Cost-Effectiveness, Cost-Feasibility, and Cost-Benefit Methods

What Are These Methods? And How Can School Districts Benefit from Using Them?

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Who We Are

The Regional Educational Laboratory (REL) Central at Marzano Research serves the applied education research needs of Colorado, Kansas, Missouri, Nebraska, North Dakota, South Dakota, and Wyoming.

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Agenda

1. Background of cost analyses

2. Review of three key cost-analysis methods (there <u>will</u> be a quiz!)

3. Cost-benefit example

Activity

Using the Zoom Q&A function, please tell us:

- What your role is in your organization.
- Why you are interested in these cost-analysis methods.

Overview

- Education leaders and policymakers constantly operate in restricted fiscal environments.

- Gaps in data from traditional education research:
  - Cost details
  - Value of benefits (ROI)

- Key for replication.

- IES emphasizing and attempting to build more cost analyses into rigorous research.

Cost Analysis Approaches

The three approaches to cost analysis we will discuss are:

1. Cost-Effectiveness
2. Cost-Feasibility
3. Cost-Benefit

Cost-Effectiveness Analysis

- Used to compare several program alternatives.
- Need a <u>common outcome measure</u>.
- Combine the common outcome measure with robust cost analysis to determine which alternative achieves the greatest outcome unit increase per dollar spent.
- Most "effective" approach is not always most cost-effective.

Which Program to Choose?

- **Program A** costs $1000 and yields a 50 point gain on MAP reading scores.

- **Program B** costs $2000 and yields a 75 point gain on MAP reading scores.

- **Program C** costs $500 and yields a 30 point gain.

Which Is Most Cost Effective?

- **Program A** costs $1000 and yields a 50 point gain ($20/point) on MAP reading scores.

- **Program B** costs $2000 and yields a 75 point gain ($27/point) on MAP reading scores.

- **Program C** costs $500 and yields a 30 point gain ($17/point).

Cost-Effectiveness Analysis

- Strengths:
  - Can incorporate into standard program evaluations.
  - Useful for comparing alternatives with a single or small number of the same objectives.

- Weaknesses:
  - Need a common outcome measure across interventions.
  - Difficult to interpret results when there are multiple effectiveness measures.
  - Cannot judge overall worth of a single alternative.

Cost-Feasibility Analysis

- Used to establish whether program alternatives are feasible within a defined budget limit.

- Focus on cost, not outcomes.

- Strengths:
  - Allows alternatives that are too expensive to be ruled out, regardless of impacts.

- Weaknesses:
  - Does not incorporate outcome measures, so cannot judge overall worth of an alternative.

Cost-Benefit Analysis

- Used to identify the full range of benefits which a program, or set of programs, produces.

- No common outcome measure needed.

- Need to conduct comprehensive analysis of costs and combine this with the identification of measurable benefits, and the potential value associated with these benefits.

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Cost-Benefit Analysis

- Strengths:
  - No common outcome measure needed. Focus solely on the monetary costs and the monetary value of benefits.
  - Can be used to judge worth of a <u>single</u> project.
  - Can also be used to compare multiple project alternatives.
  - Allows for consideration of opportunity costs.
  - Can identify both long- and short-range value.

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Cost-Benefit Analysis

- Weaknesses:
    - Often difficult to place dollar value on all relevant benefits.
    - Can place programs with monetizable benefits at an advantage.

Which Approach Would You Use?

- The State of Improvement is interested in increasing high school graduation rates statewide. State department of education officials are interested in several different programs. The cost of implementing each program statewide is about $5 million. The department wants to determine if implementing one of the programs will be worth its costs.

Which Approach Would You Use?

- The Nowhere County School Board is going to adopt a new reading intervention program for grades one through five. The district has $300,000 to spend on an intervention. The district's curriculum office is reviewing seven different interventions, with price being the most important criteria.

Which Approach Would You Use?

- Balderdash City Schools is adopting a new mathematics textbook and curriculum for its elementary schools. The district will select from one of four different vendors that passed an initial screening. The district has the estimated cost of purchasing and implementing each of the four options and has data from both the vendors and external evaluations on each program's impact on student achievement.

Which Approach Would You Use?

- No Name Public Schools is examining ways to improve student writing. Proposed solutions include:
  - Having smaller class sizes with emphasis on more writing.
  - Hiring college students with strong writing skills to support instruction.
  - Developing new writing courses for students in addition to regular English classes.

