Washington State Institute for Public Policy

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THE ECONOMIC VALUE OF LEARNING TIME IN K–12 SCHOOLS

A Summary of Research Evidence and an Economic Analysis

The Washington State Institute for Public Policy was asked by legislative staff to estimate the economic value of learning time. We address this question in two ways.

First, we quantify the economic value of an *average* school day and compare it with the cost of providing K–12 education.

Second, we systematically review the research literature that examines how *marginal* changes to the length of the school year—for example, adding one day—impact student outcomes and associated benefits and costs.

Summary

The research literature reveals a relatively small, positive impact on student outcomes resulting from a longer school year. When benefits are measured in terms of the labor market earnings gained from improved test scores, we find that increases to instructional time outweigh the cost of providing that instruction.

What Is the Economic Value of an Average School Day?

This analysis focuses on students' average learning gains in a typical school day to quantify the economic value of instructional time.

We make two key assumptions for this analysis:

1) *Student learning gains.* We assume that one year of K–12 education leads to an increase in test scores equal to roughly half a standard deviation.[1]

   We then convert this estimate into a per-day test score gain by dividing by 180 days. This conversion assumes that test score increases are equally distributed throughout the school year. In other words, the same amount of learning is assumed for the first, 100th, and last day of the school year.

2) *Assigning economic value to learning gains.* We quantify the value of education in terms of labor market earnings.[2] Specifically, we assume that a one standard deviation increase in test scores leads to a 12 percent increase in annual labor market earnings.[3] Economists have also noted non-labor market benefits to education, for example, lower health care costs. However, we restrict our focus to the more well-established empirical link between education and labor market performance. The estimates below should, thus, be considered a lower-bound estimate of the benefits to student learning time.

   We "present value" all the estimates of education impacts on earnings back to the time when student learning occurs, using a 3 percent discount rate. For example, the labor market earnings for a first grader would not begin until about age 19, and, thus, we present value earnings' gains back to age six. We make similar calculations for each grade level.

[1] Annual learning gains vary by grade level, with larger gains in elementary school than in later years. This analysis uses a weighted average standard deviation (SD) gain for all students to gauge average impacts in K–12. The math test score gain across grade levels is 0.47 SD per year, or 0.0026 SD per day. C. Hill, H. Bloom, A. Black, & M. Lipsey. (2007). *Empirical benchmarks for interpreting effect sizes in research.* MDRC Working Papers on Research Methodology, July 2007.

[2] Earnings estimates are taken from the U.S. Census Bureau's March Supplement to the Current Population Survey, which provides cross-sectional data for earnings by age and by educational status. To these data, we apply different measures of the net advantage gained through increases in a human capital outcome, such as test scores.

[3] This assumption has been borne out by a number of studies that we have analyzed, and economists across the spectrum generally agree on this magnitude. See, for example, E. Hanushek. (2004). *The economic value of improving local schools.* Downloaded from: http://www.clevelandfed.org/research/conferences/2004/november/pdf/hanushek.pdf

Estimated benefits, based on the average learning gains in a typical school day. Test score increases that occur on a typical school day generate additional lifetime labor market benefits of $319 per day per student, or $638 for the biennium. These are increases in earnings, so most of the benefits accrue directly to the students; a portion would return to the state in taxes paid.[4]

Costs. Legislative fiscal staff estimate that one day of K–12 education costs the state $55 million for the 2011–13 biennium. The per-day per-student cost is $27 annually, or $54 for the biennium.

Thus, the labor market benefits that accrue from student learning in a typical school day ($319) exceed the costs of providing that school day ($27).

We checked the reasonableness of these estimates using an alternative method that economists often use to measure the economic value of education. There is a long list of research literature measuring the value of an extra year of education. Economists have found that an extra year of education generates about a 10 percent boost in labor market earnings per year.[5] We conducted an analysis using this estimate (instead of using increases in test scores), and the results were very similar to the test score based estimates.

How Does Altering the Length of the School Year Impact Test Scores?

In the previous section, we estimated the economic value of an *average* school day. Now, we turn to estimates of the impacts of a *marginal* school day: what happens when schools add or subtract a day at the end of a school year? This analysis recognizes that not all school days are equal; students learn more on some days than on others.

We searched the research literature (national and international) for high-quality studies that empirically link the time spent in school to student outcomes. We located 17 credible studies that examine how the length of the school year is associated with student outcomes (test scores and long-term labor market earnings).

