THE EFFECT OF INSTRUCTIONAL EXPENDITURES ON STUDENT OUTCOMES: EVIDENCE FROM ST. LOUIS-AREA PUBLIC SCHOOL DISTRICTS

by

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ABSTRACT

NOAH ANTLE: The Effect of Instructional Expenditures on Student Outcomes:
Evidence from St. Louis-Area Public High Schools

This thesis seeks to contribute to the broader conversation over the relationship between school spending and student outcomes. Using twenty-two public school districts in the St. Louis area, annual data on instructional expenditures and two measures of student outcomes (average composite ACT score and the percentage of high school graduates to enroll at a 2- or 4-year college or university within 180 days of graduation) was collected by request from the Missouri Department of Education and Secondary Education. Regression analysis was conducted with this data to determine whether or not raw changes in instructional expenditures per student or the amount that a school district “focuses” on instruction (instructional expenditures as a percentage of total expenditures) influence these measures of outcomes. The findings indicate no relationship between changes in instructional spending per student and the selected outcome measures but support the proposed “65-percent rule”, a common guideline throughout the relevant academic literature which suggests that 65-percent of a school district’s budget should be allocated to instruction. Ultimately, the results indicate that a student’s family background and environmental factors are far more important in influencing student performance than changes in instructional expenditures per student, and that allocation is a more effective avenue through which policymakers can improve student performance than simply increasing the amount of funding which a school district receives.
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I. INTRODUCTION

In the words of Nobel laureate economist Theodore Schultz (1961, page 3), “Laborers have become capitalists not from a diffusion of the ownership of corporation stocks, as folklore would have it, but from the acquisition of knowledge and skill that have economic value.” During the early 1960s, Schultz focused on the now-ubiquitous economic concept of human capital: the significance of people’s investments in themselves in the growth of an economy and in the productivity of a nation’s labor force. Schultz (1961) makes the claim that economists prior to his publication on the subject in the 1960s tended to “shy away” from formal discussions of human capital, possibly due to the moral implications of treating human beings as a type of material component or marketable asset. Since Schultz’s publication, economists have widely adopted the notion of human capital and have come to terms with the undeniable importance of personal investments of time and money into the acquisition of knowledge, skills, and useful experience.

A discussion of human capital is inextricable from a discussion of education. Human capital, as the Organization for Economic Co-operation and Development (OECD) defines it, is “the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being” (2007, page 29). Certainly, the centrality of education to the policy issues related to human capital accumulation is undeniable. The thought process is wholly-logical, too; if a country at any point in its development hopes to promote economic growth and spur the productivity of its labor force, it follows that an increased investment in education, i.e., public schools, would be the obvious route for policy-makers.
Willona Sloan (2012) writes that, in theory, education in the United States provides individuals with the skills required to be competitive in a global economy, promotes the innate desire to learn, and aids in the development of emotionally, intellectually, and mentally healthy adults who are able to positively contribute to their society through personal achievement and civic involvement. When education works, it produces several significant positive externalities which contribute to its immense significance as a policy issue. Truly, schooling often exists as the obvious example of positive externalities within economic principles courses. In his analysis of positive externalities resulting from education, Joshua Hall (2006) summarizes decades of prior analyses and discussion, stating that the two positive externalities most often attributed to education are its contribution to a stable and thriving democracy through increased civic engagement and the ability for an educated workforce to create and adopt new technologies, thus spurring economic growth (p. 166).

Since schooling is the most visible component of human capital that can be controlled through legislation, not to mention the fact the education is a noteworthy and often emotional cause for voters, the issue is front and center within government at all levels. Expenditures on education in the United States are significant. According to the Office of Management and Budget (OMB) and the U.S. Census Bureau’s 2018 Annual Survey of State and Local Finances, education accounts for 3 percent of the federal budget, 18 percent of state government budgets, and 37 percent of expenditures of local governments’ budgets.¹ Local governments, in particular, place a notable emphasis on education; while 37 percent of local government budgets in the United States are devoted

¹ For federal data, see https://www.govinfo.gov/app/collection/BUDGET/2020/BUDGET-2020-TAB
For state and local data, see https://www.census.gov/programs-surveys/gov-finances.html
toward education, the next most-funded government program is Protection—for example, police and fire departments—which accounts for just 10 percent. On the state level, education accounts for a greater percentage of state budgets than any area except for health care. In total, public education spending in the United States totaled $1.13 trillion, and currently accounts for 5.37 percent of gross domestic product.

