

From Program Effect to Cost Savings

Valuing the Benefits of Educational Innovation Using
Vertically Scaled Test Scores and Instructional
Expenditure Data

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Agenda

1. Effectiveness, Efficiency, and Program Adoption
2. Cost-Benefit Analysis Using Instructional Time Equivalent
3. Example: Two Programs
4. Summary

Program Evaluation: Effectiveness vs. Efficiency

- Conventional program evaluation in education focuses on establishing program's *effectiveness*, i.e. its statistically significant positive impact on student performance, or:

Does it work? ($E > 0$?)

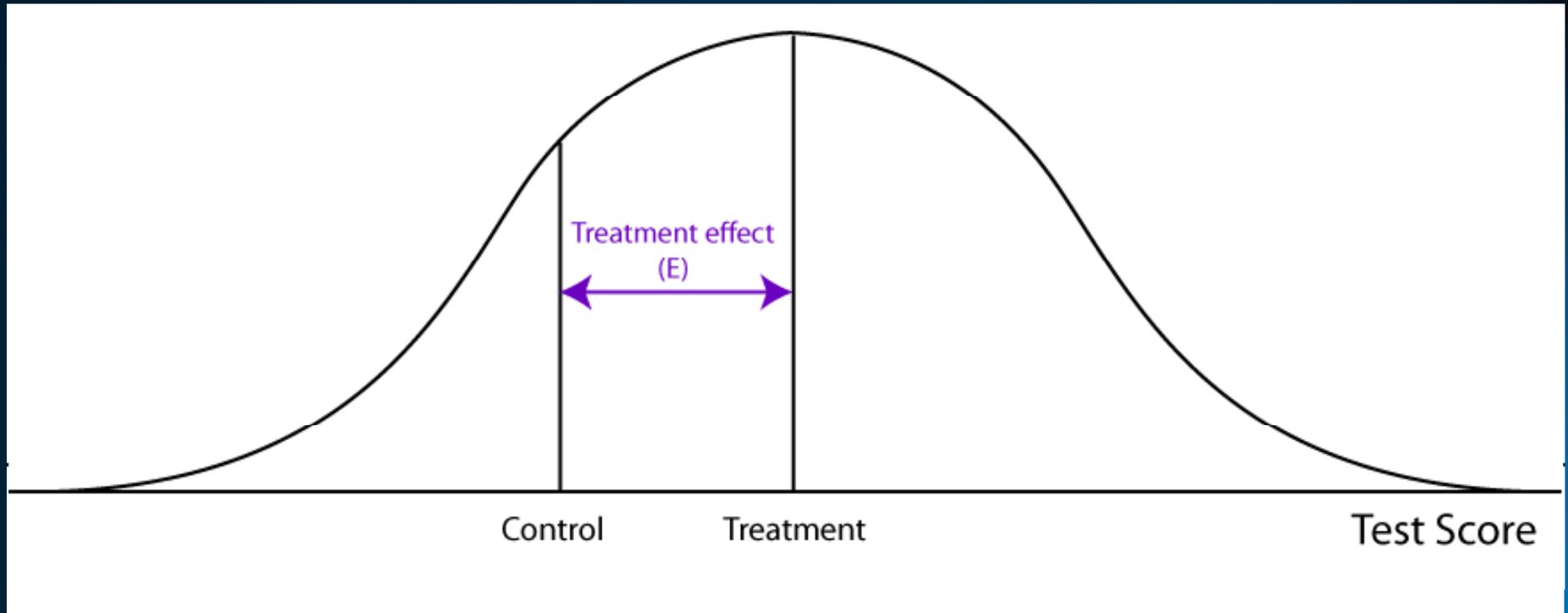
- Educational authorities need to know if the program is *efficient* enough to be adopted, or:

Do the expected benefits of the program exceed the program costs? ($B > C$?)

