenditures per Pupil, Teachers per 1000 students, Total Instructional Positions per 1000 students, Student to Teacher Ratio in Grades 8 – 12, Student to Teacher Ratio Across all Grade Levels, and Counselors per 1000 students are alterable by local school divisions. Virginia's Standards of Quality (SOQ) establish minimum levels or guidelines in some of these areas, but localities can autonomously increase funding in these areas if they feel it will benefit their divisions and students.

The fourth research question investigates connections between fiscal effort and educational efficiency in Virginia school divisions during the 2012-2013 academic year. Significant correlations have been found between higher levels of local fiscal effort and reading achievement on standardized tests as well as enrollment in AP courses (Table 15). Of particular note is the high correlation between fiscal effort and AP course enrollment.

Research Contributions and Implications

The findings from this study have implications for local school division leaders as well as local and state policy makers. Fiscal Effort will be an important measure for the local taxing authorities to monitor as they decide how to allocate a locality's fiscal capacity. It will also be an important measure for local school boards and superintendents to monitor so they can properly advocate for increased funding for their school division,

especially if the local taxing authority is not the school board. In times of limited fiscal resources, advocating for additional funding using a platform of educational efficiency may be an effective strategy.

The findings revealed by the modified quadriform and the educational efficiency measure have several practical implications. School division size or location were not predictors of high levels of efficiency. Rather, intentional decisions that allocate additional funding to instructional positions that directly impact students were indicators of high levels of educational efficiency. In the immediate future, inefficient school divisions could begin to chart a course to improve their efficiency by altering some of the specific local spending decisions identified by this study. Over time, state policy makers could consider some of the efficiency indicators when updating the Local Composite Index and the Standards of Quality. This may begin to provide students throughout Virginia with some level of equity, regardless of the school division where they reside.

Recommendations for Future Scholarship

As discussed above, there is a relatively limited body of research related to fiscal effort and educational efficiency utilizing the modified quadriform. It could be beneficial to develop ways to utilize both of these measures over time. It could also be revealing to look at both of these measures at the national level over time. Scholars may consider studying multiple methods of measuring fiscal effort to develop a metric that provides the greatest amount of practical information and usable data to policy makers and school leaders. Additionally, this study focused on the fiscal practices of school divisions that were considered to be efficient. Future research could explore the commonalities of

school divisions considered to be effective, inefficient, and ineffective, as well as the various combinations of these categories. Identifying the spending decisions of ineffective and inefficient divisions could provide information that informs educational funding policy that is just as valuable as the practices of efficient divisions. Additional scholarship in the areas of fiscal effort and educational efficiency can continue to refine these measures so they can be reliable predictors in school finance research.

In Virginia, it would be helpful to establish some norms related to Fiscal Effort, such that policy makers could ascertain whether the Fiscal Effort applied in a given school division would be considered adequate. It will be important to continue to monitor, measure, and refine the way the Local Composite Index is used to allocate state funds. Additionally, fiscal effort levels throughout Virginia and over time may warrant further research. This could be especially important if policy makers ever considered a minimum fiscal effort level in combination with the Standards of Quality. Qualitative interviews with Chief Financial Officers and equivalent positions in school divisions throughout Virginia may be a valuable contribution to this body of research that can provide context to the empirical data that is identified in empirical studies such as this dissertation.

Based on the findings from the ANOVA, it could be beneficial to investigate how state funding would change if the 1.2 billion dollars from the State Retail and Use Tax were distributed using a local-ability-to-pay model.

Conclusions

This study focused on the connection between student achievement and the manner in which the school divisions in Virginia choose to utilize their funding. This research explored the division-level decision-making process that is used to determine where school funds are allocated and identify variations in this process that may have an impact on student achievement. This inquiry attempted to determine if these spending patterns are effective, and if school leaders are receiving adequate return on their educational investment.

This research found significant variance in fiscal effort at the division level in Virginia. Even after adjusting the funding levels for influential variables, some school divisions, while exerting the same amount of fiscal effort, cannot support the same per-pupil expenditures as their counterparts. Additionally, this analysis discovered significant variance in the productivity at the division level as evidenced by the educational efficiency metric. There are several high-spending divisions that do not get the most out of their educational investments and numerous low-spending divisions that maximize every dollar spent. These findings are significant because they add to the current research on educational funding and equity by incorporating the extra step of analyzing the fiscal effort alongside educational efficiency. This will provide a greater level of clarity or understanding to some of these expected findings.

