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Spending and Student Achievement: Money Matters When Equity is at Issue

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The results of a 2009 longitudinal study of per pupil investment and student achievement in mathematics indicated statistically significant relationships between student outcomes and investment which grew stronger over time (Mathias, 2009). Outcomes were positively related to investments in direct instruction and instructional support. Investment in direct instruction was linked to higher achievement for low income students.

Introduction

The increase in per pupil spending in the United States approaches a tripling of expenditures in the past forty years. At the same time, the internationally benchmarked achievement performance of American students has been dismal, sparking renewed interest in return on investment. The relationships among spending, student outcomes, student backgrounds, the quality of the opportunities students have to learn and other measures of the capacity of schools to affect learning are complex and not well understood. Existing models of efficiency are only partially predictive of observed student outcomes (Boser, 2011). Decisions made regarding spending at the local, state and federal level have a strong focus on dollars with inadequate information regarding the relationship between spending and student outcomes. To measure the return on investment for public education, we need a deeper understanding of the cumulative impact of resources employed to educate a student over time.

By the time third grade students take their first statewide assessment, they will have been provided with at least three years of educational investment. However, the investment doesn't end there. Questions on a standardized assessment are geared towards the standards applied to the grade level of the examination, but the skills and knowledge required to perform on the test are acquired throughout students' academic careers.

Investment differences between schools for one year may not appear to be large or important but, when aggregated over time, they can result in an amplification of impact on student outcomes. When disaggregated by the type of investment in various budget categories the differences include both amounts of investment and the specific types of investment that are made (Wenglinsky, 1997). A closer look at different categories of investment in education can provide a better defined view of the relationship between investment and student outcomes. The nested categories of investment examined in this study included:

Total Investment includes all local investments that are not capital projects and Supervisory Union costs, including administrative costs and Direct Instruction.

Direct instruction includes Teacher salaries and benefits, books, equipment and supplies. It is closest to the students and accounts for 70% of total investment on average, including special education.

Direct Instruction without Special Education Costs The amount of direct instruction dollars categorized for general education and invested in all students.

Instructional Support includes curriculum development, professional development, technology and libraries.

The range of investment levels were categorized as high, mid or low range as follows: (Mean Spending in 2006 was $10,835; SD $1,331).

- *High* Investment: $12,166 or more.
- *Mid* Investment: Between $9,405 and $12,165.
- *Low* Investment: Less than $9,405.

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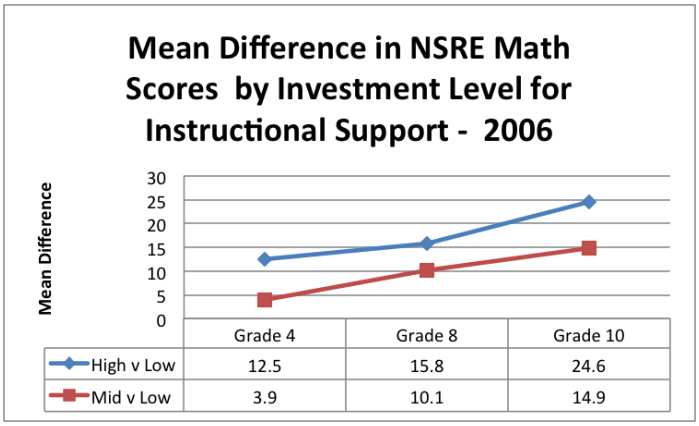
Research

In 2006, the Vermont Department of Education's database provided a unique opportunity to examine the relationship between cumulative per pupil investments and outcomes on the New Standards Reference Exam for a cohort of 1,355 students attending 56 fiscally self-contained K-8 schools, controlling for student transience (Mathias, 2009). These students were identified at the fourth grade level in 1999, with student outcomes based upon three assessment points, in fourth, eighth and tenth grades for students within the sample. The goal of this research was to learn whether students in schools that provided higher levels of investment over time performed better than students in schools that made lower levels of investment. We also wanted to know whether this relationship had a greater or lesser impact over time and whether some types of investment might be better than other types. The answers to these questions should inform educators, and policy makers in the need for appropriate investment in education. It can also provide a basis for determining the equity of student achievement when matched against the geographic boundaries of whatever governance structure provides the various levels of investment.