Program Evaluation in Education

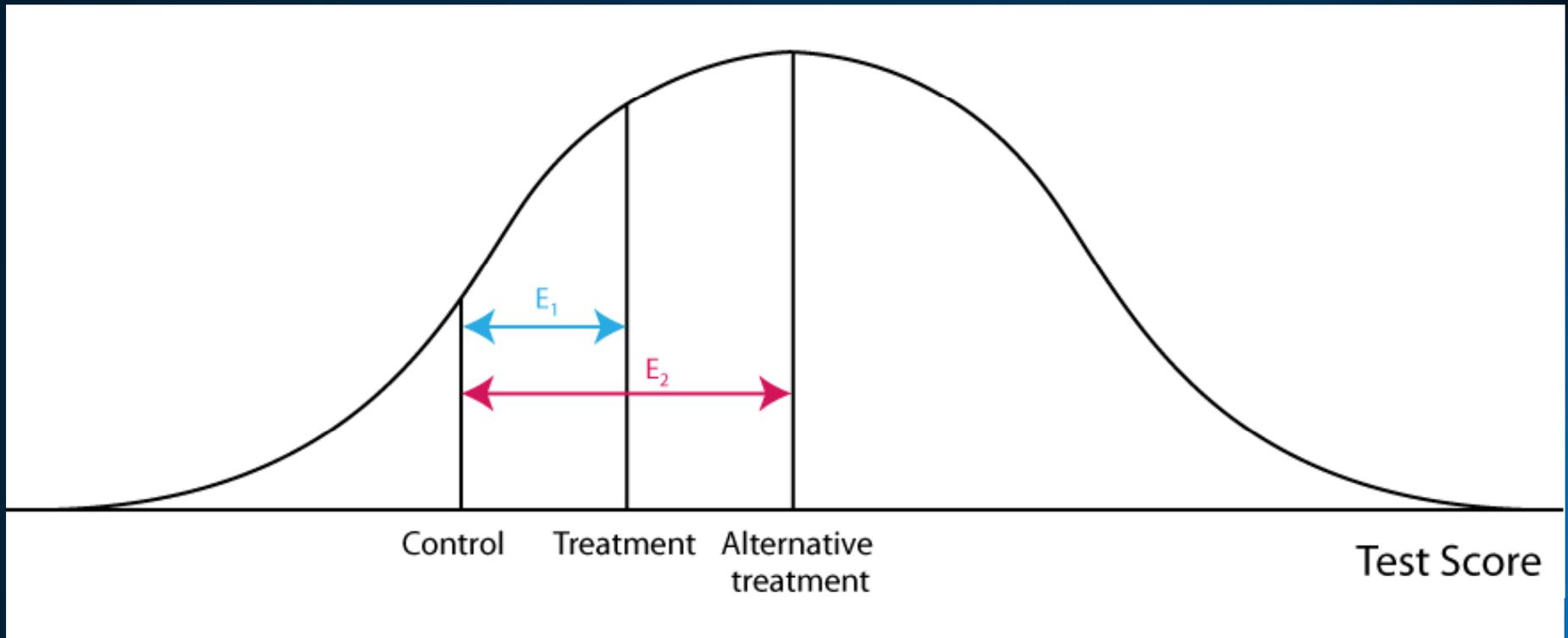
- Program cost, C , is relatively easy to estimate (purchase price + professional development + cost of maintenance over expected time in use).
- Outcome in education is typically an indicator of achievement or behavior as measured by a test or survey-based metric.

Program Evaluation in Education



- Program effect = performance of treatment group relative to control group
- What is the value of program (“treatment”) effect?

Program Evaluation: Comparison



- Comparative Effectiveness: $E_2 > E_1$
- Comparative Effectiveness: $E_2 / C_2 > E_1 / C_1$
- Should the better program be adopted?

Valuing the Benefits of Educational Innovation

- Economic benefits (B) are not inherent in the program effect estimate (E)
 - Unless there is a direct link to market outcomes (programs affecting the probability of high school graduation, vocational training, etc.)
- Direct valuation of the program effect involving utility/social welfare-based approaches depends heavily on disputable assumptions.
- We need a transparent and practicable valuation method.

