



Cost Analysis

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ELITE
RESEARCH



Objectives

- To reflect on similarities and differences between types of cost analyses
- To lay the **groundwork** for a solid cost analysis
- To walk through the **IES Starter Kit** to better help you understand the process
- To provide **real-world examples and considerations** for how to develop a cost analysis to better help you gain confidence in the process



Impact is
necessary, but
not sufficient



Purpose

- Focus beyond hypothesis testing
- Prioritize resources
- Evaluate social priorities to make better use of limited resources
- Improve policy making
- Balance science and policy
- Priority to programs with the highest benefit/cost ratio or net present value (benefits minus costs)



Primary Tools

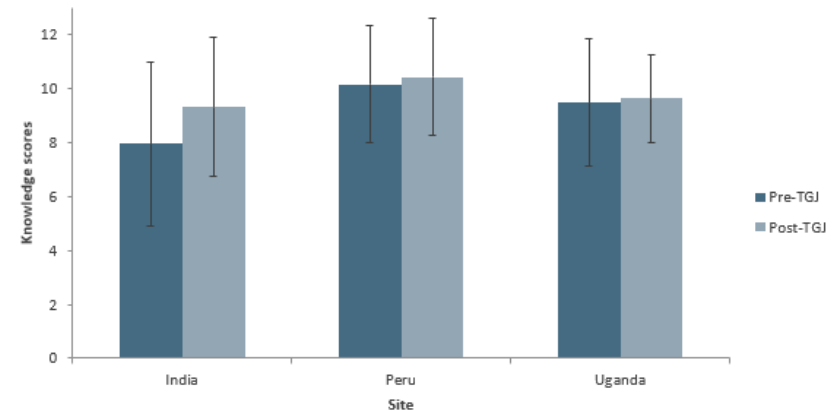
- **Research/evaluation** – determine if a program or its elements make an impact, how large (the magnitude) of an impact
- **Cost analysis** - Describes a program's resources and their value, and calculates an overall program cost
- **Benefit cost analysis** – informs investment decisions to determine if the benefit of a program exceeds the cost
- **Cost effectiveness** – compare program alternatives that have the same goals to determine which has the largest effect (impact) relative to the cost



Research/Evaluation

- Feasibility
- Hypothesis Testing
- Significance/p-values
- Magnitude/effect sizes
- Budget varies by design, setting, sample size, etc.
- Answers questions such as:
 - ❖ Does [Program Name]/ program element significantly improve student achievement?
 - ❖ How large is the impact of the program?
 - ❖ Does the size of the impact differ among key groups/characteristics?

Figure 1. Means and Standard Deviations of Site by Pre-Post Program





Research Budgets

- Costs or expenditures to conduct the research
- Budgets or data on expenditures is informative but does not capture the total cost to implement or conduct a program
- Often relies on in-kind donations or volunteer time, but does not describe those costs for later adopters of the program.
 - ❖ Examples – school staff time, computers used at the schools, volunteered time (by the researchers or others)



Groundwork

- Why conduct a **Cost Analysis (CA)**?
 - ❖ Crucial to support education and health agencies' decision making for programs, policies, and practices
 - ❖ Helps others know what a specific program entails and how to allocate resources
 - ❖ Allows for transparency and accountability
 - ❖ Sets the foundation for more complex economic analyses (CFA, CEA, CBA)
 - ❖ You are informed decision maker, other criteria that are relevant



Cost Analysis

- Cost analysis attempts to estimate the costs of a specific program, not the cost of the research.
- Differentiates total cost to who pays what costs
- Answers questions such as:
 - ❖ What is the cost of the program?
 - ❖ What resources are needed to replicate the program?
 - ❖ What portion of the cost is borne by the school/students/parents?



