



Education Outcomes and Spending

A Data Driven Analysis

September 22, 2014

Tom Pelham, Founding Partner

Benjamin Kinsley, Policy and Operations Manager



Report on Education Outcomes and Spending

September 22, 2014

Campaign for Vermont is committed to creating a flexible world-class education system that provides Vermont's young people with the skills and tools to succeed in our 21st century workforce. (Please see our [Putting Children First](#) position paper) Important to this goal is evaluating how our current system is performing. To this end, Campaign for Vermont has generated this report that evaluates Vermont's current education system using a data driven approach and statistical analysis.

There has, to this point, been no serious effort to compare Vermont's education system on a spending to outcomes basis. Campaign for Vermont used the most recent NECAP and spending data from the Vermont Agency of Education (AOE) combined with 2012 income information from the Vermont Department of Taxes to profile the performance of Vermont's education system at the school district level.

Given that we are an organization with limited resources, we have conducted a broad analysis inclusive of all Vermont school districts to identify causal relationships between school district size, spending per student, district measures of income and student outcomes as measured by NECAP scores. Our intent is to encourage a data driven discussion of education reform in Vermont and avoid policy decisions based on assumed but unproven relationships. We encourage the Vermont Agency of Education and others, like the Legislature's Joint Fiscal Office, to provide more in-depth analysis at what drives education outcomes in Vermont, especially to inform legislators, parents and citizens during discussions of education reform in the coming legislative session.

For example, the AOE might conduct a similar analysis for school years 2011 through 2013 to see if our statistical results are replicated over time or develop data sets that don't currently exist but which are important to student outcomes, such as recommended by the Picus Report with regard to the talent and performance levels of our educators. The consideration of reforms to Vermont's education funding system absent of such data driven analysis is otherwise a fool's errand.

Data Sources

Campaign for Vermont used three specific sources of data:

- A database from the Agency of Education's School Finance Team profiling a number of variables for school year 2014 at the school district level. These variables include:

- Average Daily Membership (ADM)¹ and Equalized Pupil counts². The definition of ADM and Equalized Pupils can be found at the links footnoted below.
 - District school budgets and district spending per ADM and Equalized Pupil.
 - Education Spending³ per both ADM and Equalized pupil. Education spending is a legislatively defined value and a subset of school district budgets. Its definition can be found in the referenced footnote below.
- Agency of Education data report on “Reading, Mathematics, Writing & Science: 2013” (NECAP scores).⁴ These variables include:
 - Free and Reduced Lunch (FRL) Percentages
 - 3-8th Grade Math Scores
 - 3-8th Grade Reading Scores
 - 11th Grade Math Scores
 - 11th Grade Reading Scores
 - Vermont Department of Taxes 2012 report on “Town Median Income – All Returns.”⁵ This report profiles a town’s median adjusted gross income based on state tax returns and is organized by school district.

The district spending data from the AOE and the median income information from the Department of Taxes were organized on a per district basis; however, the NECAP data was organized on a per exam per school basis. In order to compare them accurately the NECAP data had to be consolidated to the school district level (See Appendix A).

Major Findings

1. Similar to the findings of the legislatively sponsored Picus Report⁶, school district spending per pupil, whether ADM or Equalized Pupil, appears unrelated to district income measures. For example, Derby’s spending per student is nearly equal to Shelburne’s, even though Derby’s median income is nearly half of Shelburne’s. This finding affirms the equity in Vermont’s school funding system found by Picus and resulting from the Supreme Court’s Brigham decision and the passage of Act 60 and Act 68.

