



# Costing Out an Adequate Education

## A Primer

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### Introduction

In an ideal world, school funding formula targets would be set according to perfectly accurate measures of the cost of achieving desired outcomes such as student achievement and high school graduation. In other words, if school funding policies were perfect, states would know precisely, based on actual data, how much money every school district would need to meet the educational adequacy goals set by the state. This adequacy-based cost information would account for differences across settings both in the price of resources (e.g., teacher salaries) and in student populations served (e.g., children in poverty) as well as differences in other factors (e.g., district size) that may affect the per pupil costs of achieving common outcome goals. In reality, states lack precise information on the funding needed to achieve educational targets, requiring costs to be estimated in some fashion. The purpose of this brief is to provide an overview of methods for measuring costs that are used to guide the development of state school finance formulas.<sup>1</sup>

Costing out approaches applied to elementary and secondary education have typically fallen into two categories:

- **Input-oriented analyses** identify the staffing, materials, supplies and equipment, physical space, and other elements required to provide specific educational programs and services capable of producing the desired educational outcomes for identified student populations being served in various settings.
- **Outcome-oriented analyses** start with student outcomes that are generated by the programs and services offered by existing schools and districts. This type of analysis examines the relationship between spending on these programs and services and specific outcomes, while taking into account different student populations and the characteristics of the settings in which they are being served.<sup>2</sup>

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<sup>1</sup> Additional reports that describe methods used to cost out educational adequacy can be found in Chambers and Levin (2009) and Baker and Levin (2014).

<sup>2</sup> Note that the approach can also be used to identify schools and districts with relatively high outcomes given their existing characteristics and spending levels (i.e., those that are more efficient). After identifying schools and districts that are more efficient, deeper investigation can be conducted to explore the programmatic decisions and patterns of resource allocation associated with their success.

The primary methodological distinction here is whether one starts by specifying inputs or by designating specific outcome targets. One approach works forward, starting with the inputs necessary to achieve the desired outcome and measures their associated costs; the other, backward, starting with the outcomes achieved and directly linking these outcomes to spending on the inputs used. Regardless, any measure of cost must consider the outcomes standard to be achieved (Duncombe & Yinger, 1991). Ideally, the researcher would use both in concert, providing iterative feedback to one another.

## Input-Oriented Cost Analysis

Setting aside for the moment the often proprietary labeling of the approaches used by costing-out studies, there really exists just one basic method for input-oriented analysis, which since the late 1970s has been given two names: the Ingredients Method and Resource Cost Modeling (RCM) (Chambers, 1999, 2001; Chambers & Hartman, 1981; Levin, 1983; Levin & McEwan, 2001; Levin, McEwan, Belfield, Bowden, & Shand, 2018). The latter term (RCM) is used to denote input-oriented analysis going forward. RCM involves three basic steps:

1. Identifying the various resources, or “ingredients,” necessary to implement a set of educational programs and services for an entire school, district, or statewide system
2. Determining the input price for these ingredients or resources (considering competitive wages, other market prices, etc.)
3. Combining the necessary resource quantities with their corresponding prices to calculate a total cost estimate ( $\text{Cost} = \text{Resource Quantities} \times \text{Price}$ )

RCM was applied in both Illinois and Alaska in the early 1980s to determine the statewide costs of providing the desired (implicitly “adequate”) level of programs and services (Chambers & Parish, 1982, 1984) long before it was first used in the context of school finance adequacy litigation in Wyoming in 1997 (Guthrie et al., 1997).

A distinction between the input-oriented studies conducted prior to the modern emphasis on outcome standards and assessments is that they focused on tallying the resource needs of education systems designed to provide a given set of curricular requirements, programs, and services intended to be available to all children. Modern analyses instead begin with goals—or the outcomes the system is intended to achieve—and then require consultants or expert panels to identify the inputs needed to achieve these goals. Nonetheless, the empirical method is still one of tallying inputs, attaching prices, and summing costs.

RCM can be used to evaluate

- resources currently allocated to actual programs and services that are intended to deliver or currently result in a specific set of outcomes,
- resources needed for providing specific programs and services that are not currently being provided, and
- resources hypothetically needed to achieve some specific set of outcome goals—as defined by both the types of outcomes and their desired levels at which they are achieved.