The aforementioned findings are the “what” of the current fiscal challenges that our schools face and this analysis of fiscal decision-making can be a starting point for action steps that would benefit all of our students.

Appendix A

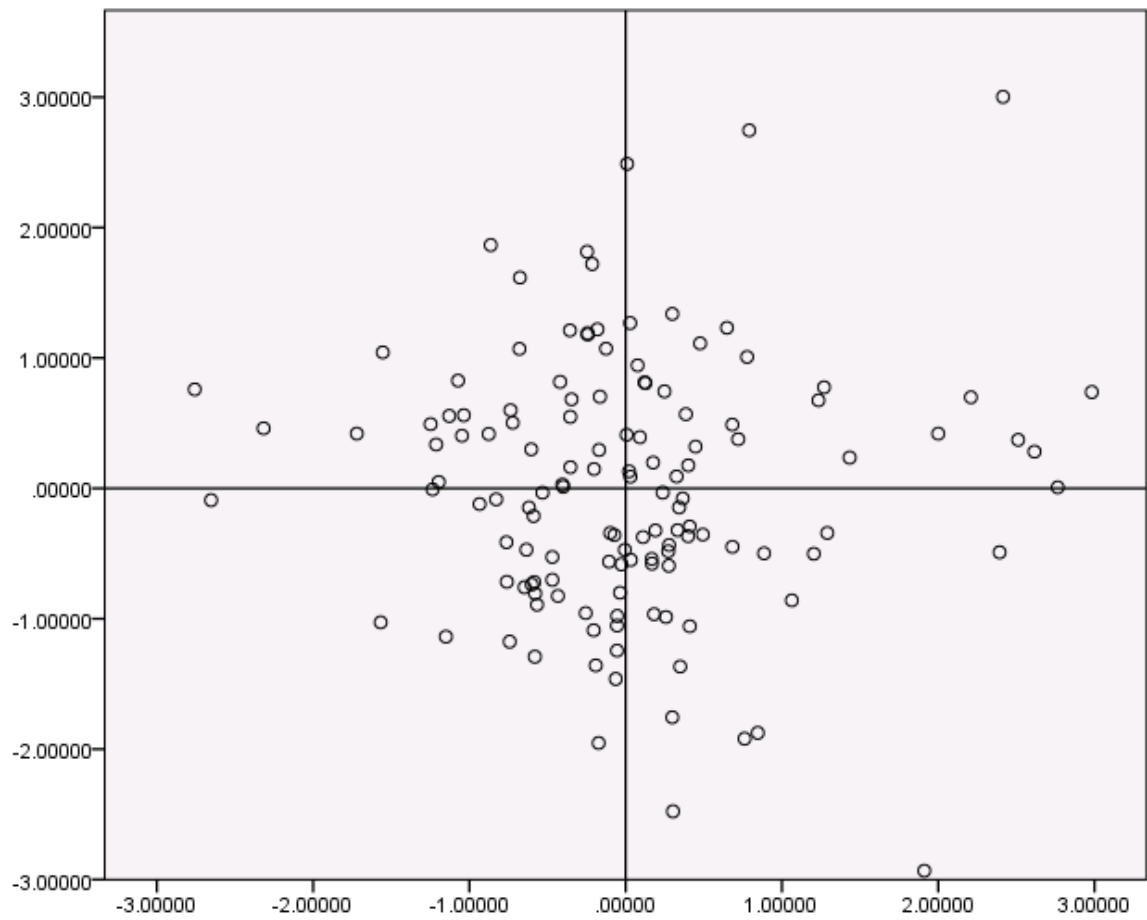


Figure 3. Residual scatterplot displaying the relationship between funding and 5th grade reading SOL performance during the 2012-2013 academic year.

