Equity and Adequacy of Colorado School Funding

A Cost-Modeling Approach

Drew Atchison, Stephanie Levin, Jesse Levin, Arun Kolar, Damon Blair, Ajay Srikanth, Brad Salvato

April 2025

Version 2: Updated April 7, 2025

American Institutes for Research® | AIR.ORG

AIR®
Advancing Evidence.
Improving Lives.

Contents

Exhibits

Version Update: Report version 2 corrects four numbers in the last sentence of page 85 and first sentence of page 86.

1. Introduction

By the spring of 2023, Colorado's funding formula had been in place for almost 3 decades, and there was growing recognition that the funding formula was possibly outdated and in need of modernizing (e.g., Brundin, 2021). The Public School Finance Act of 1994 created Colorado's original foundation aid formula, which established a base per-pupil funding amount with adjustments for cost of living and district size, and an additional amount for at-risk students (defined by free or reduced-price lunch [FRL] eligibility).[1] In addition to the formula being considered outdated, there was growing frustration with the "budget stabilization factor," a legacy of the Great Recession that allowed lawmakers to cut a percentage of state education funding each year in order to balance the state budget (Colorado School Finance Project, n.d.).

In May 2023, the Public School Finance Act for the 2023–24 fiscal year (SB23-287) established a Public School Finance Task Force to examine and make recommendations regarding how Colorado's schools are funded and called for two independent entities to conduct studies examining the amount of additional funding needed to provide an adequate education. The Task Force established the parameters that each study should address, including the base amount of funding for students without additional learning needs and funding adjustments for students with additional needs.[2]

The American Institutes for Research® (AIR®) study team was awarded a contract to conduct an outcome-focused adequacy study using a cost-function modeling methodology. This report is the culmination of the resulting study, providing an overview of the study, the study findings, and recommendations for improving the equity and adequacy of Colorado school funding.

Study Overview

The AIR study team conducted an outcome-oriented study using cost-function modeling and other descriptive quantitative analyses. The study also included analyses of input from citizens garnered through townhall meetings and a public engagement survey. Specifically, the study was designed to:

- Evaluate strengths and weaknesses of the current funding formula, particularly as it relates to the equity and adequacy of Colorado's existing school funding system.
- Estimate an appropriate base level of funding and cost adjustments (funding weights) for

[1] Additional funding for English learners was added in the 2022–23 fiscal year as an 8% multiplier of the preliminary per-pupil amount (Legislative Council Staff, 2023).
[2] The two studies use different methodologies. The AIR study uses a cost-function modeling approach that determines the relationships between student outcomes, school spending, and student needs and other cost factors to estimate the cost of achieving a target outcome level for each school or district. The second study primarily uses a professional judgment approach where expert practitioners are asked to specify the resources needed to provide an adequate education.

- students with additional needs [at-risk students, English language learners (ELLs), and students with disabilities (SWDs)],
- school contextual factors that influence cost (e.g., school/district size, urbanicity), and
- geographic differences in costs required to hire and retain staff.

The public engagement component of the study helped build public awareness of the study and provided an opportunity for public discourse. The process was designed to help stimulate a spirit of cooperation and to encourage key constituents, including students, parents/guardians, educators, community members, and others, to feel vested in the process. The public engagement component also sought to identify how Coloradans envisioned the goals and priorities of their public schools and how those goals and priorities relate to the funding of Colorado's schools.

To address these study purposes, we collected data from different sources and engaged in multiple analysis activities (Exhibit 1).

Exhibit 1. Study Data Collection and Analysis Activities

Activity	Description
Data collection activities	
Public engagement	Conducted eight town hall meetings, organized to cover all geographic regions in Colorado. Developed and administered a public engagement survey to ask Colorado citizens their perspectives regarding the quality of education and sufficiency of funding and resources for Colorado's schools.
Collection of administrative data	Gathered and compiled extant administrative data at the school and district levels on spending/funding, enrollment and demographics, student outcomes, and other contextual and geographic characteristics.
Analysis activities	
Review of policy documents and existing literature on Colorado's school funding formula	Examined existing documentation describing Colorado's current and new funding formulas. Reviewed existing formula calculation files and simulations.
Analysis of administrative data	Quantitatively analyzed administrative data to examine equity of resources, the extent of equal opportunity to achieve outcomes, and the adequacy and use of resources.
Analysis of public engagement survey	Descriptively analyzed public engagement survey data to examine and report the perspectives of Colorado's citizens regarding issues of equity and adequacy.

Description of Data

Our data came from two primary data collection activities: (a) the gathering of administrative data on education finances, student enrollments and demographics, student characteristics, and other district and school characteristics; and (b) primary data collection on the perspectives of Colorado's citizens as it relates to their school funding system gathered through our public engagement activities. We describe these data in more detail below.

Administrative Data

The administrative data provided by the Colorado Department of Education (CDE) were essential to most of the study's analytical approaches investigating the equity and adequacy of school funding in Colorado. The administrative data used for this study, described in the following paragraphs and referenced throughout this report, includes expenditures, enrollments, student outcomes, school characteristics, and geographic contexts from the 2017–18 through 2022–23 school years. In addition, the study also used administrative data on school staffing from the 2022–23 school year. Descriptive statistics for the administrative data used in the analysis are available in Appendix E in Exhibit E-3.

Enrollments, School Characteristics, Student Outcomes, and Geographic Context

The enrollment data came from the publicly available pupil membership data files.[3] The pupil membership data files count student enrollment and attendance based on the Student October Count, typically occurring on October 1. For students to be counted in membership, they must attend a school before the day of the Student October Count and be enrolled by count day in the given school year. Students must also attend or resume attendance within 30 days following the count day to be included in a school's pupil membership for the given school year.

The pupil membership data files also disaggregate enrollments according to various student groups, including SWDs, ELLs, and economically disadvantaged students, as well as by grade level. Using these disaggregated enrollments, we calculated the percentages of students in each school within each student group and by grade.

We used publicly available school-aggregated outcome data to determine student test scores (Colorado Measures of Academic Success and SAT), attendance and absenteeism rates, graduation rates, and dropout rates from the CDE. For other variables describing schools' geographic contexts, we used the population density of 5- to 17-year-olds by ZIP Code provided through data on the 2020 Census and a measure describing geographic differences in the price

[3] To access enrollment data, see https://www.cde.state.co.us/cdereval/pupilcurrent. For student outcome data, see https://www.cde.state.co.us/cdereval.

levels of educational staff called the Comparable Wage Index for Teachers (CWIFT), available from the U.S. Department of Education's Institute for Education Sciences.[4]

Fiscal and Staffing Data

The CDE provided fiscal data used in this report. The fiscal data contained end-of-year expenditures for each district and school, organized by the state's chart of accounts. For this study we only used operational spending (also often called current spending) for education services, which make up the regularly occurring expenses that schools and districts face. As such, expenses for capital and building construction, debt service, and community services are excluded from our expenditures. Using the data on operational spending, we calculated school-level spending per pupil for each school in the state, which consisted of the following steps:

1. We isolated expenses directly attributed to specific school sites within the data and calculated the total amount of spending attributed to each school and year (2017–18 through 2022–23).
2. We divided the total spending attributed to each school by its enrollment totals to calculate the amount of attributed spending per student for each school.
3. We used the chart of account codes to identify and calculate the total spending on special education not assigned to individual schools for each district. We divided this unassigned spending on special education by district enrollment of SWDs to calculate a per-SWD amount.
4. We calculated the total spending that was not assigned to individual schools excluding special education spending for each district. We calculated per-student amount, we divided the district-level spending by total district enrollment.
5. We added the district-wide spending on special education per SWD and the non-special education district-wide spending per student to the school-attributed spending for each school based on the school's enrollment of SWDs and total enrollment. For example, if the district-level spending per SWD was $5,000 and a school enrolled 20 SWDs, we multiplied $5,000 by 20 SWDs to calculate the portion of district-level spending on SWDs for the given school.
6. We added together the district-level spending that was allocated to schools based on enrollment and the school-attributed spending to calculate an overall expenditure for each school. We divided the overall spending by total enrollment for each school to calculate the per-student figure for each school that accounts for all spending (both at the district level and attributed to specific schools).

[4] Census data can be downloaded here: https://data.census.gov/. Additional documentation regarding the CWIFT as well as CWIFT data publicly available for download can be found at https://nces.ed.gov/programs/edge/Economic/TeacherWage.

Using the chart of accounts, we also distinguished spending according to the source of funding (federal funding versus state and local funding). Federal funds are typically distributed according to their own established distribution mechanisms. By contrast state and local funding is subject to the state's funding formula and other policies regarding the raising of revenue. Because our study is focused on the state's funding formula, for certain analyses we exclude expenditures from federal funding sources to focus on the amount of spending from state and local sources.

The CDE also provided school-level staffing data used in this report. The staffing data included the following for schools: the average salary for teachers, principals, and paraprofessionals; average years of experience for teachers and principals; and the number of full-time equivalent teachers, principals, and paraprofessionals. The student-to-teacher and student-to-paraprofessional ratios were calculated by dividing a school's total enrollment by the respective number of full-time equivalent teachers and paraprofessionals employed by the school.

Schools Excluded From the Analysis

For most of the school-level analyses presented in this report, we excluded unique school types that likely have atypical spending patterns, including early childhood schools, special schools, adult schools, and juvenile correctional education centers. In addition, observations were excluded if fiscal data critical for an accurate calculation of a school's per-pupil expenditure for a given year was either missing, incomplete, or flagged in the data for having an error or problem.

Public Engagement Data

To ensure a robust approach to public engagement, this study used a two-part design to gather citizens' views on the role of public education and school funding systems. We collected data from a public online survey (*n* = 2,093 surveys received) and eight virtual townhall meetings (*n* = 31 townhall meeting participants).

To recruit Coloradans to share their views, we announced activities and posted invitations to participate in data collection activities on a project website that was publicized widely by the CDE and the research team.[5] The research team emailed all Colorado superintendents (*n* = 180), BOCES executive directors (*n* = 21), and leaders of statewide and local organizations (e.g., PTA members, unions, education advocates, community members) (*n* = 61). These emails explained the school funding study and asked recipients to share the link to the website with their constituents and community members and encourage them to take the survey and participate in one of eight virtual townhalls. For both surveys and townhalls, we targeted a range of

[5] The project website can be found at https://www.air.org/project/colorado-financial-adequacy-study).

participants (i.e., students, parents, teachers, administrators, community members, business leaders, interested citizens).

Online Surveys. In order to solicit opinions and perspectives surrounding the priorities of public education and Colorado's school funding system from the maximum number of constituents, the AIR research team developed an online survey available in both English and Spanish. The questions addressing Coloradans' priorities and desires for public education and the state's school funding system were developed with input from the School Finance Task Force report (Public School Finance Task Force, 2024), CDE officials, and a sample of Colorado residents.[6] The online survey was posted on the project website and heavily publicized in townhall meetings. The survey instrument, additional details on the survey sample, and detailed survey results can be found Appendix A.

Virtual Townhalls. We solicited input from concerned and interested citizens to gain a more nuanced understanding of Coloradans' views and how they may differ across the state during eight virtual townhall meetings. The meetings were highly publicized through our outreach efforts. Each meeting began with a brief presentation on school finance and AIR's study, but the time was mostly spent engaging participants in discussions about their experiences with and views on public education and the state's funding system. Additional information on the virtual townhalls, including the townhall materials, can be found in Appendix B.

Analytic Approach

The Education Cost Model Approach

To examine the adequacy of school funding, the we used an outcome-oriented cost analysis approach called the Education Cost Model (ECM), a cost-function model.[7] The ECM is used to estimate what must be spent to achieve the desired outcomes given the set of other factors that can affect the cost of achieving those outcomes. Salient cost factors include scale of operations (i.e., the existence of diseconomies of scale where costs are higher for very small schools or districts), geographic variation in the price of resources (particularly the salaries necessary to hire and retain staff), and the characteristics of the student populations served with respect to their needs. Typically, economically disadvantaged students, ELLs, and SWDs are the student groups recognized as requiring additional resources to achieve educational success. In addition, the ECM accounts for the fact that there may be investments in outcomes that are either not measured or not included in the model. For example, having an exemplary athletics program may be something that a community values and is willing to invest in but may not

[6] Colorado residents providing input included parents, educators, and community members active in education advocacy.
[7] For a review of cost model analyses, see Duncombe and Yinger (2011) and Gronberg, Jansen, and Taylor (2011). Our team has also used this approach in Delaware (Atchison et al., 2023), New Hampshire (Atchison et al., 2020), and Vermont (Kolbe et al., 2019).

strongly affect the types of student outcomes included in the ECM. A thorough ECM, therefore, considers spending as a function of (a) measured outcomes, (b) characteristics of the educational setting (e.g., economies of scale, population density), (c) regional variation in the prices of inputs (e.g., teacher wages), (d) student population characteristics, and (e) factors affecting spending that are unrelated to outcomes.[8]

Identifying statistical relationships between spending and outcomes under varied conditions requires high-quality measures of important student outcomes, spending, and cost factors as well as a large number of schools or districts that exhibit sufficient variation in those factors. Much can be learned from the variation that exists across districts and schools regarding the production of student outcomes. Specifically, these models can be used to estimate the cost of achieving a target level of outcomes and how those costs differ across schools and districts according to their student populations and other contextual differences. For this study, the ECM focuses on schools to evaluate the empirical relationship between per-pupil spending and student outcomes, given the educational context.

One limitation of ECMs, as traditionally used, is that they provide no direct information on *how* resources are used to produce desired outcomes. However, we extend the ECM by exploring how otherwise similar schools achieve different outcomes with the same level of spending or the same outcomes with different levels of spending. That is, we use the ECM to reveal differences across schools in terms of their relative efficiency in achieving outcomes. Once schools that are more efficient are identified, we investigate patterns of resource use to better understand whether certain uses of resources are associated with differences in efficiency. We discuss our methods in more detail in the chapters that present our analyses and results.

Public Engagement

To understand Coloradans' perspectives, we conducted descriptive analyses using data from the public survey and townhall meetings. To analyze the survey, we tabulated the percentage of responses by response option for each survey item and reported them. In addition, we also calculated two-way tabulations of responses by demographic, geographic, and role-based subgroups. We have presented results for these analyses in the report when meaningful and statistically significant. Also, we include selected results in Appendix A.

[8] Additional technical details regarding the ECM can be found in Chapter 7 as well as Appendix E in the Technical Appendix.

Key Findings

Colorado's current level of funding is inadequate to meet the state's educational goals.

- We find a gap of $4,600 per student between the funding needed to provide students with an adequate education and existing levels of spending from state and local sources as of the 2022–23 school year. In total, $4.1 billion in additional funding is needed to provide all Colorado's K–12 students with an adequate education, representing a 33% increase over what was spent in 2022–23.
- Coloradans who participated in our public engagement activities felt strongly that the current levels of funding are inadequate. The public also shared that existing funding is insufficient to address the needs of students with additional needs, including students who are economically disadvantaged, ELLs, and SWDs.
- Students in Colorado perform below the level of the state's educational goals and do not meet the state's benchmarks for proficiency or college and career readiness, on average.
- Student outcomes, as measured by the National Assessment of Education Progress, have declined during the past decade, with the decline beginning well prior to the Covid-19 pandemic.

Colorado's current school funding system is not sufficiently equitable to provide all students an equal opportunity to achieve the state's student outcome goals.

- The schools in the state with the highest student needs, particularly as measured by the percentage of students eligible for FRL, have systematically lower student outcomes compared to schools with lower levels of student needs.
- After accounting for other student-need variables and school characteristics, schools with higher percentages of students eligible for FRL receive less in state and local funding than otherwise similar schools with lower FRL rates.
- Our cost-function analysis and resulting estimation of funding weights indicates a need to provide much stronger funding adjustments on the basis of students eligible for FRL, ELLs, and SWDs.

Teachers are one of the most important resources in driving students outcomes, but Colorado's teachers are poorly paid and inequitably distributed.

- We conducted an analysis relating the efficiency of schools to how schools use their resources, where efficiency is defined as the difference between observed student outcomes and expected outcomes of schools based on their spending levels, school demographics, and other characteristics. We found that more efficient schools had higher paid and more experienced teachers, suggesting the importance of the teacher workforce in driving better student outcomes.

- The discrepancy in salaries between teachers and other workers with similar education and of similar age is larger in Colorado than in any other state. Colorado also has a higher number of students per teacher than the median state nationally.
- Teachers in Colorado are also inequitably distributed when considering pay, experience level, and staffing levels. Schools with higher FRL rates have lower-paid, less-experienced teachers and employ fewer teachers relative to student enrollment compared to otherwise similar schools with lower FRL rates, on average.
- Coloradans who took our public engagement survey were most likely to agree that teachers in Colorado are not well paid, class sizes are too large, and there are not enough staff to serve students with additional needs.

Colorado's current funding system does not appropriately account for local capacity in determining the share of funding levels that should come from local revenue, resulting in property tax rates that vary drastically across districts and enabling higher spending levels in high-wealth districts relative to lower-wealth districts.

- Under the current funding system, the state allows for a wide range of tax rates to satisfy the local share requirement. As a result, the state covers a large share of funding for many districts with exceptionally low tax rates while other districts have much higher tax rates.
- On average, districts with lower tax rates are wealthier in terms of their assessed property values per students meaning that wealthier residents in the state typically pay lower tax rates than poorer residents.
- On average, districts with higher assessed property values per student spend more in state and local funding, meaning that students who reside in wealthier areas typically attend better funded schools.

Recommendations

1. Increase education funding so that funding levels are commensurate with the state's educational goals.
2. Increase the strength of funding weights for economically disadvantaged students, ELLs, and SWDs, so that more resources are distributed based on student need. This would help provide more equal opportunities to all students to achieve the state's goals regardless of background.
3. Invest more in teachers by: (a) increasing teacher pay to be more comparable to the pay of non-teachers with similar education levels and experience and (b) increasing the number of teachers to reduce student-to-teacher ratios.
4. Address tax inequity in the local tax rates that go toward the local share calculations so that the local share required for each district is based on a more uniform property tax rate.
5. Adjust for geographic differences in staffing costs using a comparative wage index to reflect a region's cost of living and available amenities.

Report Organization

This report details the main activities and analyses undertaken during our study as well as the results.

- Chapter 2 contains a description of Colorado's current school funding formula.
- Chapter 3 assesses the extent to which Colorado's current funding system equitably distributes funding to school districts.
- Chapter 4 examines student outcome levels and variation in student outcomes across schools to inform whether student performance in Colorado currently meets the state's goals and whether the education system provides students in the state an equal opportunity to meet those goals, regardless of students' backgrounds.
- Chapter 5 presents our analyses of adequacy conducted using a cost-function or education cost-modeling approach.
- Chapter 6 presents an analysis of resource use in relation to the efficiency of schools in producing student outcomes.
- Chapter 7 provides our overarching recommendations and conclusions.

The main report is accompanied by a Technical Appendix. The Technical Appendix contains additional information about the public engagement process we undertook for the study as well as additional detail and exhibits regarding the completed analyses.

2. Colorado's Current School Funding System

In May 2024, the state signed into law a new public school finance formula (HB24-1448). Phasing in of the new formula will begin in the 2025–26 fiscal year and is set to be fully implemented in the 2030–31 fiscal year. During the phase-in period, funding amounts under both the old and new formulas will be calculated, and districts will be funded at amounts in between the two formulas, with the amount shifting closer to the amount represented by the new formula as 2030–31 approaches (Colorado General Assembly, 2024). In the sections that follow we describe how school funding works under both the old and new formulas.

Colorado's Old Formula (Based on the Public School Finance Act of 1994)

Colorado's school funding formula, established by the Public School Finance Act of 1994, is a foundation formula that calculates a district's total program funding amount as the sum of (a) a per-pupil funding amount that varies according to a personnel cost factor times a cost-of-living factor and a size factor, (b) at-risk funding for economically disadvantaged students, and (c) ELL funding (first added in the 2022–23 fiscal year).

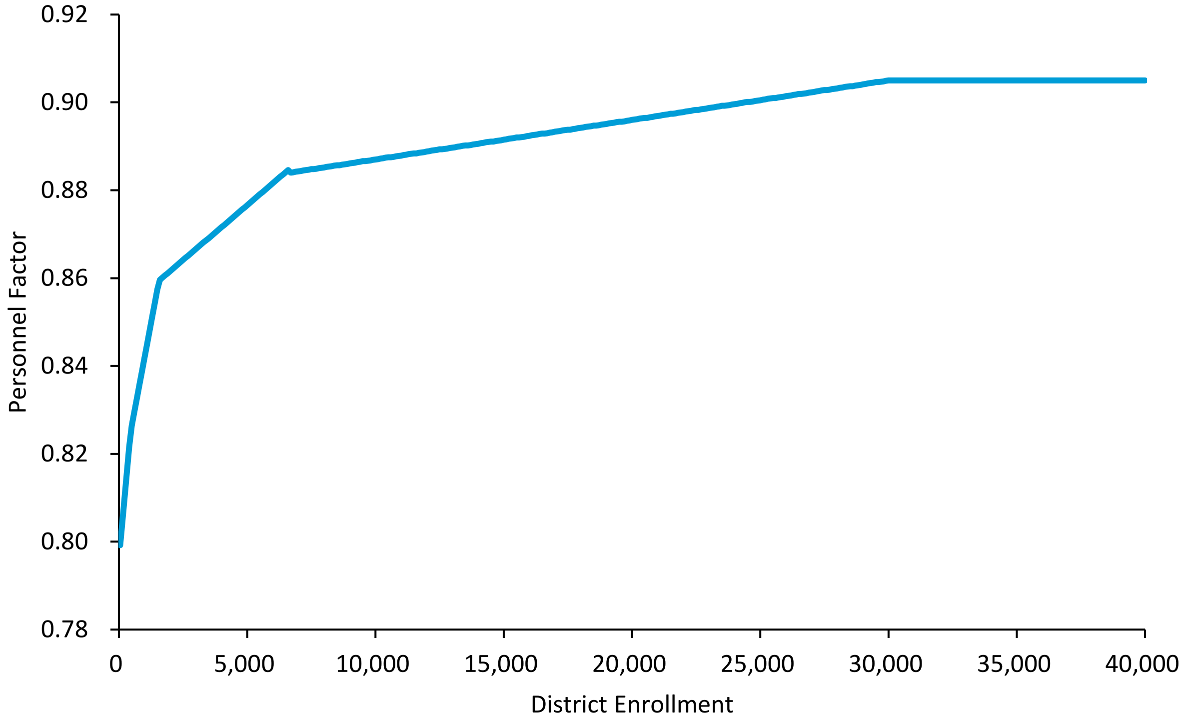
Per-Pupil Funding Amount

The state legislature sets a base funding amount annually for every student in Colorado. The base is required to increase annually to keep pace with inflation. The base amount for the 2023–24 fiscal year was $8,076. This base amount is then adjusted for each district to account for differences in cost of living and economies of scale (district size).

Cost of Living. Cost of living is presumably related to differences in the cost of hiring and retaining staff across districts, so that districts in areas with a higher cost of living receive more funding to compensate for needing to pay higher salaries. The cost-of-living factor for each district is based on cost-of-living studies that are completed every 2 years (see, for example, the 2023 Colorado School District Cost of Living Analysis). For the 2023–24 school year, the cost of living ranged from a low of 1.02 in Kim Reorganized 88 and Branson Reorganized 82 school districts to a high of 1.65 in Aspen 1 school district.

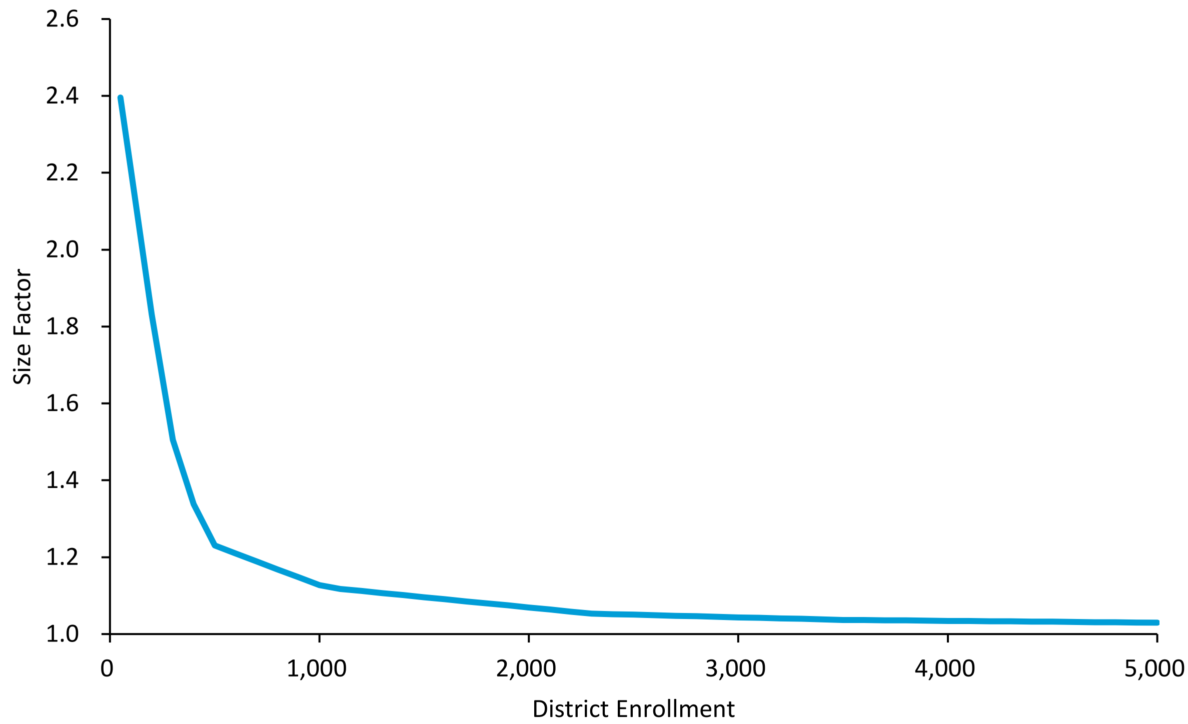
Because the cost-of-living adjustment is intended to account for differences in required salaries, the adjustment is applied only to a portion of the base using a personnel factor. The personnel factor assumes that personnel accounts for a larger share of expenses in larger districts. As such, the personnel factor increases with district size, from a low of 79.9% to a high of 90.5% for all districts with greater than 30,000 students (Exhibit 2). The remaining portion is defined as the nonpersonnel factor (e.g., for a district with a personnel factor of 85%, the nonpersonnel factor would be 15%).

Exhibit 2. Personnel Factor as a Function of District Enrollment



Economies of Scale. The base amount is adjusted to account for economies of scale, intending for smaller districts that do not benefit from such economies to receive more funding per student. The size factor is based on a series of calculations that apply to districts with varying enrollments of less than 5,000. Exhibit 3 shows how the size factor varies according to district enrollment. The slope of the line is steepest for districts with fewer than 276 students and becomes increasingly less steep as district enrollment approaches 5,000. All districts with enrollments of at least 5,000 have a size factor of 1.0297. The maximum size factor is 2.3958 and is applied to districts with 50 or fewer students.

Exhibit 3. Size Factor as a Function of District Enrollment



Calculation of the Per-Pupil Funding Amount. The per-pupil funding amount, which is the base amount adjusted for the cost of living, personnel factor, and size factor, is then calculated as follows:

$$\begin{aligned} &Per\text{–}\ Pupil\ Funding \\ &\quad = [(Base * Personnel\ Factor * Cost\ of\ Living\ Factor) \\ &\quad + (Base * Nonpersonnel\ Factor)] * Size\ Factor \end{aligned}$$

In 2023–24 the per-pupil funding amount ranged from a low of $9,406 to a high of $22,119.

At-Risk and English Language Learner Funding

The per-pupil funding amount is supplemented with funding provided on the basis of student needs for at-risk students and ELLs.

At-Risk Funding. Colorado defines at-risk based on measures of economic disadvantage.[9] The state applies two weights for the at-risk adjustment.

