IES Institute of Education Sciences

Cost Analysis: A Starter Kit

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Cost Analysis: A Starter Kit

Why was this starter kit developed and who is it for?

IES encourages, and sometimes requires, cost analysis for IES-funded research and evaluation projects. IES believes cost analysis is crucial to support education agencies' decision-making in the adoption of programs, policies, or practices.

IES has released this starter kit for grant applicants who are new to this kind of analysis. The kit will help you plan a cost analysis, setting the foundation for more complex economic analyses. We outline a three-phased approach, which we have broken into additional steps.

Do you have feedback on this document? This is the first version of the IES Cost Analysis Toolkit. IES will update it regularly as readers find errors and offer improvements. We would appreciate your feedback on this resource. Comments can be sent to ncee.feedback@ed.gov.

Quick Start Checklist

This quick-start checklist summarizes the major steps in a cost analysis. You may not be familiar with each of the terms it uses until you have read this Toolkit. We encourage you to read the Toolkit in its entirety and then return to this checklist when you are ready to begin your first cost analysis.

Step 1: Clarify the program model

- ☐ The program has a clear theory of change.
- ☐ A logic model depicts the theory of change, clearly identifying how core components of the program work together to influence outcomes.

Step 2: Choose the perspective(s)

- ☐ I have checked which perspective(s), if any, is required or encouraged by the IES grant program to which I am applying.
- ☐ I am clear about the intended audience(s) for my research and its cost analysis and have considered audience needs in determining which perspective(s) will be useful.
- ☐ I have chosen a perspective that best fits the purpose of my research while also being feasible for me carry out. If I have not undertaken an analysis from the societal perspective, I am clear about the relative advantages and disadvantages of that approach.
- ☐ The perspective I have chosen is clear in my description of the analysis.

Step 3: Identify the quantity and quality of the program's key ingredients

- ☐ I used different data collection approaches as needed to determine what resources were used by the program, including those that might not have been originally anticipated by its developer.
- ☐ I have considered each main category of typical ingredients and identified the specific ingredients used by the program.
- ☐ I have recorded program ingredients in enough detail, in terms of quantities and qualities, so that others will understand what it takes to implement the program.

- ☐ I considered any important induced behaviors of the program and added relevant resources to my list of ingredients.

Step 4: Identify or estimate a price for each ingredient

- ☐ I am prepared to conduct parallel cost analyses using both national and local price data.
- ☐ If there is a constraint on my choice of prices, I have determined whether national or local prices make the most sense given the specific purpose and target audience of my cost analysis.
- ☐ I have assigned prices to each ingredient in my analysis using CostOut or other sources.
- ☐ I have ensured that units of both price and quantity align.

Step 5: Adjust costs for your context

- ☐ I have made contextual adjustments, such as geographic or present value adjustments, relevant to the program I am examining.

Step 6: Calculate costs

- ☐ I have presented costs in a way that fits the needs of my audience.
- ☐ If I have a multiyear program, I have considered whether the costs change year to year and presented the results accordingly.

Step 7: Conduct sensitivity analysis

- ☐ I have considered the biggest cost drivers of my program and whether they should be included in a sensitivity analysis.

Step 8: Determine whether to use the results for further economic evaluation

- ☐ I am aware of both strengths and weaknesses of the economic evaluation methods I am using.
- ☐ I have referenced the current IES Requests for Applications and I know if there are requirements for a specific type of economic evaluation for my grant.

Introduction

What is cost analysis?

Cost analysis examines the costs of specific programs—including interventions, education practices and policies, and tools—designed to improve students' academic outcomes. Cost analysis—

- Describes the resources needed to run a program, whether related to personnel, facilities, or materials
- Attaches value (estimates prices) for those resources
- Gathers information to estimate a program's cost

What is the purpose of cost analysis?

Researchers analyze cost to help state and local education providers decide how to best allocate their resources. This could include adopting new programs, implementing new instructional strategies, or deciding to continue an existing curricular approach.

Cost analysis can also—

- **Identify the resources for a specific program.** Cost analysis can help schools and districts understand how to implement a program with fidelity.
- **Surface issues of implementation and accountability.** Cost analysis can inform whether, under current policies and practices, resources are used as planned.

Cost analysis is often a building block for further economic evaluation, including cost-feasibility analysis (CFA), cost-effectiveness analysis (CEA) and cost-benefit analysis (CBA). These other approaches can—

- **Clarify whether an education agency has the resources available to implement a program.** By comparing the resources needed to implement a new program and the costs to procure them with the existing resources and available budget, decision makers can determine whether they prefer to adopt a new program or continue or scale up an existing one.

- **Inform choices among different programs or strategies.** Choosing the option that does the most good per dollar spent requires cost information, as well as results from the specific programs or strategies.
- **Support making decisions about existing programs.** When cost information about a program is compared to its results or benefits, it can inform whether that program should be scaled up or cut back.

You can find more information about more types of economic analysis later in this toolkit, in Step 8.

What concerns about cost analysis does the starter kit help to tackle?

- **Cost analysis is complex and tedious.** A basic cost analysis does not need to be overly difficult or time-consuming. You should identify and price the most important ingredients, whether staffing, facilities, or materials. Less costly inputs can often be approximated, since their accuracy is less important. A good cost analysis is about being as accurate as you can be–being "within the ballpark"–with the analytic resources you have. The time-saving tips included in this starter kit can help you do that.
- **Cost analysis is an additional, distinct process from other forms of program evaluation.** One of the main steps in cost analysis–identifying the required resources–is a critical component of implementation research within a program evaluation. By acknowledging this overlap during the study-design phase, you can intentionally incorporate cost analysis from the very beginning of the research effort, saving time in the long run.

Cost analysis and the Ingredients Method

Within the costing field, the term "ingredients" refers to the resources needed to implement a program. The approach to cost analysis that focuses on identifying and then valuing those ingredients is known as the "Ingredients Method" (Levin, McEwan, Belfield, Bowden, & Shand, 2018).

Are there other methods for doing cost analysis besides the Ingredients Method? Practically speaking, no: Any credible cost analysis needs to carefully consider the resources–that is, the ingredients–that a program uses. There are ways to help speed up that process, however, as we will discuss.

Total costs versus incremental costs

As its name implies, the total cost of an intervention is the sum of the prices of all ingredients needed to deliver it. In contrast, the incremental cost of an intervention represents only those costs *above and beyond* one or more alternative conditions.

For example, if a school spends an hour per day on math instruction and a new program is a direct substitute–that is, it requires the same teachers to offer the same 60 minutes of math daily–there would be no incremental cost associated with teacher labor. (There may, of course be other incremental costs. Consider, for example, the cost of teacher time spent in professional development to offer the new program.)

In contrast, if the new program requires an additional ten minutes per day of instruction, the additional resources used in support of those ten minutes and the prices of those resources would represent incremental costs.

Finally, if there is no existing program serving the need of the intervention being considered, be sure to include *all* ingredients required to deliver it. In this instance, the total and incremental costs are effectively the same.

Is my program cost-free?

Some programs appear not to need a cost analysis because they involve no new expenditures to implement. For example, a program may be using already-available classroom space, involve staff that are already employed, and use computers already on hand. Is such a program cost free?

From a financing viewpoint, given those details, new expenditures may be zero.

However, from a cost analysis viewpoint, resources are being reallocated to a new purpose. These items will not incur any new budget outlays but still have a value that you should account for. Therefore, you should still note these resources as a cost–even though they do not result in expenditures. Anyone considering adopting the program will benefit from full transparency about the resources required to implement it properly. This includes being able to ask themselves, "Do we have the ability to recruit those 'free' resources in our own context?"

Remember: while decision-makers may care most about new burdens to the budget, the purpose of a cost analysis is to document the resources required to implement a program regardless of how they are financed.

How is the starter kit organized?

The starter kit is organized into eight steps that represent a basic cost analysis, grouped into three phases. Those phases relate to ingredients, prices, and costs:

- **Phase 1: Identify the ingredients.** This step involves determining what resources are used by the program–whether related to personnel, facilities, equipment, supplies or other inputs–and then describing them in characteristics and quantity.
- **Phase 2: Price the ingredients.** Value each program resource by estimating or determining their prices for the period.
- **Phase 3: Create and use the cost estimate.** Calculate the cost of the program, test assumptions (sensitivity analysis), and then decide whether to use the results for any further economic evaluation.

The steps in the table below correspond to the sections of this starter kit.