When identifying the cost of actual resources deployed in existing programs, one must thoroughly quantify these inputs, determine their prices, and sum their costs. If seeking findings that are generalizable, one must explore how input prices (not only teacher and other staff salaries but also the prices of nonpersonnel items) vary across the sites where the programs and services are implemented and whether the needs of the students being served and other contextual characteristics (economies of scale, grade ranges) affect how inputs are organized in ways consequential to cost estimates.<sup>3</sup>

When identifying the cost of achieving hypothetical outcome goals, several approaches can be taken—including drawing upon the judgment of panels of expert educators or relying on research literature identified by consultants—to hypothesize the resource requirements for achieving desired outcomes with specific populations of children educated in particular settings. Specifically, the Professional Judgment (PJ) and Evidence-Based (EB) approaches have historically competed with one another as preferred methods for identifying and costing out appropriate combinations of resources or ingredients that will deliver the outcome goals.

As mentioned, PJ involves convening focus groups to propose the resource quantities needed to achieve specific outcomes at prototypical schools that replicate the contexts of those found across the state. Specifically, the prototype schools are defined by varying levels of school needs, scale of operations (enrollment size), and geographic setting (degree of rurality, population density, etc.) that typically occur in a state. In contrast, the EB approach involves the compilation of published research studies on existing school interventions that have proved effective at producing specific outcomes and deriving from these various studies both the resources used and their associated costs. These interventions are chosen as models because they are deemed adequate in their particular school and district contexts (needs of students served, scale of operations, geographic setting), although the generalizability of the combined findings of research studies performed in a variety of contexts to schools/districts in a given state that is different from where some or all of studies were performed is unknown.

Many studies have used PJ and EB as mutually exclusive approaches. Ideally, one would want to ensure that the expert educators selected to serve on PJ panels were well versed in the latest research that the EB approach draws upon. To this end, some well-designed input-oriented resource cost analyses have engaged expert educators in a context-specific PJ process that also makes available sufficient information in the form of research briefs containing research evidence on best practice with respect to educational programming and resource allocation that would be used in an EB approach (Chambers, Levin, Delancey, & Manship, 2008; Levin et al., 2018). However, even under the best “hybrid” application of the two input-oriented approaches, the resulting cost estimates are only a hypothesis of the true resource requirements necessary to produce the desired outcome goals.

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<sup>3</sup> Note, mainstream education finance literature refers to these types of elements that drive educational costs but are outside of the control of schools and districts as *cost factors*.

## Outcome-Oriented Cost Analysis

The primary tool of outcome-oriented cost analysis is the Education Cost Model (ECM).<sup>4</sup> ECMs focus on schools or districts to evaluate the relationship between aggregate per pupil spending and student outcomes given the contextual conditions or cost factors under which the outcomes are produced. As mentioned previously, salient cost factors include scale of operations (the existence of diseconomies of scale where unit production costs are higher for very small organizational units), geographic variation in the price of resources, and the characteristics of the student populations served with respect to needs, which may require greater or fewer resources to achieve common outcome goals. In addition, rigorous ECMs will take into account the fact that there may be investments in outcomes that are either not measured or included in the model. A thorough ECM, therefore, considers spending as a function of (a) measured outcomes, (b) student population characteristics, (c) characteristics of the educational setting (economies of scale, population sparsity, etc.), (d) regional variation in the prices of inputs (such as teacher wages), and (e) factors affecting spending that are unassociated with outcomes.<sup>5</sup>

Identifying statistical relationships between spending and outcomes under varied conditions requires high-quality measures of desired outcomes, spending, and cost factors as well as enough schools or districts that exhibit sufficient variation in the conditions under which they operate. Much can be learned from the variation that exists across districts and schools regarding the production of student outcomes, including differences in both aggregate per pupil spending and the specific programs and services delivered.

This last point—how funding is used to deliver services—is particularly salient in the context of costing out an adequate education. Cost models have often been used in educational adequacy analysis as a tool that simply projects the required overall spending targets associated with certain educational outcomes. In contrast to the input-oriented approaches described previously, the outcome-oriented ECM approach provides no direct insights into how resources (staffing, programs and services, etc.) supported by the estimated spending levels that produce adequate outcome levels are organized within schools and districts. This is an unfortunate, reductionist use of the method.