[9] As of the 2023–24 fiscal year, Colorado defined at-risk according to FRL eligibility. Because some high schools do not offer FRL and students at the high school level are more likely to choose not to participate, districts have the option of defining at-risk student counts by applying the FRL rate in Grades 1 through 8 to the district's total enrollment (Legislative Council Staff, 2024).

- An additional 12% of the per-pupil funding amount applies to the share of economically disadvantaged students below the statewide average.
- A concentration weight provides a sliding adjustment between 12% and 30% of the per-pupil funding amount that increases as a district’s at-risk percentage further exceeds the statewide average and applies only to the share of students who exceed the statewide average.

In 2023–24, the statewide average at-risk percentage was 47.2%. Any district below this rate would only be eligible for the lower 12% weight, which would be applied to each at-risk student. Districts with more than a 42.7% at-risk percentage would be eligible for a concentration factor. Las Animas Re-1 school district, for example, had an at-risk pupil percentage of almost 83%, which resulted in a concentration weight of 22.7%. In a hypothetical district with 1,000 students, with 83% of them at-risk, the first 472 at-risk students (up to the statewide average of 47.2% at-risk) would count for the 12% at-risk weight. The remaining 358 at-risk students (between 47.2% and 83% at-risk) would qualify for the 22.7% concentration weight.

ELL Funding. Beginning in 2022–23, a supplemental amount is added for ELLs. ELLs are defined as students who are non-English proficient or who have limited English proficiency.[10] The amount of additional funding per ELL is equal to 8% of the per-pupil amount.

Online and Extended High School Student Funding

Students who participate in multi-district online education programs or extended high school programs are funded at a uniform rate. In 2023–24 the rate for students attending these programs was $9,738 (Legislative Council Staff, 2024).

Counting the Number of Students

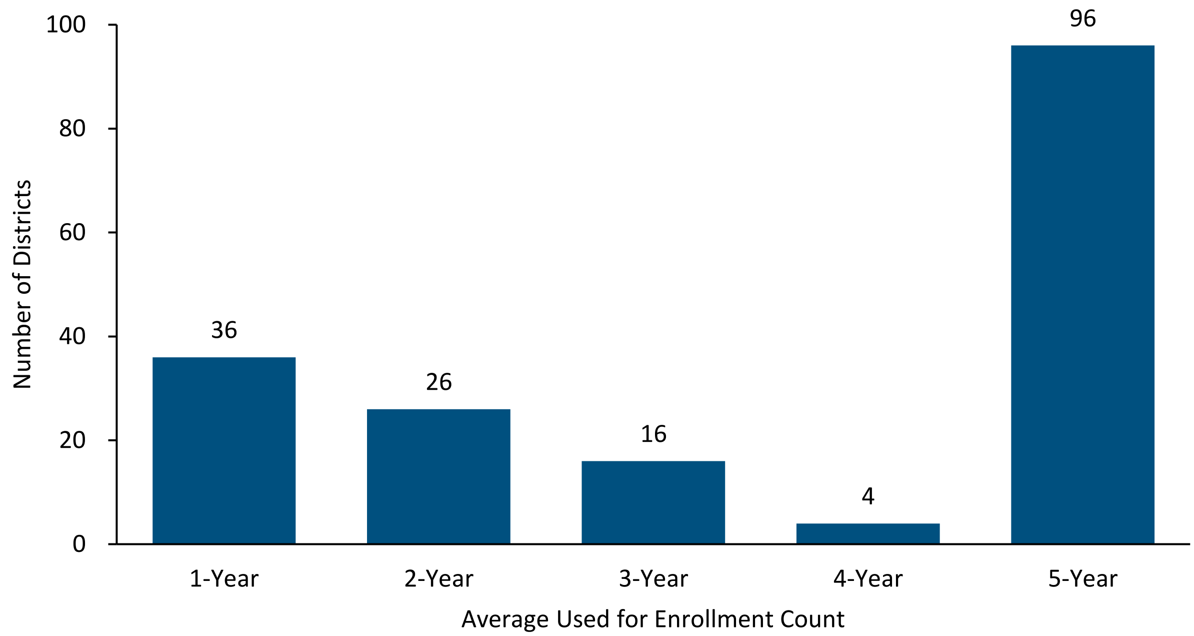
To determine total funding, per-pupil funding amounts are applied to the counts of students enrolled in the district on October 1 of the given fiscal year. However, to help improve the stability of funding for districts that lose students from one year to the next, the pupil count for districts with declining enrollment is the maximum enrollment of a 2- to 5-year average of the October counts. In 2023–24, 36 of the 178 districts used a single-year count for their funded enrollment, indicative of a pattern of increasing enrollment (Exhibit 4). Of the remaining 142

A new measure of at-risk will be used in the 2024–25 fiscal year based on (a) certification of free lunch eligibility through receipt of public benefits; being identified as foster, homeless, migrant, or runaway, or participating in a Head Start program; or participation in Medicaid or Children’s Basic Health Plan and (b) a neighborhood socioeconomic status index (Legislative Council Staff, 2024).

[10] Students who are not English proficient are students who speak a language other than English and do not comprehend or speak English. Students with limited English proficiency have some comprehension of English and can speak some English, but their primary comprehension and speech is in a language other than English (Legislative Council Staff, 2024).

districts with declining enrollment trends, 96 used a 5-year average enrollment, suggesting that most districts have experienced a pattern of declining enrollment lasting at least 5 years. In contrast to total funded enrollment, at-risk and ELL counts are solely based on the October count from the current year.

Exhibit 4. Counts of Districts, by the Number of Years Used for the Enrollment Count (2023–24)



Budget Stabilization Factor

During the Great Recession, to address state budget shortfalls, the state legislature created the budget stabilization factor, which allowed the state to reduce funding proportionately across all school districts. In 2023–24, the budget stabilization factor reduced total funding by just over 1.5%, amounting to $141.2 million less in total funding compared to the formula without the budget stabilization factor (Legislative Council Staff, 2024). This was the smallest reduction in funding due to the budget stabilization factor since 2009–10, the first year in which the budget stabilization factor was implemented (Colorado School Finance Project, 2023). Beginning in 2024–25, the budget stabilization factor is eliminated (SB24-188).

Local Versus State Share

The total funding allocated through the foundation aid formula accounts for both local and state funding sources. After the total amount of required funding is established, each district's local share is calculated, and state aid makes up the difference between the total amount of funding and the local share. The local share is made up of the prior year specific ownership tax (a tax paid on the value of a vehicle when a vehicle is registered) and property taxes.[11] The local share is then set based on the lesser of the mill levy when the district approved to waive the Taxpayer's Bill of Rights (TABOR) limit, the mill limit required to fully fund the amount required by the formula, or 27 mills (where a mill is the amount collected per $1,000 of assessed property valuation). In 2023–24, 63 districts paid the maximum 27 mill limit toward their local share. Only five school districts were able to fully pay for the required funding amount through their local share, requiring no state share. Districts can also raise additional local revenue through voter approval. These overrides are capped at 25% of total program funding (Carey & Gerstle, 2024).

Categorical Funding Programs

In addition to the revenue that districts receive from the main funding formula, districts also receive revenue from state categorical programs. This includes funding for transportation, vocational education, ELLs, SWDs, gifted and talented, and small schools. The special education categorical funding program accounted for 68% of all categorical funding in the 2023–24 school year. Special education funding through the categorical funding program provides funding to districts on a per SWD basis in two tiers that are distinguished based on the needs of SWDs. The Tier A amount, for all SWDs, amounted to $1,750 per SWD in 2022–23. Tier B funding is intended for students with more significant needs and amounted to $4,318 per Tier B student in 2022–23 (Special Education Fiscal Advisory Committee, 2024).[12] In amount, special education is followed by transportation funding, which accounted for about 14% of all categorical funding in 2023–24 (Legislative Council Staff, 2024). However, categorical funding in total accounts for only a small portion of school districts' funding. In 2023–24, categorical funding amounted to approximately 5% of what was provided through the main foundation formula.

Colorado's New Formula (Established by HB24-1448)

In 2023, the Colorado General Assembly commissioned a Public School Finance Task Force to examine Colorado's school funding formula with the intent of making recommendations in January 2024. The Public School Finance Task Force made a number of recommendations on how to update the state's school funding formula, including increasing the base funding amount, increasing at-risk and ELL funding weights, adding new weights for SWDs, changing the application of the size and cost-of-living factors to make them additive rather than

[11] Although Colorado has strict limits on increases to property tax revenues as a result of the state's TABOR, almost all school districts in Colorado have received voter approval to retain property tax revenue above the TABOR limit (Legislative Council Staff, 2024).

[12] Tier B students are identified based on having one or more of the following disabilities: visual impairment, including blindness; hearing impairment, including deafness; deaf-blindness; serious emotional disability; autism spectrum disorders; traumatic brain injury; multiple disabilities; and intellectual disability (Special Education Fiscal Advisory Committee, 2024).

multiplicative, capping the cost-of-living factor to not exceed a certain maximum values, and adding a new weight to account for sparsity/rurality (Public School Finance Task Force, 2024).

Largely in response to the Public School Finance Task Force, Colorado's new school funding formula established by HB24-1448 intends to address some of the perceived shortcomings of the 1994 funding formula. The new formula will be phased in starting in 2025–26 through 2029–30, with full implementation in 2030–31. During the phase-in years, funding amounts will be calculated using both the old and new formula, and the funding amounts will shift closer to the new formula over time. For example, in 2025–26, districts will be funded at 18% of the difference between the two formulas, and in 2026–27, districts will be funded at 34% of the difference. There is also a hold harmless provision that prevents districts from receiving less than they would have under the old formula.

Compared with the 1994 funding formula, the new formula uniformly applies the statewide base per-pupil funding amount rather than adjusting the base to create a per-pupil amount that varies by cost of living and size. Instead, the cost-of-living factor and size factors are treated as additive weights. For example, in a district with a cost-of-living factor of 1.1, the cost-of-living weight would be 0.1 or 10%. The base would be multiplied by 10% to determine the additional amount per student, and that amount would be multiplied by the total enrollment in the district to determine the additional cost-of-living factor funding. The cost-of-living factor is capped at a maximum of 23%. Weights for the size factor and a new locale factor for rural and small town districts are similarly applied. Locale factor weights range from 25% of the base per-pupil amount for districts with a rural remote locale to 2.5% for districts with a town fringe locale.

The new formula also updates the weight for at-risk to 25% and applies it uniformly to all at-risk students, removing the separate concentration at-risk weight; updates the ELL weight to be 25%; and adds a special education weight, also set to 25%. Although these weights are higher than in the old formula, they do not meet the levels suggested by the Public School Finance Task Force, which recommended weights of at least 31% for at-risk, 50% for ELL, and 50% for Tier A SWDs and 85% for Tier B SWDs, where Tier A includes all special education students and Tier B includes students with more intensive special education needs (Special Education Fiscal Advisory Committee, 2023).

HB24-1448 also updates the measure for a district's funded pupil count from the previous funding formula, which mandated the highest of either the current enrollment, 2-year average, 3-year average, 4-year average, or 5-year average enrollment serve as the funded pupil count. The new formula removes the ability of districts to use the 5-year average enrollment as the funded pupil count, instead allowing for the maximum of up to the 4-year average.

Funding Projections From the Old and New Formulas

Here we compare funding projections calculated by the CDE under both formulas for the 2025–26 school year (Exhibit 5).[13] The amounts we compare are as if the new formula were fully implemented. As such, we are not accounting for the phase-in and hold harmless provisions that will be in place during the period of transition from the old to the new formula.

Although the base amounts used in the two formulas are the same for the 2025–26 projections, the funded pupil count in the new formula is slightly lower, resulting in a slightly smaller total amount of funding distributed through the base. In addition, even though the new formula adds a separate locale factor, the overall amount of funding distributed as a result of cost of living, size, and locale is slightly lower in the new formula as a result of instituting a cap on the cost-of-living-factor and making the size and cost-of-living-factors additive rather than multiplicative.

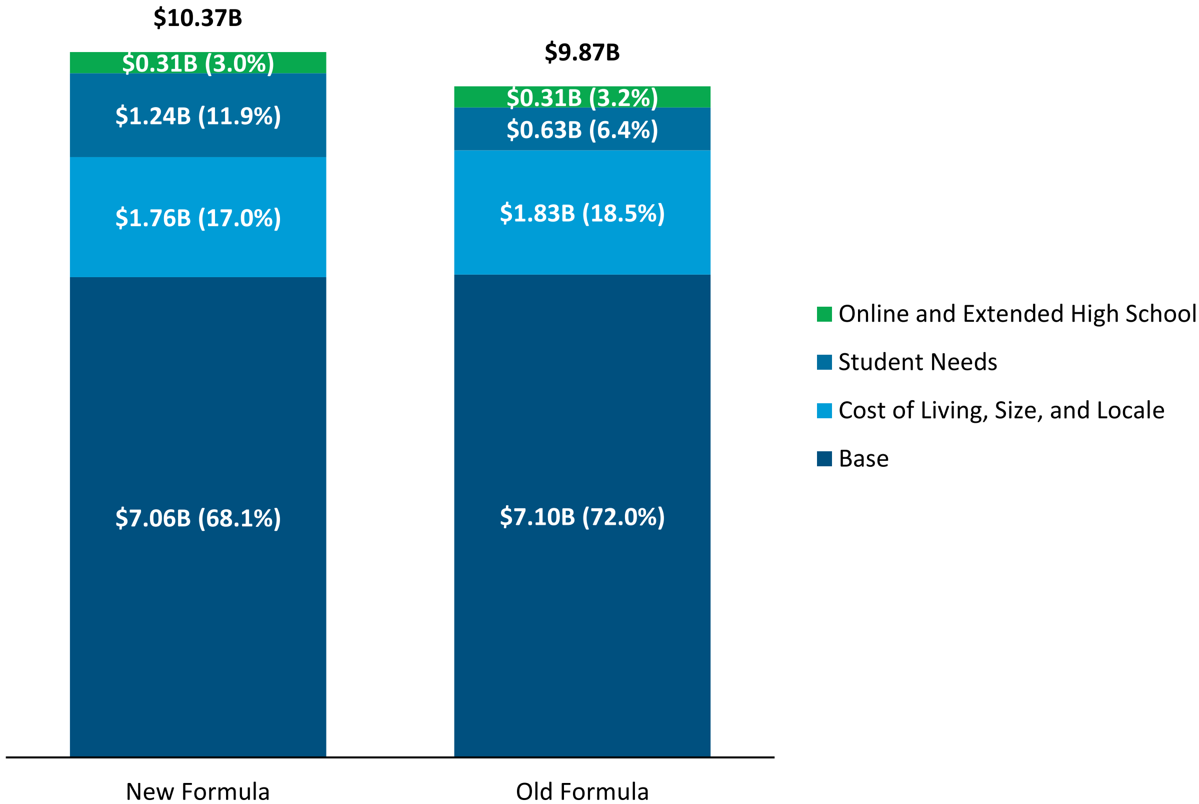
The biggest difference between the old and new formula is in the amount of funding distributed according to student needs. Almost 12% of the total formula funding in the new formula is distributed on the basis of student needs compared with just over 6% under the old formula. Specifically, the amount distributed based on student needs in the new formula is almost double that of the old formula. The new formula includes almost $300 million in additional funding for at-risk students, and about $85 million in additional funding for ELLs. The new formula also includes a new funding allocation for special education, amounting to about $240 million in the funding projections.

Lastly, the amounts of funding allocated for online and extended high school under the two alternative projections are identical.

In total, the new formula is projected to result in about $500 million additional funding allocated through the state's foundation formula.

[13] The calculations for the projected funding amounts can be found at https://www.cde.state.co.us/cdefinance/fiscalyear2025-26schoolfinancfunding.

Exhibit 5. Comparing Funding From the Old and New Formulas (2025–26 Projections)



Note. Student needs under the new formula include at-risk, ELL, and special education. The old formula does not account for special education (under both formulas, additional funding for special education is provided through categorical funding). Cost of living, size, and locale under the new formula includes all three factors. The old formula does not include a locale factor.

Adjusting for Staffing Costs—Colorado's Cost-of-Living Factor Versus the Comparable Wage Index for Teachers

One of the factors influencing variation in the cost of providing an education in different districts is geographic differences in the wages needed to recruit and retain staff. Different areas may have a different cost of living or be more desirable places to live, and these factors affect the wages that teachers and other staff are willing to accept to work in a given location. Therefore, state funding formulas should account for differences in wages across geographic locations but should do so in an equitable way.

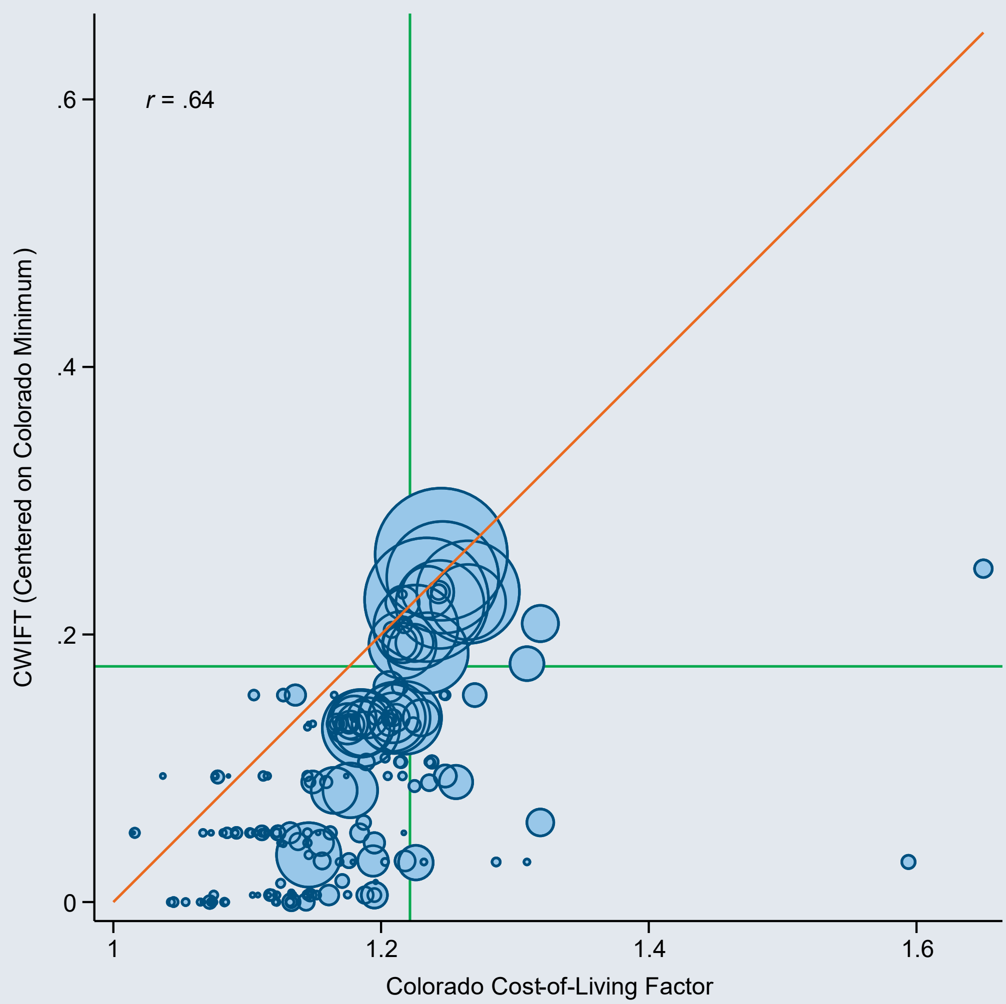
Colorado is one of only few states that use a cost-of-living index to adjust for differences in prices needed to pay staff across geographic locations (Taylor et al., 2021). Although cost of living is one aspect that affects salaries, it ignores that certain areas are more desirable than others because they may have comfortable climate, low crime rates, access to good restaurants and entertainment, or access to beautiful nature (Cornman et al., 2018). In other words, people make tradeoffs between cost of living and living conditions when deciding where to live and what salaries to accept. Adjusting salaries based only on cost of living will overstate geographic cost differences in high-cost areas that also have favorable living conditions and may understate geographic cost differences in low-cost areas that may have few attractive amenities (Stoddard, 2005).

A more common approach states have taken to adjust for wage differences is a comparable wage index approach. The comparable wage index approach relies on the assumption that geographic differences in educator salaries will follow patterns of differences in the salaries for other professions. In other words, if salaries for nurses, police officers, and IT professionals are 10% higher than average in a given location, then the salaries for educators will also have to be 10% higher than average to be competitive within a given labor market. By using data on salaries rather than cost of living, the competitive wage index approach accounts for the tradeoffs people make between cost of living and living conditions. One version of a comparable wage index that has been developed nationally is the Comparable Wage Index for Teachers (CWIFT) (Cornman et al., 2018).

In Exhibit 6, we compare values of the CWIFT adjusted to the minimum CWIFT value in Colorado to the Colorado cost-of-living factor from 2022–23. We adjusted the CWIFT index so that it has a minimum value of 0 for Colorado. In its raw form, the CWIFT is centered on the national average, where a value of 1 represents the national average, values less than 1 represent areas with geographic costs below the national average, and values greater than 1 represent areas with geographic costs above the national average. However, centering it on the minimum value for Colorado gives it an interpretation more applicable to a funding adjustment where the minimum cost districts would receive no adjustment and districts with geographic costs higher than the minimum would receive some additional funding. This has a similar interpretation to Colorado's cost-of-living factor, where a value of 1 represents no cost adjustment and values greater than 1 represent an additional cost adjustment. Furthermore, they are both interpreted in percentage terms. Therefore, a value of 0.25 on the adjusted CWIFT has a similar interpretation to a value of 1.25 on the cost-of-living factor.

Overall, there is a moderately strong correlation between the two indexes (r = .64). However, there are some notable differences. In particular, there are two districts with notably higher cost-of-living factors than any of the other districts. These correspond to Aspen and Telluride. Although undoubtedly these areas have a very high cost of living, they also have very high amenities, making them attractive places to live. As such, the CWIFT values for these districts are much lower, particularly so for Telluride, which has a CWIFT value of approximately 0.05.

Exhibit 6. Comparing the Colorado Cost-of-Living Factor and the Comparable Wage Index for Teachers



Note. Each dot in the scatter represents a district. The size of the dots is weighted by enrollment. The horizontal green line shows the overall average of the CWIFT, and the vertical green line shows the overall average of the cost-of-living factor. The diagonal orange line shows where the CWIFT and cost-of-living factor are equivalent (after subtracting 1 from the cost-of-living factor). A majority of districts fall below the orange line, indicating that the cost-of-living factor for those districts is larger than the CWIFT. The correlation coefficient in the school-level scatter is denoted by r.

Another interesting pattern is clusters of districts that have the same CWIFT value. Because the CWIFT relies on survey data on wages and respondent characteristics, it must be estimated in geographic areas with large enough samples to make estimates sufficiently precise. As such, estimates are based on Census labor markets, which are then applied to counties and school districts. In other words, school districts within counties that are in the same labor market will have the same CWIFT. Index values based on larger geographic areas than the school districts themselves potentially mask some variation in geographic wage differences. However, applying values to districts may also overstate geographic differences. In the case of Telluride, the district is in the same geographic area as other districts with much lower cost-of-living factors. If Telluride is able to recruit teachers from nearby areas and those nearby areas have much lower living costs, the cost of living for where teachers live may be substantially lower. In other words, applying the geographic cost adjustments based on larger geographic areas than district boundaries accounts for the fact that teachers may be willing to commute a reasonable distance to work in a district different from where they live.

The Public School Finance Task Force recognized that the wide range in the existing cost-of-living factor was problematic. Their solution was to impose a cap on the factor of 10% (or 1.1, when centered on 1). A minority of the Task Force members disagreed with the approach, arguing that the cap was arbitrary and unfair to districts in high-cost areas. The new funding formula compromises on the recommendation of the Task Force, imposing a cap of 23%. The Task Force also recommended exploring what they termed a "cost of doing business" factor, which is how the Task Force characterized the CWIFT. Using a comparable wage index approach would accomplish the Task Force's recommendation of reducing the range of the geographic cost adjustment. A comparable wage approach is also more justifiable based on the research, which suggests accounting for both cost of living and living conditions or amenities of areas when adjusting for geographic differences in the wages needed to attract and retain educators.

Coloradans' Perspectives on Public School Funding Systems

Chambers and Levin (2009) identified a framework for evaluating state school funding systems. We used this framework as a starting point for asking Coloradans to weigh in on the priorities for their state's public school funding system. Specifically, to inform potential reforms, we sought public input on the importance of the following characteristics of Colorado's school funding system:

- provides *adequate* levels of resources appropriate to meeting the needs of the unique populations served by schools and districts;
- provides *equitable* resources, such that program quality meets the needs of the students served and funding levels are not associated with the amount of local wealth of school districts;
- is *transparent* and understandable by all concerned parties, with straightforward calculations and procedures that avoid unnecessary complexity;
- is *predictable* and *stable,* such that policymakers can count on receiving a certain level of resources from year to year and such that the system allows policymakers to develop the long-term planning necessary to allocate resources properly;

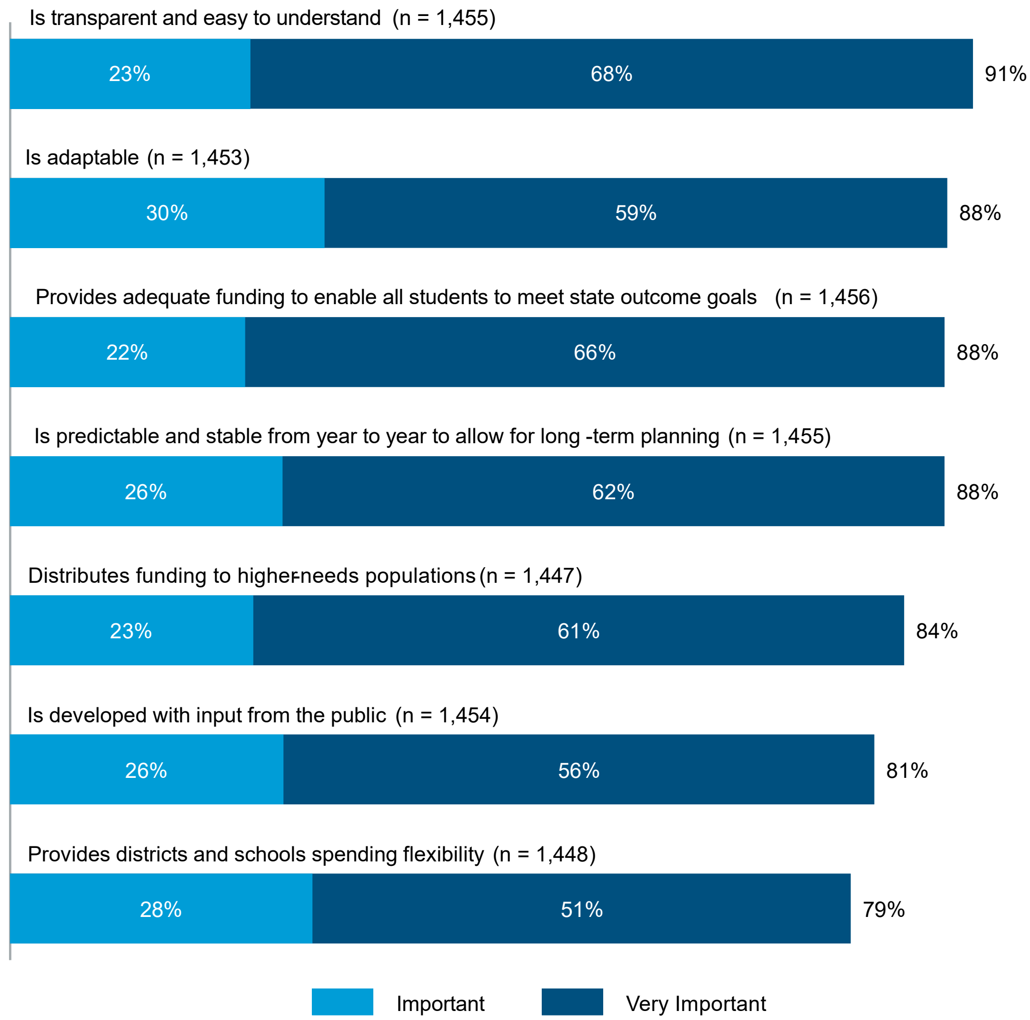
- allows for *flexibility* in resource use such that resources can be used to address specific circumstances and conditions unique to a given school or district; and
- is *adaptable*, such that funding amounts are related to measured cost differences in providing adequate programming across educational contexts and change from year to year as changes occur in the funds required to support adequate programming.