We pooled the results of these studies using meta-analysis, and found that marginal changes to the length of the school year have a relatively small, positive impact on student outcomes.

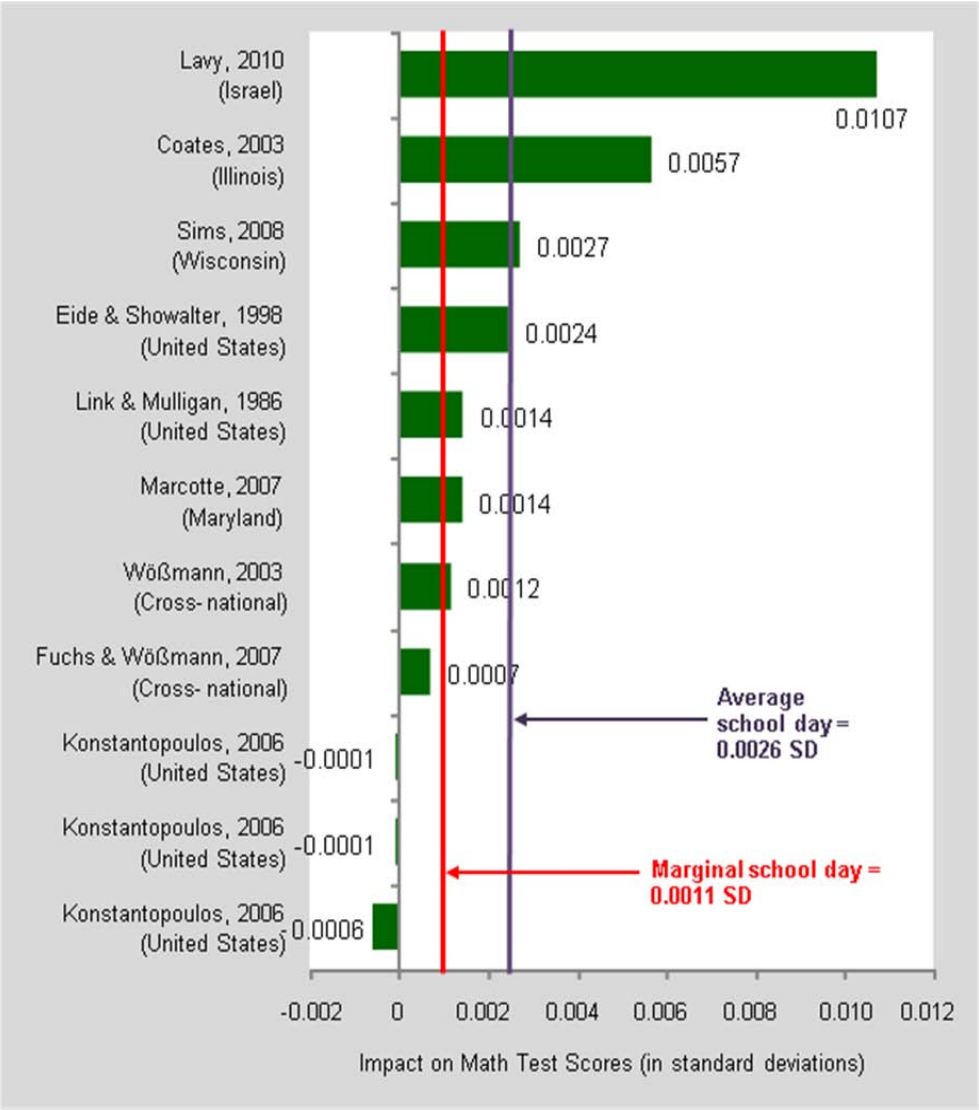
For example, a marginal day (added or subtracted from the regular school year) is associated with math test score impacts of about two-fifths that of an average day in a typical year (see Exhibit 1).[6] The associated benefits would also be proportionately lower ($128), but still larger than the cost of providing one day of school.

[4] These estimates of labor market benefits are lower than those provided to legislative staff via email in January, 2011, because we revised our findings based on information provided in Hill et al. (2007) about average learning gains in a typical school year.

[5] See, for example, E. A. Hanushek, & L. Wößmann. (2008). The role of cognitive skills in economic development. *Journal of Economic Literature, 46*(3), 607-668.