However, as an alternative to limiting the use of ECM as a “black box” approach, the models can be useful for exploring how otherwise similar schools or districts achieve different outcomes with the same level of spending or the same outcomes with different levels of spending. That is, the ECM can reveal differences across schools and districts in terms of their relative *efficiency*. Once schools or districts that are more efficient have been identified, patterns of resource allocation and use of specific programming can be investigated as a means to better understand best practices in terms of the use of specific inputs. In this way, one can leverage the strengths of both the input- and outcome-oriented approaches.

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<sup>4</sup> For a review of cost model analyses, see Duncombe and Yinger (2011) and Gronberg, Jansen, and Taylor (2011).

<sup>5</sup> The American Institutes for Research (AIR) study team has dedicated a brief to a more in-depth exposition of the ECMs.

## Acknowledging Methodological Strengths and Weaknesses

Although all cost estimation methods have strengths and weaknesses, some weaknesses represent critical flaws. For example, where the objective is to determine comprehensive, institutional costs of meeting specific outcome goals across varied contexts, the EB approach used in isolation may fall short. Research evidence can be useful for identifying specific interventions and the resource inputs that may yield positive outcomes; however, it rarely addresses the organization of whole institutions, which is the question of interest for policymakers. Evidence on an array of interventions cobbled together does not constitute evidence on an entire institution (inclusive of administrative structures, etc.).<sup>6</sup> Similarly, assuming that the outcome impacts of stemming from a variety of individual interventions would be replicated when all were simultaneously implemented is highly problematic. In addition, the applicability of the results of a given EB model to contexts different from those in which the evidence was gathered is questionable. Nevertheless, depending on the rigor of the research studies chosen, the EB approach provides empirical linkages between the types of interventions from which resource costs are derived and student outcomes.

The greatest shortcoming of the arguably more robust RCM process used in the PJ approach is that the link between resources and outcomes is purely hypothetical (i.e., based on the opinion of expert educators as opposed to being empirically observed). In addition, there is no guarantee that the planned programs and associated collections of resources necessary to support them represent the most efficient manner in which to produce the desired student outcomes. Specifically, the programs and resources the expert educators suggest are needed to produce the desired student outcomes may be more than are actually necessary, leading to costs figures that are too high. Finally, PJ fails to utilize existing data to examine the link between resources and outcomes across the full spectrum of contexts. It is highly impractical to use the RCM process to gather data on adequate resources for prototypical schools across all of the contexts in a state; the best that can be done is to develop programs and calculate corresponding costs for a representative sample of the school contexts that exist. Therefore, the applicability of the calculated costs resulting from the PJ approach can be limited and will tend to be less generalizable the smaller the number of contexts that are costed out and the less representative they are of the population of schools that exist across the state.

The greatest weaknesses of the ECM approach are that (a) predictions may understate true costs of comprehensive adequacy where outcome measures included in the model are too narrowly defined, and (b) the results are not able to shed light on the types of programs and resource configurations that were used to produce student outcomes. However, a key strength of the ECM approach lies in the fact that it does not rely on a hypothetical relationship between resources and outcomes as does PJ. Instead, ECM makes use of the empirical relationship between spending, outcomes, and cost factors. Furthermore, because it includes data on *all* schools or districts in a state, the results are necessarily representative of all contexts and do not suffer the lack of generalizability of the other two approaches (especially EB).<sup>7</sup>

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<sup>6</sup> Overly confident efforts to suggest otherwise have been met with sharp ridicule. See Hanushek (2007).

<sup>7</sup> Given the various strengths and weaknesses of the three approaches, the authors feel that that future research should explore innovative ways to combine the approaches in an effort to leverage their strengths and minimize their weaknesses.

On a final note, it is important to point out a weakness that all costing-out approaches have. Specifically, when desired goals far exceed those presently achieved, extrapolations may be suspect. Stressing the latter point, all costing-out approaches are most useful where there exist institutions (schools and districts) in the sample or population that actually perform to expectations and/or meet desired standards. That is, costing out an adequate education is most reliable when the range of variation among existing institutions includes those that are sufficiently resourced, successful, and efficient as well as those that are not; this reduces the need to extrapolate well beyond observed conditions.

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