In addition to having these properties, we asked Coloradans to consider the extent to which the state's public school funding system should:

- be *informed by and responsive to public sentiment*.

Exhibit 7 shows survey respondents' perspectives on how important these properties of school funding formulas are for Colorado's school finance system. The five properties with the highest percentages of survey respondents were: transparency (91%), adequacy (88%), adaptability (88%), predictability (88%), and equity (85%).

Exhibit 7. Percentage of Survey Respondents Who Believe It to Be Important or Very Important That Colorado's Public School Funding Formula Has Specific Characteristics.



We analyzed survey findings to determine the extent to which variation existed across respondent groups and highlight findings that are meaningful and statistically significant (additional details are provided in Appendix A).

When considering the respondent role, we found that educators were more likely than noneducators to identify *providing adequate funding* to all students (90% versus 86%), *distributing funding equitably* (89% versus 80%), and *being adaptable* as important goals of a funding formula (90% versus 86%).

There were some differences by region as well.

- Lower percentages of respondents who had lived in the Metro Area region in the past 10 years than respondents from other regions identified *equitably distributing funding* (81%

versus 87%) and *being transparent* (88% versus 93%) as important goals of the fundings formula.

- Respondents who had lived in the Northeast region in the past 10 years were also less likely to report that transparency is an important goal compared to all others (77% versus 91%).
- Higher percentages of respondents who had lived in the Metro Area region and the Southwest region in the past 10 years than all others reported that district *spending flexibility* is an important goal for the funding formula, respectively at 83% versus 74% and 91% versus 79%.

Townhall attendees also shared their views on the importance of the various properties of funding formulas, and how their experience informs their thinking.

Adequate*. I think it goes back to the fact that individual districts have to go to their taxpayers and keep asking for more and more and more, and some can do that, and some cannot. But if it [the funding] was adequate, I don't think we'd continuingly have to ask taxpayers for more money.*

—Statewide Townhall Attendee

Equitable. *We're seeing a huge rate of increase in need for specialized assistance and support and education, and that costs money. [It] is important and absolutely necessary to get funding into places that otherwise don't have that access.*

—Metro Area Region Townhall Attendee

Transparent*. There is just a lot of misunderstandings from the public about how schools are funded. … When we keep having to go back to the taxpayers to get certain things to fund the school … it's set up for some sort of distrusting relationship between our community members and us as the district. Because it's like, 'Well, hey, wait! Don't you get money from the State?'*

—Statewide Townhall Attendee

Predictable. *I don't think that we should build school funding on the back of grants. … It always is short term. Our district doesn't go for many grants because we know that you can't build programs on them unless you have a sustainable way to keep that funding going.*

—Northwest Region Townhall Attendee

Flexible. *The Structural Funds probably came through a tax on marijuana. And there are funds from that … that school districts can use. {But only] how the State tells you to use it, even if that's not what you need.*

—Statewide Townhall Attendee

Adaptable*. The district and the schools should decide. Are those teachers? Are those counselors? Are those after school programs? We should have the flexibility to decide what is the next person we need. … What my school needs is different than like what the school down the street needs, which is different from what somebody in Durango needs.*

—Statewide Townhall Attendee

Chapter Conclusion

Colorado's school funding formula is a foundation formula consisting of a base per-pupil funding amount that applies to all students and additional funding weights that provide additional funding based on student needs and other district characteristics. Colorado is at a transition point, as it recently passed a new funding formula that updated the weights and added several new weighting factors. Compared to the old formula, the new formula simplifies several of the calculations (such as the at-risk factor), allocates more funding on the basis of student need, and reduces the influence of the cost-of-living factor. When asked about the factors they feel are important in a funding formula, Coloradans indicated that transparency, adequacy, predictability, and adaptability were the most important.

3. Equity of the Distribution of Education Funding

In most states, a majority of funding is distributed to public schools according to a statewide formula. The details of these formulas vary widely from state to state, but they are designed, in theory, to accomplish two goals:

1. Account for differences in the costs of achieving equal educational opportunities across schools and districts based on the students that they serve (e.g., some schools and districts serve larger shares of students from low-income families).
2. Account for differences in fiscal capacity, or the ability of local jurisdictions to pay for the costs of education (e.g., their ability to raise local revenue, mostly via property taxes).

Districts and schools differ with respect to the populations they serve, which means programming and services must adjust to meet all students' needs. In addition, districts can vary widely in terms of wealth, which means that districts differ in their capacity to raise revenues through property taxes. These two factors are often linked. That is, districts with lower local taxable wealth often have higher concentrations of student poverty in their schools. Districts with the highest need for additional resources may also have the least means to raise additional resources locally.

In recent years, researchers and prominent educational organizations have adopted a common understanding that state school finance systems should provide not merely the same but substantially more resources per pupil to districts serving greater shares of students in poverty (Baker & Green, 2008; Baker & Levin, 2014).[14] This conception of equity can be operationalized by defining school funding systems that systematically provide more resources (i.e., funding) to districts and schools with higher student poverty rates as being relatively "progressive" and those that provide fewer resources to districts with higher student poverty rates to be relatively "regressive."[15] Given the mounting evidence that money matters for educational outcomes, and particularly so for students from low-income families (Baker, 2016; Jackson, 2018; Jackson et al., 2016; Johnson & Tanner, 2018; Lafortune et al., 2018), maintaining a progressive distribution of resources is an important step toward ensuring that students have access to equal educational opportunities.

Although equity for students is of the utmost importance when evaluating school finance systems, equity to taxpayers should also be considered (Berne & Stiefel, 1979). In systems such

---

[14] These educational organizations include The Education Trust, the Urban Institute, and the School Finance Indicators Database.

[15] This report often refers generally to student poverty and in various analyses makes use of measures meant to serve as a proxy for poverty. Colorado's measure of "at-risk" is defined as students who are eligible for free- or reduced-price meals.

as Colorado's, where local revenue is primarily determined through local property taxes, high wealth districts can often raise greater amounts of revenue through lower tax rates. A school funding system that appropriately accounts for differences in fiscal capacity should allow a district with lower fiscal capacity (i.e., less property valuation per student) to raise a similar overall amount of revenue at a similar tax rate as districts with higher fiscal capacity. In other words, state revenue should be distributed in such a way that districts with lower property wealth should not have to tax themselves at higher rates to achieve similar levels of overall funding.

In this section of the report, we examine the existing distribution of education spending in Colorado with respect to student needs to evaluate the progressiveness of the current system of funding. We also look at the variation in tax rates and property valuation across districts to better understand issues of tax equity in the state.

Evaluating Equity of School Funding

Our approach to evaluating the equity of financial inputs consists of regression modeling of inputs with respect to the factors that should explain variation in costs and student need. This type of model shows whether levels of education spending or revenues are associated with determinants of costs and need. Although student poverty often is a proxy for student need, the standard model of student need has evolved across time to include multiple factors: (a) the share of students from families in poverty, (b) the share of SWDs, (c) the share of ELLs, (d) the distribution of students by grade range, (e) the size of the district or school, (f) population density, and (g) geographic differences in the price of resources.

Of primary interest is whether and to what extent schools and districts serving student populations needing higher levels of educational investment to provide equal opportunities have access to more funding (or spend more per student) to support those needs, after controlling for the other factors that influence costs. In other words, is the system progressive with respect to student poverty and other student characteristics indicative of greater need?

Equity in Colorado

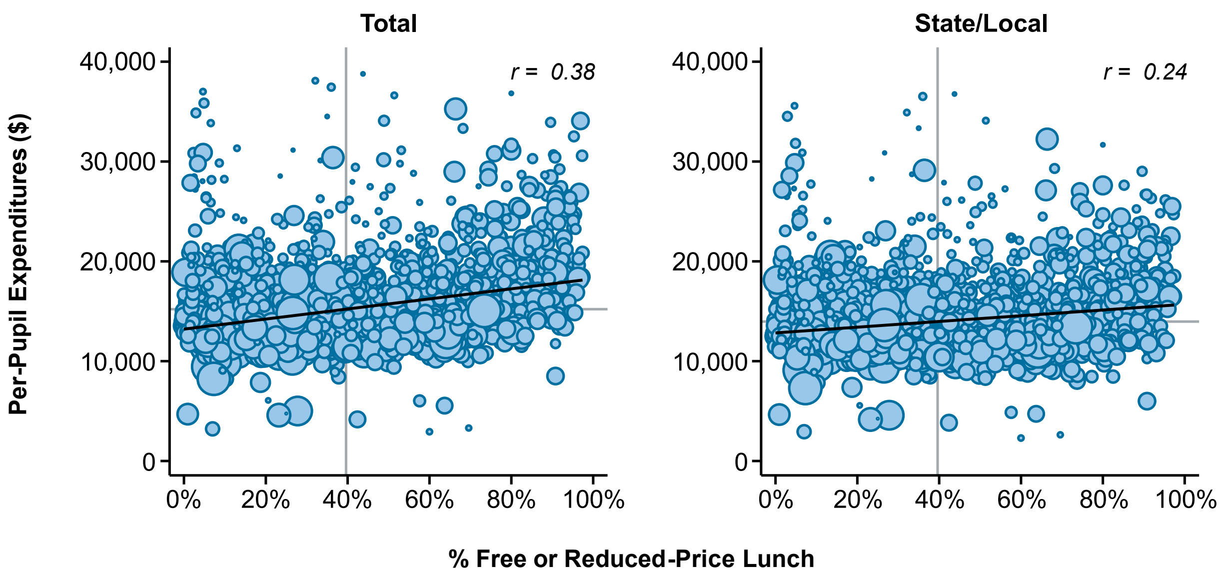
Student Equity

This section explores the relationship between student needs and school expenditures to examine whether Colorado's current education funding system distributes funding in a way that provides more resources to schools and districts serving students with higher needs. By analyzing various factors such as student demographics, school size, and regional indicators, we can better understand the disparities in education funding and their impact on equity. This detailed examination provides a clearer picture of how resources are distributed and where adjustments may be necessary to ensure all students receive fair support.

Simple Correlational Analyses of Spending and Student Needs

We begin our exploration of student equity in Colorado by examining the relationship between school spending and student economic disadvantage, which is most commonly measured in Colorado using FRL eligibility. Exhibit 8 presents two scatterplots showing per-pupil expenditures from all sources and from state/local sources only. Both plots compare these expenditures to the percentage of students eligible for FRL during the 2022–23 school year. Each dot represents a single school, with its size proportional to total enrollment. The black line represents the line of best fit, and the correlation coefficient (*r*) is displayed in the top-right corner of each plot. Additionally, light gray horizontal and vertical lines indicate the mean per-pupil expenditures and the mean percentage of FRL students, respectively.

Exhibit 8. Relationship Between Current Per-Pupil Spending and Percentage of Students Eligible for Free or Reduced-Price Lunch (2022–23)



Note. Each dot in the scatters represents a school. The size of the dots is weighted by enrollment. The horizontal gray lines show the overall average per-pupil expenditure, and the vertical gray lines show the overall average percentage of students who are eligible for FRL. The black sloped line is the line of best fit. The correlation coefficient is denoted by *r*. Schools with per-pupil total or state/local expenditures exceeding $40,000 were excluded from these scatterplots. A version without omitted observations can be found in Appendix C.

These graphs show that, on average, both total and state/local per-pupil expenditures increase slightly across schools as the FRL percentage increases. For instance, a typical school with 40% FRL students spends a total of approximately $12,500 per student while a typical school with 60% FRL students spends around $13,000 per pupil. The increase in state/local expenditures is even smaller, with an average increase of around $1,000 between 0% and 100% FRL enrollment. The weaker relationship between spending and FRL percentage indicates that at least some of the positive relationship between spending and FRL when using all spending sources is the result of a progressive distribution of federal funding with respect to FRL percentage.

The correlation table below shows the relationships between per-pupil expenditures and a broader range of student needs variables as well as the relationships among student needs. The results indicate moderately strong relationships between per-pupil expenditures (both total and state/local) and the percentage of ELLs and immigrants (Exhibit 9). We also observe a positive but somewhat weaker relationship between per-pupil expenditures and SWDs.

With respect to the relationships among student needs, there are moderately strong positive relationships between FRL percentage and other high-needs groups, including ELLs, students experiencing homelessness, and SWDs. This suggests that these high needs student groups are often concentrated in the same schools, which also receive slightly more funding. This makes it difficult to know which factors are driving increased spending in schools. For example, because high FRL schools also tend to have higher percentages of SWDs and ELLs, it may be funding distributed on the basis of SWDs and ELLs that is driving the higher spending in high FRL schools rather than funding distributed on the basis of FRL directly. Notably, a school's percentage of gifted students is negatively correlated with other student-need variables, particularly FRL, SWDs, and ELLs, indicating that schools with higher percentages of gifted students tend to have lower percentages of students in these categories.

Exhibit 9. Correlation Table Between Per-Pupil Expenditures and Student Needs Variables (2022–23)

	Total PPE	State/Local PPE	FRL %	SWD %	ELL %	Homeless %	Gifted %	Immigrant %
Total PPE	1.00							
State/Local PPE	0.95	1.00						
FRL %	0.37	0.20	1.00					
SWD %	0.21	0.15	0.45	1.00				
ELL %	0.45	0.35	0.71	0.25	1.00			
Homeless %	0.16	0.10	0.48	0.30	0.30	1.00		
Gifted %	-0.11	-0.02	-0.40	-0.35	-0.31	-0.19	1.00	
Immigrant %	0.32	0.26	0.42	0.07	0.63	0.18	-0.16	1.00

Note. FRL = free or reduced-price lunch eligible; SWD = students with disabilities; ELL = English language learner. Correlations weighted by total school enrollment.

Regression Analysis Examining Student Equity

For more rigorous analysis of equity of school expenditures in Colorado, we must consider that multiple factors affect educational costs and resulting spending simultaneously. Here, we provide the results of regression analyses that include student demographics (student FRL eligibility, SWDs, and ELL status), school grade-level enrollment, a measure of geographic differences in labor costs, total school enrollment, and urbanicity. These regression models allow us to isolate the individual relationship that school characteristics might have with expenditures.

Exhibit 10 provides four regression models that differ according to the expenditure variable used (total expenditures versus state/local expenditures) and the period included [the 2 most recent years (2021–22 to 2022–23) versus the past 6 years (2017–18 to 2022–23)]. The differing time periods in these models enable us to compare longer term trends with more recent developments in education spending. The coefficients shown in the models are relative to 1 and can be interpreted as a multiplier of the constant term. Essentially, they describe the change in per-pupil expenditures associated with a 100-percentage point change in student needs indicators.

The regression analyses (shown in Exhibit 10) indicate that schools with higher FRL rates do not have substantially higher spending per student once other student need factors and school characteristics are accounted for. In Model 1, which is based on the two most recent school years, the coefficient for the FRL proportion is 1.050 and is not statistically significant indicating that otherwise similar schools with different levels of economic disadvantage spend approximately the same amount, on average. Including all years since 2017–18 (Model 2), the FRL coefficient is 0.95 and statistically significant, meaning that schools with higher FRL rates actually spent less than those with lower FRL rates over the prior 6 years, holding other variables constant. When considering only spending from state and local sources, which would be subject to the state funding formula, there is a statistically significant and negative relationship between the percentage of FRL students and expenditures across both the entire time period and the most recent 2 years. In the most recent 2 school years of data availability, schools with 100% FRL students were estimated to spend around 8.4% less than otherwise similar schools with 0% FRL students.

Despite the lack of money, we have performing schools. … We do career tech ed programs very well, [with] vocational programs throughout our entire district. And we rob Peter to pay Paul so that we can make sure that our really rural districts, our really rural schools, get the same sort of opportunities that some of our bigger schools get.

—Pikes Peak Townhall Attendee

Exhibit 10. Regression Results Examining Spending Equity

	Model 1 Total per-pupil expenditures (last two years)	Model 2 Total per-pupil expenditures (all years)	Model 3 State/Local per-pupil expenditures (last two years)	Model 4 State/Local per-pupil expenditures (all years)
Student needs				
FRL proportion	1.050	0.947*	0.916*	0.861*
SWD proportion	1.133	1.932*	1.343	1.961*
ELL proportion	1.560*	1.535*	1.597*	1.527*
Proportions of enrollment by grade				
Grades K to 5	0.930*	0.902*	0.922*	0.893*
Grades 6 to 8	0.966	0.948*	0.964*	0.945*
CWIFT geographic cost index	1.910*	1.735*	2.146*	1.911*
School and district size (scale)				
School < 200	1.586*	1.551*	1.551*	1.523*
School 200 to < 400	1.181*	1.212*	1.164*	1.198*
School 400 to < 800	1.100*	1.100*	1.089*	1.099*
District < 2,000	1.090*	1.087*	1.099*	1.100*
Locale				
Suburb	0.939*	0.932*	0.943*	0.937*
Town	0.937*	0.923*	0.931*	0.925*
Rural	0.919*	0.921*	0.918*	0.925*
Constant	11,072.9*	10,279.9*	9,247.6*	8,892.2*
Number of school *X* year observations	3,353	9,990	3,353	9,990
Number of unique schools	1,703	1,770	1,703	1,770
Pseudo R^2	0.355	0.276	0.293	0.239

Note. All years = 2017–18 to 2022–23 school years. Last two years = 2021–22 to 2022–23 school years. FRL = free or reduced-price lunch eligible; SWD = students with disabilities; ELL = English language learner; CWIFT = Comparable Wage Index for Teachers. * $p < .05$.

By contrast, the regression analysis reveals that one of the biggest drivers of increased school spending per student is the percentage of ELLs. The coefficient for ELLs for Model 1 is 1.56, indicating that a school with 100% EL students is predicted to spend around 56% more per pupil in the 2021–22 and 2022–23 school years compared to an otherwise similar school with 0% EL students. This relative increase in funding with respect to ELLs noted by the ELL coefficient is consistent across all models, suggesting that Colorado's funding model between 2017–18 and 2022–23 favors ELLs even when excluding federal funding. A similar but slightly lower effect is observed for SWDs. All models show a coefficient above 1, indicating higher spending for schools with more SWDs, but the coefficients have notably decreased in recent years. For instance, schools with high proportions of SWDs spent nearly double (1.9 times) per-pupil compared to schools with low proportions in all years of data (Model 2) but only around 10% more between the 2021–22 and 2022–23 school years (Model 1). When we examine only expenditures from state and local funding sources, the relationships for SWDs are slightly stronger, suggesting that patterns of state and local funding with respect to SWDs are just as strong if not stronger than distributions of federal funding on the basis of SWDs.

A school's grade levels are additionally related to how much schools spend per student. The models indicate that, on average, elementary and middle schools spend about 5% to 10% less per student than high schools, both in total and through state/local expenditures.

Our regression models also show a clear negative relationship between a school's size and per-pupil expenditures. The largest enrollment category (schools with more than 800 students) was omitted and used as the reference level. In all models, the coefficient decreases as total enrollment increases, indicating that spending per student is higher in smaller schools. For example, Model 3 indicates that schools with fewer than 200 students spend 55% more per student than schools with more than 800 students. Our models also show a similar trend that smaller districts (those with fewer than 2,000 students) spend more per pupil than larger districts.

Lastly, our models show the relationship between spending and two factors representing the geographic contexts in which schools operate. First, we included a school's locale to gauge whether urbanicity independently affects spending. The indicator for urban schools was omitted and used as the reference level. In all models, a trend emerges that school expenditures per student are slightly higher in denser areas designated as cities compared to other locales. Rural schools spend around 8% less than urban schools, while suburban schools spend around 6% less. Second, the coefficient for the CWIFT, which represents differences in labor costs across geographic areas, indicates that spending per student is significantly higher in areas that require higher compensation to attract and retain teachers. This effect has increased in magnitude during the past 2 years compared to the past 6 years. Schools in areas with the highest labor costs spent around 20% more in the most recent years compared to schools with the lowest labor costs.[16]

To help with the interpretation of the student needs coefficients, we translate the regression model results using all years of data (Models 2 and 4, respectively) into average predicted spending amounts at the 10th and 90th percentiles of each student-need variable, holding all other covariates constant at their observed levels. Exhibit 11 shows that a school with 39.3% ELLs (the 90th percentile) is expected to spend around $2,500 more per pupil in total and $2,300 more in state/local funds than a school with 0.8% (the 10th percentile). Similarly, schools in the 90th percentile for SWD percentage spend slightly more in total and in state/local funds than those in the 10th percentile. As in regression Models 2 and 4, we observe that schools with higher rates of FRL are expected to spend less, holding all other factors constant. While schools in the high and low percentiles of FRL students exhibit similar total spending per student, schools in the 90th percentile of FRL percentage spend around $1,100 less per pupil from state and local sources than schools in the 10th percentile.

Exhibit 11. Total and State/Local Expenditures at Demographic Extremes

Student need variable	Percentile	Level of student-need variable at percentile	Model 2 Total per-pupil expenditures		Model 4 State/local per-pupil expenditures	
			Average per-pupil expenditures	Difference in per-pupil expenditures	Average per-pupil expenditures	Difference in per-pupil expenditures
FRL-eligible	10th	8.0%	$15,230	-$19 (-0.1%)	$14,484	-$1,142 (-7.9%)
	90th	84.2%	$15,211		$13,342	
ELLs	10th	0.8%	$14,385	$2,528 (+17.6%)	$13,226	$2,318 (+17.5%)
	90th	39.3%	$16,913		$15,544	
SWDs	10th	7.2%	$15,085	$376 (+2.5%)	$13,790	$512 (+3.7%)
	90th	19.5%	$15,461		$14,302	

Note. FRL = free or reduced-price lunch eligible; SWD = students with disabilities; ELL = English language learner. The difference in per-pupil spending is expressed as a percentage in parentheses.

[16] CWIFT values in Colorado have a range of 0.26, so the regression coefficient, which estimates the change in spending for a 100% change in variables, must be altered. To do so, we raise the coefficient to the power of 0.26, which adjusts the coefficient to account for the smaller variable range. For example, Model 3's CWIFT coefficient estimates that a 100% change in CWIFT would result in 2.146 higher spending. Because such a change is impossible, we can adjust the coefficient so that a 26% change in CWIFT would result in $2.146^{0.26} = 1.220$ times the (22% more) state/local expenditures.

Equity of Teachers for Students

The most expensive and most impactful educational resources are teachers. To examine equity in the distribution of teachers across schools, we use a regression model that accounts for the independent effects of student needs variables, schooling level, school enrollment, and locale on three teacher variables: average teacher salary (average number of students per FTE teacher), student-to-teacher ratio, and average teacher experience at a school. We have condensed this regression into a table that shows the average predicted values of the main outcome variables at the 10th and 90th percentiles of key student-need variables (for the full regression table, see Appendix C).

> *School funding has definitely been an issue in Douglas County, and there's a lot of issues around equity, around special education, gifted education … English language development. All those things suffer, and it creates this scarcity mindset that if we are putting money towards a certain group of students, then other students are losing out. And it's really, really harmful to the social and communal aspects of public education. And it really complicates and further divides and polarizes the community.*
>
> *–Metro Area Townhall Attendee*

Exhibit 12 illustrates several key disparities in teacher salaries, staffing levels, and experience across student demographic extremes. On average, teachers at schools in the 90th percentile of FRL students earn about $9,500 (or 13%) less than those at schools in the 10th percentile. Conversely, schools with a higher percentage of SWDs pay their teachers approximately 16% more than schools with fewer SWDs. Additionally, teachers at schools with high populations of ELLs and SWDs benefit from smaller student-to-teacher ratios—10% and 14% smaller, respectively—compared to schools with lower populations of these students. However, teachers at high FRL schools face about 9% more students in their classrooms than those at low FRL schools. Our model also indicates that schools with high FRL and ELL populations tend to have teachers with around 9% less experience, whereas schools with high SWD populations have teachers with approximately 14% more experience compared to schools with lower respective populations.

Exhibit 12. Teacher Salaries and Classroom Conditions at Demographic Extremes

Student need variable	Percentile	Level of student-need variable at percentile	Model 1 Average teacher salary		Model 2 Average student to teacher ratio		Model 3 Average teacher experience	
			Average teacher salary	Difference in average teacher salary	Average student to teacher ratio	Difference in average student to teacher ratio	Average teacher experience	Difference in average teacher experience
FRL-eligible	10th	8.0%	$73,127	-$9,481 (-13.0%)	17.25	1.52 (+8.8%)	10.67	-1.82 (+8.8%)
	90th	84.2%	$63,646		18.77		8.85	
ELLs	10th	0.8%	$68,660	$1,360 (+2.0%)	18.40	-1.76 (-9.6%)	10.29	-1.22 (-9.6%)
	90th	39.3%	$70,020		16.64		9.06	
SWDs	10th	7.2%	$65,631	$10,450 (+15.9%)	18.76	-2.65 (-14.1%)	9.49	1.28 (-14.1%)
	90th	19.5%	$76,081		16.12		10.77	

Note. FRL = free or reduced-price lunch eligible; SWD = students with disabilities; ELL = English language learner. The differences in teacher variables are expressed in parentheses.

Taxpayer Equity and Wealth Neutrality

In addition to providing equitable resources to students, an effective education funding system should account for differences in the ability/capacity of districts to raise revenue locally. Failing to appropriately account for differences in local capacity can lead to inequities to students and/or to taxpayers. In other words, districts with less capacity will either have fewer educational resources or will have to tax themselves at disproportionately higher rates to provide similar resources as districts with greater capacity. In this section, we investigate the relationships between district-level property taxes (known as mill levies), property wealth (measured by assessed valuation), and education spending. By examining these relationships, we aim to understand the extent to which Colorado's education funding system successfully accounts for local capacity in its formula.

Tax Rates and Property Valuation

We begin our analysis of taxpayer equity by illustrating the inverse relationship between a district's assessed valuation per student and two mill levy tax rates: the total program mill levy and the overall mill levy. The total program mill levy contributes to a district's share of formula funding and constitutes the bulk of a district's local share under the funding formula. In contrast, the overall mill levy includes the total program mill levy as well as other mill levies that raise local revenue for education, including the voter approved override. Assessed valuation per student is a measure of local property wealth on a per-student basis.

Mathematically, if two districts have equivalent tax rates, the districts with higher valuation per pupil will be able to raise more revenue from local sources given that local revenue from property taxes is simply the property tax rate multiplied by the assessed valuation.

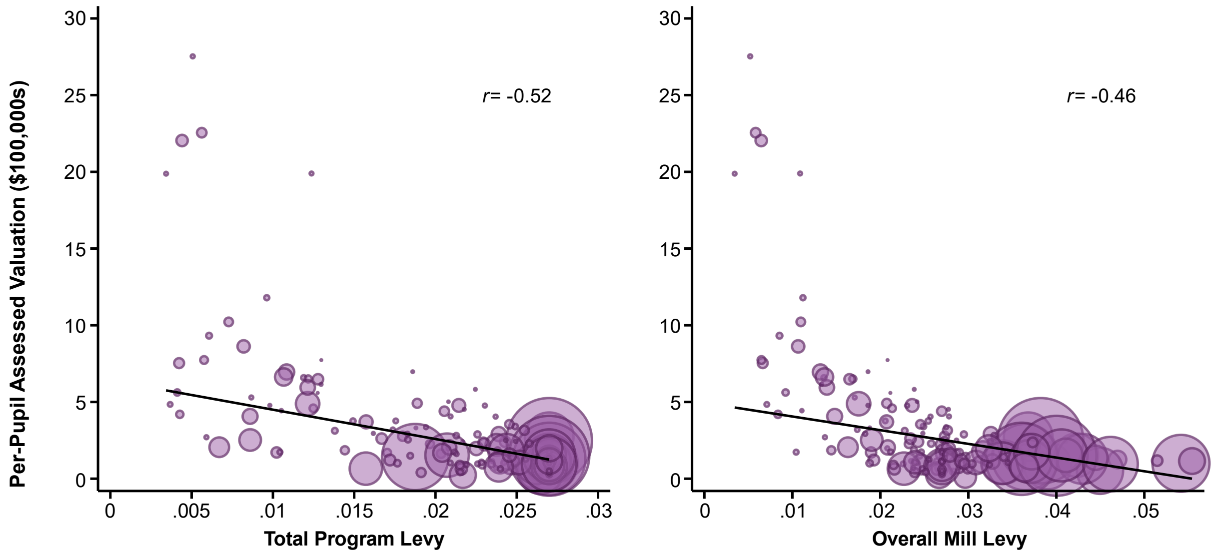
Exhibit 13 shows that, on average, districts with the highest valuations per student tend to have the lowest tax rates. Districts with valuations per student of at least $500,000 per pupil have a total program mill levy of around 0.005, on average. In contrast, districts with the lowest assessed valuations have a program mill levy of approximately 0.025. In other words, the districts with the lowest property wealth per student tend to have tax rates that are five times greater than districts with the highest wealth per student.

