Tutoring: Supplemental computer-assisted instruction for struggling readers (vs. other assistance)

Pre-K to 12 Education

Benefit-cost estimates updated December 2023. Literature review updated March 2020.

Current estimates replace old estimates. Numbers will change over time as a result of model inputs and monetization methods.

The WSIPP benefit-cost analysis examines, on an apples-to-apples basis, the monetary value of programs or policies to determine whether the benefits from the program exceed its costs. WSIPP's research approach to identifying evidence-based programs and policies has three main steps. First, we determine "what works" (and what does not work) to improve outcomes using a statistical technique called meta-analysis. Second, we calculate whether the benefits of a program exceed its costs. Third, we estimate the risk of investing in a program by testing the sensitivity of our results. For more detail on our methods, see our Technical Documentation.

Program Description: Supplemental computer-assisted instruction (CAI) reflects education that supplements rather than replaces regular classroom instruction. In this analysis, supplemental CAI provides reading instruction to students that either test below average on reading comprehension or test below grade-level on reading ability.

Supplemental CAI is provided after school to bring below-grade level performers up to grade-level in reading. Students participate in CAI for three weekly, 20-minute lessons for four weeks up to an entire school year. In the included studies, CAI was provided to elementary-aged students using several programs, including GraphoGame, FLASH, Alphie's Alley, and DaisyQuest. The analysis excludes studies that focus exclusively on special education populations. Studies in the analysis compare students receiving reading CAI to students who receive either other forms of CAI in non-reading subjects (i.e., math) or another type of supplemental tutoring to improve reading ability and comprehension.

Benefit-Cost Summary Statistics Per Participant

Benefits to:

Taxpayers	$360
Participants	$848
Others	$447
Indirect	($341)
Total benefits	$1,313
Net program cost	($682)
Benefits minus cost	$632

Benefit to cost ratio	$1.93
Benefits minus costs	$632
Chance the program will produce benefits greater than the costs	51%

The estimates shown are present value, life cycle benefits and costs. All dollars are expressed in the base year chosen for this analysis (2022). The chance the benefits exceed the costs are derived from a Monte Carlo risk analysis. The details on this, as well as the economic discount rates and other relevant parameters are described in our Technical Documentation.

Meta-Analysis of Program Effects

Outcomes measured	Treatment age	No. of effect sizes	Treatment N	Adjusted effect sizes and standard errors used in the benefit-cost analysis						Unadjusted effect size (random effects model)	
				First time ES is estimated			Second time ES is estimated				
				ES	SE	Age	ES	SE	Age	ES	p-value
Test scores	6	4	277	0.020	0.155	6	0.008	0.170	17	0.039	0.803

Meta-analysis is a statistical method to combine the results from separate studies on a program, policy, or topic in order to estimate its effect on an outcome. WSIPP systematically evaluates all credible evaluations we can locate on each topic. The outcomes measured are the types of program impacts that were measured in the research literature (for example, crime or educational attainment). Treatment N represents the total number of individuals or units in the treatment group across the included studies.

An effect size (ES) is a standard metric that summarizes the degree to which a program or policy affects a measured outcome. If the effect size is positive, the outcome increases. If the effect size is negative, the outcome decreases.

Adjusted effect sizes are used to calculate the benefits from our benefit cost model. WSIPP may adjust effect sizes based on methodological characteristics of the study. For example, we may adjust effect sizes when a study has a weak research design or when the program developer is involved in the research. The magnitude of these adjustments varies depending on the topic area.

WSIPP may also adjust the second ES measurement. Research shows the magnitude of some effect sizes decrease over time. For those effect sizes, we estimate outcome-based adjustments which we apply between the first time ES is estimated and the second time ES is estimated. We also report the unadjusted effect size to show the effect sizes before any adjustments have been made. More details about these adjustments can be found in our Technical Documentation.

Detailed Monetary Benefit Estimates Per Participant

Affected outcome:	Resulting benefits:[1]	Benefits accrue to:				
		Taxpayers	Participants	Others[2]	Indirect[3]	Total
Test scores	Labor market earnings associated with test scores	$360	$848	$447	$0	$1,654
Program cost	Adjustment for deadweight cost of program	$0	$0	$0	($341)	($341)
Totals		$360	$848	$447	($341)	$1,313

[1]In addition to the outcomes measured in the meta-analysis table, WSIPP measures benefits and costs estimated from other outcomes associated with those reported in the evaluation literature. For example, empirical research demonstrates that high school graduation leads to reduced crime. These associated measures provide a more complete picture of the detailed costs and benefits of the program.