¹ <http://www.leg.state.vt.us/statutes/fullsection.cfm?Title=16&Chapter=133&Section=04001>

² <http://www.leg.state.vt.us/statutes/fullsection.cfm?Title=16&Chapter=133&Section=04010>

³ Definition of education spending can be found here:

<http://www.leg.state.vt.us/statutes/fullsection.cfm?Title=16&Chapter=133&Section=04001>

⁴ This report can be found here: <http://education.vermont.gov/assessment/data#necap>

⁵ The report can be found here: <http://www.state.vt.us/tax/statisticsincome.shtml>

⁶Picus Report, January 18, 2012: “The state has designed an equitable system. We found virtually no relationship between district fiscal capacity (measured by either district property wealth or personal income) and spending levels. Disparities in per pupil spending across districts meet or nearly meet well established benchmark standards for school finance equity. Page iii

2. Further, school district spending per pupil, whether ADM or Equalized Pupil, appears unrelated to school district pupil counts. This means that high spending and low spending school districts are found across the spectrum of Vermont school districts regardless of a school district's enrollment size. For example, the Burlington, South Burlington and Rutland school districts are the largest in the state and all spend above the \$17,512 state average per ADM at \$19,095, \$17,519 and \$22,312 respectively. However, there are also small districts that have high spending. Brighton, Stockbridge, Shrewsbury also spend well above the state average per ADM. Conversely, large districts such as Barre City, Spaulding and Milton spend well below the state average at \$14,134, \$15,894, and \$14,876 respectively along with small districts, like Montgomery, at \$13,977. This finding does not speak favorably to the concept that large consolidated school district's are necessarily more cost effective than Vermont's small school districts.
3. Further, NECAP test scores appear unrelated to both school district ADM and Equalized pupil counts except for a possible very slight relationship for 11th grade math. The Burlington school district with 3,944 students, for example, has test results similar to Royalton with 320 students. Again, this finding does not speak favorably to the concept that large consolidated school district's offer students greater educational opportunity than smaller school districts.
4. NECAP test scores appear unrelated to levels of total spending per pupil, whether ADM or Equalized Pupils. Eden, for example, spends \$20,074 per ADM with 3-8th grade math and reading proficiencies of 56.2% and 62.53% respectively. Pomfret spends about the same at \$20,577 but achieves proficiencies of 89.5% for math and 100% for reading.

However, there does appear a modest positive relationship between levels of "education spending" per Equalized Pupil, especially associated with 11th grade math and reading scores. This possible correlation requires additional analysis for the result can simply be a product of the data sets used. For example, NECAP scores are driven by the count of ADM pupils taking the test, and not adjusted for the artificial shifts in student count resulting from the calculation of Equalized Pupils, which modestly shifts the student count in favor of lower wealth districts.

5. The strongest relationship, by far, were district NECAP test scores in relation to district median adjusted gross income (AGI) and Free and Reduced Lunch (FRL) measures. (See Chart 1 below) As district AGI increased so did test score results and vice versa relative to FRL. However, it's important to note that relative to a school district's measures of income, there is no significant difference in spending per ADM as district incomes change. Out of the ten towns reporting median AGI above \$50,000, all but one was below the state average for

spending per student. Shelburne, for example, spends \$14,829 per student, well below the state average.

6. The calculation of Equalized Pupils is not transparent, and in fact is significantly confidential, and submissions of statutorily defined “Education Spending” to the Agency of Education are not audited. Given the use of a district’s Equalized Pupils and Education Spending for purposes of both setting local education tax rates and comparing expenditure patterns among school districts, Campaign for Vermont views the above lack of transparency and lack of financial oversight as major weaknesses. How can school boards and citizens be sure Vermont’s education funding system is fairly administered when tax rates are determined using essentially confidential and unaudited information?

Increases in equalized pupils and decreases in education spending tend to lower local tax rates, and vice versa. For example, the 2014 calculation of equalized pupils diminishes Essex Town’s school population relative to ADM by 51.9 students while Barre City’s relative count increases by 36.91 students. Similarly, South Burlington’s student count relative to ADM decreases by 72.6 students while Burlington’s and Rutland City’s increase by 136.9 and 111.7 respectively.

With regard to “education spending,” there is a wide variation in the portion of a school’s budget certified by school superintendents as “education spending.” Education spending is a legislatively defined value and a subset of school district budgets. Statewide, the average is 78 percent of school districts’ budget is attested to by superintendents as “education spending”. However, the level in Rutland City was only 61 percent while Milton’s was at 87 percent, for example.

