Predicting Student Achievement in Ohio: The Role of Expenditure Distribution

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Introduction and Background

In the spring of 2005, political columnist George Will coined the phrase the "65 percent solution" in his *Washington Post* column in reference to an Arizona referendum that would have required at least 65% of every school district's operational budget be spent on classroom instruction.[1] The originators of this idea, according to Toppo (2006), a journalist for *USA Today*, were Tim Mooney, a Republican political consultant, and an entrepreneur, Patrick Byrne, founder of Overstock.com, who discovered that, "...the top-performing states on federal skills tests...spend, on average, a little over 64% of school operating budgets in the classroom; those at the bottom spend as little as 49%." [2] Approximately a year after Will's column, Georgia and Kansas had enacted laws adopting the 65% solution. Texas Governor Rick Perry had signed an executive order requiring it, and the Louisiana legislature had passed a nonbinding resolution (Toppo 2006). In addition, ballot initiatives were being considered in several states. However, not everyone was convinced of the merits of the 65% solution. A study undertaken by Standard and Poor's (2005) found no significant relationship between student achievement and any particular instructional spending level while Bracey (2006, 1), in "A Policy Maker's Guide to 'The 65% Solution' Proposal," asserted that it "...suffers logical and definitional confusions."

Long before Mooney and Byrne's populist initiative came research to answer the broader question: Does money matter in relationship to student achievement? Hanushek (1989, 1994, 1997) found little, if any, relationship between increased resources and improved student achievement. In contrast, Hedges, Laine, and Greenwald (1994) and Greenwald, Hedges, and Lane (1996a, 1996b) did.[3] In a 2010 study, Jones and Slate conducted a study that combined the impact of the 65 percent solution with the impact of expenditure on student achievement. Using data from results of the Texas Assessment of Knowledge & Skills tests, they concluded, "...[I]t is clear that money does influence student achievement (18)." The evidence as to whether money matters, and if it does, whether there is a threshold level, remains inconclusive.

Table 1 | **Definition of Expenditure Categories**

Expenditure Category	Definition
Administration	Costs incurred for the board of education, superintendent's office fiscal services, business manager, and support services; do not deal directly with the education of the students; encompass planning, research, information services, staff services, and data processing expenditures.
Building Operations	Salaries for the directors of plan maintenance, transportation, and the food service operation.
Instruction	Costs incurred for teaching and learning, which generally occur n the building classroom; includes teachers, teacher aides or paraprofessionals, as well as materials, computers, books and other consumable materials that are used with students in the classroom.
Pupil Support	Costs incurred for support services, guidance services, health services, psychological services, speech pathology and audiology services, attendance and any social work activities, as well as instructional media services for students.
Staff Support	Costs expended by the central office; include in-service for district staff members, instructional improvement services, and meeting expenses for all staff.

Source: Ohio Department of Education. 2006. *Reporting School District and Spending per Pupil.* Columbus, OH.

The purpose of this research was to investigate the role of school district expenditures in predicting student achievement in Ohio for the school year 2009-2010. Building upon the concept of the 65 percent solution, the research questions that guided this study were: (1) What percentage of Ohio's school district's operating budgets were spent on classroom instruction in comparison to administration, building operations, instruction, pupil support, and staff support; (2) To what extent did these predict student achievement; and (3) Which category of expenditure best predicted academic achievement?

Research Methods

This study included 607 of Ohio's 613 school districts. Two districts were excluded due to incomplete data, and four districts with very small enrollments were excluded because the authors considered them outliers. All data were secured from the Ohio Department of Education's Education Management Information System. Variables included were school district operating expenditures on administration, building operations, instruction, pupil support, and staff support for each of the three academic achievement levels (highest, continuous improvement, lowest) for 2009-2010. See Table 1 for definitions of the expenditure categories.