The extraordinary amount of funding and resources poured into public schools in the United States combined with the fact that education is a widely-debated, important issue for voters and a source of endless analysis for scholars begs the all-important question of whether or not the money distributed to public education results in an accumulation of human capital within students that at least offsets the costs. There is a common belief that a strong positive relationship exists between school funding and the outcomes of students; after all, the more money a school has, the more it should be able to hire top-tier teachers, administrators, or guidance counselors, acquire higher-quality and up-to-date educational resources, and make investments to aid in the enrichment of students and a school’s community like arts or athletics programs. This gut-reaction instinct says that the more funding that is available to a public school, the better off the students in the school should be, a reality which should be reflected in meaningful measures of student outcomes. As is often the case in economics, however, the reality of this situation is far more complex and ambiguous than popular perception would suggest.

Perhaps the most important document related to school spending and student outcomes is the James S. Coleman’s 1966 report entitled *Equality of Educational Opportunity*, now more commonly known as The Coleman Report. This report, which was commissioned by the Civil Rights Act of 1964, was completed in order to aid the federal government in arriving at an understanding of “the lack of availability of equal education
opportunities for individuals by reason of race, color, religion, or national origin” (page iii). While the Coleman Report arrived at some notable conclusions of racial inequality and lack of opportunity for minority groups in the United States, its ultimate conclusion is what has been of the most significant importance to those interested in the question of the effect of government expenditure on student outcomes. The report states that:

…it one implication stands out above all: That schools bring little influence to bear on a child’s achievement that is independent of his background and general social context; and that this lack of an independent effect means that the inequalities imposed on children by their home, neighborhood, and peer environment are carried along to become the inequalities with which they confront adult life at the end of school. (page 325)

This conclusion has been the launching point of innumerable studies and articles published since 1966. Nonetheless, this endlessly-influential report has contributed more to public perception on education policy than any other document. As Eric Hanushek (2006, page 3) writes, “Reporters, columnists, and policymakers turned their understanding of results and conclusions into conventional wisdoms—simplified, bumper-sticker versions of the report’s conclusions. . . .it fundamentally altered the lens through which analysts, policymakers, and the public at large view and assess schools.” Certainly, the Coleman Report leads to some fairly ambiguous conclusions for those in charge of educational policy and, therefore, ambiguous conclusions for the general public. Hanushek has been largely critical of the Coleman Report’s methodologies and the implementations of policy that derive from the Report’s conclusions. In his feature article for Education Next (2016, page 28), he asserts that “How money is spent is much more important than how much is spent. Just providing more funds to a typical school district without any
change in incentives and operating rules is unlikely to lead to systematic improvements in student outcomes.”

Education is a complex issue to tackle. Questions about how much money should be spent, where this money should go, or how much influence funding has on student performance dominate the minds of policymakers, while the general public is presented with data reflecting that education in the United States is inferior to our global competitors, such as a Pew Research Center analysis that finds that students in the United States are “around the middle of the pack, and behind many other advanced industrial nations” in math and science assessments (Desilver, 2017). Important steps need to be taken in the effort to improve American education. Of course, we must understand the effect of funding on student outcomes. If billions of dollars are going to be funneled into education, it is crucial to ensure that the funding is being used efficiently and in a way that will provide the most benefit (result in the greatest possible accumulation of human capital) to students.

An abundance of research finds that student outcomes are not affected by expenditures, i.e., human capital accumulation is not influenced by increased funding, suggesting a dismal reality for policymakers who feel pressure from their electorate to boost funding toward public schools despite evidence that the additional money is inconsequential. Further, we must decide what a proper outcome should be to judge student performance and outcomes. A multitude of proposed explanations for these findings exists, such as the suggestions offered by C. Kirabo Jackson, Rucker C. Johnson, and Claudia Persico (2015, page 159) that test scores are not necessarily the best measurements of student learning, that the policies in the United States that exist to funnel increased funding to schools experiencing an increase in low-income students may negatively skew the data, and the fact that if a locality diverts more funding to schools it
must remove funding from another potentially-productive recipient. As long as it is tested thoroughly, the conclusion that funding does not affect student achievement can certainly be a meaningful conclusion, as it can inform future policy and spending decisions in a way that may suggest sending money elsewhere, to places where students can actually reap the rewards.

