MEASURING EDUCATIONAL ADEQUACY IN PUBLIC SCHOOLS

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INTRODUCTION

The goal of this report is to provide a concise, thorough, and balanced review of methodologies employed in state studies for measuring the cost of an adequate public elementary and secondary education. We seek to relate how the structure, methodologies,

and experiences of these studies might help guide Texas decision makers as they seek to construct the best school finance plan for the State of Texas.

WHAT IS AN ADEQUACY STUDY?

For purposes of this report, we define an "adequacy study" as a publicly-reported attempt by state officials, special interest groups, or independent researchers to apply an empirical methodology to estimate the costs of providing an adequate public education at the elementary and/or secondary level.

TYPES OF ADEQUACY STUDIES

Three major categories of adequacy studies presently dominate the landscape. (Studies reviewed are listed in appendix A.) Those categories include:

Average Expenditure Studies

Prior to the 1990s, notions of educational adequacy were often guided by the average or median expenditures of districts in the prior year. A common presumption was that median spending is adequate, and that states should strive to bring the lower half of districts up to the median.[1]

With increased prevalence of state standards and assessments, consultants and policymakers in the early 1990s turned their attention to the average expenditures of districts meeting a prescribed set of outcome standards, rather than the simple average or median of all districts. This approach was coined the "Successful Schools Model."

Successful Schools studies use outcome data on measures such as attendance, dropout rates, and student test scores to identify that set of schools or districts in a state that meet a chosen standard of success. (Outcomes used in several states' Successful Schools studies are included in appendix B.) Then the average of the expenditures of those schools or districts is considered adequate (on the assumption that some schools in the state are able to be successful with that level of funding). "Modified Successful Schools" analyses include some consideration of how schools use their resources. This is done in either of two ways. In most cases, analysts may use data on how schools use their resources to identify and exclude peculiar, or outlier, schools or districts from the Successful Schools sample. Alternatively,

one might seek patterns in resource allocation to identify those schools that allocate resources in such a way as to produce particularly high outcomes, with particularly low expenditures. [2]

Resource Cost Studies

The "Resource Cost Model" (RCM) is a method that has been used extensively for measuring the costs of educational services.[3] In general, RCM is a method for measuring costs of services, existing or hypothetical, adequate or not. The RCM methodology typically involves three steps: (1) identifying and/or measuring the resources (people, space, time, and stuff) used in providing a particular set of services; (2) estimating resource prices and price variations from school to school or district to district; and (3) tabulating total costs of service delivery by totaling the resource quantities (resource intensity) and their prices. RCM has been used for calculating the cost of providing adequate educational services since the early 1980s (Chambers, 1982; 1984).

Two relatively new (circa 1997) variants of RCM have been specifically tailored to measure the costs of an "adequate" education—"Professional Judgment"-driven RCM and "Evidence-Based" RCM. The difference between them lies in the strategy for identifying the resources required to provide an adequate education. In Professional Judgment studies, focus groups of educators and policymakers are typically convened to prescribe the "basket of educational goods and services" required for providing an adequate education. In Evidence-Based studies, resource needs are derived from "proven effective" school reform models. Early Evidence-Based studies focused on Comprehensive School Reform (CSR) models, such as Robert Slavin's "Roots and Wings/Success for All" model.[4] More recently, Evidence-Based analyses have strived to integrate a variety of "proven effective" input strategies such as class size reduction, specific interventions for special student populations, and comprehensive school reform models, rather than relying on a single reform model.

Because Evidence-Based strategies have been recently broadened to include and blend a variety of reform strategies, we adopt the phrase "Evidence-Based" rather than "cost of comprehensive school reforms" to describe the approach. We note, however, that this may lead to a blurred distinction between Evidence-Based and Professional Judgment models. One might assume, for example, that a panel of well-informed professionals would prescribe

inputs for schools based at least partly on the professionals' knowledge of research literature on effective reform strategies. The subtle distinction between this and Evidence-Based analysis is that Evidence-Based analysis requires an *empirical* research basis for recommended resource configurations. Further, in Evidence-Based analysis, the recommendation is provided by consultants conducting the cost study and does not typically include panels of experts from schools and districts in the state.

Statistical Modeling Studies

Less common among recent analyses of educational adequacy are statistical methods that may be used either to estimate (a) the quantities and qualities of educational resources associated with higher or improved educational outcomes or (b) the costs associated with achieving a specific set of outcomes in different districts serving different student populations. The first of these methods is known as the education "Production Function" and the second of these methods is known as the education "Cost Function." The two are highly interconnected and—like Successful Schools analysis—require policymakers to establish explicit, measurable outcome goals.

Education Production Function analysis can be used to determine which quantities and qualities of educational resources are most strongly and positively associated with a designated set of student outcomes. For example, is it better for a school to have more teachers or fewer teachers with stronger academic preparation at the same total cost? Further, education Production Function analysis can be used to determine whether different resource quantities and qualities are more or less effective in districts serving different types of students (economically disadvantaged, English language learners) or in different types of districts (large urban, small remote rural).

Cost Function analyses, like Production Function analyses, use statistical equations. In Cost Function analysis, the goal is to estimate the cost of achieving a desired set of educational outcomes and further to estimate how this cost differs in districts with certain characteristics, serving students with certain characteristics. A cost function that has been estimated with existing data on district spending levels and outcomes, and including data on district and student characteristics, can be used for predicting the average cost of achieving a desired level of outcomes in a district of average characteristics serving a student population

of average characteristics. Further, the Cost Function can be used to generate a cost index for each district that indicates the relative cost of producing the desired outcomes in each district. For example, it would likely be found that per pupil costs of achieving target outcomes are higher than average in small, rural districts, that costs are higher in districts with high percentages of economically disadvantaged and limited English proficient children, and that costs are higher where competitive wages for teachers are higher.

The Cost Function is an extension of the Production Function where the goal is to estimate directly, in a single model, the costs of achieving desired outcomes, while with a Production Function, the goal is to identify those inputs that produce desirable outcomes and to subsequently estimate the cost of those inputs. To date, outcome measures used in Cost Function studies have been narrowly specified, including primarily measures of student achievement in core subject areas (see appendix B2).

PLACING THE METHODS ON A CONTINUUM

Adequacy study methods may be generally characterized as "resource-oriented" or "performance-oriented." This characterization is in part a function of the type of data incorporated into the analyses. Resource-oriented analyses focus specifically on categories of educational resource inputs, including numbers of teachers, classrooms of particular dimensions, or computers and software required for implementing specific programs. Again, most such studies prescribe resources toward the achievement of specifically identified sets of performance outcomes. Performance-oriented studies, on the other hand, focus on measures of student performance outcomes of interest to policymakers, and use either tabulation methods (Successful Schools) or statistical models (Cost Function) to estimate the costs of achieving those performance standards.

Table 1 summarizes the previously discussed models and their variants on a continuum from resource-oriented (*top*) to performance-oriented (*bottom*) analysis.

TABLE 1 TYPES OF ADEQUACY ANALYSES

		Model	Research Question	Methodology
Resource Oriented		*Professional Judgment*	What is the total cost of providing students with the "basket of educational goods and services" determined to be "adequate" [for achieving specified outcomes] by a panel of educational experts?	Tabulation of resource quanties (and qualities) and calculation of total cost of purchasing those resources at competitive market prices
		Evidence-Based Professional Judgment	Is present funding adequate (and/or how much more is needed) for high poverty and low performing schools to implement *Roots and Wings/Success for All* or other comprehensive school reforms or combinations of proven effective strategies (class size reduction)?	Tabulation of resource quantities required for implementing *specific reform strategies* in high poverty schools
	Blended Methods	*Modified Successful Schools*	What resource quantities and qualities exist in successful schools? How much would it cost for other schools to have similar resources or reorganize their resources to be more similar?	Tabulation of resource quantities and qualities of successful schools and estimation of the costs of having similar resources in other schools
Performance Oriented		*Production Function*	Given student population and district characteristics, what resource quantities and qualities are positively associated with student outcomes?	Statistical modeling to determine the relationship between districts' resource quantities and qualities and outcomes produced by those districts, controlling for district and student characteristics, then using market prices to estimate the cost of the optimal input mix
		Cost Function	What is the cost of achieving a target set of outcomes, in a district of average characteristics serving a population of average characteristics? How does the cost of achieving that set of outcomes vary by district and student characteristics?	Statistical modeling to determine the relationship between district spending and student outcomes, while accounting for factors within and outside the control of local officials (economies of scale, competitive wages, student needs); simulation using cost function to estimate the "cost of achieving specified outcomes" in districts with varied characteristics, serving varied student populations
		Successful Schools	How much do schools that meet specific outcome criteria presently spend?	Calculation of the weighted (by enrollment) average spending per pupil of districts meeting outcome criteria

Professional Judgment analyses where consideration is given only to identifying resources required for providing particular educational programs, regardless of expected or desired outcomes, might be considered *pure resource-oriented* analyses. Such analyses would be unlikely in the present policy context. Most recent applications of Professional Judgment analysis have included at least some discussion of the types of performance outcomes that should result from providing a given set of inputs, most often drawing on outcomes specified

in state standards and accountability systems. Often, resource selection is guided by state curricular standards promulgated by legislatures or boards of education on the assumption that particular curricular offerings (core content standards) will lead to desired performance outcomes (often as measured by standardized assessments on core content — e.g. math, reading). Evidence-Based analyses are resource-oriented similar to Professional Judgment methods in which professionals are guided by the need to meet certain outcome standards. As with Professional Judgment analyses, outcome data do not directly influence Evidence-Based analyses.