The state of Ohio measures student academic achievement by a "Performance Index Score," which is continuous, ranging from zero to 120, and is based on the percentage of students scoring at each of six performance levels on state assessments multiplied by the point value assigned to that performance level. The performance levels and accompanying point levels are advanced (1.2), accelerated (1.1), proficient (1.0), basic (0.6), limited (0.3), and untested (0). Ohio students are tested annually in grades three through eight on reading and mathematics skills using the state achievement assessments. Fifth and eighth graders are also tested in science, and tenth graders take the states tenth grade graduation assessment (Ohio Department of Education n.d.).

The performance index score for a school district is then translated into one of six designations: excellent with distinction, excellent, effective, continuous improvement, academic watch, or academic emergency.[4] (See Figure.) In this study, these six state designations were combined to form three: highest (n=534); continuous improvement (n=64); and lowest (n=9). The highest achievement category included school districts with the designations of effective, excellent, or excellent with distinction. The designation of continuous improvement remained the same while the lowest academic achievement category included state designations of academic watch and academic emergency.

The predictor or independent variables were the percent of total district expenditure for administration, building operations, instruction, pupil support, and staff support. The dependent variable was Ohio's measure for student achievement, the performance index score. The unit of analysis was the school district. Descriptive statistics were calculated for the independent and dependent variables. Stepwise multiple regression was used to analyze the relationship between predictor and outcome variables. An analysis of residuals was also conducted.

Analysis of Results

Descriptive statistics for the independent and dependent variables are found in Tables 2 and 3, respectively. For all three academic achievement groups, instruction represented the category with the highest average percentage of expenditures.[5] Average percentages of expenditures for instruction ranged from 52.9% in the academic emergency/academic watch group to 56% in the highest achieving group. The range between the minimum (31.1%) and maximum (66.36%) for instruction was most pronounced for the latter group at 35.6 percentage points. Building operations represented the second highest category of average expenditure percentage. Here the averages for the three groups of school districts were very similar, ranging from 19.2% to 20.73%. Third was administration where the average percentage of expenditures was

Figure | **Ohio School District Designations**

Performance Index Score	and	AYP Status	Preliminary Designation		Did the Preliminary Designation increase or decrease based on AYP Status?		Preliminary Designation	and	Amount of Growth Using Value-Added Calculation	Final Designation
100 to 120	and	Met or not Met	Excellent				Excellent	and	Above expected growth	Excellent with Distinction
									Below expected growth for at least 3 consecutive years	Effective
									Otherwise no effect on rating	Excellent
90 to 99.8	and	Met or not Met	Effective				Effective	and	Above expected growth	Excellent
									Below expected growth for at least 3 consecutive years	Continuous Improvement
					IF YES, STOP HERE. If no, additional change to designation can occur based on value-added calculation.				Otherwise no effect on rating	Effective
0 to 89.9	and	Met or not Met	Continuous Improvement	→		→	Continuous Improvement	and	Above expected growth	Effective
80 to 89.9	and	Met or not Met							Below expected growth for at least 3 consecutive years	Academic Watch
									Otherwise no effect on rating	Continuous Improvement
70 to 79.9	and	Met or not Met	Academic Watch		**IF NO, CONTINUE.** Value-added **MAY** affect a designation when it has not been changed by AYP Status.		Academic Watch	and	Above expected growth	Continuous Improvement
									Below expected growth for at least 3 consecutive years	Academic Emergency
									Otherwise no effect on rating	Academic Watch
0 to 69.9	and	Met or not Met	Academic Emergency				Academic Emergency	and	Above expected growth	Academic Watch
									Otherwise no effect on rating	Academic Emergency

Source: Adapted from the table, "How Schools and Districts Earn Designations," in *Guide to Understanding Ohio's Accountability System, 2009-2010.* Columbus, OH: Ohio Department of Education, 6.