This thesis contributes to the scholarship on the relationship between educational expenditures and student outcomes by examining the twenty-two public school districts in the metropolitan area of St. Louis, Missouri for the years between 2001 and 2017. Regression analyses are conducted to provide empirical evidence on the relationship between spending and student outcomes. The educational spending measures used are K-12 instructional spending per student, and instructional spending as a percentage of total educational expenditures. The student outcomes that are examined are the average composite ACT score and the percentage of high-school graduates who enroll in a 2- or 4-year college within 180 days of graduation. In 2017, almost 92 percent of Missouri’s graduates took the standardized ACT, so this score should serve as a useful comparison between students in different districts. The choice to use data on the percentage of high school graduates to attend college was made in order to reflect the previously-mentioned fundamental goals of education, including intellectual development and instilling within students a desire to learn.
II. LITERATURE REVIEW

As to be expected with such an intricate and societally-important topic like education and the funding of public schools, no consensus has been reached by scholars on the exact nature of the connection between funding and student success since the publication of the Coleman Report in 1966. This intricacy has lent itself to a wide variety of studies approaching the topic from countless angles, from theoretical speculations on human capital theory to analyses of federal stimulus packages, from variables affecting the in-the-classroom experience of students to studies of environmental factors and their influence on student performance. The United States’ education system directly influences the lives of almost every citizen, so its ubiquitous place within academic literature is firmly secured.

In the previously-mentioned paper by Jackson, Johnson, and Persico (2017, page 212), the authors focused on the intergenerational transmission of poverty, finding that increased school spending is particularly beneficial to low-income students, yielding “large improvements in educational attainment, wages, family income, and reductions in the annual incidence of adult poverty.” Further, the authors found that such substantial benefit was not observed to the same extent in students from non-poor families, indicating diminishing marginal returns on educational outcomes as household income of the student increases, a result which reflects the economic theory of convergence and should be informative in guiding allocative decisions of policymakers. It seems that the majority of literature echoes the Coleman Reports findings that there is a negligible relationship between school spending and outcomes, but Jackson et al. demonstrate that long-term
indications of success, like wages and levels of adult poverty, can be improved in low-income students through increased school spending.

A prevalent theme within the economic literature concerning school spending is a focus upon allocation of funds. Hanushek (2009) expresses criticism of a federal stimulus package aimed at pulling the nation out of recession, writing that the stimulus will “pour more money into (schools), but the structure of the package guarantees that most of the money will be allocated and spent the same way it has always been spent.” In his critique, Hanushek raises the point that per-student spending has increased dramatically in the decades prior to the stimulus without any measurable effect on student performance; essentially, increasing spending will not produce change if the spending is allocated the way it always has been.

Echoing the emphasis on allocation of funding, Deborah A. Cobb-Clark and Nikhil Jha (2016, page 263-264) suggest that schools in Victoria, Australia have been able to visibly improve student performance relative to schools elsewhere (for example, the United States) through affording individual school principals significant autonomy and flexibility—of course, with close monitoring—in making allocative decisions. This study used standardized test scores as a measure of student performance, indicating that it is possible to observe some change in short-term performance (as opposed to long-term measures like future earnings) based on a given change in school expenditures.

William Blankenau and Gabrielle Camera (2007, page 505) raise a slightly-different concern related to allocation of funding, suggesting that “If one takes the view that students are to a large extent passive beneficiaries of the schooling process, then poor educational outcomes simply reflect a misallocation of educational resources,” but if students are required to actively participate in the schooling experience, then “poor
educational outcomes might also stem from inadequate incentives for academic achievement.” Blankenau and Camera echo the popular sentiment that simply providing schools with increased funding will fail to generate improved outcome—in fact, increasing funding in the form of subsidizing the cost of private education will negatively affect student outcomes by harming aggregate productivity and increasing class size. Instead, the promotion of increased incentives for students, resulting in greater productivity, is a far more effective target for funding.

Since education is a direct influence in the life of the average taxpayer and citizen, it is of great concern to many that the allocation of funding within schools is well-researched and implemented to optimize student outcomes and human capital accumulation. Real-world evidence shows, however, that suggestions from state legislatures on what this allocation should look like are not always followed by local school boards. For example, the Kansas Supreme Court ordered an $853 million increase in educational funding in 2005, and the state legislature implemented a recommendation that 65 percent of total expenditures be put toward instruction (which the Kansas Department of Education defines as “direct interaction between students and teachers”). Instead of following this recommendation, however, instructional spending as a percent of total spending in Kansas has dropped from 54.2 percent at the time of this funding increase in 2005 to just 53.9 percent in 2018 and is set to decline further to 51.1 percent in the largest Kansas school districts in 2019 (Trabert, 2018). Examples like Kansas contribute to the reality that increased educational funding often fails to generate any noticeable benefit, and inefficient allocation by school boards is largely to blame. The National Center for Education Statistics reported in 2017 that 61 percent of all total educational spending in the United States was put toward “instruction”, using the same definition for instruction as
Kansas’s Department of Education (Cavanagh, 2017). Even if spending patterns have dramatically increased in the past several decades, if school boards distribute increased funding irresponsibly, then one can hardly expect to find a noteworthy increase in student performance.