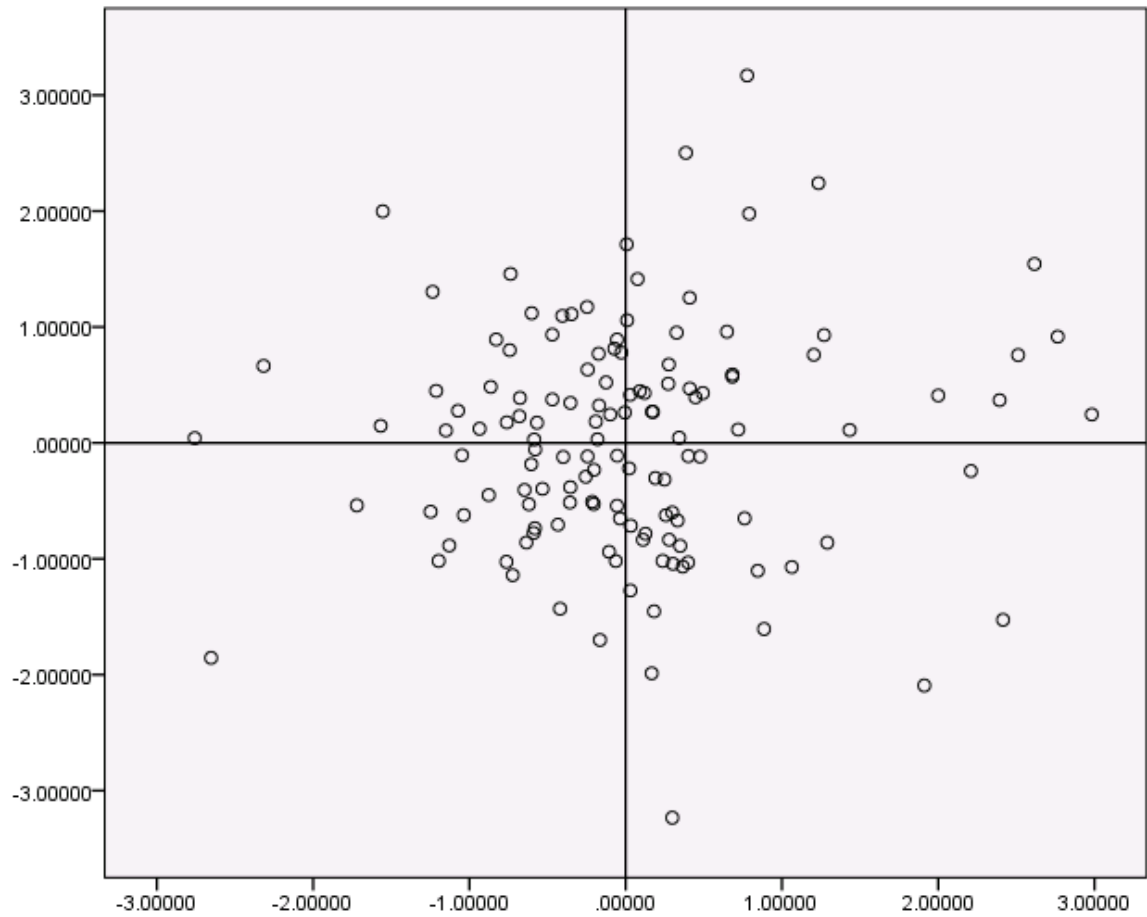


Figure 4. Residual scatterplot displaying the relationship between funding and 8th grade reading SOL performance during the 2012-2013 academic year.

