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Proposing Cost and Cost-Effectiveness Studies: Designing Studies to Address Various Questions

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Need for Economic Evaluation

- Many interventions, reforms, programs, policies
- Intensively investigate "What Works"
- Very little guidance on
 - "...At What Cost?" "...Is it Worth the Cost?"
- Replication is impossible without knowing what to replicate
- With major resource constraints and pressing, complex needs, decisionmakers depend on research to provide the evidence they need to select among alternatives to meet goals

Costs are defined as all resources to deliver an approach to achieve an effect.

Economic metrics (cost-effectiveness or benefit-cost ratios) support selecting among alternatives to achieve goals.

Cost to replicate an impact

Educational Research Goals

- Measurement: student assessed and information gained
- Development Pilot: innovative practice to improve student outcomes
- Efficacy: determining if a program works as intended when delivered under highly controlled conditions
- Effectiveness: examining effects when program delivered at scale

Goals and Costs

- Measurement: cost to deliver assessment
- **Development Pilot**: costs to deliver innovation
- Efficacy: costs to produce effects
- Effectiveness: costs to produce effects

What is business-as-usual to you?

What practices are you trying to change?

What choice are you informing?

Alternatives Apply to All

- **Measurement**: other assessments, non-systematic practice, intensive, computer-based, adaptive
- **Development Pilot**: innovating to improve practice or to invent new practice
- Efficacy: improving approach to producing an effect
- Effectiveness: improving approach to producing an effect

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The Ingredients Method

ECONOMIC EVALUATION in EDUCATION Cost-Effectiveness and Benefit-Cost Analysis



Ingredients Method

- Identify and measure changes in resources or ingredients delivered to obtain a given result
- Obtain standardized market prices or equivalents for ingredients and adjust as needed (prices from BLS, NCES, Amazon, Apple, etc.)
- Calculate the overall cost, cost per student, etc.
- Determine who pays cost distribution
- Relate costs to effectiveness and compare to alternatives

Standards to Estimate Costs

- Opportunity Cost all inputs delivered are valued, regardless of where they came from
- Describe inputs with replication in mind
- Clarify program's theory and components, and how the program changes resources in practice
- Separate quantity from price
- Provide total and distribution of costs across agents
- Transparency note all assumptions
- Consistency comparability

Ingredients Worksheet

Ingredients	Description	Quantity	Unit	Price	Total
Personnel					
Training					
Facilities					
Materials					
Other					

Integrating Costs into Your Proposal

Good Proposals

- Tell a coherent story all aspects of the proposal flow together and connect in a well conceived and planned study that will contribute important new knowledge
- Typical sections include:
 - 1. Justification
 - 2. Research Plan
 - 3. Personnel
- Design the study so that these components are not separate, show that they are intended to build on one another

Design Overview: Integrate Costs

 See the problem and the connection between the need for this work and the framework for the evaluation

(skill improvement, inequitable outcomes, labor market needs — constrained resources)

- Identify and describe the design of the program or assessment that is being studied, review prior literature, discuss business-as-usual (theory of change shows important allocation resources)
- Primary and secondary **outcomes** (the goal —- the output being produced or changed)
- Establish a **design** for the evaluation

(research questions, logic model, sampling, random assignment)

Design Overview: Personnel

- Reference training in economics, cost-effectiveness, benefit-cost analysis
- Reference experience in economic evaluation
- Discuss how you will seek out and use resources
- Expert Advisor or partner as needed, if you add this be sure to include a letter of support, clarify how team will work together
- Align budget, research plan, and timeline

IES FY21 RFA

Grant type	Max Award	<u>Cost</u>
Measurement	\$2,000,000	Encouraged
Exploration	\$1,700,000	Not required
Development & Innovation	\$2,000,000	Required
Initial Efficacy	\$3,800,000	Required
Efficacy Follow-up	\$1,500,000	Required

Measurement

- The cost study component documents the resources needed to deliver the measure successfully
- If the assessment comes as a kit, clarify what comes in the kit and what materials, manipulatives, rewards, etc. are needed
- Specify how the assessment will be delivered
 - One-on-one, small group, whole class
 - During class, pull-out, other
 - Paper and pencil, workbooks, computers
- Specify who delivers the assessment
 - Teachers, counselors, psychologists
 - Special training or experience to successfully deliver assessment
 - How much time does the assessment take for them to deliver it? Does the assessment require a FT person?

Cost Value of Assessment

- Easy to use the CBCSE cost tool, *CostOut,* for this purpose
- Best to use national average prices
- Clarify what is covered in the purchase price and what must be incurred as costs to others

if teachers must provide stickers, snacks, data entry, scheduling, etc. —- the teacher's time is a cost that is borne by the school because that teacher's time is not infinite and it has value

Measurement: Costs Example

- Early childhood executive function, 10min per child
- Data collection: observations during piloting
- 3 classrooms, 25 children

Ingredient	Quantity	Price	Cost			
Training Time	5 hours	\$20.00/hr	\$100			
Aide Time	12.5 hours	\$20.00/hr	\$250			
Tablet	1	\$40/year	\$40			
App 1 \$5,000		\$5,000	\$5,000			
Total Cost per School \$5,390						
Average Cost per Student ~\$100						

\$5,000 (93%) as a fee for assessment

Remaining 7% reallocated from existing school resources

Show that you have a plan and how this fits with your purpose.