At the other end of the continuum are education Cost Function and Successful Schools analyses, where performance outcome data drive the estimation of costs. These methods attempt to estimate directly the costs or expenditures associated with schools and/or districts that achieve specific educational outcomes. Cost Function analyses differ substantially from Successful Schools analyses in that they involve much more empirically rigorous attempts to not only determine what levels of present spending are associated, on average, with a specific set of outcomes, but also how those levels of spending may vary for districts of different characteristics serving different student populations.

Toward the middle of the continuum are hybrid methods like Modified Successful Schools[5] that involve analysis of both student outcomes and the expenditures required to achieve those outcomes and of how schools and districts internally organize their resources. Production Function analysis, like Cost Function analysis, provides a more empirically rigorous alternative to observation methods like Modified Successful Schools. As noted previously, Production Function analysis might be used to statistically estimate relationships between schooling resources and student outcomes, rather than attempting to discern, by observation, whether there appear to be patterns of similarity in resource use by schools or districts achieving desired outcomes.

RECONCILING THE VARIOUS APPROACHES

Since the various methodologies are aimed at the same target—identifying the costs of an adequate education—they should lead to similar predictions about costs, all other things being equal. Ideally, well-informed professionals advising districts on how to meet a specific performance goal would prescribe the same mix of resources as would economists optimizing an educational production function, and that mix, when evaluated at market

prices, would cost exactly as much as predicted by a cost function.

Different cost estimates arise when all other things are not equal. The scope of information required to conduct the analysis provides insight into the potential for divergent cost estimates. Table 2 summarizes the data demands of the various methods. As the table illustrates, the various methods have very different data needs.

TABLE 2 DATA DEMANDS OF VARIOUS MODELS

	Model	Outcomes	Input Quantities	Input Prices	Expenditures
Resource Oriented	*Professional Judgment*		X	X	
	Evidence Based Professional Judgment		X	X	
Performance Oriented	*Modified Successful Schools*	X	X	X	X
	Production Function	X	X	X	
	Successful Schools	X			X
	Cost Function	X		X	X

For obvious reasons, all of the performance-oriented methods require some measure of student outcomes to be able to calculate costs. Professional Judgment and Evidence-Based approaches have no such requirement. However, in Professional Judgment analysis, researchers might ask professionals to keep a particular performance goal in mind when forming judgments. Further, researchers may evaluate and share with professionals data on current performance of schools and districts at current resource levels. Proponents of Evidence-Based analysis posit that reform strategies that have produced positive results elsewhere on standardized outcome measures are most likely to achieve the positive outcomes in the state in question on that state's desired outcome measures. As such, Evidence-Based analysis requires no direct measure of outcomes within the state in question.

All of the methods, with the exception of the Successful Schools approach, require information about input prices, particularly educator wages. Ideally, such information represents price variations outside of school district control. Isolating uncontrollable variations in input prices can be a major analytic challenge for any adequacy studies. We discuss issues of input price estimation and variation later in this report and in related reports in this series.

Whereas all of the other methodologies require information on input quantities, Cost Function and Successful Schools analyses require information on total expenditures. (Modified Successful Schools analysis may require both.) As such, Cost Function analysis and Successful Schools analysis tend to require less detailed financial data than other

approaches. The obvious trade-off is that these analytic techniques also offer less information about the optimal level of input quantities.

WHAT METHODOLOGIES HAVE BEEN USED IN OTHER STATES?

Using the methodological classification presented in the introduction to this report and taking into consideration their origins, existing studies may be summarized as follows:

State Sponsored and/or Conducted Studies

- Six states have contracted external consultants to perform or provide guidance for state agencies to perform Successful Schools analyses. [6]

- In three states (Ohio, New Hampshire, and Illinois) consultants used additional analyses of district resource allocation to narrow the sample of successful schools. In Ohio, they also used statistical analysis to determine costs associated with student needs and geographic variations in prices.

- Five states have contracted external consultants to perform Professional Judgment analyses. Two of those states (Maryland and Kansas) had consultants conduct Successful Schools analyses along side Professional Judgment analysis.[7]

- Four states have or are performing their own Professional Judgment analyses. In all but Illinois, the analysis does not involve a one-time adequacy study, but rather involves developing a Quality Education Model (QEM) and tying funding to the costs of implementing that model as it evolves over time.[8]

- Three states have contracted external consultants to provide cost estimates based on comprehensive school reforms (Evidence-Based analysis). Kentucky subsequently requested that the same consultants perform Professional Judgment analysis as well.[9]

- New York, under its ongoing "Education Finance Research Consortium,"[10] has provided support for education Cost Function analysis.

Special Interest Group Sponsored Studies

- Special interest groups in nine states have contracted external consultants to perform Professional Judgment analyses.[11]

- In Missouri and Colorado, special interest groups requested that consultants perform both Successful Schools and Professional Judgment analysis.

In general, there appears to be a shift in interest among state policymakers away from Successful Schools analyses and toward Professional Judgment and Evidence-Based analyses.

- Between 1993 and 2000, at least 10 separate cost analyses were performed in eight states, including both government and special interest group sponsored studies.
    - Five of the analyses were Successful Schools (or Modified Successful Schools) analyses.[12]
    - Four were Professional Judgment analyses.[13]
    - One was Evidence-Based.[14]

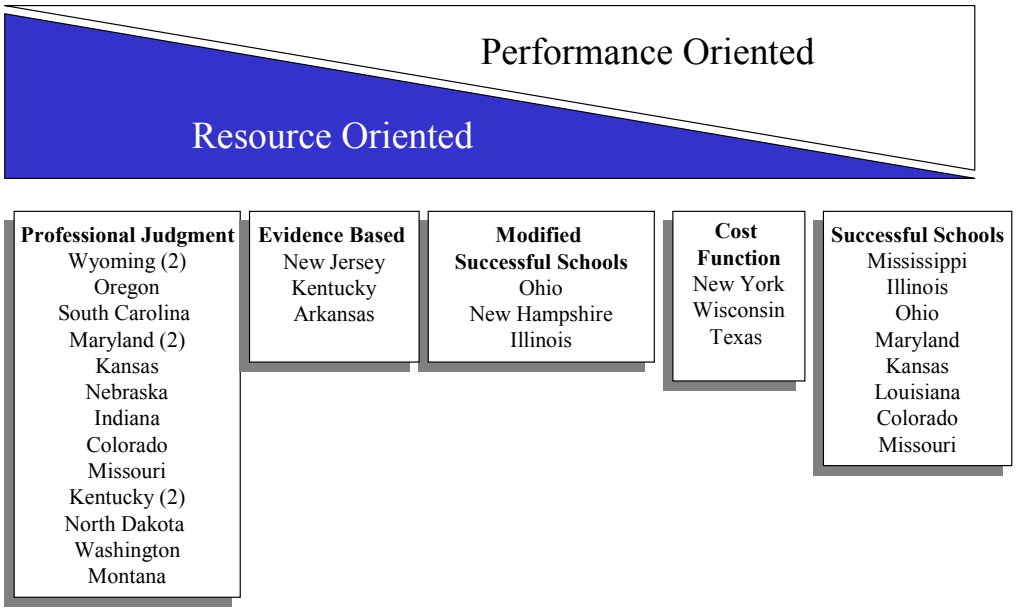
- Between 2001 and 2003, 18 separate cost analyses were performed in 11 states, including both government and special interest group sponsored studies.
    - Six of the analyses were Successful Schools (or Modified Successful Schools) analyses, but four of those six studies also included Professional Judgment analyses.[15]
    - Eleven studies in nine states were Professional Judgment analyses.[16] Of these 11, seven studies were sponsored by special interest groups.
    - Two studies were Evidence-Based.[17]

In most cases, special interest groups have sponsored Professional Judgment analyses. Special interests in Colorado and Missouri supported the two-method approach.

Figure 1 summarizes the distribution of adequacy studies reviewed in this report, across the resource-oriented to performance-oriented continuum of methods.

FIGURE 1 CONTINUUM OF EDUCATION COST ANALYSIS METHODS,

ADEQUACY STUDIES 1993-2003



HOW DO THE RESULTS VARY?