Table 1. Steps in a Cost Analysis

Phase 1: Identify Program Ingredients
Step 1: Clarify the program model
Step 2: Choose the perspective(s)
Step 3: Describe key ingredients
Phase 2: Price the ingredients
Step 4: Identify or estimate a price for each ingredient
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

Appendices at the end of the starter kit provide additional information and resources.

- Appendix A includes a blank logic model template.

- Appendix B lists additional resources that may be useful as you conduct your first cost analysis.
- Appendix C includes a list of resources from which key content in this starter kit was sourced.
- Appendix D includes a list of the individuals who were interviewed during the development of the starter kit.

A brief example

Table 2 shows data from hypothetical cost analysis of a one-year program or the first year of a multi-year program. We are assuming the program is an add-on to existing programs. The program requires additional teacher and classroom time above what was already being used within the school. In the first three columns, Phase 1, we see those ingredients. The next column, Phase 2, adds prices for each ingredient. And finally, Phase 3 multiplies quantity and price to produce a cost per ingredient. If we summed up those costs (not shown), we would arrive at a cost estimate for the program in year one.

Table 2. Building Blocks of a Cost Analysis: An Example

Phase 1			Phase 2	Phase 3
Ingredient	**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 / hour	$7,200 (120*60)
Classroom space	120 hours per academic year; 1 classroom	900 sq. ft.	$5 / hour	$600 (120*5)

As you move through the starter kit, each step will provide more information about these three phases, exploring some of the nuances of identifying ingredients, pricing them, and creating and using a cost estimate.

How does the starter kit align to IES grant requirements or recommendations?

IES recommends applicants use this starter kit in conjunction with the specific requirements or recommendations of the IES grant they are applying for.

Cost analysis attempts to estimate the costs of a specific program, not the cost of the research. Also, keep in mind that IES is asking you to include a *plan* for carrying out your cost analysis in your application. At a minimum, that plan should include your choice of perspective (Step 2) and prices (Step 4), as well as other details related to the steps you plan to take to complete the required economic evaluation (Step 8). You are not expected to a include the actual analysis of cost in your application.

What other resources on cost analysis are out there?

Depending on your needs, you may want to deepen your knowledge about cost analysis beyond what this starter kit can provide. Appendix B contains a list of all resources referenced in this guide.

One resource to mention here, however, since it provides a useful big-picture overview, is the set of free online videos of an IES-funded workshop on cost analysis organized by the Center for Benefit-Cost Studies of Education (CBCSE) at Teachers College, Columbia University. They include–

- *The Ingredients Method Part 1 and Part 2* by A. Brooks Bowden
- *Pricing Ingredients* by Robert Shand

Phase 1: Identify program ingredients

Table 3. Building Blocks of a Cost Analysis: Phase 1

Phase 1			Phase 2	Phase 3
Ingredient	**Quantity**	**Description**	**Price**	**Cost (Quantity x Price)**
Ingredient 1	Quantity in units	Descriptive details	$	Quantity x Price
Ingredient 2	Quantity in units	Descriptive details	$	Quantity x Price

Overview

The first phase of cost analysis focuses on identifying the ingredients (or resources) needed to implement a program. Phase 1 asks: What resources are required to implement a program with fidelity? The list of ingredients includes their quantity and other important characteristics. For simple programs, this phase might be straightforward. For others, it will require some work to figure out the key resources used by the program. Either way, as we look ahead, this sets the stage for Phase 2, which is about attaching prices to those ingredients.

What steps are involved?

1. Clarify the program model
2. Choose the perspective(s)
3. Identify the quantity and quality of the program's key ingredients

Step 1: Clarify the program model

Why is this important?

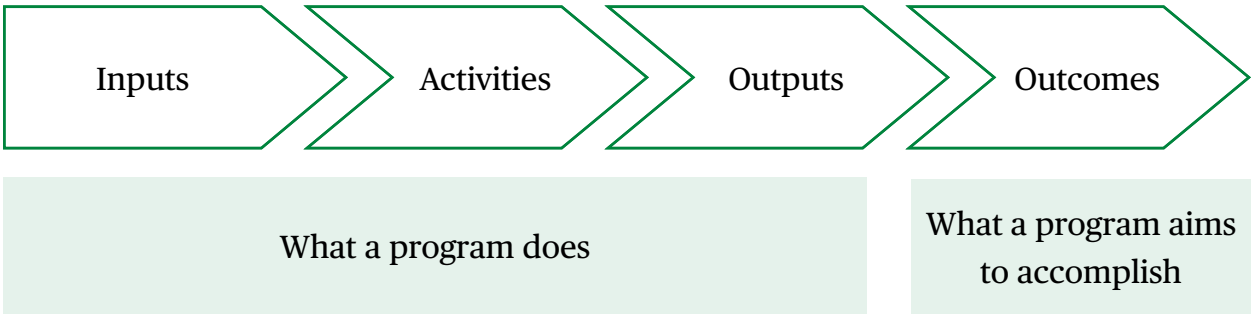
Logic models depicting a program's theory of change help identify ingredients for a cost analysis, including inputs, activities, and, in some cases, outputs. Logic models represent plans, while cost analysis should be based on actual program implementation. The outcomes of your logic model can help you plan further economic evaluations.

Developing a logic model to visualize a program's theory of change

A logic model describes what a program does with–

- **Inputs:** The program ingredients (resources), such as funding, staff, or facilities
- **Activities:** How the program accomplishes its goals
- **Outputs:** What the program produces
- **Outcomes:** Short-term, medium-term and long-term goals

Figure 1. Key Components of a Logic Model



Logic models and costs

It is worth considering: Does a logic model capture all the resources used by a program and therefore all its costs?

Not necessarily. There may be costs that are overlooked when focusing on a program's theory of change, including unintended costs that were not predicted by the model or described by its developer but that are observed in implementation. It is often helpful to talk with individuals directly involved in delivering the program to identify these otherwise hidden costs. Clarifying the program model is only Step 1 of a cost analysis.

Time-saving tip: Timely information collection

An important time-saving tip: If possible, do not wait until after the program ends to gather information about cost and implementation. The process will be much more tedious (including tracking down people who recall key details), not to mention less accurate.

This time saver applies not only to gathering information about the program model, which is the focus of this step, but also to any information gathering needed for the next steps, such as data on program ingredients. Gather those data while the program is running.

An example

The running example used in this starter kit is the fictional *Summing Up* program. We have adapted details of this fictional program from materials developed by Fiona Hollands and Yilin Pan of Teachers College, Columbia University and presented by Robert Shand of American University at an IES-funded workshop on cost analysis.

Summing Up is a computer-assisted math program where students use adaptive software to practice their math skills. The setting for its evaluation was a public school within the United States in academic year 2018 to 2019. It involved 100 students in the third grade. Outcomes were measured using the STAR math assessment. As part of the intervention–

- Five groups of 20 students practiced their math skills using *Summing Up* for 30 minutes per school day
- One of five teachers supervised each group to check students' progress and answer questions
- The teachers participated in a four-hour training session
- The program license fee was $100 per student and included the training fee
- Purchasing the software required 5 hours of district administrator time

Logic model using Summing Up

The questions that motivate a cost analysis of *Summing Up* might be: What was the total cost of implementing the program and the average cost per student? We begin examining that question by clarifying the program model through the creation of a logic model. Table 4 shows an example what a logic model might look like for *Summing Up*.

Table 4. A Logic Model for *Summing Up*

Inputs	Activities	Outputs	Outcomes	
			Short term	Long term
• Summing Up adaptive software • Five teachers' time (for program implementation and training) • Program license fees • Administrator time (to buy software) • Classroom/lab space • Computer for each student	• Students use software to practice their math skills (30 min. per day) • Teachers take part in training • Teachers supervise student use of software	• 100 students engage in 90 hours of adaptive math instruction per year • 5 Teachers are trained in implementing *Summing Up*	• Students have better understanding of the math concepts covered in the curriculum	• Students have higher STAR math assessment scores at year-end

Key points

- Start a cost analysis by clarifying a program's purpose and theory of change.
- Create a logic model, a visual representation of a program's theory of change.
- Clarify the program model with program documentation, interviews with experts or implementers, previous studies, and direct observations via site visits.
- Document a program's theory of change for strong grant applications.

Checklist

- ☐ The program has a clear theory of change.
- ☐ A logic model depicts the theory of change, clearly identifying how core components of the program work together to influence outcomes.