Table 2 | **Descriptive Statistics by Academic Achievement Designation for Independent Variables: Percentage of School District Expenditures by Category**

School District Expenditure Categories	Mean	Median	Standard Deviation	Range	Minimum	Maximum
	Effective, Excellent, Excellent with Distinction (n=534)					
Administration	12.20	12.02	2.05	21.53	4.37	25.89
Building Operation	19.55	19.45	3.31	46.93	9.16	56.09
Instruction	56.00	55.93	3.72	35.25	31.11	66.36
Pupil Support	9.95	9.87	2.21	16.78	4.12	20.95
Staff Support	2.29	2.08	1.57	8.59	.01	8.59
	Continuous Improvement (n=64)					
Administration	12.58	12.36	2.87	17.30	7.17	24.48
Building Operation	19.20	18.61	3.03	14.43	12.17	26.60
Instruction	54.74	54.71	3.75	16.02	46.90	62.92
Pupil Support	9.93	9.75	2.33	13.12	5.22	18.34
Staff Support	3.55	3.29	2.20	9.28	.24	9.52
	Academic Emergency/Academic Watch (n=9)					
Administration	12.63	12.54	2.79	9.28	8.78	18.06
Building Operation	20.73	21.46	2.99	9.50	16.29	25.79
Instruction	52.90	52.55	3.20	9.21	47.01	56.22
Pupil Support	8.60	8.69	2.06	6.30	5.06	11.36
Staff Support	5.15	5.13	1.99	6.60	.82	7.42

Table 3 | **Descriptive Statistics for Dependent Variable: Performance Index Score**

Dependent Variable	Mean	Median	Standard Deviation	Range	Minimum	Maximum
Performance Index Score	97.14	97.40	6.17	38.10	72.40	110.50

n=607

also similar across the three groups, ranging from 12.20% to 12.63%. Interestingly, the highest achieving group had the lowest average percentage of administrative expenditures. The fourth factor was average percentage of expenditures on pupil support. There were notable differences across the three groups, with averages ranging from 8.60% in the lowest achieving group of districts to 9.95% in the highest group. The average expenditure of the continuous improvement group was very similar to that of the highest achieving group of districts at 9.93%. For the final category, staff support, average percentage of expenditures differed across groups. Perhaps surprisingly, the highest achieving group of districts spent, on average, the lowest percentage on staff support at 2.29%. Districts identified as "continuous improvement" spent on average 3.55%, and the lowest achievement group spent the highest average percentage at 5.15%. Table 3 contains the descriptive statistics for the dependent variable, Ohio school districts' performance index scores for 2009-2010. Scores ranged from 72.4 to 110.5, on a scale of zero to 120 points, with a mean of 97.14.

Prior to undertaking the stepwise regression analyses, a bivariate correlation of the independent variable was conducted to test for collinearity. (See Table 4.) No strong intercorrelation was found. As a result, all variables were included in the regression analysis. Table 5 presents the stepwise regression analysis results for the population of Ohio school districts and for each of the three achievement groups. For all Ohio school districts (n=604), the independent variables predicted only15.9% of the variation in student achievement. For the highest achieving group, the predictor variables accounted for even less, 8.2%. For the continuous improvement group, the predictor variables accounted for a substantially

Table 4 | **Correlation Matrix of Independent Variables**

Independent Variables	Administration	Building Operation	Instruction	Pupil Support	Staff Support
Administration	1.000	-.079	-.355*	-.141*	-.153*
Building Operation	-.079	1.000	-.610*	-.283*	-.113*
Instruction	-.355*	-.610*	1.000	-.246*	-.248*
Pupil Support	-.141*	-.283*	-.246*	1.000	-.041*
District Staff	-.153*	-.113*	-.248*	-.041	1.000

* Correlation coefficient is statistically significant at the 0.01 level (2-tailed).