The growing track record on adequacy analysis provides us with increased opportunities to compare the results of adequacy studies and assess whether certain patterns exist. Table 3 presents a comparative look, with adjusted dollar figures, at selected available state studies.[18] As a general rule, the table is restricted to publicly available studies sponsored by states or interest groups. However, we also include Jennifer Imazeki and Andrew Reschovsky's cost-function analyses for Texas and Wisconsin.[19]

TABLE 3 ADEQUACY ANALYSIS FINDINGS
RANKED LOW TO HIGH, CONSTANT 2000 DOLLARS, REGIONALLY COST ADJUSTED

State	Method	Study Release	Data/ Cost Year	Basic Cost (Current Dollars)		Basic Cost (2000 Dollars)	State Mean NCES GCEI	Adjusted Cost (2000 Dollars)
Mississippi	SS	1993	1992	$ 2,614		$3,203	0.87	$ 3,675
Illinois (a)	MSS	2001	2000	$ 4,470	1	$4,470	1.04	$ 4,309
Ohio	SS	1997	1996	$ 3,930		$4,304	0.99	$ 4,347
Colorado	SS	2003	2001	$ 4,654		$4,514	0.99	$ 4,564
Ohio (low)	SS	1999	1999	$ 4,446		$4,574	0.99	$ 4,619
Kansas	SS	2001	2000	$ 4,547		$4,547	0.90	$ 5,059
Illinois (b)	MSS	2001	2000	$ 5,270	1	$5,270	1.04	$ 5,080
Missouri	SS	2003	2002	$ 5,664		$5,389	0.95	$ 5,655
Oregon	PJ	2000	2002	$ 5,762		$5,482	0.97	$ 5,668
Ohio (high)	SS	1999	1999	$ 5,560		$5,720	0.99	$ 5,777
Maryland	SS	2001	2000	$ 5,969		$5,969	1.02	$ 5,853
Nebraska	PJ	2003	2002	$ 5,845		$5,561	0.89	$ 6,248
Texas (mean)	CF	2001	1997	$ 5,610	2	$5,974	0.95	$ 6,321
Montana	PJ	2003	2002	$ 6,048		$5,755	0.91	$ 6,336
Kentucky	EV	2003	2003	$ 6,130		$5,740	0.90	$ 6,408
North Dakota	PJ	2003	2002	$ 6,005		$5,714	0.89	$ 6,420
Kansas	PJ	2001	2000	$ 5,811		$5,811	0.90	$ 6,466
Maryland	PJ	2001	2000	$ 6,612		$6,612	1.02	$ 6,484
Colorado	PJ	2003	2001	$ 6,815		$6,610	0.99	$ 6,683
Indiana	PJ	2002	2002	$ 7,094		$6,750	0.94	$ 7,215
Washington	PJ	2003	2002	$ 7,992		$7,604	1.04	$ 7,316
New York (140)	CF	2002	2000	$ 8,423	3	$8,423	1.13	$ 7,471
Wisconsin (mean)	CF	1998	1995	$ 6,372	2	$7,168	0.96	$ 7,485
New York (150)	CF	2002	2000	$ 8,652	3	$8,652	1.13	$ 7,675
Missouri	PJ	2003	2002	$ 7,832		$7,452	0.95	$ 7,819
New York (160)	CF	2002	2000	$ 9,032	3	$9,032	1.13	$ 8,012
Wisconsin	PJ	2002	2002	$ 8,730		$8,306	0.96	$ 8,674

SS= Successful Schools
MSS = Modified Successful Schools (Sample limited by spending patterns)
PJ= Professional Judgment
EV= Evidence-Based
CF=Cost Function

1. Illinois (a) Low cost of 80% standard with low poverty. Illinois (b) Low cost of 100% standard with low poverty.
2. Cost of achieving average outcomes in district of average characteristics.
3. Cost of achieving the designated performance standard for *upstate suburbs* presently below the specified standard. Average performance of upstate suburbs below the 140 standard was 130, below the 150 standard was 146 and below the 160 standard, was 149.

When constructing table 3, we attempted to make the findings as comparable as was feasible. We adjusted dollar figures for year-to-year and state-to-state differences in the price level using the Consumer Price Index and the National Center for Education Statistics' geographic Cost of Education Index, respectively.

More important, we focused on basic costs associated with a scale efficient (optimally-sized) school district. We excluded wherever possible any incremental cost

associated with special student populations. In all recent Professional Judgment studies, basic costs were easily identifiable and most often listed as the total of school and district level costs (before student need adjustments) of a large prototype district. For the Evidence-Based Kentucky study, it was not possible to strip away the student need adjustments, so the cost figure in table 3 represents the average cost for the least-cost 10 percent of districts. As such, this value is overstated relative to the Professional Judgment estimates. Cost Function estimates for New York represent the average cost of achieving specified outcomes in upstate suburban New York districts.[20] While student needs may be low in upstate suburbs, costs associated with student needs (excluding disabilities) are included. As such, New York Cost Function estimates are overstated when compared with Professional Judgment estimates. The Cost Function estimate for Texas represents the cost of achieving average outcomes in the average district. As such, this estimate is most overstated (relative to Professional Judgment estimates) by including higher cost small districts and by including costs associated with students with special needs.

In spite of our efforts to make these figures as comparable as possible, caution is in order. Perhaps most important, differing state standards for adequacy will generate differing estimates of the costs of an adequate education.

That said, it is readily apparent in table 3 that studies employing Successful Schools methods have produced the lowest estimates of the cost of an adequate education (after adjustments for inflation and regionally price differences). Resource-oriented methods like Professional-Judgment and Evidence-Based methods produced consistently higher results, as did the Cost Function analyses. However, we stress again that the Successful Schools approach (which by construction uses a performance standard that some schools already meet) may estimate the cost associated with a lower performance standard than the one implicit or explicit in the other methodologies.

Table 4 summarizes findings of cost studies where the same researchers examined alternative methods on the same state in the same year.

TABLE 4 COMPARISON OF FINDINGS (CURRENT DOLLARS) FROM ALTERNATIVE MODELS WHERE ANALYSES WERE PERFORMED BY THE SAME CONSULTANTS

State	Author	Year	Professional Judgment	Successful Schools	Evidence Based	Cost Function
Maryland	Augenblick	2001	$6,612	$5,969		
Kansas	Augenblick	2001	$5,811	$4,547		
New York	Duncombe	2002	$8,352 (a)	$8,468		$9,532
Colorado	Augenblick	2003	$6,815	$4,654		
Missouri	Augenblick	2003	$7,832	$5,664		
Kentucky	Picus	2003	Higher		$6,130	

(a) includes only staffing cost analysis

In four cases, the firm of Augenblick, Myer & Associates of Denver, Colorado conducted both Professional Judgment and Successful Schools analyses.[21] In all four cases, Successful Schools analyses produced much lower basic cost figures than Professional Judgment analyses. In one case, the consulting firm of Lawrence O. Picus & Associates of North Hollywood, California performed both Professional Judgment analysis and Evidence-Based analysis. While they do not report a specific basic cost figure (preferring instead to discuss total state budget impact), they do indicate finding higher costs per pupil under the Professional Judgment model, where inputs are dictated by panels of experts, than under the Evidence-Based model where inputs are dictated by comprehensive school reform packages.

Finally, William Duncombe and Anna Lukemeyer, in an independent analysis,[22] compare versions of Professional Judgment analysis, Successful Schools (which they call empirical observation) analysis, and an education cost function. Duncombe and Lukemeyer generate the lowest cost estimate using the Professional Judgment model and the highest estimate using the Cost Function model.[23] However, their Professional Judgment estimate reflects only the wage costs associated with staffing needs, while the other two models include non-personnel costs. If non-personnel costs and benefit expenses exceed 15 percent of the school district's budget, then again the Professional Judgment model yields the highest cost estimates and the Successful Schools approach the lowest cost estimates.

Table 5 summarizes cost findings from states where similar methods were performed by different researchers or policymakers.

TABLE 5 COMPARISON OF FINDINGS FROM SIMILAR MODELS WHERE ANALYSES WERE PERFORMED BY DIFFERENT CONSULTANTS

	Per-Pupil Cost of an Adequate Education				
Successful Schools Studies					
	Study Release	*Governor*	*Senate*	*House*	*House Compromise*
Ohio	*1999*	$4,446	$4,481	$5,560	$4,814
		Finding A	*Finding B*	*Finding C*	*Finding D*
New Hampshire (secondary)	*1998*	$5,449	$5,487	$5,245	$4,722
New Hampshire (elem)	*1998*	$4,681	$4,447	$4,287	$4,145
Illinois	*2001*	$4,470	$5,103	$5,270	$6,678 *
Professional Judgment/Evidence Based Studies					
	Study Release	*State*	*Independent*		
Maryland	*2001*	$6,612	$7,461		
Kentucky	*2003*	$8,303	$6,551		

*Augenblick generates 40 separate estimates for K-12 School districts. Figures presented are high and low unit school district estimates. Estimates vary by (a) outcome objective, (b) percent poverty and (c) an "effiency filter."

The most intriguing findings in table 5 are for Ohio, where various constituents continue to duel over which group of schools to claim as successful and use as the basis for calculating costs.[24]

In Illinois, consultants provided 40 separate Successful Schools cost estimates for unified districts, varying widely on the basis of outcome standards and other inclusion criteria and leading to a cost-range of over 14 percent. Results in New Hampshire also varied as a function of both different outcome standards and different rules for including and excluding districts on the basis of resource allocation.