Equalized pupil counts are calculated using confidential Agency of Human Services (AHS) data. This information is not available to the public or anyone outside of the AHS. In response to a Freedom of Information request to the Secretary of Education, the AOE states,

“The equalized pupil count is weighted for students residing in families receiving nutrition benefits. The Agency of Education receives these counts from the Agency of Human Services. AHS does not send AOE identifying information as part of this function. Federal standards limit the sharing of such identifying information. See, e.g. 7 CFR §272.1”

Further, AOE states “With regard to information on students who reside within a family receiving nutrition benefits,” the Agency relies upon confidential information received directly from the Agency of Human Services. AOE does not receive identifying information within this data, but nonetheless cannot share this data because of the ways in which small community, school, and grade sizes within Vermont can allow

identifying inferences that would run contrary to AOE's duties to protect student records under FERPA, 1 V.S.A. § 317(c)(11), and, in this case, potentially, the federal School Lunch program (see, e.g. 42 U.S.C. § 1758(b)(6))."

"As with the data for families receiving nutrition benefits, the state-placed student data can also allow identification as the data are received by district and by grade. Again, that would run counter to AOE's duties to protect student records under both FERPA and 1 V.S.A. § 317(c)(11)."

With regard to oversight of district "education spending," as defined in statute, the AOE response was:

"the Superintendent of each school district must submit a signed form attesting to the accuracy of the information." Further, "Any independent reviews would be carried out by or for the State Auditor of Accounts, who would be the custodian of any resulting records."

However, the website of the State Auditor of Accounts does not profile any audits of "education spending" as statutorily defined.

Discussion and Recommendations

Campaign for Vermont found that in most cases there is no relationship between NECAP exam scores and measurements of spending or district size. While all correlations between test scores and ADM counts were under 10%, the correlation between 11th grade math scores and ADM was 24.6% with an R-squared value of 6%. While this is not particularly significant, it does indicate a possible relationship and might suggest that school district size has a slight effect on high school level math scores, at least in 2014.

We see this trend again when it comes to education spending per equalized pupil. Eleventh grade math and scores showed a 23.1% correlation with an R-square value of 5.3%. Three through eighth grade math and reading scores showed no correlation. This again suggests a possible, but weak, relationship between education spending and high school educational outcomes per equalized pupil. However, given that the redistributive effect of the calculation of equalized pupils among districts, as noted in finding (4) above, the apparent correlation, though weak, might be further diluted when controlled for such redistribution.

While the above data may be indicative, we do not consider the 11th grade statistics to be as accurate as the 3-8th grade statistics for two reasons. First, the number of school districts with an 11th grade is fewer than those with 3-8th grades and thus offers a smaller sample size. Secondly, since the 11th grade test only measures one class, results could vary significantly from

year to year within a particular school. This measure may be more accurate if averaged over a longer period of time.

The most salient statistics were found regarding the comparisons of educational outcomes to income measurements. See chart below:

Chart 1 – Test Scores by Income Measures

Measure	Correlation Coefficient	R-Squared
3-8 Math : AGI	44.9%	20.2%
3-8 Reading : AGI	43.9%	19.2%
3-8 Math : FRL	-47.3%	22.4%
3-8 Reading : FRL	-40.9%	16.7%
11 Math : AGI	49.6%	24.6%
11 Reading : AGI	32.1%	10.3%
11 Math : FRL	-44.3%	19.6%
11 Reading : FRL	-36.3%	13.2%

You will notice that the above correlations related to income reflect relationships in both 3-8th grade and high school populations. Using both the percentage of students on Free or Reduced Lunch and district AGI profiles, we can see that both measures track fairly close, though the relationships are inverse.

Decision makers should evaluate the above relationships, or absence thereof, carefully. They suggest that more money dedicated to our school system will not achieve measurable improvements in student outcomes. As noted by Picus, “Vermont’s schools have among the highest levels of per pupil revenue in the United States.”⁷ Further, the Secretary of Education and legislative leaders, absent compelling supporting data and analysis, should not embrace politically crafted education reform proposals, such as the neutering of local school districts last session in House Bill 883, in favor of state enforced consolidated districts. The recommendations and decisions of these top shelf leaders should be thoughtful and data driven and not crafted in the heat of political expediency.

