GETTING DOWN TO FACTS II

Technical Report

What Does It Cost to Educate California's Students? A Professional Judgment Approach

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October 2018
Version 2

About: The *Getting Down to Facts* project seeks to create a common evidence base for understanding the current state of California school systems and lay the foundation for substantive conversations about what education policies should be sustained and what might be improved to ensure increased opportunity and success for all students in California in the decades ahead. *Getting Down to Facts II* follows approximately a decade after the first Getting Down to Facts effort in 2007. This technical report is one of 36 in the set of *Getting Down to Facts II* studies that cover four main areas related to state education policy: student success, governance, personnel, and funding.

Stanford University

PACE Policy Analysis for California Education

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Acknowledgments

This study is part of a larger group of studies coordinated through Stanford University and funded by the Bill & Melinda Gates Foundation, the Dirk and Charlene Kabcenell Foundation, the Silver Giving Foundation, and the Stuart Foundation.

American Institutes for Research (AIR) would like to extend its appreciation to the "Getting Down to Facts II" group for providing valuable feedback, and especially Susann Loeb at Stanford University for her support throughout this study.

The AIR research team would also like to thank the outstanding educators who participated in the two professional judgment panels for this study: Alysia Odipo, Amy Enomoto-Perez, Cheryl Marelich, Chris Funk, Crechena Wise, Dianne Glasser, Erin Oxhorn-Gilpin, Jason Willis, James Parrish, Jennifer Freeman, Jennifer Tedford, Kim Dammann, Lupe Jaime, Matt Hewitson, Nicole Knight, Octavio Rodriguez, Rebecca Mieliwocki, Ryan Ruelas, Shannon Henry, Susan Sherwood, Tina Brar, and Whitcomb Hayslip.

In addition, AIR would like to thank the following individuals and organizations for their professional opinions and their recommendations for highly qualified panel participants:

- California Association of African-American Superintendents and Administrators
- California CORE Districts
- California Teachers Association
- First 5 California
- School Services of California
- Small School District Association
- Stanford Graduate School of Education
- The Calculus Roundtable
- WestEd
- Multiple current and former superintendents, school board members, and other district and school staff

Last, we are grateful to Martin Estrada of Munger, Tolles & Olson, LLP for making available a location in Southern California to hold one of the professional judgement panel workshops; Jay Chambers for his guidance; Suzette Chavez and Dawn Smith for supporting the logistics of the professional judgment panels; and, Phil Esra and Emma Ruckley, our editors.

The AIR research team takes sole responsibility for the entire substance and content of this report and independently provided all recommendations regarding the costs of adequacy.

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Executive Summary

What is the cost of providing all California public school students with access to the California content standards and achieving appropriate levels of proficiency in accordance with standards established by the California Department of Education?

This report presents the results of the professional judgment component undertaken by American Institutes for Research (AIR) to answer the question posed above. The following discussion summarizes the major elements of this "costing out" study. The term "costing out" is regularly used to describe this type of analysis of adequacy in education. In the course of this endeavor, AIR obtained input from professional educators and convened two 3-day meetings with highly qualified California educators to estimate the cost of an "adequate" education.

The Bottom Line

Public schools in California had about $66.7 billion in operational spending in 2016–17 to educate their students.[1] The main results of this study suggest that an additional $25.6 billion— 38% above actual spending—would have been necessary to ensure that all students had the opportunity to meet the goals set by the State Board of Education (SBE):

> *All California students of the 21st century will attain the highest level of academic knowledge, applied learning and performance skills to ensure fulfilling personal lives and careers and contribute to civic and economic progress in our diverse and changing democratic society.*

On a per-pupil basis, the adequate district-level cost was estimated to average around $16,890 per student. Actual district-level spending was $12,204 per student. While $16,890 per student is a sizable difference from actual spending levels, Connecticut, the District of Columbia, New Jersey, New York, Vermont and Massachusetts (adjusted for inflation) all spent more on a per-pupil basis in 2014–15 than the presented adequate estimates for California (Cornman, Zhou, Howell, & Young, 2018)[2].

Furthermore, the amount of additional funding required ($25.6 billion or 38%) is substantially lower than the amount projected in the previous AIR adequacy study for California (Chambers, Levin & DeLancey, 2006), which estimated that an additional $24.1 billion to $32.0 billion of additional funding was needed, on top of $45.3 billion in actual spending at the time –

[1] Operational spending excludes capital and debt service spending. This also does not include spending for independent charter schools.

[2] In terms of staffing levels, the Professional Judgement Panel recommended a substantial increase in the number of teachers and assistant teachers. In 2016–17, the elementary student teacher ratio in California was about 25 to 1, whereas the projected adequate average teacher ratio is 13:1, which is similar to Massachusetts' current staffing levels. Similarly, for middle and high the projected adequate teacher ratio is about 15:1, a substantial decrease from the actual which is about 25:1.

a 53% to 71% increase. This suggests that California has made substantial progress toward providing an adequate education in recent years.

Research Methods

The study employs the "professional judgment" approach as the centerpiece of the analysis. The AIR research team selected highly qualified California educators to participate on professional judgment panels (PJPs); these panels convened for 3-day meetings to design instructional programs for schools of varying size and demographic composition. These programs were designed so that students would have the opportunity to meet the SBE's outcome goal (specified above). The panels were then asked to specify the resources needed to deliver those programs.

The professional judgment process. The first stage of the project was devoted to developing a series of tasks to guide panelists in their deliberations. To support this work, the AIR research team relied on goals and benchmarks for student outcomes outlined in the SBE's vision and mission statements and the California accountability system, as designed under the federal Every Student Succeeds Act (ESSA). This culminated in the *Goals Statement*, which was used to define adequacy for the purposes of this study.

The AIR team developed a process for selecting "highly qualified" educators to serve on two independent PJPs. One panel took place in northern California and the other in southern California. These two panels were convened to develop instructional program designs and to specify the resources necessary to deliver those programs. Through this process, we estimated the resources needed to achieve school finance adequacy for students in the state.

The panels worked to complete a set of exercises. First, they focused on instructional programs and necessary resources for a "typical" California school—one with average enrollment and average demographic composition (in terms of the proportion of students eligible for free or reduced-price lunch, the proportion of English learners [ELs], and the proportion of students enrolled in special education services). The panels were then asked to modify their original instructional programs for schools with varying proportions of students living in poverty, students classified as ELs, and students enrolled in special education, and for schools of varying sizes.

Translating resource specifications into costs. Based on the resources specified by the PJPs, we developed estimates of the costs of an adequate education for California public schools across various grade levels, school sizes, and demographic configurations. Using regression analysis, we used the cost estimates from the PJP specifications to predict school-level spending for each school in California, accounting for school size, grade configuration, and student needs (students eligible for free or reduced-price lunch, students classified as ELs, and

students enrolled in special education).[3] These school-level predictions were then aggregated to the district level and additional district-level spending (on central administration, maintenance and operations, transportation, and food) was added on to facilitate comparisons with actual spending seen in the CDE's Standardized Accounting Code Structure (SACS) data.

Results

Overview of instructional program design trends. Overall, panelists in both the northern and southern California PJPs emphasized the importance of supporting teachers with sufficient planning time and training, hiring experienced but flexible teachers, ensuring opportunities for all students outside of core subjects (including science, technology, engineering, and mathematics [STEM] enrichment; the arts; and extra-curricular subjects), providing opportunities for high-quality early education for all children, engaging families in meaningful ways, providing dual-language learners with home-language support, and supporting social-emotional development. Panelists specified resources to reflect these priorities.

To account for the additional needs of schools serving high proportions of students living in poverty, students classified as ELs, and students enrolled in special education, the PJPs added resources to reduce class sizes, build richer special education programs, and foster professional development opportunities for teachers. High-quality professional development was seen as integral to improving student achievement and retaining quality teachers in schools with higher levels of student need. Most importantly, panels emphasized that student achievement was not necessarily dependent solely on the number of personnel at the school level, but also on how their roles and time were allocated.

The panels also added resources for early childhood education and extended day and year programs, especially for schools with high proportions of students living in poverty, students enrolled in special education, and students classified as ELs. Extended time (day and year) programs were seen as necessary not only for students who were unable to meet the standards, but also as enrichment opportunities for students already performing at proficiency levels. Early education programs were included to help students prepare for school, especially those with little parental or home support.

As a result of specifying additional resources for schools with higher levels of need, the cost of providing adequate educational opportunities increased in schools with larger proportions of students living in poverty, students classified as ELs, and students enrolled in special education. For both elementary and middle schools, the high-poverty/high-EL program design required the highest spending levels, with per-pupil costs $3,100 to $4,700 above the base models. At the high school level, the cost of the high-poverty/high-EL program design was

[3] Please note, in this report we interpret free- and reduced-price lunch as a proxy for poverty and therefore use terms interchangeably with the full understanding that the formal definition of poverty is defined by a more stringent standard.

almost $2,400 above the Base Model. The low-enrollment scenario had the highest adequate cost, about $2,800 per-pupil costs above the high school base model.

Comparing actual and adequate per-pupil cost estimates. In 2016–17, actual spending totaled $12,204 per pupil, and cost of adequacy was estimated to be $16,890 per pupil. This indicates that actual funding in 2016–17 needed to be 38% higher to achieve the adequate funding levels indicated through the PJP process. Of the total adequate cost per pupil ($16,890), $13,485 was predicted based on the school-level specifications of the PJPs. The remaining $3,405 was predicted based on district overhead calculations accounting for district administration, maintenance and operations, food, and transportation expenditure, as well as district special education costs specified by the PJPs.

High-poverty districts typically had larger spending deficits, indicated by the difference between actual spending and adequate cost. When comparing pupil-weighted quartiles of districts by free or reduced-price lunch eligibility, the lowest-poverty quartile had adequate cost levels that were just under $2,500 per pupil above actual spending levels—a difference of 22%. As poverty increased, both predicted adequate cost and actual spending increased, but adequate cost increased more than actual spending. In the two highest-poverty quartiles, adequate cost was approximately $5,700 to $6,200 (46% to 47%) higher than actual spending.

By locale, districts identified as being in cities showed the smallest differences between actual spending and adequate cost levels, while districts located in rural areas or small towns showed the largest differences. In both rural and town districts, 2016–17 spending levels needed to be 46% to 52% higher than actual spending levels to support an adequate education. Spending in cities and suburbs needed to be 37% to 38% higher than actual spending. However, compared to districts in cities and suburbs, town and rural districts served a relatively small proportion of students enrolled in school across the state.

Number of districts and students in districts with actual spending below or above adequate cost levels. Actual spending exceeded adequate cost in 8% of districts (serving 2% of students). For 87% of districts, adequate cost was more than 10% higher than actual spending in 2016–17. More than half of students were in districts where adequate cost was at least 40% higher than actual spending.

Of the more than 2.7 million students in the two highest-poverty quartiles of districts, only a few hundred attended schools in districts where spending was above adequate levels. Almost all students in the top half of districts with the highest poverty levels attended schools in districts where spending did not meet adequate cost levels.

Total costs required to achieve adequacy. Total adequate cost across the state of California for 2016–17 amounted to $92.3 billion. Actual spending in 2016–17 was $66.7 billion—$25.6 billion lower than projected adequate cost. When examined across free or reduced-price lunch eligibility quartiles, $16.3 billion of the additional spending required to achieve adequacy was attributed to the two highest-poverty quartiles. Only $3.4 billion of the additional spending was required for the lowest-poverty quartile.

By locale, we found that the majority of additional costs were in city and suburban districts. On a per-pupil level, districts in towns and rural locales required larger investments than city and suburban districts. However, investments in the towns and rural locales only amounted to an additional $3.1 billion to achieve adequate levels of spending, while city and suburban districts required an additional $22.6 billion.

Validation exercise. As a validation exercise, we examined the relationship between Grade 3–8 test scores in mathematics and English language arts (ELA) and the difference between adequate and actual spending. The results of this analysis showed that districts with larger funding deficits clearly performed worse, on average, than those with smaller deficits. Furthermore, the results showed that in districts where adequate cost and actual spending levels were equivalent or actual spending exceeded adequate cost, the average student performed above the set benchmark indicating proficiency. In districts where adequate cost exceeded actual spending, students did meet proficiency benchmarks, on average.

A Cautionary Note

Although the PJPs created instructional designs through which schools could construct adequate opportunity for students to meet the California content standards and proficiency levels, these theoretical designs did not recommend specific components as mandates for local practice. However insightful the panels' instructional designs, and however persuasive the case for their effectiveness, creating a "one size fits all" prescription for best educational practice was not the intention of this exercise. Rather, the model provided a justifiable systematic process for determining necessary expenditures to provide an adequate education across a wide range of circumstances (i.e., needs and scale of operations). Harnessing creativity and commitment and taking advantage of the experience of local educators necessitates providing them with discretion to determine exactly how funds should be used, coupled with an effective accountability system and governance structure within which to operate.

Concluding Remarks

California has made progress on funding public education. As our estimates show, that in 2016–17 California would need to increase its spending by approximately 38% compared to more than 50% estimated in the 2007 AIR California Adequacy Study. Resources to address the needs of students eligible for free or reduced-price lunch, English learners, and students enrolled in special education are major factors underlying the variation across our adequate cost estimations. However, one must recognize that investments in education cannot guarantee the desired outcomes. Moreover, a dialogue between local educators and policy makers is needed to determine how funds should be used in conjunction with a strong accountability system and a governance structure within which to operate.

Chapter 1: Introduction and Overview

This report presents the results of a thorough study conducted by American Institutes for Research (AIR) to investigate the cost of providing an "adequate" education to California students attending public elementary, middle, and high schools. The study addresses the following question:

> *What is the cost of providing all California public school students with access to the California content standards and achieving appropriate levels of proficiency in accordance with standards established by the California Department of Education?*

The AIR research team employed a professional judgment approach to costing out an adequate education. This approach leveraged the knowledge and experience of groups of expert educators, known as professional judgment panels (PJPs), to develop school programs that are capable of delivering an adequate education. For the purposes of this study, an adequate education was defined as providing access to instructional programs consistent with the California content standards and providing the opportunity to achieve the proficiency standards established by the California State Board of Education. The PJPs' school program designs needed to deliver adequate education at a minimum cost, and in a variety of contexts with different enrollment sizes and different student needs (i.e., different proportions of students eligible for free or reduced-price lunch, students classified as English learners [ELs], and students enrolled in special education).

This chapter provides an overview of funding educational adequacy in the California context, discusses the importance of using standards to determine adequate resources, and provides a brief summary of the professional judgment model. It then discusses the specifics of the California professional judgment model, including what the PJPs were *not* designed to accomplish.

Funding Adequacy in the Context of California

Over the last several decades, there has been a nationwide shift in public school funding from local taxes to state revenue sources. Traditionally, schools were funded mostly through local taxes, supplemented by both federal and state funding, with the smallest share coming in the form of federal dollars. However, a general trend nationwide has seen an increase in the proportion of public school funding coming from the state level, along with decreasing local responsibility for school funding.

While California has followed this national trend closely, the funding shift it has experienced has been far more pronounced. The federal share of total California revenues has, for the most part, mirrored the national trend, but the proportions of education funding coming from state and local revenues differ dramatically. Compared to its counterparts, California public schools receive a significantly higher proportion of school funds from the state.

It is widely accepted that California public school finance was profoundly affected by the *Serrano v. Priest* court case and the subsequent passage in 1979 of Proposition 13, which effectively limited the amount of local tax revenue that could be collected by capping property tax rates. The end result was a significant shift in financial support for public schooling from local to state revenue sources, as Downes (1992) notes:

> The primary effect of *Serrano II* and Proposition 13 was thus to create what was effectively a state-financed system of public education.

In this new era of school finance, the growing role of the state focused the funding debate on equity—or, more precisely, what the school finance literature referred to as "horizontal equity." This concept suggested that students and taxpayers across districts should be treated similarly with respect to the resources they received and the taxes they were required to pay (Sugarman, Coons, & Clune, 1970; Berne & Stiefel, 1984). An unfortunate and unintended consequence of Serrano II was that funding was to be equalized *down*. Rather than providing additional aid to poorer districts so that their funding was on par with more affluent districts, spending limits were imposed at a level between the two. While poorer districts had their levels of general aid increased as a result, many less-needy districts witnessed dramatic decreases in the amount of general aid they received.

Recent school finance reform in the state has made strides towards reversing the "leveling down" of funding brought on by the Serrano case. In 2013, the state's focus turned more towards *vertical* equity, creating a system where districts' funding is greatly affected by the needs of the students they serve. Specifically, the Local Control Funding Formula (LCFF) consists of a weighted funding mechanism through which funds are distributed from the state to districts based on the number of students with various needs served at different schooling levels (students eligible for free- or reduced-price lunch [FRL], students classified as ELs, and students in foster care).[4] The formula distributes base per-pupil funding to all districts depending on the number of students in each grade level (different base amounts apply to different grades). Districts then receive additional funding for each student who is from a low-income family (eligible for free or reduced-price lunch), classified as an EL, or in foster care. Districts also receive additional funds for high concentrations of students with these needs. This state system has created a policy environment that may facilitate better outcomes for students if the amounts of funding distributed through the system are indeed adequate. To this end, a key objective of this study is to better understand how much funding is necessary to provide all students access to the state's content standards and the opportunity to achieve the proficiency standards set by the State Board of Education.

[4] Please note, in this report we interpret FRL as a proxy for poverty and therefore use these terms, as well as low-income, interchangeably with the full understanding that the formal definition of poverty is defined by a more stringent standard.

Using Standards to Determine Adequate Resources

The clauses found in state constitutions often provide vague descriptions rather than exact definitions of an adequate education. For instance, the requirement to deliver a "thorough and efficient" education system was first introduced into a state constitution during Ohio's Constitutional Convention of 1850–51, and 14 states incorporated one or both terms over the next 20 years (Neff, 2007). How these constitutional obligations are interpreted drives the determination of what resources are deemed necessary to support educational adequacy. For this reason, it is essential to have a well-defined objective for the public education system, including measurable outcomes that must be attained, before the issue of adequate cost can begin to be addressed.

While formal, concrete goals statements stemming from constitutional adequacy clauses are not readily available across all states, two factors have helped push the creation of such statements. First, several court cases revealed the need for states to operationalize their goals for public education. For example, a significant focus of the *DeRolph v. State* (1997) case in Ohio was to define the concept of "thorough and efficient" and how it relates to school funding adequacy.[5] A high-profile court case in New York similarly sought to define the concept of a "sound basic education" and to determine the cost of providing this opportunity to all children in New York public schools.[6]

Second, the federal Every Student Succeeds Act (ESSA) requires states to design accountability systems, which necessarily define public schools' goals with respect to student outcomes, both academic and non-academic. For example, the California State Board of Education (SBE) has outlined a diverse set of content standards that they expect students to have access to, as well as outcome standards that all students should have an opportunity to achieve. This study uses these standards as its definition of educational adequacy for costing-out purposes. The SBE's vision, mission, and goals were incorporated into a *Goals Statement*, which the PJPs used to develop program designs that would deliver an adequate education in a variety of school settings and at a minimum cost. The research team then used information on the corresponding staff and non-personnel resources to estimate the cost associated with providing an adequate education to students across the state's public elementary, middle, and high schools. More detail about the implementation of this PJP approach is provided later in this chapter.

Research Methods

Historical application of the professional judgment approach. The methodological centerpiece of this study is the professional judgment approach, and AIR has a long history of implementing and refining this method. Indeed, staff involved with this research project

[5] For a full discussion of *DeRolph v. State* (1997), 78 Ohio St.3d 193, see McKinley (2005a, 2005b).

[6] See Supreme Court of The State of New York, County of New York, Campaign for Fiscal Equity, Inc., et al., Plaintiffs, against THE STATE OF NEW YORK, et al., Defendants. Index No. 111070/93, Justice DeGrasse, J.

pioneered strategies for involving informed educators in the process of designing costing-out models. Initial research in this area was conducted in Illinois and Alaska (see Chambers & Parrish, 1982, 1984). These early studies asked panels of educators to define service delivery systems that were appropriate to meet the educational needs of various student populations. Detailed input models (e.g., regular classrooms and specialized instructional and related services) were designed for separate categories of students, including regular elementary and secondary school students, disadvantaged students, students with disabilities, gifted students, and vocational students.

In more recent projects in New York State, California, and New Mexico, Chambers et al. (2004, 2006) and Chambers, Levin & DeLancey (2008) used an enhanced professional judgment model to determine the cost of an adequate education. Three elements distinguished these more recent applications of the professional judgment model from the earlier work of Chambers and Parrish (1982, 1984):

- The goals established for the PJPs were clearly focused on student outcomes.
- The PJPs were asked to begin their deliberations by designing instructional programs at each schooling level. First, the panels determined the content and structure of each educational program, then the panels were asked to develop the resource specifications necessary to deliver the desired services.
- The professional judgment process was structured to provide a more integrated approach to meeting the needs of all types of students.

The current study incorporates these three elements.

Current application of the professional judgment approach. The AIR research team selected highly qualified California educators to serve on two PJPs, each of which participated in a 3-day meeting to design instructional programs for students in schools with varying demographic compositions. We asked the panels to design instructional programs so that students would have the opportunity to meet "academically rigorous content standards and performance standards in all major subject areas," as stated in California's Education Code, as well as targeted proficiency levels, as defined in the state's accountability plan (Exhibit 2-2). The panels were then asked to specify the staff and non-personnel resources necessary to deliver those programs.

Prior to their deliberations, the PJPs were presented with five summary briefs about existing educational research on school effectiveness, written by educational scholars and practitioners. These briefs discussed elements that contribute to adequately serving specific student populations (at-risk students, students enrolled in special education, students classified as ELs, early childhood education students, and rural students) and the subsequent promotion of school success. During their deliberations, panels were provided with additional information on personnel resource utilization in typical public schools in California. In total, each panel was tasked with designing instructional programs and specifying resources for 15 different school prototypes that varied with respect to schooling level (elementary, middle, and high school), student needs, and enrollment size. Chapter 2 provides further details on the PJP process.

In order to identify the cost of the instructional programs designed by the PJPs, we assigned prices to each of the specified resources and calculated a total cost for each school prototype. This information was then used to predict the cost of providing an adequate education for each traditional public elementary, middle, and high school in California. The predictions of school-level costs for providing an adequate education were aggregated to the district level, and additional dollars to cover the costs of district-level functions were added in order to generate district-level cost figures. Our final district-level costs for providing an adequate education also took into account variations in the costs of hiring and retaining comparable personnel across geographic labor markets. The rationale behind these geographic cost adjustments was that available revenues should, at a minimum, be sufficient to provide an opportunity for all students to meet the California content and performance standards. In order to accomplish this objective, projected revenues for each school district needed to be adjusted to account for geographic cost differences across labor markets within California in order to equalize the purchasing power of the educational dollar.