Findings of reported Professional Judgment and Evidence-Based analyses are less directly comparable. In Maryland, for example, the state's consultants and special interest consultants dealt differently with costs associated with special education. Table 5 compares minimum adequacy costs for Maryland in each study, excluding children with disabilities. In Kentucky, per pupil basic costs were not reported in the state-sponsored Professional Judgment analysis, but were included in the state-sponsored Evidence-Based analysis. In Maryland, the finding of $6,612 was from the state-sponsored study, but the legislature eventually chose to adopt (for five year phase in) the even lower finding from the Successful Schools analysis. In Kentucky, the finding of $8,303 came from the state-sponsored Evidence-Based analysis for large districts. The state-sponsored Professional Judgment analysis proved even more costly, while the special interest-sponsored study produced a lower basic cost per pupil. Note, however, that Larry O. Picus and Associates found lower costs per pupil ($6,130) under the Evidence-Based model for smaller districts.

HOW HAVE STATE LEGISLATURES AND COURTS RESPONDED?

In only a handful of states has there been significant response to the adequacy analyses that have been performed. A synopsis of state-by-state events appears in appendix C.

Courts have generally been more receptive to resource-oriented analyses while legislatures have been more receptive to Successful Schools analyses. Courts have viewed critically legislative use of Successful Schools analysis to guide school finance policy.

In Wyoming, the court that mandated the Professional Judgment-based adequacy study has chosen to exercise unprecedented oversight (*read: micromanagement*) of additional analyses and policy implementation. In a February, 2001, decision, the Wyoming State Supreme court struck down numerous cost adjustments that had been adopted in response to consultants' 1997 reports, including small school and district adjustments and adjustments for at-risk children.[25] The Supreme Court indicated that the cost adjustments were not sufficiently cost-based. In response, the legislature contracted consultants to produce a series of follow-up studies, most of which were released in 2002. The follow-up studies generally included, per the Court's demand, more detailed resource-oriented cost analyses of specific programming alternatives for the special populations in question.

It is possible that use of input-driven analyses to define the cost of adequacy may open the door to more extensive judicial and legislative involvement in defining appropriate schooling inputs and even more extensive judicial and legislative oversight to ensure that schools and districts purchase specific sets of inputs. That is, resource-oriented analyses may lead to input-based policies and management. In Wyoming, judicial emphasis thus far has been focused on critically evaluating the "cost basis" of each and every aspect of that state's new "cost-based block grant" formula and not on dictating that Wyoming schools attempt to use their resources to become more like the "prototypical schools" created by consultants for their analyses. The consultants' original rationale for promoting a block grant aid allocation approach was to reduce potential judicial or legislative involvement in dictating how districts use their block grants.

The entire premise of Evidence-Based analyses is that resources are adequate if they can be used to implement a specific comprehensive school reform strategy. Further,

adequacy is only achieved by implementing one of a handful of recommended reform strategies. In New Jersey, the court has mandated and legislature responded by ordering districts to implement specific comprehensive school reforms. Note, however, that the present New Jersey court order[26] applies to a limited set of special needs districts.

Because our intent in this report is to review the available studies of the cost of an adequate education, we do not measure the importance or validity of any studies by either their source of origin or ultimate influence on state policy. As we note, only a few adequacy studies have, as of yet, directly influenced state policy via legislative processes. Other more recent studies, in particular those sponsored by special interests or plaintiff groups, may lead to court-mandated policy changes. Finally, ongoing state-supported research on education costs may play a significant role in shaping adequacy-based policies and advancing the state of the art. Examples include work in New York under that state's Education Finance Research Consortium, recent research on variations in education costs in Texas through the University of Texas at Austin Charles A. Dana Center, and support for the study of costs associated with the Oregon Quality Education Model.

WHAT LESSONS CAN BE LEARNED?

As we have demonstrated, there are many analytic approaches to answering the critical question, "What level of public funding is needed to provide an adequate public education?" All of the approaches have strengths and weaknesses in giving decision makers the definitive information they need to set appropriate funding levels.

General Strengths and Weaknesses

This section briefly summarizes the strengths and weaknesses of alternative methods, treated generally as resource-oriented or performance-oriented:

Resource-Oriented

Strengths

- In the policy context, the primary strength of resource-oriented methods, like professional-judgment models or Evidence-Based analyses, is that the methods are relatively simple and transparent and produce easily understood results. That is, resource-oriented models *appear* not to involve more complex statistical modeling. Of course, well-designed resource-oriented models require researchers to use statistical modeling to determine market prices for educational inputs,[27] and professionals frequently rely on statistical analysis to form their opinions. So input-driven models are probably best described as filtered versions of statistical models.

- Because achieving consensus regarding desired educational outcomes can be difficult and precise measurement of those outcomes even more complicated, one advantage of resource-oriented analyses is that they avoid these complexities altogether. Professional Judgment approaches can also incorporate outcomes that are difficult to measure, while outcome-based analyses can only estimate the costs associated with measurable outcomes.

Weaknesses

- In an era of increasing emphasis on educational standards and accountability, it can be difficult to justify a cost figure for an "adequate education," where that cost figure is, at best, indirectly linked to student outcomes.

- While proponents of Evidence-Based analysis infer a strong connection between specific comprehensive school reforms and improved outcomes, research evidence regarding the effectiveness and more specifically the cost effectiveness of these reforms is mixed at best.[28] Furthermore, there may be little connection between the outcomes such reform models are "proven" to accomplish and the outcomes policymakers hope to achieve.

- For practical reasons, resource-oriented analyses rely on a limited set of prototypical districts, which can lead to problems when actual school districts differ from the prototypes. For example, it can be difficult to estimate the costs of operating a district with 600 pupils, when prototypes have been estimated with 200 pupils and 1000 pupils. Similar issues exist in the accommodation of student needs, where only a limited range of possibilities may be feasibly represented in the prototypes. The greater the difference between the prototypes and the actual schools, the greater the margin for error. Even apparently subtle differences in applying the prototypes to the real world (such as choosing to interpolate between

prototypes linearly instead of nonlinearly) can lead to significantly different cost estimates.[29]

- Resource-oriented analyses frequently prescribe sharp increases in resource utilization, but tend to presume that implementing such changes will have no effect on resource prices. If the increase in demand resulting from the new intensity requirement drives up the price of inputs, then the total cost predictions from the analysis will be greatly understated.

In summary, to use an analogy, with resource-oriented analysis, you know the mode of transportation you're going to take, but you're not sure exactly where you're going.

Performance-Oriented Methods

Strengths

- The primary strength of performance-oriented models is that they establish a direct link between education costs and desired outcomes. Understanding the link between costs and outcomes and designing aid formulas based on this understanding is arguably a critical objective in an era of increased emphasis on standards and accountability.

Weaknesses:

- A central difficulty of performance-oriented analysis involves the politics of achieving consensus regarding *important outcomes* and the empirics of precisely measuring those outcomes. Many outcomes that policy-makers consider important may be too difficult to measure, and that which is measured well may be a biased representation of that which we hope to achieve. Appendix B provides a sampling of educational outcomes that have been used by states in the context of Successful Schools analyses and researchers in Cost Function analyses. The Cost Function and Production Function approaches are data intensive, requiring high quality measures of school district performance and expenditures. Many states lack the necessary data to conduct such analyses. For example, Maryland does not collect detailed data on school expenditures. Thus, although the state of Maryland was able to identify 104 schools that it considered to be successful, researchers conducted a Successful Schools analysis on a narrower sample of less than 60 schools on the grounds that it would be difficult to obtain fiscal data from the full 104 within the time available. Cost or Production Function analyses on the basis of such a small sample would be problematic.

- A difficulty with more complex statistical methods like education Cost Functions is that both the underlying methodologies and eventual outcomes of those methodologies can be difficult to understand and difficult to communicate to constituents. The underlying methodologies may rest on

theoretical and analytical assumptions with which informed parties may disagree.

- Statistical modeling inherently involves errors of estimation. While other methodologies are also vulnerable to error and bias, there can be political resistance to methodologies that reveal the inherent imprecision of social science.

- By design, statistical models describe relationships within the experience of the data. It is problematic to extrapolate beyond that experience to predict the costs associated with a level of performance that is not regularly achieved, or is not achieved by districts with a particular set of geographic and demographic characteristics.

- While performance-oriented methods like Cost Function analyses estimate a statistical relationship between spending and outcomes, they do not provide specific insights into how districts should internally organize their resources to effectively and efficiently produce outcomes.

In summary, again, with performance-oriented analysis, you know where you're going and how much money it should take to get there, but you're not quite sure of the best way to go.

SPECIFIC ISSUES WITH EXISTING APPLICATIONS

Review of the vast array of existing adequacy studies raises additional, more specific, methodological and practical concerns. These concerns arise primarily from the geographic, demographic, and organizational complexity of large states such as Texas.