[2]"Others" includes benefits to people other than taxpayers and participants. Depending on the program, it could include reductions in crime victimization, the economic benefits from a more educated workforce, and the benefits from employer-paid health insurance.

[3]"Indirect benefits" includes estimates of the net changes in the value of a statistical life and net changes in the deadweight costs of taxation.

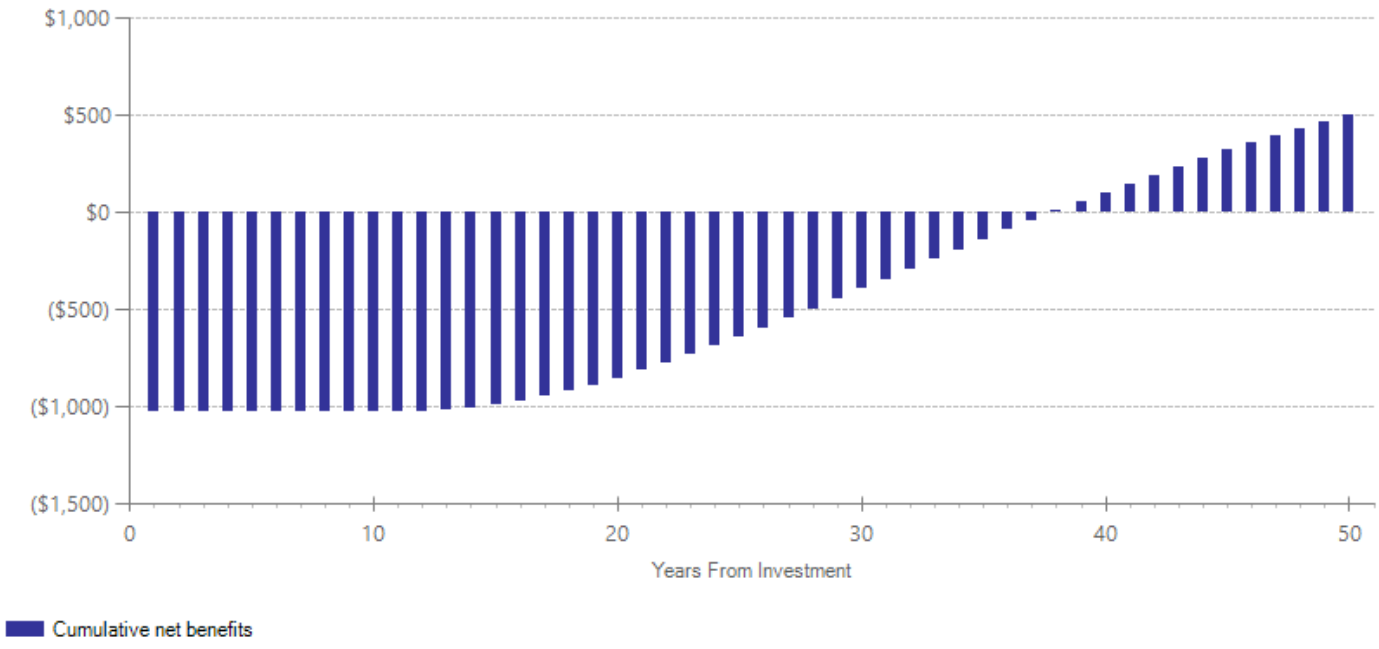
Detailed Annual Cost Estimates Per Participant

	Annual cost	Year dollars	Summary	
Program costs	$1,413	2018	Present value of net program costs (in 2022 dollars)	($682)
Comparison costs	$812	2018	Cost range (+ or -)	40%

The cost of the supplemental computer-assisted instruction (CAI) can vary widely based on the number of students in each school using the program and the number of students using the program at one time. The interventions included in this review required an average of 7.8 hours of teacher time per student over a school year. In the studies included in the analysis, the comparison students received supplemental teacher time because they participated in other supplemental tutoring. We estimate the difference in the reported teacher-time across groups and estimate the difference in the per-participant cost of the program used in the interventions included in the analysis. We estimate that the per-participant cost is $589 for a program like GraphoGame in 2017 per Agora Center. (2017). Evaluation report: GraphoGame™ Teacher Training Service. University of Jyväskylä, Finland.