Additional resources

A blank logic model template is provided in Appendix A that you can print and use. The IES Regional Educational Laboratories (RELs) provide additional examples of logic models here and here.

Step 2: Choose the perspective(s)

Why is this important?

This step is about deciding: Whose costs are we measuring?

While all cost analyses focus on measuring how much a program costs, there are different "lenses" or perspectives that one could adopt in doing that analysis. Perspective determines which ingredients will require you to assign prices to them. While you may not assign prices to all ingredients, it is still important to document in your write-up every ingredient used in a program to aid future replication.

What are the main perspectives?

Three common perspectives of cost analyses are–

- **Societal perspective:** From this perspective, all resources used by a program have value and are counted–regardless of who pays for them and even if they are provided in kind. Every resource needs to be assigned a price. That includes resources where the "price" is the opportunity cost, meaning the forgone gains of using the resource for another purpose–a concept we will discuss in Step 3.
- **School perspective:** Count only the school resources used to implement the program. Time spent by parents or program volunteers would not be counted, since the school does not pay for their time.
- **District perspective:** Any district resources used to implement a program would be included. This includes, for example, the time spent by a central office program director to monitor implementation across schools.

For higher-education studies, another perspective could be–

- **Student perspective:** How much does it cost the student to participate in a program? That includes not only direct costs, such as fees, but also the opportunity cost of their time. Note that cost analyses of K-12 programs in developed countries generally do not include a student perspective, since it is less relevant in that context–students at that age are usually not able to choose between school and work.

How costs vary by perspective

Choosing the perspective(s) of a cost analysis typically happens at the start of the process. For illustrative purposes, we will assume you have already calculated the value in Year One of each of the additional resources above and beyond business as usual used by a certain program. The incremental costs for a program for struggling readers are shown in the table below

Table 5. Incremental Costs of a Fictitious Reading Program

Ingredient	Cost (per student)	Payer
Training time for teachers	$250	School
Fees for teacher training	$20	School
Classroom space	$30	School
Volunteer time using minimum wage to estimate opportunity cost	$170	Volunteers
Workbooks	$25	School

So, how much does this program cost? It all depends on the perspective.

- From a **societal perspective**, all of the costs would need to be included. Adding them together, we arrive at a program cost of $495 per student.
- From a **school perspective**, the program cost would be only $325. This is because the value of the volunteer time would not be included, since it is free to the school.

As this example shows, the choice of perspective can have an important effect on the answer to the question, "How much does this program cost?"

Choosing the perspective(s)

Ideally, anyone doing a cost analysis would calculate and convey multiple perspectives, starting with the societal one. Multiple perspectives make your findings relevant to the broadest range of decision makers. Including a societal perspective allows for the most comparability between your study and those of other researchers.

Other perspectives may be needed to be responsive to different key stakeholders.

For example, in studying a district-based reform, you should include both societal and district perspectives. That way decision makers at different levels would have cost information that is the most relevant to them. It would also make your analysis the most comparable to existing studies of that type of reform, some of which might use one perspective or the other.

When you only have time or resources to take one perspective, however, the key question should be: *How will my analysis or study be used, and by whom?*

For instance, if you are helping principals choose among common options that only rely on school-based resources, then the school perspective will be the most relevant. If you are informing a broader set of decision makers, including research that could be used nationally, then a societal perspective will convey all the program costs. Of course, once you have calculated costs from a societal perspective, identifying costs from more narrow perspectives is relatively easy, since you would simply not count costs considered in that perspective.

Time-saving tip: Your choices of perspective(s)

If you are new to cost analysis or have limited resources to undertake the analysis, a school or district perspective could be a useful approach, since it is the simplest to undertake. However, you need to consider the downsides involved.

For example, not including a societal perspective may make your analysis less relevant to a broader set of decision makers. Moreover, different education agencies split costs between schools and districts differently, so choosing a school perspective might not produce generalizable information.

Even if you choose to take a school or district perspective, you still should identify all of the ingredients used in the intervention (but not their costs if they are paid from other sources) so that others will have a fuller understanding of the intervention's ingredients and will be able to calculate the full costs.

Let us continue the example of *Summing Up*, the fictional computer-assisted math program we introduced in Step 1. What perspective or perspectives might a researcher choose who is studying *Summing Up*? If the researcher were, say, employed by the school or the district to evaluate their programs, such as *Summing Up*, they might choose to take a narrower perspective of the school or the district.

More likely, however—especially if this research were part of an IES research grant—the researcher is aiming to generate insights that will be used more broadly, such as in their region or even nationally. In that case, they will want to use a societal perspective for their cost analysis. They might choose to also include a school perspective to ensure that their findings are also relevant to principals and other local decision makers that might use the research.

IES research grants and the choice of perspective(s)

For IES grant applicants or recipients, a key factor in choosing the perspective(s) of a cost analysis is being responsive to any required or recommended approaches for that grant. A good place to start is by examining the grant RFA and supporting documents for any guidance or requirements related to cost analyses.

IES recommends that researchers use the societal perspective. Student, school, and district perspectives can be derived from the societal perspective, giving applicants maximum flexibility in conducting economic analysis and consumer maximum flexibility in making use of it.

Key points

- Choosing a perspective, or set of perspectives, for your cost analysis is about deciding whose costs you will focus on.
- A societal perspective is the broadest perspective and, therefore, has the advantage of being transparent about all costs associated with a program. A school (or district) perspective, which can be derived from a cost analysis initially developed at the societal perspective, provides information that is directly relevant to decision makers at that level.
- IES recommends analysts initially take the societal perspective. Your choice of perspective may vary depending on the purpose of your research and your target audience of decision makers.

Checklist

- ☐ I have checked which perspective(s), if any, is required or encouraged by the IES grant program to which I am applying.
- ☐ I am clear about the intended audience(s) for my research and its cost analysis and have considered audience needs in determining which perspective(s) will be useful.
- ☐ I have chosen a perspective that best fits the purpose of my research while also being feasible for me carry out. If I have not undertaken an analysis from the societal perspective, I am clear about the relative advantages and disadvantages of that approach.
- ☐ The perspective I have chosen is clear in my description of the analysis.

Step 3: Describe, in quantity and quality, the program's key ingredients

Why is this important?

This step is about describing what resources are needed to implement and carry out the program you are studying. This is at the heart of a cost analysis, since identifying the ingredients (this step) and pricing those ingredients (the next step) are the basic building blocks of a cost estimate.

Time-saving tip: Consider implementation surveys

Time saving tips: Save time by including questions identifying program ingredients and their costs into implementation surveys—that is, any already-planned initial data collection. By weaving those questions in, you could obtain information for Step 3 with little additional effort. Seeing your cost analysis as part of your program evaluation, and not an add-on, is fundamental.

Sources of information on ingredients

Where can you find information on a program's ingredients? It can come from many different sources:

- Reports and **descriptions of the program**, including information from program developers or previous evaluations
- **Interviews** you conduct with those involved in developing, implementing, monitoring or evaluating the program, such as program directors, school personnel, parents and (for program serving adults) program participants
- **Survey data** you collect from individuals involved in program implementation
- Your **direct observation** of the program
- **Program budget information**, which we discuss in more detail below

Whatever the source, the focus should be on determining the ingredients actually used by the program, rather than what was planned. Moreover, for programs with

multiple sites, you will need to identify a sample of sites from which to collect information on ingredients–ideally the same sites where effectiveness data are being collected for an impact evaluation. This may result in a range of resource use and associated costs across sites. In addition to presenting averages, it may also be useful to present a low and high estimate of resource use and costs across sites.

If there is a lack of consensus about the key ingredients of a program–say, different sites used different key ingredients–you can explain that in your analysis and present results from cost estimates using different assumptions about the key ingredients.

For some impact evaluations, business as usual for the control group may be comprised of a variety of practices. In this situation, you would ideally obtain information on ingredients used in each of these control group programs. This may not be feasible given *your* available resources; specific suggestions for addressing this concern are discussed more below in Step 4.

Using program budgets to identify ingredients

Budgets can be an incomplete source of information about ingredients and their costs. *Planned or projected* expenditures focus on actual resources *used* rather than *planned*. In addition, budgets often report items not associated with a particular program, making it hard to attribute the correct ingredients or quantities to the program you are analyzing.

However, budget information that describes *expended* costs can help create a list of ingredients and–in later steps of a cost analysis–support valuing those ingredients. These types of budgets can speed up cost analysis and can supplement surveys, interviews, or invoices.