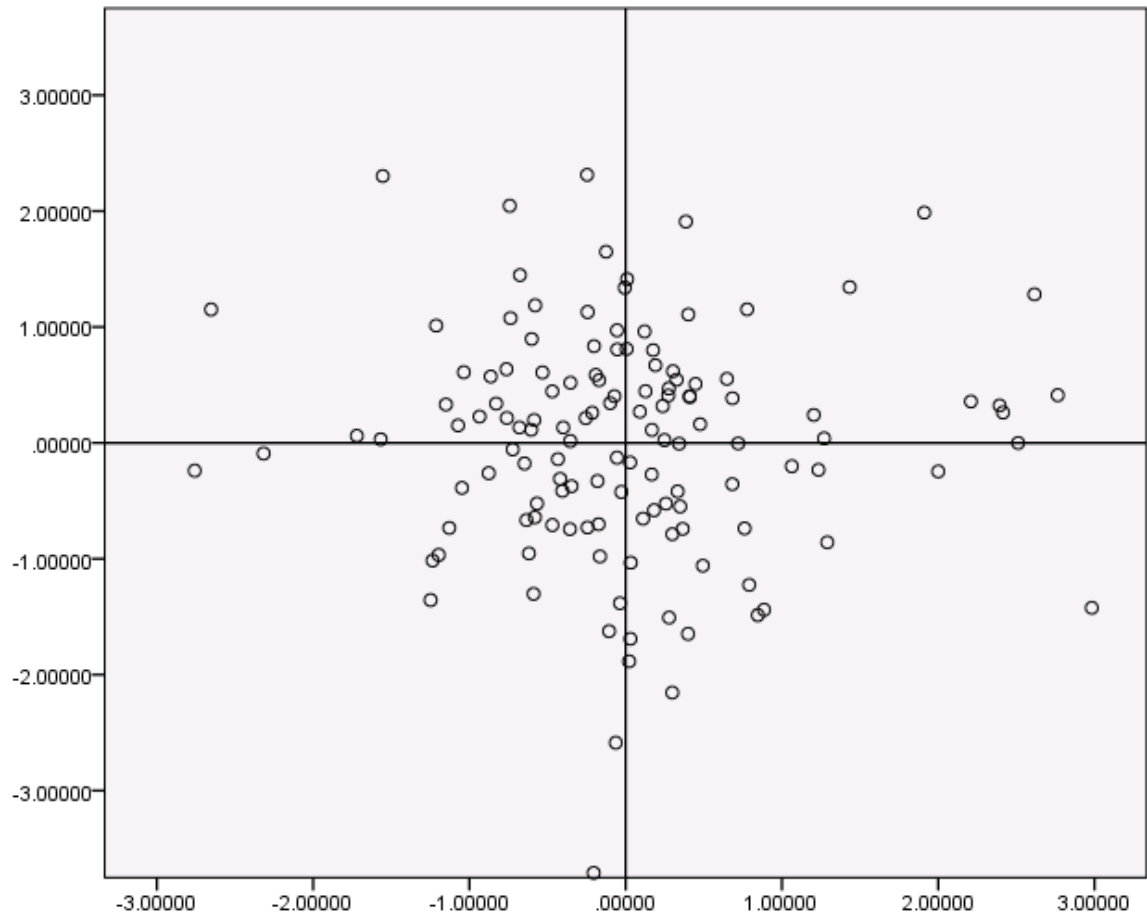


Figure 5. Residual scatterplot displaying the relationship between funding and end of course reading SOL performance during the 2012-2013 academic year.

