A Case Study for Estimating Cost-Effectiveness of Education Programs

Conner Brannen & Meghan Mahoney
J-PAL Policy Group
Department of Economics, MIT

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Presentation Outline

• What is Cost-Effectiveness Analysis (CEA)?
• The Teacher Community Assistant Initiative (TCAI)
• Estimating CE Prior to the Start of the Program
• Refining Your CE Estimate Based on the Evaluation
• Considering the Program at Scale
What is Cost-Effectiveness Analysis?

$$CE \text{ Ratio} = \frac{\text{Total Cost of Implementing Program}}{\text{Total Impact of Program on Specific Outcome}}$$

- Summarizes a complex program in terms of a simple ratio of costs to impacts
- Allows for comparison between different programs evaluated in different contexts across different timeframes
Comparing Multiple Programs

- Remedial education, INDIA: 0.28 SD
- Individually-paced computer assisted learning, INDIA: 0.48 SD
- Read-a-Thon, PHILIPPINES: 0.13 SD
Incorporating Costs

- Remedial education in INDIA: 3.05 SD
- Individually-paced computer-assisted learning in INDIA: 1.54 SD
- Read-a-Thon in PHILIPPINES: 1.18 SD
CEA Can Be Undertaken at Two Distinct Stages of Program Implementation

- **Prospective analysis** takes place prior to the start of a pilot or at-scale program
- **Retrospective analysis** takes place after an evaluation of the program is completed
At Both Stages, the Methodology for Calculating Cost-Effectiveness Is the Same

• But interpretation of the ratio and the conclusions that can be drawn from the analysis depend on when the CEA is conducted

• The purpose of this case study is to illustrate how to approach CEA at distinct stages in a program lifecycle by working through CEA calculations for the Teacher Community Assistant Initiative (TCAI)
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The Teacher Community Assistant Initiative (TCAI)

• In 2009, 20% of grade 3 students reached expected proficiency levels in English, 25% in math.

• Previous research shows that targeting instruction to pupil’s learning levels achieves significant improvements at low cost.

• Based on these insights, the Ghana Education Service (GES) and Innovations for Poverty Action (IPA) developed TCAI.
The Teacher Community Assistant Initiative (TCAI)

- **In-School Remedial TCAs (TCAI-ISR):** Teacher Community Assistants (TCAs) worked *during school* on basic numeracy and literacy with *struggling pupils* for 2 hours/day

- **After-School Remedial TCAs (TCAI-ASR):** TCAs worked with *struggling pupils* on basic numeracy and literacy skills for 2 hours *after school*

- **Normal Curriculum TCAs (TCAI-NC):** TCAs pulled pupils *at random* to review the standard curriculum for two hours *during school hours*
The Teacher Community Assistant Initiative (TCAI)

- All TCAs received one week of training
- Remedial TCAs also received teaching materials focusing on basic literacy and numeracy
- GES provided district officials, head teachers, and school management committees with an orientation to TCAI
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Before Implementing TCAI

• Imagine you are a program manager at GES and you want to know whether TCAI will be a good investment

• Program has not yet been implemented so data on actual costs and impacts does not exist

• What can you do? Read Section III and answer Q.1 (p.4) based on what you learned in the previous session
**Estimated Costs for After-School Remedial TCAs Intervention (TCAI-ASR)**

<table>
<thead>
<tr>
<th>Table 1: Estimated Prospective Cost per Child for TCAI-ASR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total estimated, monetary cost per year to implement TCAI-ASR</strong></td>
</tr>
<tr>
<td><strong>Total number of schools/children in TCAI-ASR treatment group</strong></td>
</tr>
<tr>
<td><strong>Projected cost per child per year to implement</strong></td>
</tr>
</tbody>
</table>

\[
\frac{\$74,800}{12,000 \text{ children}} = \$6 \text{ per child}
\]
Q.2 (p. 5): Based on the 1.4 SD benchmark and the total cost of the program, how large must the impact of TCAI-ASR be for the program to be a cost-effective investment?
Calculating the Necessary Impact to Meet the Benchmark for Cost-Effectiveness

\[
1.4 \text{ SD per } $100 = \frac{$100}{1.4 \text{ SD}} = $71.43 \text{ per additional SD}
\]

\[
\frac{\text{Cost per Child per Year}}{\text{Average Impact on an Individual's Test Scores}}
\]

\[
\frac{$6 \text{ per student}}{X \text{ impact}} = $71.43
\]

\[
X = 0.09 \text{ SD}
\]