Table 6 summarizes the extent to which existing adequacy analyses have included direct estimates of cost variations by district types or by student needs. That is, has an empirical basis been established not only for the basic level of spending, but also for various cost adjustments that must be applied to that base? Again, Professional Judgment studies dominate the studies reviewed for this report with a total of 15 studies (excluding Oregon's Quality Education Model) while nine Successful Schools analyses were reviewed. We include academic cost function analyses for comparison purposes.[30]

TABLE 6 SUMMARY OF SELECTED COSTS DIRECTLY MEASURED OR ESTIMATED IN EXISTING STUDIES

	Analytical Method			
	Professional Judgment	Evidence Based	Successful Schools	Cost Function
Total Number of Studies Reviewed	**15**	**3**	**9**	**3**
District Cost Factors				
Input price variation	**0**	**0**	**1**	**3**
Economies of scale	**9**	**0**	**0**	**3**
Student Cost Factors				
Children with disabilities	**12**	**0**	**1**	**2**
LEP children	**11**	**2**	**1**	**3**
Economically disadvantaged children	**11**	**2**	**4**	**3**
Migrant children	**1**	**0**	**0**	**0**
Gifted children	**1**	**0**	**1**	**0**

	Analytical Method			
	Professional Judgment	Evidence Based	Successful Schools	Cost Function
Total Number of Studies Reviewed	**15**	**3**	**9**	**3**
District Cost Factors				
Input price variation	**0**	**0**	**1**	**3**
Economies of scale	**9**	**0**	**0**	**3**
Student Cost Factors				
Children with disabilities	**12**	**0**	**1**	**2**
LEP children	**11**	**2**	**1**	**3**
Economically disadvantaged children	**11**	**2**	**4**	**3**
Migrant children	**1**	**0**	**0**	**0**
Gifted children	**1**	**0**	**1**	**0**

Input Price Variations

An important aspect of any adequacy study is the degree to which researchers control for price variations that are beyond the control of school districts, such as variations in the cost of living. The lack of such controls is a common failing among the existing applications. Among Professional Judgment studies reviewed, none employed *comprehensive* statistical analyses of wages or other input prices. The original Wyoming study and 2001 follow-up included a review and critique of existing indices available in that state. Neither Evidence-Based analysis considered input price variations. Only one Successful Schools analysis considered input price variations.[31] The Wyoming study appears to have relied primarily on existing wage and/or cost of living indices in that state.

By design, education Cost Function analyses include measures of resource price variation across districts. It should be noted, however, that many academic Cost Function studies use either teacher and other staff salaries[32] or the National Center for Education Statistics Geographic Cost of Education Index (NCES GCEI) as their input price measure,[33] rather than estimating more precise input price indices to isolate price variations outside the control of local district officials.

In some cases, lack of sufficient data may have been at issue. Price analyses of the primary educational input—labor—require detailed information on compensation. Such data can be costly to collect and analyze.

Geography may also play a role in the apparent omissions. In small, homogeneous states, there may be little reason to believe that input prices vary significantly across school districts and therefore little reason to invest in a full-blown model of price variation. In lieu of conducting their own price studies, several Professional Judgment studies recommended adoption of the NCES GCEI.[34] Such an approach can be questionable, particularly in rural areas. Harrison Keller and Lori L. Taylor (2003) find that the NCES GCEI for rural Texas is not especially well correlated with geographic cost indexes estimated from Texas data. William Duncombe et al. (2003) also conclude that the NCES GCEI is not a good predictor of the CEI they estimate from New York data.

Economies of Scale

Of the existing Professional Judgment studies, it is a relatively recent development that those studies include attempts to measure costs associated with economies of scale. In total, nine of 15 Professional Judgment analyses have attempted to capture costs associated with economies of scale.[35] These studies have estimated costs of three to five prototypical districts of varied size, assuming linear changes in costs between the prototypes. These attempts have produced widely varied results, even in contiguous states. The same team of consultants found that costs were minimized in districts with 12,500 students (Nebraska), 11,200 students (Kansas), 5,200 students (Colorado), 4,380 students (Missouri), and 1,740 students (Montana). In Nebraska, a district with 400 pupils had costs 40 percent above the minimum, but in Missouri a district with 364 pupils had costs only nine percent above the minimum. Evidence-Based and Successful Schools studies have not included attempts to estimate costs associated with economies of scale. As a standard, education Cost Function analyses include district size measures, typically resulting in a curved pattern showing costs of producing outcome minimized for districts with 2,000 to 5,000 pupils[36] and sweeping sharply upward for very small districts with fewer than 300 pupils.

Students with Disabilities

As with economies of scale, it is a relatively recent occurrence that Professional Judgment analyses attempt to capture the costs associated with providing additional resources necessary for serving children with disabilities. Twelve recent Professional Judgment studies have specifically tabulated those resources under guidance of expert panels, and eight of those 12 have separately tabulated resource needs by district size (interaction of scale and special education).[37]

Evidence-Based analyses have not integrated additional costs associated with serving children with disabilities, perhaps because the comprehensive school reform models in question do not. Authors of some Cost Function analyses have chosen to include children with disabilities,[38] while others have chosen to focus their analyses on regular education operating expenses.[39]

Other Student Needs

Professional Judgment analyses in recent years have included tabulations of costs of the additional staff required for serving children from economically-deprived backgrounds and for serving children with limited English proficiency. In some cases, separate staffing demands were calculated for these subgroups by district size. Only one study has separately considered the costs of providing additional staff for migrant or for gifted and talented children.[40] Cost findings for special student populations under Professional Judgment models have varied widely, even when methods have been carried out by the same researchers/consultants and when those methods have been applied in contiguous or relatively similar states.[41]

Evidence-Based analyses in Kentucky and Arkansas addressed additional costs associated with providing additional staffing to meet the needs of at risk and/or limited English proficiency students. Specific estimates of how these costs vary across different types of schools or districts, however, were not provided. In general, comprehensive school reform strategies cited in Evidence-Based analyses, like Slavin's "Success for All," are designed for use in schools with higher concentrations of economically disadvantaged and/or limited English proficient children. Among Successful Schools analyses, the Ohio expenditure function analyses included measures of economic disadvantage. The 1996

Illinois study evaluated, separately, expenditures of higher and lower poverty schools and districts that met specific outcome standards. Separate expenditure averages were taken for high and low poverty successful districts in Mississippi and in Illinois as well.

Cost Function analyses typically include measures of percentages of children from economically-disadvantaged backgrounds and percentages of children who are limited in their English language proficiency. Some more recent Cost Function analyses have attempted to separately evaluate poverty in urban and rural contexts.[42]

IMPLICATIONS FOR TEXAS

Texas is an advantageous context for a study of educational adequacy, in large part due to the vast array of highly detailed, relatively well-organized data on Texas schools, children, and teachers. At the same time, Texas is a challenging context for any analysis of the cost of an adequate education due to its size and complexity relative to other states.

Education Data in Texas

Texas has an existing system of performance measurement that represents a rough political consensus about the important indicators of educational outcomes. The Academic Excellence Indicator System (AEIS) provides parents and policymakers with information about student performance on a variety of scales, including student performance on standardized tests, student improvement on standardized tests, student retention, and advanced placement coursework. While few would argue that the AEIS indicators represent the sum total of expectations of schools, the State of Texas has a history of using the AEIS indicators to drive funding decisions and school policy. As such, the AEIS system offers researchers a roadmap to available and familiar measures of educational outcomes.

In order to make the AEIS work, Texas collects and audits student performance data for each of the four million students in its public school system. The state also tracks student improvement across time so that researchers can disentangle the part of student performance that is attributable to the school from the rest of the student's score. These data give Texas access to much better measures of school outcomes than are available in other states.

Texas collects detailed financial data at the fund and function level for each school and district in its public school system. Such data permit a level of detail in the analysis that is only dreamt of in other states.

Texas also collects data on the compensation and characteristics of more than 250,000 teachers. Such data can be merged with information on classroom assignments and labor market conditions to support a very high quality analysis of uncontrollable variations in the price of a schools' most important resource—its teachers.

The Complexity of the Texas Context

Researchers face a threefold challenge related with the complexities and diversity of the Texas's public K-12 education system. First, Texas has enormous variations in the characteristics of the students served by the public school system. There are 194 districts with less than one percent of students with limited English proficiency, but 11 districts with more than 50 percent of students with limited English proficiency. Special education students comprise up to 39 percent of a school district's enrollment, although the average district has only 14 percent of students in special education. The share of children in poverty ranges from zero to 100 percent, with half of students eligible for free or reduced lunch in the average Texas school district.

Second, Texas has large differences in school district size. The five largest Texas districts have average daily attendance of more than 65,000 students; the five smallest Texas districts have average daily attendance of fewer than 30 students. The typical Texas school district has fewer than 1,000 pupils, but more than 60 percent of Texas's students attend districts with more than 10,000 students. The literature suggests that the district size that minimizes cost lies somewhere in between.[43]

Finally, Texas faces large variations in resource costs. Recent estimates suggest that districts in high-cost parts of Texas must spend at least 25 percent more than other districts to hire a comparable staff.[44]

Given the differences among Texas school districts, evaluating the cost of providing an adequate education will require methods that can be used to estimate, with the greatest available precision, the uncontrollable costs associated with geographic price variations, economies of scale, and variations in student need.