The guideline that 65 percent of educational spending be devoted to “classroom instruction” has become a hotly-debated policy issue, stemming from the No Child Left Behind Act’s educational reforms. According to a report made by Standard and Poor’s (2005, page 1), an organization called First Class Education (“FCE”) advocated for the passing of the “65 Percent Solution”, arguing that it would help students by “1) increasing the amount of money spent in the classroom without increasing taxes; 2) reducing the amount spent on ‘wasteful’ administrative costs by making districts accountable for how they spend their money; and 3) improving student performance by focusing on classroom activities.” Based on the previous decades of academic research that found negligible ties between school spending and student outcomes, this effort was met with widespread debate that continues to this day. In the same Standard and Poor’s report, it is observed that “the 65 Percent Solution is an input-driven initiative, without any measurable outcome, such as a quantified achievement goal or targeted return on resources,” raising the question of “whether there is empirical evidence that allocating more money to instruction will necessarily result in higher student achievement.” Criticism of such rigid allocative requirements was plentiful. In his critique, aptly titled “100 Percent Phony: Why the ’65 Percent Solution’ is a Political Gimmick That Will Do Nothing To Improve Student Performance in Oregon”, Michael Leachman (2006, page 1) emphasizes the importance of autonomy of schools who have “legitimate reasons to direct resources differently than the formula prescribes” and the problems associated with dismissing support services within
schools (which are not counted in instructional spending). As if the topic of school funding and student outcomes was not sufficiently steeped in debate and disagreement already, this 2004 “65 Percent Solution” further complicated the discussion.

Based on the relevant literature, I expect to find in this analysis a negligible relationship between educational spending and student outcomes, namely due to the fact that most significant results were achieved by employing outcomes that unfolded over a much longer-term than standardized test results or enrollment in a college within months of graduating from high school. It seems as if these short-term outcomes simply do not reflect any trends or changes in school funding. While these outcomes certainly make sense and should accurately reflect student performance and human capital accumulation, long-term measures like adult poverty levels or career earnings may be more indicative of these traits. Further, in many studies where notable positive relationships between spending patterns and student outcomes were found, the researchers focused their attention on changes within populations of low-income students. While this analysis does include the percentage of students who are eligible for free or reduced lunch within the regressions to account for poverty levels within a school district, it will not analyze low-income students separately from non-poor students. The most convincing research in support of a positive relationship between school spending and student outcomes typically centers around low-income students over very long (possibly multi-generational) periods of time. Policymakers may take at least a small amount of comfort in this fact, as it can be shown that student performance can be influenced and improved by exogenous changes in spending, but it is unlikely that this particular analysis will mirror these results.

An aim of this thesis will be to contribute to the research related to allocation of school funding. It can be expected that the following analysis will mirror the findings of
the Kansas legislature and, hopefully, the spending conditions that currently exist in the United States in arriving at the conclusion that the ideal level of instructional expenditures as a percent of total expenditures lies somewhere between 60 and 70 percent. This information is tremendously important for policymakers, as efficient allocation of funding is a necessary condition in order for a positive relationship to exist between funding and student outcomes. If much of the long tradition of academic research finding little to no relationship between educational spending and student outcomes is based upon data from school districts who inefficiently allocate funding, then this is perhaps a significant flaw. The “65 Percent Solution” may arise within the analysis of St. Louis’s schools. However, it must always be considered that such a rigid requirement may over-simplify the issue of allocation of educational funding and that, as with many debates presently occurring within this arena, valid points and effective policy implications come from both sides. A brief glimpse into the relevant academic literature displays the intricacy and discord associated with education funding. The aim of this thesis is to understand how public schools in St. Louis reflect the common understandings and positions taken in the relevant literature.
III. DATA AND EMPIRICAL METHODOLOGY

Annual data for twenty-two public school districts in the St. Louis metropolitan area between 2001 and 2017 are used to analyze the relationship between instructional expenditures and student outcomes. Average composite ACT score and the percentage of graduates who enrolled at a 2- or 4-year college or university within 180 days of graduation serve as the variables measuring student outcomes. Due to the standardized nature of the ACT, scores on this test serve as a convenient and meaningful way to directly compare student performance between school districts and across the entire time period being analyzed. The data on the percentage of graduates enrolled in a college or university captures how well public-school districts aid in the intellectual development of students. Use of ACT scores is a useful way to compare the majority of high school graduates in the area, as even in a school district like Normandy Schools Collaborative (one of the lower-performing districts), more than half of students took the exam over the relevant time period. Further, one of the higher-achieving districts, Ladue, saw almost 84 percent of graduates take the ACT over the same time period, a figure well above the state average.