Is it realistic to expect an impact of this size?
Choosing an Impact Estimate

• Potential sources:
  – Best: Evaluation of pilot version of program in exact context
  – Next Best: Look in growing body of impact evaluations for an evaluation of the program model from a similar context

• Key considerations to assess the quality or applicability of an impact estimate:
  1. The methodology used to generate the estimate
  2. The similarity of the evaluated program to the proposed program
  3. The context in which the program was evaluated
  4. The scale and sample composition of the evaluated program
Estimating Program Impact

There have been several evaluations of programs similar to TCAI-ASR from which you can draw impact estimates.

<table>
<thead>
<tr>
<th>Evaluated Program</th>
<th>Duration</th>
<th>Avg. Impact on an Individual’s Test Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remedial tutoring by volunteers, India</td>
<td>2 years</td>
<td>0.28 SD</td>
</tr>
<tr>
<td>Tracking students by ability, Kenya</td>
<td>18 months</td>
<td>0.18 SD</td>
</tr>
</tbody>
</table>

Q.3 (p.6):

- Why do you think the impact estimate from India may or may not be a good approximation of the impact of the TCAI-ASR intervention?
- Why do you think the impact estimate from Kenya may or may not be a good approximation of the impact of the TCAI-ASR intervention?
Calculating Cost-Effectiveness

Q.4 (p.7): Based on the impact estimates from comparable programs, calculate a range of potential cost-effectiveness.

Table II: Estimated Cost-Effectiveness of TCAI-ASR

<table>
<thead>
<tr>
<th>Estimated cost per child per year of TCAI-ASR</th>
<th>$6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remedial tutoring by volunteers, India</td>
<td>$23.09 per additional SD</td>
</tr>
<tr>
<td>Tracking students by ability, Kenya</td>
<td>$24.62 per additional SD</td>
</tr>
<tr>
<td>Estimated impact per child per year</td>
<td>0.28</td>
</tr>
<tr>
<td>Estimated cost-effectiveness</td>
<td>$34.62 per additional SD</td>
</tr>
</tbody>
</table>
Interpreting Your *Prospective* Cost-Effectiveness Estimate

**Q.5 (p. 7):**
- How would you explain what this estimated range of cost-effectiveness means to your colleagues at GES?
- Does this predict exactly how cost-effective TCAI-ASR will be?

<table>
<thead>
<tr>
<th>The estimate can be interpreted as...</th>
<th>The estimate should NOT be interpreted as...</th>
</tr>
</thead>
<tbody>
<tr>
<td>The average cost-effectiveness that might be expected if all of the assumptions made in the calculations were correct</td>
<td>A precise prediction of the cost-effectiveness of the program</td>
</tr>
<tr>
<td>An indication of the order of magnitude of the program's cost-effectiveness</td>
<td>The general cost-effectiveness of this kind of program</td>
</tr>
</tbody>
</table>
Interpreting Your *Prospective Cost-Effectiveness Estimate*

**Q.6 (p. 7):**

- Are there any potential risks or uncertainties that could make TCAI-ASR not cost-effective?

- What are the most important assumptions that must hold true to make TCAI-ASR cost-effective?
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Results of Randomized Evaluation of TCAI

• Having TCAs provide remedial instruction targeted to struggling students, both during and after school, had modest but significant impacts on basic literacy and numeracy test scores.

• Simply reducing the class size by adding a TCA had minimal effects on test scores.

• Remedial classes taught by TCAs after school were more effective than those taught during school.
Impact on Basic Literacy Skills

Table IV: Impact of TCAI on Basic Literacy Skills

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Duration</th>
<th>Impact on Literacy Test Scores ‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-School Remedial TCAs (TCAI-ISR)</td>
<td></td>
<td>0.122**</td>
</tr>
<tr>
<td>After-School Remedial TCAs (TCAI-ASR)</td>
<td>1 year</td>
<td>0.190***</td>
</tr>
<tr>
<td>Normal Curriculum TCAs (TCAI-NC)</td>
<td></td>
<td>0.092</td>
</tr>
</tbody>
</table>

*** p<0.01, ** p<0.05

ǂ Note: Hypothetical numbers
Gathering Detailed Actual Cost Data

- Table VI – each cost category is collapsed such that only the total is shown.
- A portion of the *Instruction Materials* category has been expanded as an example of how to specify the unit cost and number of units needed for each line item.