Fitting Available Methods to the Texas Context

Perhaps the strongest arguments favoring resource-oriented methods like Professional Judgment are (a) that they can be conducted in the absence of detailed student outcome data and (b) that prototypical sets of schooling inputs are both conceptually and methodologically easy for policymakers to understand. The availability of detailed, student level outcome data in Texas mutes the importance of the first advantage. On the second point, it is difficult to conceive that three to five separate prototypical districts or schools (as evaluated in Kansas, Nebraska, Montana, Colorado, and Missouri) would suffice for characterizing the varied needs of Texas's independent school districts and charter schools. Further, it is difficult to conceive just how many prototypes would be required to sufficiently characterize the diversity of Texas school districts.

The logistics of implementing Successful Schools analysis would be far easier to overcome in Texas. However, in order to produce valid estimates of basic costs and cost variations across Texas districts, such an approach must be heavily modified to accommodate regional variations in input prices and student characteristics. With enough modifications, Successful Schools analysis morphs into a limited, special case of a Cost Function analysis.

An education Cost Function analysis uses regression analysis to measure the systematic relationship between current operating expenditures and educational outcomes, given input price differentials and technological factors like student characteristics and school district size. Such an analysis appears feasible and is the most obvious fit to the challenges of educational cost analysis in Texas. As discussed previously, there are drawbacks to the Cost Function approach, ranging from problems with measurement error that may lead to difficulties in sorting out precise differences in district efficiency to difficulties in crafting the ideal statistical model for estimating costs. However, it is likely the best available method for estimating costs of achieving desired outcomes in Texas and how those costs vary across Texas's diverse schools and districts.

APPENDIX A STATE BY STATE SUMMARY OF STUDIES OF EDUCATIONAL ADEQUACY

State	Performed by:	Sponsored by:	Year of Study	Analytical Method	Estimated Basic Cost
State Government Sponsored Studies					
Mississippi	Augenblick & Myers, Inc.	State Dept. of Education	1993	Successful Schools (District Level)	$2,614
Illinois	Coopers and Lybrand	Illinois State Board of Education	1996	Successful Schools	$4,225
Ohio	Augenblick & Myers, Inc.	Ohio Dept. of Education	1997	Successful Schools (District Level)	$4,269 (in 1999)
Wyoming	Management, Analysis & Planning, Inc.	Legislature	1997	Professional Judgment (School Level)	E: $6,165; M: $6,403; H: $6,781
Illinois	Internal	Illinois State Board of Education	1998	Professional Judgment	K-3: $6,604; 4-6: $5,022; JH/MS: $5,132; HS: $5,393
New Hampshire	Augenblick & Myers, Inc.	Legislature	1998	Successful Schools	Elementary, $4,681 Secondary $5,449
New Hampshire	Augenblick & Myers, Inc.		1998	Successful Schools (School)	
New Jersey	Allan R. Odden, U. of Wisconsin and Consortium for Policy Research in Education	Court[5]/Legislature	1998	Evidence-Based	$8,864
Oregon	Internal (reviewed by Management, Analysis & Planning, Inc.)	Legislature	1997/ 2000	Professional Judgment (QEM)	$5,762 (in 2002)
Louisiana	Augenblick & Myers, Inc.	State Board of Education	2001	Successful Schools (S)	$4,234
Illinois	Augenblick & Myers, Inc.	Education Funding Advisory Board	2001	Successful Schools (D)	$4,600
Kansas	Augenblick & Myers, Inc.	KS Legislature	2001	Professional Judgment	$5,811
Kansas	Augenblick & Myers, Inc.	KS Legislature	2001	Successful Schools (D)	$4,547

State	Performed by:	Sponsored by:	Year of Study	Analytical Method	Estimated Basic Cost
Maryland	Augenblick & Myers, Inc.	Thornton Commission	2001	Professional Judgment (S)	$6,612 ($10,631 w/SPED)
Maryland	Augenblick & Myers, Inc.	Thornton Commission	2001	Successful Schools (S)	$5,969
Kentucky	Lawrence O. Picus & Associates	State Board of Education	2003	Professional Judgment	
Kentucky	Lawrence O. Picus & Associates	State Board of Education	2003	Evidence-Based	$6,130 to $8,303 (Very Large)
Arkansas	Lawrence O. Picus & Associates	Legislature	2003	Evidence-Based	
North Dakota	Augenblick, Palaich & Associates	Legislature	2003	Professional Judgment	$6,005
Maine	Management, Analysis & Planning, Inc.			Professional Judgment	
California	California Quality Education Commission		in progress	Professional Judgment (Quality Education Model: QEM)	
Special Interest Group Sponsored					
South Carolina	Augenblick & Myers, Inc.	School Boards Association	2000	Professional Judgment	$6,189
Maryland	MAP	Maryland Education Coalition	2001	Professional Judgment	$7,461 to $9,313
Nebraska	Augenblick & Myers, Inc.	Coalition of special interests*	2002	Professional Judgment	$5,845 (large K-12 district)
Indiana	Augenblick & Myers, Inc.	State Teachers Association	2002	Professional Judgment	$7,094 to $7,365 (large to small)
Montana	Augenblick & Myers, Inc.	Coalition of special interests*	2002	Professional Judgment	$7,681 to $9,954 (large to small)
Colorado	Augenblick & Myers, Inc.	Colorado School Finance Project	2003	Professional Judgment	$6,815
Colorado	Augenblick & Myers, Inc.	Colorado School Finance Project		Successful Schools (District Level)	$4,768 to $4,845
Missouri	Augenblick & Myers, Inc.	Missouri Education Coalition for Adequacy	2003	Professional Judgment	$7,832
Missouri	Augenblick & Myers, Inc.	Missouri Education Coalition for Adequacy		Successful Schools (District Level)	$5,664
Kentucky	Deborah Verstegen, University of Virginia	Council for Better Education, Inc.	2003	Professional Judgment	$6,551 (very large K-12 district)
New York	American Institutes for Research & Management, Analysis &	Campaign for Fiscal Equity & School Boards Association	in progress	Professional Judgment	

State	Performed by:	Sponsored by:	Year of Study	Analytical Method	Estimated Basic Cost
	Planning, Inc.				
Adequacy Studies or Cost Analyses by Independent Researchers					
Wisconsin	Institute for Wisconsin's Future		2002	Professional Judgment	$8,500
Washington	Ranier Institute		2003	Professional Judgment (Quality Education Model)	E: $8,393 M: $7,830 H: $7,753
Wisconsin	Reschovsky & Imazeki	Ind. Research	1997/ 2001	Cost Function	$6,372
Texas	Reschovsky & Imazek	Ind. Research	1999/ 2001	Cost Function	
New York	Duncombe & Lukemeyer	Ind. Research	2000/ 2003	Cost Function	$9,532 (Standard = 160)
New York	Duncombe & Lukemeyer	Ind. Research	2000/ 2003	Resource Cost (staffing only)	$8,352 (cost adj.)
New York	Duncombe & Lukemeyer	Ind. Research	2000/ 2003	Empirical Identification	$8,468 (cost adj.)

APPENDIX B TABLE OF OUTCOME MEASURES INCLUDED IN SUCCESSFUL SCHOOLS ANALYSES

State	Source	Outcome Standard
Mississippi (1993)	Education Commission on the States[45]	The study identified schools by using socioeconomic information including percent of students receiving free/reduced price lunch, the local operating tax levy, the assessed valuation per pupil, and school size. Once districts were identified to be within a "normal" range for each of those categories, the study looked at their institutional cost. The information that was reviewed to determine instructional cost included accreditation level, number of Carnegie units offered at the high school level, and the average teacher experience in the district.
Ohio (1997)	Augenblick & Myers, Inc.	• A passing rate of 75 percent on the 4th-grade proficiency tests in reading, mathematics, writing, and citizenship • A passing rate of 75 percent on the 9th-grade proficiency test in reading, mathematics, writing, and citizenship administered in the 9th grade • A passing rate of 85 percent on the 9th-grade proficiency test in reading, mathematics, writing, and citizenship administered in the 10th grade • A passing rate of 60 percent on the 12th-grade proficiency tests in reading, mathematics, writing, and citizenship • A dropout rate of 3 percent or less • An attendance rate of at least 93 percent
Louisiana (2001)	Education Commission on the States	Schools scoring a grade of over 100 on the State Performance Score and any school that improves its grade by at least 75 percent over a two-year period would be seen as a successful school.
Illinois (2001)	Augenblick & Myers, Inc.	A successful school was defined as one that will have 83 percent of its students meet standards for the Illinois Standards Achievement Test (ISAT) by 2004 (which was five years beyond 1999, the first year the test was given). The ISAT test is given in reading, writing, and math to 3rd, 5th, and 8th graders in the state.
	Legislation: The Cost of an Adequate Education – ORC 3317.012	The bill redefines the methodology used to determine the cost of an adequate education. The method is largely based on the State Board of Education's "Resources and Accountability Model." To be included in the model used to determine the statewide base cost formula amount, districts must meet the following criteria: • Meeting at least 20 out of 27 performance standards (25 proficiency tests, attendance rate, and graduation rate) currently included in the local report cards • Having at least 80 percent of teachers with five or more years of experience • Offering at least one advanced placement course • Having a district average K-12 regular student-teacher ratio of 21:1 or less • Not in the top and bottom five percent of all districts in property value per pupil or school district median income per tax return[46]