Photo by Elisa Stone on Unsplash

Research Plan: Efficacy & Effectiveness

- Three main components of these evaluations:
 - 1. Effects
 - 2. Implementation
 - 3. Costs
- Research Questions, Data, and Methods
 Costs should be reflected in all three

Must Do Items.

- Include a research question
- Specify method guiding the research
- Outline data collection on ingredients/resources during implementation considering treatment contrast
- Clarify sample for ingredients data collection
- Outline plan to estimate the cost value of ingredients with national average prices
- Plan for sensitivity tests
- Compare to extant research if possible
- Include these activities in the timeline

Research Question Ideas

- What is the total cost of [intervention] to produce changes in [Y]?
- How were the costs of [intervention] financed? What portion of costs are borne by the school and what portion are contributed by volunteers?
- How do costs vary among sites?
- How does the cost-effectiveness of [intervention] compare to alternative interventions that effect equivalent outcomes?

Pro Tips!

- Efficiency tip: integrate data collection on ingredients into the implementation study
- Alignment tip: If you anticipate effect heterogeneity or implementation variation, consider the ingredients data needed to examine this from a resource perspective
- Critical: specify treatment contrast



Figure 1. A Conceptual Framework for Studying Variation in Program Effects, Treatment Contrasts, and Implementation.



Resources can be identified at this point based on program as designed and planned for the evaluation

This is an important starting point in designing research on costs. By understanding the program as planned and the program's theory of change, the research on costs can be designed and outlined at the proposal stage. This helps to ensure that the cost component is part of the larger story.

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Worksheet at Design Stage

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Figure 1. A Conceptual Framework for Studying Variation in Program Effects, Treatment Contrasts, and Implementation.



Figure 6.2. Theoretically expected relative treatment strength and effects. Y = outcome; Tx = treatment condition; C = counterfactual condition.

Cordray, D. S., & Pion, G. M. (2006). Treatment Strength and Integrity: Models and Methods. In R. R. Bootzin and P. E. McKnight (Eds.), Strengthening Research Methodology: Psychological Measurement and Evaluation (pp. 103-124). Washington, DC: American Psychological Association.



Expected Relative Strength =.25

Figure 1. Representing fidelity and relative strength in experiments. Adapted from Cordray and Pion (2006, p. 116).

Chris S. Hulleman & David S. Cordray (2009) Moving From the Lab to the Field: The Role of Fidelity and Achieved Relative Intervention Strength, Journal of Research on Educational Effectiveness, 2:1, 88-110, http://dx.doi.org/10.1080/19345740802539325



Treatment contrast is critical for estimating impacts. The contrast in resources (treatment - control) reflects the production of these impacts. In many cases, we need to know the resources for treatment, control, and the contrast.



Many treatments in education induce a change in services received by students that mediate the outcome ("service mediation interventions). This is a critical component of treatment contrast and the production of effects.

See: Bowden, A.B., Shand, R., Belfield, C.R., Wang, A., & Levin, H.M. (2017). Evaluating Educational Interventions that Induce Service Receipt: A Case Study Application of City Connects. American Journal of Evaluation, 38(3), 405-419.

Zoology One Efficacy Study

Replacement Contrast



Here, the treatment, and associated costs, is an alternative to business as usual. The program replaces current practice.

Zoology One Efficacy Study Cost Study Data

- Program Data
- Teacher Surveys:
 - teacher characteristics (years total, in K, in school)
 - reading specialization
 - assignment of home reading, % completed
 - # books destroyed
- Time Logs:
 - 30 minute increments throughout the day
 - focus on teaching: reading, science



	As D	esigned	As Imp	lemented
gredients	Quantity	Units	Quantity	Units
Personnel				
Kindergarten Teacher	120	Minutes per day	170	Minutes per day
Home Reading	120	Minutes per week	75	Minutes per week
Training				
Initial PD Module	1	session	1	session
Coaching Sessions	10	sessions	10	sessions
Materials				
ARC Core Unit 1: Literacy Lab	1	kit	1	kit
ARC Core Unit 2: Zoology	1	kit	1	kit
ARC Core Unit 3: Ecology	1	kit	1	kit
ARC Core Unit 4: Entomology	1	kit	1	kit
IRLA Foundational Skills Toolkit Y-2G	1	kit	1	kit
Supplemental Books for Advanced Readers	0	set	1	set*
Data Management & Technology				
Computer	1	item	1	item
SchoolPace/eIRLA	1	subscription	1	subscription

Zoology One Cost Per Student

				1	
T Otv	C Otv	Unit	Total Cost	Distrib	oution
				School	Home
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1	1	Assistant			
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Efficacy Questions?

Development Pilots

- Really similar to efficacy because the pilot involves studying a small scale delivery of the intervention
- Contrast matters: How does your new development differ from standard practice? Will it replace business-as-usual or will this program offer services that are not in contrast to anything else?
- What resources are provided? Does the program leverage external resources? Did the resources used vary widely?
- Focus on what is most important to deliver the program as designed and to use what is learned during the pilot and to inform future implementation.

This is a lot. I know. Pilot questions?

Reach out. More to come!

Photo by Stan Y on Unspla

Thank you!

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