If the role of education is to develop students into lifelong learners, then it follows that the percentage of graduates to enroll at a 2- or 4-year college or university shortly after graduation from high school should be a useful measure of the success of the educational experience. The percentage of students enrolled in college after high school is reflective of the success of a school district and student achievement.

Total instructional expenditures per student and instructional expenditures as a percentage of total expenditures are the expenditure variables considered in the empirical
analysis. The Missouri Department of Education and Secondary Education (DESE) defines “Instruction” as

“…the activities dealing directly with the teaching of pupils, or the interaction between teachers and pupils. Teaching may be provided for pupils in a school classroom, in another location such as a home or hospital. It may also be provided through some other approved medium such as television, radio, telephone and correspondence. Included here are the activities of aides or assistants of any type (graders, teaching machines, etc.) that assist in the instructional process.”

In order to focus upon spending allocation and to compare results from this analysis to the debated “65-percent rule,” instructional spending as a percent of total spending is used.

Student performance is influenced by numerous factors other than the amount of instructional spending a school district provides. As the literature suggests that environmental factors are of overwhelming importance, the empirical analysis includes the percentage of students who are eligible for free or reduced-price lunch as a rough proxy for poverty levels within school districts. This variable is used in all of the regressions (regardless of outcome or spending measure) in an effort to capture the presumably-important environmental factors that would be impossible to account for without a significant increase in socioeconomic data for each district.

Table 1 provides an overview of the outcome and spending categories that are used throughout the analysis. It is worth noting that, on average, St. Louis-area public schools fall below the recommended 65 percent of total spending composed of instructional-

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3 Data for percentage of students eligible for free/reduced lunch can also be found at https://apps.dese.mo.gov/MCDS/home.aspx
spending. Perhaps more eye-catching, however, are the statistics on the percentage of students eligible for free or reduced-price lunch. In this measure, the most affluent district of Ladue (which averaged 10.28 percent between 2001 and 2017) and are utterly dwarfed by districts like St. Louis City (85.51 percent), and Normandy Schools Collaborative (85.59 percent). If it is to be assumed that environmental conditions are of significant importance in determining student outcomes and that the percentage of students eligible for free/reduced lunch is a rough but practical proxy for poverty levels, then this data suggests discrepancies in student performance between school districts in the St. Louis area (which can be seen, for example, in the large difference between the maximum and minimum values for percentage of students to enroll in a college or university).

In general, Table 1 shows tremendous disparities between the most- and least-successful school districts in the St. Louis area, both in spending and in the relevant measures of student outcomes. With these vast differences throughout the sample set in mind, an empirical analysis will allow for any relationship between spending and outcomes to be made apparent.

To assess the impact of spending on student outcomes, the following regressions are estimated:

\[
(1) \quad \text{Outcome}_{it} = \alpha_0 + \alpha_1 ISP_{it} + \alpha_2 ISP^2_{it} + \alpha_3 FL_{it} + \text{Dummies} + \epsilon_{it}
\]

\[
(2) \quad \text{Outcome}_{it} = \alpha_0 + \alpha_1 IS\%_{it} + \alpha_2 IS\%^2_{it} + \alpha_3 FL_{it} + \text{Dummies} + \epsilon_{it}
\]

Where, for district \( i \) in year \( t \), \( ISP = \) Instructional Spending per Student, \( IS\% = \) Instructional Spending as a Percentage of Total Spending. Equations (1) and (2) are run with and without squared terms \( ISP^2 \) and \( IS\%^2 \) which have been included in the
regressions to allow for a nonlinear relationship between spending and outcomes. The squared terms are of particular interest in calculating an optimal value for instructional spending as a percentage of total spending in order to determine whether or not the data on St. Louis area public schools agrees with the literature on the “65-percent rule”. Also, equations (1) and (2) are estimated both with and without dummy variables for years and school districts in order to capture unobserved factors that may influence outcomes.

It is likely that student outcomes may influence spending, as a low-achieving district may receive additional funding with the hope that the funding will improve student outcomes. This potential simultaneity between spending and outcomes may lead to imprecise estimates on the spending coefficients in equations (1) and (2). To reduce this problem, additional regressions assess whether spending in 2001 affects growth in outcomes from 2001 and 2017. The regressions are:

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<tr>
<td>Average Composite ACT Score</td>
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<tr>
<td>Percentage of Graduates to Enroll in 2- or 4-Year College</td>
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<tr>
<td>Real Total Instructional Expenditures Per Student</td>
</tr>
<tr>
<td>Instructional Expenditures as a Percentage of Total Expenditures</td>
</tr>
<tr>
<td>Percentage of Students Eligible for Free/Reduced Lunch</td>
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</table>

Calculations based on 22 districts over the period 2001-2017. Sample size = 374.
(3) \( \text{Outcome Growth}_{2001-2017} = \alpha_0 + \alpha_1 ISP_{2001} + \alpha_2 FL_{2001} + \epsilon \)

(4) \( \text{Outcome Growth}_{2001-2017} = \alpha_0 + \alpha_1 IS\%_{2001} + \alpha_2 FL_{2001} + \epsilon \)

for both measures of outcomes, resulting in a total of four regressions.