Overall mill levies, which include voter approved overrides, show a similar pattern. This seemingly regressive tax structure, where wealthier districts pay lower tax rates than poorer districts, is indicative of tax inequity. Furthermore, it is not simply a matter of taxpayers electing to pay higher tax rates due to local preferences for better education. The total program mill levy is the rate that is required of districts to satisfy their local obligations. Lower wealth districts must pay higher tax rates, on average, simply to satisfy their local obligations. This also means that the state is subsidizing the low tax rates of many wealthy districts with state revenue, given that the state makes up the difference between the local share and the foundation formula funding amount.

I think a lot about the local share of the funding versus the State share. And that's a whole conversation about tax policy. However, I do think the amount of burden that we have on the local share should be decreased or should be examined, and that state share should be increased.

–Statewide Townhall Attendee

Exhibit 13. Relationship Between Per-Pupil District Tax Assessed Valuation and Mill Levy Tax Rates

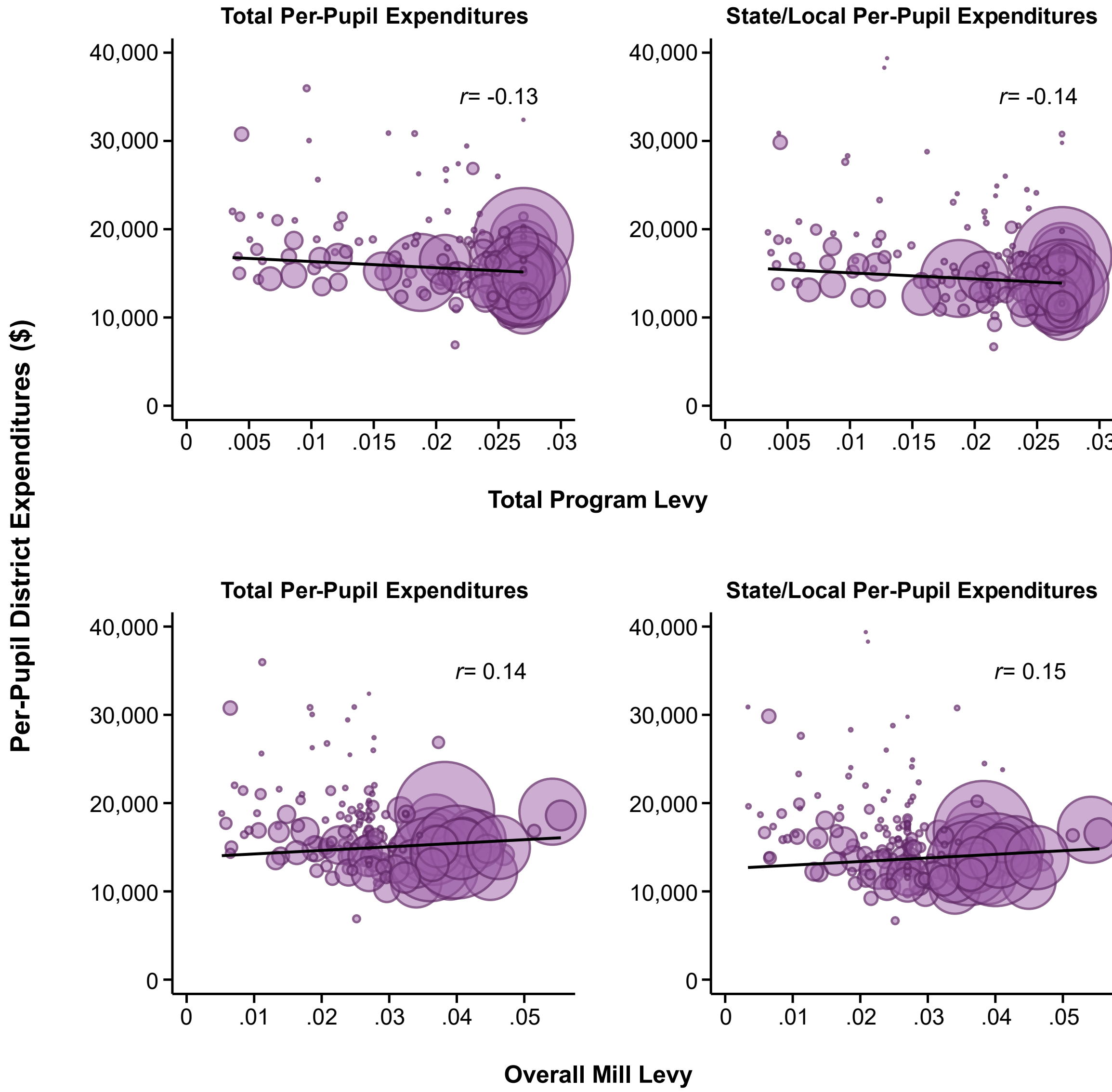


Note. Each dot in the scatterplot represents a district. The size of the dots is weighted by district enrolment. The black line is the line of best fit. The correlation coefficient is denoted by *r*. One district with a per-pupil assessed valuation was excluded from these scatterplots for simplicity.

Tax Rates and Education Spending

Below, we show the relationship between a district's mill levy tax rates and per-pupil expenditures (Exhibit 14). There is little variation in either total or state/local per-pupil expenditures according to the tax rate of districts. This can likely be explained, in part, by the inverse relationship between assessed valuation and mill levy mentioned above. Wealthier districts can raise more revenue at lower tax rates, meaning that their lower tax rate does not result in less spending. Conversely, this also means that districts with disproportionately higher tax rates are not able to achieve higher spending, on average. This again points to the conclusion that districts with higher tax rates are not raising higher tax rates due to their preferences to spend more. Instead, districts with higher tax rates are simply achieving parity, which is inequitable to taxpayers in those districts with high tax rates and relatively low education spending.

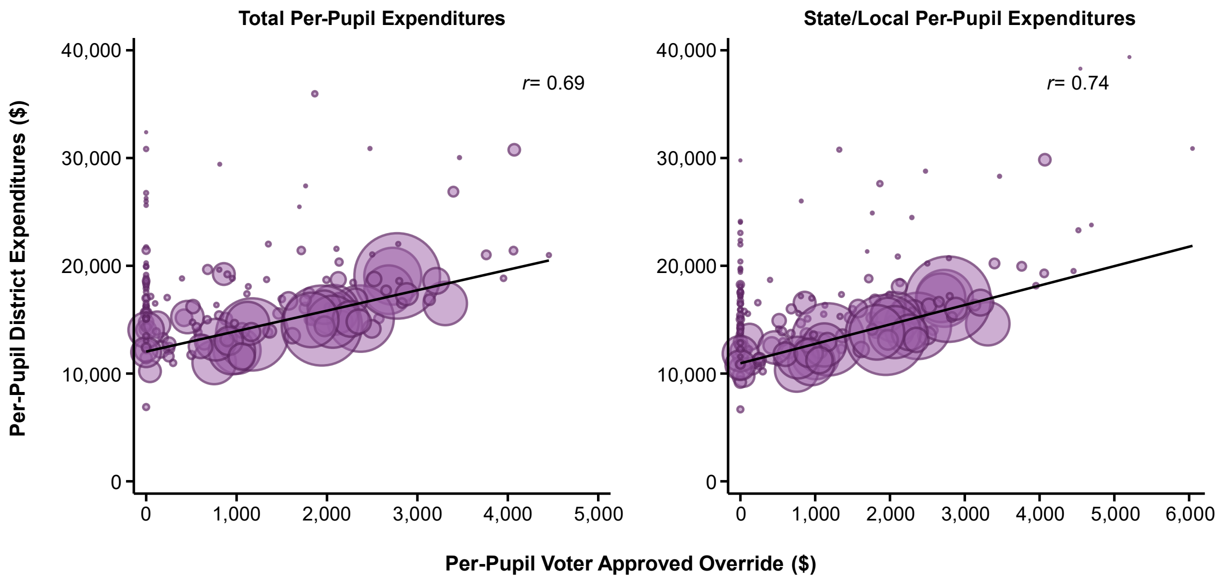
Exhibit 14. Relationship Between Total and State/Local Per-Pupil Expenditures and Mill Levy Tax Rates



Note. Each dot in the scatterplot represents a district. The size of the dots is weighted by district enrolment. The black line is the line of best fit. The correlation coefficient is denoted by *r*. Districts with per-pupil expenditures exceeding $40,000 were omitted from this analysis. A version without omitted observations can be found in Appendix C.

Although there is little relationship between tax rates and spending, there is a strong and positive relationship between the amount of the voter-approved override on a per-pupil basis and overall spending on a per-pupil basis (Exhibit 15). Districts that are able to pass voter-approved overrides spend more per pupil.

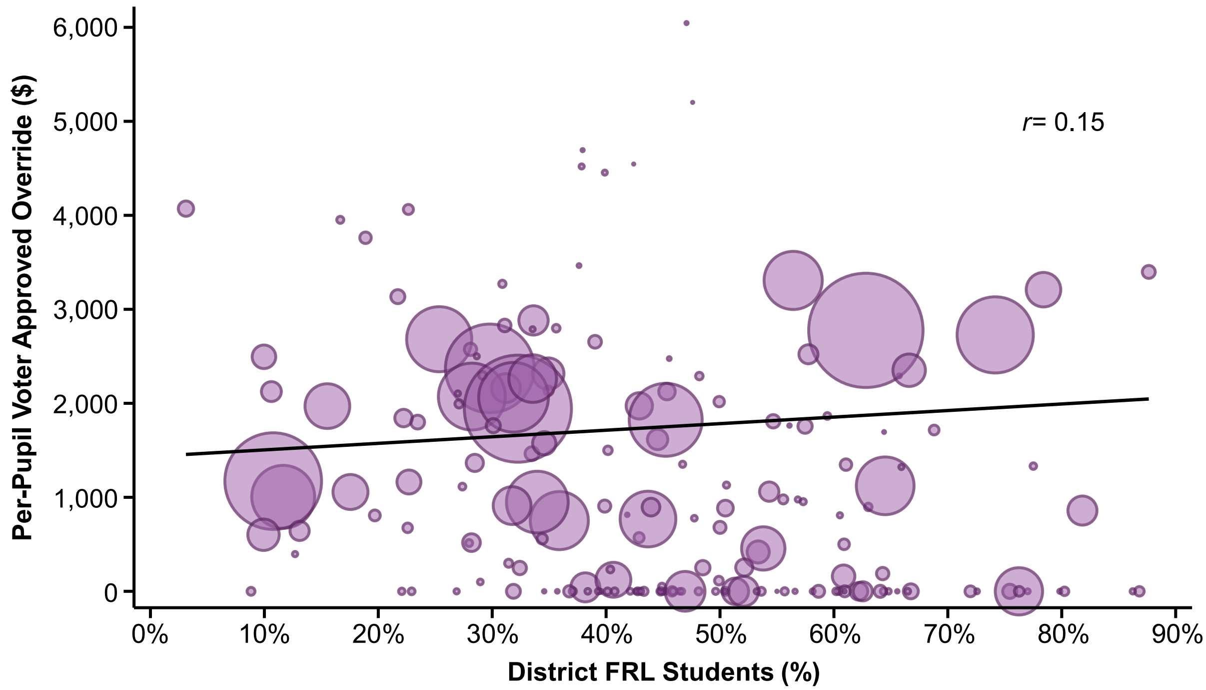
Exhibit 15. Relationship Between Per-Pupil District Expenditures and Per-Pupil Voter Approved Override



Note. Each dot in the scatterplot represents a district. The size of the dots is weighted by district enrolment. The black line is the line of best fit. The correlation coefficient is denoted by *r*. Districts with per-pupil expenditures exceeding $40,000 were omitted from this analysis. A version without omitted observations can be found in Appendix C.

Voter-approved overrides could result in inequity if districts with lower student needs are more likely to pass voter-approved overrides. In Exhibit 16, we examine whether there is a relationship between the amount of the voter-approved overrides per pupil and the percentage of students in the district who are FRL eligible. There is no clear pattern, with higher-FRL districts having similar voter approved overrides on a per-pupil basis.

Exhibit 16. Relationship Between Percentage of Students Eligible for Free or Reduced-Price Lunch in a District and District Override

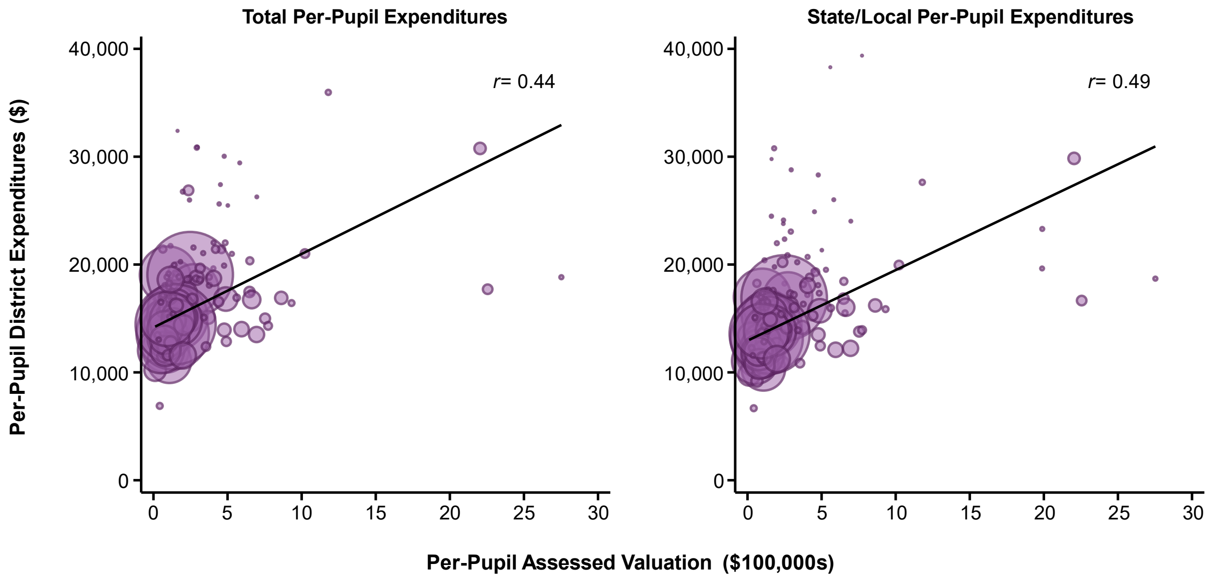


Note. Each dot in the scatterplot represents a district. The size of the dots is weighted by district enrolment. The black line is the line of best fit. The correlation coefficient is denoted by *r*.

Property Valuation and Education Spending

Lastly, we examine the relationship between per-pupil assessed valuations and a district's per-pupil expenditures (Exhibit 17). There is a positive correlation between these two variables, indicating that high-wealth districts spend more per pupil than low-wealth districts, as defined by the assessed valuation per pupil of districts. For instance, a district with an assessed valuation of $2,000,000 spends around $30,000 per pupil whereas a district with a valuation of $100,000 spends around $15,000. A clear pattern of higher spending in high-wealth districts suggests that Colorado's system is not "wealth neutral." In other words, the amount of resources that districts have is related to the wealth of the area where students live, which is unfair to students in lower-wealth areas.

Exhibit 17. Relationship Between Per-Pupil District Expenditures and Per-Pupil Tax Assessed Valuations



Note. Each dot in the scatterplot represents a district. The size of the dots is weighted by district enrolment. The black line is the line of best fit. The correlation coefficient is denoted by *r*. Districts with per-pupil expenditures exceeding $40,000 were omitted from this analysis.

Coloradans' Perspectives on Funding Equity

> *I feel that the districts that can pay more get not only the better educators but [also] get all of the better equipment. Their students have all the iPads and we have pieces of crap computers that barely stay together. And so, again, that equity piece.*
>
> *—Pikes Peak Region Townhall Attendee*

To assess Coloradans perspectives on equity, we asked them for their views on the equitable distribution of funds and the extent to which they see their current school funding system as equitable. Coloradans who responded to our survey and attended townhalls shared their views on the importance of having an equitable public school funding formula. As presented earlier, more than four out of five survey respondents (84%) indicated that distributing more funding to higher needs populations is an important feature of a school funding formula (see Exhibit 7). It was also the case that a large majority of respondents (78 to 85%) indicated that current levels of funding are insufficient to meet the needs of multiple student groups (see Exhibit 18).

CDE Definitions of Identified Student Groups

At-risk/low-income students. Students who are likely to have below-average academic outcomes due to poverty or socioeconomic disadvantage.[1]

Gifted and talented students. Children and youth who are between the ages of 4 and 21 and have exceptional abilities, talents, or potential in one or more areas.

English language learners (ELLs). Children and youth who are in an out-of-home placement and receiving educational services. This includes children who are in foster care and receiving services through a state-licensed day treatment facility.

Students with disabilities (SWDs). Children and youth between the ages of 3 and 21 who need additional support in public schools to receive a reasonable benefit from regular education. There are 14 disability categories.[1]

Students in foster care. Children or youth who are in an out-of-home placement and receiving educational services. This includes children who are in foster care and receiving services through a state-licensed day treatment facility.

Newcomer students. K–12 students who were born outside the United States and have arrived in the country in the past 3 years. Some newcomers may have come voluntarily while others may have been forced to leave their home countries.

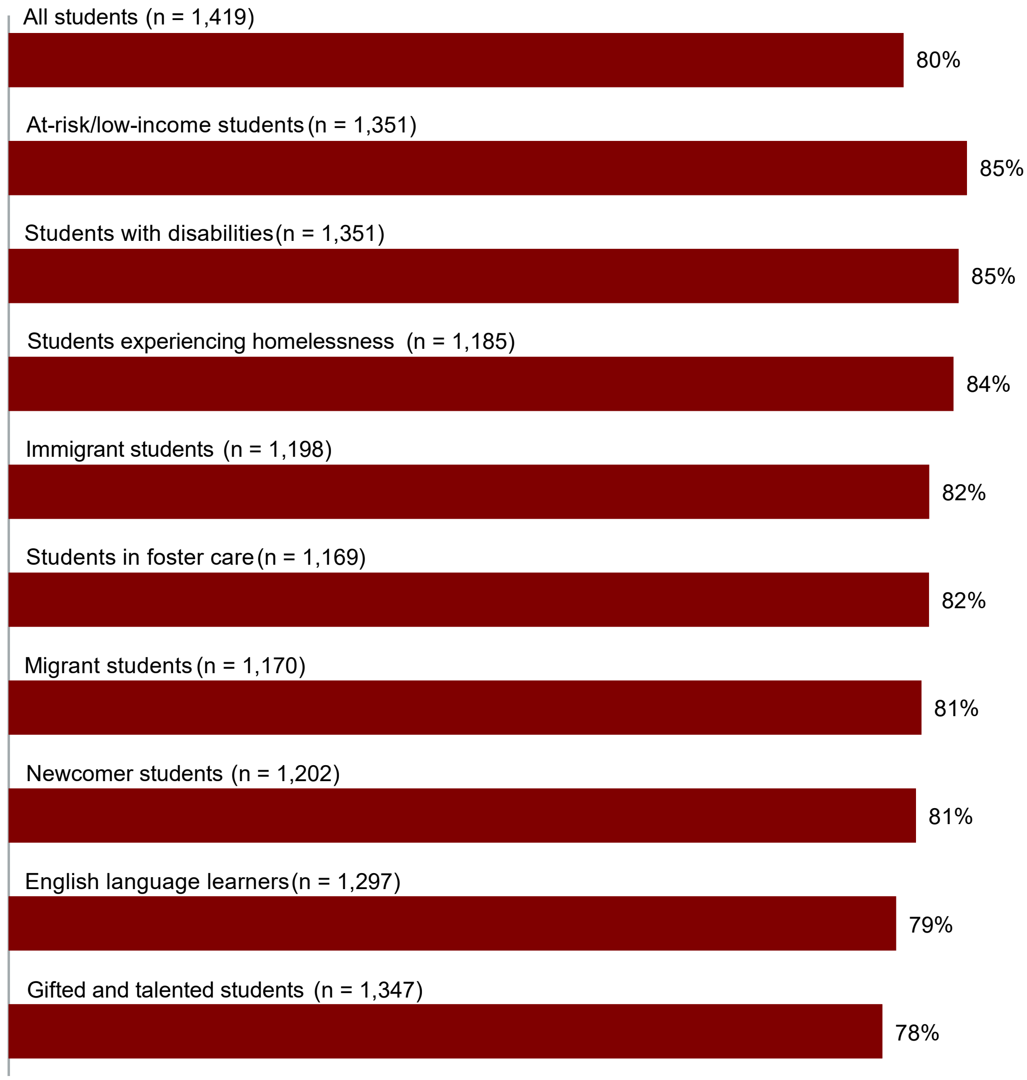
Immigrant children and youth. Children and youth who were not born in the United States or any U.S. territory and have not attended U.S. schools for more than 3 full academic years.

Students experiencing homelessness. Children or youth who lack a fixed, regular, and adequate nighttime residence. This includes those who are living in cars, parks, public spaces, abandoned buildings, substandard housing, bus or train stations, or similar settings.

Migrant students. Children and youth who have moved across state or school district lines within the past 3 years with a migrant parent or guardian who works in agriculture, fishing, or dairy.

Source. Colorado Department of Education (See https://www.cde.state.co.us/.)
Notes. [1] The CDE's at-risk measure includes the percentage of students in a district who are eligible for free lunch, a neighborhood's socioeconomic status index, and students who are directly certified for Medicaid or Children's Basic Health Plan. (See https://www.cde.state.co.us/cdefinance/atriskmeasureforschoolfinanceworkinggroup.)
[2] Disability categories include: autism spectrum disorder (ASD), deaf-blindness, developmental delay, hearing impairment including deafness, intellectual disability, multiple disabilities, orthopedic impairment, other health impaired (OHI), serious emotional disability (SED), specific learning disability (SLD), speech or language impairment, traumatic brain injury (TBI), and visual impairment including blindness. (See https://www.cde.state.co.us/cdesped/sd-main).

Exhibit 18. Percentage of Survey Respondents Who Reported That the Current Level of Funding Is Not Enough to Meet the Educational Needs of Students, Across Different Student Groups



We analyzed survey findings to determine the extent to which variation existed across respondent groups and highlight findings that are meaningful and statistically significant (additional details are provided in Appendix A).

Respondents who identified as White (compared to all other respondents) were more likely to report that current funding is insufficient to meet all students' needs (82% versus 75%) and the specific needs of English language learners (83% versus 75%). When considering respondent role, we found that educators were more likely than noneducators to respond that funding is insufficient to meet students' educational needs for all groups of students except students with disabilities and students identified as gifted and talented (with an average difference of four percentage points).

There were only a few meaningful and statistically significant differences by region.

- Lower percentages of respondents who had lived in the Northeast region in the past 10 years (compared to all others) reported insufficient funding for all students (68% versus 80%), students in foster care (62% versus 83%), newcomer students (70% versus 81%), and migrant students (71% versus 82%).
- Respondents who had lived in the Southeast, Southwest, and West Central regions also were less likely to report insufficient funding for some student groups. For example,
  - Southeast region: 68% versus 83% for immigrant students,
  - Southwest region: approximately 68% versus 82% for both newcomer students and migrant students,
  - West Central: 78% versus 86% for low income/ at-risk students.

Chapter Conclusion

This comprehensive analysis of student and taxpayer equity in Colorado highlights several critical disparities and their underlying causes. Schools with higher percentages of ELLs and SWDs demonstrate higher expenditures, higher teacher wages, and lower student-to-teacher ratios, reflecting an adjustment toward meeting these students' needs. However, this is not the case for schools with high populations of students eligible for FRL. These schools spend less in total, pay teachers lower wages, have more students in classrooms, and have less experienced teachers. The disparities in teacher experience and compensation between low- and high-wealth districts highlight the challenges faced by schools in poorer communities in retaining and attracting teachers. These schools likely require additional funds to hire additional teachers, improve working conditions, and provide additional compensation to attract and retain teachers to such schools. These inequities underscore the necessity for further financial adjustments to ensure equitable support across all student groups but particularly for economically disadvantaged students.

The taxpayer equity and wealth neutrality analyses also reveal inequity in school spending and tax rates with respect to property wealth of districts. The inverse relationship between wealth and property tax rates highlights a regressive tax structure that disproportionately burdens taxpayers of poorer districts. To add to the inequity, districts with higher wealth also tend to spend more on education than lower wealth districts, indicating that the state's education funding system is not meeting the goal of wealth neutrality. By implementing policies that promote fairer tax contributions and leveraging state funding to ensure that spending levels are not a function of local wealth, Colorado can move toward a more equitable and adequate educational system.

4. Student Outcomes

Each state's constitution requires that their education funding system meet some criteria for quality for all students attending public schools. Although the phrasing of the constitutional requirements varies from state to state, in general, the notion that public education must meet some set of standards of quality has become known as *adequacy*. Adequacy is ultimately interpreted as providing sufficient levels of funding or resources, but it is first and foremost about the outcomes of students. When framed around student outcomes, adequacy can be determined by asking two questions:

1. Are Colorado's children meeting the educational outcome goals set by the state?
2. Do students across the state, regardless of their backgrounds or where they attend school have equal opportunity to achieve those educational outcome goals?

In this chapter, we examine student outcomes in Colorado to inform how the state can focus its efforts to achieve adequate funding. If the typical student in the state is not able to meet the state's educational goals, Colorado may consider increasing resource levels to improve the overall quality of education. Further, if students who attend districts and schools that serve higher need populations systematically have lower performance than students in districts and schools with lower need populations, Colorado may consider providing higher need districts and schools with more resources relative to lower need districts and schools. In other words, achieving educational goals requires adequate funding. Examining the extent to which outcome goals are being met overall or by certain types of districts or schools is an indicator of whether the school funding system is achieving adequacy.

Approach to Examining Student Outcomes and Student Needs

To address the first question, on whether the students in Colorado are meeting outcome goals, we conduct several sets of comparisons examining the level of overall student outcomes in the state:

- We examine the average statewide outcomes for math and English language arts (ELA) performance and graduation rate compared to Colorado's stated goals in its Every Student Succeeds Act (ESSA) plan, as amended in 2024 (Colorado Department of Education, 2024).
- We compare Colorado's performance on the National Assessment of Educational Progress (NAEP) to two benchmarks—the proficiency benchmark set by NAEP and Colorado's

proficiency benchmark equated to a NAEP Score—and to a set of peer comparison states.[17] Although state educational goals should not be dictated by performance relative to other states, comparisons to other states can provide a meaningful point of comparison, given that the setting of proficiency benchmarks can be somewhat arbitrary and may either be too low or overly ambitious. By contrast, the actual performance levels of other states are a tangible and perhaps more realistically achievable point of comparison. Relative performance is also practically meaningful. Students from Colorado will compete with students from neighboring states and beyond when applying to colleges and universities and when competing for jobs in the labor market. As such, the relative performance of students compared to other students regionally or nationally has important implications for future success.