Cost Analysis

- Examines program costs
 - ❖ For education, this translates to interventions, practices, policies, and tools that are intended to improve student outcomes
 - ❖ For health, this translates to interventions, practices, policies, and tools that are intended to improve health and population outcomes
- Describes resources, attaches value to them, and then calculates an overall cost

$$\text{Cost} = \text{Quantity} \times \text{Price}$$



Common Cost Categories

- Resources last for multiple years
- Multi-year interventions
- Training is tricky when training is the program
- Administration/development vs. delivery of the program
- Research/evaluation/monitoring costs
- Student time
- Transfer/fees



Standards to Estimate Cost

- Include all inputs and their value (opportunity cost)
- Program delivery costs and induced costs (students in school longer, teachers more work hours)
- Describe inputs with replication in mind
- Separate quantity from price for scalability
- Consider fixed versus variable costs
- Transparency – note all assumptions
- Consistency – provide comparable numbers relative to a local context
- Estimate for treatment and control (BAU)
- Partial use or multiple use resource and their cost



Cost Analysis Framework

Resource	Quantity	Description	Price	Cost (Quantity x Price)
Resource 1	Quantity in units	Descriptive details	\$	Quantity x Price
Resource 2	Quantity in units	Descriptive details	\$	Quantity x Price
Year 1 Total Cost				Sum of Above



Cost Analysis Example

Resource	Quantity	Description	Price	Cost (Quantity x Price)
Resource 1	Quantity in units	Descriptive details	\$	Quantity x Price
Resource 2	Quantity in units	Descriptive details	\$	Quantity x Price
Year 1 Total Cost				Sum of Above

Resource	Quantity	Description	Price	Cost (Quantity x Price)
Teacher time	120 hours per academic year (1 teacher)	Bachelor's degree with 5+ years of experience	\$60/hr	\$7,200 (120*60)
Classroom space	120 hours per academic year (1 classroom)	900 sq. ft.	\$5/hr	\$600 (120*5)
Year 1 Total Cost				\$7,800



Benefit Cost Analysis

- Determine if the benefit of a program exceeds the cost to inform investment into a program
- Links cost to economic consequence
- Benefits are often predicted not measured
- Answers questions such as:
 - ❖ What are the consequences if the program is implemented?
 - ❖ Should we invest in [Program Name] program?
 - ❖ Is the cost of implementing this program worth the benefit?



Benefit Cost Analysis

- Example
 - ❖ Youth support program with high cost, but saves on future incarceration
 - ❖ Early education with high cost, but saves on future remedial education
- What is the value in \$ of each/all benefits/outcomes of your program minus (divided by) the cost of the program
- What is the value/cost with and without your program?



Benefit Cost Analysis

Early education program increases HS graduation rates by 12%	Early Education Program		
Total cost over BAU	610000		\$610,000
New HS graduate yield	12		12
HS graduate lifetime earnings	120000		\$120,000
Total earnings gain benefit (B)	=C5*C4		\$1,440,000
Saves taxpayer spending on crime	30000		\$30,000
Total crime saving benefit (B)	=C4*C7		\$360,000
Benefits (\$)	=C6+C8		\$1,800,000
Net Benefit (B-C)	=C10-C2		\$1,190,000
Benefit -Cost Ratio (B/C)	=C10/C2		2.95



Cost Effectiveness Analysis

- Compare program alternatives that have the same goals to determine which has the largest effect (impact) relative to the cost
- What works at what cost?
- Comparison means they must have the same measure of effectiveness
- Answers questions such as:
 - ❖ Which reading program best prepares children for the cost?
- Examples
 - ❖ Reducing class size has big impact but at a high cost
 - ❖ New curricula has modest impact but at a low cost
 - ❖ Mentoring has varied impact with varied costs

Cost Effectiveness Analysis

		Program A	Program B	Program A	Program B
Program A reduces HS dropout rates by 12%	Cost per student	1050	630	\$1,050	\$630
Cost \$1050 per student	Baseline Dropouts	=450*0.2	=450*0.2	90	90
	HS dropout reduction rate	0.12	0.08	12%	8%
Program B increases HS graduation rates by 9%	New HS graduates yield	=C3*C4	=D3*D4	11	7
Cost \$630 per student	Total program costs	=C2*450	=D2*450	\$472,500	\$283,500
	CE Ratio	=C6/C5	=D6/D5	\$43,750	\$39,375
HS dropout rate = 20%					
School Size = 450					



IES Cost Analysis Plan

- In your application, IES is asking you to **include a Cost Analysis plan**. You must include:
 - ❖ Choice of perspective (Step 2)
 - ❖ Prices (Step 4)
 - ❖ Details related to the steps you plan to take to complete the required economic evaluation (Step 8).
- Put processes in place to capture data *along the way* (do not wait until the end of the program)
- Be sure that you clearly describe



IES Project Types

1) Measurement

- Supports both the development and validation of new or modified instruments for use by educators or education researchers

2) Exploration

- Supports projects that identify relationships between learner-, educator-, school-, and policy-level characteristics and meaningful education outcomes

3) Development & Innovation

- Supports the development and pilot testing of new or modified education interventions that are intended to produce beneficial impacts on learner outcomes.