Further, the Secretary of Education and legislative leaders should further explore areas where there are clear and positive relationships to student outcomes. The data indicates that higher income households engender better education outcomes for students than lower income households. Vermont’s education system is not structured nor directly tasked with the responsibility of raising household incomes. However, the Secretary might explore and identify the characteristics of households, in addition to higher levels of resources, that nurture better student outcomes. Are such outcomes just a function of more income or are their associated

⁷ Picus Report, January 18, 2012, Executive Summary, page xv

qualities that can inform educators, Agency of Human Service leaders and social workers alike, causing them to leverage public investments in human service programs that advantage student outcomes.

Finally, the Secretary of Education should be more proactive in developing additional data sets and analysis that will better inform those interested in education reform opportunities. For example, the Picus report contained case studies that identified important variables that improve student outcomes.⁸ The report states:

“An in depth study of five schools that have shown substantial improvements in student performance over the last five years shows that Vermont schools, even those with high proportions of low income children, can produce large gains in student learning. The case studies also identified a number of promising practices for improving student performance.”

One such area was the talent of educator and school leadership. The report recommends that policy makers:

- “Assess the degree to which Vermont has the teacher and principal talent to execute effective school improvement strategies that dramatically boost student learning. Specifically conduct an analysis of the teacher and principal supply channels in Vermont. This would include analysis of the institutions from which teachers and principals are recruited, assessment the quality of the talent that is recruited for Vermont’s schools, and development of an understanding of the degree to which Vermont recruits teachers and principals from the top or bottom half of the talent pool.”

“This information could be used to design policies to ensure that future educator talent is recruited from the top so that the best and the brightest teach in and administer Vermont schools.”

- “Join the action of nearly two-thirds of the other states in the country to develop new and comprehensive teacher and principal evaluation systems. These systems would use multiple measures to place teachers and principals into 4-5 different categories of effectiveness – effectiveness defined as producing student learning gains. Use these new metrics to design new systems to license, tenure and pay educators.”⁹

However, a search of the Agency of Education’s website does not find any teacher talent or evaluation profiles at the district level as encouraged by the Picus recommendation. If a parent wants to find the kind of information recommended by Picus or a policy maker wants to test

⁸ Picus Report, January 18, 2012, page iii

⁹ Picus Report, January 18, 2012, page xvii

whether Picus' recommendation is statistically validated, the necessary data set is simply unavailable.

The Agency of Education does publish the following topside information on teacher and principal evaluations, but this information is mostly process oriented and not available for or of value to profiling talent levels at the district level.

http://education.vermont.gov/documents/EDU-Memo_0914_Teacher_Principal_Survey.pdf

Appendix A

In order to accurately compare NECAP scores to spending and income statistics, the dataset had to be consolidated to the school district level.

NECAP scores are calculated on four levels of proficiency. Level 1 being substantially below proficient, Level 2 partially proficient, Level 3 proficient, Level 4 proficient with distinction. The NECAP results data gives you the percentage of students in each category. We combined level 3 and 4 proficiency to give the percentage of students considered proficient and above, which we refer to as proficiency level.

We then consolidated the district's data creating a weighted average proficiency for each district and each exam. The four exams we chose to look at were 3-8th Grade Math scores, 3-8th Grade Reading scores, 11th Grade Math scores, and 11th Grade Reading scores.

Once all the datasets were in the same district level format we combined them into one database in order to run our statistical analysis. We sorted the database for each exam and compared them against our spending and district size variables.

You can request more information on the process used by emailing Ben Kinsley at ben@campaignforvermont.org.

Appendix B

Methodology

To measure the relationship between the variables, the correlation coefficient (Pearson’s R value) and the R-squared value were used.

The Correlation coefficient is “a measure of the degree of linear relationship between two variables.”¹⁰ A correlation coefficient may be between -1 and 1 with 0 being no relationship and a negative value being an inverse relationship.

R-squared is the proportion of variance in one variable that can be explained if you know another variable. R-squared is on a scale of 0 to 1 showing what percentage the value of one variable can account for the value of another.