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Instructional Time Equivalent

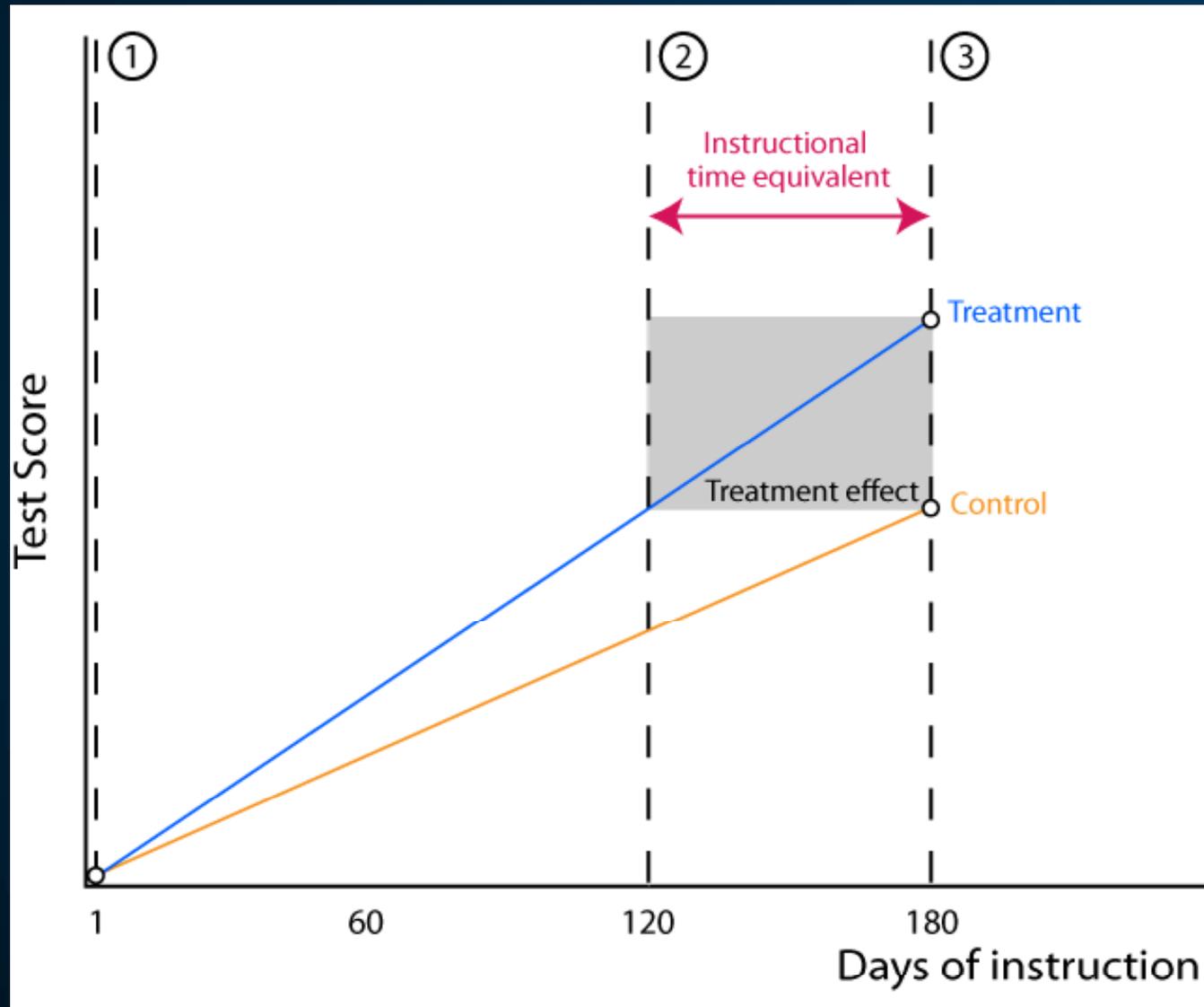
Approach: An effective program is a “time-saving technology”

If a school that adopts an effective program wants to keep the student outcomes constant, it could reduce the total instruction time and save a portion of instructional expenditure.