4) Initial Efficacy & Follow-up

- Supports initial efficacy studies of education interventions predicted to have a meaningful effect on important education outcomes using designs that meet the What Works Clearinghouse design standards and longer term follow-up studies of rigorously evaluated interventions.



IES Starter Kit - Phases & Steps

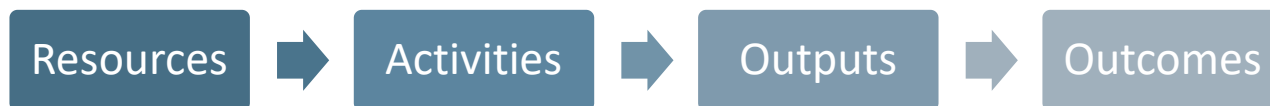
- Phase 1: Identify Program Resources (Ingredients)
 - ❖ Step 1: Clarify the program model
 - ❖ Step 2: Choose the perspective(s)
 - ❖ Step 3: Describe key resources
- Phase 2: Price the Resources
 - ❖ Step 4: Identify or estimate a price for each resource
 - ❖ Step 5: Adjust costs for your context
- Phase 3: Create and Use the Cost Estimate
 - ❖ Step 6: Calculate costs
 - ❖ Step 7: Conduct sensitivity analysis
 - ❖ Step 8: Determine whether to use the results for further economic evaluation