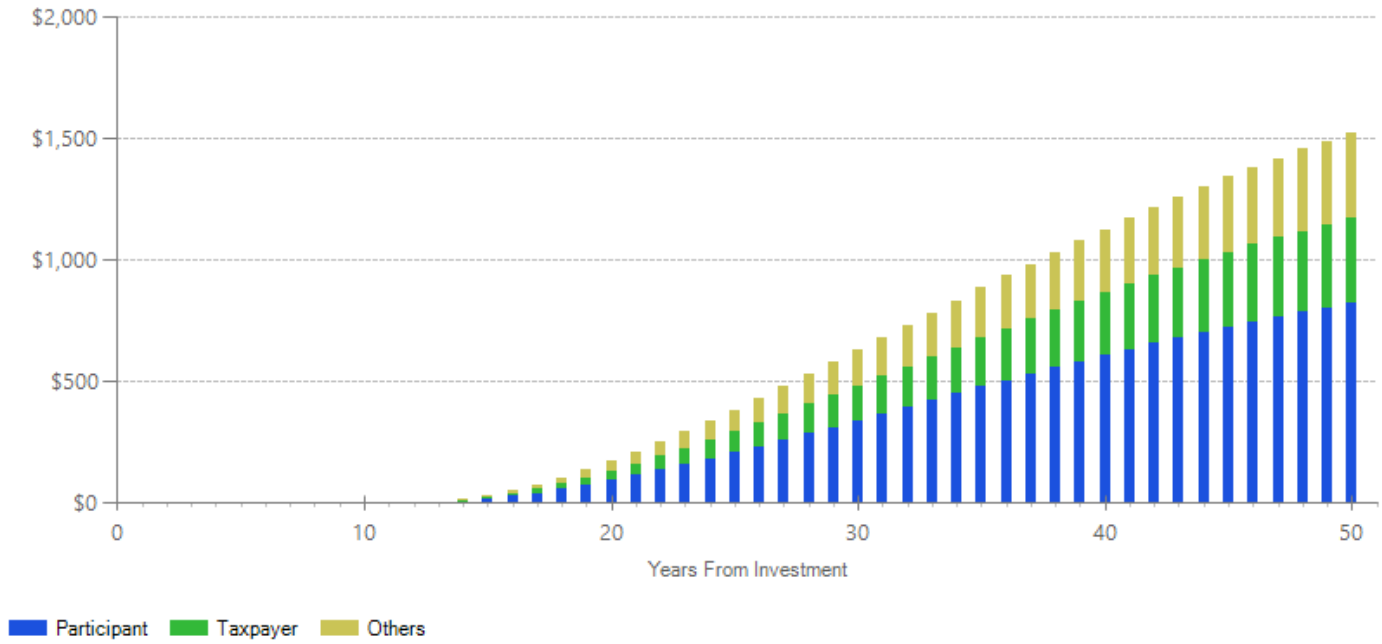
The figures shown are estimates of the costs to implement programs in Washington. The comparison group costs reflect either no treatment or treatment as usual, depending on how effect sizes were calculated in the meta-analysis. The cost range reported above reflects potential variation or uncertainty in the cost estimate; more detail can be found in our Technical Documentation.

Benefits Minus Costs Over Time (Cumulative Discounted Dollars)