State	Source	Outcome Standard
Maryland (2001)	Augenblick & Myers, Inc.	In order to identify successful schools, Augenblick & Myers asked MSDE to identify a set of elementary, middle, and high schools that met existing state performance standards. The standards are based on schoolwide average performance on the Maryland School Performance Assessment Program (MSPAP) as well as other indicators (attendance, drop-out rate, and curriculum) that are components of the School Performance Index (SPI) used by MSDE to evaluate schools. Using these standards, MSDE identified 104 schools that it considered to be successful. However, since Augenblick & Myers felt that it would be difficult to obtain fiscal data from that many schools within the time available, they asked MSDE to reduce the number to 60 or fewer. MSDE, therefore, selected a subset of 59 schools that included elementary schools, middle schools, and high schools that were representative of the state in terms of geographic location.
Kansas (2001)	Augenblick & Myers, Inc.	The output standards focused on tests for reading and math given in both 2000 and 2001. These reading and math tests are given in three grades every year. In the 2000–01 school year, a district was selected if it was either already meeting the test score standards for five of the six tests or was improving, between the 2000 and 2001 tests, at a rate that would get the district to the standards in the five-year time period. Augenblick & Myers next looked to see if the districts that met the output standards also met the input standards. They asked the Kansas Department of Education to give us a list of all the districts that did not meet the Quality Performance Accreditation standards for the state in the 2000-01 school year. By comparing this list to the list of 86 districts that met the output standard they were able to filter out any district that did not meet the input standards. Only one of those districts did not meet the input standard, leaving them with 85 districts that met both the input and output standards related to a suitable education.
Colorado (2003)	Augenblick & Myers, Inc.	School districts were selected if they met the baseline score, established by the Colorado Department of Education, on both math and reading Colorado Student Assessment Program and had at least 95 percent of their students taking *every* test. The baseline score was created in order to be in compliance with the No Child Left Behind Act. Additionally, these school districts had more than an 85 percent graduation rate. The baseline scores use 2002 Colorado Student Assessment Program and include partially proficient, proficient, and advanced scores. The baseline scores are as follows: • Elementary Reading 77.5 • Middle School Reading 74.6 • High School Reading 80.3 • Elementary Mathematics 79.5 • Middle School Mathematics 60.7 • High School Mathematics 50.5

State	Source	Outcome Standard
Missouri (2003)	Augenblick & Myers, Inc.	Augenblick & Myers asked the Missouri Department of Elementary and Secondary Education (DESE) if it had a procedure to identify successful school districts in the state. The department responded with an approach for identifying successful school districts using the Missouri School Improvement Program (MSIP) indicators. MSIP looks at a number of factors that include test scores on the Missouri Assessment Program (MAP) tests and other indicators, such as course offerings, after high school placement, dropout rates, and attendance rates. DESE identified any district that received all of the program points, associated with MAP, on the Annual Performance Report (APR) as successful for the study. This approach identified 102 districts with total enrollment of 308,206 students.

APPENDIX B2 OUTCOME MEASURES USED IN COST FUNCTION STUDIES

State	Source	Outcome Measures
Texas	Reschovsky & Imazeki	Composite TAAS Exam Score (and lagged score) Average ACT Score Relative Efficiency
Wisconsin	Reschovsky & Imazeki	10th Grade Exam Score (and 8th Grade score) Relative Efficiency
New York	Duncombe et al.	4th and 8th Grade Math and English: Percent reaching levels 3 or 4 Regents Math and English: Percent reaching 65 or higher Relative Efficiency

APPENDIX C SUMMARY OF LEGISLATIVE RESPONSES AND JUDICIAL REVIEW

State	Legislative Response	Judicial Review	Legislative Response
New Hampshire	In 1999, the New Hampshire Legislature adopted into law the method by which successful schools would be identified and basic costs calculated for driving that state's new funding formula (Section 198:40). Adequate funding would be phased in by 2004. During the 2003 legislative session, a bill was introduced declaring, "The state cost for an adequate education shall be zero dollars,"(HB 0569) in an attempt to exempt itself from completing the phase in.	The New Hampshire Supreme Court continues to allow the Legislature some latitude on the ongoing phase-in (through September of 2004) of adequate state aid. However, the court did recently (2002) declare a system of standards and accountability to be integral to an adequate education and in doing so, overturned the present accountability system (147 N.H. 499; 794 A.2d 744; 2002 N.H.)	
Ohio	As noted previously, the Ohio Legislature has continued to tinker with the Successful Schools sample, deriving over time widely varied estimates of the cost of an adequate education.	In December, 2002 the Ohio Supreme Court declared the system still unconstitutional. However, the state court also ended its jurisdiction over the case at this time. After years of failed attempts to remedy school finance in state courts, plaintiffs have filed a petition to the U.S. Supreme Court. (http://www.bricker.com/legalservices/practice/education/schoolfund/briefs/051603supctderolph.pdf)	
Wyoming	In Wyoming, following the 1997 Professional Judgment study, the Legislature implemented a Cost Based Block Grant as per consultant recommendations and judicial mandate (cost basis).	In February of 2001, the Wyoming Supreme Court issued a decision highly critical of many of the assumptions made in the cost analyses prepared in 1997. In particular, the court found that various cost adjustments for small schools and districts and for student needs like economic disadvantage and limited English proficiency lacked sufficient cost justification. The court overturned those cost adjustments and requested more empirically substantiated evidence. (State v. Campbell County School District (2001 WY 19; 19 P.3d 518; 2001 Wyo.))	A subsequent series of more detailed analyses and re-analyses was released by consultants in 2002.
Maryland	The Thornton Commission, appointed by the Governor, recommended to the Legislature a plan to phase in educational adequacy from a basic cost of $3,500 in 2002 to $5,600 per pupil in 2007 (based roughly on Successful Schools findings). The commission also recommended that cost adjustments for special needs, based on professional judgment analyses, be included in the new aid formula.		
New Jersey	In 1990, the Court had ordered the Legislature to achieve spending parity between the state's Special Needs, or Abbott districts (plaintiff's in Abbott v. Burke) and the 108 highest wealth districts. The court had further requested that the Legislature provide sufficient additional funds to these districts to meet the special needs of their student population. Evidence-Based analysis was performed with respect to the latter goal. Following the 1998 recommendations that poor urban districts implement specific whole school reform models, the Legislature began a multi-year phase-in process whereby state aid to special needs districts would be maintained at levels sufficient to implement Roots and Wings/Success for All. Implementation would require some additional aid (Additional Abbott Aid or Supplemental Aid), above and beyond the state's "parity aid" (or foundation program). In February of 2002, the Governor created the Abbott Implementation and Compliance Coordinating Council to oversee the court-ordered reforms.	Most recently, due to the state's lagging economy, the New Jersey Supreme Court granted the state a one year "relaxation" of remedies (Abbot IX and X). The "relaxation" applies specifically to the Additional Abbott Aid granted to special needs districts, but not to the state's foundation aid. Professional Judgment analyses are underway for guiding foundation aid levels to all NJ districts.	

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NOTES

[1] For example, a commonly used index of school finance equity/adequacy is the McLoone index, which compares the average expenditures of the lower 50 percent of children with the median expenditures. A "perfect" McLoone index is equal to 1.0, or a situation where no children fall below the median (50 percent are at the median).

[2] Early successful schools analyses in Ohio used data on district resource allocation as a partial basis for modifying the sample of districts to be used for calculating average costs of achieving standards. Proposed analyses in New York recommend deeper analyses of how successful districts organize their resources. For information on the proposed approach in New York, see Chambers, Jay G., Thomas Parrish, James Guthrie, and James Smith (2002) A Proposal for Determining Adequate Resources for New York Public Schools. http://www.cfequity.org/costingoutsummary.pdf.

[3] Chambers, J.G. 1999. "Measuring Resources in Education: From Accounting to the Resource Cost Model Approach." Working Paper Series, National Center for Education Statistics, Office of Educational Research and Improvement (Washington, DC: U.S. Department of Education) Working Paper #1999-16. Hartman, William T., Denny Bolton and David H. Monk, "A Synthesis of Two Approaches to School-Level Financial Data: The Accounting and Resource Cost Model Approaches." In *Selected Papers in School Finance, 2000 – 01*, edited by W. Fowler. National Center for Education Statistics, Office of Educational Research and Improvement. Washington, DC: U.S. Department of Education, 2001.