Instructional Time Equivalent

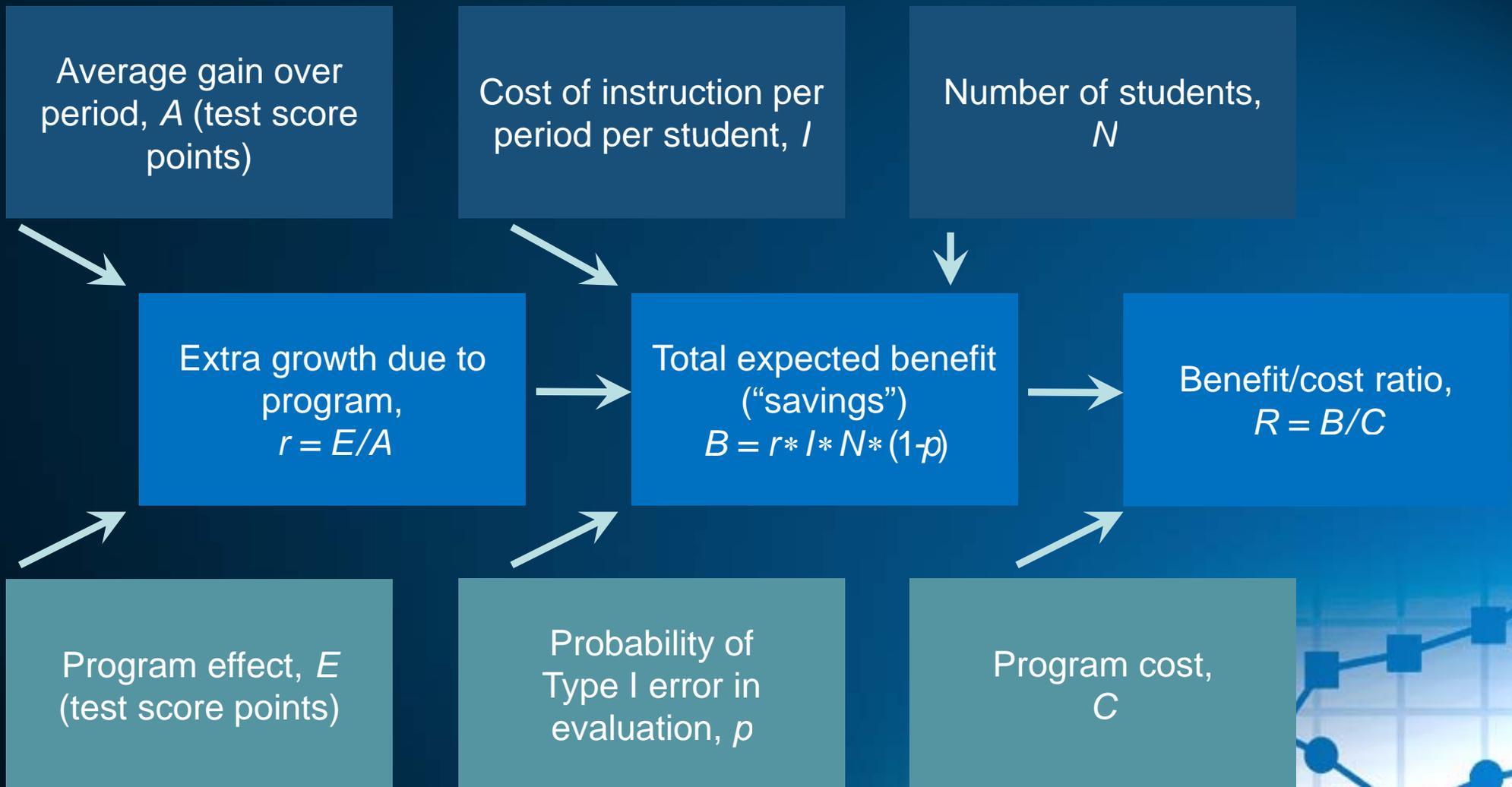
- Requirements:
 - Student outcomes are measured on a growth (vertically-aligned) scale
 - Allows measuring score gains per time unit
 - Program effect, E , can be expressed as share of normal (control group) growth
 - Marginal cost of instruction can be identified
- Program benefit, B = program effect (as % of normal score gain) multiplied by the marginal cost of instruction

Instructional Time Equivalent



- ① Beginning-of-year test
- ② Point where treatment group achieves the “normal” end-of-year result
- ③ End-of-year test

