Educational Considerations

Volume 40 | Number 3 Article 5

7-1-2013

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Recommended Citation

Ziswiler, Korrin M.; De Luca, Barbara M.; and Stedrak, Luke J. (2013) "The Role of Expenditures in Predicting Adequate Yearly Progress for Special Needs Students in Ohio," *Educational Considerations*: Vol. 40: No. 3. https://doi.org/10.4148/0146-9282.1093

The Role of Expenditures in Predicting Adequate Yearly Progress for Ohio K-12 Students with Special Needs

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> Perhaps no challenge in American schooling is as perplexing and under-examined as special education, particularly its costs, its benefits, and the relationship between them.[1] (Chester E. Finn, Jr., and Michael J. Petrilli)

Although there exists a large body of research concerning the relationship between expenditure and student achievement,[2] a lack of research exists analyzing this relationship as it pertains specifically to students with disabilities. At the same time, students receiving special education services represented 13.1% of K-12 students in the United States in 2008-2009,[3] and hence a significant portion of school district student populations and budgets. In Ohio, the percentage of special education students was even higher, at 14.6% of K-12 enrollment. Further, between 2001 and 2009, the percentage of Ohio's student population identified in need of special education services grew by 11.6%, nearly triple that of the national average of 3%.

Because federal law mandates that all students with disabilities receive an education in the least restrictive environment,[4] but provides only a small portion of the necessary funding, states and local school districts are left to fund the bulk of the costs associated with special education while at the same time meeting federal requirements for student achievement, referred to as "adequate yearly progress" (AYP), under the No Child Left Behind Act of 2001. Given the increasing fiscal and academic pressures districts face to allocate resources efficiently, the purpose of this exploratory study was to predict which categories of district level special education expenditures best predicted Ohio special education students' meeting AYP criteria in reading and mathematics for the 2008-2009 school year.

Research Methods

The data source for this study was *Special Education Weighted Funds Fiscal Account-ability Report, Fiscal Year 2009*.[5] In Ohio, special education expenditures are divided into six

categories: speech allowance, special education transportation, catastrophic costs, support services for special education, instruction for special education, and required-versus-spent expenditure variance.[6] Catastrophic cost represents state aid that was created by the state to supplement district expenditures for students with extreme needs, defined as exceeding $25,000 per year. Support services consist of activities such as occupational therapy, physical therapy, and other indirect activities that contribute to a student's educational progress. Because speech services are technically a support function for students with disabilities, this expenditure was combined with the support services category in this study to create a total support expenditure variable. Each category of expenditure was divided by the number of special education students in each district to determine a per-pupil expenditure.

Five independent variables were included in the study: Per-pupil expenditures on special education transportation, catastrophic costs, support services for special education, and special education instruction; and percentage of students in poverty. Students in poverty were defined as those whose families receive Ohio Works First assistance.[7,8] Poverty represents a factor that complicates the analysis of relationships between expenditures and student achievement. A number of researchers have argued that gaps in educational attainment exist due to family income level.[9] Reardon asserted that "...family income is now nearly as strong as parental education in predicting children's achievement."[10]

This study included 594 of Ohio's 611 school districts, and the school district was the unit of analysis. Due to missing data, 17 school districts were eliminated from the analysis. Descriptive statistics were calculated to create a profile of special education expenditures and the percent of students in poverty in Ohio for the 2008-2009 school year. Binary logistic regression analysis was conducted to determine the relationship of categories of special education expenditures and percentage of students in poverty to the academic performance of special education students where academic performance of special education students was defined as achieving adequate yearly progress (AYP) in mathematics and reading as measured by the Ohio achievement assessment.[11]

The use of binary logistic regression was appropriate because preliminary analysis indicated that the data were not normally distributed, and the dependent variable, AYP, was dichotomous; that is, if AYP was met, the dependent variable was coded 1, and if AYP was not met, the dependent variable was coded zero. According to Menard, a stepwise method is the most appropriate method when using a logistic regression analysis for exploratory studies where theory is not well established.[12] As a result, this study employed the forward likelihood ratio (Forward LR) stepwise loading method to load the independent expenditure variables into the predictor model.[13] In preparation for the regression analysis, data were analyzed for collinearity and outlier cases. A correlation analysis revealed that no strong relationship existed between independent variables. (See Table 1.) Even though statistical outliers existed in the data set, they were included in the analysis because eliminating them would have excluded districts with high levels of poverty and special education expenditures.