Assessing Cost: Ingredients Approach

- Regardless of approach, need a consistent, recognized, method of assessing <u>costs</u>.

- Ingredients approach (or "resource cost" model).
    1. Requires detailed description of intervention.
    2. Based on description, identify all resources needed to execute the intervention.
    3. Assign costs to each identified resource.

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Assessing Cost: Ingredients Approach

Typical major categories in the ingredients approach:

1. Personnel
2. Facilities
3. Equipment and materials
4. In-kind inputs
5. Other inputs
6. Opportunity costs

Identifying and Valuing Benefits

- Applies to cost-benefit analyses only.
- Benefits may be short- or long-term.
  - Reducing teacher turnover may increase productivity and reduce human resources/induction costs.
  - Improving educational attainment may lead to higher lifetime earnings, higher tax revenues, and lower social spending.
- Monetizing benefits can be complex.

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Identifying and Valuing Benefits

Three common approaches to valuing benefits:

1. By conducting an experimental, quasi-experimental or correlational study.

2. By surveying individuals on their willingness to pay for the benefit and at what price.

3. By observing individuals' actual willingness to pay for the benefit in the marketplace.

4. In reality, most of us will rely on the research of others to provide estimates of the value of benefits.

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Identifying and Valuing Benefits

- Examples of studies for valuing benefits:
  - Conducting a longitudinal study of whether participants in a vocational training program experienced higher earnings than similar individuals who did not participate.
  - Surveying low-income parents of preschool children about how much they would be willing to pay (if they had the funds) to send their children to a high-quality, full-day preschool program.
  - Observing differences in prices for homes in a neighborhood with exemplary schools versus similar homes in neighborhoods served by less effective schools.

What We've Covered So Far

- Overall, cost-effectiveness/cost-benefit analysis is missing from the <u>vast majority</u> of education evaluation studies.
- Three cost analyses with greatest utility to states and districts are cost-effectiveness, cost-feasibility, and cost-benefit.
- Cost-effectiveness analysis compares the ratio of a unit increase in outcome to cost; requires a common outcome measure.
- Cost-feasibility analysis compares total cost to available budget; no direct assessment of effectiveness.

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What We've Covered So Far

- Cost-benefit analysis compares the ratio of the value of all measurable benefits to total costs; does not require a common outcome measure; may be difficult to value or monetize benefits.

- All methods require detailed accounting of implementation costs – we recommend the "ingredients approach."

- Cost-benefit analysis also requires valuing benefits, which can be short-or long-term. This is often a complex task. If possible, rely on the estimates of others.