Below are the results for each statistical analysis we conducted. None of these results indicate a high degree of relationship between the two variables except income measures in relation to test scores. A few others indicate that further analysis might be useful. These have an asterisk * next to the variables.

Correlations				
Test Scores relative to district’s ADM count	Correlation	R ²	District Count	
3-8 Math	-0.04005	0.001604	196	School district size appears to have little relationship to test score outcomes. There does appear to be a slight relationship between ADM and 11 th grade math scores.
3-8 Reading	-0.019974	0.0004041	196	
11 Math*	0.2458918	0.0604628	52	
11 Reading	0.0824402	0.0067964	52	
Test Scores relative to district’s Equalized Pupil Count	Correlation	R ²	District Count	
3-8 Math	-0.055757	0.0031088	191	Similar to district size based on ADM, district size based on equalized pupil counts have little bearing on test score outcomes. Again, as with ADM, there may be a slight relationship with regard to grade 11 math scores.
3-8 Reading	-0.029858	0.0008915	191	
11 Math *	0.2305283	0.0531433	52	
11 Reading	0.0696833	0.0048558	52	
Test Scores relative to Education Spending per ADM	Correlation	R ²	District Count	
3-8 Math	-0.02426	0.0005886	196	The level of “education spending” per ADM does not appear to have a significant relationship to test score outcomes.
3-8 Reading	0.0432067	0.0018668	196	
11 Math :	-0.024138	0.0005827	52	
11 Reading	0.0766687	0.0058781	52	

¹⁰ <http://www2.webster.edu/~woolfm/correlation/correlation.html>

Test Scores relative to Total Spending per ADM		R²	District Count	Total school district expenditures per ADM do not appear to have a significant relationship to test score outcomes.	
3-8 Math	-0.068506	0.0046931	196		
3-8 Reading	-0.048398	0.0260064	196		
11 Math	-0.120293	0.0850621	52		
11 Reading	0.0347017	0.1259522	52		
Test Scores in relation to “education spending” per equalized pupil		R²	District Count	A slight relationship between “education spending” per equalized pupil appears at the 11 th grade level, however this could be merely a function of the calculations behind education spending and equalized pupils. (See Findings 4 and 6 above)	
3-8 Math	0.1364751	0.0186255	191		
3-8 Reading	0.1612649	0.0260064	191		
11 Math *	0.291654	0.0850621	52		
11 Reading *	0.3548975	0.1259522	52		
Test Scores in relation to district median income (adjusted gross income – AGI)		Correlation	R²	District Count	The strongest relationship found was between median district income (AGI) and test scores. These correlations indicate that test results increase as household incomes rise, indicating that the home environment in economically better off households is more conducive to academic achievement.
3-8 Math *	0.4489159	0.2015255	169		
3-8 Reading *	0.4385738	0.192347	169		
11 Math *	0.4962555	0.2462695	28		
11 Reading *	0.3206791	0.1028351	28		
District spending in relation to ADM or Equalized Pupil count		Correlation	R²	District Count	There appears no significant relationship between spending per student count and school district size, whether counted as ADM or Equalized pupils. This may indicate there is little proven value in assuming cost efficiencies based upon school district size.
\$/ADM : ADM	0.0037956	0.0000144	273		
\$/EqPup : ADM	0.0021017	0.0000044	273		
Ed\$/ADM : ADM	0.0006547	0.0000004	273		
Ed\$/EqPup : ADM	-0.001378	0.0000019	273		
\$/EqPup : EqPup	0.002801	0.0000078	273		
Ed\$/EqPup : EqPup	-0.0015	0.0000023	273		
Spending in relation to income measures		Correlation	R²	District Count	The correlation between measures of spending per pupil and income measures (AGI and FRL) indicate a district’s wealth is not a predictor of levels of spending per pupil, possibly reflecting the success of redistributive effects of Act 60/68 subsequent to the Brigham decision.
\$/ADM : FRL	-0.04153	0.0017248	176		
Ed\$/ADM : FRL	0.0009245	0.0000009	176		
\$/ADM : AGI	-0.203722	0.0415028	252		
Ed\$/ADM : AGI	-0.157698	0.0248686	252		