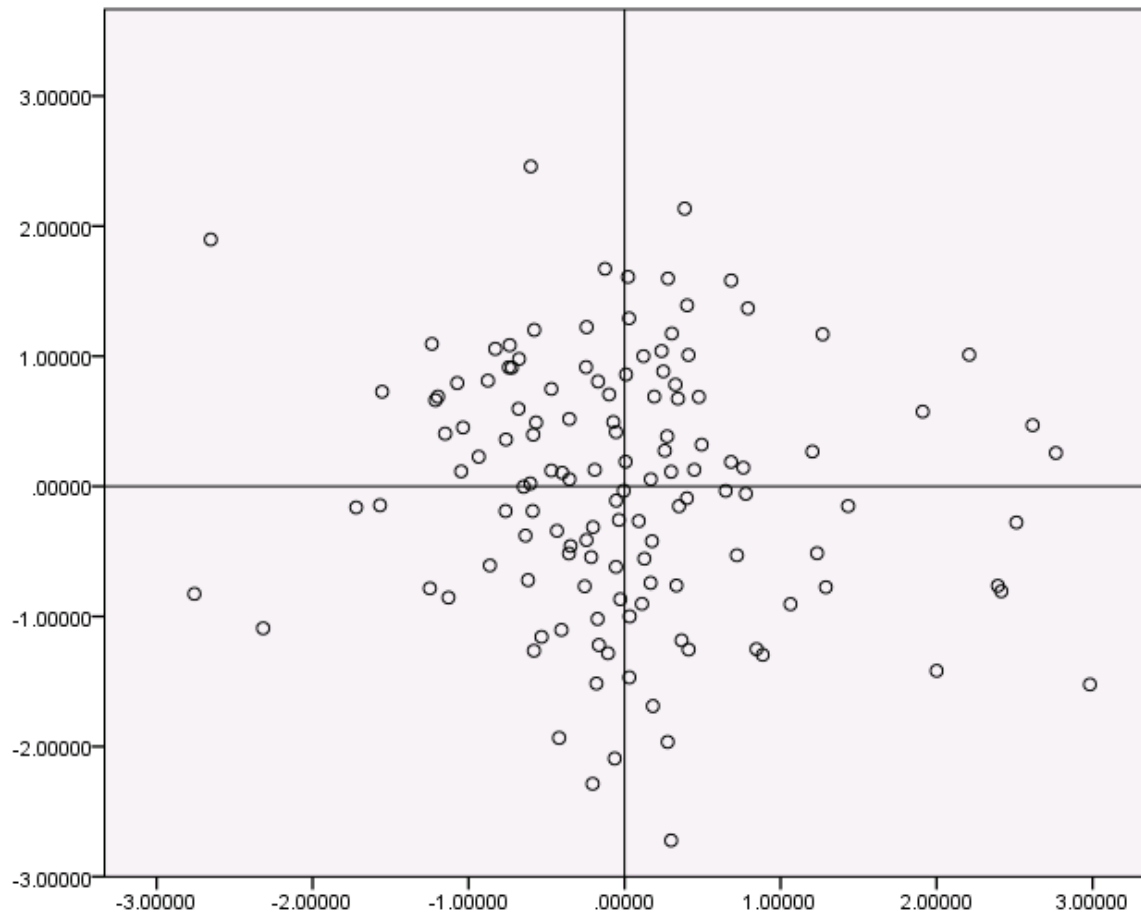


Figure 6. Residual scatterplot displaying the relationship between funding and high school graduation rates during the 2012-2013 academic year.