Improvements in applying professional judgment. Since the AIR costing-out studies in New York, California, and New Mexico were completed, the research team has taken additional steps to improve its application of the PJP approach. First, the team placed a stronger emphasis on program design during the PJP deliberations, including providing panels with a more explicit definition of the instructional program design component of the process (discussed in Chapter 3). In addition, the panels were provided with a more structured set of questions surrounding instructional program design during their deliberations (see Appendix B).

Second, AIR provided the panelists with information on the relative costs of the resources used in their specifications and the per-pupil cost implications of their decisions. In New York, the panels were only asked to specify the resources required to deliver the programs, without any information about how much cost each decision added. In the current study, immediate (real-time) feedback on the per-pupil cost implications of their resource allocation decisions was provided to all panels through an interactive cost model spreadsheet. This modification was intended to encourage efficiency at the programmatic level.

Finally, information about current resource usage in typical California schools was provided to panelists as a point of reference (see Appendix C). Using publicly available data from the CDE, the research team estimated the average number of full-time equivalent staff (by position type) at elementary, middle, and high schools with typical enrollments and proportions of students living in poverty, students classified as ELs, and students enrolled in special education. The panels were also provided with information on average school-level operational non-personnel spending per pupil, estimated using data from the CDE's district-level Standardized Account Code Structure (SACS) fiscal files.

What professional judgment panels were not expected to accomplish. Panels were not asked to develop program designs or determine staff and non-personnel resource specifications associated with district-level functions such as student transportation, building maintenance

and operations, district office operations, or food services. The AIR team incorporated estimates of these costs at a later stage of analysis (see Chapter 4).

Debt service and major facility construction matters were also not within the purview of the PJPs. Excluding these components does not mean that they are not important. Both interact in significant ways with any effort to address the adequacy of funding for educational services. However, these components would require specialized analyses that were beyond the scope of this project.

Finally, PJPs were not asked to impute input prices for the staff and non-personnel resources specified for their instructional program designs. The research team used average compensation levels (i.e., salaries and fringe benefits) and adjusted these for geographic variations in the costs of school personnel across the state. However, panelists were able to indirectly affect staff salaries for each program design through the inclusion of extra professional development and service days, and to indirectly affect teacher salaries by adjusting the distribution of teacher experience levels.

Organization of the Remainder of the Report

The remainder of this report is organized into four chapters. Chapter 2 describes the PJP process and panel deliberations. Chapter 3 describes how the program designs and PJP specifications were translated into school-level cost estimates. Chapter 4 presents the projections of the funding needed to achieve educational adequacy, as well as a comparison between actual costs and projected costs to achieve adequacy. Chapter 5 offers conclusions and observations regarding the processes involved in this study and the study's outcomes.

Chapter 2: Measuring Adequacy Cost Estimates through the Professional Judgment Approach

An Overview of the Professional Judgment Panel Component

The AIR research team used a professional judgment approach to develop a range of cost estimates for providing an adequate educational program in California public K–12 schools. This approach involved convening two independent panels of highly qualified educators—one panel in northern California and one in southern California—to carry out a series of tasks over the course of a 3-day meeting. Specifically, the panels were charged with developing model instructional program designs for schools that were capable of producing student outcomes defined in the *Goals Statement* at a minimum cost. Each panel was first asked to develop a base model instructional program design for elementary, middle, and high schools reflecting the size and needs of a "typical" California school at each schooling level. After completing the instructional program designs, each panel was asked to specify the staff and non-personnel resources necessary to support their designs at a minimum cost, which were then entered into a system of Microsoft Excel worksheets (known as a resource cost model). For example, a panel's program design might emphasize the importance of providing core subject teachers with a daily planning period and/or time for collaboration with their colleagues. The panel

might then include additional staff for non-core classes in its resource specifications to ensure core teachers had a free period during the day.

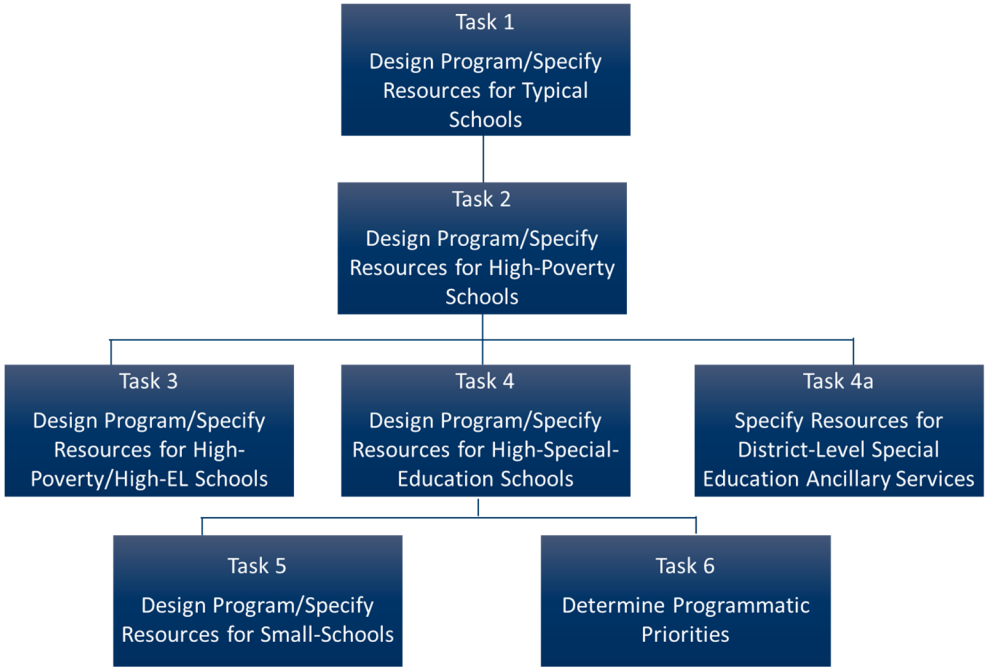
After completing the instructional program designs and resource specifications for the base models for "typical" schools, each panel was asked to make modifications for schools with varying demographic compositions (higher proportions of students living in poverty, students classified as ELs, and students enrolled in special education) and varying enrollment sizes. To make the process more efficient, each of the panels was divided into elementary and middle/high school sub-panels to complete these exercises. Sub-panels made modifications for hypothetical schools with typical enrollment, EL and special education, but significantly higher poverty levels compared to the typical elementary, middle, and high school. These sub-panels also completed exercises for hypothetical schools with significantly lower enrollments than the typical elementary, middle, and high school in order to gather data on the impact of scale on adequate cost.

Subsequent tasks focused on schools with higher proportions of students classified as ELs and students enrolled in special education. For these exercises, panels were again split into two sub-panels: one focused on students classified as ELs and one focused on students enrolled in special education. The EL and special education sub-panels engaged in similar tasks, modifying their program designs and resource specifications to suit hypothetical schools with higher proportions of students classified as ELs and students enrolled in special education, respectively. Recognizing that schools with large proportions of ELs also tend to have high levels of student poverty the demographics of the hypothetical schools created for the EL and poverty tasks were linked in order to be more representative of schools found across the state[7]. The full panels were given the opportunity to review the work completed by the sub-panels and to ensure program designs were consistent across grade levels and student populations.

Exhibit 2-1 provides an overview of the organization of the series of tasks completed by the professional judgment panels (PJPs).

[7] The estimated correlation between students eligible for free and reduced price lunch and English language learners was 0.58 and statistically significant with a p-value less than 0.001.

Exhibit 2-1. Tasks Completed by the Professional Judgment Panels



Recruitment Process for the Professional Judgment Panels

The study team solicited nominations for outstanding educators from organizations across the state. Emails to solicit nominations were sent to all district and county superintendents, the California Association of African-American Superintendents and Administrators, California CORE Districts, the California Teachers Association, First 5 California, School Services of California, the Small School District Association, Stanford's Graduate School of Education, the Calculus Roundtable, and WestEd.

We solicited nominations for the following 11 panel positions: elementary, middle, and high school teachers; elementary, middle, and high school principals; a superintendent; an EL specialist; a special education specialist; a school business official; and an early childhood specialist.

Selection process. Before receiving nominations, the study team outlined the desired criteria for professional judgment panelists and developed a corresponding scoring rubric for evaluating candidates. Points were given to candidates for having an advanced degree, more than 20 years of experience, recognition via an award such as Teacher of the Year, experience working with disadvantaged students, experience working in a school or district that had demonstrated success or high growth, and experience with school budgeting.

Each nominee was scored according to these criteria. The study team also sought representation on the panel from multiple races and both genders, and from both rural and urban districts. Based on these criteria, a set of first-choice candidates was invited to participate in the panels. When panelists were not able to accept the invitation, the study team

invited additional candidates with the next highest scores. (See Appendix E for the selected panelists and their biographies.)

Overview of Panel Deliberations

AIR convened two 3-day PJP workshops on December 8–10, 2017 (northern California) and January 19–21, 2018 (southern California). In total, 22 outstanding educators participated in these panels. To this end, the northern and southern panels operated completely independently of one another. As described above, panels were first asked to design instructional programs and then specify needed resources for the "typical" California elementary, middle, and high school. The panels then completed exercises to determine how resources would need to change for schools with higher proportions of students living in poverty, students classified as ELs, and students enrolled in special education, as well as low enrollments. In addition, panels completed an exercise to specify district-level resources to serve students enrolled in special education. Panelists were charged with ensuring that resources were as efficient as possible to meet the outcomes laid out in the *Goals Statement* (Exhibit 2-2).

Exhibit 2-2. Goals Statement

California Department of Education Vision, Mission, and Goals

The State Board of Education (SBE) has set the following vision for all California students:

> *"All California students of the 21st century will attain the highest level of academic knowledge, applied learning and performance skills to ensure fulfilling personal lives and careers and contribute to civic and economic progress in our diverse and changing democratic society."*

Under this framework, SBE has also defined its mission as:

> *"Create strong, effective schools that provide a wholesome learning environment through incentives that cause a high standard of student accomplishment as measured by a valid, reliable accountability system."*

The overarching goals of the SBE are focused on two areas: Standards and Achievement. SBE's goal is to adopt and support rigorous academic content and performance standards in the four core subjects for kindergarten and grades 1 through 12. In regard to achievement, SBE's goal is to ensure that all students are performing at grade level or higher, particularly in reading and math, at the end of each school year, recognizing that a small number of exceptional needs students must be expected, challenged, and assisted to achieve at an individually determined and appropriately high level. Advocate for mandatory intervention for every child not at grade level. Do everything possible to ensure that "the job is done right in the first place."

Regarding assessment, the SBE has developed policies that assure that all students receive the same nationally normed and standards-based assessments, grades 2 through 11, again recognizing that a small number of exceptional needs students must be separately and individually assessed using appropriate alternative means to determine achievement and progress.

The California accountability model. A key part of the accountability system in California is based on the combination of current performance (Status) and improvement over time (Change). Status is measured based on the school or student group's current year of data for each indicator. Change is measured as the difference in results from the current year to the prior year. There are five levels of both Status and Change. The combination of the five Status levels and the five Change levels results in 25 performance levels displayed in a five-by-five colored matrix, as illustrated below.

Exhibit 2-2. Goals Statement (Continued)

Goals Statement for Professional Judgment Panels:
(1) Student Outcomes
Regardless of student body, all California schools will meet the criteria to be rated at least GREEN, as described at https://www.cde.ca.gov/ta/ac/cm/fivebyfivecolortables.asp#AcademicTable, on all four state accountability indicators:

- Suspension rate
- English learner progress
- Graduation rate
- Academic indicator (English language arts/literacy assessment or mathematics)

California Accountability Matrix

Levels		Change				
		Declined Significantly	Declined	Maintained	Increased	Increased Significantly
Status	Very High	Yellow	Green	Blue	Blue	Blue
	High	Orange	Yellow	Green	Green	Blue
	Medium	Orange	Orange	Yellow	Green	Green
	Low	Red	Orange	Orange	Yellow	Yellow
	Very Low	Red	Red	Red	Orange	Yellow

(2) Access to California Content Standards
All students should have access to instructional programs and services that are consistent with the California content standards in all subject areas, listed below, as adopted by the State Board of Education and described at https://www.cde.ca.gov/be/st/ss/.

- English Language Arts
- Mathematics
- English Language Development
- Career Technical Education
- Computer Science
- Health Education
- History-Social Science Model School Library
- Physical Education
- Science
- Visual and Performing Arts
- World Language

Source: California State Board of Education

Prior to convening the PJP meetings, each panelist was provided a full set of PJP instructions, which included the *Goals Statement* and four research briefs on effective educational practices for the following student populations: rural, at risk, EL, and special education. In addition, they were provided a practitioner brief on effective school leadership and a publication on experts' consensus on early childhood education research, published by the Brookings Institution (Phillips et al., 2017). Panelists were informed that the summaries of research were provided for their reference, and that they could determine how much to rely on that information. Panelists were also provided with school resource profiles—showing recent staffing patterns for typical California elementary, middle, and high schools—to serve as reference points in their panel deliberations. The specific instructions provided to the panelists are included in Appendix B.

Task Assumptions

The panels were given a set of assumptions to work with during their deliberations. These assumptions were intended to make the exercise as realistic as possible, within the constraints of available participant time and expertise. Panelists were instructed to assume that specified levels of spending on facilities, district administration, and transportation were fixed and could not be changed as part of the exercise. Panelists were also instructed to assume that prototypical schools were not being newly created; rather, schools were to be thought of as ongoing enterprises, which meant that panelists were not responsible for purchasing items that would already be in place at an operational school, such as desks and chairs.

Exhibit 2-3 presents demographics for each hypothetical school for which panelists were asked to design programs, by schooling level.[8]

[8] The demographics used to define each schooling-level specific Base Model (Task 1) represent averages across those schools that were in the second and third quartiles (between the 25th and 75th percentiles) of the respective within-schooling level statewide distribution of each measure. Demographics used to define the student needs models (Tasks 2 through 4) represent the average of schools that were in the fourth quartile (above the 75th percentile) of the respective within-schooling level statewide distribution of each student need measure. The school enrollments used to define the Low Enrollment model (Task 5) represent the average of schools that were in the first quartile (below the 25th percentile) of the respective within-schooling level statewide distribution of school enrollment.

Exhibit 2-3. School Demographics by Schooling Level

School Characteristics	Task 1		Task 2		Task 3		Task 4		Task 5		Task 6	
	Base Model		High Poverty		High Poverty and High EL		High Special Education		Low Enrollment		Programmatic Priorities	
Elementary												
K–5 Enrollment	522		522		522		522		283		522	
Free or reduced-price lunch	335	64%	484	93%	484	93%	335	64%	182	64%	335	64%
English learner	147	28%	147	28%	319	61%	147	28%	80	28%	147	28%
Special education	61	12%	61	12%	61	12%	99	19%	33	12%	61	12%
Middle												
6–8 Enrollment	609		609		609		609		264		609	
Free or reduced-price lunch	416	68%	563	93%	563	93%	416	68%	180	68%	416	68%
English learner	128	21%	128	21%	327	54%	128	21%	56	21%	128	21%
Special education	66	11%	66	11%	66	11%	110	18%	29	11%	66	11%
High												
9–12 Enrollment	1,471		1,471		1,471		1,471		286		1,471	
Free or reduced-price lunch	859	58%	1,265	86%	1,265	86%	859	58%	166	58%	859	58%
English learner	141	10%	142	10%	382	26%	141	10%	29	10%	141	10%
Special education	137	9%	137	9%	137	9%	235	16%	27	9%	137	9%

Note: Light blue cells denote school characteristics that differ from the base model (Task 1).

Source: California Department of Education (CDE) Student & School Data Files (https://www.cde.ca.gov/ds/sd/sd/) and California Assessment of Student Performance and Progress (CAASPP; https://caaspp.cde.ca.gov/sb2017/ResearchFileList)

Summary

Every effort was made to secure two diverse panels of highly qualified educators. Nominations were solicited from a wide variety of constituent groups from around the state, and a careful process was followed to screen these potential candidates. The AIR research team tried to secure panelists with a wide variety of expertise and experience who were representative of district diversity in terms of size, urbanicity, and location.

During program deliberations, panelists were instructed to proceed through a series of tasks that emphasized program design first and only asked about resource specifications after program designs had been completed. We began with a base model prototype for the typical elementary, middle, and high school and then asked panels to explore variations in program design and resource specifications associated with the following changes in pupil needs: higher proportions of students living in poverty, higher proportions of students classified as ELs, and higher proportions of students enrolled in special education. Additional information provided to panelists included current resource profiles for schools with similar demographics for all tasks, as well as default values for certain personnel and non-personnel expenditures for the base model task (to provide a starting point).

The panels' deliberations resulted in complex and thorough program designs. These provided a valuable foundation for the cost analysis of educational adequacy presented in the following chapters.

Chapter 3: Translating Resource Specifications into Cost Estimates

Each of the two professional judgment panel (PJP) workshops generated a series of five school program designs for each schooling level (i.e., elementary, middle, and high school) that varied with respect to levels of pupil need and school size, providing 30 data points in total. Using the collection of staff and non-personnel resources specified for each program design, the research team calculated a series of estimated costs. The cost estimates reflect the per-pupil dollar values of those resources deemed necessary for the hypothetical elementary, middle, and high schools to achieve the specified goals for each combination of pupil needs and school size they represented. These data were then used to generate an equation that describes how adequate per-pupil cost varies by schooling level, size, and pupil needs. This chapter explores the patterns of resource allocation specified by the panels including variations in adequate program costs by school size and student needs.

Description of the PJP School Program Designs

The program designs and resource specifications generated by the PJPs provide a wealth of information. The most important point to keep in mind when interpreting the PJPs' programs and resource allocations is the outcome standard specified for this study. Each panel was asked to design programs that would provide the opportunity, at a minimal cost, for *all California students to attain the highest level of academic knowledge, applied learning, and performance skills to ensure fulfilling personal lives and careers and contribute to civic and economic progress*

in our diverse and changing democratic society. The program designs and subsequent resource specifications resulting from the PJP process must be interpreted with this outcome standard in mind.

As mentioned above, the PJPs' program designs included an enormous amount of information concerning the types of programs and services panelists felt were necessary to reach the educational outcome goals, along with the corresponding resource combinations necessary to support these programs at a minimum cost. The AIR research team performed a thorough review of the program designs and extracted the main resource allocation themes. The program designs emphasized the following:

- Providing sufficient time for teachers to plan and collaborate with colleagues during the school day
- Keeping class sizes at a reasonable level, but not so small as to be inefficient
- Focusing on opportunities in science, technology, engineering, and mathematics (STEM)
- Providing opportunities outside of core subjects, such as visual and performing arts (VAPA) and other electives, for students at all schooling levels in order to foster student engagement
- Providing resources to serve all four-year-old children in a high-quality prekindergarten or transitional kindergarten (TK) program
- Engaging families in meaningful ways, especially in early childhood and elementary education
- Providing a fully inclusive special education program, with aides to provide appropriate student support, particularly in schools with large numbers of students enrolled in special education, and incorporating response-to-intervention practices
- Supporting dual-language learners to master reading and writing in their native language before learning a new language
- Including intentional training for all teachers in language development
- Promoting focused professional development activities that are purposeful, do not attempt to accomplish too much at once, include post-training follow-up with teachers, and are well-integrated with evaluation and feedback systems
- Acknowledging the diversity of needs among all students, and providing sufficient staff for differentiation
- Supporting social-emotional development through a team-based approach to supporting students
- Valuing vertical alignment but not being overly bound by it; in other words, making sure that curricula and instruction align across grades, which requires additional effort to coordinate among instructional staff across grades (and schooling levels)

Overview of Cost Estimates

As mentioned above, adequate per-pupil costs for each school program design were derived from resource specifications generated by the two PJPs, which operated independently

from one another.[9] The figures presented in the following exhibits reflect overall adequate school-level program costs per pupil, excluding all costs associated with district-level functions such as central administration, maintenance and operations, food, and transportation. Chapter 4 describes how these district-level cost components were calculated and combined with the school-level costs required to support an adequate education (i.e., generated through the PJP process). Calculating these figures involved using average compensation rates (including salaries and benefits) for the various categories of school personnel included in the school prototypes.[10,11]

In order to describe the types of resources specified by the PJPs, we created two different ways of categorizing costs. The following categories show how we grouped costs by programmatic cost component:

- Core instruction – costs of teachers and educational assistants for core instructional classes
- Special populations – costs associated with preschool, English learner (EL) supports, and special education instruction and services
- Student and other support – costs of instructional and pupil support services (guidance counselors, school psychologists, social workers, and other support staff), as well as professional development, maintenance and operations, and the costs of substitute teachers
- School administration – costs of principals, vice principals, clerical and office staff, and any other school administrative staff
- General non-personnel – costs of books and curriculum, supplies and equipment, contracted services, communications services, and any rentals, leases, or repairs
- Extended time – costs of school athletic programs, extended day programs, and extended year (summer) programs

[9] Specifically, panelists were convened in two separate PJP workshops, organized in northern California (December 8–10, 2017) and southern California (January 19–21, 2018).

[10] Salaries for teachers and principals were obtained from 2016–17 California Department of Education (CDE) Form J-90 data (https://www.cde.ca.gov/ds/fd/cs/). Salaries for other staff types were obtained using 2017 occupational employment statistics (OES) specific to California from the Bureau of Labor Statistics (BLS) (https://www.bls.gov/oes/). Benefits rates for certified and non-certified staff were calculated from the CDE annual financial data, as reported in the Standardized Account Code Structures (SACS) (https://www.cde.ca.gov/ds/fd/fd/).

[11] AIR generated average teacher salaries for three different experience ranges, based on teacher salary steps (steps 1–4, 5–8, and 9 and above). Panelists then specified in each program design the percentages of teachers who would fall into each of the three experience ranges.

The second method of categorizing costs was based on dollars associated with certified personnel (teachers, administrative staff, counselors, etc.), non-certified personnel (educational assistants, paraprofessionals, clerical staff, etc.), and non-personnel (supplies and materials, contracted services, etc.).[12]

Base cost estimates were generated for elementary, middle, and high schools with typical levels of student enrollment and student need. Again, these figures do not include district-level expenditures on central administration, maintenance and operations, student transportation, and food, which were considered beyond the scope of the PJP deliberations.

The overall cost of elementary school programs also includes the cost of prekindergarten and TK programs. However, all per-pupil calculations in this report are calculated using K–12 enrollment (instead of prekindergarten to Grade 12 enrollment) because panelists were able to specify the number of prekindergarten and TK students they felt should be served in each of the elementary school program designs.