Cost-Benefit Analysis Example

Study published in spring 2017

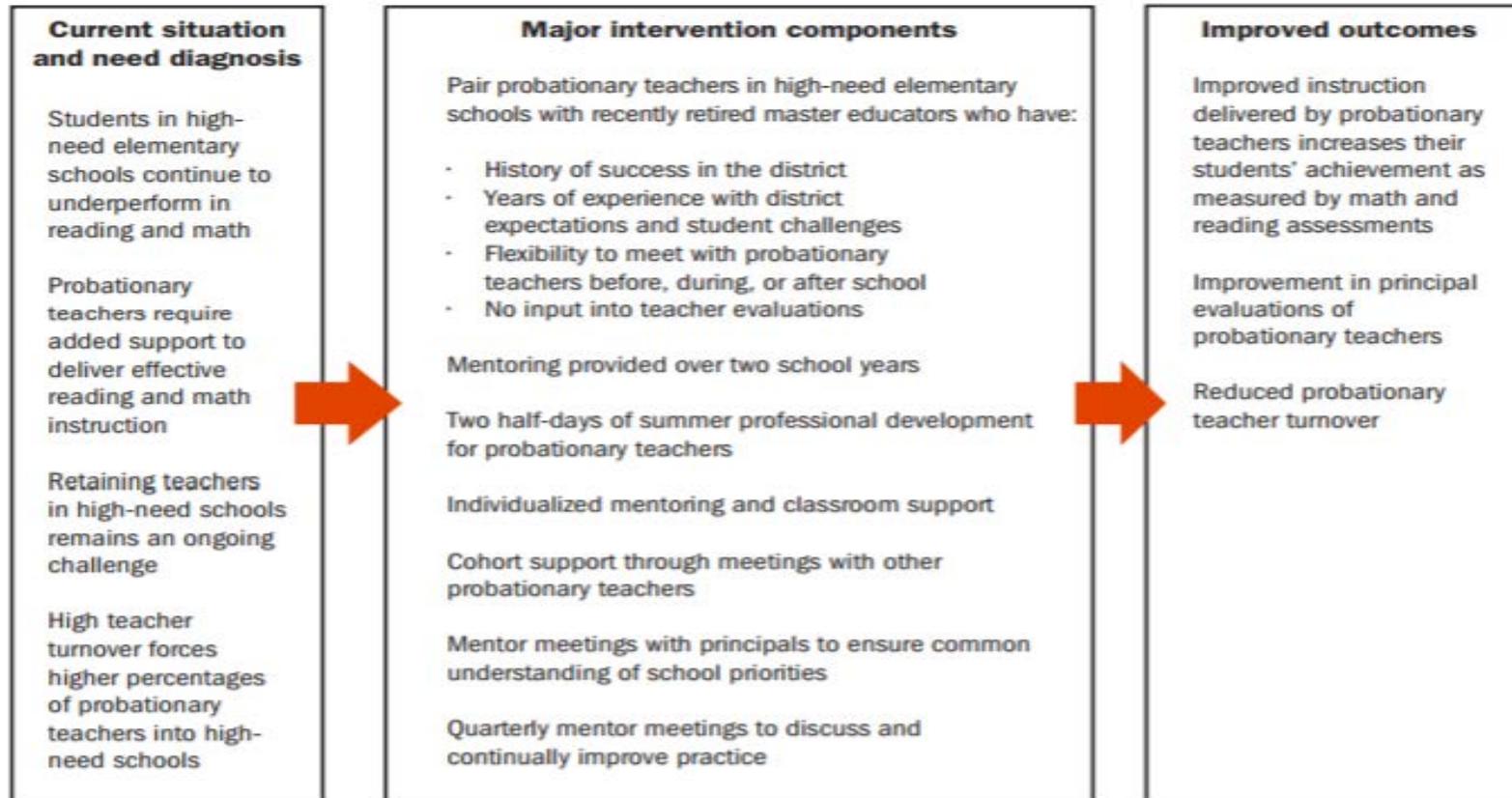**https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=REL2017225**
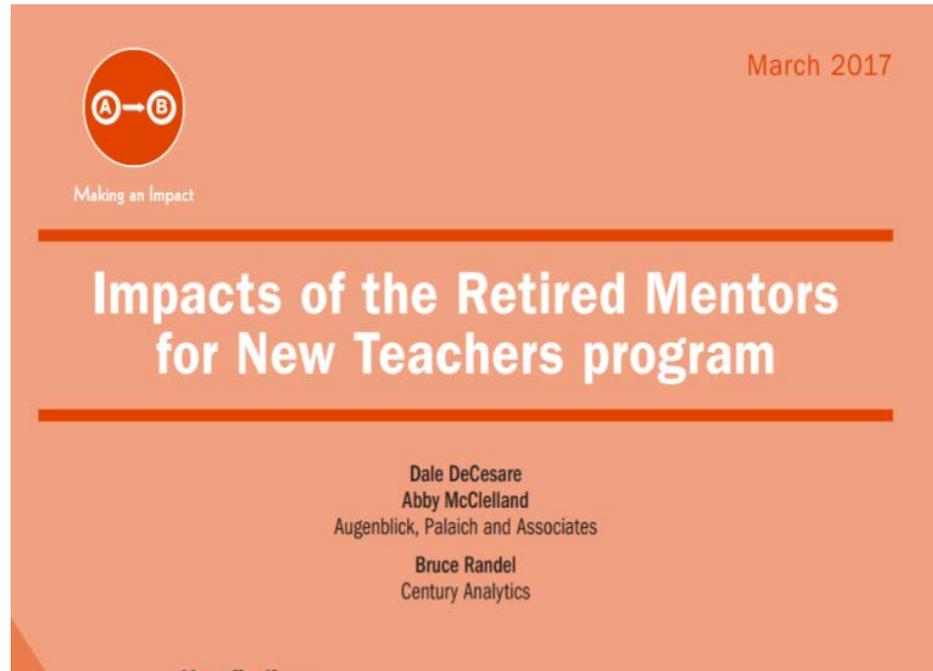
Cost-Benefit Analysis Example

- Impacts of the Retired Mentors for New Teachers Program
  - Two-year randomized controlled trial study.
  - 77 classroom teachers across 11 schools randomly assigned, half to "business-as-usual" program, half to retired mentors program.
  - Compared impacts on (1) new teachers mentored by retired, highly effective educators with long term experience teaching in the district, and (2) new teachers participating in district's business-as-usual mentoring program.