For a simple program, a budget with expended costs might capture all the relevant ingredients. For other programs, it might capture *some* of the ingredients and costs, but you will need to determine the others.

The value of data triangulation

Sometimes you only have time or resources to gather data about ingredients from a single data source. However, using multiple data sources to validate your information can help you be more confident about the information accuracy. For example, if you are administering a survey to program implementers, you might also add some

interviews with them, to ensure that the survey data are correct. Collecting data from different sites can also confirm how resources are being used.

Describing quantity and quality

The more descriptive you can be about a program's ingredients, the easier it will be for you to value (price) those ingredients later. It will also help users of your research who want to replicate the program elsewhere.

As a result, describing both the quantity and characteristics of program ingredients is important. To pick one example, if volunteers are used by a program, it would be useful to specify how many volunteers there are, how long each volunteers for, and what types of volunteers they are—parents? community members?—and describe what education levels or relevant skills they need to fulfil the role they are serving to help implement the program being evaluated.

Some ingredients are used part-time by a program. Take a teacher who works halftime within a program, or a computer only used two hours per day by that program. Be sure to include in your analysis only the amount of time the relevant resource is used to implement your program.

Focusing on key ingredients

This step is about focusing your time, in terms of quantifying and describing ingredients, on the most important resources used by a program, not on spending a lot of time on small costs. A misunderstanding about cost analysis is that it requires researchers to meticulously account for every resource, down to the smallest detail.

Of course, being as detailed as you can, given the time and resources available to devote to the cost analysis, is the goal. But small costs, such as office supplies, can be estimated with little impact to the cost estimate. If you are unsure whether your estimate for those smaller costs (or any cost) substantially affects your overall cost estimate, you can always run sensitivity tests to see how using different assumptions about quantities and prices affect the overall cost estimate.

What are the most common key ingredients? Since most educational programs are labor intensive, involving teachers or other instructors, those costs will often be the most important. For programs that involve unsupervised computer-based learning, equipment costs may be the most important.

Categories of ingredients

The major categories of ingredients in your analysis will depend on the program–there is no single, agreed upon set of categories. That said, frequently used categories include personnel, facilities, equipment and materials, required client inputs, and other inputs. That list, and the more detailed descriptions next, draw on the book *Economic Evaluation in Education* (Levin et al., 2018, pp. 62-69).

- **Personnel.** This category includes the human resources used, including employees, consultants, external trainers and coaches, volunteers, and parents. Remember to include both time personnel spend delivering the program as well as their time spent in training and professional development. If administrator or educator time is needed to monitor the on-going success and improvement of the program, that time should be included as well. Personnel should be listed according to their roles, qualifications, and time commitments.
- **Facilities.** Physical space, such as classrooms, offices, storage areas, training space or recreational facilities. It is useful to specify facilities' dimensions and characteristics.
- **Equipment and materials.** Furnishings, instructional equipment or materials used by the program. That might include books, manuals, computers or software required for implementation or training purposes.
- **Required client inputs.** Contributions from the participants and their families. At the K-12 level, that could include transportation, books, uniforms or other items required by the program and paid for by the family. In postsecondary and adult education programs, it could include textbooks or other required resources that students need to buy. Moreover, for postsecondary and adult education programs, participants' time needs to be valued, since they could have been using that time to earn wages (opportunity cost).
- **Other program inputs.** Any other ingredients not captured by the categories above. That might include costs for identifying or recruiting program participants, transportation, prizes, food, scholarships, and financial incentives for participants or teachers. If the program includes oversight, monitoring, or tracking staff participation or student progress and outcomes, be sure to include the personnel costs of those efforts above and other costs here.

Indirect costs

Within the categories above, there may be costs that are considered indirect, which are resources that are not purchased specifically for the program. Examples include overhead costs such as network infrastructure and internet connectivity; security, custodial and maintenance services; human resource functions; the work of the budget/finance office; or administrative costs. Where possible, these costs should be treated the same way in terms of quantity and price but estimating indirect costs as a percentage may be more feasible.

Being aware of induced costs

A more complicated issue is induced costs. These costs arise not as part of the main program model but occur because of behavioral changes caused by the program.

For example, let us say a program uses extra quizzes to make students more aware of their progress. The direct costs would include the time and materials to administer the quizzes. But observations or interviews at the school may show that teachers using the method devote more time to their students, since students with low quiz scores come in for extra help. That extra teacher time might not have been part of the initial program model, but it affects program outcomes and would be considered an induced cost of the program.

As you consider your program's ingredients, look for such changes in behavior so you can add the resources to your ingredients.

Continuing our working example of *Summing Up*

Let us continue the example of the computer-assisted math program we introduced in Step 1, *Summing Up*. The table below shows an example of program ingredients–with quantity and characteristics–including program licenses, teachers' monitoring time, teachers' training time, classrooms, computers, and administrator time.

This step should document all the program's ingredients so that others can replicate the program elsewhere, regardless of whether they will reallocate ingredients or acquire new ones.

Table 6. Key Ingredients to Implement *Summing Up*

Ingredient	Quantity	Quality/Description
Program licenses	100	Single-user program licenses for one year
Teachers' monitoring time	30 minutes per school day per teacher during the academic year (180 days); 5 teachers	Elementary school teacher
Teachers' training time	4 hours per teacher; 5 teachers	Elementary school teacher
Classrooms	30 minutes per school day per classroom during the academic year; 5 classrooms	900 sq. ft elementary school classrooms
Computers	30 minutes per school day per student during the academic year, 100 computers	Dell Inspiron 21.5" Touch Screen All-in One (AMD E2 series with 4 GB memory and 1 TB hard drive) with expected lifetime use of 5 years
Administrator time	5 hours	Elementary school district administrator

Key points

- Identify and describe program ingredients to implement a program with fidelity
- Quantify and describe ingredients in proportion to their importance to the program, spending most of your time on the key ingredients.
- Save time and effort by building questions about ingredients into your main data collection strategy.
- Make use of existing program planning and expenditure data, when available.

Checklist

- ☐ I used different data collection approaches as needed to determine what resources were used by the program, including those that might not have been originally anticipated by its developer.
- ☐ I have considered each main category of typical ingredients and identified the specific ingredients used by the program.
- ☐ I have recorded program ingredients in enough detail, in terms of quantities and qualities, so that others will understand what it takes to implement the program.
- ☐ I considered any important induced behaviors of the program and added relevant resources to my list of ingredients.

Additional resources

A sample set of interview questions is available from the CBCSE's CostOut resource. Register to access the Interview Protocol under the "Additional Resources" tab.

For more information on induced costs, see "Evaluating educational interventions that induce service receipt: A case study application of *City Connects*" in the American Journal of Evaluation (2016) by A. Brooks Bowden and her co-authors.

Phase 2: Price the ingredients

Table 7. Building Blocks of a Cost Analysis: Phase 2

Phase 1			Phase 2	Phase 3
Ingredient	Quantity	Description	Price	Cost (Quantity x Price)
Ingredient 1	Quantity in units	Descriptive details	$	Quantity x Price
Ingredient 2	Quantity in units	Descriptive details	$	Quantity x Price

Overview

While Phase 1 was about identifying the resources (ingredients) used by a program, Phase 2 is about placing values on, or assigning prices to, each ingredient. In Phase 3, you will multiply ingredient quantities by prices to obtain costs.

What steps are involved?

1. Identify or estimate a price for each ingredient
2. Adjust costs for your context

Step 4: Identify or estimate a price for each ingredient

Why is this important?

In the previous step, we discussed how you identify the ingredients of the program you are examining. Step 4 is about assigning a price to each ingredient, which will allow you to calculate costs in the next phase.

The importance of estimating both national and local prices

Imagine you are studying a teacher professional development program in the Milwaukee (WI) Public Schools. In this scenario, teacher time is a key ingredient to the program's success. The average hourly compensation of a teacher in Milwaukee is $X, while the national average is $Y. Which price should you use in your cost analysis?

The answer? Both.

In general, IES research informs the education field broadly, so national prices are most appropriate. However, because local stakeholders have real and pressing questions about education practice in their school or district, using local prices in your research makes it especially relevant. Although conducting your cost analyses with two parallel cost bases adds some burden to *your* work, it pays dividends to both local and national audiences.

One word of caution: do not mix national and local prices in a single analysis. Accuracy and interpretation rely on consistency in your cost analysis.