Results

Direct Instruction:

Higher investment in direct instruction is related to higher achievement as measured by raw mathematics scores. There is less impact on achievement for medium levels of investment. Direct Instruction is the largest single investment category, and includes those funds needed for the classroom. It includes teacher salaries and benefits, special education, texts, furniture and equipment. The difference in mean math scores is readily evident, rising to close to 18 points between high and low investing communities, and 14.6 points between medium and low investing communities by tenth grade. This level of difference would be sufficient to move a student from Substantially Below Proficient to Proficient on today's NECAP assessment. The following graph depicts the statistically significant mean difference in NSRE math scores based upon high, medium and low investing districts.



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Instructional Support:

Instructional Support, a subset of Direct Instruction, proves to be of significant importance in student outcomes and ironically, is a category of investments that is more vulnerable to budget cuts. It includes dollars for professional development, curriculum development, technology and libraries. The dollars represent a comparatively small proportion of education budgets, from a low of 1.5% to a high of 5%. The cumulative per pupil investment for the eight year period ranged from $752 to $4,453 with a mean of $2,054, or $256 per pupil per year. The mean difference between groups of schools formed by level of investment by tenth grade is significant at 24.6 points. The point differential could mean the difference between Substantially below Proficient and Distinguished in today's NECAP scores. The point here is that in order to understand the importance of investment on achievement the specific investments that represent the most classroom-related spending must be separated from the larger category of Direct Instruction.

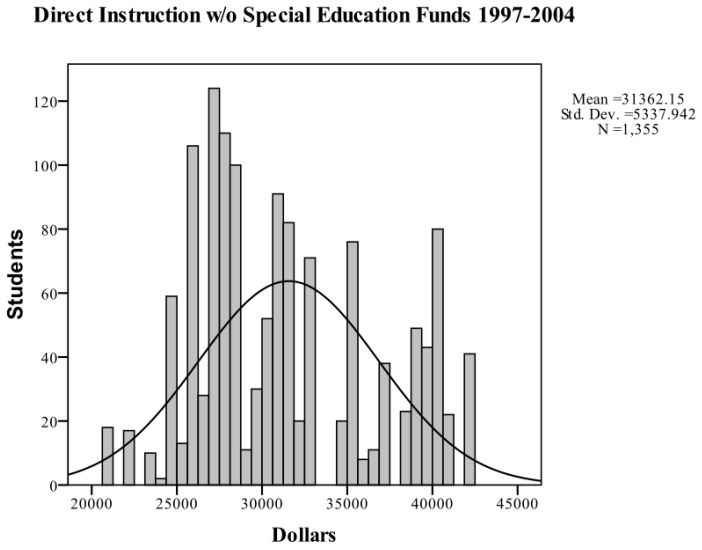
Income levels appeared to play a role in student success. The achievement gap between low income and other students continues to exist and actually widens over time as low income students drop out of school and fail to achieve at the higher levels of their peers. However this analysis indicates that students within the same socio-economic group perform differently based upon investment levels. There was a statistically significant interaction between free and reduced lunch eligibility, investment in direct instruction, district wealth as indicated by a town's Adjusted Gross Income (AGI) and 10th grade math scores. In districts with higher levels of investment in direct instruction low income students perform better on achievement tests. This is stated with caution because the size of the samples within the various groups varies dramatically and the results may be indicative of specific programming within districts. Even within direct instruction it is likely that all investments are not equally effective.