Program Logic Model

Current situation and need diagnosis	Major intervention components	Improved outcomes
Students in high-need elementary schools continue to underperform in reading and math Probationary teachers require added support to deliver effective reading and math instruction Retaining teachers in high-need schools remains an ongoing challenge High teacher turnover forces higher percentages of probationary teachers into high-need schools	Pair probationary teachers in high-need elementary schools with recently retired master educators who have: - History of success in the district - Years of experience with district expectations and student challenges - Flexibility to meet with probationary teachers before, during, or after school - No input into teacher evaluations Mentoring provided over two school years Two half-days of summer professional development for probationary teachers Individualized mentoring and classroom support Cohort support through meetings with other probationary teachers Mentor meetings with principals to ensure common understanding of school priorities Quarterly mentor meetings to discuss and continually improve practice	Improved instruction delivered by probationary teachers increases their students' achievement as measured by math and reading assessments Improvement in principal evaluations of probationary teachers Reduced probationary teacher turnover

Source: Authors' compilation based on data from Aurora Public Schools.

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Aurora's Retired Mentors for New Teachers Program

- Business-as-usual "buddy" mentor program:
  - 1 year. No selection process, no mentor training, or classroom release time. Expected to meet for 15 hours during year. No required class observation. Mentor paid $500 stipend.

- Retired mentors for new teachers program:
  - 2 years. Rigorous mentor selection criteria, ongoing mentor training, mentors have schedule flexibility. Expected weekly mentoring and observation. Mentor average pay of $42.50 per hour.

Aurora's Retired Mentors for New Teachers Program

- RCT examined program's impact on:
  - Student achievement on standardized assessments in reading and math.
  - Teachers' evaluation scores.
  - Teacher retention.

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Cost-Benefit Example

Three basic steps:

1. Collect detailed data on program costs.
2. Collect impact data on teachers and students.
3. Determine value of program benefits to teachers or students.

Cost-Benefit Example

- What costs do you think would be associated with this program?

- What benefits and associated dollar savings might be expected?

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Program Costs

- Used ingredients method to collect costs for both years of program.
  - Mentor pay
  - Mentee stipends
  - Substitute teacher costs for mentee release time
  - Program administration personnel and nonpersonnel costs
  - Facilities costs
- Costs then summed and cost per mentee determined.
- Ingredients costed out using both local and national "prices."

Program Benefits: Sources of Impact Data

- Teacher retention rates for each of the two groups of mentees.

- District teacher evaluation scores.

- Student achievement: MAP test scores in reading and math over two school years.

Program Benefits

- Teacher retention: costs of replacing a teacher can range from $5,000 to more than $20,000 per teacher.

- NCTAF estimates teacher turnover costs U.S. nearly $5 billion annually.

- No statistically significant effect on teacher retention was found, although data show that more hours of mentoring led to greater retention (see next slide).

Program Benefits

Figure 2. Among teachers in the program group who stayed in the district after the first year (2013/14), those who received more hours of mentoring over two years were significantly more likely to return to Aurora Public Schools for a third year than were teachers who received fewer hours