Step 1

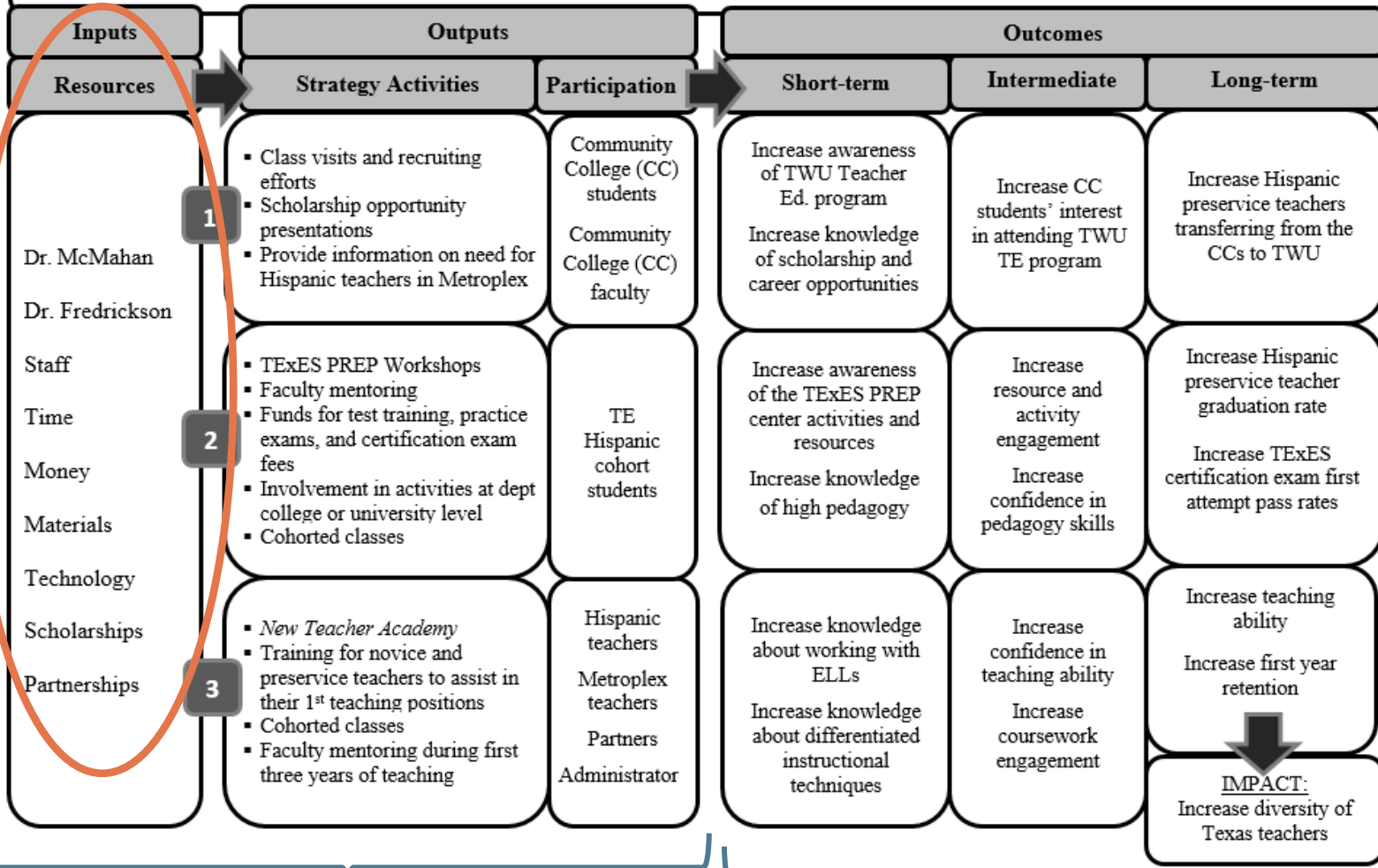
Clarify Program Model

- Logic model
 - ❖ 1 page clear visual (road map) of how your program is intended to work
 - What you will do or intend to do (activities)
 - What change you intend to see (outcomes)
 - ❖ Provides your *theory of change*
 - Causal linkages (what causes what)
 - Relationship between elements *and* future



Statement of the Problem: Hispanic teachers are traditionally underrepresented in Texas. Increased representation is needed in order to reflect the greater EC-12 student population of the state of Texas, and thus increase the diversity of worldview and thought.

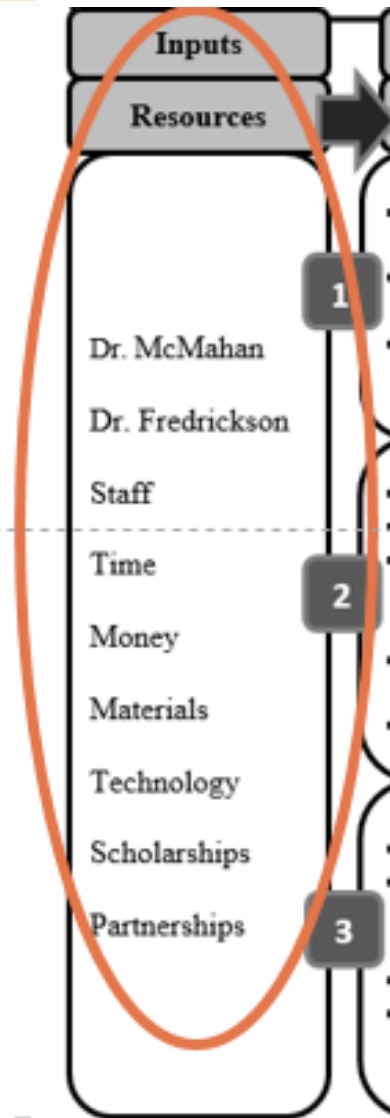
Theory: When TWU provides appropriate funding, resources, training, and access to options in education, more Hispanic teachers are likely to transfer from Community Colleges to TWU, graduate, get certified, and remain as teachers in the state of Texas.



What this program does

What this program aims to accomplish

Step 1



- **Personnel**
 - ❖ PI (2)
 - ❖ Staff
 - ❖ Time
- **Facilities**
- **Equipment/Materials**
 - ❖ Materials
 - ❖ Technology
- **Required Client Inputs**
- **Other Program Inputs**
 - ❖ Scholarships
 - ❖ Partnerships



Step 2

Choose the Perspective

- Perspective determines which resources will be assigned prices
- Perspective types
 - ❖ **Societal** – all resources are counted
 - ❖ **School** – only school resources are counted
 - ❖ **District** – only district resources are counted
 - ❖ **Student** – costs of students participating (including direct and opportunity costs)
- The key question should be: **How will my analysis or study be used, and by whom?**
- The RFA will provide indications of required perspective.