**Q.7 (p. 10)** Use Table V to fill in the blue boxes in Table VI

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit Cost, Local</th>
<th>Local Currency</th>
<th># Sets Per School</th>
<th>Total # Sets Needed</th>
<th>Total Cost, 2011 USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.1 Sentence Cards</td>
<td></td>
<td>2011 GHC</td>
<td></td>
<td></td>
<td>2011 USD</td>
</tr>
<tr>
<td>10.2 Paragraph Cards</td>
<td></td>
<td>2011 GHC</td>
<td></td>
<td></td>
<td>2011 USD</td>
</tr>
<tr>
<td>10.3 Word Cards</td>
<td></td>
<td>2011 GHC</td>
<td></td>
<td></td>
<td>2011 USD</td>
</tr>
<tr>
<td>10.4 Letter Cards</td>
<td></td>
<td>2011 GHC</td>
<td></td>
<td></td>
<td>2011 USD</td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2011 USD</td>
</tr>
<tr>
<td>Total Cost of Instructional Materials</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20,369.49</td>
</tr>
</tbody>
</table>
Calculating Cost- Effectiveness

Q.8 (p. 11): Now that you have the actual costs of the program, please calculate a more accurate cost per child.

Table VII: Actual Costs of the TCAI-ASR

<table>
<thead>
<tr>
<th>What was the total cost?</th>
</tr>
</thead>
<tbody>
<tr>
<td>$139,482</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How many students did TCAI-ASR reach?</th>
</tr>
</thead>
<tbody>
<tr>
<td>12,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What was the cost per child per year?</th>
</tr>
</thead>
<tbody>
<tr>
<td>$11.62</td>
</tr>
</tbody>
</table>
Calculating Cost-Effectiveness

Q.9 (p. 11): With both the cost and impact information, please calculate a retrospective estimate of the cost-effectiveness of the intervention and fill Table VIII

<table>
<thead>
<tr>
<th>Table VIII: Actual Cost-Effectiveness of TCAI-ASR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual cost per child per year</td>
</tr>
<tr>
<td>Actual impact per child per year</td>
</tr>
<tr>
<td>Actual cost-effectiveness</td>
</tr>
</tbody>
</table>
Comparing Your Estimate Against the Benchmark for Cost-Effectiveness

- **Remedial education**
  - India
  - 3.05 SD

- **Individually-paced computer assisted learning**
  - India
  - 1.54 SD

- **Read-a-Thon**
  - Philippines
  - 1.18 SD

- **Estimated CE of TCAI**
  - 1.63 SD

- **Estimated CE of TCAI**
  - 1.4 SD
## Interpreting Your *Retrospective* Cost-Effectiveness Estimate

### Q.10 (pg. 11):
- How would you explain this cost-effectiveness estimate to your colleagues at GES?
- How is your explanation and interpretation of this estimate different from the prospective calculation?

<table>
<thead>
<tr>
<th>The estimate can be interpreted as...</th>
<th>The estimate should NOT be interpreted as...</th>
</tr>
</thead>
<tbody>
<tr>
<td>The cost-effectiveness of this program as it was implemented in this specific context</td>
<td>A prediction of the cost-effectiveness of the program if it is implemented in other contexts</td>
</tr>
<tr>
<td></td>
<td>The general cost-effectiveness of this kind of program</td>
</tr>
</tbody>
</table>
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Considering the Program at Scale

• Based on the results of the evaluation and your CEA, the Ghana Education Service (GES) is now considering a nationwide scale-up of the program

• Need to assess how the cost-effectiveness of the program might change when scaled up
Additional Resources and Contact Information

Comparative Cost-Effectiveness Analysis to Inform Policy in Developing Countries:
A General Framework with Applications for Education

Iqbal Dhaliwal, Esther Duflo, Rachel Glennerster, Caitlin Tulloch
Abdul Latif Jameel Poverty Action Lab (J-PAL), MIT

http://www.povertyactionlab.org/publication/cost-effectiveness

Contact: cbrannen@mit.edu or mahoneym@mit.edu

www.povertyactionlab.org/policy-lessons