Probability of returning to teach in Aurora Public Schools

Hours of mentoring in the first and second years
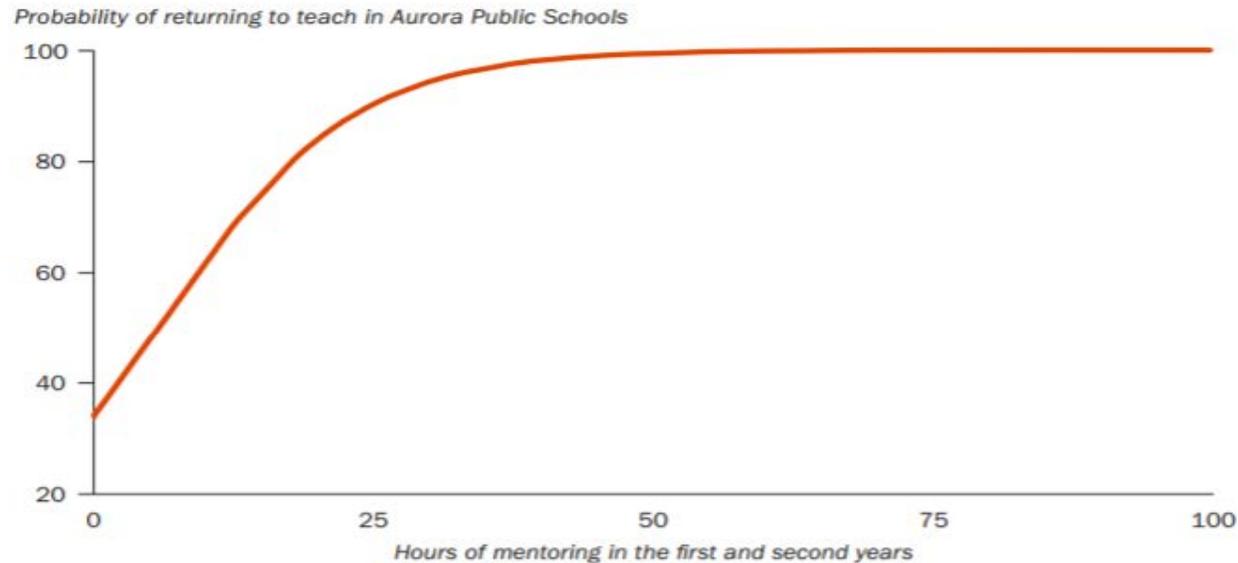
The odds of a mentee staying in the district doubled with each additional 10 hours of mentoring. Even one additional hour of mentoring increased the odds of staying by 12 percent. At 40 hours of mentoring and above, teachers approach 100 percent likelihood of staying in the district

Note: The program group refers to teachers who received mentoring through the Retired Mentors for New Teachers program in addition to the district's typical "buddy" mentoring approach.

Source: Authors' analysis of 2013/14 and 2014/15 data from Aurora Public Schools; see appendix A.

Program Benefits

- Teacher evaluation: Better evaluation scores can impact retention and student achievement.

- No statistically significant relationship was found between the mentoring program and improved evaluation scores.

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Program Benefits

- <u>Student achievement</u>: A statistically significant impact on student math scores was found after one year for students in the treatment group when compared with those receiving business-as-usual mentoring.

- Literature links impact of increased math achievement on graduation rates.

- Literature also provided insight on effects of high school graduation on:
    - Lifetime earnings and increased federal and state taxes paid.
    - Savings in federal and state spending on health care, criminal justice, welfare costs.
    - Social gains – higher post-tax earnings, costs to victims of crime, productivity externalities.

Cost-Benefit Findings: 2015

Benefit	Local Pricing	National Pricing
Cost per Student	$173	$239
Federal Fiscal Benefits per Student*	$222	$222
State/Local Fiscal Benefits per Student*	$104	$104
Social Benefits per Student*	$763	$763
Total Benefits per Student*	$1,090	$1,090
Teacher Retention Benefits	$0.00	$0.00
Teacher Evaluation Benefits	$0.00	$0.00
Net Present Value (Benefit-Cost)	$917	$850
Benefit-Cost Ratio	6.32	4.55

Return on Investment

- Longitudinal research indicates that students taught math by teachers in the treatment group in the first year could earn nearly $2 million more combined over their lifetimes than students taught by teachers in the business-as-usual group.

- The estimated increase in lifetime earnings alone could pay back the annual cost of the program more than 15 times over.

Return on Investment

- Return could be higher if it were possible to quantify the value of other documented benefits of improved student performance in math, including:
  - Increased probability of attending college by age 20.
  - Reduced probability of teenage births.
- More research is needed to accurately estimate the dollar value of these benefits.

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Questions?

- Dale DeCesare at APA Consulting: dmd@apaconsulting.net

- Mark Fermanich at APA: mlf@apaconsulting.net

Other resources:

- Levin, H. M., & McEwan, P. J. (2001). *Cost-Effectiveness Analysis* (2nd ed.) Thousand Oaks, CA: Sage Publications.

- Center for Benefit-Cost Studies of Education – Levin's center at Teachers College, Columbia University: http://cbcse.org/
  - Includes cost analysis study reports, CostOut analysis tool.

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