- We examine the performance of three sets of schools: those that are relatively low performing, those performing near the state average, and those that are relatively high performing. Comparing these three groups allows us to understand how outcomes vary across Colorado's schools and to better understand what level of performance might be considered adequate.

To address the second question, on providing equal opportunity, we examine the relationship between schools' average student outcomes and school-level measures of student need. Our resulting analyses use scatter plots and correlations to show the relationship between student outcomes and specific student-need variables. We then use regression analysis to account for multiple student and school characteristics that may be related to student outcomes to isolate the relationship between specific student-need variables and outcomes while controlling for other factors that may also be related to student outcomes.

Constructing the Outcome Factor Score

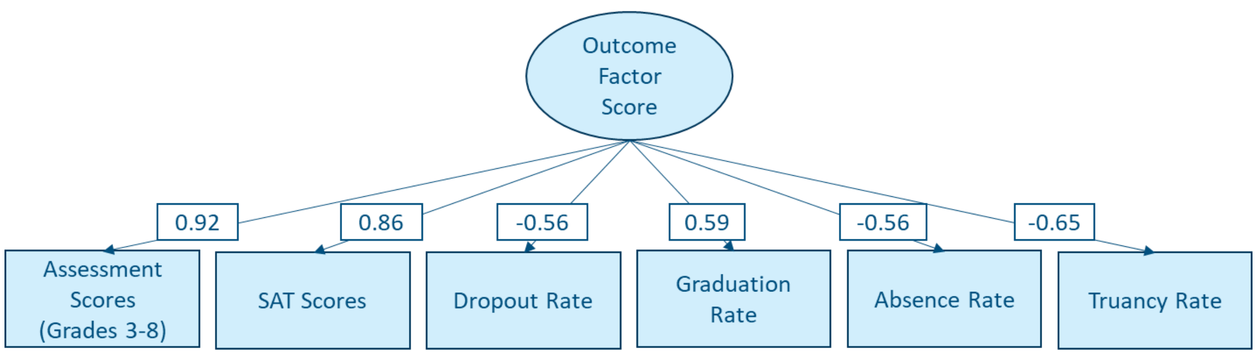
We constructed an aggregate outcome score that describes overall school performance by combining the outcome measures related to test performance, high school completion, and absenteeism. Combining multiple outcome measures into a single score—referred to as the outcome factor score—creates a more robust measure of school performance that reflects a broader set of education goals than any single outcome measure. To construct the outcome factor score, we conducted confirmatory factor analysis using a structural equation model that treats the overall outcome measure as a latent (i.e., unobserved) variable, which is estimated to best fit the data. Rather than make an arbitrary decision to weight each outcome equally or choose another arbitrary weighting scheme, the model uses the existing variation in outcomes

[17] NAEP proficiency benchmarks are typically higher than the benchmarks of most states and are meant to represent "solid academic performance for each grade assessed" (National Assessment Governing Board, n.d.). New York equated proficiency benchmarks are based on a study by Ji et al. (2021), which determined the NAEP equivalent proficiency score for each state.

across each measure to identify the relative importance of each measure to the unobserved aggregate outcome score. Another advantage of this approach is that the statistical program used to construct the factor score can appropriately generate a factor score even when individual measures are missing for some schools. For example, only schools serving Grade 12 students would be expected to have a graduation rate reported.

Exhibit 19 shows the structural equation model used to generate the factor scores, along with the standardized factor loadings for each outcome measure included. As shown, the outcome factor scores were generated based on assessment scores in Grades 3–8, SAT scores, dropout rate, graduation rate, absence rate, and truancy rate.[18] Assessment scores and SAT scores were the outcome measures with the strongest factor loadings, at 0.92 and 0.86, respectively. The remaining outcome variables had somewhat lower but still strong factor loadings, with magnitudes between 0.56 and 0.65. Once constructed, the outcome factor score has a mean of 0 and a standard deviation of 1. In other words, positive values represent above average outcomes, and negative values represent below average outcomes.

Exhibit 19. Structural Equation Model Used to Generate the Outcome Factor Score



Note. The model is weighted by enrollment. The model also allows for the error terms between absence and truancy rate to be correlated. The dropout rate and graduation rate were transformed using a logit transformation. All variables were then standardized as z scores prior to inclusion in the model. All factor loadings are statistically significant ($p < .001$).

To demonstrate that the outcome factor score is working as intended, Exhibit 20 shows the correlations between the outcome factor score and a number of student outcomes. The outcome factor score is strongly to moderately correlated to each of the outcomes included in the correlation table. By contrast, not all outcomes included are strongly correlated with each other. For example, the correlation between graduation rate and average SAT score is only 0.46, which is lower than the correlation between the outcome factor score and any of the

[18] The absence rate accounts for all absences regardless of whether they were excused or not. The truancy rate consists of only unexcused absences.

individual outcome measures. This indicates that the outcome factor score is a better representation of the collection of outcomes included than is any individual outcome measure.

Exhibit 20. Correlations Between Outcome Measures

	Outcome FS	Math MSS	Math prof.	ELA MSS	ELA prof.	Truancy %	Absence %	SAT score	Grad. rate	Drop. rate
Outcome FS	1.00									
Math MSS	0.96	1.00								
Math prof.	0.95	0.98	1.00							
ELA MSS	0.97	0.93	0.93	1.00						
ELA prof.	0.96	0.94	0.93	0.98	1.00					
Truancy %	-0.66	-0.60	-0.59	-0.58	-0.62	1.00				
Absence %	-0.62	-0.54	-0.55	-0.53	-0.55	0.85	1.00			
SAT score	0.91	0.85	0.85	0.82	0.82	-0.54	-0.53	1.00		
Grad. rate	0.57	0.26	0.26	0.28	0.28	-0.47	-0.45	0.46	1.00	
Drop. rate	-0.51	-0.29	-0.27	-0.29	-0.29	0.53	0.55	-0.51	-0.56	1.00

Note. FS = factor score; MSS = mean scale score; Prof. = proficiency rate; Grad. = Graduation; Drop. = Dropout

Is Colorado Meeting Educational Goals?

One purpose of examining outcomes in the context of a study of education funding is to understand whether the current level of student outcomes in the state meets the state goals. Here we examine overall performance in the state, comparing outcomes to the state's defined goals, performance benchmarks and other states, and across schools performing at different levels.

Comparing Performance to ESSA Plan Goals

In Exhibit 21, we compare the state's actual performance in the 2022–23 school year with the long-term goals stated in the Colorado State ESSA Plan. For Colorado's state assessments (the Colorado Measures of Academic Success, or CMAS), a score of 750 aligns with the proficiency benchmark. In other words, Colorado's long-term goal for ELA and math performance is for students, on average, to achieve proficiency. Currently, the state's average scores for both subjects (742 and 734, respectively) are in the "approaching expectations" performance level. In addition, Colorado's current performance does not meet the state's goals for graduation, although the 4-year graduation rate for 2022–23 (83.1%) was close to the state's long-term goal for this measure (84.2%). Actual performance on the 7-year graduation rate (87.6%) lagged further behind the state goal (92.2%). In short, we find that for each of the measures included in the state's long-term goals, Colorado is currently not meeting the stated goals.

Exhibit 21. Comparing 2022–23 Performance to Long-Term Outcome Goals Defined in the State's ESSA Plan

Performance measure	2022–23 Performance	Long-term goal
English language arts performance (mean scale score)	742	762.7
Math performance (mean scale score)	734	750.0
4-year graduation rate	83.1%	84.2%
7-year graduation rate	87.6%	92.2%

Colorado NAEP Scores in Comparison to Proficiency Benchmarks and Performance in Other States

Next, we compare academic performance to established benchmarks of proficiency and to other states using assessment scores from NAEP, often referred to as the nation's report card. Because states establish their own standards, use different assessments, and establish their own benchmarks for proficiency, it is difficult to compare performance across states using state standardized assessments. Therefore, the gold standard for making cross-state comparisons in student achievement in math and reading is NAEP, which is comparable both across states and time (U.S. Department of Education, 2010).

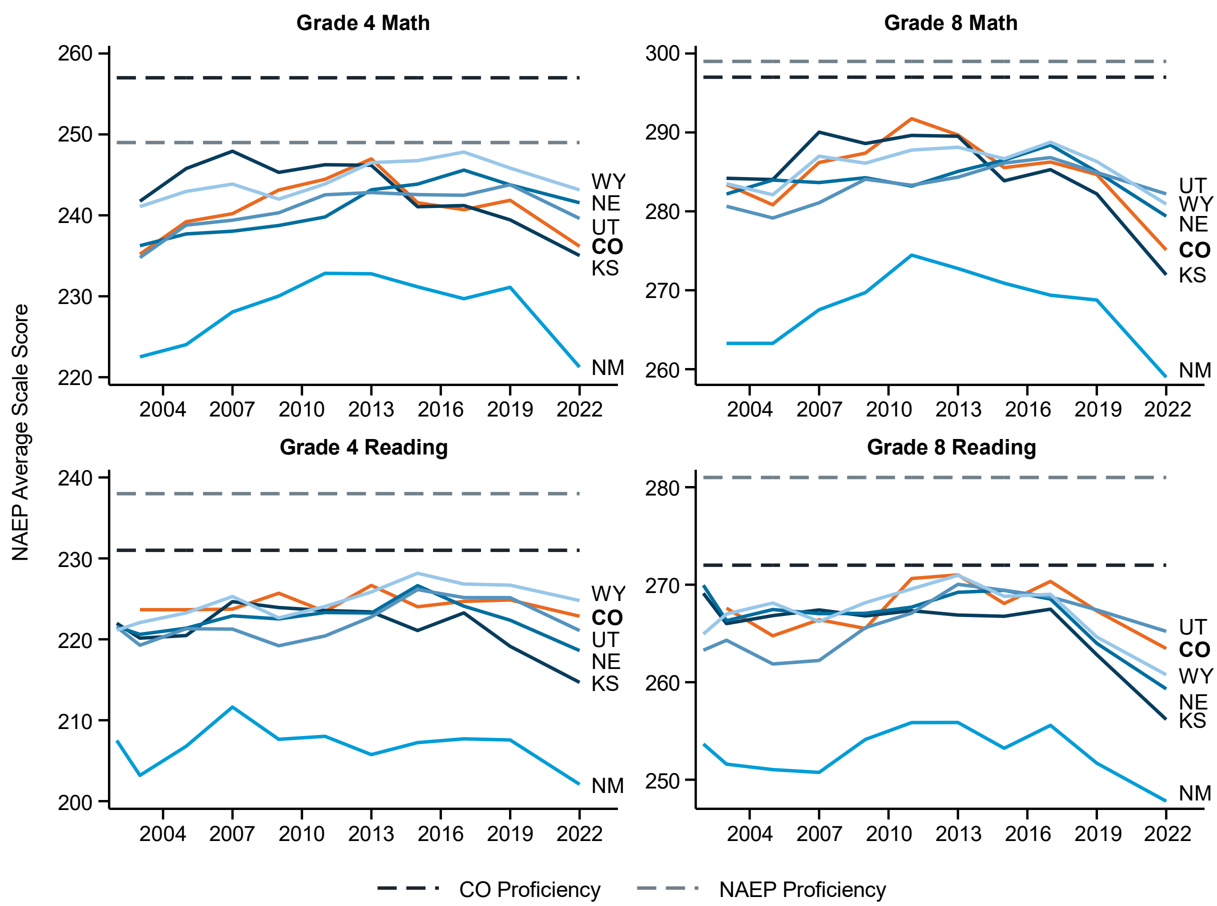
Exhibit 22 shows Colorado's NAEP performance throughout the past 2 decades compared to neighboring states and to the NAEP threshold for proficiency and Colorado's proficiency benchmark equated to a NAEP score (Ji et al., 2021).[19] In Grades 4 and 8 math, Colorado performs in the middle of peer states, below Utah, Wyoming, and Nebraska, and well below both the state and NAEP benchmarks. Colorado once led its peer states in math performance, but performance has declined in both absolute and relative terms during the past decade.

In Grades 4 and 8 reading, Colorado fairs better compared to peers and is somewhat closer to attaining the state performance benchmark. Specifically, Colorado performed better than all comparison states but Wyoming in Grade 4 reading and Utah in Grade 8 reading. Although performance has also declined during the past decade in reading, the declines are somewhat smaller, and declines in other states have typically outpaced those in Colorado. In sum, these results suggest that Colorado's students perform decently compared to neighboring states but

[19] To provide additional context to these state-specific results, Exhibit D–1 in Appendix D shows how student need in Colorado compares to other states based on several demographic measures. Compared to neighboring states, Colorado has lower poverty rates, higher income, and a smaller share of SWDs. However, Colorado has a higher percentage of ELLs compared to neighboring states except New Mexico.

also suggest that improvement is needed to disrupt the downward trends in performance over time and achieve state proficiency benchmarks.

Exhibit 22. Comparison of Fourth- and Eighth-Grade Math and Reading National Assessment of Education Progress Scores to Proficiency Benchmarks and Comparison States



Note. NAEP average scale scores are from https://nces.ed.gov/nationsreportcard/. Colorado's NAEP equivalent proficiency benchmark is from Yi et al. (2021).

Comparing Performance Across Three Groups of Schools

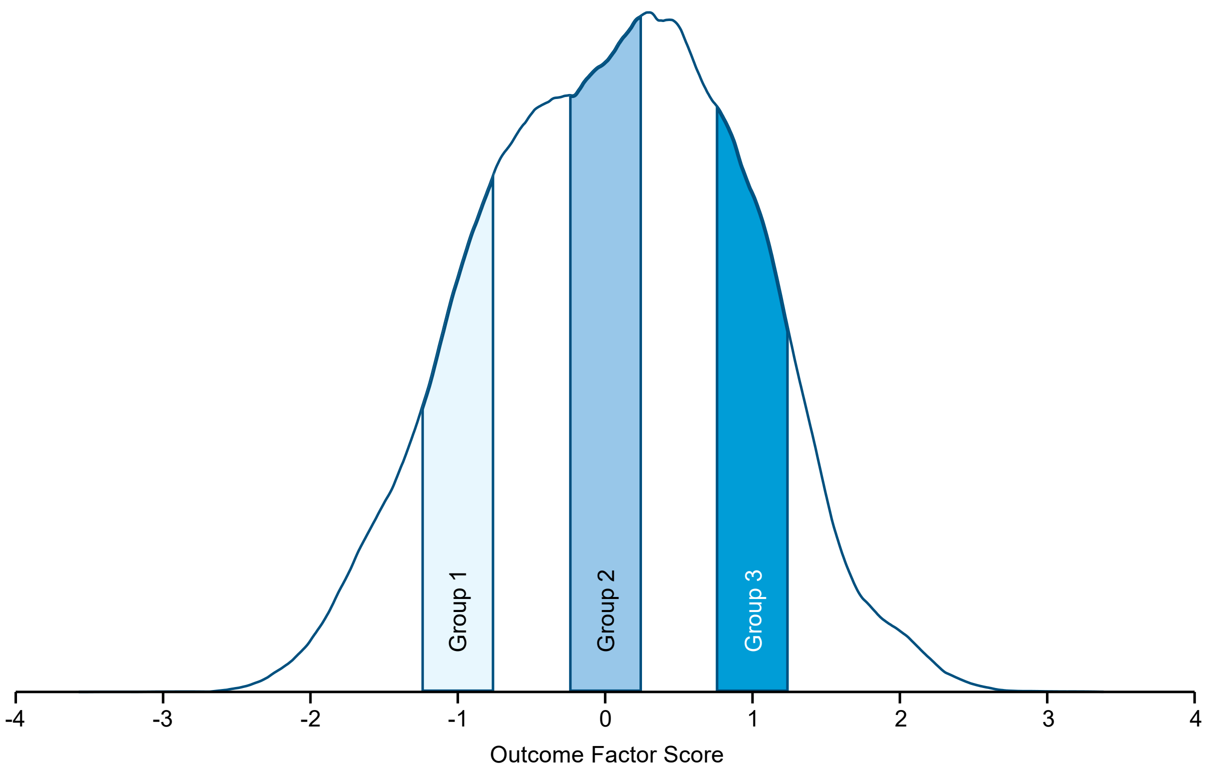
As a final way to examine typical outcome levels of schools in the state, we compare the individual outcomes of three groups of schools distinguished by their performance on the outcome factor score (Exhibit 23). Group 1 schools are a set of relatively low-performing schools with an outcome factor score between -1.25 and -0.75; Group 2 schools are the set of schools performing near the state average with an outcome factor score between -0.25 and 0.25; and Group 3 schools are a relatively high-performing set of schools with an outcome factor score between 0.75 and 1.25. These three groups of schools can serve as reference points in a discussion about what level of outcomes would be considered adequate and reasonably attainable. The figure in Exhibit 23 shows that none of the three groups are at the extreme ends of the distribution, with a sizable share of schools performing lower than the Group 1 schools and another share of schools performing at levels higher than the Group 3 schools.

The table in Exhibit 23 shows that for all outcome measures, average performance improves from Group 1 to Group 2 and then from Group 2 to Group 3. This finding serves as an additional point of validation for our approach used to generate the outcome factor score. Examining outcomes in these three groups also serves to contextualize various levels of the outcome factor score in familiar data points regularly reported on the state's school report cards. Among the schools in Group 1, the math mean scale score is 714, and only 13% of students achieved proficiency in math. The results are slightly higher but qualitatively similar for ELA in Group 1. These results are well short of the state goals and indicate that the average student performance in the Group 1 schools is at the level of "partially met expectations." In addition, high school students in Group 1 have an average SAT score of just over 850. College Board, the creator of the SAT test, indicates that a score of 1010 (480 on reading and 530 on math) is the benchmark for college and career readiness (College Board, 2024). In addition, only 80% of high schoolers in Group 1 graduated from high school in 4 years.

Group 2 schools have somewhat higher test scores and proficiency rates, although these scores still do not meet the state's goals. In addition, well below half of the students in Group 2 schools achieve proficiency and average scores are in the *approaching expectations* range of performance. SAT scores in Group 2 also do not meet the benchmark of college and career readiness, on average, with an average SAT score of 950. That said, 88% of students in Group 2 graduated from high school in 4 years, a rate well above the state's overall goal.

Lastly, students in Group 3 schools perform very close to the state math and ELA performance goals, with more than half of students in those schools achieving proficiency and average ELA and math scores at or near the proficiency benchmark. The average SAT score for students in Group 3 schools (a score of 1047) exceeds the benchmark for college and career readiness, and almost 95% of students graduated from high school in 4 years. As such, based on comparing these measures across the three groups of schools, performance in the Group 3 schools best aligns with the state's performance goals.

Exhibit 23. Distribution of Performance in Colorado Schools Using the Outcome Factor Score (2019 to 2023)



	Group 1		Group 2		Group 3	
	Mean	*n*	Mean	*n*	mean	*n*
Math mean scale score	714.3	1089	730.6	1654	749.8	1150
Math proficiency rate	13.1	854	28.8	1350	52.5	957
ELA mean scale score	722.5	1094	740.3	1653	758.0	1150
ELA proficiency rate	21.6	883	41.2	1366	62.3	957
Truancy rate	5.6	1280	2.6	2052	1.1	1361
Absence rate	10.4	1280	7.7	2052	5.9	1361
SAT total score	852.7	267	954.9	464	1046.9	168
Graduation rate	85.1	222	89.7	411	94.8	169
Dropout rate	1.3	590	0.7	1086	0.3	555
Total *N*	1308		2097		1369	

Note. The *n* represents the numbers of school-by-year observations between the 2018–19 and 2022–23 school years for which a given outcome measure applies. The Total *N* represents the total number of school-by-year observations in a given group between the 2018–19 and 2022–23 school years.

Student Outcomes in Relation to Student Need

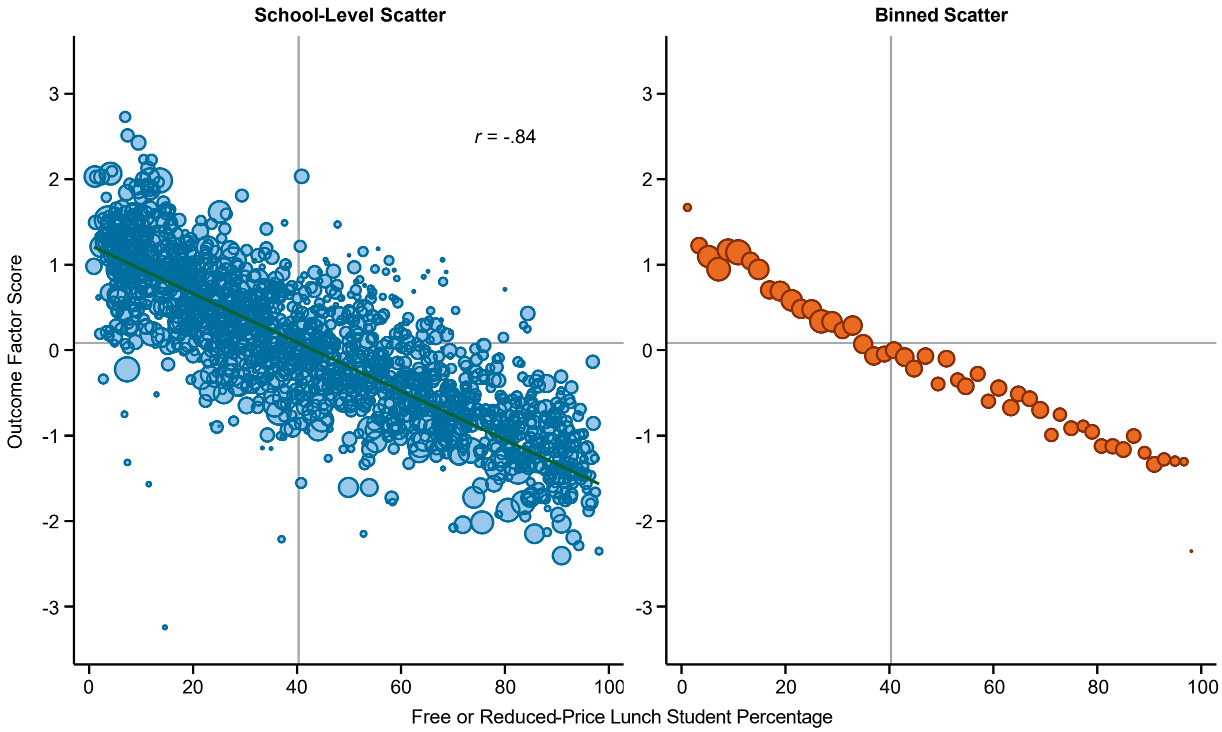
In this section, we examine the relationships between student-need variables and student outcomes. This analysis allows us to understand the extent to which the current system provides equal opportunity to students to achieve a common level of outcomes. The analysis also allows us to evaluate which student-need variables are most strongly associated with poorer student outcomes. It is these variables that should be included in a state funding formula and should be used to drive additional funding to districts and schools. We start by examining the relationship between the outcome factor score and the percentage of students who are economically disadvantaged. We follow this with analyses examining the associations between multiple student need measures and student outcomes.

Student Outcomes in Relation to Economic Disadvantage

We start by examining the relationship between the outcome factor score and the percentage of students who are economically disadvantaged. As shown in Exhibit 24, there is a strong negative relationship between the level of student outcomes and the percentage of students who are eligible for FRL. Whereas schools with the fewest low-income students typically perform about 1 *SD* above average, the schools with the highest percentage of economically disadvantaged students typically perform about 1 *SD* below average. In other words, the high poverty schools are similar to the Group 1 schools in Exhibit 23, where students perform well below the state's educational goals. In contrast, the low-poverty schools perform comparably to the Group 3 schools, where students meet the state's goals, on average.

The school-level scatter in the left panel of Exhibit 24 shows a decent amount of variation in the outcome factor score at any given level of economic disadvantage, but outcomes tend to be lower for schools with higher percentages of students who are economically disadvantaged, resulting in a correlation coefficient of -.84. The binned scatter in the right panel shows the average performance for every 2-point increment in the FRL percentage. Using this approach to visualizing the data shows that the relationship is quite linear, with average outcomes systematically decreasing as FRL percentage increases. This provides evidence that students in schools with higher levels of economic disadvantage are not being provided an equal opportunity for educational success.

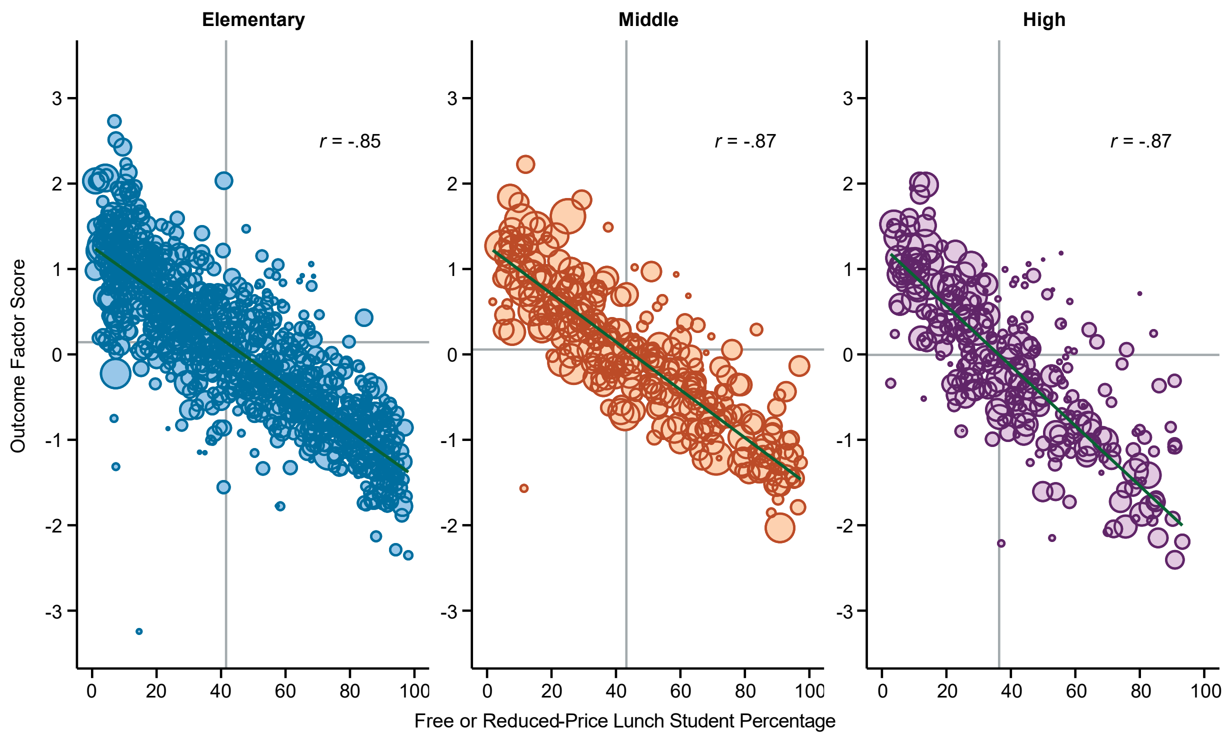
Exhibit 24. Relationship Between School-Level Student Outcomes and Free or Reduced-Price Lunch Percentage (2022–23)



Note. Each dot in the school-level scatter represents a school. Each dot in the binned scatter represents the average outcome factor score for all schools within a given bin. Bins are defined using a width of two percentage points. The size of the dots in both panels is weighted by enrollment. The horizontal gray lines show the overall average outcome factor score, and the vertical gray lines show the overall average percentage of students who are economically disadvantaged. The green line in the school-level scatter is the line of best fit. The correlation coefficient in the school-level scatter is denoted by *r*.

In Exhibit 25, we display the relationship between the student outcome scores and the free or reduced-price lunch percentage by school level. Across school levels, we find that the negative relationship between the two variables is consistent in correlation, suggesting that the challenges faced by schools with high levels of economic disadvantage persist as students advance through their education.

