Cost-benefit Analysis of Educational Innovation Using Growth Measures of Student Achievement

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Introduction.

Problem

Program evaluations focus on establishing if a program has a statistically significant positive impact on student performance. State and local educational decision-makers need to know if the program under consideration should be adopted, answering the question: Do the expected benefits of the program outweigh the total cost of the program implementation and support? Answering this question requires performing a cost benefit analysis. Cost of new program implementation often known precisely or relatively easy to estimate. Converting estimated program effects into economic benefits is a complex problem that does not have a universal solution and depends on the preferences/values of decision-makers and their constituents. Approaches to evaluating benefits of an educational program can be based, for example, on:

-Labor market outcomes for high school graduates (using changes in graduation and college matriculation rates if applicable)

-Utility-based measures derived from student and parent surveys, etc.

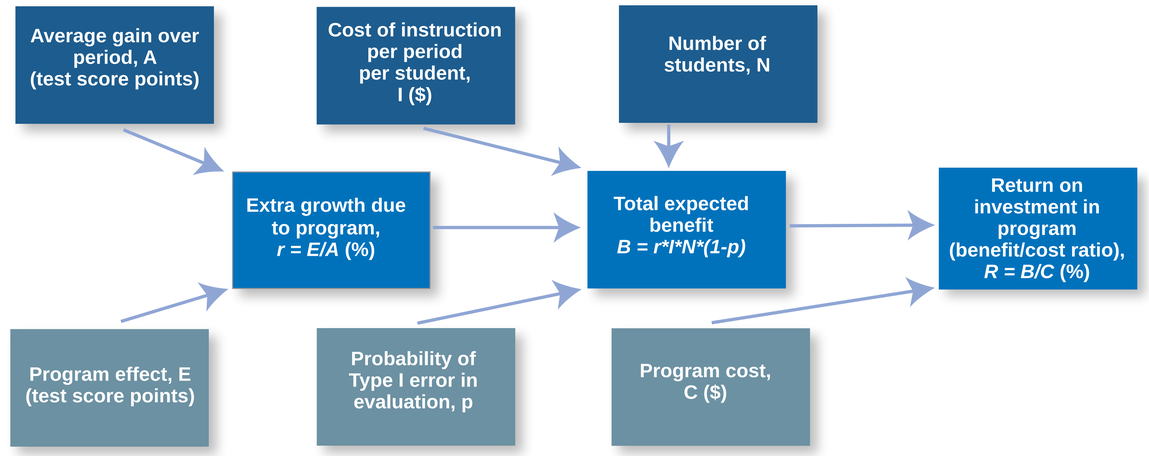
We propose a feasible and generally applicable method based on the estimation of instructional time equivalent ("time savings") of a program effect.

Instructional Time Equivalent

Assumptions: Student outcomes are measured on a growth scale and program effects are measured in terms of score gains per period.

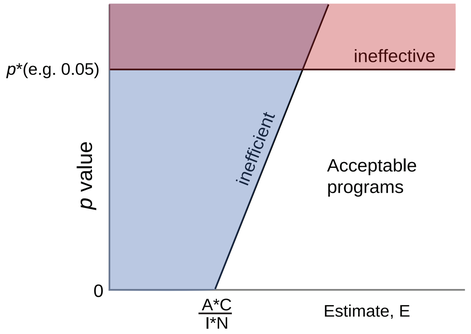
Approach: Positive effect of a program on score gains can be interpreted as equivalent to an increase in the overall instructional time: If it were not for the innovation, schools would have to increase the instructional time to achieve the same outcome and bear the cost of additional instruction. Alternatively, if the school that adopts the program wants to keep the student outcomes constant, it could reduce the total instruction time. In either scenario, effective program leads to "time savings." Program effect expressed as a percentage of normal (control group) score gain per period multiplied by the per-period cost of instruction is therefore a measure of the program benefit. Comparing the cost of program to thus estimated program benefit allows making an informed decision to adopt or reject the program.

Cost Benefit Analysis.



Efficient program: $R = \frac{E*I*N*(1-p)}{A*C} \geq 1 \Rightarrow E \geq A * \frac{C}{I*N*(1-p)}$

If program is priced per student: $C = c*N \qquad E \geq A * \frac{c}{I*(1-p)}$



Example. Analysis of two new literacy programs

	Program 1	Program 2
Grades	4-5	6-8
Delivery mode	Study pack (textbook and supplemental materials)	School computer network
Cost	$196 per student	$10,000 per site license

Annual gain, A	Program effect, E	Growth due to program, r	Instructional time equivalent, days	Annual cost of reading instruction, I	Savings per student	Cost per student
4.23	0.67	16%	29	$1,100	$174	$196

Grade level	Annual gain, A	Program effect, E	Growth due to program, r	Instructional time equivalent, days	Annual cost of reading instruction, I	Savings per student*	Cost per student
6	3.28	0.00	0%	0	$1,100	$0	$27
7	3.17	0.18	6%	10	$1,100	$62	$27
8	2.33	0.36	16%	28	$1,100	$172	$27
Average						$78	$27

* For a school with 450 students

Program 1 is not accepted although it is more effective than Program 2.

Discussion.

Feasibility

1. Requires data on (marginal) cost of instruction and program costs, which can be found in school financial records (payroll, etc.)
2. Does not require collecting subjective data through interviews/surveys or data on post-secondary careers
3. Based on reasonable counterfactuals
4. Can account for external effects (impact on growth in subject other than targeted by the program)

Caveats

1. Programs are implemented for a number of years and require calculating NPV of total benefits and costs – requires knowing planning horizon and appropriate discount rate.
2. Assesses benefits from the school finance perspective only, no accounting for welfare effects on students (e.g. value of time when a program incentivizes more homework time)