Where do I find price data?

National prices

If you use national prices, a fast-track method you can use is *CostOut*, which provides a database of national average prices, such as teacher and principal salaries. Otherwise, you can search for your own sources of national prices using, for example, compensation surveys produced by the Bureau of Labor Statistics.

A second approach for generating national prices is to adjust actual local prices paid with a geographic price index (discussed more in step 5). You can do this in *CostOut*. This adjustment will make local prices comparable across different regions of the

country. If a local price is the same across the country, such as ordering a laptop online, no adjustment is needed.

Local prices

Local prices are how much an ingredient costs in a specific region. Many school districts publish salary schedules and salary databases for public accountability. While it may be your instinct to always rely upon actual salaries, be wary: any individual's salary can be affected by idiosyncrasies (additional certifications, coaching assignments) that might cause it to deviate significantly from a local average. It may be better to rely upon teacher pay schedules, or average across several actual teacher salaries, to create your local price.

To find facility prices, check with local realtors about comparable rents, or speak with builders about the cost to build similar space. Later in this section, we provide more information about pricing specific types of ingredients.

Another option is to use *CostOut*, which allows users to adjust national prices to reflect geographic differences. You can adjust to a specific state or to metropolitan or non-metropolitan areas. The prices are still based on national averages, but they may better reflect the specific state or locality on which you are focusing.

Time-saving tip: Dealing with larger quantities of ingredients

If a program has a large quantity of any ingredient, simplifications—so long as you are transparent about your analysis—can be helpful. For example, if your program employs 20 teachers, you do not need to price each teacher as an individual. Instead, you could use an average price ("20 teachers at $65,000 each") or disaggregate teachers into a few categories ("10 new teachers at $55,000 each" and "10 experienced teachers at $75,000 each") rather than listing a price for each person.

Pricing ingredients that lack market prices

Some ingredients may not have an obvious market rate, such as classroom space or volunteers' time. We share some suggestions for estimating so-called "shadow prices" for several common ingredients.

School facilities

Some schools allow community members to rent space, which seems like a market price. Yet those prices might be subsidized to support the community, or higher than the market rate to support the school, so they are likely not very useful for cost analyses.

Instead, if you are using local prices, consider these two options. One is to look at what a similar space would cost to rent in the private market. The other is to consider what it would cost to build a similarly sized space today and then amortize that construction cost. We will discuss amortization more in Step 5.

If you are using national prices, the best option is to adjust a local rental rate with a geographic price index. If it is difficult to find a local rental rate, you can use *CostOut*.

Parental or volunteer time

Often, researchers price parents' or volunteers' time at the minimum wage. If volunteers have some specialized, relevant skill–say, they are all trained teacher aides– you might want to choose a higher wage. The goal is to approximate the cost of hiring someone to do that volunteer work.

Student time

The cost of K-12 students' time is generally not included in a cost analysis, since these students would not be working anyway during the program. (There could be exceptions for high school students who could be working during program times.)

For postsecondary and adult education programs, you generally will assign a price to students' time, from both a societal and individual perspective. That is because those students could be working rather than being in the program. We need to count these costs, known as "forgone wages." To do that, cost analyses typically assign the minimum wage, similar to pricing volunteer and parent time.

Pricing other common ingredients

Teacher time

For teachers' time, determine average national salaries with *CostOut*. If you are using local prices, look at the pay schedule for whichever district(s) you are working with, or glean information from a program budget or expenditure report.

Either way, for full-time teachers, you will need to decide what constitutes full-time work in the specific context. Ask your school district collaborators or from examining teacher contracts to determine expected hours of work. Alternatively, *CostOut* notes that full-time is generally defined as 2,080 hours for a typical U.S. worker, 1,440 hours for a K-12 teacher, and 1,260 hours for an instructor at a college or university.

Training fees

Training costs can involve multiple ingredients, such as teacher and trainer time, materials, and training space.

It is important to note that, even though training may be planned for a program's first year, its cost (and benefits) may extend longer than expected.

First, even if all the training occurs in one year, the benefits of that training may last longer, with staff continuing to use the new practices they learned in training. Conversely, some staff may leave a multi-year program in the middle of the effort, which leads to training costs for their replacements. In all these cases, the costs should be spread over the number of years for which the training is applied by the staff to their practices.

For example, if teachers get trained in year one of five, but only tend to stay in the school for 2.5 years, you will include new training costs for replacement staff. This would double the cost of training for the program and the cost of each training would be amortized over 2.5 years.

Matching units

In choosing a suitable price for each ingredient, you will need to make sure that the units of ingredient prices and the units of their quantities match. For example, if you have an hourly compensation rate for teachers, you will need to express their time devoted to the program in hours. You could do that by changing, say, an annual compensation rate to an hourly rate by dividing by the number of hours worked, ensuring that you express price and quantity in equivalent terms.

A slightly trickier example is the cost of a classroom. If you know how much a 900 square foot classroom costs to build (say, $235,000), but your units are the number of hours the classroom will be used in a year, you will need to spread out that cost over its usable life (typically 30 years). Then, once you have an annual cost for a

classroom ($235,000 ÷ 30 = $7,833 using straight line amortization), you can divide by the number of hours in a standard school year (1,440), in a calendar year (8,760), or another estimate of total hours the building is available. Finally, you can take that hourly cost and multiply it by your hours to match your units to obtain the total cost of the use of the classroom.

Continuing our working example of *Summing Up*

In our example with the computer-assisted math program, *Summing Up*, we derived prices for the ingredients in Step 3.

In Table 8, we use national prices since the goal of the analysis is to inform education decision makers broadly. Given our decision to use the societal perspective, we would determine a price for each ingredient, not just those paid for by the school or district.

As you will see in Column 2, we also introduce the business as usual condition into our example to show the estimation of incremental costs. Recall that, for incremental costs, you only assign a price to ingredients that are used differently than in the business as usual or other alternative condition.

For example, as the table shows, *Summing Up* uses 100 program licenses, while business as usual–before the program was introduced–used none. That means you should assign a price to program licenses and include that ingredient in your incremental cost analysis. Contrast that with classroom time, which is unchanged between the program and business as usual and therefore would not be assigned a price or included in the cost analysis if you are only interested in incremental costs.

For the sake of demonstrating how to price different ingredients, we include a price for each ingredient in the table below, even though an incremental cost analysis of Summing Up would not need to price every ingredient. While *Summing Up* is a fictitious example, we discuss how we would have found the prices of its ingredients.

Table 8. Adding Real Prices to *Summing Up*

Ingredient	Quantity (business as usual)	Quantity (*Summing Up*)	Price per unit	Source/ Methodology
Program licenses	0 licenses	100 licenses	$100/license	Interview
Teachers' time	450 hours	450 hours	$41.02/hour	*CostOut*
Teachers' training time	0 hours	20 hours	$41.02/hour	*CostOut*
Classrooms	450 hours	450 hours	$9.65/hour	*CostOut*
Computers	25 hours	9,000 hours	$.07/hour	*CostOut*/online
Administrator time	0 hours	5 hours	$69.69/hour	*CostOut*

To calculate these prices in *CostOut*, we set the pricing year to 2019 and took the following (imaginary) steps to price each resource:

- **Program Licenses**. We found out this price by asking the Chief Technology Officer at the district office.
- **Classrooms**. We were unable to find a rental rate for a similar space, which is the preferred method of pricing a facility. Therefore, we searched for an elementary school classroom in *CostOut*, and chose "Elementary School Classroom," which has a 2015 price of $238,135. We used the recommended interest rate of 3.5% to amortize the cost of the classroom. For simplicity, we entered 1 for the quantity needed and 100% for the percentage of time the ingredient is used. This means that *CostOut* will give us the price of using a classroom 100 percent of the time for one year. In the column "Adj. price of ingredient," which is the column we will be using, you will see $13,897. (Note, if you enter quantity as 1 and 100% for the percentage needed, the estimated cost will equal "Cost.") The next step is to convert from a price per year to a price per hour. We divided $13,897 by 1440, the number of hours in a typical school year. We got $9.65 as an hour for an answer.