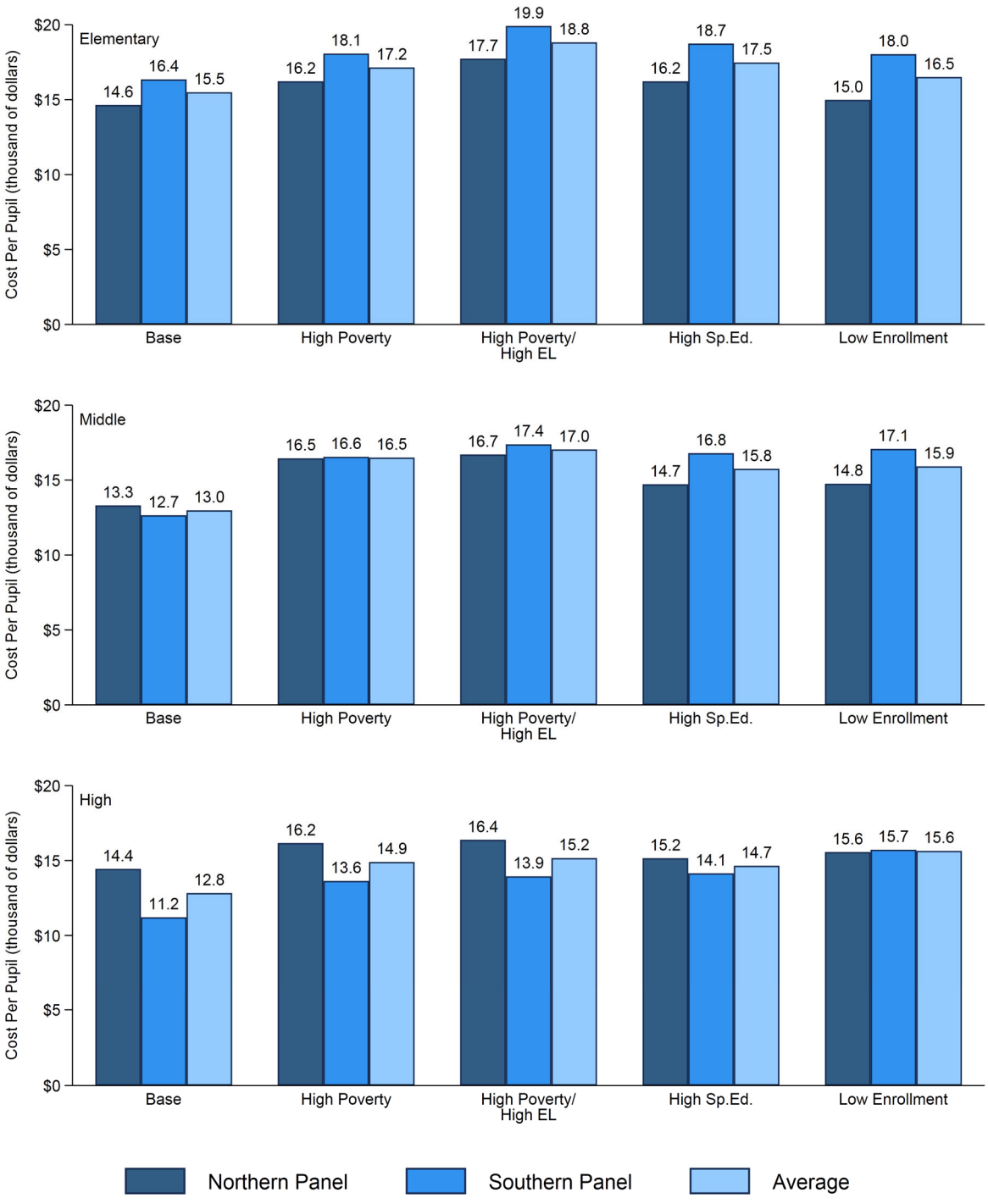
General Trends

Exhibit 3-1 shows the projected adequate per-pupil costs for different program designs across the three schooling levels, allowing us to see how the costs generated from high-poverty, high-poverty/high-EL, high-special-education, and low-enrollment program designs compare to the costs generated in the base models. In general, the panels specified additional resources (beyond those specified in the base models) in instructional program designs for schools with additional needs or smaller enrollments. Common program design modifications were reducing class sizes, extending the length of the instructional day and school year for all students, and building stronger special education programs by increasing the number of staff devoted to special education instruction and administration. In addition, high-quality professional development was seen as integral to improving student achievement and retaining quality teachers in schools with higher student needs. The panels emphasized that student achievement was not solely dependent on the number of personnel at the school level, but also on the quality of staff, how their roles were defined, and how their time was allocated.

The panels also added resources for early childhood education and extended day and year programs, especially for schools with high proportions of students living in poverty, or with high proportions of students enrolled in special education and students classified as ELs. Extended time programs (day and year) were seen as necessary not only for students who were unable to meet the standards, but also as enrichment opportunities for students already performing at proficient levels. Early education programs were included to help students prepare for school, especially those with little parental or home support.

[12] An in-depth discussion of the differences in program design between the northern and southern panels can be found in Appendix F, along with a discussion of costs broken out by personnel and non-personnel categories.

Exhibit 3-1. Comparison of Adequacy Projected Costs by Model and Schooling Level



Source: AIR calculations based on PJP resource specifications.

As a result of specifying additional resources for schools with higher levels of need, the cost of providing adequate educational opportunities increased in schools with higher proportions of students living in poverty, students classified as ELs, and students enrolled in special education. At both the elementary and middle school levels, the high-poverty/high-EL program designs had the highest adequate per-pupil costs, which were $3,100 to $4,100 above that of the corresponding base models. At the high school level, the per-pupil cost of the high-poverty/high-EL program design averaged $2,400 above the base model. The high school low-enrollment program design had the highest average cost across all models at this schooling level.

The following sections examine the base model program designs and resource allocation patterns for elementary, middle, and high schools. Modifications to these base models made in response to changes in student needs and school size are also examined in greater detail. We stress that although the panels specifically delineated specific quantities of different resources (e.g., core classroom teachers, instructional assistants, pupil support personnel, etc.), their specifications are not intended to be prescriptive. That is, they are not meant to serve as mandates for regulating the types and quantities of resources districts and schools allocate.

Elementary School Program Designs

Elementary school base model. The panels independently designed instructional programs that were similar in scope and nature, but somewhat different in the intensity of their resource needs. The panels suggested similar lengths for the regular instructional school year (between 180 and 185 days) and extended the contract year for teachers by 10 days to allow more time for planning, training, and collaboration. Key resource allocation decisions for specific programmatic components of the PJPs' designs were as follows:

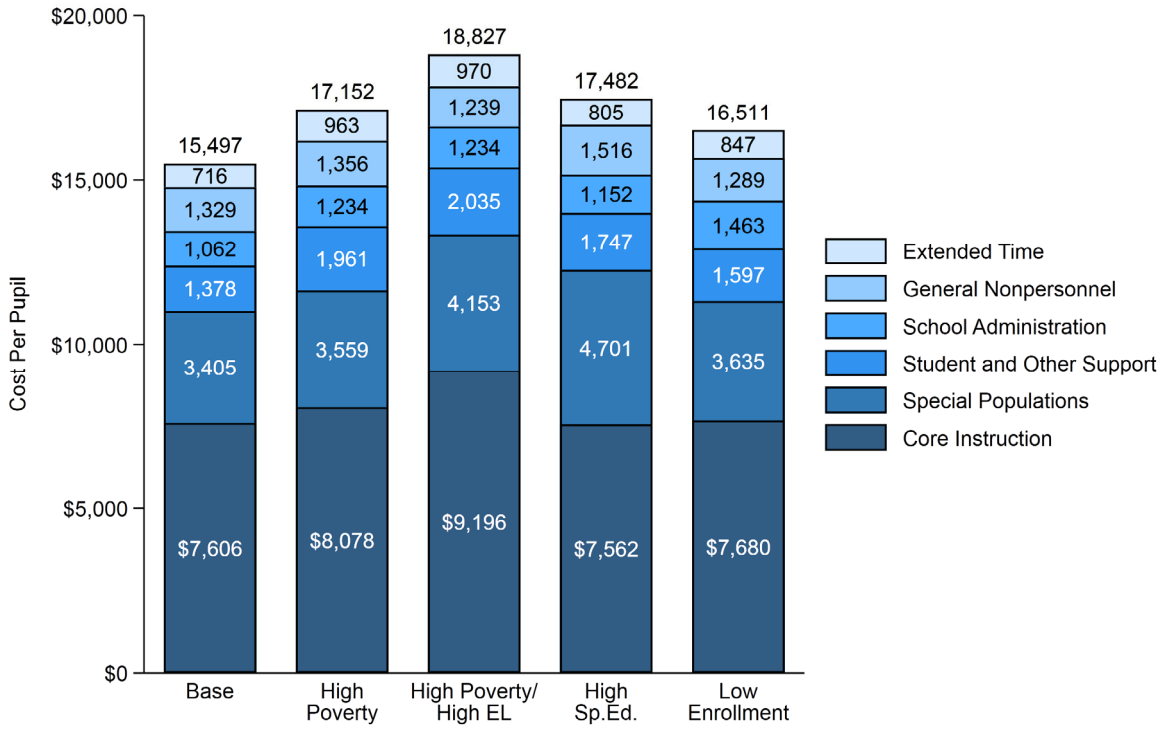
- Core instruction: Both panels suggested having an average class size of 22 students and assigned resource teachers for STEM and VAPA courses.
- Special populations: Panels recommended a preschool program that should be offered to all the age-eligible population.
- Student and other support: Both panels specified bilingual resource teachers for ELs for the purposes of testing, student reclassification, and data analysis. Both panels also specified special education program staff, including teachers, educational assistants and specialist service providers (e.g., speech pathologists), instructional support staff (e.g., librarians), and pupil support staff (e.g., psychologists and social workers) to better serve student needs.
- Extended day and year: Panels specified extended-day programs for student enrichment in STEM and VAPA, and extended-year programs to prevent student summer learning loss, especially for students with special needs (e.g., at-risk students, ELs).

It is important to note that the average class size listed for the core instructional program does not take into account resource teachers or those teachers supporting special education and English learner students. Once these additional instructors are considered, the

estimated pupil–teacher ratio for the base model is 13:1, which is in line with the average in other states with higher funding and higher performance.[13]

As seen in Exhibit 3-2, the base model specifications resulted in an average per-pupil cost between the PJPs of about $15,500. The core instruction component accounted for almost half of the overall predicted per-pupil cost, while the special populations component accounted for more than a fifth of the overall predicted cost. It is important to remember that the prekindergarten and TK programs were included in the special population component of the elementary school base model and accounted for about 8% of the overall cost.

Exhibit 3-2. Comparison of Elementary School Adequacy Projected Costs by Cost Component Breakdown



Source: AIR calculations based on PJP resource specifications.

Elementary school high-poverty program design modifications. The panels decided that educational supports must be more targeted for schools with higher proportions of students living in poverty. This included allocating resources to the development of safe spaces and programs to address the circumstances of students in living poverty. In general, the panels

[13] For example, the current (2017-18) average pupil-teacher ratio across schools in Massachusetts is also 13:1 (see Massachusetts Department of Elementary and Secondary Education Teacher Data Reports at http://profiles.doe.mass.edu/state_report/teacherdata.aspx).

suggested that schools should provide access to resources that students lack at home, so that students can prepare for and have a successful day at school. This model follows a "break-the-cycle" approach, where programmatic elements focus on making students feel valuable and nurture their ability to contribute to society. To implement this approach, the panels made substantial modifications to their base instructional design and resource specifications.

One of the panels adjusted the teacher qualification distribution by decreasing the percentage of relatively inexperienced teachers (step 4 or below) from 30% to 25% and commensurately increasing the percentage of mid-career teachers (steps 5–8) from 35% to 40%. For the core instruction component and the student and other support component, the panels specified additional support personnel to address the increased levels of student need, such as English language arts (ELA) and mathematics specialists, guidance counselors, social workers, and psychologists. In the special populations component, one of the panels increased the expected attendance for the preschool program to cover 90% of the age-eligible population (up from 75%) in order to better support students and address their needs at an early age.

An additional element of this model involved building connections between the school and the community so that they mutually support one another. This necessitated focused leadership and dedicated liaisons to implement the work. To support this, both panels added positions for a family engagement coordinator or community liaisons in the student and other support component, and one panel explicitly mentioned the role of parent advocacy groups and mentors.

Another critical factor included in the panel design was the provision of expanded afterschool programs in order to maintain a safe space for high-poverty student populations, which is not always available. Both panels suggested dramatic increases in the expected percentage of students enrolled in both the general afterschool program and more specific extracurricular activity programs. In addition, both panels increased the expected participation rate in the extended-year programs to promote learning over the summer and prevent learning loss, especially for those families that cannot provide learning opportunities for their children during this period.

The resources specified for the high-poverty elementary school program design resulted in an average increase in adequate costs of about $1,650 per pupil above that of the average base model, resulting in an overall per-pupil cost of $17,152. While the average per-pupil cost of each component in the high-poverty program design was higher than in the average base model, the component that saw the largest average increase was student and other support, which rose by almost $600 per pupil (Exhibit 3-2).

Elementary school high-poverty/high-EL program design modifications. For schools with higher proportions of both students in living poverty and students classified as ELs, panelists made several modifications to the high-poverty model. Under the special populations component, both panels increased the number of bilingual resource teachers, EL specialists, and aides to either assist current teachers or teach core subject classes. The panels also allocated additional professional development funding dedicated to EL topics under the student

and other support component. Moreover, both panels indicated that a significant share of student support staff should be bilingual.

The resources specified for the high-poverty/high-EL program design resulted in the highest average per-pupil cost to support adequacy across the five models. In this case, the average overall adequate per-pupil cost was $18,827—an increase of $3,330 above the elementary school base model. As seen in Exhibit 3-2, the high-poverty/high-EL programmatic components with the largest increases above the base model were core instruction ($1,590), special populations ($748), and student and other support ($657).

Elementary school high-special-education program design modifications. For schools with higher proportions of students enrolled in special education, the PJPs were aligned in terms of the types of services they believed students enrolled in special education should receive. Modifications were made mostly to the special populations and extended time programmatic components. Both panels decided to increase the number of special education instructional teachers and aides assigned to assist certified instructional personnel. To meet the needs of students enrolled in special education, the panels specified more staff in the form of school psychologists, social workers, nurses, and counselors. Moreover, both panels explicitly indicated the need for additional non-personnel resources to provide assistive technology for working one on one with students enrolled in special education, especially those with hearing impairments.

The resources specified for the high-special-education program design resulted in an average overall adequate per-pupil cost of about $17,500—$1,985 more than the average cost of the base model specifications. As seen in Exhibit 3-2, the per-pupil amounts for each cost component were increased above base model levels, with the largest increase ($1,295) occurring in the special populations component.

Elementary school low-enrollment program design modifications. In general, panels modified their instructional program designs and resource specifications by making adjustments that were proportional to the smaller school sizes, or by combining two or more roles into one staff position. However, panelists made some changes that did not follow this overall trend. For example, the panels provided more professional development opportunities for teachers in order to improve their ability to provide instruction in multiple subject areas by increasing spending devoted to contracted professional development services.

The resources specified for an elementary school with low student enrollment resulted in an increase in the average overall adequate per-pupil cost of about $1,000 above that of the average base model specification (to $16,511). Exhibit 3-2 shows that the programmatic component experiencing the largest average increase above the base model was school administration ($401), reflecting the relatively fixed costs of certain administrative staff types, such as principals, which do not tend to decrease proportionally with enrollment.

Middle School Program Designs

Middle school base model. Exhibit 3-3 shows the average per-pupil expenditures by different cost components for each middle school program design.

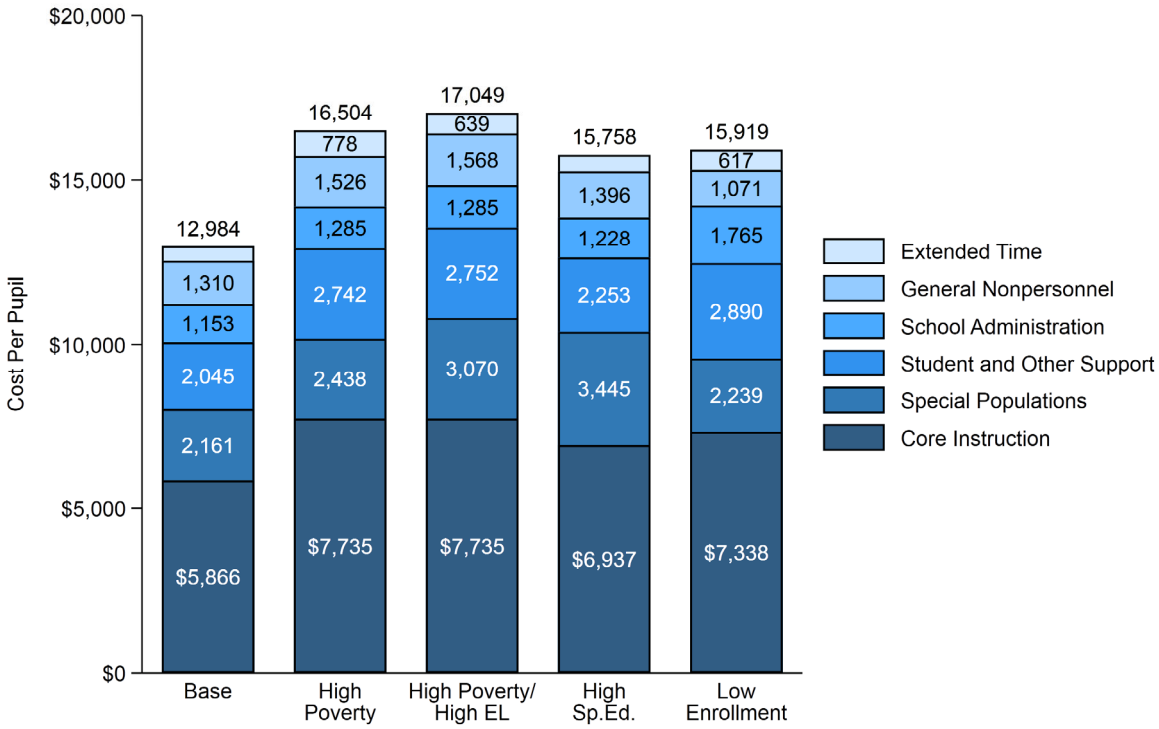
Similar to the elementary school base model, the panels allocated 10 additional days to the middle school base model for teacher planning, training, and collaboration. Both panels specified 180 days for student instruction and a relatively normal distribution of teacher experience, with average percentages of new, mid-career, and veteran teachers of 25%, 45%, and 30%, respectively. The main resource allocation decisions by programmatic component were as follows:

- Core instruction: Both panels recommended having seven periods per day and allocating teachers two periods for planning and collaboration with other teachers. The panels suggested having an average class size of 22 students for the core subjects (i.e., ELA, Math, and Science).
- Special populations: Panels specified between one and two EL specialists, as well as two EL educational assistants dedicated to supporting new students who had been classified as ELs. To better support students in special education, both panels specified small caseloads for staff: up to 7 students with high-severity disabilities per educational specialist, and 17 students with low-severity disabilities per educational specialist.
- Student and other support: Panels specified approximately 10 full-time equivalents (FTE) of instructional and pupil support staff for a typical middle school with 609 students. Professional development for staff included funds for teachers to attend conferences, as well as funds for in-house professional development.
- Extended day and year: Both panels recommended smaller class sizes in the extended time programs (compared to the core program class sizes), reducing the pupil–teacher ratio from 30:1 to 18:1. They also expected all students with severe disabilities who were enrolled in special education to attend summer school.

Again, we note that the average class size listed above for the core instructional program does not take into account resource teachers or those teachers supporting special education and English learner students. Once these additional instructors are considered the estimated pupil–teacher ratio is 15:1.

The specifications resulted in an overall adequate per-pupil cost of almost $13,000, with the core instruction component accounting for almost half of the overall per-pupil cost. The second largest component was special populations, which accounted for one sixth of the overall cost.

Exhibit 3-3. Comparison of Middle School Adequacy Projected Costs by Cost Component Breakdown



Source: AIR calculations based on PJP resource specifications.

Middle school high-poverty program design modifications. Following a program design philosophy of providing students living in poverty with supports that may not be available at home, the panels made substantial modifications to their middle school base model specifications in order to account for increased levels of student poverty in the middle school high-poverty program design. A substantial increase in adequate per-pupil cost stemmed from the core instruction component, which can be attributed largely to a shift to a more experienced teaching force, where the average shares of new, mid-career, and veteran teachers were 15%, 38%, and 48%, respectively. In addition, the panels suggested adding two reading specialists and reducing average class size to 20 students.

The panels also made modifications to the special populations component and the student and other support component in response to the higher levels of poverty. In the special population component, the panels suggested adding one additional resource teacher to support ELs. In terms of the special education program, the panel suggested reducing the class size to 14 for students with low-severity disabilities, with the expectation that these students would have additional needs due to the higher proportions of these students living in poverty. The costs for the student and other support component included adding three FTE instructional and pupil support staff to the eight FTE staff specified in the middle school base model. The

panels also increased the dollars specified for professional development by over 25% on average.

The adequate per-pupil costs attributable to the extended time, general non-personnel, and school administration components also increased, compared to the middle school base model. The panels expected increases in the percentages of students participating in the extended day extracurricular program and the extended year summer program. They also expected to buy additional instructional support supplies and curricular materials (e.g., software for ELA and mathematics, bilingual dictionaries, etc.), requiring an average 13% increase from the base model specifications.

The resources specified for the middle school high-poverty program design resulted in an increase in the overall adequate per-pupil cost of just over $3,500 above that of the middle school base model (to $16,504). On average, while the per-pupil cost for each individual component in the high-poverty program design was higher than in the base model, the component with the largest absolute increase in cost was core instruction, which was $1,869 higher. In addition, the average per-pupil cost associated with the student and other support component increased by almost $697 above the base model specifications.

Middle school high-poverty/high-EL program design modifications. While the panel specifications for the high-poverty/high-EL program design resulted in a large increase in adequate per-pupil cost compared to the base model, the cost was quite similar to the cost calculated for the high-poverty program design. The most noteworthy modifications were made to the student and other support component: an increase in the number of EL specialists and educational assistants, as well as additional resources devoted to professional development geared toward EL instruction and EL non-personnel resources such as workbooks, thinking maps, dictionaries, and software.