The twelve regressions will provide insight into any relationship between school spending and short-term measures of student success in school districts in the St. Louis area, keeping in mind the question of allocation of instructional spending within a school district. Based on the relevant literature, I expect to find no relationship between instructional expenditures per student and the selected outcome variables. This is possibly due to the fact that the outcome variables are not long-term enough to capture the beneficial effects of increased instructional expenditures or the focus is not directed specifically upon low-income students (as suggested in Jackson et al., 2017). Since a diverse cross section of students from schools of varied socioeconomic status is used in the analysis, the beneficial effects of instructional expenditures on low-income students might be obscured. As far as allocation is concerned, there is no reason not to anticipate the results of these regressions supporting the 65-percent rule. Overall, if results of this analysis largely reflect the general consensus within the literature on the topic, then we should observe a negligible or nonexistent relationship between instructional spending per student and short-term measures of student performance, whereas the 65-percent rule should be supported by the findings.
IV. RESULTS

This section presents the results obtained for equations (1) through (4). Table 2 presents the estimates for equations (1) and (2), both with and without the inclusion of dummy variables, which regresses each outcome measure on real total instructional spending per student and real total instructional spending per student squared. The estimated coefficients on the spending measures in Table 2 have been multiplied by 1000 to adjust for scaling factors (the constant and coefficient on percentage of students eligible for free or reduced lunch have not been multiplied by 1000). This allows the regressions to capture changes in the Average ACT score and the percentage of students to enroll in college after graduation due to a $1000 change in instructional spending per student rather than a $1 change.

Regardless of which performance outcome is analyzed or whether or not year/district dummy variables are included, the results in Table 2 reveal that there is no statistically significant relationship between school spending and short-term measures of student performance. These results are wholly reflective of my original hypothesis. The policy implication of this finding echoes much of the literature on the subject, confirming that “pouring money into schools,” in the words of Hanushek (2009), should not be expected to increase short-term measures of student performance.

Table 2 reveals one of the most important findings of this thesis. For each regression run with or without dummy variables, statistically significant negative coefficients have been estimated for the percentage of students eligible for free and reduced lunch. This result holds for all regressions run in each of the following tables. While no relationship is found
between instructional expenditures per student and student performance, the estimations show that poorer school districts tend to have lower average composite ACT scores and lower percentages of graduates to enroll in college. A student’s family background and environment are far more important in influencing student outcomes than instructional expenditures per student.
Table 3 presents the results from the same regressions as Table 2, but the regressions in Table 3 consider instructional expenditure as a percentage of current expenditures rather than instructional expenditures per student. This is done to capture how much attention school districts give to instruction as opposed to other sources of funding, like administrative salaries, athletics, or transportation. Thus, the following regressions are more inclined to answer important questions related to the allocation of total resources. As opposed to the results found in Table 2, we see statistically significant coefficients for the spending measure in Table 3. The results in column (2) that include year/district dummy variables reveal that an additional percentage point in instructional expenditures per student results in a roughly 0.80 increase in average composite ACT score. Further, the squared spending measure in this regression has a significant coefficient of -0.006, which, when combined with the positive coefficient on IS%, indicates that the returns to increasing the allocation of total spending to instruction increase at a decreasing rate. We can use this result to compare to the 65-percent rule established in earlier literature. After calculations are made, the optimal value for IS% is 66.5%, which closely reflects of the 65-percent rule. The results in columns (1) and (2) support the conclusion that allocation is arguably the most effective tool available to policymakers hoping to generate improved outcomes within schools.

The results in Table 4 have been estimated to reduce the simultaneity problems that may exist as school performance might directly affect the amount of funding a district receives (as when a low-achieving school district receives an increase in funding).