[4] Goertz, Margaret E. and Malik, Edwards. (1999). In Search of Excellence For All: The Courts and New Jersey School Finance Reform. *Journal of Education Finance.* 25(1), 5-31

[5] Note that earlier in this document we identified two common approaches to *modifying* successful schools analysis, each of which involves some consideration of how successful schools use their resources. The most common modification, not addressed in this table, is where schools or districts that appear to be outliers in their use of resources are excluded from the calculation of average expenditures. In this table, we refer to those cases where successful schools analysis is used to identify schools achieving success under certain circumstances and to explore how those schools are using their resources to achieve that success. This is an uncommon use of successful schools analysis, but an approach that is being used in New York State in their ongoing study.

[6] Mississippi, Illinois, Louisiana, Kansas, Maryland, Ohio

[7] Wyoming, Kansas, Maryland, Kentucky, North Dakota

[8] California, Illinois, Oregon, Washington. Detailed information was found only regarding Oregon and Washington studies.

[9] Arkansas, Kentucky, New Jersey

[10] Studies in New York have been done by academic researchers under the Education Finance Research Consortium, funded through The Research Foundation of the State University of New York, Governed by the New York State Board of Regents.

[11] South Carolina, Maryland, Nebraska, Indiana, Montana, Colorado, Missouri, Kentucky, New York. The New York study is still in progress.

[12] Mississippi, Illinois, Ohio, New Hampshire

[13] Wyoming, Illinois, Oregon, South Carolina

[14] New Jersey

[15] The six states are Louisiana, Illinois, Kansas, Maryland, Colorado, and Missouri. The four states are Kansas, Maryland, Colorado, and Missouri.

[16] The nine states are Kansas, Maryland, Kentucky, Nebraska, Indiana, Montana, Colorado, Missouri, and North Dakota. The seven states are Maryland, Kentucky, Nebraska, Indiana, Montana, Colorado, and Missouri.

[17] Kentucky, Arkansas

[18] We exclude studies from which it was not possible to extract a district-level cost estimate.

[19] The Cost Function estimate for Texas is drawn from Andrew Reschovsky and Jennifer Imazeki's forthcoming book chapter titled *School Finance Reform in Texas: A Never Ending Story?* Previously presented at the Conference on State Aid to Education, Education Finance and Accountability Program, Center for Policy Research, Maxwell School, Syracuse University. This study was neither state sponsored nor initiated by a special interest group, but, rather, is a product of independent research associated with other partially supported similar research through the Consortium for Policy Research in Education (CPRE) at the University of Wisconsin at Madison. We include the findings of this study in table 3 on the request of reviewers of this brief, and due to the relatively limited number of available Cost Function estimates of educational adequacy. The Wisconsin estimate is from Reschovsky, Andrew & Jennifer Imazeki. (1998). The Development of School Finance Formulas to Guarantee the Provision of Adequate Education to Low-Income Students. In William J. Fowler, Jr., (Ed.), *Developments in School Finance*, 1997 (NCES 98-212). Washington, DC: U.S. Department of Education, National Center for Education Statistics.

[20] Table B-16. Duncombe, 2002.

[21] The North Dakota study was formally attributed to Augenblick, Palaich & Associates.

[22] Under the umbrella of the "Education Finance Research Consortium"

[23] Duncombe, William and Anna Lukemeyer. 2002. Estimating the Cost of Educational Adequacy: A comparison of approaches. Paper presented at the Annual Meeting of the American Education Finance Association, Albuquerque, NM.

[24] The findings for Ohio represent analyses prepared by the Governor's Office using 43 districts meeting 20 of 27 1999 standards, the Senate using 122 districts meeting 17 of 18 1996 standards, the House using 45 districts meeting all 18 original standards in 1999, and the House again in an amended bill using 127 districts meeting 17 of 18 1996 standards in 1996 and 20 of 27 standards in 1999.

[25] State v. Campbell County Sch. Dist., 19 P.3d 518 (Wyo. 2001).

[26] Specifically, the court order pertaining to the allocation of "Additional Abbott Aid" to special needs districts such that those districts may implement comprehensive school reforms (*Abbott V*).

[27] It is important to note that one critical phase in *well developed* resource cost modeling is the setting of competitive market prices for educational resources and the estimation of how those prices vary from one district to another in a state. This phase is best performed via statistical modeling not too unlike Cost Function modeling. See Chambers, Jay G. "Patterns of Variation in the Salaries of School Personnel: What Goes on Behind the Cost Index Numbers?" *Journal of Education Finance* 25 (1999a): 255.

[28] See Levin, Henry M. 2002. The Cost Effectiveness of Whole School Reforms. Urban Diversity Series No. 114. Eric Clearinghouse on Urban Education. Institute for Urban and Minority Education. Borman, Geoffrey D. and Gina Hewes. "The Long-Term Effects and Cost Effectiveness of Success for All." *Educational Evaluation and Policy Analysis* 24, no. 4 (2002): 243–66. Borman, Geoffrey D., Gina Hewes, Laura Overman and Shelly Brown "Comprehensive School Reform and Achievement: A Meta-Analysis." *Review of Educational Research* 73, no. 2 (2003) 125-230. Bifulco, Robert, Carolyn Bordeaux, William Duncombe and John Yinger 2002. Do Whole School Reform Programs Boost Student Performance? The Case of New York City. Smith-Richardson Foundation.

[29] In Kansas, for example, differences in aid resulting from applying linear segments between Augenblick and Myers prototypes and applying a curved *expenditure* function of similar high-low range exceed 10 percent across some ranges. (See appendix D for a comparison using Kansas data.)

[30] We count only three Cost Function studies, though, excluding replication and/or related analyses by researchers on a single state.

[31] In a separate report, Kenyon College economist Bruce Gensemer performed "expenditure function" analysis, a statistical approach similar to Cost Function analysis, to estimate the relative costs of serving children with special needs and relative costs of doing business in different parts of the state of Ohio.

[32] See, for example, Duncombe, William and Anna Lukemeyer. 2002. Estimating the Cost of Educational Adequacy: A comparison of approaches. Paper presented at the Annual Meeting of the American Education Finance Association, Albuquerque, NM.

[33] See, for example, Reschovsky, Andrew and Jennifer Imazeki. "Achieving Educational Adequacy through School Finance Reform." *Journal of Education Finance* 26, no. 4 (2001): 373-96. Reschovsky and Imazeki use the NCES GCEI for their Texas analyses, but construct an index using state data for their Wisconsin cost function.

[34] We discuss concerns with this recommendation in our technical reports to follow.

[35] Including studies in Kansas, Nebraska, Indiana, Colorado, Missouri, Montana, Kentucky (Verstegen), and Wisconsin.

[36] Andrews, M., W. Duncombe, and J. Yinger. "Revisiting Economies of Size in American Education: Are we any closer to consensus?" *Economics of Education Review* 21 (2002): 245.

[37] The 12 include South Carolina, Kansas, Colorado, Montana, Kentucky (both Verstegen and Odden and Picus Professional Judgment Studies), Indiana, Maryland, Missouri, Nebraska, North Dakota and Wisconsin. Those including the interaction between scale and special education include Kansas, Nebraska, Indiana, Montana, Colorado, Missouri, North Dakota and Kentucky (Verstegen).

[38] See, for example, Duncombe, William and John Yinger. "School Finance Reforms: Aid Formulas and Equity Objectives." *National Tax Journal* 51, no. 2 (1998): 239-63. See, also, Reschovsky, A., Imazeki, J. (2001) Achieving Educational Adequacy through School Finance Reform. *Journal of Education Finance* 26 (4) 373-396

[39] See Duncombe, W.D., Lukemeyer, A. (2002) Estimating the Cost of Educational Adequacy: A comparison of approaches. Paper presented at the Annual Meeting of the American Education Finance Association, Albuquerque, NM.

[40] Verstegen, D. (2003) Calculating the Cost of an Adequate Education in Kentucky. Prepared for the Council for Better Education.

[41] See technical report comparing student and district cost adjustments derived from professional judgment and Cost Function analyses.

[42] See Duncombe, William and Jocelyn Johnston. "The Impacts of School Finance Reform in Kansas: Equity is in the Eye of the Beholder." In *Helping Children Left Behind: State Aid and the Pursuit of Educational Equity,* edited by J.M. Yinger. Cambridge, MA: MIT Press (forthcoming).

[43] A comprehensive review of literature on economies of scale in education by Andrews, Duncombe and Yinger (2002) indicates consistently that education costs per pupil rise significantly in smaller districts and that costs per pupil are minimized in districts with 2,000 to 6,000 pupils.

[44] Alexander, Celeste, Timothy Gronberg, Dennis Jansen, Harrison Keller, Lori Taylor and Philip Triesman 2000. A Study of Uncontrollable Variations in the Costs of Texas Public Education: A summary report prepared for the 77th Texas Legislature. Charles A. Dana Center. University of Texas at Austin.

[45] A Survey of Finance Adequacy Studies. Education Commision on the States. September, 2001.

[46] http://www.lbo.state.oh.us/fiscal/budget/education/education124/edu/permtemp.htm