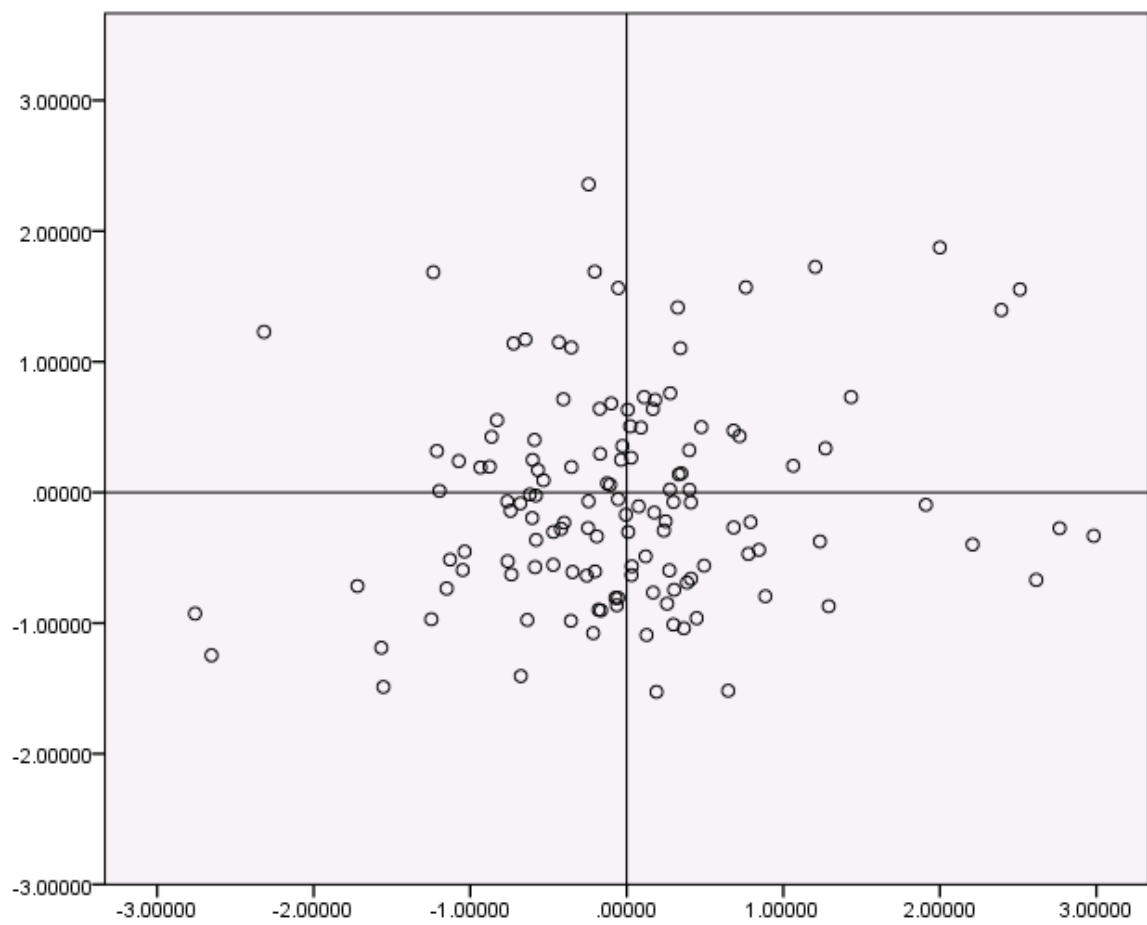


Figure 7. Residual scatterplot displaying the relationship between funding and AP course enrollment during the 2012-2013 academic year.

References

- Anderson, D. (1996). Stretching the tax dollar: Increasing efficiency in urban and rural schools. In L. O. Picus, L. O. & J. L. Wattenbarger (Eds.). *Where does the money go?: Resource allocation in elementary and secondary schools* (pp.156 - 177). Thousand Oaks, CA: Corwin.
- Barton, D. S. (2013). An assessment of Texas school finance reform: The health of school funding since 2006. Retrieved from <https://repositories.tdl.org/ttu-ir/handle/2346/50716>
- Baker, B. D., Sciarra, D. G., & Farrie, D. (2014). Is school funding fair? A national report card. *Education Law Center*. Retrieved from <http://schoolfundingfairness.org/>
- Boser, U. (2014). Return on Educational Investment: A Division-by-Division Evaluation of US Educational Productivity. *Center for American Progress*. Retrieved from <https://www.americanprogress.org/issues/education/report/2014/07/09/93104/return-on-educational-investment-2/>
- Brownson, A. B. (2002). School finance reform in post Edgewood Texas: An examination of revenue equity and implications for student performance. Retrieved from <http://repositories.lib.utexas.edu/bitstream/handle/2152/475/brownsonab029pdf?sequence=2>
- Calzini, C. R. (2011). Educational efficiency in Virginia public school divisions (Order No. 3455213). Available from ProQuest Dissertations & Theses Full Text. (867839324). Retrieved from <http://search.proquest.com/docview/867839324?accountid=14541>
- Cedo, K. M. (2014). A correlational study examining the relationship between state fiscal effort and high school graduation rates (Order No. 3581716). Available from ProQuest Dissertations & Theses Full Text. (1612797801). Retrieved from <http://search.proquest.com/docview/1612797801?accountid=14541>
- Costrell, R., Hanushek, E., & Loeb, S. (2007). What do cost functions tell us about the cost of an adequate education? *Peabody Journal of Education*, 83, 198-223. <http://dx.doi.org/10.1080/01619560801996988>

- Dickey, K. C. (2013). Overview of K-12 education funding in Virginia: Direct aid to public education budget. [PowerPoint slides]. Retrieved from http://www.doe.virginia.gov/school_finance/budget/funding_stds_quality/soq_funding_presentation.pptx
- Driscoll, L.G., & Salmon, R.G. (2008). How increased state equalization aid resulted in greater disparities: An unexpected consequence for the Commonwealth of Virginia. *Journal of Education Finance*, 33(3), 238-261. Retrieved from <http://www.jstor.org/stable/40704328>
- Fiester, L. (2010). Early Warning! Why Reading by the End of Third Grade Matters. KIDS COUNT Special Report. *Annie E. Casey Foundation*. Retrieved from <http://www.aecf.org/resources/early-warning-why-reading-by-the-end-of-third-grade-matters/>
- Hanushek, E. A. (1986). The economics of schooling: Production and efficiency in public schools. *Journal of economic literature*, 1141-1177. Retrieved from <http://www.jstor.org/stable/2725865>
- Hanushek, E. A. (1997). Assessing the effects of school resources on student performance: An update. *Educational Evaluation and Policy Analysis*, 19(2), 141-164. <http://dx.doi.org/10.3102/01623737019002141>
- Hanushek, E. A. (2005). Pseudo-science and a sound basic education: Voodoo statistics in New York. *Education Next*, 5(4), 67-73. Retrieved from <http://mutex.gmu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=eft&AN=507834943&site=ehost-live&scope=site>
- Hanushek, E. A. (1999). The evidence on class size. In S.E. Mayer & P. Peterson (Eds.), *Earning and learning: How schools matter* (pp.131-168). Washington, D.C.; Brookings Institute Press.
- Hickrod, G. A. (1989). *The biggest bang for the buck: An initial report of technical economic efficiency in K-12 schools with a comment on Rose v. The Council*. Norman, IL: Center for the study of Education Finance. Retrieved from <https://education.illinoisstate.edu/downloads/csep/series11.pdf>
- Hickrod, G. A. (1990). *The biggest bang for the buck: A further investigation of economic efficiency in the public schools of Illinois*. Norman, IL: Center for the study of Education Finance. Retrieved from <https://education.illinoisstate.edu/downloads/csep/series16.pdf>