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4 Using the results in column (2) of Table 2, we can calculate an optimal value of IS% by taking the first partial derivative of Outcome with respect to IS%, setting it equal to zero to obtain an optimal value IS%*, then taking the second partial derivative of Outcome with respect to IS% and using this to determine whether the optimal value is a local maximum or minimum.
Table 3 – Effect of Instructional Expenditure as a Percent of Current Expenditure on Student Outcomes

<table>
<thead>
<tr>
<th></th>
<th>(1) Dependent Variable: Average Composite ACT Score</th>
<th>(2) Dependent Variable: % of Graduates Attend 2/4 Yr. College</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>−0.474 (8.283)</td>
<td>−4.153 (7.256)</td>
</tr>
<tr>
<td><strong>Instructional Expenditure as a % of Current Expenditure</strong></td>
<td>0.803** (0.272)</td>
<td>0.798** (0.238)</td>
</tr>
<tr>
<td><strong>Instructional Expenditure as a % of Current Expenditure (squared)</strong></td>
<td>−0.006** (0.002)</td>
<td>−0.006** (0.002)</td>
</tr>
<tr>
<td><strong>% Eligible for Free and Reduced Lunch</strong></td>
<td>−0.093** (0.002)</td>
<td>−0.056** (0.006)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>No</th>
<th>Yes</th>
<th>No</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year Dummies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>District Dummies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong># obs.</strong></td>
<td>374</td>
<td>374</td>
<td>374</td>
<td>374</td>
</tr>
<tr>
<td><strong>Adjusted R²</strong></td>
<td>0.871</td>
<td>0.955</td>
<td>0.659</td>
<td>0.793</td>
</tr>
</tbody>
</table>

Standard Errors in Parentheses, * denotes significance at 10%, ** denotes significance at 5%

The results in Table 4 are similar to those in Table 2. There is no statistically significant relationship between instructional expenditures in 2001 and the overall change in each of the measures of student performance from 2001 to 2017. Again, these results support the finding that instructional spending per student does not influence outcomes.

Table 5 presents the results from the final two regressions, in which the change in each outcome measure from 2001 to 2017 is regressed on instructional expenditures as a percent of total expenditures in 2001. As with the previous specification, these growth regressions reduce the simultaneity between school performance and funding.
In these results, we once again notice a relatively stronger relationship between ACT scores and instructional expenditure as a percent of total expenditure than is seen when instructional expenditures per student are used as the spending measure. In these estimations, the coefficients on instructional expenditures as a percentage of current expenditures are negative, indicating that school districts who had a higher focus on instruction relative to other targets of expenditures actually had negative growth in each outcome measure from 2001 to 2017. This result can be explained by the fact that higher-performing districts in 2001 had less room for growth in student performance since composite ACT scores are capped at 36. School districts with lower ACT scores in 2001 had more room to improve relative to the higher-performing districts, and this would

| Table 4 – Effect of Spending Per Student in 2001 on Student Outcome Growth |
|--------------------------------------------------|------------------|------------------|
| **Constant** | -10.504 (9.344) | 22.754 (27.527) |
| **Per Student Instructional Spending in 2001** | 0.003 (0.002) | -0.003 (0.005) |
| **% Eligible for Free and Reduced Lunch** | -0.143* (0.079) | -0.424* (0.237) |
| **# obs.** | 22 | 22 |
| **Adjusted R²** | 0.24 | 0.058 |

Standard Errors in Parentheses, * denotes significance at 10%, ** denotes significance at 5%
produce a negative coefficient on instructional expenditure as a percentage of current expenditures in 2001.

As expected, the results from these regressions largely support the predominant conclusions from the relevant academic literature. Each regression that was estimated with instructional spending per student produced statistically insignificant coefficients, indicating no relationship between spending and student outcomes. The regressions in which instructional spending as a percentage of total spending was selected as the spending measure reveal that the optimal value of IS% matches closely with the proposed 65-percent guideline. In sum, this analysis shows that instructional spending per student has no effect

### Table 5 – Effect of Instructional Expenditure as a Percent of Current Expenditure in 2001 on Student Outcome Growth

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>56.889** (23.735)</td>
<td>63.835 (72.6)</td>
</tr>
<tr>
<td>Instructional Expenditure as a Percent of Current Expenditure (2001)</td>
<td>-0.801** (0.359)</td>
<td>-0.827 (1.098)</td>
</tr>
<tr>
<td>% Eligible for Free and Reduced Lunch</td>
<td>-0.249** (0.079)</td>
<td>-0.459* (0.24)</td>
</tr>
<tr>
<td># obs.</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.306</td>
<td>0.073</td>
</tr>
</tbody>
</table>

Standard Errors in Parentheses, * denotes significance at 10%, ** denotes significance at 5%
on outcomes. Instructional spending as a percentage of total expenditures can influence outcomes, but these effects are diminishing.
V. CONCLUSION

Education is one of the most important issues on the minds of policymakers and the general public. Due to the fact that public education affects the lives of so many Americans (roughly 90% of American students were enrolled in public schools in 2017)\(^5\) the issue is of utmost importance to voters and to those in positions of authority whose job it is to implement policy and improve the outcomes of students. The issue of education is central to the issue of human capital accumulation and the effort to produce a competitive labor force and active and engaged population.