Exhibit 25. Relationship Between Student Outcomes and Percentage of Economically Disadvantaged Students by School Level (2022–23)



Note. Each dot in the scatters represents a school. The size of the dots is weighted by school enrollment. The horizontal gray lines show the overall average outcome factor score, and the vertical gray lines show the overall average percentage of students who are economically disadvantaged. The green lines are the lines of best fit. The correlation coefficient is denoted by *r*. School level was assigned based on the grade range with the highest percentage of students, with the grade ranges being prekindergarten to Grade 5 (elementary), Grades 6–8 (middle), and Grades 9–12 (high).

Student Outcomes Across Different Student Need Measures

Although economic disadvantage is one of the critical measures of student need, student need is multifaceted. In addition, students with different characteristics may perform differently on different types of outcomes. We begin by showing the simple correlations between various outcome measures and several measures of student need. This is followed by results from a regression analysis that show the relationship between the student outcome factor scores and student-need variables, controlling for other student needs and school characteristics.

Simple Correlational Analysis of Student Outcomes and Student Need

In Exhibit 26, we show the correlations between different student-need variables and various school-aggregated student outcome measures. We see that, in addition to the FRL percentage, both the SWD percentage and the EL percentage are negatively correlated with each of the student outcome measures included. However, across all need measures, the FRL percentage is the student need measure most strongly correlated with each individual outcome. All but one of the student demographic variables included is indicative of lower outcomes, including FRL, SWD, EL, homeless, and immigrant percentages. By contrast, the percentage of students who are gifted is moderately related with higher outcomes, potentially meaning that the gifted percentage is indicative of lower need.

Exhibit 26. Correlations Between Student Outcomes and Student Need Variables (2017–18 Through 2022–23)

	Outcome FS	Math MSS	Math prof.	ELA MSS	ELA prof.	Truancy %	Absence %	SAT score	Grad. rate	Drop. rate
FRL %	-0.80	-0.79	-0.76	-0.80	-0.80	0.52	0.44	-0.77	-0.42	0.31
SWD %	-0.41	-0.41	-0.39	-0.42	-0.41	0.19	0.23	-0.57	-0.25	0.19
ELL %	-0.61	-0.58	-0.54	-0.62	-0.61	0.41	0.28	-0.59	-0.35	0.22
Homeless %	-0.40	-0.39	-0.39	-0.41	-0.42	0.21	0.21	-0.42	-0.23	0.17
Gifted %	0.43	0.45	0.45	0.48	0.48	-0.08	-0.07	0.56	0.32	-0.11
Immigrant %	-0.38	-0.32	-0.29	-0.36	-0.35	0.31	0.22	-0.36	-0.32	0.26

Note. FRL = free or reduced-price lunch eligible; SWD = students with disabilities; ELL = English language learner

Regression Analysis of the Outcome Factor Score in Relation to Student Need

These simple correlational analyses ignore the overlap between student need measures, given that the three main student need measures are moderately to strongly correlated with each other. The correlation between FRL and ELL percentages in Colorado is .71, and the correlation between FRL and SWD percentages is 0.43, meaning that schools with higher FRL percentages also tend to have higher ELL and SWD percentages. Therefore, the negative relationship between FRL and student outcomes shown in these simple correlational analyses could be the result of schools with higher FRL also having higher percentages of SWDs and ELLs.[20] To disentangle the relationships between various student needs (and other school characteristics) and student outcomes, we use multiple regression modeling to estimate the relationships while controlling for other student need and school characteristic variables (Exhibit 27).

The results in Model 1 demonstrate that each of the main student-need variables (proportions of FRL, SWD, and ELL students) has an independent and statistically significant negative relationship with student outcomes. The coefficients for the student needs variables describe the change in outcomes associated with a 100-percentage point change in student needs. In

[20] See Exhibit D–2 in Appendix D for the correlations between student-need variables. Also of note is that the percentage of students identified as gifted is negatively related to other student needs. In other words, in schools with higher FRL, SWD, ELL, homeless, and immigrant percentages, a smaller percentage of students is identified as gifted.

other words, the coefficients describe the expected difference in outcomes for a school where all students (100%) have a particular need compared to a school where none of the students (0%) have a particular need. For example, the coefficient for FRL indicates that schools where all students qualify for FRL are expected to have student performance that is 2.4 *SD*s lower on the outcome factor score variable compared to schools where none of the students qualify for FRL. This aligns with the finding from the scatter plot shown in Exhibit 24. The coefficient for SWDs is slightly larger in magnitude than that for FRL, whereas the coefficient for ELL is somewhat smaller.

In Model 2, we add several additional student-need variables that are less commonly included as part of school funding formulas, including the proportions of homeless, gifted, and immigrant students. The coefficient for homelessness is negative, large, and statistically significant, and the coefficient for gifted is positive, large, and statistically significant. The coefficient for immigrant students is not statistically significant. When these variables are included, the coefficients for FRL, SWD, and ELL student proportions become smaller, indicating that the additional variables in Model 2 overlap with FRL, SWD, and ELL in explaining student outcomes.

Interpreting coefficients as changes from 0% to 100% of students does not align with the actual variation in student need across schools. To help with the interpretation, we also show the expected changes from the 10th to the 90th percentiles of each student-need variable in Exhibit 28, where the predictions hold all other variables constant at their observed values. Using Model 1, we see that moving from the 10th to 90th percentiles for each of the three main student-need variables result in meaningful changes in student outcomes. However, by far the largest difference is based on FRL, where schools at the 90th percentile of the percentage of students eligible for FRL are expected to perform almost 1.8 *SD*s lower than schools at the 10th percentile of FRL. In addition to a strong negative regression coefficient, FRL also has the largest amount of variation across schools among the student-need variables (there is a 75 percentage point difference in FRL between the 90th and 10th percentiles).

By contrast, despite a larger regression coefficient, schools at the 90th percentile of SWD percentage perform 0.34 *SD*s lower than schools at the 10th percentile. This is largely the result of only a 12 percentage point difference in SWD percentage between the two prediction levels. Examining Model 2, differences in outcomes between the 90th and 10th percentiles of homeless and immigrant student percentages are quite small. This is due to the small amount of variation in those student-need variables.

Exhibit 27. Regression Results Examining Relationships Between School Characteristics and the Student Outcome Factor Score

	Model 1		Model 2	
	Coef.	*SE*	Coef.	*SE*
Student needs				
FRL proportion	-2.396*	(0.064)	-2.136*	(0.071)
SWD proportion	-2.826*	(0.312)	-2.146*	(0.264)
ELL proportion	-0.673*	(0.101)	-0.494*	(0.102)
Homeless student proportion			-1.211*	(0.444)
Gifted student proportion			3.151*	(0.406)
Immigrant student proportion			-0.648	(0.574)
Proportions of enrollment by grade				
Grades 6 to 8	-0.041	(0.028)	-0.263*	(0.039)
Grades 9 to 12	-0.460*	(0.041)	-0.676*	(0.049)
CWIFT geographic cost index	0.593*	(0.196)	0.038	(0.169)
School and district size (scale)				
School < 200	0.159*	(0.052)	0.164*	(0.048)
School 200 to < 400	0.126*	(0.038)	0.114*	(0.034)
School 400 to < 800	0.091*	(0.034)	0.101*	(0.030)
District < 2,000	0.064	(0.043)	0.117*	(0.040)
Locale				
Suburb	-0.135*	(0.030)	-0.098*	(0.028)
Town	-0.207*	(0.042)	-0.193*	(0.036)
Rural	-0.140*	(0.044)	-0.121*	(0.042)
Constant	1.544*	(0.071)	1.307*	(0.071)
Number of school *X* year observations	10,128		10,128	
Number of unique schools	1,779		1,779	
R^2	.746		.789	

Note. Coef. = coefficient; *SE* = standard error; CWIFT = Comparable Wage Index for Teachers. The models also include year fixed effects, which are not shown in the regression results. The constant term reflects spending in the 2022–23 school year.

* $p < .05$.

Exhibit 28. Predicted Student Outcome Factor Scores at the 10th and 90th Percentiles of School-Level Student Need Variables

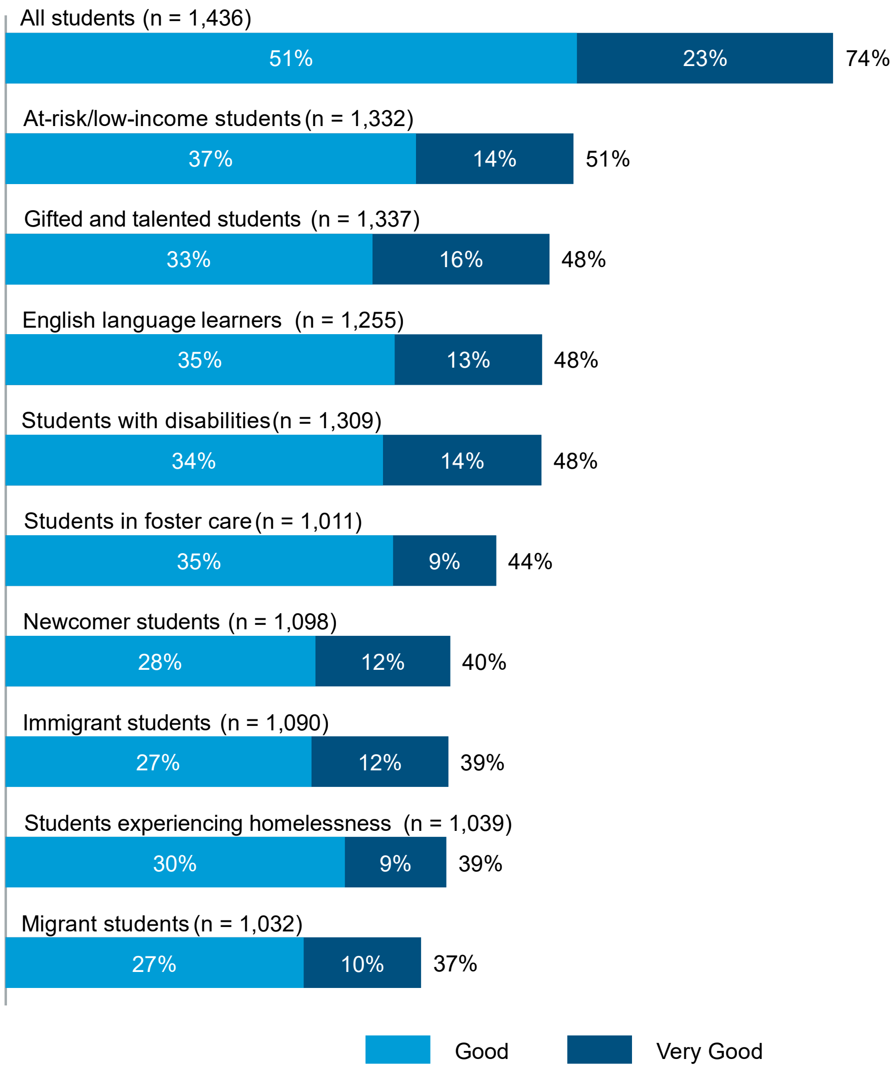
Student need variable	Prediction percentile	Level of student-need variable at prediction percentile	Model 1		Model 2	
			Average predicted outcome factor score	Difference in predicted outcome factor score	Average predicted outcome factor score	Difference in predicted outcome factor score
FRL	10th	9.9%	0.83	-1.79	0.75	-1.59
	90th	84.5%	-0.95		-0.84	
ELLs	10th	1.1%	0.19	-0.26	0.17	-0.19
	90th	39.3%	-0.06		-0.02	
SWDs	10th	7.4%	0.23	-0.34	0.20	-0.26
	90th	19.5%	-0.11		-0.06	
Homeless	10th	0.1%			0.12	-0.05
	90th	4.5%			0.07	
Gifted	10th	1.0%			-0.11	0.40
	90th	13.8%			0.30	
Immigrant	10th	0.0%			0.12	-0.03
	90th	4.0%			0.09	

Note. FRL = free or reduced-price lunch eligible; SWD = students with disabilities; ELL = English language learner

Coloradans' Perspectives on Student Outcomes

Survey respondents were asked to rate the quality of their local public schools for high-needs students (i.e., at-risk/low-income students, ELLs, SWDs, students in foster care, etc.). We found that approximately three out of four respondents rated the quality as good or very good in serving all students (Exhibit 29). However, when asked to rate the quality for groups of students with greater needs, participants responded less favorably. Only half of respondents indicated that the quality of education for at-risk/low-income students was good or very good (51%). Slightly less than half of respondents indicated that the quality of education for SWDs and ELLs was good or very good (48%). Finally, fewer than two out of five respondents indicated that that the quality of education for newcomer students, immigrant students, students experiencing homelessness, and migrant students was good or very good.

Exhibit 29. Survey Respondents Ratings of the Quality of Education for Students, by Different Student Groups



We analyzed survey findings to determine the extent to which variation exists across respondent groups and highlight findings that are meaningful and statistically significant (additional details are provided in Appendix A).

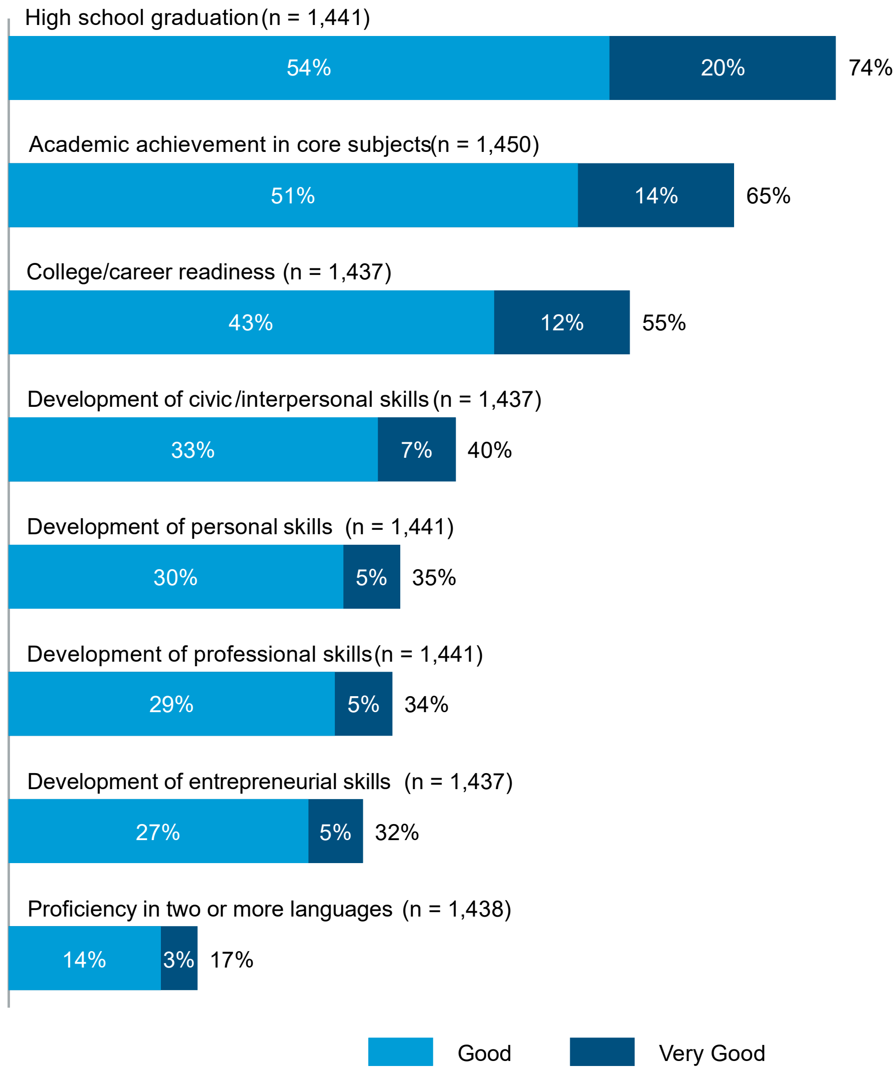
We found no significant differences across racial groups. When considering role, we saw differences among educators and noneducators, with educators being more likely than noneducators to report that the quality of education is good for all students (77% versus 70%), low income/at-risk students (54% versus 47%), and students in foster care (48% versus 35%).

There were also some differences by region.

- Compared to respondents from regions other than the Metro Area, lower percentages of respondents that had lived in the Metro Area region in the past 10 years were likely to report that the quality of education is good for low-income/at-risk students (44% versus 55%), students experiencing homelessness (34% versus 43%), students in foster care (37% versus 48%), newcomer students (36% versus 42%), and migrant students (31% versus 41%).
- Respondents who had lived in the Pikes Peak region were more likely than those from other regions to report that the quality of education was good for migrant students (41% versus 35%).
- Respondents who had lived in the Southeast were less likely than all others to find the quality of education good for all students (64% versus 75%) and for gifted and talented students (36% versus 50%).
- Respondents who had lived in the Southwest or West Central regions each were more likely than those who did not live in their regions to report that the quality of public education is good for students experiencing homelessness (53% and 52% versus 38% and 39%), students in foster care (54% and 60% versus 43%), and immigrant students (55% versus 39%).

Participants were also asked to rate how well their local public schools performed in helping students achieve certain outcomes (e.g., academic achievement, high school graduation, college/career readiness, proficiency in two or more languages, personal skills, civic/personal skills, professional skills, and entrepreneurial skills) (Exhibit 30). Participants rated their school the highest in terms of helping students in academic achievement (65%) and high school graduation (74%). This aligns with findings from the townhalls, where educators and parents expressed that the primary purpose of school is education in core subjects. Survey participants rated the performance of their local public schools less favorably on other outcomes. For example, fewer than two in five participants rated their schools favorably in terms of helping students develop civic/interpersonal skills (40%), personal skills (35%), professional skills (34%), and entrepreneurial skills (32%). In addition, fewer than one in five participants indicated that their schools performed good or very good in helping students achieve proficiency in two or more languages (17%).

Exhibit 30. Survey Respondents' Views on Their Local Public Schools' Performance, by Outcome



We analyzed survey findings to determine the extent to which variation existed across respondent groups and highlight findings that are meaningful and statistically significant. Respondents who identified as Hispanic or Latino were less likely than White respondents to describe their local schools' performance in supporting high school graduation and college and career readiness as good (66% versus 76% and 42% versus 59%, respectively).

We found little variation by respondent role, with one exception: Educators were less likely than noneducators to describe their local schools' performance in supporting students' proficiency in two or more languages as good (14% versus 20%).

We also found some variation by region.

- Respondents who had lived in the Metro Area, Pikes Peak, and the Southeast regions in the past 10 years were less likely to report positively about their local schools' performance. Compared to all others, respondents who had lived in the:
  - Metro Area region respondents were less likely to report that their public schools are supporting students' development of professional skills (30% versus 38%).
  - Pikes Peak region respondents were less likely to report that their public schools are supporting students' successful high school graduation (68% versus 76%).
  - Southeast region respondents were less likely to report that their public schools are supporting students' successful high school graduation (65% versus 75%), proficiency in two or more languages (9% versus 18%), and the development of professional skills (28% versus 36%).
- Respondents who had lived in the Northwest and the Southwest regions in the past 10 years were more likely to report positively about their local schools' performance. Compared to all others, respondents who had lived in the:
  - Northwest region respondents were more likely to report that their public school helped students to develop personal, professional, and entrepreneurial skills (49% versus 34%, 48% versus 33%, and 46% versus 31%, respectively).
  - Southwest region respondents were more likely to report that their public school helped students become proficient in two or more languages (29% versus 16%) and develop personal and civic skills (49% versus 34% and 54% versus 39%, respectively).
  - Most Coloradans responding to the public survey shared that high school graduation (96%) and academic achievement (93%) are important outcomes for public schools. The results did not vary considerably by race, with one exception: Nearly half of non-White respondents (44%) and more than half of Hispanic/Latino-identifying respondents (52%) indicated that proficiency in two languages is important or very important, compared to only 24% of White respondents ($p < 0.001$). Yet, lower percentages of non-White respondents than White respondents indicated that their public schools are helping students succeed academically (53% versus 67%) and graduate from high school (69% versus 76%).

Those attending townhall meetings also shared their views on student outcomes.

I think our district struggles with providing that social-emotional support and those basic life skills because we push academics so much that the kids struggle more because they don't have the access to the social-emotional support that they need to be able to be successful academically.

—Pikes Peak Region Townhall Attendee

I think without the additional staffing and interventions and support we need, I don't know that what we are going to be able to get is really good, especially when it comes to our special needs students.

—Statewide Townhall Attendee

Honestly, I feel like the wealthier districts are … more able to set up their students to have those higher paying jobs, and the lower paying districts and the lower SES districts are not equipped enough to help students out of that cycle of poverty.

—Pikes Peak Region Townhall Attendee

Chapter Conclusion

In this chapter, we examined whether students in Colorado are meeting the state's educational goals and the extent to which all students, regardless of their backgrounds, are provided an equal opportunity to achieve those goals. Our findings indicate that current levels of student performance are not at the level of the state's goals for ELA and math performance nor for graduation rates. Colorado's performance in math, as measured by NAEP, has fallen precipitously during the past decade. Whereas Colorado once led its region in math performance, it is now in the middle of the pack.

We also find that in schools performing near the state average based on a combined outcome measure called the outcome factor score, fewer than half of students do not meet benchmarks for proficiency in math or ELA, and high school students do not meet benchmarks for college and career readiness. By contrast, we show that in a relatively high-performing group of schools, more than half of students achieve proficiency, and students meet college and career readiness benchmarks, on average. These findings inform our subsequent adequacy analysis when we set a target outcome level for that analysis (see Chapter 5).

Perhaps more troubling than the analysis of overall state outcomes, we show that the average outcomes of schools are strongly related to the characteristics of the students they serve. We find that economic disadvantage as measured by the percentage of students eligible for FRL is strongly correlated to lower outcomes in schools. In addition, the percentages of students who are SWDs and ELLs are also related to lower outcomes, independent of the relationship between FRL and lower student outcomes. These findings suggest that the goal of providing equal opportunity to achieve may be unmet, pointing to a possible need to distribute funding more strongly according to student need (which we investigate further in Chapter 5).

5. Adequacy Estimates Based on Education Cost Modeling

The evaluation of equity in Chapter 3 presented the existing distribution of spending or resources across Colorado's districts and schools with respect to student needs or other structural or geographic differences. It did not, however, address adequacy, which we define as the level of resources needed to provide opportunities for all students to meet target levels of achievement. To examine adequacy, we use a cost-function approach that incorporates student outcomes along with common cost factors (e.g., student needs, district or school enrollment size) as predictors of spending within a regression model, which we term the Education Cost Model (ECM). The ECM estimates the levels of spending needed to achieve the desired student outcome level across all schools and districts while retaining each school or district's current observed level of other cost factors (such as percentage of low-income students or district size). The ECM also indicates how spending should be distributed across schools or districts to achieve common desired levels of student outcomes while accounting for differences in student needs across schools and districts and other structural and geographic differences that drive costs. We use the ECM to estimate a base funding amount and funding weights that could be applied in a revised funding formula to achieve more adequate and equitable funding.[21]

The remainder of this chapter is organized as follows. First, we describe the cost-model methodology in more detail to provide a foundation for our cost-modeling application to Colorado. Next, we justify the selection of a target outcome for estimating adequacy. We then present the results of the ECM and the subsequent estimation of funding formula weights. Finally, we show how the funding formula derived from the ECM and weight estimation would be used to distribute funding equitably and adequately to Colorado's districts.

Applying the Education Cost Model

The study team applied a three-step process for using education cost models to inform the design, redesign, or recalibration of state school finance formulas. A similar process was recently used in Delaware (Atchison et al., 2023), New Hampshire (Atchison et al., 2020) and Vermont (Kolbe et al., 2019)

- **Step 1:** Estimate the ECM with school-level data spanning several prior school years using rigorous statistical methods. This model determines the predicted cost of meeting defined student outcome targets, accounting for differences in a host of factors related to student needs and district characteristics that drive educational costs (i.e., cost factors).

[21] For additional information on alternative approaches to estimating the cost of an adequate education, see Baker, Levin, et al., 2020.

- **Step 2:** Generate a set of formula weights derived from the ECM that reflect the relative importance of different cost factors in a potential funding formula. These weights are generated by fitting a statistical model of the relationship between the predicted costs from the cost model in Step 1 (discussed in the next section) and cost factors commonly found in state aid formulas (e.g., measures of student need, school or district enrollment size, and degree of geographic remoteness).
- **Step 3:** Apply the weights generated in Step 2 (discussed next) in a formula simulation to generate district-level adequacy projections and compare those projections to actual spending levels of districts.

Applying the Cost Modeling Steps

In Step 1, we estimated an ECM using data on operational education spending,[22] outcomes such as student achievement, and a variety of factors influencing the cost of achieving these outcomes. The ECM was used to generate the predicted spending per pupil needed to attain a predetermined outcome for schools for which we have complete data for the years included in the model. These predicted spending levels are termed the *cost*.

The ECM included some necessary complexities as well as basic elements. The dependent variable in the cost model is a measure of per-pupil spending. The model then predicts spending based on student outcomes and factors that affect the differential cost of achieving a given level of outcome and assumed to be outside the control of districts: (a) variation in student needs, (b) geographic variation in the price levels of educational inputs (e.g., teacher salaries), and (c) structural or geographic factors such as school/district size and population density.

The goal of the ECM is to determine the relationship between spending and student outcomes across schools or districts while accounting for the various cost factors. The relationship between spending and student outcomes is circular, meaning that increased spending can drive student outcomes, but higher outcomes also may drive increased spending; for example, higher outcomes could make the district more attractive, leading to increased property values and higher amounts of locally raised revenue. The ECM uses appropriate statistical techniques to account for this circular relationship between outcomes and spending.

Education spending includes expenditures that contribute to those observed student outcomes that have been included in the model—thought of as the cost portion of spending—and expenditures not related to student outcomes—thought of as inefficiency. Specifically, districts

[22] Operational spending refers to expenditures devoted to the ongoing operation of schools and districts and excludes large-scale capital investments in buildings and land, which regularly require long-term financing. This is also frequently referred to as current spending.

may make investments that do not necessarily contribute to the outcomes under consideration. This can include significant investments in music or arts programming, athletics, or other extracurricular activities that may not directly affect student outcomes included in the models, such as those measured by standardized tests of student achievement. The ECM accounts for this potential inefficiency by including efficiency controls that predict increased spending behavior but do not contribute to higher outcomes. After accounting for these statistical complexities, we used our model to predict per-pupil spending levels needed (i.e., costs) for each school to achieve specific outcome targets. More technical detail regarding cost modeling is included in Appendix E.

In Step 2, we used school-level predicted cost estimates corresponding to a level of outcome that is considered adequate (defined later in this chapter) and subtracted portions of those costs that would be expected to be covered through funding sources outside of the state formula (e.g., federal funding). We then identified a smaller set of cost factors to be used as weights in a simulated funding formula that are commonly accounted for in state funding formulas and were significant predictors of cost in the ECM. Using this smaller set of cost factors, we fit a weight estimation model that relates these factors to the predicted costs. The weight estimation model produces a base per-pupil funding amount and a series of funding adjustments (or weights) for each factor included in the model. The base per-pupil funding amount represents the estimated per pupil funding amount needed for a district that faces none of the factors that put upward pressure on cost. An example is a large school in a low-cost area and with no students who are economically disadvantaged, ELLs, or SWDs. Although it is helpful to be able to conceptualize what the base funding amount represents, in practice all schools and districts have some characteristics and students for which weights apply, meaning that no school or district would actually be funded at the level of the base. Furthermore, although we estimate the cost function and weights estimation models at the school level, state funding formulas distribute funds to districts. Therefore, we demonstrate how the weight estimation model can be applied to districts to simulate a foundation aid formula.

Formula weights represent the differential funding amounts associated with a given cost factor. Formula weights estimated from our analyses have a simple interpretation as the percentage increase in funding required for providing opportunities for an adequate education when the associated cost factor is present (e.g., when a student is an English learner). For this report we have modeled additive weights so that our estimated weights are comparable to those included in Colorado's new funding formula (established by HB24-1448). Additive weights are centered on 0, meaning that weights greater than 0 result in additional dollars being provided for the given characteristic to which the weight applies. When additive weights are applied to the base, they result in an additional per-pupil amount added on top of the base amount. Weights for one category do not affect the magnitude of the per-pupil adjustments in other categories.[23]

In Step 3, the study team used the formula weights estimated in Step 2 to simulate per-pupil funding projections for each Colorado school district. The difference between these simulated funding projections and actual spending determines how far each district is from adequacy—the assumed funding needed to achieve target outcomes. This type of simulation, which is based on a formula derived from an empirically estimated ECM, can be translated directly into legislation and incorporated into state finance systems.