Table 5 | **Regression Results***

Predictor Variables and R^2	Beta	t-test	Significance
All Districts (n=604)			
Staff Support	-.342	-8.916	.000
Building Operation	-.159	-4.003	.000
Administration	-.171	-4.426	.000
Pupil Support	.088	2.221	.027
Constant		39.127	.000
$R^2 = .159$			
Academic Emergency/Academic Watch (n=9)			
Instruction	.747	2.973	.021
Constant		.311	.765
$R^2 = .558$			
Continuous Improvement (n=64)			
Staff Support	-.365	-3.178	.002
Instruction	.271	2.363	.021
Constant		7.740	.000
$R^2 = .265$			
Effective/Excellent/Excellent with Distinction (n=534)			
Pupil Support	.262	6.082	.000
Instruction	.204	4.735	.000
Constant		23.277	.000
$R^2 = .082$			

* Only predictor variables that were statistically significant in predicting student achievement level at $p \leq .05$ are reported here.

Table 6 | **Ohio School Districts with Highest Positive Residual Values**

School District	Performance Index Score	Predicted Value	Residential	Academic Group	Typology
Mason City	109.4	93.245	16.154	Highest	7
Cuyahoga Heights Local	106.1	91.766	14.334	Highest	6
Sycamore Community City	108.2	93.927	14.273	Highest	7
Chagrin Falls Exempted Village	108.1	93.968	14.132	Highest	7
Independent Local	106.1	93.539	12.561	Highest	6
Aurora City	108.1	95.547	12.553	Highest	7
Brecksville-Broadview Heights	107.8	95.677	12.123	Highest	7
Blanchester Local	101.9	89.802	12.098	Highest	7
Indian Hill Exempted Village	109.0	97.638	11.362	Highest	7
Hudson City	108.3	97.183	11.117	Highest	7

Table 7 | **Ohio School Districts with Highest Negative Residual Values**

School District	Performance Index Score	Predicted Value	Residential	Academic Group	Typology
Youngstown City	72.4	93.348	-20.948	Lowest	5
Euclid City	79.4	99.084	-19.684	Middle	5
Dayton City	72.6	90.537	-17.937	Lowest	5
Cleveland Municipal City	74.3	92.031	-17.731	Middle	5
Warren City	77.0	94.284	-17.284	Lowest	5
Mansfield City	77.3	94.352	-17.052	Lowest	4
Lorain City	78.1	94.776	-16.676	Lowest	5
East Cleveland City	72.5	88.771	-16.271	Lowest	5
Jefferson Township Local	75.7	91.601	-15.901	Lowest	2
Toledo City	82.6	97.528	-14.928	Middle	5

higher percentage of the variation at 26.5%; and, for the lowest achievement group, the predictor variables accounted for over half of the variation at 55.8%.[6]

However, not all regression coefficients were statistically significant. For the population of Ohio school districts, the percentage of school district operating expenditure on instruction was not statistically significant. Only the percent expenditure on pupil support was positive and statistically significant, but the coefficient was small at .088. Coefficients for percent expenditure on staff support, building operation, and administration were statistically significant and larger, indicating a greater influence on student achievement, but they were negative.

For the highest achieving group of school districts (n=534), those referred to as "effective/excellent/excellent with distinction," only coefficients for pupil support and instruction were statistically significant at .262 and .204 respectively. For the next highest achieving group of school districts (n=64), those referred to as "continuous improvement," only coefficients for staff support and instruction were statistically significant at -.365 and .271 respectively. For the lowest achieving group of school districts (n=9), percent expenditure for instruction was the only statistically significant coefficient at .747.

To gain greater insight into the regression results, an analysis of the residuals was conducted.[7] Table 6 and Table 7 present the results of the ten school districts with the highest positive residuals and the results of the ten school districts with the highest negative residuals, respectively. These districts are classified by their achievement level and by the Ohio Department of Education typology of school districts. (See Table 8 for a description of the typology.)

