Introduction

Education spending is one of the most debated topics in economics and public policy. We would often assume that higher per-student spending translates into better outcomes for students. Do schools with higher spending have higher test scores?

Data Description

The data set includes the averages for all 50 United States and the District of Columbia from 2022. The main independent variable is expenditures per pupil, and the dependent variables are average eighth and fourth-grade NAEP math scores. NAEP scores range from 1-500. Expenditures per pupil range from $9,496 to $29,284. Eighth-grade state-average scores range from 259 to 284, and fourth-grade scores range from 221 to 243. Figure 1 shows scatterplots showing expenditure per pupil vs. eighth and fourth-grade scores.

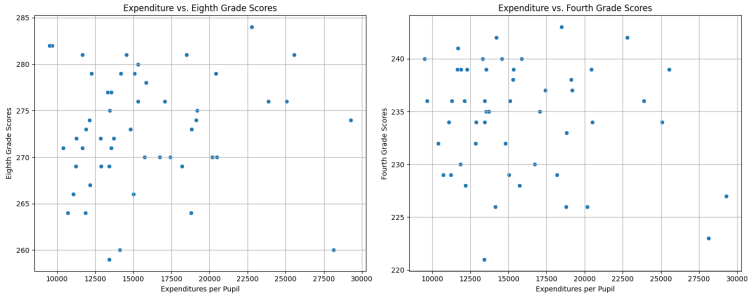

Figure 1: *Expenditure vs. Eighth and Fourth Grade Scores*

The expenditure and revenue data used in this analysis are from the *Revenues and Expenditures for Public Elementary and Secondary Education: School Year 2021- 22 (Fiscal Year 2022)*: *First Look* report (NCES 2024-301), published by the U.S. Department of Education's National Center for Education Statistics in May 2024. Test score data are drawn from the National Assessment of Educational Progress (NAEP), which reports average fourth and eighth-grade math scores by state.

Statistical Methodology

To identify whether states that spend more per pupil achieve higher average test scores, this study utilizes a Simple Generalized Linear Model (GLM) with state-level data, as noted above. The dependent variable is the average math score for either fourth or eighth grade, and the primary independent variable is per-pupil expenditures.

$$\text{MathScore} = \beta_0 + \beta_1 \cdot \text{Expenditure} + \epsilon$$

Figure 2 shows the relationship of the variables with regression lines.

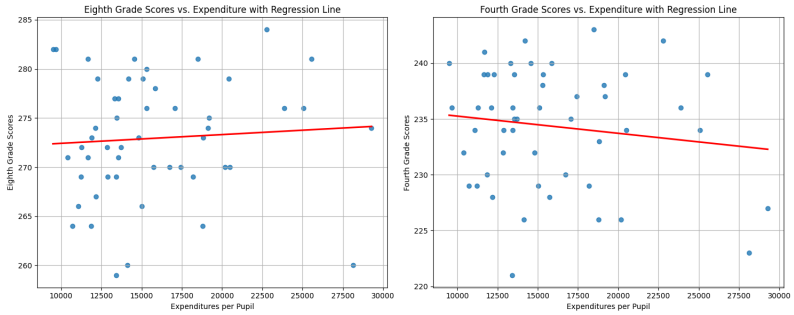

Figure 2: *Plotted Data with Regression Lines*

The model estimates the linear relationship between spending and test scores, allowing the assessment of whether higher expenditures are associated with higher test scores.

Results and Analysis

The linear regression produced the following output.

Table 1: *Eighth Grade Linear Regression*

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	271.5310	3.048	89.075	0.000	265.405	277.657
expenditure	8.908e-05	0.000	0.482	0.632	-0.000	0.000

Table 2: *Fourth Grade Linear Regression*

	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	236.7918	2.614	90.585	0.000	231.539	242.045
expenditure	-0.0002	0.000	-0.973	0.335	-0.000	0.000

The model observes that for every $1 expenditure increase per eighth-grade pupil is associated with an average score increase of 8.908e^-05, and for every $1 expenditure increase per fourth-grade pupil is associated with an average score decrease of -0.0002. However, this would only be the case for change that is less than 1 percent of the time under the default null of no relationship ($p < 0.01$) From Tables 1 and 2, p-values were also interpreted. Both values (0.632 and 0.335) both greatly exceed 0.01, and therefore lead to failing to reject the null hypothesis. This concludes that there is no statistically significant relationship between expenditures per pupil and NAEP math test scores.

Conclusion

This project examined the relationship between increased school per-pupil expenditures and improved test scores. The data demonstrates a weak and inconsistent relationship: eighth-grade scores increase a small amount with more spending, while fourth-grade scores fall slightly. Spending accounts for little of the variation in test scores, which implies that other factors, such as socioeconomic status or quality of schooling, likely have a greater impact on higher student test scores than just spending alone. Overall, there is little evidence to support the hypothesis that increased per-pupil expenditure increases test scores.

References

Cornman, S. Q., Doyle, S., Moore, C., Phillips, J., & Nelson, M. R. (2024). *Revenues and Expenditures for Public Elementary and Secondary Education: School Year 2021–22 (Fiscal Year 2022): First Look (NCES 2024-301).* U.S. Department of Education, National Center for Education Statistics. https://nces.ed.gov/national-center-education-statistics-nces/products. Accessed November 20, 2025.
NAEP Report Card: 2022 NAEP Mathematics Assessment. *The Nation's Report Card*, www.nationsreportcard.gov/highlights/mathematics/2022/. Accessed 2 Dec. 2025.