Step 2

Choose the Perspective

■ Education Research Grant Program CDFA 84.305A Development & Innovation

Describe how you will determine the cost of the fully developed intervention and its implementation during the pilot study (for an introduction see the *IES Cost Analysis Starter Kit* at https://ies.ed.gov/seer/cost_analysis.asp). You may already have an estimated cost for your intervention, or you may plan to make your intervention available to schools at no cost. Regardless, your application must include a plan for determining the cost during the pilot study. The plan should include a discussion of how you will do the following:

- Determine the resources used by the intervention—whether these resources are related to personnel, facilities, equipment, materials, training, or other things—and describe the resources' characteristics (quality) and quantity.
- Price each resource - determine their actual or estimated cost. If any entity, including the project, will provide a resource for free or at a reduced cost during the pilot study, you should use the resource's real cost (what it would cost if there were no subsidy).
- Calculate the cost of the fully developed intervention (total the cost of the resources).
- Test your assumptions (sensitivity analysis).

If you already have an estimate of the cost of the intervention, you still must include a plan to calculate the actual costs when implemented during the pilot study.

If you intend to offer the intervention free of charge, you must still include a cost analysis plan as part of the pilot study.



Step 2

Choose the Perspective

■ Education Research Grant Program CDFA 84.305A Initial Efficacy & Follow-Up

Cost and cost-effectiveness analysis plan:

A cost-effectiveness analysis provides information about the costs to achieve a particular impact when using a particular program, practice, or policy.

- A cost-effectiveness analysis is required only for the primary learner outcome(s). The analysis should be conducted at the level that is most relevant for the intervention being studied, whether the school, classroom, or individual learner level.
- If you are evaluating the impact of any specific component(s) of the intervention—in addition to the overall impact of the intervention—you should provide additional cost-effectiveness analyses for the separate components evaluated.
- If you are unable to conduct a cost-effectiveness analysis, explain why.

Describe how you will determine the cost of the intervention and its implementation (for an introduction see the IES Cost Analysis Starter Kit at https://ies.ed.gov/seer/cost_analysis.asp), the cost of the comparison condition, and the cost effectiveness of the intervention (the comparison of costs and impacts between the intervention and the comparison condition). The plan should include a discussion of how you will do the following:

- Determine the resources used by the intervention—whether these resources are related to personnel, facilities, equipment, materials, training, or other things—and describe the resources' characteristics (quality) and quantity.
- Price each resource - determine their actual or estimated cost. If any entity, including the project, will provide a resource for free or at a reduced cost during the study, you should use the resource's real cost (what it would cost if there were no subsidy).
- Calculate the cost of the intervention (total the cost of the resources).
- Compare alternative approaches to determining costs:
 - Total cost and incremental cost of the intervention
 - Calculating costs using national average prices and local prices



- Identify different breakdowns of cost:
 - Identify who is responsible for which costs.
 - Identify startup costs and maintenance costs.
 - Identify annual costs if the intervention is multi-year.
- Test your assumptions (sensitivity analysis).
- Following the same process, calculate the cost of the comparison condition.
- Determine the cost effectiveness of the intervention:
 - Describe how you will use the difference in cost and the difference in learner outcomes for the intervention versus the comparison condition to determine the cost per beneficial impact provided by the intervention (if there are any beneficial impacts from the intervention).
 - Focus on the key student outcomes.
- If your study proposes to evaluate any key components of the intervention, you should conduct a separate cost analysis and cost-effectiveness analysis for those components.

If you already have an estimate of the cost of the intervention, you still must include a plan to verify the estimated costs.

If you intend to offer the intervention free of charge, you must still include a cost analysis and cost-effectiveness analysis plan.

Include a plan to conduct a cost analysis for Follow-Up studies. If cost information is not available, explain this.

Step 3

Identify Resource Quantity & Quality

KEY RESOURCES

- Personnel - employees, consultants, external trainers and coaches, volunteers, program monitors, and parents, etc.
- Facilities - classrooms, offices, storage areas, training space or recreational facilities
- Equipment/Materials - books, manuals, computers, software, etc.
- Required Client Inputs - transportation, books, textbooks, uniforms or other items required by the program and paid for by the family, and time (opportunity costs for older participants)
- Other Program Inputs - costs for identifying or recruiting program participants, transportation, prizes, food, scholarships, financial incentives for participants or teachers, and costs for monitoring/tracking



What Other Costs?