- **Teachers' monitoring time**. We started with the "elementary and middle school teacher" price in *CostOut*: $1,009/week (2016 price). We used the unit converted in *CostOut* to change the salary from weekly to hourly. For the fringe benefit rate, we used the CBCSE database, and chose the closest description for an elementary school teacher. The recommended fringe rate was 53.37% of salary. We entered 1 as the quantity used and 100% as the percentage of time used. We get a cost of $41.02. We converted the units to hours and recorded the quantity of this ingredient in hours, so no adjustment is necessary.
- **Teachers' training time**. We priced the teachers' monitoring and training time the same way.
- **Computers**. For this example, we used the price of a desktop computer available in *CostOut*, labelled "desktop computer." It has a 2018 price of $449.99. Because the price of a computer does not vary by region, it is also an option to look up the price of a computer online. We assumed that the computer would last five years and used the recommended discount rate of 3.5%. We entered 1 as the quantity used and 100% as the percentage of time the ingredient is used. *CostOut* gives us a price of $100.98. But this is the yearly price of a computer, and we measured computer use in hours. Much like teacher time, we divide $100.98 by 1440 hours, the number of hours in a typical school year. We got 7 cents as an hourly rate.
- **Administrator time**. We started with the price (converted to hours) of an "administrative services managers - elementary and secondary schools" in *CostOut*. It is a 2015 price of $42.40 an hour. For the fringe benefit rate, we relied on the CBCSE database, and chose the closest description for an elementary school teacher. The recommended fringe rate was 53.37% of salary. We entered 1 as the quantity used and 100% as the percentage of time the ingredient is used.

Note that in *CostOut*, you will see that prices listed in the database are from several different years. Setting the pricing year in *CostOut* will cause it to inflation-adjust any of the prices you select regardless of its year of origin.

Incremental costs vs. total costs of implementation

In *Summing Up*, "business as usual" was a standard math class and we showed costs of our program that were incremental to that class. Some programs, especially

after-school and summer programs, will not be replacing any alternative. For those programs, business as usual is no program at all, so you would price all ingredients, producing total implementation costs rather than incremental costs.

If a program takes place across multiple sites, business as usual might vary. If that is the case, you would need to compare the program to its multiple alternatives. If you think that the alternatives are similar, or if you have limited resources to examine every site, you might choose a sample of sites as a comparison. If you know that sites are likely to have different business as usual conditions, it is best to visit each site to properly identify and price the resources in use.

Key points

- Although cost analyses based in national prices have a different purpose from those based in local prices, both can be important to consumers of your research. National prices are more likely to generalize, while local prices are more likely to be relevant to your immediate stakeholders.
- Even if you choose local prices, using market prices (when different from actual prices) will help reduce unwanted "noise" from your cost estimate.
- Which ingredients of a program you will need to assign prices to will depend on the perspective(s) you choose for the cost analysis. Using the recommended societal perspective means you will need to place values on all ingredients, assigning a price for each one. Narrower perspectives require less pricing but may yield less useful data in the long run.
- *CostOut* provides national prices on a wide range of ingredients. It also allows you to adjust national prices to a local level, if you want to use local prices.

Checklist

- ☐ I am prepared to conduct parallel cost analyses using both national and local price data.
- ☐ If there is a constraint on my choice of prices, I have determined whether national or local prices make the most sense given the specific purpose and target audience of my cost analysis.

- ☐ I have assigned prices to each ingredient in my analysis using *CostOut* or other sources.
- ☐ I have ensured that units of both price and quantity align.

Additional resources

A useful online overview of pricing ingredients is provided by Robert Shand, as part of an IES-sponsored workshop by CBCSE, and is available here.

Step 5: Adjust costs for your context

Why is this important?

By this point, you have identified the ingredients and have assigned prices to them. You now have enough information for a basic cost estimate: quantity × price.

In Step 5, we focus on adjusting these costs to improve their accuracy. These include adjusting for the geographic location, amortizing capital costs, and discounting costs in the later years of a multi-year program. You may already have adjusted some costs in Step 4 but pay attention to the common adjustments below.

How to make the adjustments

CostOut prompts you to enter the relevant information needed for all adjustments discussed in this section and does the math for you. Using *CostOut* ensures you will not mistakenly overlook an adjustment, since it will prompt you for each one.

Another possibility is to calculate the adjustments yourself. You can consult the short descriptions below of the key adjustments, as an overview. For more information, including any formulas involved, you will want to consult other sources. One useful source is the manual provided within *CostOut* (available after free registration), even if you do not use the software to make the calculations.

The adjustments include–

- **Adjustments for geographic differences.** This is useful because the cost of ingredients will vary between locations–the cost of space, for instance, will likely be different in an urban versus a rural area. One reason to adjust for geographic differences is if you are unable to find local prices, you may want to adjust from a national price available on *CostOut*. The other reason is to make local prices more comparable. If you were comparing the cost of a program in an urban and rural area, you could adjust both prices to eliminate geography-related factors.
- **Adjustments for multiyear capital costs.** This process is known as amortization and refers to the process of spreading out the cost over an asset's useful life. For instance, if you buy a computer in year one of a three-year program, you will not want to count the full cost of that computer in just the

first year. Rather, you would estimate the useful life of a computer (say, five years) and divide the total cost by five. Then, you would include three of those years as the cost of the computer for the program, but only a third of this in year one. For more complicated amortizations that account for the interest forgone on the dollar amount invested in a capital item—especially facilities—we recommend using the *CostOut* tool.

- **Adjustments for ingredients used for multiple purposes.** Some ingredients are used part-time by a program. Take a teacher who works halftime within a program, or a computer only used two hours per day by that program. This step is simply about multiplying a resource's cost by the fraction of time it is used by the program. You may have already done this for some ingredients, such as if you already calculated the number of hours a teacher is involved in a program rather than listing their total annual hours.
- **Adjustments to reflect present value.** This adjustment is important when you are estimating costs for programs that last multiple years. Dollar amounts in later years are valued less than amounts in the base year due to the time value of money—for example, a dollar next year is worth less than a dollar today because you cannot invest it now and earn interest on it. (The same is true for benefits.) To take that time value of money into account, we adjust costs incurred after the base year by what is called a discount rate. Choosing a discount rate is one step in this process. *CostOut* recommends a discount rate of 3.5%. (It is acceptable for IES grantees to use this discount rate.) The process of doing that adjustment is called a present value calculation. Programs that only last a year can skip this adjustment.

Key points

- Once you have identified a program's ingredients and assigned prices to them, a series of adjustments to costs can improve their accuracy for your context.
- You can use *CostOut* to make the adjustments or do them on your own.

Checklist

☐ I have made contextual adjustments, such as geographic or present value adjustments, relevant to the program I am examining.

Phase 3: Create & use the cost estimate

Table 9. Building Blocks of a Cost Analysis: Phase 3

Phase 1			Phase 2	Phase 3
Ingredient	Quantity	Description	Price	Cost (Quantity x Price)
Ingredient 1	Quantity in units	Descriptive details	$	Quantity x Price
Ingredient 2	Quantity in units	Descriptive details	$	Quantity x Price

Overview

The final phase of a cost analysis is about putting together quantity and price information, including any adjustments, to create a cost estimate. It also involves conducting any necessary sensitivity analyses to test important assumptions in your calculations to see how they affect that estimate. Finally, you can use the cost estimate, as needed, as part of more advanced forms of economic evaluation.

What steps are involved?

1. Calculate costs
2. Conduct sensitivity analysis
3. Determine whether to use the results for further economic evaluation

Step 6: Calculate costs

Now that we have discussed how to identify and price ingredients, it is time to put everything together. The most common approach is to calculate a total cost and a cost per participant.

Why is this important?

This step is about creating your cost estimate. It is also about thinking about what decision makers need to know and ensuring that what you present fits their needs.

How to present your cost estimate

To calculate the cost of each ingredient, you will multiply the quantities you identified in Step 3 by the per-unit price you found in Step 4 or the adjusted price from Step 5. As part of Step 4, you matched the units of your ingredients to the units of your prices. Make sure to use those same matching units as you present total costs. You will need the costs of each ingredient to create the different summary cost metrics below. We have included a simplified example using the hypothetical *Summing Up* math program, to explain how each metric is calculated.

Table 10 shows how to calculate the total program costs for business as usual and *Summing Up*, as well as the incremental costs for *Summing Up*. For Total Cost, you add together the costs of every ingredient required for the business as usual condition and for *Summing Up*. For the Incremental Cost of *Summing Up*, you only add together the ingredients beyond what is needed for the business as usual (as described in Table 8). These incremental costs may be a whole new ingredient (for example, program licenses) or it may be the same ingredient but with a different amount used (for example, hours of computer time). In addition to determining the incremental cost of the intervention, adding up the costs in this way also allows you to–

- Understand how much you are spending on business as usual
- Determine the cost feasibility of the intervention based on both its total and incremental cost
- Determine the incremental cost of the intervention in two ways:
  - identify the costs of ingredients not used in the business as usual but used in the intervention

» identify the total costs of the business as usual and the total costs of the intervention and then subtract them (this is useful when there may be differences of opinion on which ingredients or which portions of them are incremental costs of the intervention).