Application to Colorado

Using this process, we estimated two cost models. The first model is Colorado-specific and uses school-level data that is mostly publicly available on the CDE website. We estimate a second regional cost model that uses national data aggregated at the district level and includes Colorado as well as nearby states as a means to validate the Colorado-specific model. The Colorado-specific model has the advantage of using Colorado's data, which local stakeholders are familiar with and uses more up-to-date data (through the 2022–23 school year). In addition, for the Colorado-specific model, we incorporate multiple student outcomes using Colorado's data. Although the Colorado-specific ECM is based on school-level data, state funding policy provides dollars to districts. Therefore, in modeling weights and the application of a formula, we use district-level data. Our main results focus on the Colorado-specific model.

The second regional model has the advantage of using a large number of districts from multiple states, which increases the potential for variation in student needs and outcomes across districts. For statistical analyses underlying cost modeling, a larger number of observations (in this case, districts) and more variation in the variables used in the model can help produce more precise estimates of costs. However, the regional model relies on national data, which means that the measures used might not exactly match Colorado's own data. Furthermore, because of the time it takes to collect and process national data, the most recent school year represented in the national data underlying the regional model is 2020–21. We use the regional model as a point of validation to show that the results across the two models are consistent. Exhibit E–11 in Appendix E shows that the estimates from the Colorado-specific model and the regional model are strongly correlated with a correlation coefficient of 0.87. We present additional information about the regional model in Appendix E.

---

[23] In contrast to additive weights, multiplicative weights are centered on a value of 1, meaning that values greater than 1 represent additional funding for a given need category. Multiplicative weights are applied to both the base amount and all other weight categories, meaning that in districts with high proportions of students in multiple weight categories, the effect of the weights is compounded.

Setting Outcome Targets

Prior to estimating the cost model, we must set an outcome target at which we will estimate spending. The outcome measure used in the cost-function model is the outcome factor score, which we described in Chapter 4 on student outcomes.[24] For the cost-function modeling analysis completed for this chapter, we decided to estimate spending at both the existing average outcome level (an outcome factor score of close to 0) and at a more ambitious outcome level that more closely aligns with state goal (an outcome factor score of 1). We do this to demonstrate how costs increase when goals and the resulting performance targets increase. Then, for the purpose of modeling weights and showing the resulting funding needed to achieve adequacy, we focus on the high outcome estimates (based on achieving an outcome factor score of 1), as these most closely align with the state's reported goals.

Results of Education Cost Modeling

This section presents the results from our Colorado-specific ECM. It provides insights into the funding deficits that need to be addressed to achieve adequate educational outcomes. Our study contributes to the ongoing discourse on education funding and offers valuable recommendations for policymakers.

The Cost of Providing Opportunities for an Adequate Education (Step 1)

Exhibit 31 presents results from the Colorado-specific ECM. The ECM suggests that improving student outcomes to meet the state's goals will, on average, require schools to spend more than they do now. In addition, the ECM suggests that schools with higher shares of students experiencing economic disadvantage, SWDs, and ELLs must spend more to educate these students so that they attain outcomes similar to their peers.

Furthermore, compared with larger schools, small schools have higher per-pupil costs, and costs increase for schools with higher shares of middle and high school students. Population density was not found to have any statistically significant effect on influencing the direction of cost; however, this finding is likely due to the strong relationship between school size and rurality (sparsely populated areas). Slightly over half of all schools in the smallest school size category are in a rural locale, and slightly less than two thirds of rural schools are categorized as schools with the smallest level of student enrollment (Exhibit E–12 in Appendix E).

---

[24] In Chapter 4, we reviewed student outcomes in comparison to the state's goals as defined in the state ESSA plan and benchmarks for proficiency and college and career readiness. We also compared Colorado's performance on the NAEP assessment to performance benchmarks and to other states. We concluded that Colorado is not currently meeting the educational goals it has set for itself and the average student in Colorado is not meeting state benchmarks for proficiency or college and career readiness. In addition, we showed that schools performing around 1 SD above average on the outcome factor score are performing at levels that align with state goals.

Exhibit 31. Summary of Relationship Between Cost Factors and Costs in the Colorado Cost Model

Cost factor characteristic	Relationship to Cost
Student outcomes	↑
Economic disadvantage (based on FRL)	↑
Special education	↑
English language learners	↑
Small schools	↑
Sparsely populated areas (population density)	↔
Upper-grade levels	↑
Geographic price differences	↑

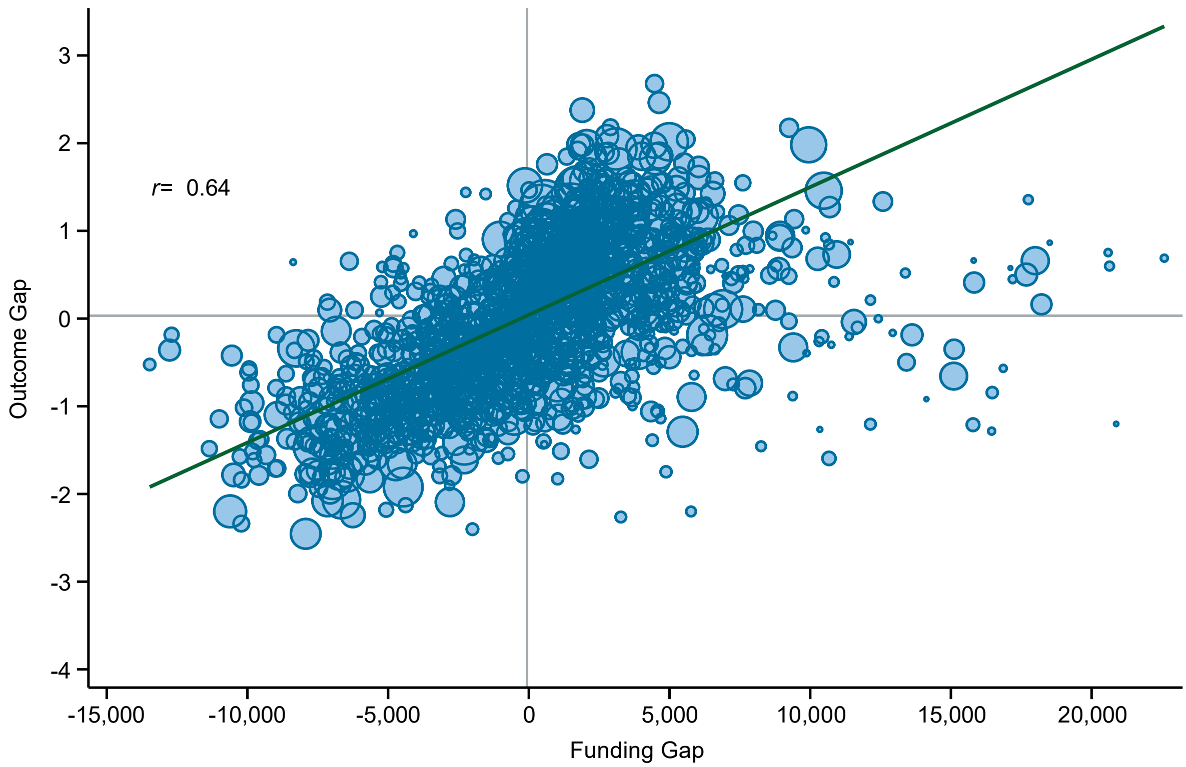
Note. FRL = free or reduced-price lunch. Arrows represent the relationship of the given cost factor characteristic with costs. Arrows pointing up (↑) represent a statistically significant increase in cost with an increase in the given characteristic. Double-headed horizontal arrows (↔) represent no significant relationship. Arrows pointing down (↓) represent a statistically significant decrease in cost with an increase in the given characteristic. Calculations for the Colorado model are based on data from the CDE, the U.S. Department of Education, and the U.S. Census Bureau.

We used the results from the ECM to estimate the amount of spending needed to achieve a target outcome level—the *cost*. As described in the "Setting Outcome Targets" section of this chapter, we estimated costs at two different target outcome levels, the current average outcome level of the state and a high outcome target that more closely aligns with the state's documented education outcome goals and college and career readiness benchmarks. Exhibit 32 shows the estimated funding deficits (the differences between actual spending and estimated cost) based on the average outcome model compared to actual outcomes to assess the validity of our model. The expectation is that schools with spending levels above their predicted costs should, on average, have higher outcomes than the target outcome level, and outcomes for schools with spending levels below their predicted costs should, on average, be lower than the outcome target in a valid model.[25] Exhibit 32 helps validate our model by showing that schools that generally spend more than necessary, according to the model, to reach the target outcome level (i.e., the right side of the plot) tend to have above-average outcomes. Furthermore, schools that spend less than needed to achieve the target outcome level typically have lower-than-average outcomes. Additional validation of our model is reflected in a reasonable, strong correlation of 0.64 between spending adequacy as reflected by the funding gap and actual

[25] For this analysis, the target level has been set at the state average, which is an outcome factor level of 0. Using an outcome target of 1 (the high outcome target) would shift the plotted schools down and to the left, meaning that more schools would be performing below the target and would have spending levels below the cost of achieving the target outcome.

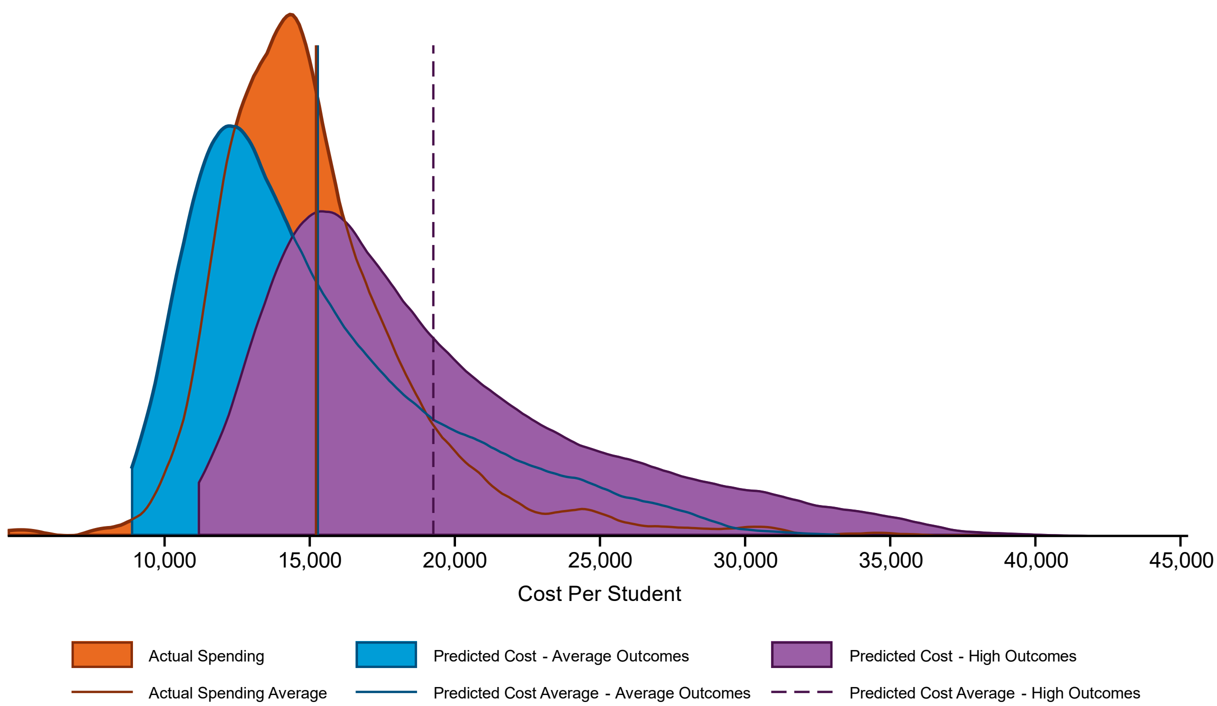
outcomes for the 2022–23 academic year. In other words, if the positive relationship between relative outcomes and the funding gap did not exist that would invalidate our model. The cost-function method relies on the assumption, which is demonstrated in Exhibit 32, that schools not achieving the target outcome require additional resources and funding, on average, to achieve a given outcome level.

Exhibit 32. Outcome Gaps Versus Funding Gaps (2022–23)



To further investigate the resulting cost estimates from the Colorado ECM, we show the distributions of those costs per pupil across schools in Exhibit 33 using target outcomes defined at both the statewide average and a high outcome that aligns with state goals. We also compare the distributions of predicted costs with the distribution of actual spending. Given that the state currently achieves average outcomes, if our model works as expected, the estimated costs necessary to achieve average outcomes should be approximately the same as actual spending. That is, indeed, what we find. The overall averages of both spending and predicted costs at average outcomes are just above $15,000 per pupil, with predicted costs for most schools between $10,000 and $22,000 per pupil. The lowest predicted costs at average outcomes are just over $9,000 per pupil, which aligns with the lowest levels (bottom 1%) of actual spending. The highest predicted costs at average outcomes are slightly below $30,000 per student, which aligns with the highest levels (top 1%) of actual spending. Thus, the variation and range in predicted costs across schools are reasonable compared to actual spending.

Exhibit 33. Cost Estimates Using Targets of Average and High Outcomes Compared With Actual Spending (2022–23)



Statistic	Actual spending per student	Predicted cost per student: average outcomes	Predicted cost per student: high outcomes
Mean	$15,214.56	$15,280.08	$19,258.12
Standard deviation	$3,554.19	$4,450.42	$5,609.04
Bottom 1% of spending	$9,456.74	$9,236.83	$11,641.56
Top 1% of spending	$28,678.80	$27,896.45	$35,159.04
Minimum value	$4,595.61	$8,841.92	$11,143.84
Maximum value	$38,780.32	$33,263.41	$41,923.29

However, as discussed in the section on setting outcome targets, defining an adequate target outcome as the current state average is inconsistent with the state's educational goals. As seen in Exhibit 33, when we raise the outcome target to a level more commensurate with state goals (the purple distribution), the costs to achieve the outcome target increase. Specifically, raising the outcome goal from the state average to 1 *SD* above the current average shifts the distribution right, and the average cost increases by about $4,000 per student from approximately $15,000 to $19,000 per student. Based on the predicted costs and statewide enrollments from 2022–23, an additional $4.1 billion in spending would be needed to achieve the higher outcome target compared with the existing average outcome level.

Modeling Weights and Simulating a Funding Formula (Step 2)

We selected a set of variables that proved to be significant predictors of spending to convert the cost predictions into weights that can be incorporated into a funding formula. The selected variables are commonly represented in state funding formulas and include[26]

- the proportion of economically disadvantaged students (defined by FRL rates),
- the proportion of ELLs,
- the proportion of SWDs,
- indicators of school size based on student enrollment, and
- percentages of students by grade level.

Next, we excluded federal funding from the cost predictions stemming from the ECM to isolate the portion of the cost targets that would be allocated through a state funding system. Federal funding is typically targeted to districts through established federal formulas and would not be accounted for in a state-level education funding formula.[27]

We estimated a second set of models using the smaller selection of variables described above to estimate funding weights. We confirmed that the models using the smaller set of variables effectively estimate the costs generated from the full ECM. In particular, the weight estimation models for Colorado closely explain 96% of the variation in the cost estimates, indicating that the simulated funding amounts based on the weight estimation model accurately estimate the required funding needed to provide adequacy and equal opportunity.

[26] The set of variables chosen for the weight estimation model reflect the formula weights in Colorado's new funding formula established by HB24-1448. The only formula weight from Colorado's new funding formula not included in the model are locale weights for rurality. The reason locale weights for rurality were not included is because the school size variables also pick up the effect of rurality in addition to representing the higher costs of education for smaller schools due to the economies of scale. In the sample, 64% of rural schools had fewer than 300 students enrolled, and 51% of schools with fewer than 300 students enrolled were in a rural locale (See Exhibit E–12 in Appendix E).

[27] To exclude federal funding, we used regression analysis to generate a predicted amount of spending from federal sources for each school based on years prior to 2020. We used predictions from the pre-2020 period because federal education funding has increased drastically in response to the Covid-19 pandemic. Our assumption is that federal funding will return to pre-Covid-19 levels. In response to the expiration of Covid-19 federal funding, state and local funding will have to increase to avoid reductions in spending.

Exhibit 34. Weight Estimation Regression Models

Weight categories	A. Average outcomes	B. High outcomes
Student needs		
At-risk (FRL) proportion	1.05	1.07
SWD proportion	1.19	1.20
ELL proportion	1.28	1.28
Grade range		
Middle school enrollment proportion	0.12	0.12
High school enrollment proportion	0.36	0.36
School enrollment		
<300	0.45	0.46
300 to <450	0.19	0.19
450 to <600	0.12	0.12
600 to <800	0.08	0.07
Geographic cost (CWIFT)	1.05	1.05
Base funding	6,648	8,443
Number of school-by-year observations	9,654	9,654
Number of unique schools	1701	1701
Pseudo R^2 / R^2	0.959	0.960

Exhibit Reads. An increase in the low-income student proportion from 0 to 1 (i.e., from no low-income students to 100% low-income students) is associated with an additional target funding level of 105% of the base funding level, on average, to base funding when using an average-outcome target. The weights presented are additive.
Note. FRL = free or reduced-price lunch eligible, SWD = students with disabilities, ELL = English language learner Additive weights shown are from an Ordinary Least Squares regression, where regression coefficients were expressed in dollar terms. Weights were calculated by dividing the coefficient by the base funding amount. Models also include year-specific indicator variables (where Fiscal Year 2023 serves as the reference group for all models). The base funding represents target funding per pupil in Fiscal Year 2023, when there are no students represented in the other weight categories and the geographic cost (CWIFT) is set to zero. Regression models are weighted by enrollment. The reference enrollment category is schools with more than 800 students. The grade range weights are interpreted relative to enrollment in elementary grades. Data are from the CDE and the U.S. Department of Education.

Exhibit 34 shows the results of the Colorado-specific weight estimation models: Model A estimates the base and weights needed to achieve the current average level of outcomes. Model B estimates the base and weights needed to achieve a higher target outcome level (i.e., an outcome factor score of 1). To more closely align with Colorado's new school funding formula—established by HB24-1448—we use additive weights in the weight estimation models. The additive weights represent the proportion of the base per-pupil cost needed to supplement the base cost when the associated cost factor is present (e.g., when a student is an ELL) to provide opportunities for an adequate education. For example, an additive weight of 1.05 means that the base cost needs to be supplemented with an additional funding level equivalent to 105% of the base cost (or the base cost multiplied by 1.05). Likewise, an additive weight of 0.45 means that an additional funding level equivalent to 45% of the base cost (or the base cost multiplied by 0.45) is needed to supplement the base cost. Although these can be considered weights for individual students, the weight and proportion of students for each category in schools or districts affect respective funding level projections when aggregated to the school or district.

Comparing both models, we see that the weights are nearly identical. The main difference between the average-outcome and high-outcome models is a higher base for the high-outcome model. For the average-outcome model, the base amount is $6,648 per student; for the high-outcome model, the base amount is $8,443 per student (see *base funding* in Exhibit 34). This is a difference of just under $1,800 per student. The base amount represents the funding provided when all additional needs and contextual variables are at zero. Thus, the base represents the per-student amount for a school defined as follows:

- Has only students in the elementary grades
- Has an enrollment greater than 800 students
- Has no students with additional needs
- Is in the lowest cost geographic area of the state

The weights represent the additional funding, in terms of proportions of base funding, needed to supplement the base funding level and can be interpreted individually as student weights for associated cost factors. For example, a weight of 1.20 for the proportion of SWDs means that along with the base cost, a student with disabilities costs an additional 120% of the base cost. Using the high outcomes base funding of $8,443, the student with disabilities costs an additional 120% of $8,443, or $10,132, to the $8,443 base for an amount equal to $18,575.

Although the weights can be interpreted as student weights, in practice they will be applied to estimate the funding levels needed for school districts based on the proportions of students that apply to given weight categories. Exhibit 35 illustrates how the weights and base from the high-outcome model can be applied as a formula to project the funding needed for a high school in Colorado in 2022–23. In step 1 of the formula, we convert each weight to an *effective weight*, which accounts for the proportion of students for which the weight category applies.

$$Effective\ Weight_c = Weight_c * Student\ Proportion_c \quad (1)$$

For example, in the hypothetical high school represented in Exhibit 35, 32% of the students are at-risk, meaning they qualify for FRL. The weight is multiplied by the student proportion to calculate the effective weight:

$$Effective\ Weight_{At-Risk} = 1.07 * 0.32 = 0.342$$

The effective weight can be converted into an additional dollar amount per pupil specific to that weight by multiplying the effective weight by the base, which results in an additional $2,887 per pupil for this high school as a result of the at-risk weight and the proportion of students in the high school who are at risk. For weight categories that are school characteristics, such as school enrollment, the student proportion for a given school will likely be 1 or 0 because the school will fall into only one enrollment category. For example, the high school presented in Exhibit 35 only enrolls students in the typical high school (9^{th} to 12^{th}) grades, so its high school enrollment proportion is 1 (and the middle school proportion is 0). As a result, the effective weight for the high school enrollment proportion is equivalent to the weight and the middle school effective weight is 0. Geographic cost is not a student proportion but ranges between 0 and 0.26, in which the lowest cost areas in the state have a value of 0, and the highest cost areas have a value of 0.26.

As an alternative to identifying the additional cost individually for each weight, the sum of all effective weights can be calculated as the *needs index* (Formula Step 2). The needs index is helpful because it describes the relative differences in student needs and additional funding across schools accounting for all weight categories.

$$Needs\ Index = \sum_{c=1}^{C} Effective\ Weight_c \tag{2}$$

Summing all effective weights in Exhibit 35 results in a needs index for this school of 0.999, meaning that the additional cost for this school accounting for all weight categories is equal to the base cost (or that the total target funding level is double the base cost). More specifically, total target funding per pupil can be calculated by multiplying the needs index by the base per pupil amount and adding the resulting product to the base (Formulas Step 3).

$$Target\ Funding\ Level = (Needs\ Index\ \times\ Base) + Base \tag{3}$$

The additional funding amount is 0.999 multiplied by the base amount ($8,443), or $8,434, for a target funding level of $16,877.

$$Target\ Funding\ Level = (0.999\ \times\ \$8{,}443) + \$8{,}443 = \$16{,}877$$

Exhibit 35. Example Application of a Weighted Student Formula for a Colorado High School Using the High Outcomes Weights Model

Weight categories	Weight	Student proportion	Effective weight	Additional cost per pupil
Student needs				**(base × effective weight)**
At-risk (FRL) proportion	1.07	0.32	0.342	+$2,891
SWD proportion	1.20	0.08	0.096	+$811
ELL proportion	1.28	0.05	0.064	+$540
Programming/grade range				
Middle school enrollment proportion	0.12	0	0	$0
High school enrollment proportion	0.36	1	0.36	+$3,039
School enrollment				
<300	0.46	0	0	$0
300 to <450	0.19	0	0	$0
450 to <600	0.12	0	0	$0
600 to <800	0.07	0	0	$0
Geographic cost (CWIFT)	1.05	0.13	0.137	+$1,152
Base x Needs index (sum of all effective weights)			**$8,443 x 0.999**	**= + $8,434**
Per-pupil funding = (base × needs index) + base			**$8,434 + $8,443**	**= $16,877**

Note. FRL = free or reduced-price lunch eligible, SWD = students with disabilities, ELL = English language learner

Since state funding formulas distribute dollars to districts, we simulate projected funding at the district level (Exhibit 36). Specifically, for the student needs weight categories, we use the student proportion for the entire district for a given category rather than for an individual school. For the programming/grade range, the student proportions reflect the proportion of students in the district who are enrolled in the middle and high school grades rather than elementary grades. Unlike weight estimation at the school level, district-level student proportions will typically not be 0 or 1 but a fraction in between since districts typically enroll students within each grade range. Likewise, school enrollment size categories will likely consist of student proportions between 0 and 1, as districts usually are made up of multiple schools and a district’s schools may fall within multiple school enrollment categories.

Exhibit 36. Example Application of a Weighted Student Formula for a Colorado School District Using the High Outcomes Weights Model

Weight categories	Weight	Student proportion	Effective weight	Additional cost per-pupil
Student needs				**(base × effective weight)**
At-risk (FRL) proportion	1.07	0.282	0.302	+$2,548
SWD proportion	1.20	0.095	0.114	+$963
ELL proportion	1.28	0.052	0.067	+$562
Programming/grade range				
Middle school enrollment proportion	0.12	0.226	0.027	+$229
High school enrollment proportion	0.36	0.322	0.116	+$979
School enrollment				
<300	0.46	0.038	0.017	+$148
300 to <450	0.19	0.230	0.044	+$369
450 to <600	0.12	0.229	0.027	+$232
600 to <800	0.07	0.124	0.009	+$73
Geographic cost (CWIFT)	1.05	0.130	0.137	+$1,152
Base x Needs index (sum of all effective weights)	**$8,443 x 0.859**			**= + $7,254**
Per-pupil funding = (base × needs index) + base	**$7,254 + $8,443**			**= $15,697**

Note. FRL = free or reduced-price lunch eligible, SWD = students with disabilities, ELL = English language learner

The hypothetical district has student proportions of 0.226 and 0.322 students enrolled in the middle and high school grades, respectively. Likewise, the student proportion for each of the school enrollment categories differs based on the proportion of the district's students that attend schools that fall into each category. The needs index for the district is 0.857, meaning that the cost for this district is the base per-pupil cost of \$8,443 in addition to the supplemental cost of 0.857 multiplied by the base amount, or \$7,235.65, for a target funding level of \$15,678.65. This is calculated as:

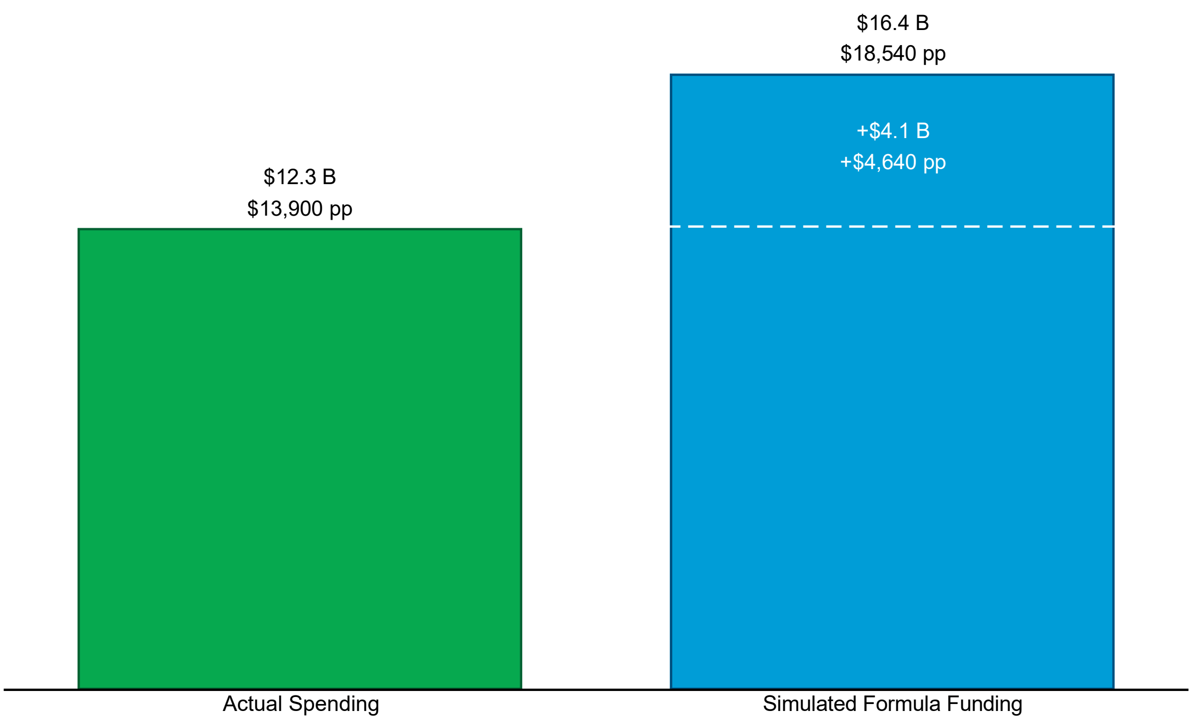
$$Target\ Funding\ Level = (0.857\ \times\ \$8{,}443) + \$8{,}443 = 15{,}678.65$$

Formula Simulation Results (Step 3)

In this section, we use the results from the high-outcome Colorado-specific model to simulate how state and local funding would be distributed across districts when applying the weights specified above based on the high outcomes weight model. We then compare those funding levels to actual spending levels, excluding spending from federal sources.