- Houck, E. A., Rolle, R. A., & He, J. (2010). Examining school division efficiency in Georgia. *Journal of Education Finance*, 35(4), 331-357.
<http://dx.doi.org/10.1353/jef.0.0022>
- Iatarola, P., & Stiefel, L. (2003). Intradivision equity of public education resources and performance. *Economics of Education Review*, 22(1), 69-78.
[http://dx.doi.org/10.1016/S0272-7757\(01\)00065-6](http://dx.doi.org/10.1016/S0272-7757(01)00065-6)
- Jackson, C. K., Johnson, R., & Persico, C. (2014). *The Effect of School Finance Reforms on the Distribution of Spending, Academic Achievement, and Adult Outcomes* (No.w20118). National Bureau of Economic Research.
<http://dx.doi.org/10.3386/w20118>
- Johnson, B. R. (2014). *Relationship between Virginia's fiscal effort and public school graduation rates* (Order No. 3580480). Available from ProQuest Dissertations & Theses Full Text. (1535273125). Retrieved from
<http://search.proquest.com/docview/1535273125?accountid=14541>
- Joint Legislative Audit & Review Commision. (2015). *Efficiency and effectiveness in K-12spending*. Retrieved from the State of Virginia website:
<http://jlarc.virginia.gov/pdfs/reports/Rpt472.pdf>
- Jimenez-Castellanos, O. (2010). Relationship between educational resources and school achievement: A mixed method intra-division analysis. *The Urban Review*, 42(4), 351-371. <http://dx.doi.org/10.1007/s11256-010-0166-6>
- Krueger, A. B. (1997). *Experimental estimates of education production functions* (No. w6051). National Bureau of Economic Research.
<http://dx.doi.org/10.3386/w6051>
- Lesnick, J., Goerge, R., Smithgall, C., & Gwynne, J. (2010). *Reading on grade level in third grade: How is it related to high school performance and college enrollment?* Chicago: Chapin Hall at the University of Chicago. Retrieved from
<http://www.chapinhall.org/research/report/reading-grade-level-third-grade-how-it-related-high-school-performance-and-college-e>
- Levin, H. M., & McEwan, P. J. (2001). *Cost-effectiveness analysis: Methods and applications* (2nd ed.). Thousand Oaks, CA: Sage.
- Lewis, D. R. (1990). Estimating the economic worth of a 5th-year licensure program for teachers. *Educational Evaluation and Policy Analysis*, 12(1), 25-39.
<http://dx.doi.org/10.3102/01623737012001025>