Table 10. Calculating Total Costs and Incremental Costs for Summing Up

Phase 1	Phase 2	Phase 3				
		Business as Usual		*Summing Up*		
Ingredient	**Price (per unit)**	**Quantity**	**Total cost**	**Quantity**	**Total Cost**	**Incremental Cost**
Program licenses	$100.00/ea.	0	$0.00	100	$10,000.00	$10,000.00
Teacher classroom time	$41.02/hr.	450	$18,459.00	450	$18,459.00	$0.00
Teacher training time	$41.02/hr.	0	$0.00	20	$820.40	$820.40
Classrooms	$9.65/hr.	450	$4342.50	450	$4,342.50	$0.00
Computers	$0.07/hr.	25	$1.75	9000	$630.00	$628.25*
Administrator time	$69.49/hr.	0	$0.00	5	$347.45	$347.45
Costs			$22,803.25		$34,599.35	$11,796.10

* Calculated by subtracting the total cost of business as usual from the total cost of *Summing Up*.

Costs per participant

Once you have your total program costs, you can divide that estimate by the number of participants served by your program. This will give you a cost per participant, which is a useful metric when comparing costs between programs. In our example, 100 students received the program so the calculation would be–

Total costs ÷ number of participants = cost per participant

$11,796.10 ÷ 100 = $117.96

Costs by payer

If you took a societal perspective, which includes the costs of every ingredient of the program, one useful option is to create a table that assigns each cost to a stakeholder that pays for that ingredient–you might call them the "payer." (Note that some of those costs are opportunity costs.) Doing this gives decision makers a clear picture of who bears a share of the cost of an intervention.

Table 11. *Summing Up's* **cost totaled by payer**

Phase 1			Phase 2	Phase 3
Ingredient	**Quantity**	**Payer**	**Price (per unit)**	**Cost**
Program Licenses	100 licenses	District	$100.00	$10000.00
Teachers' monitoring time	0 hours*	School		
Teachers' training time	20 hours	School	$41.02	$820.40
Classrooms	0 hours*	School		
Computers	8,975 hours**	School	$0.07	$628.25
Administrator's time	5 hours	District	$69.49	$347.45
Total cost to school				$1448.65
Total cost to district				$10347.45
Total cost per participant to school				$14.48
Total cost per participant to district				$103.47

* These quantities are set to zero because they are the same as business as usual.

** 9,000 hours for Summing Up minus 25 hours for business as usual

Costs by year

For programs that last more than one year, you need to determine whether ingredient use, and the costs of those ingredients, will change from year to year. If they do not, you can estimate costs for one year only and report that these will be repeated in later years. If the costs vary across years, you should present costs for each year in addition to a total across all years.

Key points

- Create your cost estimate by bringing together the ingredients and quantities you identified in Phase 1 with the prices and adjustments you found in Phase 2.
- The most common approaches to presenting costs are total program cost and cost per participant.
- Your target audience will help determine how you prepare and present your cost estimate, but we recommend showing costs by ingredient category, by payer, and by year for multiyear programs.

Checklist

- ☐ I have presented costs in a way that fits the needs of my audience.
- ☐ If I have a multiyear program, I have considered whether the costs change year to year and presented the results accordingly.

Additional resources

Along with this starter toolkit, there is also a starter spreadsheet that will help you walk through your ingredients and record your total program costs. You can search for both it and this publication by number via the IES Publication Search feature.

For more information on how costs can be aggregated and reported to decision makers, see "Guiding the Development and Use of Cost-Effectiveness Analysis in Education" in the *Journal of Research on Educational Effectiveness* (2015) by Henry Levin and Clive Belfield.

Step 7: Conduct sensitivity analysis

Why is this important?

As you build your cost estimate in the steps above, you will have made certain assumptions about the quantity of your ingredients or their characteristics, the number of participants served, the number of years over which to spread costs and the related interest rate, and the discount rate for multiyear programs. Sensitivity analysis is about varying those assumptions to see if different choices would result in significant differences to your cost estimate. While not a requirement of conducting a cost analysis, sensitivity analysis can give more credibility to your estimates and is a best practice.

What kinds of sensitivity analysis are most useful?

The most useful types of sensitivity analysis when analyzing costs of educational programs involves testing out different values for prices or quantities of the key ingredients in your program and different numbers of participants being served.

Teacher time is the most common (and often the most expensive) ingredient in educational programs, so testing different assumptions about the amount and unit costs of labor may be particularly valuable. Those assumptions might involve salaries, teacher qualifications, or the number of teachers or hours of teacher time.

Other ingredients may call for exploration based on the nature of your program. For example, a technology-based program may have high capital costs, so you may want to test any assumptions related to the computers or other technology involved.

One bit of advice: Do not get hung up if you are not sure about the use or price of a specific ingredient. Even experienced cost analysts sometimes disagree on a standard approach, such as whether to price volunteers or whether to assign costs to a classroom that is not otherwise in use. The best advice is to 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.

An example

You may know that district administration will spend time overseeing your program, but not know how much of their time they will dedicate or exactly whose time it will be. To find a reasonable estimate for district staff monitoring time, you could develop a range of hours or salaries that seem reasonable or are based on similar programs. Doing that might result in high, medium, and low estimates of hours/salary. Your next step would be to calculate costs of administrator time using each of these three estimates to determine if choosing one or another of those options will result in important differences to your overall costs. If so, you will want to be transparent about that in your write-up.

Key points

- Sensitivity analysis helps you understand to what extent assumptions you have made impact the results of your cost analysis.
- Your sensitivity analysis should focus on key ingredients about which there is the greatest uncertainty regarding assumptions about quantity and price.
- Labor is often the biggest cost driver for educational programs, but this may not hold true for every program.

Checklist

☐ I have considered the biggest cost drivers of my program and whether they should be included in a sensitivity analysis.

Step 8: Determine whether to use the results for further economic evaluation

Depending on the questions you are trying to answer with your cost analysis, more steps to assess cost-feasibility or return on investment may be necessary.

If you are only interested in documenting the resources required to implement your program and their associated costs, Steps 1 - 7 in this guide will give you the information you need.

However, if you have other cost questions—or if IES requires you to do so—you will need to take further steps. Be sure to check the specific requirements of your grant by referencing the current Requests for Applications (which can be accessed from the IES funding page). We recommend reviewing the requirements and recommendations for your grant before taking Step 8, so you can pay closer attention to the type of economic evaluation that applies to your research.

Why is this important?

When a cost analysis is completed, it can provide useful information by itself about program costs. For example, some research questions that could be examined with cost analysis include—

- What resources are needed to replicate the ABC early intervention in math?
- What is the cost of the XYZ supplemental reading program?
- What part of the cost of the EFG college counseling intervention is borne by students?

However, cost analysis often serves as a building block for other forms of economic analysis. You can think of these additional economic evaluations as cost analysis "plus", where you apply all of the knowledge you have gained in Steps 1 - 7, and take additional steps. We explain major approaches below. It is important to underscore that each of them starts with a high-quality cost analysis.

Common types of economic evaluation

The three most common types of economic analysis in education research are described below. When selecting a method, keep in mind your grant's requirements

(listed in the Request for Applications). Also consider the advantages and disadvantages of each, described later in this section.

Cost-feasibility analysis (CFA)

This relatively simple approach takes the results of a cost analysis for a program and compares it to the resources available within, say, a school or district.

Cost-feasibility analysis is used to answer the question, "Can we afford this program?" For example, if a cost analysis shows that a certain program costs $100 per high school student, the principal could use that information to consider whether the school can afford to adopt the program.

Cost-effectiveness analysis (CEA)

This approach runs cost analyses on alternative programs, estimating the incremental costs of each program compared to the business as usual condition. It then divides each program's incremental costs by the effect size that each produces when compared to the common baseline condition, assuming that effects are measured the same way across programs.