Cost-Benefit Analysis

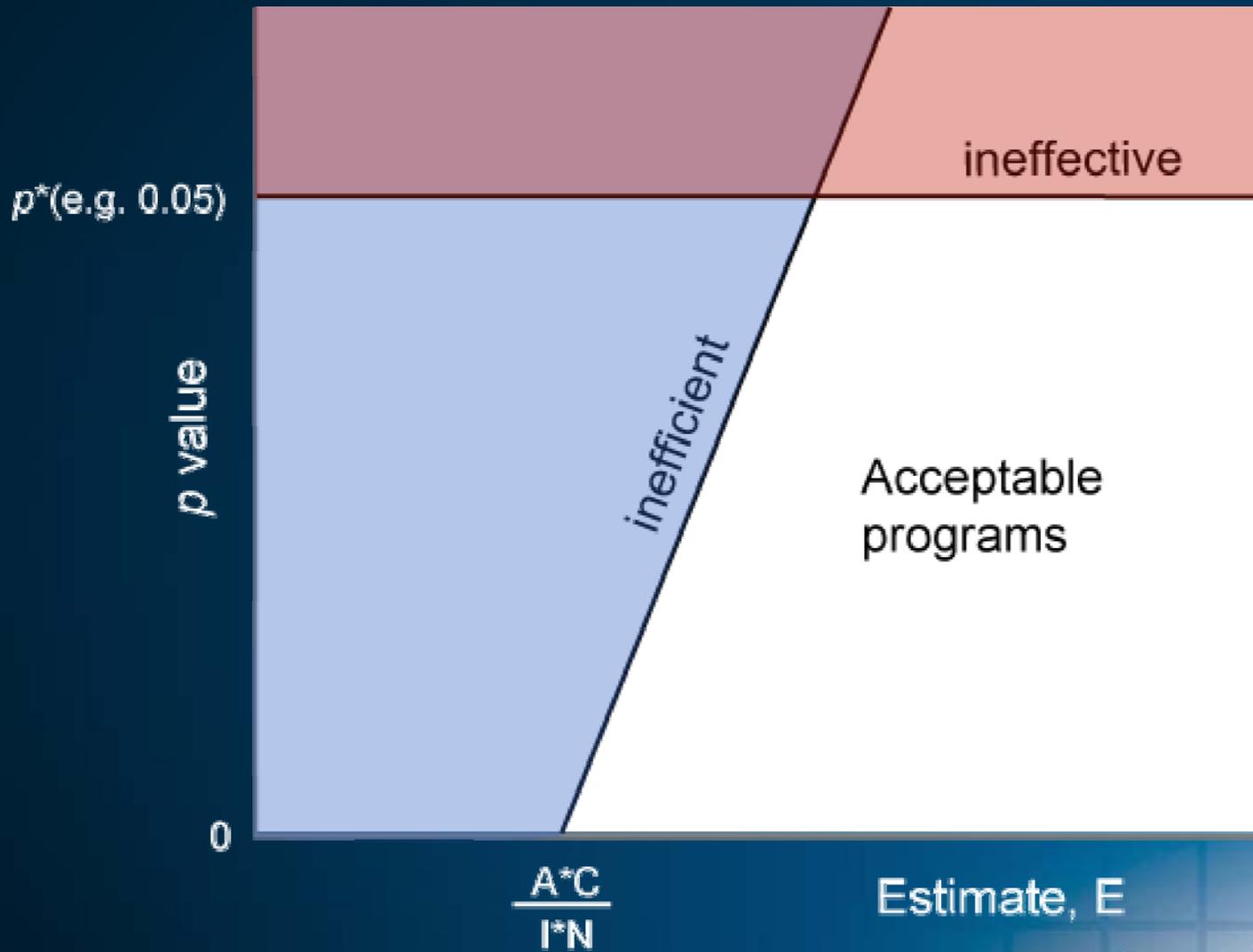


Efficiency-Based Program Adoption

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

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

Acceptable Programs



Estimate, E

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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

Program 1

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

Program 2

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

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Summary

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

Questions?

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