Results

Descriptive statistics provide a profile of per-pupil special education expenditures and the percentage of students in poverty by district for the school year 2008-2009. (See Table 2.) On average, school districts spent $3,019 per pupil on instruction followed by $2,513 on instructional support. Catastrophic costs averaged $87 per pupil while transportation was $28. Support services and instruction expenditures per pupil showed the widest range of the four categories of special education expenditures. Instruction expenditures ranged from $328 to $16,306 per pupil while support services expenditures ranged from $355 to $11,839 per pupil. Overall, 92% of districts spent less than $4,000 per student on special education instruction. The percent of students in poverty in Ohio school districts ranged from zero to 22.87%, with a mean poverty rate of 3.17%. Nearly 95% of districts had poverty levels below 9.9% while nine districts have poverty levels between 15% and 25%.

In terms of academic performance, special education students in Ohio performed better on the Ohio accountability achievement test in reading than they did in mathematics. In 2009, over half (58.8%) of school districts met reading AYP targets for special education students. In contrast, only a little more than one-third (36.7%) met AYP targets for mathematics.

Stepwise regression results indicated that only the model including per-pupil catastrophic and the percentage of students in poverty as independent variables was statistically

Table 1 | **Pearson Correlation Matrix of Independent Variables**

Aid Per Pupil	Transportation	Catastrophic	Speech	Instruction	Poverty
Transportation	1.000	.265*	.538*	.349*	.261*
Catastrophic	.265*	1.000	.528*	.029	-.066
Speech	.538*	.528*	1.000	.233*	.055
Instruction	.349*	.029	.233*	1.000	.378*
Poverty	.261*	-.066	.055	.378*	1.000

N=594

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

Table 2 | **Descriptive Statistics for Categories of Per-Pupil Special Education Expenditures and Student Poverty by School District**

Independent Variables	Mean	Median	Standard Deviation	Minimum	Maximum	Range
Transportation ($)	27.79	22.57	27.20	0.00	270.01	270.01
Catastrophic Costs ($)	87.08	27.79	181.87	0.00	2,035.21	2,035.21
Support Services ($)	2,513.32	2,312.82	980.95	355.16	11,839.82	11,484.66
Instruction ($)	3,019.14	2,889.17	1,161.93	327.67	16,306.18	15,978.51
Student Poverty ($)	3.17	2.03	3.28	0.00	22.87	22.87

n=594

Table 3 | **Classification Table for Adequate Yearly Progress in Reading**

Model	Observed		Predicted		
			Reading AYP		Percentage
			Not Met	Met	Correct
Constant	Reading AYP	Not Met	349	0	100.00
		Met	245	0	
	Overall Percentage				58.8
Step 2	Reading AYP	Not Met	278	71	79.7
		Met	114	131	53.5
	Overall Percentage				68.9
Overall Percentage					68.9

Note: Met=1.00 Not Met=0.00

Table 4 | **Regression Coefficients for Adequate Yearly Progress in Reading**

	R^2	*B*	*Wald*	*df*	*p*	Odds Ratio
Cox & Snell	.118					
Nagelkerke	.159					
Student Poverty		-.231	26.14	1	.000	.793
Catastrophic Expenditure		.001	4.389	1	.036	1.001
Constant		.330	5.21	1	.022	

Table 5 | **Classification Table for Adequate Yearly Progress in Mathematics**

Model	Observed		Predicted		
			Reading AYP		Percentage
			Not Met	Met	Correct
Constant	Math AYP	Not Met	0	218	
		Met	0	376	100.0
	Overall Percentage				63.3
Step 2	Math AYP	Not Met	75	143	34.4
		Met	38	338	89.9
	Overall Percentage				69.5
Overall Percentage					69.5

Note: Met=1.00 Not Met=0.00

Table 6 | **Regression Coefficients for Adequate Yearly Progress in Mathematics**