This analysis contributes to decades of analysis on the relationship between school district spending and student outcomes. The spending measures of instructional expenditures per student and instructional expenditures as a percentage of total expenditures are used to capture the effects of overall changes in spending and to answer questions about the importance of allocation. Use of instructional expenditures per student allow us to answer the most straightforward question of whether or not the amount of money a school district spends per student has an effect on their success. It has been suggested throughout much of the literature that no statistically significant relationship exists between spending and outcomes, and the estimations using this spending measure reinforced these findings. While this conclusion is not overly-controversial within the academic literature, perhaps more debated is the question of allocation. Arguments both for and against the proposed “65-percent rule” abound, as scholars have attempted to

\(^5\) Data on enrollment can be found at: https://nces.ed.gov/fastfacts/display.asp?id=372
clarify the importance of the proper allocation of funding. This thesis lends support to the 65-percent rule, as the optimal value calculated for instructional spending as a percentage of total spending was calculated to be 66.5 percent. This spending measure is utilized to capture how much a school district focuses on instruction relative to other areas that receive funding.

The outcome measures used in this thesis are average composite ACT score and the percentage of high school graduates to attend a 2- or 4-year college or university within 180 days of graduation. As expected, based on the typical findings in the relevant academic literature, these outcome measures are not influenced by changes in instructional expenditures per student. However, statistically significant coefficients were estimated when instructional expenditures as a percentage of total expenditures was used as the spending measure. This finding indicates that policymakers and school district administrators should focus more on the allocation of expenditures in order to influence student outcomes as opposed to simply changing how much money is spent per student. One takeaway from this thesis is the reinforcement that no relationship exists between school district spending per student and student outcomes.

Future modifications could be made to the spending and outcome variables used in this analysis to provide more insightful results which may be more helpful in guiding policy. For example, it is possible that the measures of student outcomes used in this analysis are too short-term to capture any beneficial effects of changes in spending—the ACT is taken during a student’s Junior or Senior year and the percentage of high school graduates to enroll in a 2- or 4-year college or university is measured within 180 days of graduation. Extending the time horizon for measures of outcomes will likely allow for the effects of changes in spending to become more apparent (for instance, looking at the
number of high school graduates who attend college at any point in their lives). The results highlight the difficulty in selecting meaningful measures of student outcomes. While it may seem logical that the number of high school graduates to enroll in college after graduation would reflect the effectiveness of a school district in forming its students into lifelong learners, it cannot be ignored that environmental factors unrelated to the in-the-classroom experience in high school are tremendously important in determining whether or not a student attends college (the values and expectations of parents, career aspirations, etc.). Education is a complex issue and tracing direct lines of causation is one of the greatest challenges that must be acknowledged in this type of research.

Another useful modification which could be made to this analysis would be to specifically focus upon particular populations within a school district’s student body. Basing the research on students with specific demographic backgrounds like family income level or the level of education attained by parents would be helpful in controlling for more of the all-important environmental factors which influence student performance. As demonstrated in every regression, the negative effects of higher poverty levels captured by the use of the percentage of students eligible for free and reduced lunch in the regressions support the notion that factors related to a student’s family environment are of great importance in influencing outcomes.

Finally, the age of the student population could be focused. The data used in this research focused on student performance at the end of high school—the end of a student’s interaction with their school district. While it is assumed that spending patterns throughout a student’s tenure within their school district accumulated over time to influence outcome measures, it could potentially be worthwhile to use more age-specific outcome measures, like test results within elementary schools. This would reveal any potential area within a
student body’s age range which may deserve more focus (for example, changes in spending may affect the performance of elementary students more than high school students). In summary, future research could benefit from measuring outcomes over a longer period of time than the short-term measures of outcomes used in this research and measuring more specific groups within a student population rather than a school district population as a whole.

The disparity in both funding and student performance within St. Louis area school districts is illustrative of greater issues of inequality in American society. While this research does not aim to tackle these grand humanitarian concerns, education is the most important component of human capital accumulation and the development of a productive and competitive labor force and is thus the most logical avenue through which change within society can occur. One cannot hope to tackle these humanitarian concerns through education unless one understands the ways in which the education system can be manipulated to generate more positive outcomes and facilitate the accumulation of human capital—or, perhaps more importantly, the ways in which student performance will not be affected through changes in spending. The reality of this relationship is complex, and the tradition of research and intense public interest which was triggered by the Coleman Report in 1966 will only continue as new findings and interpretations emerge.
References


Leachman, Michael. (2006). 100 percent phony: why the “65 Percent Solution” is a political gimmick that will do nothing to improve student performance in Oregon. *Oregon Center for Public Policy*. 1-10.