[6] This estimate of math test score impacts is slightly larger than the figure emailed to legislative staff on April 8, 2011. We had unintentionally omitted a study (Wößmann, 2003) and have since added it to the final analysis.

Exhibit 1
Math Test Score Gains/Losses, by Study Sample,
Associated With a One-Day Increase in the School Year



These results should not be considered definitive, because the effect sizes are not statistically significant (see Exhibit 2). However, the findings suggest that even at the margins, the labor market benefits that result from time in school ($128 per student per marginal day) outweigh the cost of providing instruction ($27 per student per day).

Exhibit 2
Meta-Analytic Estimates of Standardized Mean Difference Effect Sizes for a One-Day Longer School Year

Student Outcome Measure	Number of Effect Sizes Included in the Analysis	Number of Cases in the Treatment Groups	Weighted Mean Effect Size (estimated effect after adjustments for the quality of the evidence and units of time)	p-value
Math test scores	11	184,392	0.0011	0.54
Reading test scores	10	47,123	0.0003	0.95
Labor market earnings	10	181,533	0.0006	0.72

Studies Included in the Meta-Analyses

Math test scores

Coates, D. (2003). Education production functions using instructional time as an input. *Education Economics, 11*(3), 273-292.

Eide, E., & Showalter, M. H. (1998). The effect of school quality on student performance: A quantile regression approach. *Economics Letters, 58*(3), 345-350.

Fuchs, T., & Wößmann, L. (2007). What accounts for international differences in student performance? A re-examination using PISA data. *Empirical Economics, 32*(2), 433-464.

Konstantopoulos, S. (2006). Trends of school effects on student achievement: Evidence from NLS:72, HSB:82, and NELS:92. *Teachers College Record, 108*(12), 2550-2581.

Lavy, V. (2010). Differences across and within countries in instructional time and achievements in math, science, and reading: A causal link? NBER, May 2010. http://www.parisschoolofeconomics.eu/IMG/pdf/Classroom_Hours_and_Students_Achievement_Draft_May_13_2010.pdf

Link, C. R., & Mulligan, J. G. (1986). The merits of a longer school day. *Economics of Education Review, 5*(4), 373-381.

Marcotte, D. E. (2007). Schooling and test scores: A mother-natural experiment. *Economics of Education Review, 26*(5), 629.

Sims, D. P. (2008). Strategic responses to school accountability measures: It's all in the timing. *Economics of Education Review, 27*(1), 58.

Wößmann, L. (2003). Schooling resources, educational institutions and student performance: The international evidence. *Oxford Bulletin of Economics and Statistics, 65*(2), 117-170.

Reading test scores

Coates, D. (2003). Education production functions using instructional time as an input. *Education Economics, 11*(3), 273-292.

Fuchs, T., & Wößmann, L. (2007). What accounts for international differences in student performance? A re-examination using PISA data. *Empirical Economics*, *32*(2), 433-464.

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Sims, D. P. (2008). Strategic responses to school accountability measures: It's all in the timing. *Economics of Education Review, 27*(1), 58.

Labor market earnings

Betts, J. R. (1996). Do school resources matter only for older workers? *The Review of Economics and Statistics, 78*(4), 638-652.

Card, D., & Krueger, A. B. (1992). Does school quality matter? Returns to education and the characteristics of public schools in the United States. *Journal of Political Economy, 100*(1), 1-40.

Heckman, J., Layne-Farrar, A., & Todd, P. (1996). Human capital pricing equations with an application to estimating the effect of schooling quality on earnings. *The Review of Economics and Statistics, 78*(4), 562-610.

McHenry, P. (2009). The effect of school inputs on labor market returns that account for selective migration. *Economics of Education Review, 28*(2), 39-54.

Olson, C. A., & Ackerman, D. (2000, March). *High school inputs and labor market outcomes for male workers in their mid-thirties: New data and new estimates from Wisconsin* (Discussion Paper No. 1205-00). Madison: University of Wisconsin-Madison; Institute for Research on Poverty.

Pischke, J.-S. (2007). The impact of length of the school year on student performance and earnings: Evidence from the German short school years. *The Economic Journal, 117*(523), 1216-1242.

Rizzuto, R., & Wachtel, P. (1980). Further evidence on the returns to school quality. *The Journal of Human Resources, 15*(2), 240-254.

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