This type of analysis 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?" For example, Program A costs $4.30 per student and produces an average gain above and beyond the baseline condition of 3.55 points on a national test. That is a cost-effectiveness ratio of $1.21 (or $1.21 for each point gain above and beyond the baseline condition on the national test). Program B, on the other hand, costs $20.85 per student and produces an average gain above and beyond the baseline condition on the same test of 7.23 points. That is a cost-effectiveness ratio of $2.88 (or $2.88 for each point gain above and beyond the baseline condition on the national test). These results show that Program A is more than twice as cost-effective, given that a lower ratio means less cost per unit of gain. You get an average of a .82 point per dollar spent on Program A, but only a .34-point gain for each dollar invested in Program B.

Cost-benefit analysis (CBA)

This approach, also called benefit-cost analysis, compares a program's societal costs to a monetized value of its benefits to assess whether the benefits exceed the costs. You can also do this for multiple programs, regardless of the outcome measure.

This type of analysis helps answer the question, "Should we invest in this program—or which among several programs should we invest in?" For example, the incremental costs of a dropout program compared to business as usual at Site A are $70,560 and it produces benefits (the number of graduates above and beyond business as usual times the financial benefits to society of an averted dropout) of $344,000. That is a benefit/cost ratio of $4.90. At Site B, the incremental program costs are $214,200 and the program produces benefits of $309,600. That is a benefit/cost ratio of $1.40. These results show that Program A produces approximately 3.5 times the economic benefits as Program B.

Table 12. Comparison of economic evaluation methods

	Cost-feasibility	Cost-effectiveness	Cost-benefit
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

	Cost-feasibility	Cost-effectiveness	Cost-benefit
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

Key points

- The economic evaluation method you choose should be based on your research needs, the needs of your audience, and any applicable IES requirements.

Checklist

- ☐ I am aware of both strengths and weaknesses of the economic evaluation methods I am using.
- ☐ I have referenced the current IES Requests for Applications and I know if there are requirements for a specific type of economic evaluation for my grant.

Additional Resources

Step 8 provided only a brief overview of a few additional forms of economic evaluation. There are a number of resources available for those who need to expand on their cost analysis. The Regional Education Labs provide a useful overview of the economic evaluation methods covered here, with additional examples. We also recommended referencing CBCSE's training videos, particularly, Clive Belfield's overview of CFA, CEA, and BCA.

While cost-feasibility is a straightforward method of comparing your cost analysis to your budget, CEA and BCA are more technical. The Abdul Latif Jameel Poverty Action Lab (J-PAL) provides useful information for those conducting cost-effectiveness analysis. For BCA, the Harvard T.H. Chan School of Public Health's Reference Case Guidelines for Benefit-Cost Analysis is a useful resource. While Harvard's guide is targeted to health research, many of the same concepts can be applied to BCA for education research.

Appendix A: Logic Model Template

Inputs	Activities	Outputs	Outcomes		
			Short term	Medium term	Long term

Appendix B: Master List of Additional Resources

From Introduction

The set of free online videos of an IES-funded workshop on cost analysis organized by the Center for Benefit-Cost Studies of Education (CBCSE) at Teachers College, Columbia University. They include–

- *The Ingredients Method Part 1 and Part 2* by A. Brooks Bowden
- *Pricing Ingredients* by Robert Shand

From STEP 1: Clarify the program model

- A blank logic model template is provided in Appendix A that you can print and use.
- A summary of additional resources on logic models created by the IES Regional Education Laboratories (RELs) is provided here
- To see other formats for logic models that you might want to consider, such as a flow chart, visit this REL resource provided here.

From STEP 3: Identify the quantity and quality of the program's key ingredients

- A sample set of interview questions is available from the CBCSE's CostOut resource. Free registration is required to access the Interview Protocol. Once you log in, you can find the interview protocol under the "Additional Resources" tab.
- For more information on induced costs, see "Evaluating educational interventions that induce service receipt: A case study application of *City Connects*" in the American Journal of Evaluation (2016) by A. Brooks Bowden and her co-authors.

From STEP 4: Identify or estimate a price for each ingredient

- A useful online overview of pricing ingredients is provided by Robert Shand, as part of an IES-sponsored workshop by CBCSE, and is available here.

From STEP 6: Calculate costs

- Along with this starter toolkit, there is also a starter spreadsheet that will help you walk through your ingredients and record your total program costs.
- For more information on how costs can be aggregated and reported to decision makers, see "Guiding the Development and Use of Cost-Effectiveness Analysis in Education" in the Journal of Research on Educational Effectiveness (2015) by Henry Levin and Clive Belfield.

From STEP 8: Determine whether to use the results for further economic evaluation

- Step 8 provided only a brief overview of a few additional forms of economic evaluation. There are a number of resources available for those who need to expand on their cost analysis. The Regional Education Labs provide a useful overview of the economic evaluation methods covered here, with additional examples. We also recommended referencing CBCSE's training videos, particularly, Clive Belfield's overview of CFA, CEA, and BCA.
- While cost-feasibility is a straightforward method of comparing your cost analysis to your budget, CEA and BCA are more technical. The Abdul Latif Jameel Poverty Action Lab (J-PAL) provides useful information for those conducting cost-effectiveness analysis. For BCA, the Harvard T.H. Chan School of Public Health's Reference Case Guidelines for Benefit-Cost Analysis is a useful resource. While Harvard's guide is targeted to health research, many of the same concepts can be applied to BCA for education research.

Appendix C: Credits

The content in this guide, originally created by Grant Thornton Public Sector LLC, integrates concepts and examples drawn heavily from several important sources of information on economic evaluation. These include–

- The book, *Economic Evaluation in Education* (third edition) by Henry Levin, Patrick McEwan, Clive Belfield, A. Brooks Bowden and Robert Shand, published by Sage in 2018.
- The CostOut online tool created by the Center for Benefit-Cost Studies of Education (CBCSE) at Teachers College, Columbia University, funded by IES and accessible at no cost.
- Videos of a workshop on economic evaluation provided by CBCSE in 2017 that are available online, especially the following modules:
  - Pricing Ingredients by Robert Shand
  - The Ingredients Method, Parts 1 and 2, by A. Brooks Bowden.
- Resources on the "Conducting Cost-Effectiveness Analysis" webpage from the Abdul Latif Jameel Poverty Action Lab (J-PAL).

The approach outlined in this starter kit is based in Henry M. Levin's work, which now spans more than 45 years. His "Ingredients Method," described in Guttentag & Struening's (1975) Handbook of Evaluation Research formalized now-foundational concepts in cost-effectiveness research in education.

The starter kit was also informed by interviews conducted for this project with leaders in the costing field related to education and more broadly. Particularly central to this work was input from Rebecca Maynard, A. Brooks Bowden of the Graduate School of Education at the University of Pennsylvania, Robert Shand of the School of Education at American University, and Fiona Hollands of Teachers College, Columbia University. Other interviewees provided valuable input and they are listed in Appendix D.

We are grateful for their generosity with their time and insights.

Appendix D: Interviewees in Developing This Starter Toolkit

A. Brooks Bowden, Graduate School of Education, University of Pennsylvania

Al McGartland, Environmental Protection Agency

Alexandra Resch, Mathematica

Anthony Pember, Grant Thornton Public Sector

Anu Dathan, Abdul Latif Jameel Poverty Action Lab (J-PAL)

Ashok Vadgama, Consortium for Advanced Management International (CAM-I)

Bill Dummer, Consortium for Advanced Management International (CAM-I) and Boeing

Burt Barnow, Trachtenberg School of Public Policy, George Washington University

Caitlin Tulloch, International Rescue Committee

Catherine Bradshaw, University of Virginia

Clive Belfield, Queens College, City University of New York

Derek Sandison, CAM-I and Sapling Corporation

Fiona Hollands, Teachers College, Columbia University

Henry Levin, CBCSE, Teachers College, Columbia University

Jaunelle Pratt-Williams, SRI International

Jon Kay, Education Endowment Foundation, United Kingdom

Kerry Krutilla, Indiana University, O'Neill School of Public and Environmental Affairs

Lynn Karoly, Pardee RAND Graduate School

Max Crowley, Pennsylvania State University, College of Health and Human Development

Radhika Bhula, Abdul Latif Jameel Poverty Action Lab (J-PAL)

Rebecca Maynard, Graduate School of Education, University of Pennsylvania

Robert Shand, American University, School of Education

Shiva Verma, Grant Thornton Public Sector

Stephanie Riegg Cellini, Trachtenberg School of Public Policy, George Washington University