At just over $17,000 per pupil, the resources specified for the high-poverty/high-EL program design resulted in the highest average overall adequate cost across the different models—an increase of $4,065 per pupil, compared with the middle school base model. The cost components with the largest increases above the base model were core instruction, with a cost identical to that of the high-poverty program design mentioned above; and special populations, the cost of which increased by $909 compared with the base model, and by more than $632 compared with the high-poverty program design.

Middle school high-special-education program design modifications. Similar to the high-poverty/high-EL program designs, the most notable modifications made to the high-special-education program designs were within the special populations component. The panels increased the number of special education teachers and specialists, as well as the number of educational assistants, to support the increased number of students receiving special education services and to keep caseloads similar to the other program designs. They also added instructional and pupil support staff to further account for the needs of the increased number of students enrolled in special education.

The resources specified for the middle school high-special-education program design resulted in an average overall adequate per-pupil cost of about $15,800—an increase of approximately $2,800 per pupil above the base model cost. The programmatic components with the largest average absolute cost increases were core instruction and special populations, which increased by $1,071 and $1,284 per pupil above the base model, respectively.

Middle school low-enrollment program design modifications. Both panels generally made modifications to the low-enrollment program design by reducing the base model resource specifications proportionally (or close to proportionally) to the decrease in enrollment.[14] In response to the reduced number of teachers within the school, one of the panels specified that the distribution of teachers with respect to experience should shift from the 30%, 40%, 30% split between new, mid-career, and veteran teachers specified in the base model to a 30%, 30%, 40% split. The reasoning for this was that teachers in schools with smaller enrollments require additional experience in order to take on multiple roles and provide instruction in multiple subject areas.

The resources specified for a smaller school with lower student enrollment resulted in an increase in the average overall adequate cost of around $3,000 per pupil, compared to the base model ($15,919). The programmatic component with the largest average absolute increase above the base model was again core instruction, which rose by $1,472. However, the average costs associated with the student and other support component and the school administration component also increased substantially above the base model.

High School Program Designs

High school base model. The average overall adequate per-pupil costs for each high school model are presented in Exhibit 3-4. The overall per-pupil costs and the distribution of costs across each programmatic component for the high school base model are similar to those described for the middle school base model. As described in the following sections, the panelists tended to recommend similar resources for these two schooling levels. However, one of the main differences between the middle and high school designs was the focus on resources to support high school graduation and college and career readiness, which are unique to the high school models.

- Core instruction: Both panels assumed that students' course load would vary, from about five to eight courses, depending on grade level, the need for intervention courses, and participation in enrichment courses. The panels allocated students across subjects so that all students enrolled in courses that met graduation requirements, as well as the University of California and California State University entrance requirements. Both panels also allocated resources to support the provision of computer, career, and technical courses to at least 75% of students. Class sizes were specified to be about 24

[14] Exceptions to this general approach include the number of principals and other administrative staff, which were not proportionally decreased with enrollment.

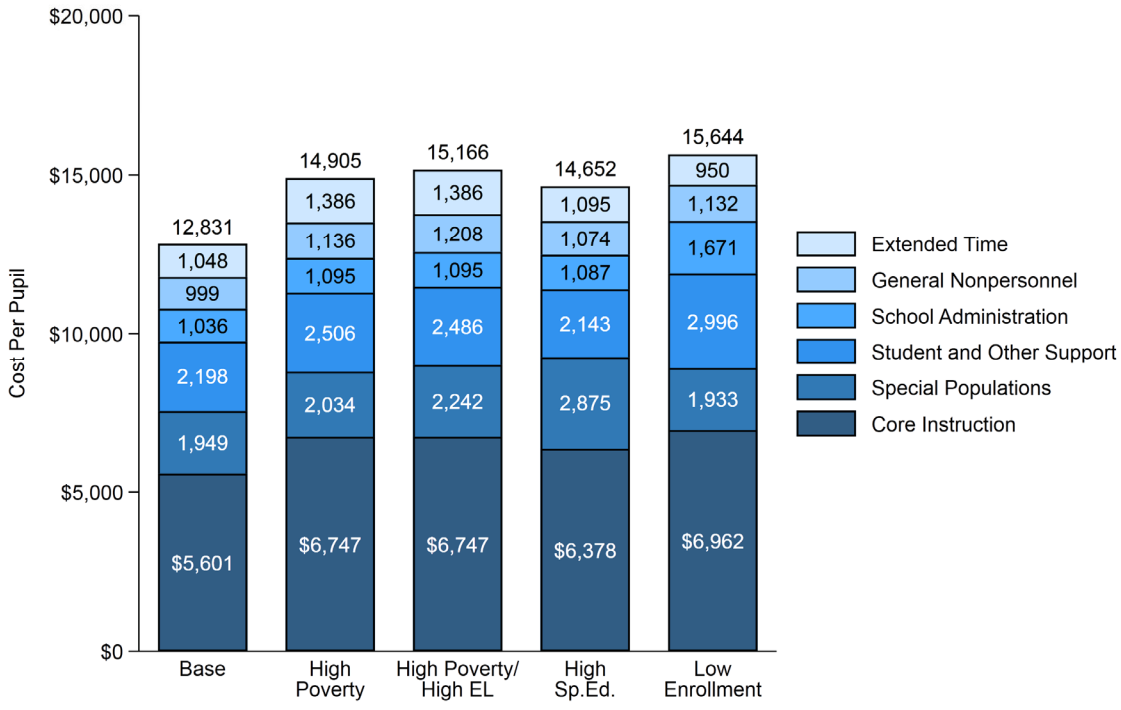
to 28 students per class. Academic coaches and resource teachers also played a significant role in the high school instructional programs. The roles of these academic coaches included working with at-risk students and coaching teachers.

- Student and other support: One panel specified 148 students per guidance counselor—roughly a 26% decrease from the approximate 200 students per guidance counselor case load in the middle school base model. Another panel specified two library assistants to extend library hours.
- Extended day and year: The panels also planned for a variety of sports programs, with teams for different sports offered both boys and girls at the varsity and junior varsity levels.

The average class size listed above for the core instructional program does not take into account resource teachers or those teachers supporting special education and English learner students. Once these additional instructors are considered the estimated pupil–teacher ratio is 15:1.

As seen in Exhibit 3-4, the panel specifications resulted in an average overall adequate per-pupil cost of $12,831 for the high school base model. The core instruction component accounted for 44% of the overall per-pupil cost, and the student and other support component accounted for 17% of the average overall adequate per-pupil cost.

Exhibit 3-4. Comparison of High School Adequacy Projected Costs by Cost Component Breakdown



Source: AIR calculations based on PJP resource specifications.

High school high-poverty program design modifications. The panels' specifications for the high school high-poverty model focused on extending support for graduation and college and career readiness, as well as offering opportunities for students to engage in more activities at school. The panels suggested having one more librarian to allow students to access the library more frequently and for longer hours, and to account for higher percentages of students expected to participate in extended time programs. Both panels specified additional support personnel to address students' nonacademic needs, such as nutrition specialists, nurses, and social workers.

The resources specified for the high-poverty high school program design increased adequate per-pupil costs on average by almost $2,100 above base model specifications, resulting in an adequate per-pupil cost of $14,905. The average per-pupil costs for all programmatic components increased above base model levels, but the component with the largest increase was core instruction, which rose by almost $1,150.

High school high-poverty/high-EL program design modifications. The panels' specifications for the high school high-poverty/high-EL model resulted in a small increase in total per-pupil costs, compared to the high school high-poverty model. The panels' modifications to the high-poverty/high-EL model were concentrated within the special populations and general non-personnel components. The number of EL specialists and the costs of books, curriculum, software, and intervention materials were increased to account for the 382 EL students in the high school (up from 141 students).

The resources specified for a school with a higher proportion of students living in poverty and classified as ELs resulted in the second highest per-pupil costs across the different models. In this case, overall average adequate per-pupil cost was about $15,166. This represents an increase of almost $2,300 per pupil, compared with the high school base model. The cost component with the largest average increase above the high-poverty model was special populations, which rose by almost $210.

High school high-special-education program design modifications. The panels differed in their high school specifications to support a larger proportion of students enrolled in special education (increased from 9% to 16%). Similar to the modifications for the high-poverty/high-EL model, the panels' modifications were in the special populations and general non-personnel components, increasing the number of special education specialists to keep special education class sizes at the same ratios (14:1 for students with low-severity disabilities and about 7:1 for those with high-severity disabilities), and increasing expenditures for instructional materials.

The resources specified for the high-special-education model resulted in an overall average adequate per-pupil cost of $14,652, an increase of about $1,800 above that of the base model specifications. While the per-pupil amount for each cost component increased on average compared to the base model, the component with the largest increase was special populations, which rose by over $900. The core instruction component also increased by almost $800 above base model specifications.

High school low-enrollment program design modifications. The panels made relatively few modifications that diverted from the principles of the base model. The modifications were similar to those made to the middle school low-enrollment model to reduce resources proportionally (or close to proportionally) to the lower number of students enrolled (286 students). Cuts in resources were made across student and other support staff, school administration, the number of students attending extended time programs, and non-personnel expenditures. In response to the reduced number of teachers within the school, one of the panels specified a similar distribution of teachers to the middle school low-enrollment model, shifting towards more experienced teachers than the distribution specified for the base model (30% new teachers, 30% mid-career teachers, and 40% veteran teachers). The reasoning was again that teachers require additional experience in order to take on multiple roles and provide instruction in multiple subject areas.

The panels expressed the need to preserve additional staff in college/career counseling and the technology education program, and highlighted the importance of keeping class sizes small in order to enrich VAPA programs in the core instruction component. Athletics programs and non-personnel spending were cut based on the lower enrollment of the school.

The resources specified for a smaller school with low student enrollment resulted in an increase of $2,813 in average adequate per-pupil costs compared to base model specifications, leading to an overall adequate per-pupil cost of $15,644. The cost components with the largest increases above the base model were core instruction, which increased by almost $1,400; and student and other support, which increased by about $800. Unsurprisingly, the average per-pupil cost of the school administration component also increased above that of the base model by more than $600.

Programmatic Priorities Program Design Task

As an additional exercise, we asked the panels what modifications they would make to their base models if there was a substantial decrease in available budget. Specifically, we asked them to consider budget cuts equal to 10% of the overall adequate per-pupil costs generated by the elementary, middle school, and high school base models. When asked where they would cut resources from in the base models in the event of a 10% budget cut, both panels came up with similar strategies. The following are examples of their suggested programmatic modifications:

- Allowing class sizes to be larger—up to 28 in the upper elementary school grades, and up to 30 in middle and high school grades
- Reducing the number of educational assistants
- Reducing travel and contracted professional development services (including reducing teacher contracts to include fewer training days) and focusing on embedded coaching, which they felt has been demonstrated by research to be more effective
- Reducing the numbers of school administrators and clerical staff if necessary
- Reducing the numbers of counselors in the high school model

- Reducing to a single librarian and fewer or no technical consultants
- Reducing the amount of funding allocated for substitutes

Though not all panelists agreed, individual panelists also suggested decreasing the budget in the following ways:

- Hiring less-experienced teachers
- Reducing non-personnel expenditures overall to existing levels
- Reducing high school sports coach stipends
- Reducing FTEs for EL specialists
- Reducing academic coach FTEs
- Reducing teacher FTEs to reduce (but not eliminate) teacher collaborative planning time
- Reducing social worker FTEs and relying more on existing counselors to provide these services
- Reducing the afterschool and summer programs so that they would be offered mainly to struggling student populations at the elementary level in order to keep the class sizes and the inclusive model proposed

District Special Education Model

The average school district in California in 2016–17 had a student population of 5,938, of which 639 students required special education services (around 10.8%). Among those students enrolled in special education, 473 were categorized as having low-severity disabilities and 166 were categorized as having high-severity disabilities. Around 39% of those who needed special education services (251 students) were specific learning disabled, and 22% (139 students) were speech/language impaired. To accommodate the needs of students enrolled in special education that could not be met by the staff specified in the school-level program designs, the panels specified additional district-level staff resources. The panels also specified non-personnel resources to account for travel and dues, office supplies, conferences, medical supplies, testing kits, audiology equipment, magnifiers, licenses for workability, vocational study kits, and community-based trips. The district-level special education resources specified by the panelists resulted in an average additional adequate per-pupil cost of approximately $2,300.

Using Regression Analysis to Model Variation in Adequate Cost

From the estimates of overall cost stemming from the program designs, we used regression analysis to estimate an equation describing the variation in adequate cost associated with the different student characteristics and enrollments defining these prototypical schools. Due to the small number of data points, we chose to pool the data from both panels and generate a single equation. We used Poisson regression to predict the total cost based on schooling level (measured as proportions of enrollment in the elementary, middle, and high school grades), natural log of enrollment (centered on the mean enrollment of 463 students),

percentage of students eligible for free or reduced-price lunch, percentage of students classified as ELs, and percentage of students enrolled in special education, as follows:[15]

Adequate Cost Per Pupil=f(Schooling Level, Enrollment, Percent FRL, Percent EL, Percent Special Education)

We also examined whether the two panel specifications for the low-enrollment program designs differed substantially across schooling levels. Specifically, we tested a model that included the interaction between enrollment and schooling level, and we found that this did not substantially improve upon the more parsimonious model that did not include these interaction terms.

The regression results are presented in Exhibit 3-5. The coefficients are the exponentiated versions of the regression coefficients. As such, the constant can be interpreted as a base per-pupil adequate cost, and the remaining coefficients can be interpreted as multipliers of the base cost or implicit weights. Coefficients above 1 result in increased costs from increases in the predictor variable, while coefficients below 1 result in reduced costs.[16]

[15] Poisson regression, by exponentiating the right side of the equation, is very similar to estimating an ordinary least squares regression with a logged outcome variable. However, using Poisson has several advantages over models using a logged outcome variable. First, in Poisson models, outcomes can be predicted in one step, rather than predicting a logged outcome and then having to exponentiate the predictions and account for nonlinear standard errors. Second, Poisson handles small values of the outcome variable better than models using a logged outcome variable. Further, in simulations of Poisson and models using logged outcome variables, Poisson models have proved to be as or more accurate (Silva & Tenreyro, 2006; Gould, 2011).

[16] Due to the small number of data points, the results of this analysis should be treated with caution. The main purpose of this analysis was to develop relationships between the PJP-generated measures of per-pupil spending and the factors included in the model, not to draw statistical inference. To this end, while measures of statistical significance are reported, we stress that these should be interpreted with caution.

Exhibit 3-5. Regression Results Predicting School-Level Per-Pupil Costs from the Professional Judgment Panels

	Total Cost Per Pupil
Ln(Enrollment) (mean centered)	0.88***
	(0.03)
Middle School Enrollment Proportion	0.93*
	(0.03)
High School Enrollment Proportion	1.07
	(0.05)
Free or Reduced-Price Lunch Proportion	1.75***
	(0.27)
English Learner Proportion	1.23
	(0.13)
Special Education Proportion	7.36***
	(4.45)
Constant	7,893***
	(1,373)
N	30
pseudo R^2	0.663

Note: Exponentiated coefficients; standard errors in parentheses; regressions weighted by K–12 enrollment. As an additional test of model fit, we calculated the mean absolute percent error (MAPE) between the regression-predicted values and the costs calculated from the PJP resource specifications. The MAPE for this model was 6.1% and no prediction was more than 12.5% different from the PJP specified costs.
* p < 0.05, ** p < 0.01, *** p < 0.001
Source: AIR calculations from PJP resource specifications.

The results indicate that an elementary school with 463 students (average-sized school), none of whom were eligible for free or reduced-price lunch, classified as ELs, or enrolled in special education, had an adequate base per-pupil cost of $7,893. At the same enrollment size, the middle school base per-pupil cost was slightly less than the elementary school, while the high school cost was slightly more. Adequate cost per pupil decreased as school size increased. The student demographic coefficients indicated that each student eligible for free or reduced-price lunch cost almost 1.8 times more than a student who was not eligible for free or reduced-price lunch. Students classified as ELs cost over 1.2 times more than students who were not classified as ELs, and students enrolled in special education cost almost 7.4 times more than students who were not enrolled in special education.[17]

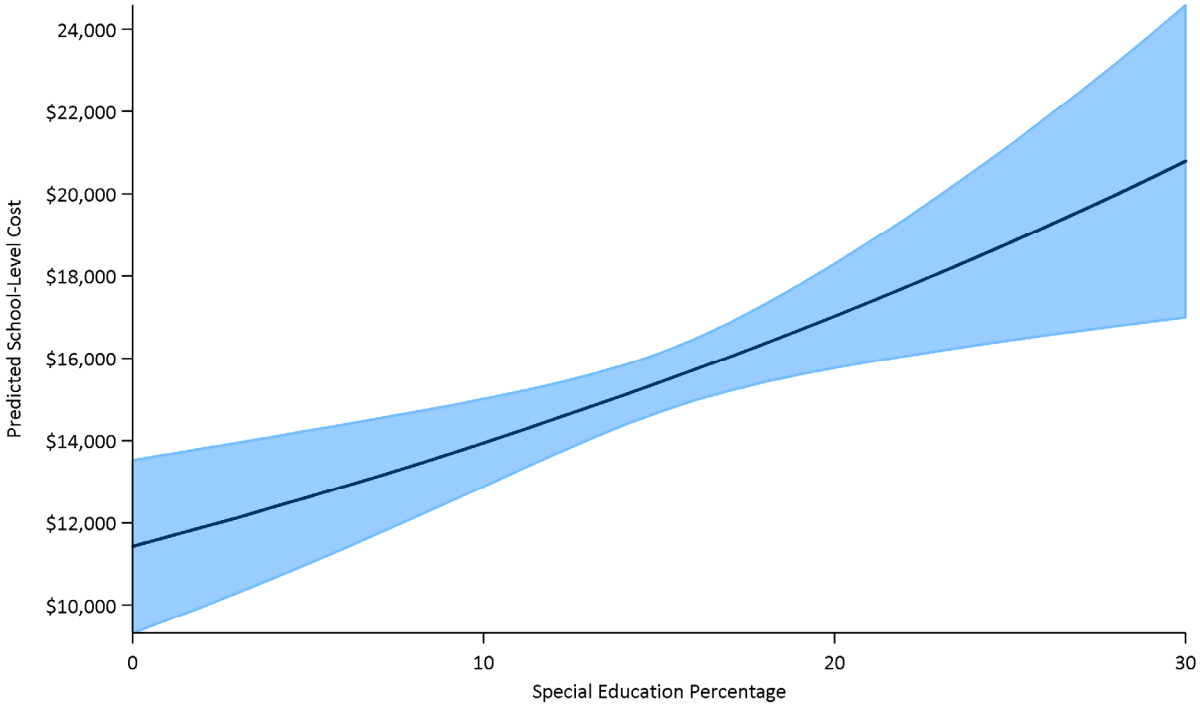
When interpreting the results of these covariates, it is important to understand the ranges under which these measures operate. The range from the 5th to the 95th percentiles of free or reduced-price lunch percentage, for example, is 7% to 94%. It is not uncommon for schools to have either quite low or quite high percentages of students eligible for free or

[17] To help with interpreting regression result as well as for determining model fit, we estimated predicted values with 95% confidence intervals for the school scenarios given to the PJPs. This can be found in Exhibit G-10 in Appendix G. As shown in this Exhibit, the regression predicted pattern of costs across the PJP scenarios maps strongly to the actual costs estimated from the PJP specifications (see Exhibit 3-1).

reduced-price lunch. However, for special education, the range from the 5th to the 95th percentile is 6% to 19%. Therefore, while each student enrolled in special education may on average cost substantially more than a student not enrolled in special education, these students account for a fairly small proportion of overall enrollment in a typical school, and most schools have a reasonably similar percentage of students enrolled in special education services.

Looking at predicted school-level costs across a continuum of special education percentages (holding all other variables at the mean), it is clear that the proportion of students enrolled in special education does impact projected costs (Exhibit 3-6). Schools with more students enrolled in special education have higher projected costs. The projected costs seem appropriate, even at the high end of the special education continuum school-level per-pupil costs. Even at special education rates of 30%—a rate well above the 95th percentile of schools—predicted school-level costs per pupil were less than twice the cost per pupil for a school where less than 5% of students were enrolled in special education.

Exhibit 3-6. Predicted School-Level Per-Pupil Cost by Percentage of Special Education Students



Note: Shaded areas represent the 95% confidence interval around the prediction.

Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data Files (https://www.cde.ca.gov/ds/sd/sd/).

As mentioned previously, district-level costs for central administration and support services, maintenance and operations, transportation, and food services were outside the scope of PJP deliberations. The panels were instructed to specify the types and quantities of resources necessary to create adequate school-level programs. As a result, the variation in costs

across schools described here is only inclusive of school-level costs indicative of the resources specified by the PJPs.[18] In the following chapter, we expand upon school-level costs by adding suitable costs for district-level functions. In Chapter 4, we examine district-level adequate costs per pupil and statewide costs of attaining adequacy, comparing those costs to actual per-pupil and total costs in California from 2016–17.

Chapter Summary

Drawing on their professional expertise, the members of both PJPs deliberated carefully over what types of programs would be necessary to meet the high educational outcome standards adopted by the state at a minimum cost. This chapter provided a brief synopsis of the detailed considerations that led to the PJP program designs and resource specifications. Panelists took great care to specify staff and non-personnel resources in a way that they felt would most efficiently meet the outcome goals.

The resources specified by the panelists largely conform to what we know about the costs of education. First, students with additional needs—whether due to poverty, learning English as a second language, or having a disability—require additional resources. The panels' school programs provided additional resources for schools serving larger proportions of students with these needs. Second, small schools face challenges resulting from diseconomies of scale. While certain positions or resources can be reduced proportionally, other resources are more fixed, resulting in increased per-pupil costs. The lower enrollment models specified by the panelists reflect this reality.