- **Program administration:** Staff hired to work throughout the implementation of the intervention, costs of facilities, and any overhead costs incurred.
- **Targeting costs:** Any costs incurred to target, identify, and raise awareness of the program among potential participants.
- **Staff training:** Costs of training staff responsible for implementing the program.
- **User training:** Any costs incurred to train participants or beneficiaries.
- **Implementation costs:** Costs directly associated with the implementation of the intervention, such as the cost of items distributed to participants, the cost of staff who worked solely on implementation activities, or the cost of creating and maintaining resources developed for the intervention.
- **User costs:** Any costs incurred by program participants, such as the cost of goods users were required to purchase or the opportunity cost of participants' time.
- **Averted costs:** Costs that were replaced or discontinued as a result of the intervention. These should be subtracted from the total cost of the program.
- **Monitoring costs:** Any costs incurred due to oversight, monitoring, or tracking program participants and staff. These are costs incurred as part of the program's ongoing M&E strategy, not part of the evaluation.



Step 3

Identify Resource Quantity & Quality

- Focus on KEY resources: Personnel, Facilities, Equipment/Materials, Required Client Inputs, Other Program Inputs
 - ❖ Don't spend too much time on small costs (estimate and then sensitivity analysis to test assumptions)
 - ❖ Include only the amount of time the relevant resource is used to implement your program
 - ❖ Labor costs (teachers, etc.) will often be most important
- Indirect costs included (% is permissible)
- Induced costs included



Step 3

Identify Resource Quantity & Quality

- Be as descriptive as you can
- Ingredients with “overlapping” uses, separate out fraction of the resource used for the program
- Goods and services provided for free
- Costs to participants
- **Start-up vs. ongoing costs**
- Quantity of participants (Fixed vs. variable costs)



Step 3

Identify Resource Quantity & Quality

- Sources of information:
 - ❖ Program descriptions/reports
 - ❖ Program budgets –“expended costs” more reliable
 - ❖ Interviews
 - ❖ Survey data
 - ❖ Direct observations
- Focus should be on resources *actually* used, not what was planned
- If multiple sites used, identify a sample of sites from which to collect resources information
- Consider inserting questions into implementation surveys that will help you gain information on program costs
- Multiple data sources preferred (data triangulation)



Step 4

Identify or Estimate Resource Price

- Local vs. national costs
 - ❖ Both should be included (parallel, not combined)
 - *CostOut*: database for national average prices
 - Bureau of Labor Statistics
 - ❖ If local price is same across country, no adjustment needed
- Certain resources lack market prices (classroom space, volunteer time, student time)
 - Consider similar sources
 - Postsecondary and adult students “forgone wages”
- Be sure units of resource prices and the units of their quantities match



Step 5

Adjust Costs for Context

- Adjustments for:
 - ❖ Geographic differences
 - ❖ Multiyear capital costs
 - ❖ Resources used for multiple purposes
 - ❖ To reflect present value
- You can:
 - ❖ Use *CostOut* to ensure you will not mistakenly overlook an adjustment
 - ❖ Make adjustments yourself (*CostOut* can provide manual for the calculations)



Step 6

Calculate Costs

- Present total costs for business as usual and program costs, as well as incremental costs
- Most common approach is to calculate a total cost and then a cost per participant.

$$\text{Total costs} \div \# \text{ of participants} = \text{cost per participant}$$

- SOCIETAL perspectives → delineate costs per stakeholder or payer (ex. school, district, cost per participant to school, etc.)
- MULTI-YEAR programs → present costs for each year *and* total across years



Step 6

Cost Examples

- Beneficiary time when a direct requirement of the program, e.g. time involved in traveling to and attending program meetings;
- Goods or services that were provided for free (in situations where free procurement would not necessarily be guaranteed if the program were replicated in a new context);
- The monetary value of both cash and in-kind transfers.

Cost Analysis Example

Resource	Quantity	Description	Price	Cost (Quantity x Price)
Resource 1	Quantity in units	Descriptive details	\$	Quantity x Price
Resource 2	Quantity in units	Descriptive details	\$	Quantity x Price
Year 1 Total Cost				Sum of Above

Resource	Quantity	Description	Price	Cost (Quantity x Price)
Teacher time	120 hours per academic year (1 teacher)	Bachelor's degree with 5+ years of experience	\$60/hr	\$7,200 (120*60)
Classroom space	120 hours per academic year (1 classroom)	900 sq. ft.	\$5/hr	\$600 (120*5)
Year 1 Total Cost				\$7,800



Step 6

Calculate Costs

- For evaluations: Compare resources from TREATMENT vs. CONTROL group
- Carefully consider any induced services that mediate the outcome
- Is the treatment an add-on to BAU? Is the treatment an alternative to BAU? It replaces the BAU or parts of the BAU?