- Odden, A., & Clune, W.H. (1998). School finance systems: Aging structures in need of renovation. *Educational Evaluation and Policy Analysis*, 20(3), 157-177. <http://dx.doi.org/10.3102/01623737020003157>
- Odden, A. & Picus, L.O. (2004). *School finance: A policy perspective*. New York, NY: McGraw-Hill.
- Owings, W., & Kaplan, L.S. (2006). *American public school finance*. Belmont, CA: Thomson Learning/Wadsworth.
- Rolle, R. A. (2000). *Marching to the beat of a different drum: An empirical analysis of public school corporations as budget-maximizing bureaus* (Order No. 9981013). Available from ProQuest Dissertations & Theses Global. (304624274). Retrieved from <http://search.proquest.com.mutex.gmu.edu/docview/304624274?accountid=14541>
- Roy, J. (2003). Impact of school finance reform on resource equalization and academic performance: Evidence from Michigan. *Princeton University, Education Research Section Working Paper No. 8*. Retrieved from https://www.aeaweb.org/assa/2005/0107_0800_1210.pdf
- Rubenstein, R., Schwartz, A. E., Stiefel, L., & Amor, H. B. H. (2007). From divisions to schools: The distribution of resources across schools in big city school divisions. *Economics of Education Review*, 26(5), 532-545. <http://dx.doi.org/10.1016/j.econedurev.2006.08.002>
- Salmon, R. G. (2010). The evolution of Virginia public school finance: From the beginnings to today's difficulties. *Journal of Education Finance*, 36(2), 143-161. <http://dx.doi.org/10.1353/jef.2010.0001>
- Salmon, R. G., & Alexander, M. D. (2014). *Taking the mystery out of Virginia school finance*. Ypsilanti, MI: NCPEA Publications.
- Silverman, R. M. (2011). How unwavering is support for the local property tax?: Voting on school division budgets in New York, 2003-2010. *Journal of Education Finance*, 36(3), 294-311. <http://dx.doi.org/10.1353/jef.2011.0003>
- Stevens, C. A. (2006). *Applying the modified quadriform to measure efficiency in texas public schools* (Order No. 3246420). Available from ProQuest Dissertations & Theses Global. (304932568). Retrieved from <http://search.proquest.com.mutex.gmu.edu/docview/304932568?accountid=14541>

- Unnever, J. D., Kerckhoff, A. C., & Robinson, T. J. (2000). Division variations in educational resources and student outcomes. *Economics of Education Review*, 19(3), 245-259. [http://dx.doi.org/10.1016/S0272-7757\(99\)00043-6](http://dx.doi.org/10.1016/S0272-7757(99)00043-6)
- Verstegen, D., & Salmon, R. (1991). Assessing Fiscal Equity in Virginia: Cross-time comparisons. *Journal of Education Finance*, 16(4), 417-430. Retrieved from <http://www.jstor.org/stable/40703791>
- Verstegen, D. A., & King, R. A. (1998). The relationship between school spending and student achievement: a review and analysis of 35 years of production function research. *Journal of Education Finance*, 24(2), 243-262. Retrieved from <http://www.jstor.org/stable/40704063>
- Verstegen, D. A., & Driscoll, L. G. (2008). Educational opportunity: The Illinois dilemma. *Journal of Education Finance*, 33(4), 331-351. Retrieved from <http://www.jstor.org/stable/40704335>
- Virginia Department of Education. (2015). *Composite index of local ability to pay*. Retrieved from Virginia Department of Education website: http://www.doe.virginia.gov/school_finance/budget/compositeindex_local_ability_pay/index.shtml
- Virginia Department of Education. (2015a). *School division regions*. Retrieved from Virginia Department of Education website: http://www.doe.virginia.gov/directories/schools/school_info_by_regions.shtml
- Webber, D. A., & Ehrenberg, R. G. (2010). Do expenditures other than instructional expenditures affect graduation and persistence rates in American higher education?. *Economics of Education Review*, 29(6), 947-958. <http://dx.doi.org/10.1016/j.econedurev.2010.04.006>
- Wu, M. J. (2013). The Effects of Student Demographics and School Resources on California Performance Gain: A Fixed Effects Panel Model. *Teachers College Record*, 115(4), 1-28. Retrieved from <http://www.tcrecord.org.mutex.gmu.edu/library/Content.asp?ContentId=16926>
- Wyckoff, J. H. (1992). The intrastate equality of public primary and secondary education resources in the US, 1980–1987. *Economics of Education Review*, 11(1), 19-30. [http://dx.doi.org/10.1016/0272-7757\(92\)90018-X](http://dx.doi.org/10.1016/0272-7757(92)90018-X)

Biography

Dustin P. Wright began his career as an educator in Fairfax County in 2006 as a middle school band director after graduating from George Mason University. He was one of the band directors at Rachel Carson Middle School in Herndon, VA until his appointment as the assistant principal at Fairfax Villa ES in 2012. He is currently serving in the same role at Daniels Run ES in the City of Fairfax. He has earned a Master's Degree from Arizona State University and an Education Specialist degree from the University of Virginia. Dustin now calls the City of Fairfax home where he lives with his wife and three children