Chapter 4: "Costing Out" California Adequacy: The Results

This chapter presents projections for the expenditures necessary to achieve adequacy in California public schools, based on the program designs and resource specifications of the professional judgment panels (PJPs). It then compares projected costs with actual levels of current expenditure. The projections reflect allocations of staff and non-personnel expenditures for school-level operations, developed by the PJPs to meet the needs of various student body compositions with respect to students living in poverty, proportion of English

[18] The regression results described in this subsection did not include the costs of school-level maintenance and operations resources specified by the panels. This is because maintenance and operations costs for a school district consist of district and school-level costs. In the next chapter, we describe how we add district-level maintenance and operations costs to the school-level costs calculated based on the resources specified by the panels. These district-level costs were estimated using district-level spending data (SACS), which could not distinguish between district and school-level maintenance and operations costs. In order to avoid double counting school-level maintenance and operations costs in subsequent steps of our analysis, they were excluded from the school-level regression model used to predict school-level per-pupil adequacy costs for all schools in the state.

learners (ELs), and proportion of students enrolled in special education, across elementary, middle, and high schools of varying sizes. For this analysis, we also calculated a cost per student enrolled in special education, based on the district-level special education task conducted by the PJPs. This cost was added to the district-level aggregations of projected school-specific costs. Finally, we added estimates of the necessary central, district-level expenditures on administration, maintenance and operations, student transportation services, and food services back into the aggregated projected school-level adequacy cost. Adding these additional costs at the district level permits the comparison of projections against actual expenditures across California public school districts. We also used the Comparable Wage Index (CWI) to adjust the school-level projected costs and the PJPs' district special education add-on cost so that they appropriately reflect differences in the costs required to hire and retain staff across geographic areas.[19] We did not need to geographically adjust the district-level costs because these already reflected the natural variation in costs across geographic regions in the state.

Projecting Adequate School-Level Programmatic Expenditures

The AIR research team used extant data to determine the grades of students served for each public school in the state of California, as well as actual levels of K–12 enrollment and poverty, proportions of ELs, and proportions of students enrolled in special education. Per-pupil costs were predicted for each school using the regression results presented in Exhibit 3-5.[20] School-level total adequate cost was then calculated by multiplying the per-pupil costs by each school's enrollment. It is important to remember that these projected costs are inclusive of the following: core instructional program costs; student support costs; school administrative costs; costs for extended day and year programs; costs for special populations of students, such as students living in poverty, students classified as ELs, and students enrolled in special education; and costs for providing adequate prekindergarten services. The prekindergarten service costs are based on a hypothetical set of prekindergarten students who are not represented in current

[19] The CWI is a measure of regional variation in salaries for college graduates who are not educators, originally developed by the National Center for Educational Statistics and updated by Lori Taylor. The CWI can be used to estimate how the cost of educators vary geographically. For this study, we used the ACS-based CWI 2012–2014. See Lori Taylor's website for more information: http://bush.tamu.edu/research/faculty/Taylor_CWI/.

[20] Schools serving only adult students and non-public schools were not included. Additionally, charter schools that reported spending as separate schools or that reported spending through a special fund were excluded. This was done to simplify the comparisons of projected adequate cost and 2016–17 actual spending. Because California allows charter schools to report spending in several different ways, it would have been difficult to appropriately model adequate levels of charter school spending and include charter schools in the district-level regression models described later in the chapter. This led to the exclusion of 928 charter schools serving 446,167 students, or 7% of the state's enrollment. There were 154 charter schools whose spending was reported as part of a traditional school district's general fund. Therefore, it is not possible to disentangle this spending from other district spending. Because of this, these charters are included and are treated the same as other non-charter schools.

enrollment numbers in California, so these costs were rolled into the per-pupil costs calculated on the basis of current K–12 enrollment. We then calculated the overall school-level costs for each district by summing the school-level costs across all schools in a district. Lastly, we calculated an overall district per-pupil cost by dividing the overall school-level cost by the district's total K–12 enrollment.

Accounting for District-Level Functions

For comparative purposes, the data on actual current expenditure on public school children in California are based on information provided by the California Department of Education (CDE) for the 2016–17 school year.[21] The figures reflect spending on K–12 instructional programs, along with expenditures on preschool programs provided by public schools in the state.

By design, most district-level expenditures were outside the scope of the school prototypes developed by the PJPs. As one of the ultimate goals of the study was to compare the results with current levels of spending in California, the next step in the process for developing the full cost model was to obtain an estimate of the functions and activities that were excluded from the PJP deliberations.

Administration, maintenance and operations, transportation, and food services. Because of the special complexities involved in determining district administration, maintenance and operations, student transportation, and food services expenditures, this study did not attempt to determine adequate cost levels for these components through a costing-out process. Instead, we utilized extant fiscal data provided by the CDE to determine suitable allocations for these four functions across districts in order to permit comparisons between total district-level adequate expenditures and projected actual expenditures. As mentioned above, adequate projected resource specifications dictated by the PJPs focused on allocations at the school level for instruction, support, and administration. The discussion that follows provides some details on how expenditure on district-level functions was estimated and then added back into the adequate costs derived from the school prototypes developed by the PJPs. This final calculation allowed us to compare the costs of an adequate elementary and secondary education with actual current expenditures.[22]

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[21] Specifically, we made use of Standardized Account Code Structure (SACS) fiscal data, for which 2016–17 is the latest available year.

[22] For the purpose of comparison, the analysis conducted by AIR excluded capital spending and debt service associated with the acquisition of land and construction of school facilities because these elements of expenditure were beyond the scope of this project.

Four district-level components were not included in the PJP deliberations: central administrative, maintenance and operations, student transportation, and food services expenditures. Each of these district-level expenditure components is defined below:

- Central administrative functions: This category included expenditures on the board of education; general administration; personnel and business functions; planning, research, development, and evaluation; and other central support.[23]
- Maintenance and operations: This category included building maintenance and operations costs. Security was also considered part of maintenance and operations; however, security costs were predicted separately from general maintenance and operations.[24]
- Student transportation: This category included all activities related to conveying students to and from school. It did not include transportation related to field trips or costs related to the acquisition of buses.[25]
- Food services: This category included all activities related to providing food to students and staff in a school district. It did not include costs incurred when food was provided during meetings or workshops, or costs for classes to instruct students in food preparation.[26]

Two separate methods were used to predict the costs of these district-level services: one method predicted the per-pupil cost, and a second method predicted a ratio of these centralized overhead costs to a base cost that represented school-level spending (such as instruction, pupil support, and school administrative spending). Regression was used to predict the overhead per-pupil costs and ratios. Per-pupil spending and ratios for each category were predicted as a function of district enrollment quintiles; district type (unified, elementary, or high); urbanicity (city, suburb, town, or rural); percentage of students eligible for free or reduced-price lunch, percentage of students classified as ELs, and percentage of students enrolled in special education; and the CWI. As shown in Exhibit 4-1, the means of the actual and predicted overhead per-pupil spending and ratios weighted by student enrollment were identical. However, the standard deviations of the predicted versions of these measures were smaller, indicating that the predictions had less variation than the actual figures.

[23] SACS function codes 7000–7999.

[24] SACS function codes 8100, 8110, and 8200 for maintenance and operations, and SACS function code 8300 for security.

[25] SACS function code 3600.

[26] SACS function code 3700.

Exhibit 4-1. Comparison of Actual and Predicted District Overhead Expenses, Calculated on a Per-Pupil Basis and as a Ratio

	Overhead Per-Pupil				Overhead Ratio			
	Actual		Prediction		Actual		Prediction	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
District Administration	$669	$243	$669	$145	7.2%	2.1%	7.2%	1.3%
Maintenance and Operations	$1,058	$262	$1,058	$141	11.3%	2.0%	11.3%	1.0%
Security	$59	$78	$59	$43	0.6%	0.9%	0.6%	0.5%
Transportation	$274	$139	$274	$78	2.9%	1.4%	2.9%	0.8%
Food	$481	$203	$481	$168	5.1%	1.8%	5.1%	1.6%

Source: Standardized Accounting Code Structure (SACS) data, California Department of Education; AIR calculations.

***The per-pupil approach*.** This first method, which is referred to as the per-pupil approach, added predicted per-pupil amounts from the 2016–17 school year in each district for these components. On average, the current district expenditure amounts for central administrative functions, maintenance and operations, student transportation, and food services that were added to the school-level costs estimated from the PJP resource specifications mirrored the amounts that existed empirically in the data. Clearly, this approach yields conservative lower-bound estimates of adequate funding levels for central administration and maintenance and operations because it does not account for any possible changes in expenditures to support any expansion in instructional programming suggested by the PJPs in order to deliver educational adequacy.

***The overhead ratio approach*.** Changes in the size of the instructional program are likely to impact the costs of central support services. As school-level costs of instructional and related services expand, the need for programmatic supervision, personnel services, business functions, and other planning functions is likely to expand. Further, if additional staff members are required to deliver the instructional program, additional classroom and other instructional space would be necessary to support these programs. It follows that maintenance and operations services may also expand accordingly. We might also surmise that food and transportation costs could increase if more students are enrolled in extended day or extended year instructional programs, and due to overall enrollment increases resulting from expanded prekindergarten programs. The overhead ratio approach takes this into account, allowing these district-level functions to change proportionately with changes in the school-level instructional program. The overhead ratio approach should be viewed as an upper bound on the potential change in expenditures for these district-level functions.

Of course, there are elements of central support services that might not change in proportion to changes in the instructional program. For example, one might imagine that the cost of school board operations and the superintendent's offices might remain relatively constant despite changes in school-level spending. As a result, it is likely that actual costs fall somewhere between the per-pupil and the overhead ratio estimates. In the results that follow, we use the average value of the additional central overhead costs predicted by these two

approaches in our cost projections. While this has intuitive appeal, we have no empirical evidence to support the accuracy of this approach. Further research on this issue is beyond the scope of the present project but should be considered in future applications of this analysis.

District-level special education expenditures. The PJP specifications assumed that students enrolled in special education were to be served largely by staff assigned to neighborhood schools. However, there may be significant numbers of centralized, district-level special education staff who are also responsible for ensuring an adequate program for students enrolled in special education. Specifically, there may be certain types of staff who serve students with specific types of disabilities, such as disabilities that are relatively uncommon or more severe. These staff (e.g., speech-language pathologists, audiologists, occupational and physical therapists, and vision therapists) may serve students with particular needs across all schools in a district. In recognition of this, the PJPs specified additional district-level staff and resources that would be necessary to serve students enrolled in special education in a typical district with an average mix of disability types. For each of the PJPs, we calculated district-level special education costs per student enrolled in special education and averaged this cost across both panels. We added this cost to each district's per-pupil adequate cost (i.e., the aggregated school-level adequacy costs) by adding the product of each district's special education count and the calculated cost per student enrolled in special education.

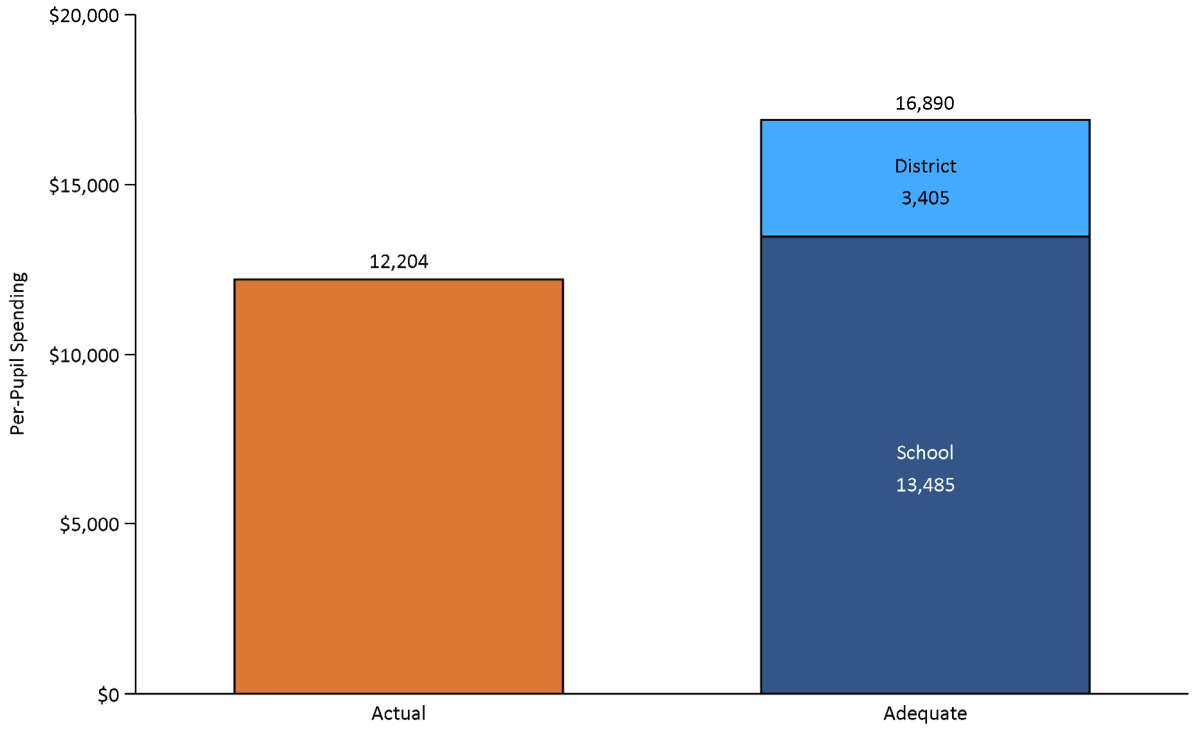
The Cost of an Adequate Education – Results

The initial adequacy cost estimates presented below reflect the resource specifications of the PJPs combined with the estimated expenditures on the district-level functions described above. These findings represent the culmination of the professional judgment process as applied in this study, accounting for major district-level expenditures and adjusting for geographic variations in wage costs.

Adequate per-pupil cost estimates. Exhibit 4-2 displays the average pupil-weighted actual spending and adequate per-pupil cost predicted using the PJPs' specifications for the 2016–17 school year. Actual spending totaled $12,204 per pupil, and adequate cost was projected to be $16,890 per pupil. This indicates that spending levels in 2016–17 needed to be 38% higher than actual spending to support an adequate education. Of the total suggested adequate cost ($16,890 per pupil), $13,485 was driven by the PJP school-level specifications, and the remaining $3,405 was generated through district overhead calculations accounting for district administration, maintenance and operations, food, and transportation expenditures, along with district-level special education costs specified by the PJPs.[27]

[27] It should be noted that the charts that follow report per-pupil costs that include prekindergarten expenditures, which were spread across K–12 enrollment (i.e., calculated using a denominator that only includes K–12

Exhibit 4-2. Actual Spending and Adequate Cost per Pupil

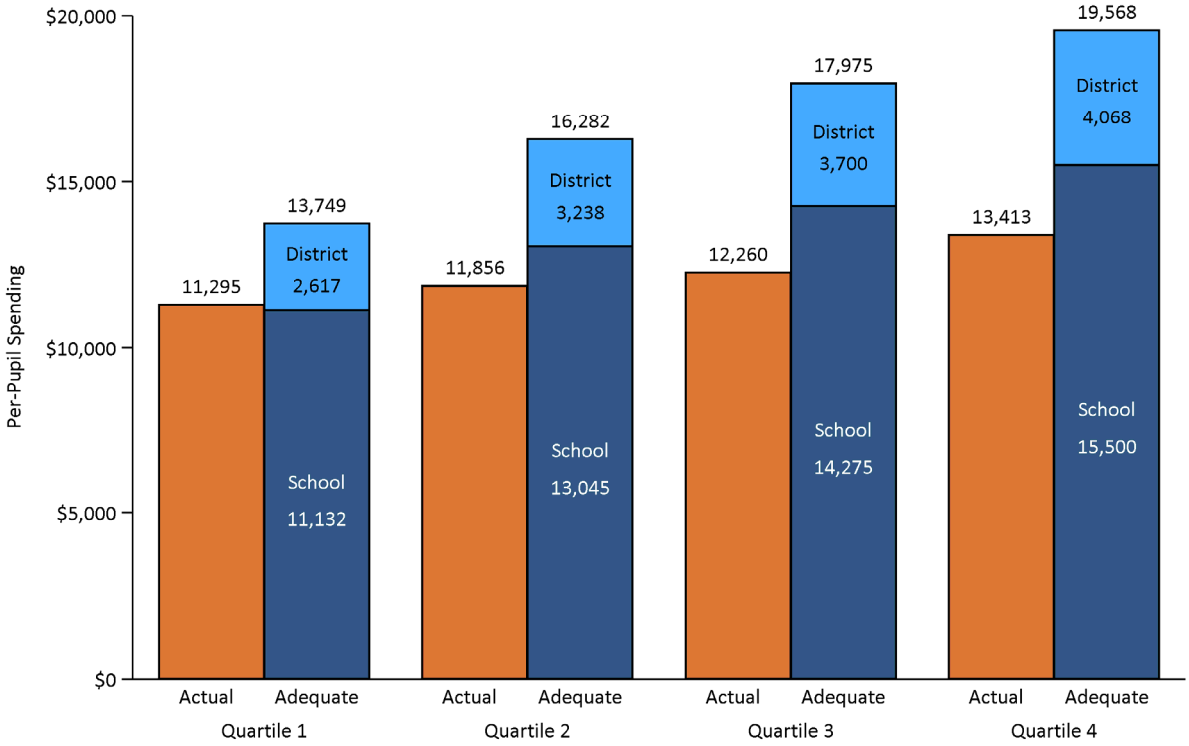


Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data Files (https://www.cde.ca.gov/ds/sd/sd/); California Assessment of Student Performance and Progress (CAASPP; https://caaspp.cde.ca.gov/sb2017/ResearchFileList); and Standardized Account Code Structure (SACS), California Department of Education (CDE; https://www.cde.ca.gov/fg/ac/ac/).

In addition to examining actual spending and adequate cost across all districts, we looked at how actual spending and adequate cost varied depending on district characteristics. In Exhibit 4-3, we present actual spending and adequate cost by district, organized into free or reduced-price lunch eligibility quartiles. The quartiles are pupil-weighted, which means that the districts within each quartile serve similar numbers of students but that quartiles may contain different numbers of districts. In quartile 1 (the lowest-poverty quartile), adequate cost is just under $2,500 per pupil above actual spending per pupil—a difference of 22%. As poverty increased, both adequate per-pupil cost and actual per-pupil spending increased, but adequate cost increased more than actual spending. In the two highest-poverty quartiles, adequate cost levels were approximately $5,700 to $6,200 (or 46% to 47%) higher than actual spending levels.

enrollment). As previously explained, the PJPs were allowed to specify the number of prekindergarten-eligible students who would be provided prekindergarten services. This meant that the prekindergarten enrollment on the predicted side was largely hypothetical. To appropriately represent the additional costs of providing adequate services to students, the cost of prekindergarten programs was counted in the total cost, which was spread over K–12 enrollment.

Exhibit 4-3. Actual Spending and Adequate Cost Per-Pupil by Free or Reduced-Price Lunch Eligibility Quartile



Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data Files; Assessment of Student Performance and Progress (CAASPP); and Standardized Account Code Structure (SACS), California Department of Education (CDE).

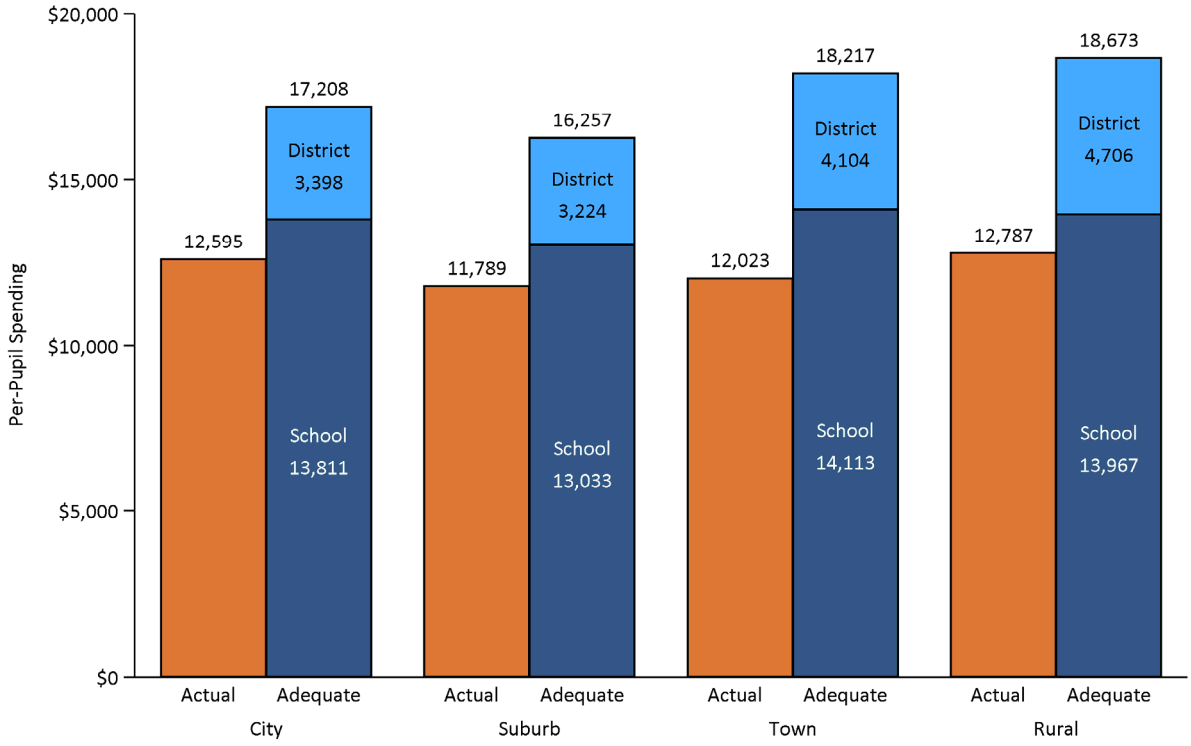
By locale (Exhibit 4-4), districts identified as being in cities showed the smallest differences between actual spending and adequate cost levels, while districts located in rural areas or small towns showed the largest differences. In both town and rural districts, 2016–17 spending levels needed to be 46% to 52% higher than the actual spending levels to support an adequate education. Spending in cities and suburbs needed to be 37% to 38% higher than actual spending levels. However, it must be noted that compared to districts in cities and suburbs, town and rural districts serve a relatively small portion of the total number of students enrolled across the state.[28] As demonstrated below, this means that these smaller types of districts account for a proportionately smaller share of the total additional statewide spending required to support an adequate education. Further, while the PJPs' resource specifications did not take locale into account, it was included as a factor in the models used to predict district-level overhead costs. Interestingly, the results from the 2006 AIR California Adequacy Study

[28] Enrollment in city and suburban districts accounts for 46% and 45% of statewide enrollment, respectively. While enrollment in town and rural districts only account for 6% and 3% of statewide enrollment, respectively.

(Chambers, Levin, & DeLancey, 2006) found that city districts required the most spending to achieve adequacy, followed by suburban, rural, and town districts.

One possible explanation for the relative increase in cost to support an adequate education in town and rural districts compared to urban and suburban districts is the substantial increase in town and rural poverty, compared with urban and suburban poverty. Using the National Center for Education Statistics' School Universe Surveys to calculate changes in student poverty over time in California, we see that urban poverty increased by less than 7 percentage points between 2007 and 2016, while poverty rates in suburbs increased by close to 10 percentage points and poverty rates in towns and rural districts increased by over 10 percentage points.