Step 7

Conduct Sensitivity Analysis

- Sensitivity analysis is about varying assumptions to see if different choices would result in significant differences to your cost estimate.
- Pick an approach, be transparent in your write-up, and use sensitivity analysis to determine if any of your choices make a substantial difference to the program's cost estimate. If they do, report that in your write-up.



Step 8

Further Economic Analysis

- Cost analysis is a foundation for economic analysis
 - ❖ **Cost-Feasibility Analysis (CFA)** is used to answer the question, “Can we afford this program?”
 - ❖ **Cost-Effectiveness Analysis (CEA)** answers questions such as, “Which program achieves a given level of improvement at the lowest cost?” or “Which program achieves the most improvement for a given cost?”
 - ❖ **Cost-Benefit Analysis (CBA)** helps answer the question, “Should we invest in this program—or which among several programs should we invest in?”



Step 8

Further Economic Analysis

	Cost-Feasibility Analysis (CFA)	Cost-Effectiveness Analysis (CEA)	Benefit-Cost Analysis (BCA)
Formula	Budget amount available minus costs of program	Incremental costs ÷ effect size	Monetized benefits minus incremental costs, or Monetized benefits ÷ incremental costs
Interpretation of Results	If > 0, you can afford the program If < 0, you do not have the resources for the program	Higher numbers are less cost-effective when comparing CEA ratios	If benefits - costs > 0, or if benefits ÷ costs > 1, it means a positive return on investment
Pros	Useful to districts Easy to understand/relay to stakeholder	Useful to school decision makers and policy makers Comparable across programs with the same effectiveness measure	Useful to policy makers Comparable across programs, regardless of effectiveness measure
Cons	Does not include any type of ROI analysis	Programs must have common outcomes for CEA ratios to be comparable	Societal benefits can be difficult to price especially for programs serving young students



Considerations

- Be sure that you clearly describe the perspective you are proposing (and why) in your analysis description
- Remember that ANY resource has a cost (Opportunity Cost Framework)
 - ❖ Volunteer time, school staff time, space/computers – they are all important for replication!
- Budgets are not the sole sources of costs
- Important to consider the counterfactual, the starting situation against which the program is being compared, and to think about what are the additional costs of running the program.



Considerations

- Determine if effectiveness or costs differ by groups or other characteristics (i.e. gender, race, SES).
- Determine if effectiveness or costs differ by site (need to conduct multi-level models) or by teacher characteristics (i.e. years of experience, training)
- What do I measure in my study that corresponds to some economic value later? (i.e. student achievement = greater income later)
- Knowledge is not easy to monetize, but behavior is, so what behavior change comes from the knowledge change.
- **Keep it simple!**



Questions

- **Research/evaluation (Hypothesis Testing)** – Does [Program Name]/ program element significantly improve student achievement? How large is the impact of the program? Does the size of the impact differ among key groups/characteristics?
- **Cost analysis** – What is the cost of the program? What resources are needed to replicate the program? What portion of the cost is borne by the school/students/parents?
- **Benefit cost analysis** – Should we invest in [Program Name] program? Is the cost of implementing this program worth the benefit?
- **Cost effectiveness** – Which reading program best prepares children for the cost?



Resources

- ***Cost Analysis: A Starter Kit, Version 1.0***
 - ❖ Published by: Institute of Education Sciences
 - ❖ https://ies.ed.gov/seer/pdf/IES_Cost_Analysis_Starter_Kit_V1.pdf
 - ❖ Online videos:
<https://www.youtube.com/channel/UC6K9RPekvxN4DewxX1oi8jA>
- ***Logic Model Development Guide***
 - ❖ Published by: W.K. Kellogg Foundation
 - ❖ <https://www.wkkf.org/resource-directory/resources/2004/01/logic-model-development-guide>
- ***CostOut***
 - ❖ Published by: Center for Benefit-Cost Studies of Education, Columbia University
 - ❖ <https://www.cbcse.org/costout>



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