Because these results are based on longitudinal data following cohorts of students over time, the investment gap is cumulative. That is, to the extent that differences in levels of investment made in districts differ across districts and schools there will be gaps in support for instruction that grow over time. While the state of Vermont has sought to ease the level of disparity through several legislative initiatives, there remains a level of disparity in investments. The conclusion of the "Picus Report" was that Vermont had achieved relative success in the equalization of spending power (Picus, 2011). The basis for this conclusion

was the calculation of a "Vertical Index" of spending based on weighted ADM.[1] This calculation was in contrast to the "Horizontal Index", also included in the Picus report, based upon the spending according to an un-weighted average daily membership or enrollment count. However, when measured over time and based upon the Horizontal Index, the cumulative difference between the highest and lowest groups of investing districts exceeded $40,000 per pupil by the end of eight years (Mathias, 2009).

Total Investment:

Investments on a per pupil basis were calculated by year in each investment category for the fiscal years beginning 1997 and ending in 2004, using the financial and enrollment data provided by the Vermont Department of Education. The cumulative educational investments experienced by students are quite variable, as shown in the accompanying histogram depicting the variation of direct instruction after removing special education costs. Given the substantial differences in mathematics performance across school-based investment categories, it would be difficult to characterize this distribution as equitable.



Implications

Students in fourth, eighth, or tenth grade could not complete any of the NSRE and NECAP exams without first learning how to read, to comprehend, to analyze and synthesize. They would have had to acquire a sense of numeracy and computational skills as well as the ability to discern which operation was appropriate for which situation in a math problem. These skills are developed over years, not months and the level of proficiency reached by the time any of the assessments are taken is impacted by the quality of educational experience to that point in time, which is related to some degree to the level of investment. Our findings in Vermont are consistent with the Monk and King study (1994) which also indicated that there is a cumulative effect of investment in concurrent student outcomes, especially in math.

It would not be possible to determine the absolute equivalency of educational experience based solely on finances. Experiences within any school are impacted by leadership, teacher efficacy, curricula, efficiencies and the make-up of the student body. Despite that, there is sufficient research within the literature to assume that investment provides a reasonable barometer for a level of educational equivalency. It seems likely that other types of investments that are consistent with higher quality instruction, higher teacher salaries for example, are related to the practice of making good investments in instruction. The data set available from the State of Vermont provided a unique ability to examine the relationship between investment and student performance while limiting the bias of student transience. The ability to filter out the impact of transience on outcomes allowed examination

Summary of Findings

Informed decisions regarding the allocation of resources cannot and should not be made without an understanding of the relationship between investment and student outcomes. The research reported in this study indicates that:

- **Investments over time make a difference in student outcomes in Mathematics, and the difference grows over time.**
- **The closer the investment is to students through instruction and practice, the stronger the relationship between investment and student performance.**
- **Higher levels of investment for low income students appear related to higher levels of achievement than would otherwise be expected.**
- **While there is a legitimate focus on the achievement gap between FRL students and their peers, it is important to also consider an achievement gap between investment levels for non-FRL students that also grows in impact over time.**

1 The Picus Report discussion of equity compared both vertical and horizontal equity as measures of equity that signified achievement of the goals of the Vermont finance system. The creation of a vertical equity scale was done by dividing spending according to a total number of students to be served that was weighted for each district according to the number of students from low-income families. The following quote was taken from the report: "Vertical equity was assessed through the use of weighted ADM. A comparison of Tables A2.1 and A2.2 shows that per weighted ADM spending figures were lower than per ADM spending. This results from the fact that pupil weights essentially increase the student count and the same expenditure figures are then divided by that higher pupil count." (p. 48)

of fiscal impacts on students without clouding the results with factors that may be more the result of social policies in the areas of low income housing, minimum wage, and welfare reform.

The poverty experienced in Vermont is based largely in certain rural areas rather than urban areas, although there are some urban areas with high poverty rates. Rural poverty, like urban poverty has a tendency to be generational but unlike urban poverty, rural students are less likely to change their circumstances because of the lack of public transportation, reliable communication, technology, health clinics, museums, and libraries and most important, comprehensive after school and summer school programs. Persistent low salary levels for teachers tends to attract teachers who are unable or unwilling to compete for higher paying jobs in higher paying districts. Poverty has been found to be detrimental to education, in all circumstances. It is therefore reasonable to generalize the findings of this study relating to poverty. The systemic nature of relationships among spending practices, opportunities to learn, poverty and student achievement and their persistence over time signals concern of a statewide rather than a local focus. Students rights to a free and appropriate education should not be limited by the boundaries of school districts, supervisory unions or even regional entities.