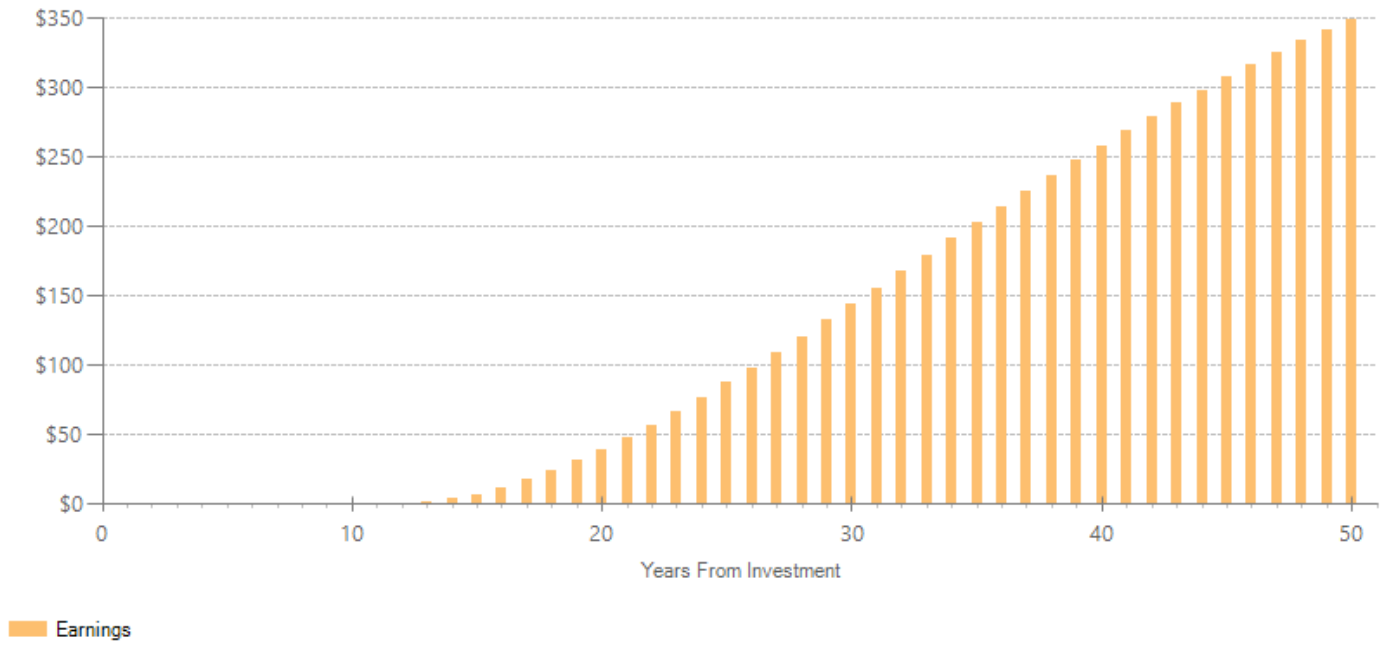
The graph above illustrates the estimated cumulative net benefits per-participant for the first fifty years beyond the initial investment in the program. We present these cash flows in discounted dollars. If the dollars are negative (bars below $0 line), the cumulative benefits do not outweigh the cost of the program up to that point in time. The program breaks even when the dollars reach $0. At this point, the total benefits to participants, taxpayers, and others, are equal to the cost of the program. If the dollars are above $0, the benefits of the program exceed the initial investment.

Benefits by Perspective Over Time (Cumulative Discounted Dollars)



The graph above illustrates the breakdown of the estimated cumulative benefits (not including program costs) per-participant for the first fifty years beyond the initial investment in the program. These cash flows provide a breakdown of the classification of dollars over time into four perspectives: taxpayer, participant, others, and indirect. “Taxpayers” includes expected savings to government and expected increases in tax revenue. “Participants” includes expected increases in earnings and expenditures for items such as health care and college tuition. “Others” includes benefits to people other than taxpayers and participants. Depending on the program, it could include reductions in crime victimization, the economic benefits from a more educated workforce, and the benefits from employer-paid health insurance. “Indirect benefits” includes estimates of the changes in the value of a statistical life and changes in the deadweight costs of taxation. If a section of the bar is below the $0 line, the program is creating a negative benefit, meaning a loss of value from that perspective.

Taxpayer Benefits by Source of Value Over Time (Cumulative Discounted Dollars)



The graph above focuses on the subset of estimated cumulative benefits that accrue to taxpayers. The cash flows are divided into the source of the value.

Citations Used in the Meta-Analysis

Chambers, B., Abrami, P., Tucker, B., Slavin, R.E., Madden, N.A., Cheung, A., & Gifford, R. (2008). Computer-assisted tutoring in Success for All: Reading outcomes for first graders. *Journal of Research on Educational Effectiveness, 1*(2), 120-137.

Fuchs, L.S., Fuchs, D., Hamlet, C.L., Powell, S.R., Capizzi, A.M., & Seethaler, P.M. (2006). The effects of computer-assisted instruction on number combination skill in at-risk first graders. *Journal of Learning Disabilities, 39*(5), 467-475.

Kamykowska, J., Haman, E., Richardson, U., Latvala, J.-M., & Lyytinen, H. (2014). Developmental changes of early reading skills in six-year-old Polish children and GraphoGame as a computer-based intervention to support them. *L1 Educational Studies in Language and Literature,* 1-17.

Mitchell, M.J., & Fox, B.J. (2001). The effects of computer software for developing phonological awareness in low-progress readers. *Reading Research and Instruction, 40,* 315-332.

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