Exhibit 4-4. Actual Spending and Adequate Cost per Pupil by District Locale



Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data; California Assessment of Student Performance and Progress (CAASPP); and Standardized Account Code Structure (SACS), California Department of Education (CDE).

While the per pupil adequate costs presented here represent our best estimates for 2016–17, in subsequent school years, these costs will almost certainly represent underestimates. This is due to the rapidly rising costs of pensions to districts. Koedel & Gassman (2018) estimate that the per-pupil district contributions to the California State Teacher Retirement System (CalSTRS) have increased from less than $400 to approximately $600 by 2016–17 and will continue to increase to approximately $1,000 per pupil in several large urban school districts. The California School Boards Association (2018) estimate that from

2013–14 to 2023–24 the combined costs of retirement pensions for teachers and staff will increase from $497 per pupil to $1,476 per pupil.

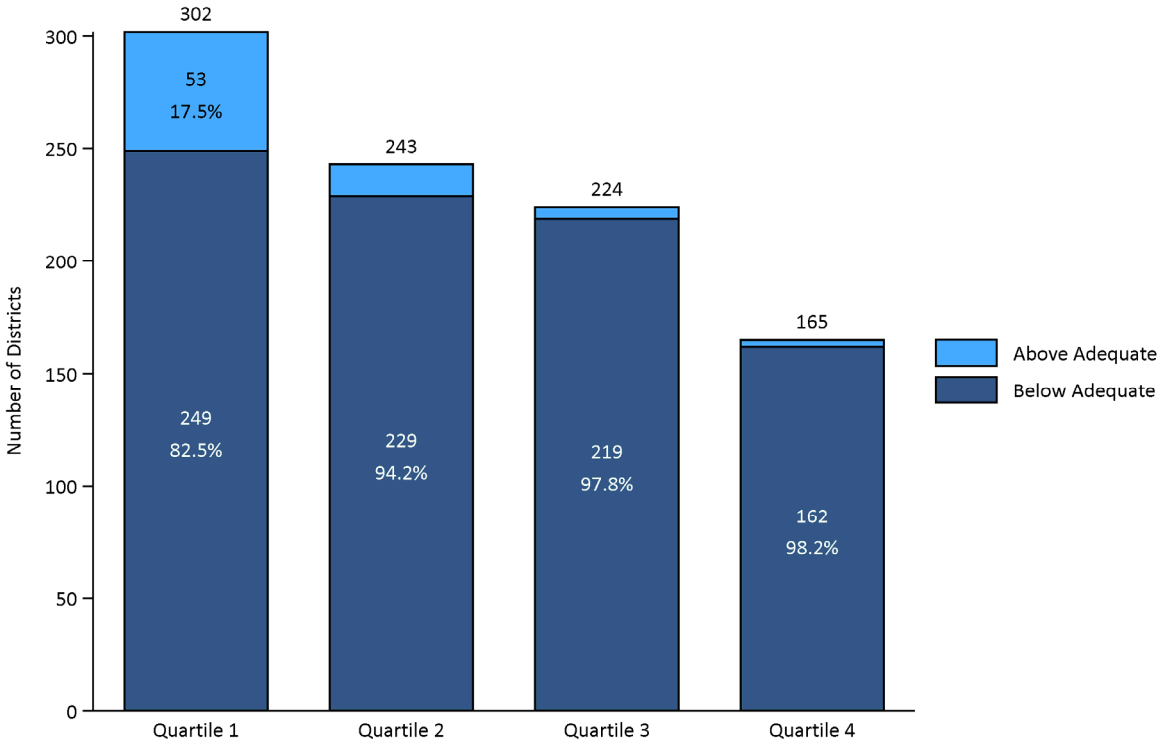
Number of districts and students in districts with actual spending below or above adequate cost levels. In addition to comparing average actual spending and adequate cost per pupil, we looked at the number of districts whose actual spending per pupil was above or below projected adequate cost per pupil. In total, only 75 school districts (8% of districts) spent above adequate cost levels in 2016–17. Fifty-one of these districts (68%) were community funded districts (formerly referred to as basic aid districts), meaning they are able to raise local revenues in excess of their projected LCFF funding levels, allowing them to raise more revenue than other districts.[29]

Exhibit 4-5 shows the number of districts in 2016–17 that spent above or below a level deemed adequate, by district free or reduced-price lunch eligibility quartile (weighted by number of students). In the lowest-poverty quartile, 53 of 302 districts (18%) had actual spending levels that exceeded adequate cost levels. The remaining 82% of districts fell below the spending level required to reach adequacy. This means that the majority of districts within this lowest-poverty quartile failed to meet adequate cost levels. In the higher poverty quartiles, even larger percentages of districts failed to meet adequate cost levels. In the highest-poverty quartile, 162 out of 165 school districts (over 98%) had actual spending levels that fell below adequate cost levels.

The results suggest that introducing increased funding for most districts would be coupled with a decrease in funding for a limited number of districts where actual spending levels were above predicted adequate cost levels. In these cases, a hold-harmless policy would normally be considered, guaranteeing that no district would receive a sudden decrease in funding. However, there is a very real cost to implementing such a policy (i.e., funding districts at a higher level than is deemed necessary, according to the adequate cost projections). The current study suggests that an additional cost of $366 million or 0.5% of the 2016–17 actual spending level would be required to keep districts with above-adequate spending at their current spending levels.

[29] In total, 123 community funded districts were used in this analysis. This means that 41% of community funded districts spent above adequate cost levels in 2016–17. The list of community funded districts was from 2012–13, the most recent list we were able to find (retrieved from https://www.cde.ca.gov/fg/aa/ca/basicaid.asp).

Exhibit 4-5. Number of Districts with Actual Per-Pupil Spending Below or Above Adequate Per-Pupil Cost, by Free or Reduced-Price Lunch Eligibility Quartile

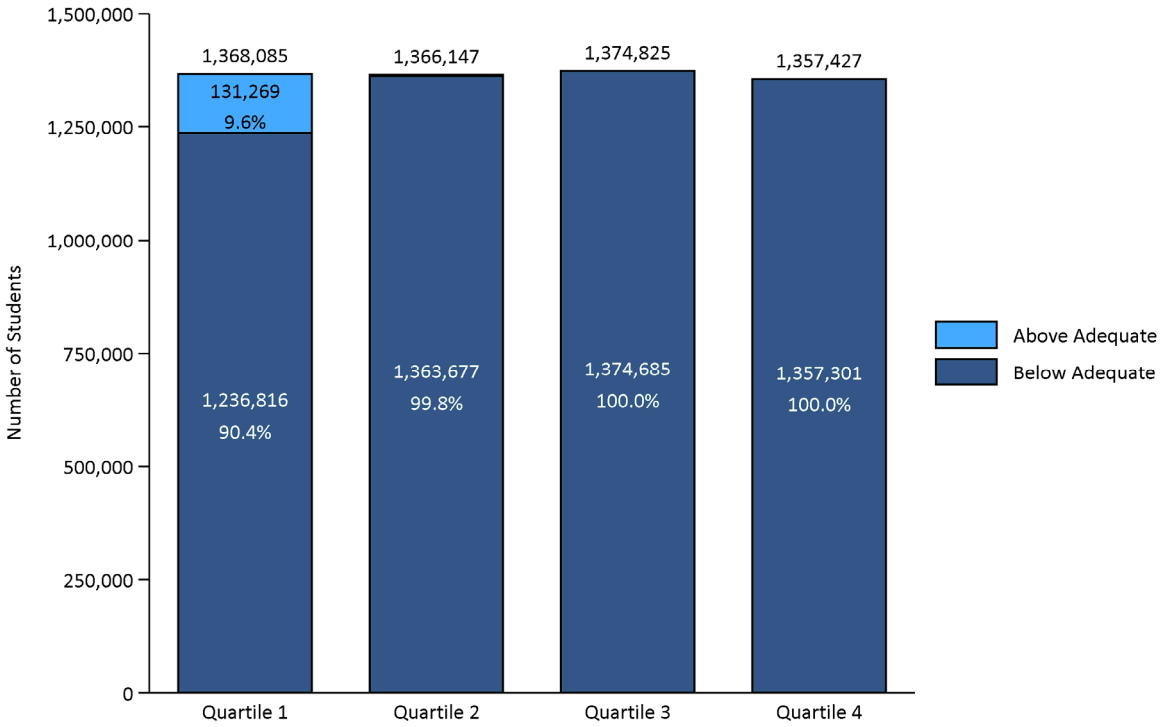


Note: Values not listed for column segments representing less than 20 districts.

Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data; California Assessment of Student Performance and Progress (CAASPP); and Standardized Account Code Structure (SACS), California Department of Education (CDE).

If we look at the number of students within districts with spending above or below adequate levels, the results are even starker. Only 10% of students in the lowest-poverty quartile attended schools in districts with above-adequate spending levels. Of the more than 2.7 million students in the two highest-poverty quartiles, only a few hundred attended schools in districts that spent above adequate levels. Almost all students in the top half of districts with the highest poverty levels were enrolled in districts that did not spend at adequate levels.

Exhibit 4-6. Number of Students in Districts with Actual Per-Pupil Spending Below or Above Adequate Per-Pupil Cost, by Free or Reduced-Price Lunch Eligibility Quartile

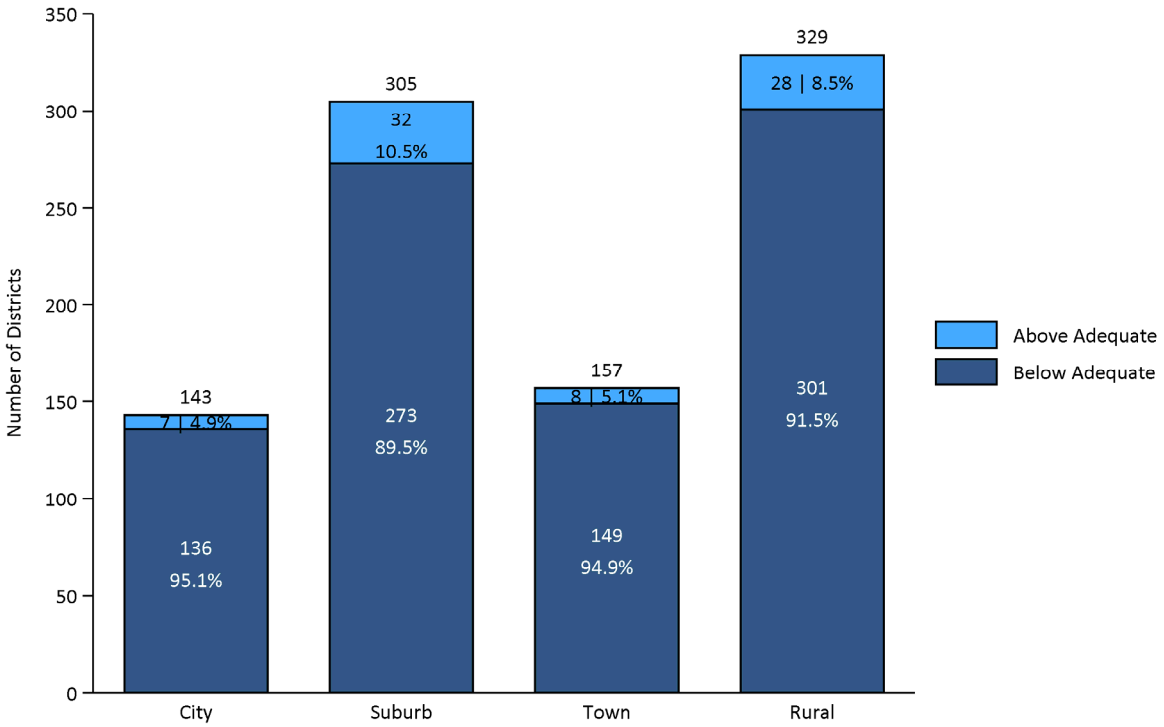


Note: Values not listed for column segments representing less than 45,000 students.

Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data; California Assessment of Student Performance and Progress (CAASPP); and Standardized Account Code Structure (SACS), California Department of Education (CDE).

When looking at districts by locale (Exhibit 4-7), we found that suburban districts were most likely to have spending levels that were deemed adequate (11%), and that town and city districts were least likely to have spending levels that were deemed adequate (about 5%). Among districts classified as rural, 9% had above-adequate spending levels.

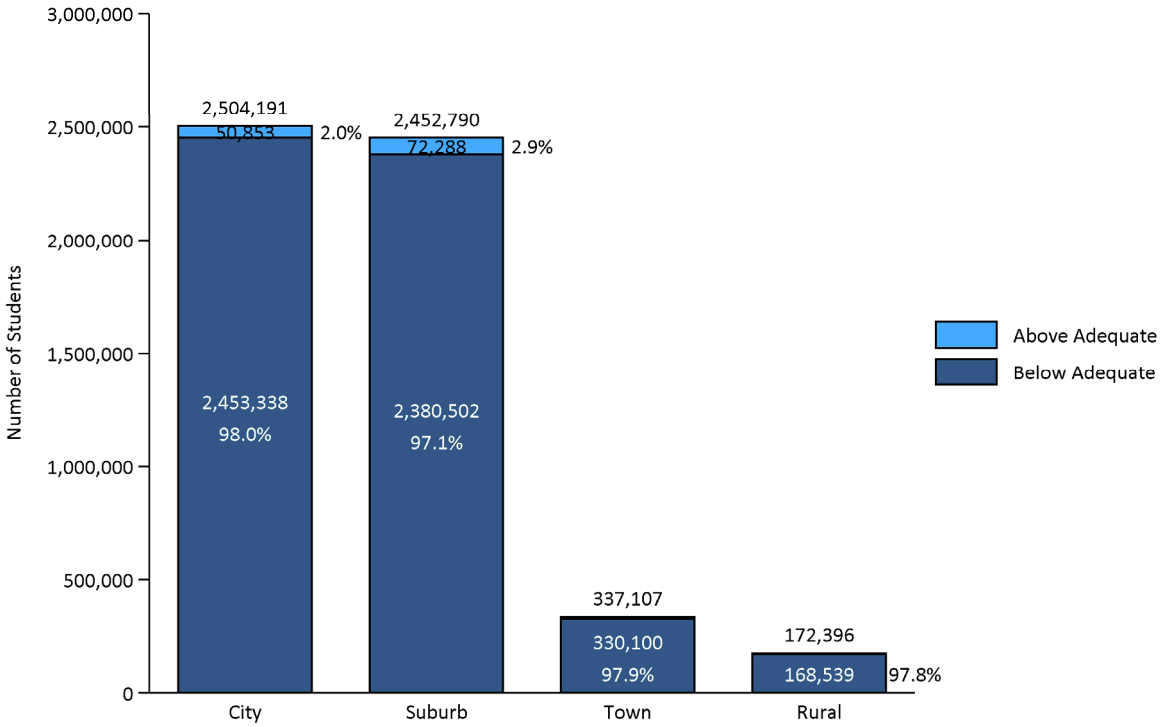
Exhibit 4-7. Number of Districts with Actual Per-Pupil Spending Below or Above Adequate Per-Pupil Cost, by District Locale



Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data; California Assessment of Student Performance and Progress (CAASPP); and Standardized Account Code Structure (SACS), California Department of Education (CDE).

When examining the number of students in districts with above or below-adequate spending by local (Exhibit 4-8), there are several key takeaways. First, it is clear just how small rural districts are, on average. Even though the rural locale is the largest in number of districts, rural districts account for a very small proportion of the total number of students in the state. Second, within all locale categories, the districts with spending above adequate levels tended to be smaller than average, and in the case of rural districts quite a bit smaller than average. Therefore, the shares of students served in districts spending above adequate levels was quite a bit smaller than the share of districts. In the case of rural districts, while 9% of districts spent above adequate levels, this accounts for only 2% of the students enrolled in rural districts.

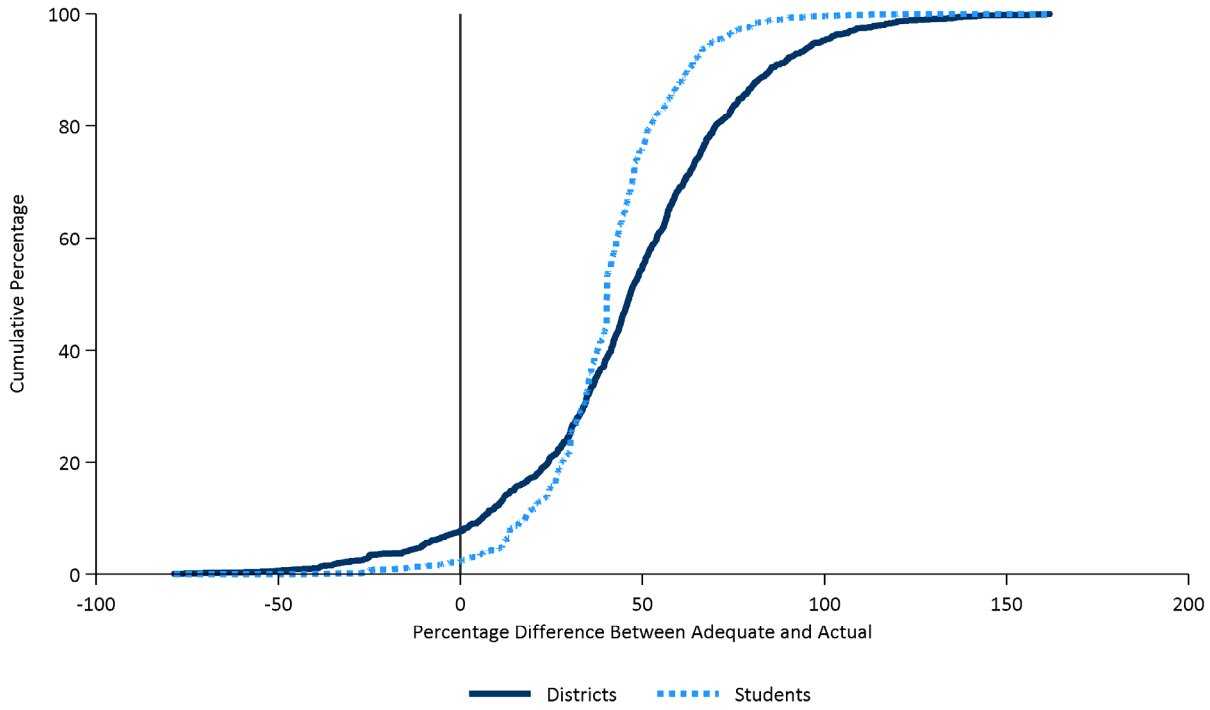
Exhibit 4-8. Number of Students in Districts with Actual Per-Pupil Spending Below or Above Adequate Per-Pupil Cost by District Locale



Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data; California Assessment of Student Performance and Progress (CAASPP); and Standardized Account Code Structure (SACS), California Department of Education (CDE).

While these binary indicators of below and above-adequate spending are useful for counting the number of districts within these categories, they do not describe how far below or above adequate cost levels districts' actual spending levels were. To find out this information, we looked at a plot showing the cumulative percentage of districts and students within districts by the percentage difference between adequate cost and actual spending (Exhibit 4-9). In this plot, negative differences show districts where actual spending exceeded adequate cost (meaning the district had a surplus) and positive differences show districts where adequate cost exceeded actual spending (meaning the district had a deficit). Actual per-pupil spending exceeded adequate per-pupil cost in just 7.6% of districts (serving 2.4% of students). For more than 87% of districts, adequate per-pupil cost was more than 10% higher than actual per-pupil spending in 2016–17. More than half of students were in districts where adequate cost was at least 40% higher than actual spending.

Exhibit 4-9. Cumulative Density of Districts and Students within Districts by the Percentage Difference between Adequate Per-Pupil Cost and Actual Per-Pupil Spending



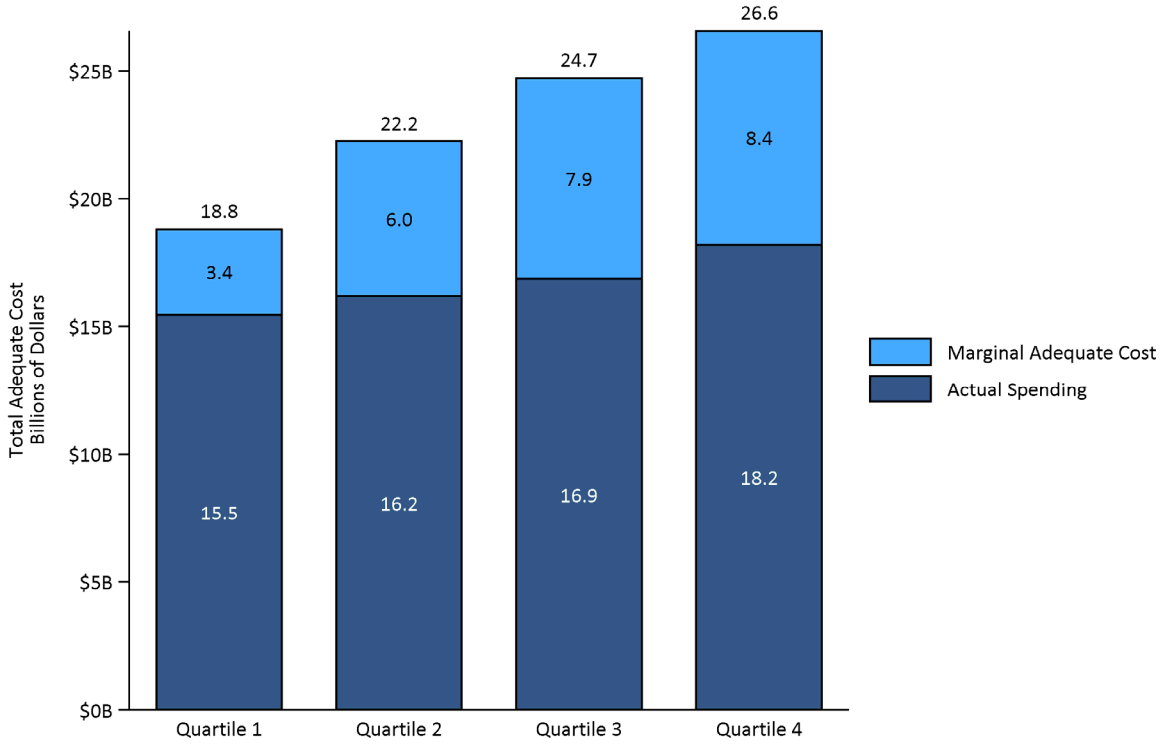
Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data; California Assessment of Student Performance and Progress (CAASPP); and Standardized Account Code Structure (SACS), California Department of Education (CDE).