It is also important to consider that the long term effect of inadequate math achievement results in a financial impact for students. Where students in high investing districts may be able to gain college credit through Advanced Placement courses, students of low investing communities may find themselves having to pay for remedial math courses in college which are not counted towards a degree. This translates to higher tuition costs for students in the communities that are least able to afford them, perpetuating a system of inequity for Vermont students.

Recommendations

Precision in relating student outcomes and school finance:

Raw scores on the NSRE were the basis for the analysis of student outcomes. Since the passage of NCLB, several studies regarding the relationship between educational investments and student outcomes have employed Adequate Yearly Progress (AYP) proficiency cut points as the basis of measurement. The use of AYP fails to adequately recognize growth or decline of individual achievement, masking the extent of the relationship between investment and student outcomes. The question of the relationship of investment to student outcomes demands more accurate and finer grained student outcome data which is readily provided through the proficiency levels that are the basis for AYP scores in the NCLB assessment results.

Recognition of Instruction Support as critical to improvement in student outcomes:

School districts and administrators must be made aware of the strong relationship between the investment category of Instruction Support and student outcomes. Further, there must be an expectation that districts are continuously allocating sufficient resources to this category. Schools failing to make AYP should be expected to maintain adequate investment levels in this category.

Measurement of Opportunity to Learn

Identifying the reasons for gaps in student performance so that the system can be improved has been a difficult task at all levels of the system, federal, state and local. The focii on funding and spending as investment and the relationship of investment policy to the outcomes of schooling such as student achievement on tests of knowledge, the demonstration of skills and eventual entry to higher education and the workforce is essential to the improvement of public education. However, the linkage between investment and the resulting opportunities to learn that are provided to students has not been explicitly examined during attempts to improve schools. Typical assessments of school quality have focused on simple check lists of curriculum provided, attitudes towards learning and other measures that are not quantified at the level of the individual student.

Spending and the resulting opportunities to learn are not perfectly related, but the opportunities that students have to learn are the direct links to their achievement.

Spending and the resulting opportunities to learn are not perfectly related, but the opportunities that students have to learn are the direct links to their achievement. A recent report by the Jeffords Center on the current state of opportunities to learn provided by Vermont school districts to children living in poverty suggests that there is a clear and direct linkage between investment and the opportunities that students have to learn what schools are claiming to teach (Jeffords Center, 2012). Opportunities to learn, unlike standardized tests and attendance, have not been systematically reported to citizens. So, the relationships between what taxpayers are providing and what all students actually get has not been transparent. The systematic measurement of opportunities that all children are provided in schools should be reported by groups of children formed by family income, language and racial groupings, disability and gender in order to inform how the resources are resulting in equity that will be related to performance outcomes.

Preservation of data resource:

Vermont is unique in its governance structure and the resulting ability to examine the relationship between investment at the school level and student outcomes. There is significant value in the information that can be gleaned from Vermont's education data base. Efforts to consolidate school districts could result in eliminating the availability of school level fiscal data without a specific requirement to continue identifying investments at the

school level. Fiscal reporting at the school level in single school districts is already established and should not be eliminated in those cases where consolidation occurs.

Public education is minimally a thirteen year investment for each child and a long term commitment. The return on investment will be experienced over the 50 plus years that each child will be in the workforce.

Public information – Education Investment:

Investments imply a long term commitment with an inherent future benefit or return. Education is a long term investment in the human resources. Public education is minimally a thirteen year investment for each child and a long term commitment. The return on investment will be experienced over the 50 plus years that each child will be in the workforce, contributing to the economy of their communities, their state, and the nation as a whole. References to education financing in school budgets and the Vermont state budget should replace the term expense with the term investment to remind voters, policy makers and legislators of the future impact of education.

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