	R^2	*B*	*Wald*	*df*	*p*	Odds Ratio
Cox & Snell	.138					
Nagelkerke	.188					
Student Poverty		-.285	30.27	1	.000	.752
Constant		1.45	104.20	1	.000	

significant in predicting the probability of special education students' meeting AYP criteria for reading (-2 log likelihood = 730.36, $\chi^2(2) = 74.80$, $p<0.001$). Of the regression steps, this model correctly categorized the highest percent of reading AYP cases, 68.9%, while the constant model accurately classified 58.8%. (See Table 3.) Goodness of fit measures, the Omnibus test and Hosmer-Lemeshow, indicated that the performance of this model was not a significant improvement over the constant model ($p < .00$). Only 11.8% to 15.9% of the variability in reading AYP was explained by the district percent of students in poverty and catastrophic expenditures per pupil. (See Table 4.) Table 4 also displays the regression coefficients. Odds ratios suggested that when a district experienced a one percentage point increase in the percentage of students in poverty, the probability of special education students' meeting AYP criteria for reading decreased by 23.1%. For every one dollar increase in catastrophic expenditures per pupil, a district was only 0.1 times more likely to meet reading AYP category.

In the case of mathematics AYP, the regression results indicated that only the percentage of students in poverty in a district was statistically significant in predicting the probability of special education students' meeting AYP criteria for mathematics (-2 log likelihood = 693.00, $\chi^2(1) = 26.50$, $p<0.001$). Of the regression steps, this model correctly categorized the highest percent of mathematics AYP cases, 69.5%, while the constant model accurately classified 63.3%. (See Table 5.) As with reading AYP, goodness of fit tests signaled that the fit of this model was also questionable as both the Omnibus test ($p<.00$) and Hosmer Lemeshow ($p<.01$) were statistically significant. Furthermore, the model accounted for only 13.8% to 18.8% of the variation in mathematics AYP. (See Table 6.) Table 6 also displays the regression coefficients for this model. Similar to the results of the reading AYP regression model, odds ratios indicated that if the district percent of students in poverty increased by 1%, the probability of special education students' meeting AYP criteria for mathematics decreased by 28.5%.

Summary and Conclusion

The purpose of this exploratory study was to predict which categories of district level special education expenditures best predicted Ohio special education students' meeting the criteria for adequate yearly progress (AYP) in reading and mathematics for the 2008-2009 school year. As such, this study

represented an effort to begin to address a gap in the research literature regarding the relationship between special education expenditure and student achievement, a type of analysis more generally referred to as production function research. Four categories of special education expenditures were included--transportation, catastrophic costs, support services, instruction—as independent variables as well as the percentage of students in poverty. Binary logistic regression was chosen for the statistical analysis given the dichotomous nature of the dependent variables—whether or not special education students met or did not meet adequate yearly progress (AYP) goals; and a stepwise approach was selected given the exploratory and predictive nature of the study.

Aside from the very small positive contribution that catastrophic expenditures made to prediction of special education students meeting AYP in reading, no other category of special education expenditure was statistically significantly. However, in both equations, student poverty was statistically significant and negative, further supporting the relationship between poverty and student performance found in the research literature. More importantly, goodness of fit test results were not encouraging, and regression results indicated the model had low predictive power. These results generally indicate misspecification of the model, i.e., missing variables and/or inclusion of nonrelevant variables, which is not uncommon in the atheoretical approach that characterizes much production function research.

Within the scope of this study, an important limitation should be acknowledged; that is, the use of alternate assessments may have had an effect on districts' AYP outcomes. In Ohio, each school district has the option of using alternate assess-ments and of excluding these scores for accountability measures for one percent of the district's average daily membership (ADM). Because of this, it is possible that not every student with a disability was included in a district's AYP measures.

Future research in this area is necessary to better understand the relationship between special education expenditures and student achievement. These studies might take a more nuanced approach by analyzing incremental gains made by districts that failed to meet percent proficient targets in order to determine if a relationship exists between expenditures and incremental increases in student achievement. For example, it is possible for a school district to realize academic improvements in disability subpopulations which are masked by reporting only the overall percentage of special education students meeting proficiency goals. In addition, future research that is longitudinal in nature will capture these sorts of gains over time, and by doing so, contribute to a more complete picture of special education student expenditure and achievement. Finally, the use of a conceptual or theoretical framework to select independent variables will minimize specification errors.

Endnotes

[1] Chester E. Finn, Jr., and Michael J. Petrilli, foreword to *Boosting the Quality and Efficiency of Special Education*, by Nathan Levenson (Washington D.C. Thomas Fordham Institute, 2012), 2, http://www.edexcellencemedia.net/publications/2012/20120905BoostingtheQualityandEfficiencyofSpecialEducation/20120905BoostingtheQualityandEfficiencyofSpecialEducation20120905BoostingtheQualityandEfficiencyofSpecialEducationFinal.pdf.