Table 8 | **Typology of Ohio School Districts, 2009-2010**

Type	Description
1	Rural: High poverty, low median income
2	Rural: Low poverty, low to moderate median income, small student population
3	Rural/small town: Moderate to high median income
4	Urban: Low median income, high poverty
5	Major urban: Very high poverty
6	Urban/suburban: High median income
7	Urban/suburban: Very high median income, very low poverty

Source: Julie Brinker and Andrew Benson. 2011. *Benchmarking Ohio's School Districts*. Columbus, OH: Ohio Department of Education, 6.

The performance index scores for the ten districts with the highest positive residual values ranged from 106.1 to 109.4. The difference between the observed and predicted scores ranged from 11.117 to 16.154 points higher than the model predicted. All of these districts were in the highest performance category used in this study (Effective/Excellent/Excellent with Distinction), and all were classified as low poverty by the Ohio Department of Education typology. Specifically, nine of the ten districts are defined by the typology as urban/suburban with high to very high median income. The remaining district is defined as low to moderate median income with a small student population.

For the ten districts with the highest negative residual values, performance index scores ranged from 72.4 to 82.6. The difference between the observed and predicted scores ranged from -14.928 to -20.9485. Seven of the ten school districts were in the lowest category of academic achievement (academic emergency/academic watch) used in the study, with the remaining three classified as "continuous improvement." Nine of the ten districts are defined by the typology as urban and high poverty. The remaining district is defined as rural and low poverty, with low to moderate income.

Conclusions and Implications

The central premise of the 65% solution is that school districts can raise student achievement, regardless of their current expenditure level, by allocating at least 65% of their operating budget to classroom instruction. Little research exists to confirm this hypothesis. Even in the broader body of research that attempts to establish a systematic relationship between expenditure and student achievement, the results have been mixed. In this article, an analysis of Ohio school districts for the 2009-2010 academic year by achievement level (high, continuous improvement, low) found that these groups spent on average nine to twelve percentage points below the 65% benchmark. Even the most academically successful group of school districts spent, on average, only 56% of their operating budget on instruction. Further, regression results indicated that attempts to predict student achievement based upon the percent of school district expenditure on instruction as compared to other categories in the operating budget yielded weak and inconclusive results. Finally, a supplemental analysis of residuals raised concerns that income levels of district residents may play a more substantial role in student achievement than the percent of the school district operating budget allocated to classroom instruction.

Today one hears little about the "65 percent solution." The web site created by Mooney and Byrne (firstclasseducation.org) to promote their solution no longer exists. It appears that the concept George Will (2005) referred to as "politically delicious" was more accurately characterized by Frederick Hess (2006) as simply a "new fad." Still, researchers continue to be fascinated by the question, does money matter? However, as this study indicated, along with many that have preceded it, there are rarely simple answers to complex questions.

Endnotes

[1] According to Will at the time of this opinion piece, 61.5% of funds were spent on the classroom nationally.

[2] Mooney helped form a group called First Class Education, designed to promote the practice of the 65 percent solution. According to Standard & Poor's (2005, 1): "The organization's goal was for all 50 states and the District of Columbia by the end of 2008 to pass a law requiring each school district 'to spend at least 65% of its operating budget on classroom instruction.'"

[3] Interestingly, Wenglinsky (1998) found that only central office and instructional expenditures were related to student achievement.

[4] For a full description of Ohio's education accountability system, see *Guide to Understanding Ohio's Accountability System, 2009-2010* (Columbus, OH: Ohio Department of Education, n.d.).

[5] Because the mean (average) and median values for the predictor variables were similar, only the mean values are discussed here.

[6] It is important to note that the lowest achieving group included only nine districts, a number some consider low for multiple regression analysis. Given this potential limitation, the regression results for this group should be viewed with caution.

[7] In regression analysis, the residual is the difference between the observed value of the coefficient and the predicted value. A positive residual means that the identified district's academic performance was above the prediction based on the independent variables used in the analysis. Conversely, a negative residual means that the identified district's academic performance was below the prediction.

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