Total costs required to achieve adequacy. We have looked at differences between actual per-pupil spending and adequate per-pupil cost, and at the percentage of districts, and students within districts, where actual spending was below or above adequate levels. However, it is difficult to understand the difference in magnitude of the total investment required to bring school spending up to adequate levels across the state based on these data.

The predicted total adequate cost for the state of California for 2016–17 amounted to $92.3 billion. Actual spending in 2016–17 was $66.7 billion—a difference of $25.6 billion, or approximately 38%.[30,31]

When examined across free or reduced-price lunch eligibility quartiles (Exhibit 4-10), $16.3 billion of the additional spending required to achieve adequacy was attributed to the two highest-poverty quartiles. Only $3.4 billion of additional spending was required for the lowest-poverty quartile.

Exhibit 4-10. Total Adequate Cost by Free or Reduced-Price Lunch Eligibility Quartile



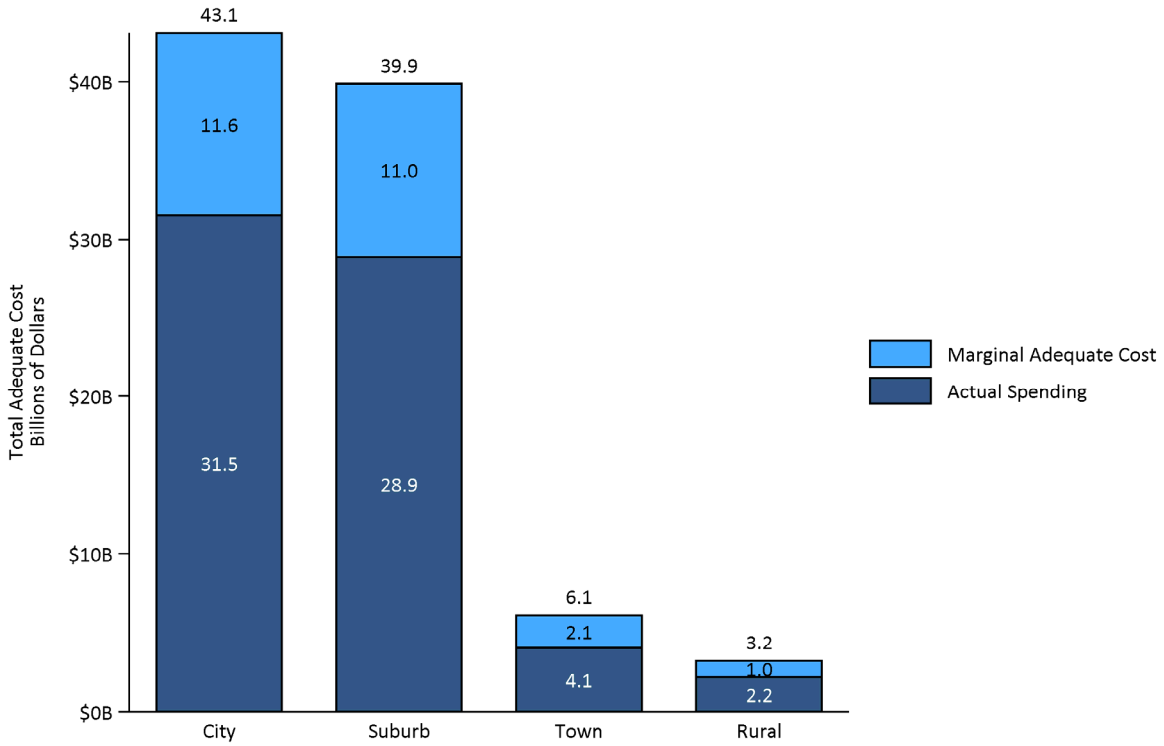
Note: Sum of actual spending and marginal adequate cost may not sum to column total due to rounding.
Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data; California Assessment of Student Performance and Progress (CAASPP); and Standardized Account Code Structure (SACS), California Department of Education (CDE).

[30] Charter schools that report their expenses separately from traditional school districts were not included in these figures. Estimates from SACS data and Charter School Alternative Form Data (https://www.cde.ca.gov/ds/fd/fd/) indicate that the excluded charter schools spent around $10,500 per pupil on average in 2016–17. Given that these schools account for 446,167 students, this means actual 2016–17 spending was approximately $4.7 billion more than the reported figure of $66.7 billion. Assuming adequate costs are 38% higher than actual costs, this would increase the difference between actual and adequate costs by $1.5 billion.

[31] This figure does not account for holding harmless districts that currently spend above the projected adequacy levels. To hold those districts harmless, an additional $366 million would be required. Additionally, this does not account for potential increases in pension costs. The California School Board Association (2018) estimates that pension costs will rise to $9.15 billion in 2023–24 from $3.08 billion in 2013–14.

When examining the total cost of achieving adequate levels of spending in 2016–17 by locale (Exhibit 4-11), we found that most of the additional cost was required in city and suburban districts. This is because districts in these locales serve far more students than town and rural districts. On a per-pupil basis, districts in towns and rural locales had higher adequate cost levels than city and suburban districts. However, the total necessary increase in spending to achieve adequacy in these districts only amounted to $3.1 billion, while city and suburban districts required an additional $22.6 billion to reach adequate spending levels.

Exhibit 4-11. Total Adequate Cost by District Locale



Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data; California Assessment of Student Performance and Progress (CAASPP); and Standardized Account Code Structure (SACS), California Department of Education (CDE).

Further Examination of the Variation across Districts in Actual and Adequate Spending

To further investigate the variation across districts in actual spending and adequate cost, we ran regressions on actual per-pupil spending and adequate per-pupil cost at the district level. The regression models used in this analysis were similar to those used to predict school-level adequate cost and district-level overhead costs. However, instead of using these regressions for predictive purposes, this analysis shows the distribution of actual spending and adequate cost across districts with different characteristics.

The district-level regression model used is as follows:

District-Level Spending/Cost Per Pupil=f(District Size, Percent FRL, Percent EL, Percent Special Education, Enrollment Shares by Schooling Level, Comparable Wage Index)

In the above equation *District Size* indicates whether district enrollment is less than 500 students, is between 500 and 1,000 students, is between 1,000 and 2,000 students, or is more than 2,000 students.[32] The remaining regression factors are fairly straightforward to interpret.

Exhibit 4-12. Regression Results Predicting District-Level Actual Spending and Adequate Cost Per-Pupil

	Actual	Adequate
Enrollment: <500	1.21***	1.25***
	(0.03)	(0.01)
Enrollment: 500–1,000	1.09**	1.15***
	(0.03)	(0.01)
Enrollment: 1,000–2,000	1.05*	1.10***
	(0.02)	(0.01)
Special Education Proportion	2.39**	5.34***
	(0.76)	(0.82)
Free or Reduced-Price Lunch Proportion	1.29***	1.80***
	(0.08)	(0.03)
English Learner Proportion	1.15	1.18***
	(0.09)	(0.04)
Middle School Enrollment Proportion	0.66**	0.88**
	(0.08)	(0.04)
High School Enrollment Proportion	1.02	0.95**
	(0.04)	(0.02)
Comparable Wage Index	1.05***	1.08***
(10 percentage point increase)	(0.01)	(0.00)
Base	10,045***	9,850**
	(483.6)	(255.7)
N	934	934
pseudo R^2	0.33	0.89

Note: Exponentiated coefficients; Standard errors in parentheses; Regressions weighted by K–12 enrollment.
* p < 0.05, ** p < 0.01, *** p < 0.001. The Comparable Wage Index is centered on the state average and set so that one unit represents 10 percentage points.
Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data; California Assessment of Student Performance and Progress (CAASPP); and Standardized Account Code Structure (SACS), California Department of Education (CDE).

[32] The choice to focus on districts with less than 2,000 students and place an additional cutoff at 500 for enrollment bands, was based on a study by Andrews, Duncombe, and Yinger (2002). The authors reviewed articles on economies of scale and found that strong evidence exists that small districts with 500 or less students would have sizeable cost savings by moving to a district with 2,000 to 4,000 students.

The regression results are shown in Exhibit 4-12. The base amounts for actual spending and adequate cost were quite similar and were not statistically significantly different, with an actual predicted base per-pupil spending of $10,045 and an adequate predicted base per-pupil cost of $9,850. These base amounts represent the predicted spending or cost per pupil for elementary students in districts with at least 2,000 students, facing a state-average cost for hiring and retaining staff, and with no student needs in terms of free or reduced-price lunch, EL services, or special education services.

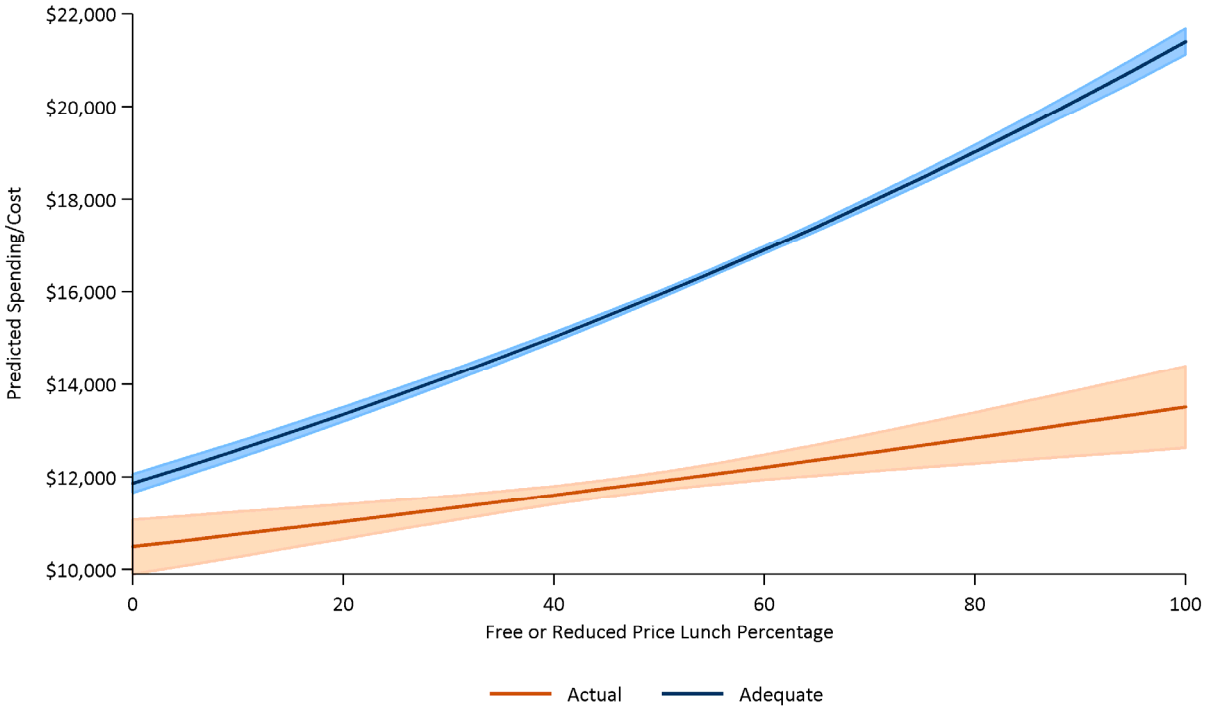
Comparing the results of the individual coefficients between actual spending and adequate cost, we found several key differences. First, while the small districts in both the actual spending and adequate cost models were estimated to have higher per-pupil spending or adequate cost than a more optimally sized district of at least 2,000 students, for all three small size categories the point estimates were not as large in the actual spending model as they were in the adequate cost model. However, these differences were not statistically significant at the conventional 5% error level, and only the difference in the point estimates for districts with 1,000–2,000 students was statistically significant at the 10% error level.

The point estimates for free or reduced-price lunch and special education were substantively different between the two models and statistically different at the 5% error level. The regression models for both actual spending and adequate cost showed a positive relationship between free or reduced-price lunch and spending or cost, but the free or reduced-price lunch coefficient in the adequate model was substantially larger. According to the adequate cost model, the average district where 100% of students are eligible for free or reduced-price lunch would require 80% more funding than a district where no students are eligible for free or reduced-price lunch.[33] This can be interpreted as the additional cost for each student eligible for free or reduced-price lunch, compared to a student with otherwise similar needs who is not eligible for free or reduced-price lunch. Using actual expenditures, the results suggest that the average district spent 29% more on students who were eligible for free or reduced-price lunch, compared to students with otherwise similar needs who were not eligible for free or reduced-price lunch.

If we look at the predicted actual spending and adequate cost across the continuum of free or reduced-price lunch percentages for a district with more than 2,000 students and otherwise average characteristics, it is evident that actual per-pupil spending was substantially lower than adequate per-pupil costs, and this gap between actual spending and adequate cost is expected to increase with district poverty (Exhibit 4-13).

[33] The implicit weight of 80% more funding for free or reduced-price lunch students is in line with estimated poverty weights from adequacy studies using professional judgement methods performed in other states, which range from 58% to 92% additional funding for students in poverty (Baker, Taylor, & Vedlitz, 2008).

Exhibit 4-13. Predicted District-Level Actual Spending and Adequate Cost Per Pupil, by the Percentage of Students Eligible for Free or Reduced-Price Lunch

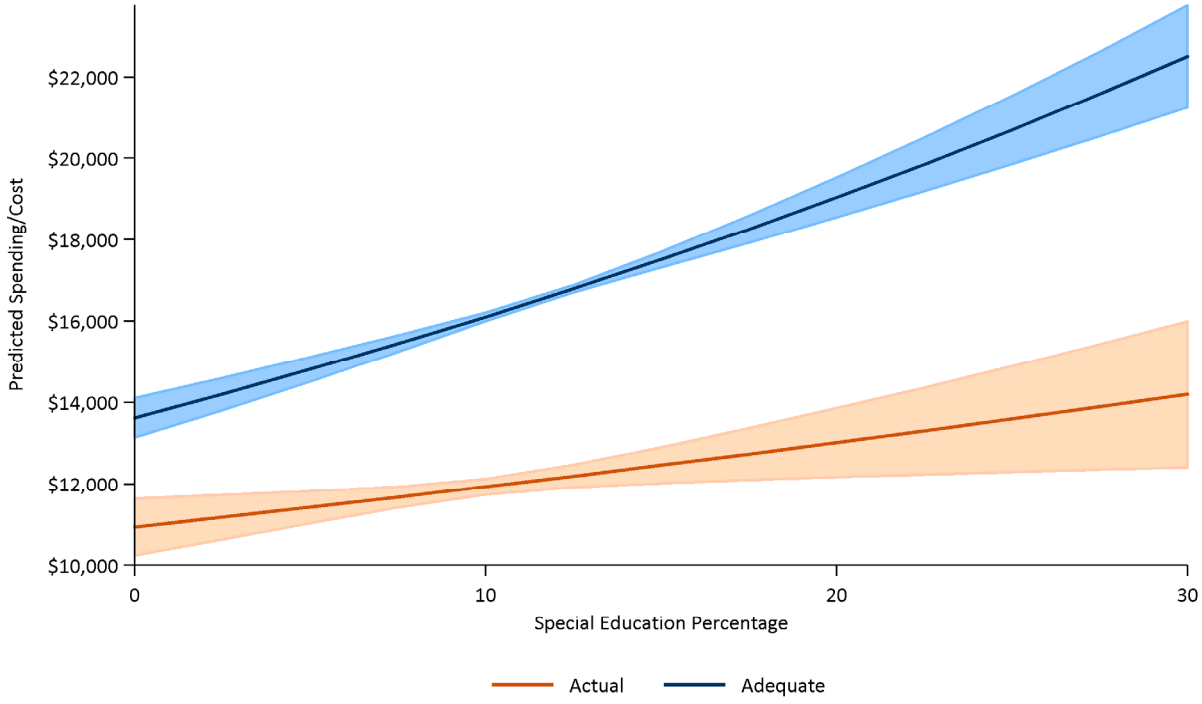


Note: Shaded areas represent the 95% confidence interval around the prediction.

Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data; California Assessment of Student Performance and Progress (CAASPP); and, Standardized Account Code Structure (SACS), California Department of Education (CDE).

The coefficient for special education in the adequate cost model was statistically significant and indicated that in order to provide educational adequacy, students enrolled in special education should be funded at 5.3 times the rate of students with no additional needs. The coefficient for actual spending indicated that spending on students enrolled in special education was 2.4 times higher on average in 2016–17 than spending on students with no additional needs. As with free or reduced-price lunch, the difference between actual spending and adequate cost was smaller if fewer students were enrolled in special education. As the percentage of special education spending increased, increases in adequate cost outpaced increases in actual spending (Exhibit 4-14).

Exhibit 4-14. Predicted District-Level Actual Spending and Adequate Cost Per Pupil by the Percentage of Students Enrolled in Special Education



Note: Shaded areas represent the 95% confidence interval around the prediction.

Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data; California Assessment of Student Performance and Progress (CAASPP); and Standardized Account Code Structure (SACS), California Department of Education (CDE).

In the actual spending model, spending for students classified as ELs was estimated to be 15% higher than otherwise similar non-EL students. However, this was not statistically significant. EL students did have a statistically significant and positive impact in the adequate cost model, which indicated that students classified as ELs should be funded at a rate that is 18% higher than students with no additional needs in order to achieve educational adequacy.[34]

The adequate cost model also showed that middle and high school students should be funded at lower levels than those in the elementary grades. The actual spending model showed that spending on middle school students was substantially lower than spending on elementary students in 2016–17, but it indicated that high school students received a similar level of funding to elementary students. Higher costs of elementary students in the adequate model

[34] The 18% increase for EL students is quite conservative compared to the recommended weights from PJP studies in other states, which ranged from 39% to 200% above the base cost (Jimenez-Castellanos & Topper, 2012). This could be a result of our choice to have PJPs estimate high EL costs only in the presence of high poverty.

could be a result of the inclusion of additional prekindergarten resources, which represented an average of 7% of the elementary resources specified by the PJPs across the elementary tasks.

Lastly, in both models, there was a strong relationship between geographic cost differences and district spending. A 10 percentage point increase in geographic cost, as indicated by the CWI, resulted in a 5% increase in actual spending and an 8% increase in adequate cost.

Unduplicated target student model. In addition to a model that included the proportion of students eligible for free or reduced-price lunch and the proportion of students classified as ELs as separate variables, we ran a model that was more comparable to the current public school funding structure under the state's LCFF. Specifically, the model included the proportion of unduplicated counts of students (i.e., those who are socioeconomically disadvantaged, ELs, or foster children) and the highly concentrated unduplicated target student proportion (which is the proportion above 0.55). To calculate the highly concentrated unduplicated proportion, 0.55 was subtracted from the unduplicated target student proportion and any value less than zero was given a value of zero. For example, if a district had an unduplicated target student proportion of 0.75, the highly concentrated proportion would be 0.20 (0.75 minus 0.55). By using these variables simultaneously in the regression, we allowed a kink—or a different slope—in the relationship for the unduplicated target student proportion for districts in the ranges below and above 0.55.

This, in effect, models how the LCFF works. Districts are given a supplemental grant of 20% of the base funding level for the proportion of students who are targeted disadvantaged pupils according to the LCFF: students classified as ELs, students eligible for free or reduced-price lunch, or students in the foster care system. Students are only counted once, even if they fall into several of these categories, which is why it is termed the unduplicated target student percentage or proportion. There is an additional concentration grant equal to 50% of the base funding level for the percentage of targeted students exceeding 55% of a school district's enrollment (California Department of Education, 2017).

Exhibit 4-15. Regression Results Predicting District-Level Actual Spending and Adequate Cost per Pupil Using Proportions of Unduplicated Counts of Students Rather Than Students Eligible for Free or Reduced-Price Lunch and Students Classified as English Learners

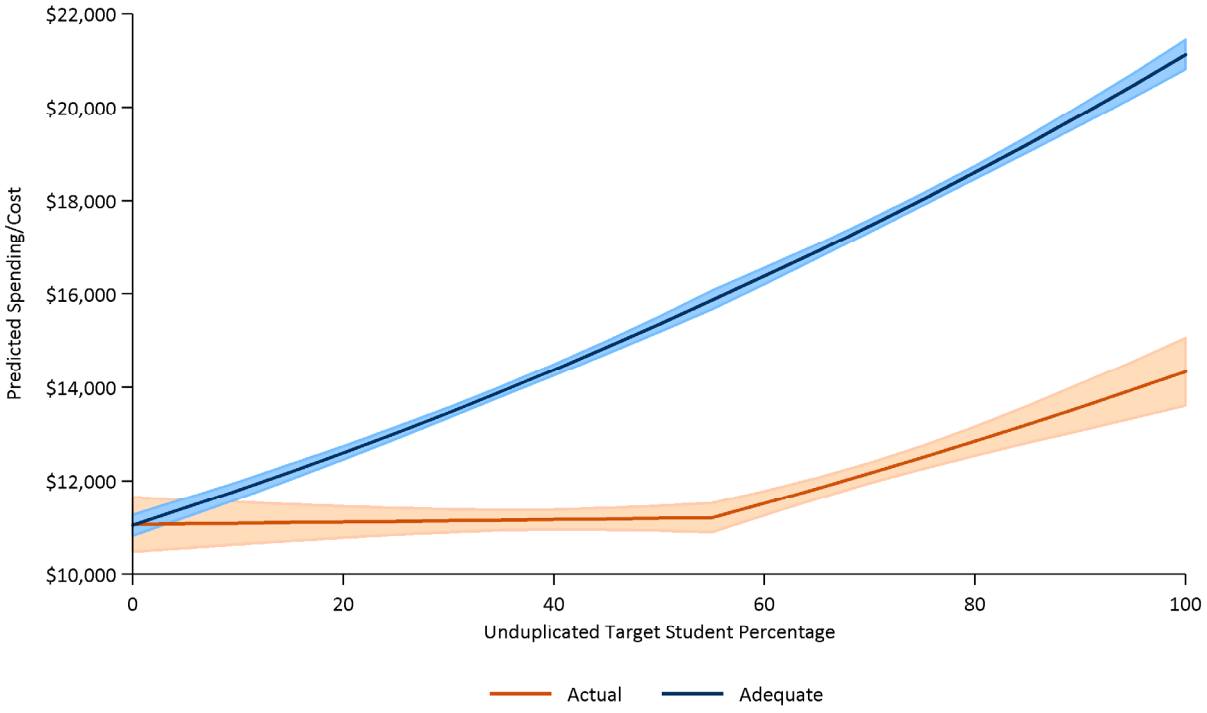
	Actual	Adequate
Enrollment: <500	1.21***	1.24***
	(0.03)	(0.01)
Enrollment: 500–1,000	1.10**	1.14***
	(0.03)	(0.01)
Enrollment: 1,000–2,000	1.05**	1.10***
	(0.02)	(0.01)
Unduplicated Target Student Proportion	1.02	1.93***
	(0.07)	(0.05)
Highly Concentrated Target Students Proportion	1.69***	0.98
(Above 55%)	(0.22)	(0.05)
Special Education Proportion	3.22***	5.24***
	(1.05)	(0.92)
Middle School Enrollment Proportion	0.68**	0.89*
	(0.08)	(0.05)
High School Enrollment Proportion	1.04	0.94***
	(0.04)	(0.02)
Comparable Wage Index	1.05***	1.08***
(10 percentage point increase)	(0.01)	(0.00)
Base	10,450***	9,503***
	(563.4)	(251.5)
N	934	934
pseudo R^2	0.38	0.86

Note: Exponentiated coefficients; standard errors in parentheses; regressions weighted by K–12 enrollment. * p < 0.05, ** p < 0.01, *** p < 0.001.

Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data; California Assessment of Student Performance and Progress (CAASPP); and Standardized Account Code Structure (SACS), California Department of Education (CDE).

As we would expect, an obvious kink appeared in the plotted relationship between actual per-pupil spending and the proportion of unduplicated target students (Exhibits 4-15 and 4-16). Below the 55% threshold, there appeared to be no relationship at all between unduplicated target students and actual spending. However, the regression results indicated that each targeted student above the 55% threshold was funded at 70% above the rate of non-targeted students. In contrast, the predictions generated by the adequate cost model showed that each unduplicated target student should receive 93% more funding than non-targeted students, and there was no kink at the 55% threshold.

Exhibit 4-16. Predicted District-Level Actual Spending and Adequate Cost Per Pupil by the Percentage of Unduplicated Target Students



Note: Shaded areas represent the 95% confidence interval around the prediction.

Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data; California Assessment of Student Performance and Progress (CAASPP); and Standardized Account Code Structure (SACS), California Department of Education (CDE).

Validation Exercise

Traditionally, not enough attention has been given to methods for improving validity in educational costing-out analysis (Baker & Levin, 2014). Though further work needs to be done to investigate whether states that have implemented the funding recommendations made by adequacy studies produce the desired student outcomes, there is strong research evidence showing that finance reforms increasing both the level and equity with which funding is distributed has led to significant improvements in student outcomes. For example, Jackson, Johnson and Persico (2014) found that both the probability of high school graduation and earnings increase significantly in response to per-pupil spending increases. Lafortune, Rothstein and Whitmore-Schanzenbach (2016) showed that funding reforms resulting in increases in the progressivity with which spending occurred (i.e., increased spending in low-income districts) had a positive impact on the achievement of students in those low-income districts. More recently, Johnson & Tanner (2018) found strong evidence that increases in school spending under California's LCFF have led to significant increases in high school graduation rates and academic achievement, particularly among students from low-income families.

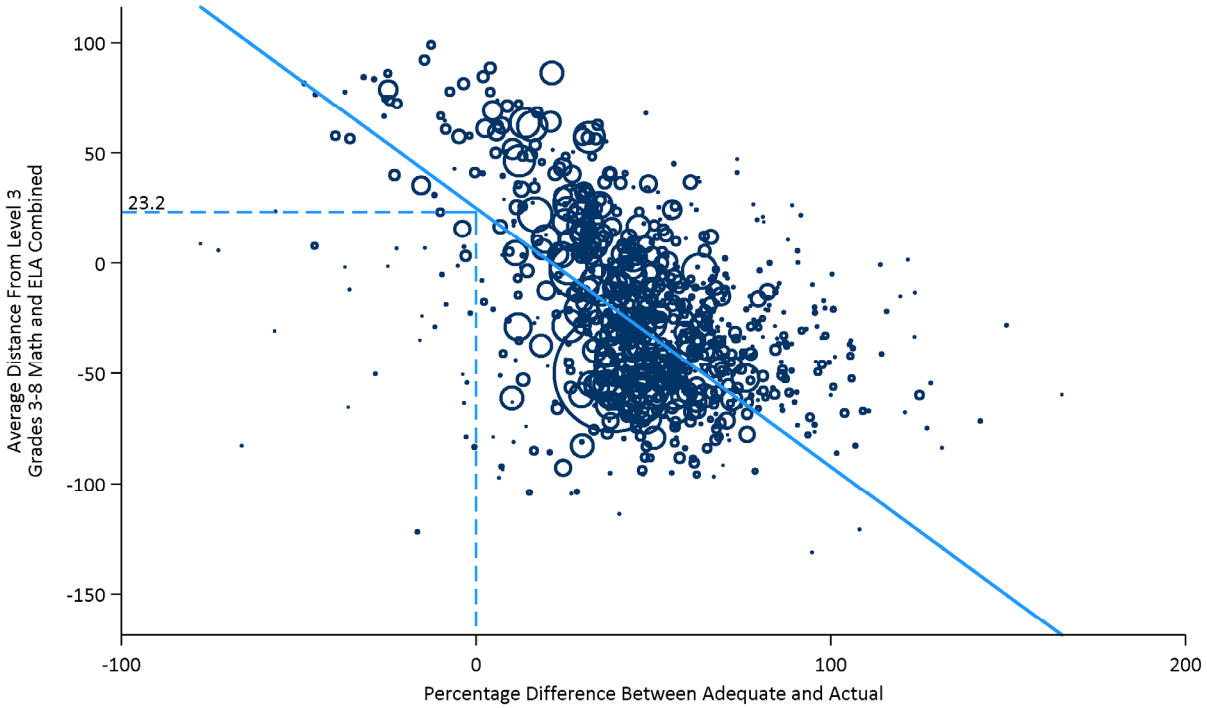
Validating the results of cost studies that make use of input-oriented approaches such as PJP is inherently difficult because the adequate spending generated is for hypothetical models of districts and schools and based on professional opinion rather than existing data on spending, outcomes and cost factors (student needs, scale of operations and price levels of inputs). In contrast, the alternative outcome-oriented approach makes use of cost function modelling, which is based on existing data describing the empirical relationships between spending, outcomes and cost factors, is easier to validate. Nevertheless, despite the costing-out approach that is used, it is important to be confident that any suggested funding increases deemed necessary to provide an adequate education are targeted to districts and schools according to their needs and circumstances.

This calls for a check of the projected distribution of adequate funding generated by a costing-out study to make sure that funding and needs are properly aligned. To this end, we feel that it is important to attempt to validate the results here by evaluating the relationship between the projected additional funding necessary to provide an adequate education and outcomes such as student achievement. If our model is working as intended so that adequate funding is provided in an equitable manner that affords all students an equal opportunity to achieve regardless of their needs or location, then we should see a systematic relationship between a district's relative need (how much more/less they need to provide a sufficient education) and student outcomes such as achievement on standardized tests.

For the purposes of this study, we conducted a validation analysis where we examined the relationship between Grade 3–8 test scores in mathematics and ELA and the relative difference between adequate cost and actual spending. We would expect districts with estimated adequate cost levels that substantially exceed their actual spending levels to have poorer student outcomes, compared to districts where estimated adequate cost was only marginally higher (or in some cases lower) than actual spending. This pattern—where larger funding deficits are associated with lower student test scores—is in fact what the data show.

Exhibit 4-17 is a scatter plot of test scores, measured as the average distance from Level 3 in Grades 3–8 for mathematics and ELA (combined) against the relative difference between adequate cost and actual spending (i.e., the ratio of adequate per-pupil cost to actual per-pupil spending minus 1). Previous studies have termed this relative difference metric the "adequacy gap" (Chambers, Levin, & Parrish, 2006; Levin, Manship, & Chambers, 2009; Levin, 2018). Larger differences indicate the degree to which additional funding above and beyond actual spending is necessary to provide an adequate education. The results showed that districts with larger funding deficits clearly performed worse, on average, than those with smaller deficits. The constant term for the linear fit line was only 23.2. This indicates that in districts where adequate cost and actual spending levels were equivalent or actual spending exceeded adequate cost, the average student performed above the set benchmark indicating proficiency. In districts where adequate cost exceeded actual spending, students were not meeting proficiency benchmarks, on average.

Exhibit 4-17. Scatterplot of Grade 3–8 Test Scores in Relation to the Percentage Difference Between Adequate Cost and Actual Spending

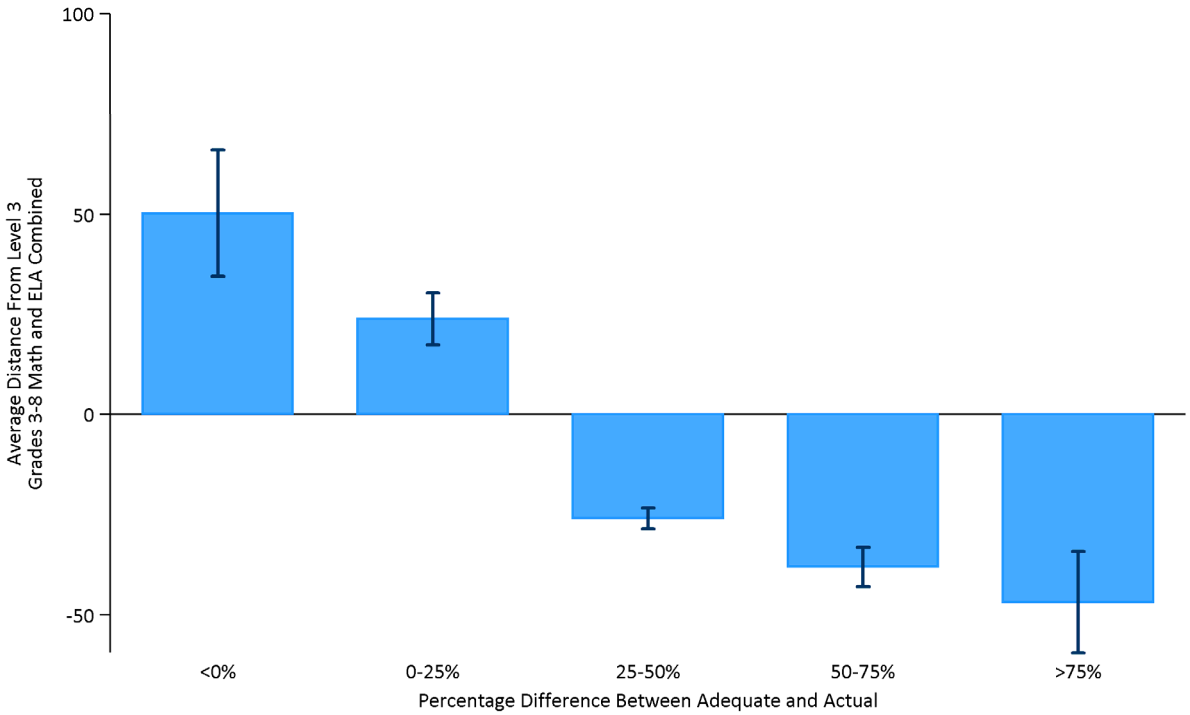


Note: Scatter plots and fitted line weighted by K–12 enrollment.

Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data; California Assessment of Student Performance and Progress (CAASPP); and Standardized Account Code Structure (SACS), California Department of Education (CDE).

When placed into groups according to the relative difference between adequate per-pupil cost and actual per-pupil spending, we found a similar trend; larger funding deficits corresponded to larger deficiencies in elementary and middle school test performance. Exhibit 4-18 shows the average student outcome (with 95% confidence intervals) within five funding gap categories: less than 0% (indicating that actual exceed adequate estimates), 0–25%, 25–50%, 50–75%, and greater than 75%. The results showed that districts with larger funding gaps tended to have lower student achievement. While districts near or above the adequacy target performed above proficiency levels, on average, districts with adequacy gaps exceeding 25% performed well below proficient, on average. We note that there seemed to be the smallest difference in average student achievement for districts in the two highest funding gap categories (50–75% and greater than 75%, respectively). Moreover, the average performance in the highest funding gap category was measured with such little precision that it did not seem to differ statistically from the category directly below it.

Exhibit 4-18. Average Distance from Level 3 by Ranges of Percentage Differences between Adequate Cost and Actual Spending



Note: Averages weighted by K–12 enrollment. Capped lines show the 95% confidence interval around the average.
Source: AIR calculations from PJP resource specifications; California Department of Education (CDE) Student & School Data; California Assessment of Student Performance and Progress (CAASPP); and Standardized Account Code Structure (SACS), California Department of Education (CDE).

Chapter Summary

This chapter has presented an overview of the results of this study, an examination of the student needs factors that drove the projections of adequate costs (using regression), and an exercise to validate the adequacy projections.

On a per-pupil basis, adequate district-level spending was estimated to be $16,890, and actual spending totaled $12,204. While $16,890 per student represents an increase of 38% compared with actual spending levels, Alaska, Connecticut, the District of Columbia, New Jersey, New York, and Vermont all spent more on a per-pupil basis in 2014–15 (not adjusting for inflation) than the 2016–17 adequacy estimates presented here for California (Cornman, Zhou, Howell, & Young, 2018). Adjusted for inflation, the 2016–17 equivalent of the 2014–15 per-pupil spending in Massachusetts was also higher than the California adequacy estimate.

When examining variation in adequacy estimates based on district characteristics, we found that high-poverty districts required larger amounts of per-pupil funding to achieve the estimated adequate levels. In terms of actual spending, high-poverty districts in California spent more on average than districts with lower levels of poverty, indicating that education spending

is already fairly equitable compared to many states (Baker, Farrie, Johnson, Luhm, & Sciarra, 2017). However, the present relationship between spending and poverty is not strong enough to achieve educational adequacy in high-poverty districts. In the highest-poverty quartile of districts, 98% of districts (representing over 99.9% of total students in this quartile of districts) did not meet the estimated cost of achieving educational adequacy.

When multiplied across the number of students, the per-pupil adequate cost estimates indicated that $25.6 billion of additional funding for education in California (prekindergarten to Grade 12) is needed, on top of the existing $66.7 billion in actual spending that occurred in 2016–17. The marginal cost to achieve adequacy represents a 38% increase in spending above the 2016–17 level. To provide a point of comparison, the additional amount of funding projected in the previous AIR adequacy study for California (Chambers, Levin, & DeLancey, 2006) was substantially higher, with a marginal cost of $24.1 billion to $32.0 billion, on top of $45.3 billion in actual spending at the time (equal to an increase of 53% to 71%). While the estimated necessary increase in funding to provide educational adequacy was larger in the previous study, it is important to note that it made use of an entirely different goals statement that was aligned with the state accountability system at that time.[35] In addition, other important changes have taken place as well. For example, school funding at the time of the previous study was arguably less equitably distributed across districts.

Chapter 5: Summary and Conclusion

This final chapter offers reflections on the main results of our investigation into the cost of providing an adequate education for all public school students in California. The study was guided by the California Department of Education's (CDE) goal of preparing all California students to "attain the highest level of academic knowledge, applied learning and performance skills to ensure fulfilling personal lives and careers and contribute to civic and economic progress in our diverse and changing democratic society." The results of this study are based on input from panels of highly qualified educators, which were convened to design instructional

[35] The goal statement used in Chambers et al. (2006) was based on school performance outcomes standards established for the 2011–12 school year and consistent with federal requirements under NCLB. Specifically, these outcomes included a California Academic Performance Index (API) score of 740, minimum proficiency rates on standardized state ELA and math tests for every elementary, middle, and high school, and a minimum high school graduation rate of 83.4%. The contemporary adequacy study also written for *Getting Down to Facts* by Sonstelie, J. et al. (2007) used a PJP inspired model and similar goals, but the projected increase in funding necessary to provide educational adequacy was based on an API of 800. Sonstelie et al.'s results showed that a minimum 40% increase in funding would be necessary to provide an adequate education, also larger than the results presented in the current study.

programs and specify the resources necessary to provide all students the opportunity to achieve California's educational goals and learning standards at a minimal cost.

To summarize, the process involved convening two professional judgment panels (PJPs) of carefully selected educators to participate in a structured, 3-day meeting. AIR then used the PJPs' staff and non-personnel resource specifications, along with prevailing input prices (i.e., compensation levels for staff resources), to estimate the cost of an adequate education for California public schools with varying characteristics in terms of schooling level, size, and student demographics.[36] The costs of district special education services and other district-level functions (administration, maintenance and operations, transportation, and food services) were added to district aggregates of the estimated school-level costs required to support an adequate education. A comparative analysis was then performed between total district-level spending required to achieve adequacy and actual spending.

The remainder of this chapter discusses some implementation issues, highlights the need for further investigation to refine the cost estimates, and offers some concluding thoughts.

Implementation Issues

Our estimates indicate that in 2016–17, actual per-pupil spending needed to increase from $12,204 to $16,890—by approximately 38%—to support adequate education statewide. California public schools' operational spending was $66.7 billion, and our estimates suggest that California needed to invest an additional $25.6 billion to adequately educate its students. To put these numbers into context, 2014–15 levels of spending in New York, New Jersey, and Massachusetts (adjusted for inflation to 2016-17 levels) were all substantially higher than the adequate cost estimated for California in this report. These states spent between 2% and 28% more than the amount we propose as adequate funding. However, it should be noted that California has made substantial progress in the last decade, as the previous AIR California Adequacy Study (Chambers, Levin, & DeLancey, 2006) estimated that the state needed to increase spending by between 53% and 71%.

To implement the PJPs' suggested resource specifications, substantial amounts of additional funding would need to be provided to many districts. This would require a great deal of planning at the state and local level to ensure that this additional funding was expended in the most cost-effective manner. The projected increases in funding are intended to support a significant expansion of instructional programs, including implementing smaller class sizes; extending the school day and instructional year; increasing the number of teachers' contracted days; expanding public preschool programs; providing opportunities for all students to access

[36] Specifically, the study team performed a regression analysis of the PJP resource specification costs to predict school-level spending for each school in California, accounting for school size, grade configuration, and student needs (proportion of students eligible for free or reduced-price lunch, proportion of students classified as English learners [EL], and proportion of students enrolled in special education).

science, technology, engineering, and mathematics (STEM) enrichment and arts activities; engaging families in more meaningful ways; increasing instructional supports for dual-language learners; and improving support for students' social-emotional development.

Implementation of some of the PJPs' models would also require hiring more personnel, including instructors—an area in which both California and the nation are facing a shortage (Stucher et al., 2016). In order to generate the personnel needed, more college students will need to be encouraged to become teachers, and the state's teacher training capacity will need to be enhanced. It will also be important to increase teacher salaries in order to make the profession more attractive, motivate those already holding credentials to return to the profession, and address high turnover in the state.

The results also suggest that an increase in funding for most districts would be accompanied by a decrease in funding for a limited number of districts where actual spending exceeds predicted adequate cost. In these cases, a hold-harmless policy would normally be considered, guaranteeing that no district receives a sudden decrease in funding. However, there is a very real cost to implementing such a policy (i.e., funding districts at a level above what is deemed necessary, according to the adequate cost results). The current study suggests that an additional cost of $366 million or 0.5% of the 2016–17 actual spending level would be required to keep districts with above-adequate spending at their current spending levels.

In addition to this monetary cost, hold-harmless policies undermine the equity intent of an adequacy-based funding formula, where all districts receive an amount deemed appropriate to provide adequate educational opportunity, taking their unique combinations of cost factors into account. This is not to say that implementing hold-harmless policies to some degree, at least for a temporary period, is unwarranted. On the contrary, it would be irresponsible to require those districts with above-adequate spending to switch to a lower funding allocation overnight, as this could result in severe uncoordinated shocks to the delivery of important educational programs and services. However, previous studies have discussed how hold-harmless policies might be gradually phased out as part of the formal plan to phase in a new funding formula (Chambers et al., 2008). Any implementation of funding reform resulting from this study's results should consider what a phase-in plan that includes a hold-harmless provision might look like.

A Need for Further Investigation

Central administration, maintenance and operations, transportation, and food services costs account for a significant proportion of spending in California schools. While it was possible to make informed estimates of adequate costs in these areas, they remain unverified, partially undermining the precision of our bottom-line estimates of adequate cost.

A detailed investigation is needed of the impact on additional spending for centralized district functions of the direct costs of educational programs specified through the PJP process. For example, to what extent does the expansion of school-level programs necessarily create an additional need for spending on the part of the central office? It would be useful to explore

with school business officials and other high-level decision makers what additional district-level resources might be necessary to support expanded school-level programs, and how best to estimate these additional costs.

In addition, we made no attempt to incorporate transportation costs into the PJP deliberations or to develop refined adequate cost estimates of student transportation services. Further research should consider ways in which school size and transportation costs impact one another, and ways in which the design of programmatic opportunities for children (e.g., magnet school programs and other choice models, as well as decisions to serve students requiring special education in neighborhood schools) impact the need for student transportation services and their costs.

Concluding Thoughts

District scale of operation and the distribution of student needs (students living in poverty, students classified as English learners [ELs], and students enrolled in special education) are the two major factors underlying the cost variations presented in this study. To inform future funding reform, policy makers should carefully evaluate the funding weights suggested by this study and consider how current dollar allocations to districts under the state's LCFF compare to those predicted by the adequate cost model.

The PJPs created instructional program designs for schools that are capable of providing all students an adequate opportunity to meet California content standards and goals. However, we stress that the designs and their specific programmatic components are not intended to be prescriptive, nor are they recommended as mandates to regulate how districts and schools allocate their resources. Rather, the program designs should serve as a starting point for a conversation about the resources that need to be put in place in order to strengthen any future educational investment. To this end, we suggest that any additional funding provided to districts and schools in an effort to support educational adequacy should come with significant autonomy as to how dollars are spent. This does not mean that we expect local school and district leadership to operate in a vacuum, with no accountability over how resources are allocated. Structures that are already in place—specifically, the current LCFF system's Local Control Accountability Plan and School Plan for Student Achievement—should continue to facilitate thoughtful planning that aligns resources with the strategic priorities of schools, districts, and the state.

Finally, one must recognize that effective investments in education cannot alone guarantee the desired outcomes. The success of our children depends on a multitude of factors that affect their ability to learn and thrive in the complex world in which we live. It requires investments in socio-emotional learning and physical health, as well as investments that support the "whole child" and family stability, all of which contribute to children's ability to succeed in school. It should also be acknowledged that schools likely cannot do the job alone. However, adequate educational funding is certainly a necessary component of the overall investment required to provide all children in the state the opportunity to achieve the outcomes expected from our public school system.

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