[2] Rob Greenwald, Larry V. Hedges, and Richard D. Laine, "The Effect of School Resources on Student Achievement," *Review of Educational Research* 66, no. 3 (1996a): 361-396; Greenwald, Hedges, and Laine, "Interpreting Research on School Resources and Student Achievement: A Rejoinder to Hanushek," *Review of Educational Research* 66, no. 3 (1996b): 411-416; Eric A. Hanushek, "The Impact of Differential Expenditures on School Performance," *Educational Researcher* 18, no. 4 (1989): 45-62; Eric A. Hanushek, *Making Schools Work: Improving Performance and Controlling Costs* (Washington, DC: Brookings Institute, 1994); Hanushek, "Assessing the Effects of School Resources on Student Performance: An Update," *Educational Evaluation and Policy Analysis* 19, no. 2 (1997): 141-164. In examining the relationship between financial resources and student achievement, Greenwald, Hedges, and Laine (1996a) found positive relationships in their studies, while Hanushek (1989; 1997) found a lack of strong evidence to suggest a relationship between financial resources and student achievement.

[3] U.S. Department of Education, "Number and Percentage of Children Served under Individuals with Disabilities Education Act, Part B, By Age Group and State or Jurisdiction: Selected Years, 1990–91 through 2009–10," Table 47, *Digest of Education Statistics 2010* (Washington, DC: National Center for Education Statistics, Institute for Education Sciences, 2011), http://nces.ed.gov/programs/digest/d10/tables/dt10_047.asp. Data in the remainder of this paragraph are drawn from the same source.

[4] U.S. Individuals with Disabilities Act of 2004, 20 U.S.C. § 1400 *et seq.* (2004).

[5] Ohio Department of Education, *Special Education Weighted Funds Fiscal Accountability Report, Fiscal Year 2009* (Columbus, OH: Center for School Options and Finance, Office of Finance Program Services, n.d.), http://www.ode.state.oh.us/GD/Templates/Pages/ODE/ODEDetail.aspx?page=3&TopicRelationID=1438&ContentID=26148&Content=124082.

[6] The variable, expenditures required vs. spent variance, represents the difference between what a district spent and the minimum required special education expenditure level set by the legislature. After consultation with an Ohio Department of Education fiscal reporting specialist, the authors decided to eliminate this variable from the analysis because of the extent of district reporting errors (Personal communication with Londa Schwierking, September 2012).

[7] Ohio Department of Education, "FY2009 District Profile Report" (Columbus, OH: last modified July 17, 2012),

http://education.ohio.gov/GD/Templates/Pages/ODE/ODEDetail.aspx?page=3&TopicRelationID=1214&ContentID=81682&Content=128512.

[8] Ohio Works First is an assistance program for needy families who meet the state's income criteria. See, "Fact Sheet: Ohio Works First" (Columbus, OH: Ohio Department of Job and Family Services, December 2011), http://jfs.ohio.gov/factsheets/owf.pdf.

[9] Julie Anne Taylor, "Poverty and Student Achievement," *Multicultural Education* 12, no. 4 (2005): 53-55; John P. Papay, Richard J. Murnane, John B. Willett, "Inequality and Educational Attainment: Evidence from Massachusetts," a presentation to the annual conference of the Association of Education Finance and Policy, Boston, MA, March, 2012.

[10] Sean F. Reardon, "The Widening Academic Achievement Gap between the Rich and the Poor: New Evidence and Possible Explanations," in *Whither Opportunity? Rising Inequality, Schools, and Children's Life Chances*, edited by Greg J. Duncan and Richard Murnane (New York: Russell Sage Foundation, 2011), 92.

[11] The Ohio achievement assessment is administered annually in reading and mathematics to students in the third through eighth grades. A composite of test results is calculated for each school district by the Ohio Department of Education to determine AYP in reading and AYP in mathematics.

[12] Scott Menard, *Applied Logistic Regression Analysis*, 2nd edition (Thousand Oaks, CA: Sage Publications, Inc., 2001), 64.

[13] With this method, a single predictor variable is entered into the model and tested for statistical significance. In each additional step another independent variables is added to the model and tested for statistical significance; statistically insignificant variables are then removed. See, T.N. Srivastava and Shailaja Rego, *Business Research Methodology* (Nagar, New Delhi: Tata McGraw Hill, 2010), 14.55.