The statewide simulated state and local funding levels for achieving the higher outcome target in 2022–23 would be $18,450 per student, requiring a $4,640 increase in state and local funding per student from state and local sources (Exhibit 37). This translates to about $4.1 billion in additional funding from 2022–23 funding levels, or about a 33% increase in state and local funding.

Exhibit 37. Comparison of Total Simulated Formula and Actual Current Spending From State and Local Sources (2022–23)



Note: B = billions in total expenditures; pp = per pupil.

In Exhibit 38, we show results of our recommended base and weights applied to the 2025–26 enrollment projections for Colorado.[28] As shown, the projected formula funding for the 2025–

[28] Colorado's funding projection worksheets were downloaded from here: https://www.cde.state.co.us/cdefinance/fiscalyear2025-26schoolfinancfunding

26 is about $1.7 billion more than what we estimated for 2022–23 (in Exhibit 37). This is the result of inflating the base per pupil amount three additional years, using the state's applied inflation rates in 2023–24 through 2025–26. The result is a base per pupil amount of $9,842. In Exhibit 38, we also break down the formula funding according to the formula components included in our weight estimation model (see Exhibit 34). We show that 44% of the formula funding is allocated through the base per pupil amount and 24% of funding is allocated through the at-risk funding weight. The remaining formula components are each responsible for about 5%–8% of the total formula funding.

Exhibit 38. Projected Funding Formula Amounts for 2025–26

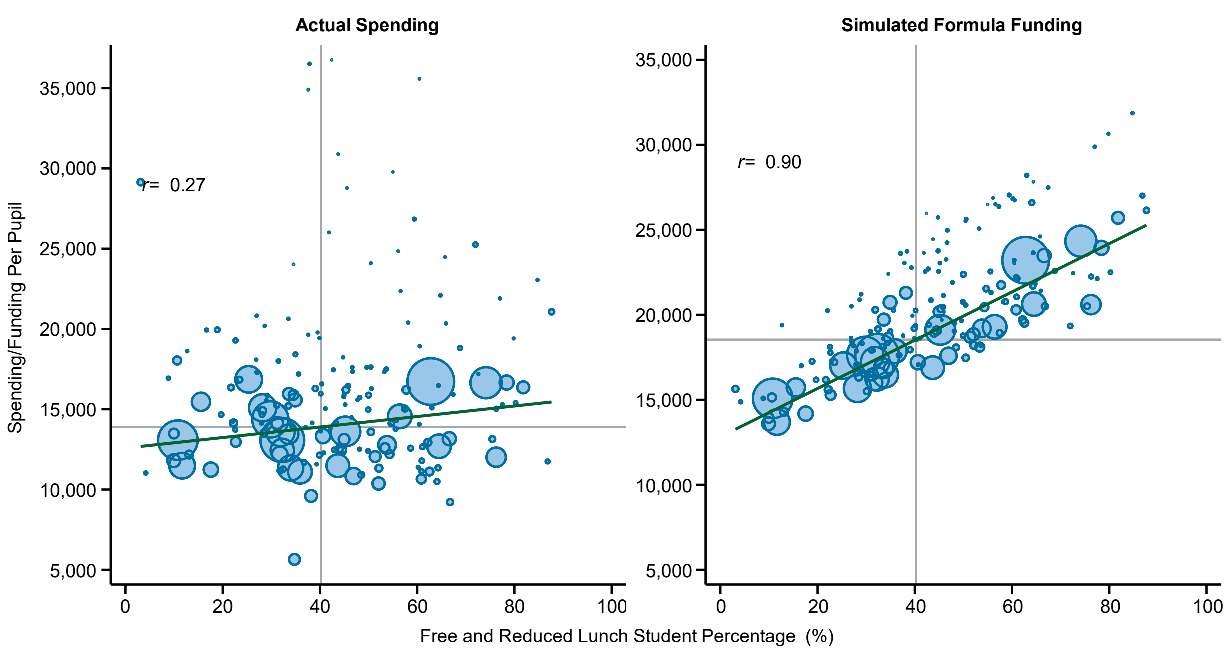
Formula Component	Statewide Totals	Amount per Pupil	Percentage
Base Funding	$7,975,024,221	$9,842	44.0%
At-Risk	$4,323,148,008	$5,335	23.9%
ELL	$861,661,442	$1,063	4.8%
Special Education	$1,358,828,256	$1,677	7.5%
School Size	$1,006,026,020	$1,241	5.6%
Grade Level	$1,113,908,035	$1,375	6.2%
CWIFT	$1,471,581,080	$1,816	8.1%
Formula Subtotal	**$18,110,177,061**	**$22,349**	**100.0%**
Multidistrict Online	$291,100,725		
Extended High School	$21,577,030		
Total	**$18,422,854,816**		

Note: The base per-pupil amount for 2025–26 was inflated from the high-outcome base for 2022–23 (Exhibit 34) based on the inflation rates applied by the state for 2023–24 through 2025–26. The amounts for multidistrict online and extended high school are simply what the state has projected, and we did not change those amounts. Amounts per pupil are calculated by dividing by the projected 2025–26 statewide funded enrollment counts not including multidistrict online and extended high school enrollment used in the HB24-1448 funding projections. The percentage is calculated by dividing the total for a given formula component by the formula subtotal, not including multidistrict online or extended high school.

In Exhibit 39, we compare the distribution of actual spending per pupil with respect to the shares of students eligible for FRL to the distribution of simulated funding based on the weights model based on the 2022–23 estimates. The relationship between actual expenditures and student FRL percentage lacks a clear direction. Although there is a progressive distribution of spending with respect to low-income student percentage, the correlation coefficient of 0.27 indicates the relationship between actual spending and the incidence of low-income students is neither clear nor strong. If funding were distributed according to the simulated weighted funding formula—which reflects the costs necessary to achieve the high-outcome target—it would look like the pattern on the right side. In this scenario, districts with higher concentrations of FRL would be spending systematically more than districts with lower concentrations of FRL.

The correlation coefficient of 0.90 indicates a significantly stronger relationship between cost-driven funding designed to provide equal educational opportunities and shares of economically disadvantaged students. There is a substantially greater cost of providing equal opportunities to achieve a high-outcome target in districts with higher proportions of FRL compared to those with lower proportions of FRL. Notably, when using a high-outcome target, districts with the lowest percentages of FRL-eligible students would receive comparable simulated funding amounts to their current spending levels, on average (approximately $13,000–15,000 per student). In contrast, districts with higher percentages of FRL-eligible students receive commensurately more than their current spending levels to provide equal opportunities for an adequate education. Whereas the highest FRL districts spend just over $15,000 per student, on average, the simulated funding formula suggests they need almost $20,000 per pupil to be provided with the opportunity to achieve the high-outcome target.

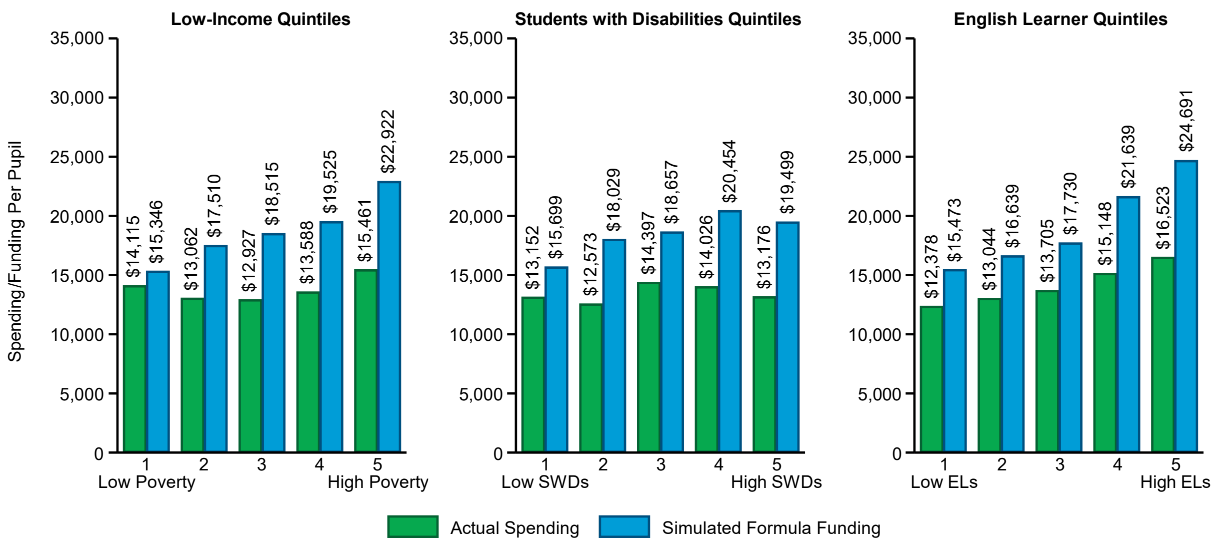
Exhibit 39. Comparing Distributions of Actual State and Local Spending and Simulated Formula Funding With Respect to Low-Income Enrollment Percentages (2022–23)



Note. The gray lines show statewide averages of both variables. The enrollment-weighted correlation coefficient is represented by *r*. Calculations are based on data from the CDE and the U.S. Department of Education.

Exhibit 40 compares actual spending and costs for districts grouped into quintiles from low to high shares of students eligible for FRL, SWDs, and ELLs.[29] Each bar represents approximately 20% of the 177 districts included in our analytic data set for the 2023 school year. The left-most panel shows districts grouped by FRL quintile. Examining actual spending, there is no clear pattern across FRL quintiles. The typical district in the highest FRL quintile currently spends $1,346 per student, or about 9.5%, more per pupil than a typical district in the lowest FRL quintile. However, districts in Quintiles 2, 3, and 4 spend less, on average, per student than districts in Quintile 1. Thus, there is no meaningful progressive relationship between actual spending and economic disadvantage as represented by FRL.

Exhibit 40. Comparing Actual State and Local Spending and Simulated Formula Funding Across Student-Need Quintiles (2022–23)



Note. Calculations are based on data from the CDE and the U.S. Department of Education.

In contrast, simulated funding steadily increases from the lowest to highest poverty quintiles. The difference between the simulated funding and actual spending steadily increases, moving from the quintile with the lowest percentages of students from low-income families to the quintile representing the districts with the highest percentages of students from low-income families. Specifically, for Quintile 1, the difference is just over $1,200 per student or about 9% above existing spending levels. For Quintile 5, the difference is almost $7,500 per student, representing an increase of almost 50% compared with actual spending. We find that the

[29] See Exhibits E-4 through E-6 in Appendix E for tables showing the average characteristics of districts in each of the student-need quintiles.

typical highest FRL district should be spending $7,576 per student, or 49% more, than the typical district in the lowest FRL quintile.

The middle panel provides a similar analysis by organizing districts based on their share of SWDs. In Quintile 1, the average simulated cost per student is about $2,547 more (19%) than the average actual spending per pupil in those same districts. In districts with the largest shares of SWDs (Quintile 5), average current spending falls short by almost $6,323 (48%) per pupil. The overall pattern in actual spending across SWD quintiles is relatively flat, with districts with the highest shares of SWDs spending nearly the same, on average, as districts with the lowest shares of SWDs. However, the cost-based formula would provide the highest SWD districts with $3,800 (24%) more funding per pupil, on average, compared with districts in the lowest SWD quintile. It is interesting that Quintile 4 has a slightly higher simulated funding level than Quintile 5. However, Quintile 4 based on SWDs has 7% higher average FRL and ELL rates than Quintile 5 (Exhibit E-5 in Appendix E). Thus, the slightly higher projected funding for a typical district in Quintile 4 for SWDs than Quintile 5 reflects the higher FRL and ELL rates for students in a typical Quintile 4 district, on average.

The right-most panel presents the distribution of actual spending and formula funding for quintiles of districts grouped by their share of students who are ELLs. The quintiles by ELL are the only student needs quintiles where actual spending increases systematically by quintile. The typical district within the highest ELL quintile spends $4,145 per student, or about 33%, more per pupil than the typical district within the lowest ELL quintile. Although this represents a relatively progressive relationship between spending and the percentage of ELLs, the results of the simulated formula funding indicate that this contrast should be far stronger to achieve equal educational opportunities. Specifically, our formula funding would provide $9,218 (60%) more on average in the highest ELL quintile compared with the lowest ELL quintile. The gaps between the cost-based formula funding and current spending are larger, on average, for districts with higher ELL percentages. Districts with the smallest shares of ELLs presently spend 3,095 (25%) less, on average, than our formula funding would provide, and districts with the largest shares of ELLs spend $8,168 (49%) less, on average, than our formula would provide.

In summary, across all three student need dimensions, the cost-based model suggests that funding/spending must be more strongly related to student needs of districts. Additional funding is needed overall; however, the most substantial increases in funding are needed in districts serving larger shares of students from low-income families, SWDs, or ELLs.

Those attending townhall meetings shared their views on the adequacy of school funding.

[The amount of funds for public education is] too low, and it's been too low for a long time. I think the reason why we're here [at this townhall] is because we're thinking, 'even though I'm in a metro area, there hasn't been enough funding to meet needs and adequate needs.'

—Metro Area Region Townhall Attendee

I think the current local public funding is not enough for the number of programs that we're trying to deliver through public education. It could be the right level if there weren't as many obligations to public schools.

—Northwest Area Region Townhall Attendee

It's not fair to just reallocate funds. We need more funds at this point.

—Statewide Townhall Attendee

Chapter Conclusion

Our analysis reveals that achieving higher student outcomes requires significantly more funding than current spending levels. Furthermore, the findings underscore the need for targeted funding to address the diverse needs of students and ensure equitable educational opportunities for all. Districts with higher shares of low-income students, SWDs, and ELLs face higher costs to achieve common outcome levels, compared to districts with lower incidences of these student needs. The current school funding system does not sufficiently differentiate funding to meet the higher costs represented in districts with high-need student populations. This study contributes to the ongoing discourse on education funding by providing a detailed analysis of the cost factors influencing education spending in Colorado. Our model provides a valuable tool for estimating the funding needed to meet these goals and highlights the disparities in funding requirements across different school populations. By understanding the specific cost factors that influence education spending, Colorado's policymakers can make more informed decisions about resource allocation to ensure that all students can achieve adequate educational outcomes.

6. Efficiency and Resource Use

One of the limitations of cost-function modeling is that it does not provide information on how schools should spend their funding to improve student outcomes. We address this limitation by identifying schools that are more or less efficient and examining whether more efficient schools use resources differently (i.e., make different choices in how to spend their funds) than less efficient schools.

Approach to Examining Resource Use in Relation to Efficiency

In this study, efficiency is defined as the extent to which schools outperform expectations given their level of fiscal resources, school demographics, and other characteristics. Efficiency is measured by an efficiency index, calculated by regressing the difference between a school's actual spending and predicted spending on the difference between the school's actual student outcomes and target student outcomes while controlling for school demographics and characteristics. Conceptually, referring to Exhibit 25 in Chapter 5, schools above the fitted green line have higher student outcomes than expected based on their actual spending levels and show high efficiency in producing student outcomes given their spending levels relative to the predicted cost for the given school. In contrast, schools below the green line in Exhibit 25 have lower-than-expected student outcomes based on actual spending and exhibit low efficiency in producing student outcomes given the school's relative spending level. Our regression model adds some additional complexity compared to this conceptual example by also accounting for differences in school demographics and school characteristics (see Exhibit F-1 in Appendix F for the regression results).

Using the regression model, we estimated the residual error for each school, which represents the difference between actual outcomes from expected outcomes based on the regression, and we standardized the residuals by year. For our analysis, we use the efficiency index to categorize schools as having low, average, or high efficiency in utilizing funds to improve student outcomes. Schools below 0.5 standard deviations from the mean for the efficiency index were classified as having low efficiency. In contrast, schools within one standard deviation around the mean were considered to have average efficiency and schools over 0.5 standard deviations above the mean for the efficiency index were assigned to the high-efficiency category.

Exhibit 41 shows that school demographics and characteristics are consistent across efficiency categories in the 2022–23 academic year. The mean proportion of ELL and SWDs enrolled are nearly the same across the three categories and close to the 12% state average of ELLs and SWDs for 2022–23. In addition, the mean FRL percentage in each category is close to the state average of 40% enrollment in FRL programs. Schools across efficiency categories also do not differ substantially in terms of median enrollment. One difference, however, is that the high-efficiency category has a slightly lower average proportion of students in middle school and a slightly higher proportion of high school students than the low- and average-efficiency categories.

Exhibit 41. School Demographics and Characteristics, by Efficiency Category (2022–23)

Variable	Low efficiency (*n* = 472)	Average efficiency (*n* = 673)	High efficiency (*n* = 443)
Mean ELL proportion	0.13	0.13	0.12
Mean FRL proportion	0.42	0.42	0.36
Mean SWD proportion	0.12	0.13	0.12
Mean middle school % enrollment	0.24	0.26	0.17
Mean high school % enrollment	0.27	0.26	0.39
Median student enrollment	561 students	565 students	612 students

Note. FRL = free or reduced-price lunch eligible, SWD = students with disabilities, ELL = English language learner

After measuring efficiency and identifying schools with different efficiency levels, we analyzed the use of resources at the school level by examining the relationship between a school's efficiency and its staffing of certain administrative, support, and instructional positions. Specifically, we investigated the association and impact of teacher and principal average salary, experience, and student-to-teacher and paraprofessional ratios on school efficiency.

Efficiency and Resource Use Results

Exhibit 42 presents the means for each of our staffing variables of interest in low, average, and high-efficiency schools, with the final column showing the average difference between the high- and low-efficiency categories along with an indicator (*) for whether the difference is statistically significant based on an ANOVA test. High-efficiency schools have higher average teacher and principal salaries and experience than average or low-efficiency schools. In addition, high-efficiency schools have student-to-teacher (full-time equivalent) ratios close to the overall sample mean (approximately 17:1), whereas low-efficiency schools have a slightly higher average student-to-teacher ratio of 18:1, although the difference is not statistically significant. Lastly, high-efficiency schools tend to hire fewer paraprofessionals for a given student population, resulting in a larger paraprofessional-to-student ratio than low-efficiency schools.

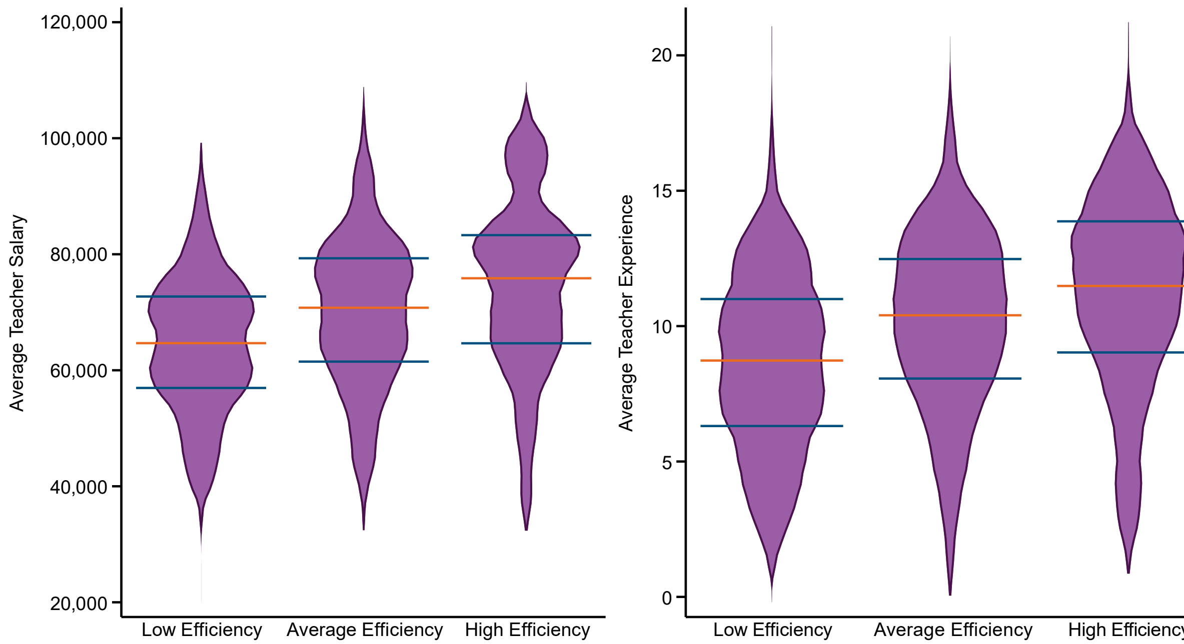
Exhibit 42. Staffing Resource Use, by Efficiency Category (2022–23)

Variable	Low efficiency	Average efficiency	High efficiency	Total sample mean	Mean difference between high and low efficiency
Average teacher salary	$64,317	$69,931	$74,489	$69,740	$10,172 (+16%)*
Average teacher experience (years)	8.6	10.1	11.1	10.0	2.5 (+29%)*
Average principal salary	$106,685	$111,763	$114,807	$111,294	$8,122 (+8%)*
Average principal experience (years)	11.9	13.0	13.6	12.9	1.7 (+14%)*
Student to teacher (FTE) ratio	18.1:1	16.8:1	17.5:1	17.4:1	-0.54 (-3%)
Student to paraprofessional (FTE) Ratio	75.0:1	70.6:1	90.6:1	77.7:1	15.6 (+21%)*
N	456	659	448	1563	

Note. * Mean difference between high and low efficiency is statistically significant based on a Bonferroni significance test estimated using ANOVA, $p < .05$.

In Exhibit 43, we show the distributions of average teacher salary and teacher experience in each efficiency category using violin plots. The width of the purple shaded area is indicative of the density of observations at given level of average salary or teacher experience, meaning that a given teacher salary or teacher experience is more common where the shape is widest. The horizontal blue lines represent the 25th and 75th percentiles of the distribution, and the horizontal orange line displays the median. As shown, the distributions shift upward as efficiency increases. The 25th, 50th, and 75th percentiles each increase moving from lower to higher efficiency categories. This indicates that higher average teacher salary and teacher experience in high-efficiency schools are not the product of a small number of schools with exceptional salary or experience levels but are a systemic shift toward higher teacher salaries and experience levels.

Exhibit 43. Distribution of Average Teacher Salary and Average Teacher Experience Across Schools, by Efficiency Category (2022–23)



Note. The horizontal blue lines denote the 25th and 75th percentiles, and the horizontal orange line denotes the 50th percentile.

Exhibit 44 presents the regression of the resource variables of interest on the efficiency index while controlling school demographics and characteristics. As opposed to the comparisons of means across efficiency groups, here we account for the resources levels of multiple staffing variables simultaneously. The estimates for school demographics and characteristics are not found to be statistically significant in the model, indicating the measure of efficiency does not substantially vary by these factors. By contrast, several of the staffing resource variables are statistically significant. We find that higher average teacher salary and experience have statistically significant positive associations with increased efficiency in improving student outcomes through spending. In addition, a higher student-to-teacher ratio is negatively associated with efficiency. In other words, hiring more teachers for a given number of students (likely resulting in smaller class sizes) improves efficiency. Collectively, these findings highlight the importance of the teacher workforce in producing better student outcomes. Schools that staff more experienced teachers, pay a more competitive salary to attract and retain effective teachers, and/or hire more teachers potentially produce better student outcomes.

In contrast, paying principals a higher salary and having more experienced principals does not seem to be related to increased efficiency when holding the teacher staffing variables and other school demographics and characteristics constant. In fact, paying principals a higher salary may result in lower efficiency in student outcome production. The two variables describing pay and staffing levels of paraprofessionals were not statistically significant.

Exhibit 44. Efficiency Regression for 2022–23

Variable	OLS estimate outcome: Efficiency
Log average teacher salary	0.526***
Average teacher experience	0.023***
Pupil-to-FTE teacher ratio	-0.006***
Log paraprofessional salary	0.118
Pupil to FTE paraprofessional ratio	<0.001
Log average principal salary	-0.255**
Average principal experience	<0.001
FRL proportion	-0.114
SWD proportion	-0.216
ELL proportion	0.174
Percentage of students in middle school grades	-0.033
Percentage of students in high school grades	0.063
School Enrollment:	
<300	0.067
300 to <450	0.039
450 to <600	0.047
600 to <800	-0.027
Charter school institute	-0.126
CWIFT	-0.144
Constant	-4.198***
Number of unique schools	1,499
R^2	0.141

Note. FRL = free or reduced-price lunch eligible, SWD = students with disabilities, ELL = English language learner
*** $p < .001$, ** $p < .01$.

To help interpret the regression results, we show the predicted efficiency levels of schools when the staffing resource variables are set at the 10th and 90th percentiles of their distributions but all other variables are held constant at their observed levels (Exhibit 45). For example, schools with average teacher salaries at the 10th percentile of schools ($46,699) have an average predicted efficiency of -0.2, or .2 *SD*s below average. In contrast, schools with average teacher salaries at the 90th percentile ($83,849) have an average predicted efficiency of 0.11 *SD*s above average, for a difference between the two of 0.31 *SD*s. Differences in average predicted efficiency between the 90th and 10th percentiles of average teacher experience are slightly smaller but similar. The differences in efficiency when all other resource variables are changed from the 10th to the 90th percentile of the given variable are substantially smaller, indicating that improving teacher pay and teacher retention are important in improving student outcomes and efficiency of resource use.

Exhibit 45. Predicted Efficiency at the 10th and 90th Percentiles of Selected Staffing Resource Variables

Staffing resource variable	Percentile	Level of staffing resource variable at percentile	Average predicted efficiency	Difference in average predicted efficiency
Average teacher salary	10th	$46,699	-0.20	0.31
	90th	$83,849	0.11	
Average teacher experience	10th	4.8	-0.11	0.22
	90th	14.4	0.10	
Student-to-teacher ratio	10th	11.5	0.04	-0.05
	90th	19.6	-0.01	
Average paraprofessional salary	10th	$23,137	-0.02	0.06
	90th	$37,467	0.03	
Student-to-paraprofessional ratio	10th	19.5	-0.01	0.03
	90th	125.3	0.02	
Average principal salary	10th	$77,680	0.09	-0.14
	90th	$132,260	-0.04	
Average principal experience	10th	3.7	0.00	0.00
	90th	23.0	0.01	

Coloradans' Perspectives on Sufficiency of Particular Resources

Previously we reported that 80% of all respondents indicated that Colorado's schools lacked the resources to meet students' needs (Exhibit 18 in Chapter 3). Participants also indicated that their local public schools lack specific resources that could be supported with additional funding. There were high percentages of survey respondents who indicated their disagreement that Colorado public schools had sufficient resources, especially as related to staffing. More than four fifths of survey respondents disagreed that teachers are well paid in Colorado (82%); there are enough staff to support the needs of low-income/at-risk students, ELLs, and SWDs (78%); and there are enough staff devoted to student health and wellness (72%). A similarly high percentage of respondents felt that class sizes are too large (71%). Across nearly every statement, more than one third of participants disagreed that there are sufficient resources to support a variety of programming, such as social-emotional learning, mental health and wellness, family engagement, arts, and afterschool programming (Exhibit 46).

We analyzed survey findings to determine the extent to which variation existed across respondent groups and highlight findings that are meaningful and statistically significant (additional details are provided in Appendix A).

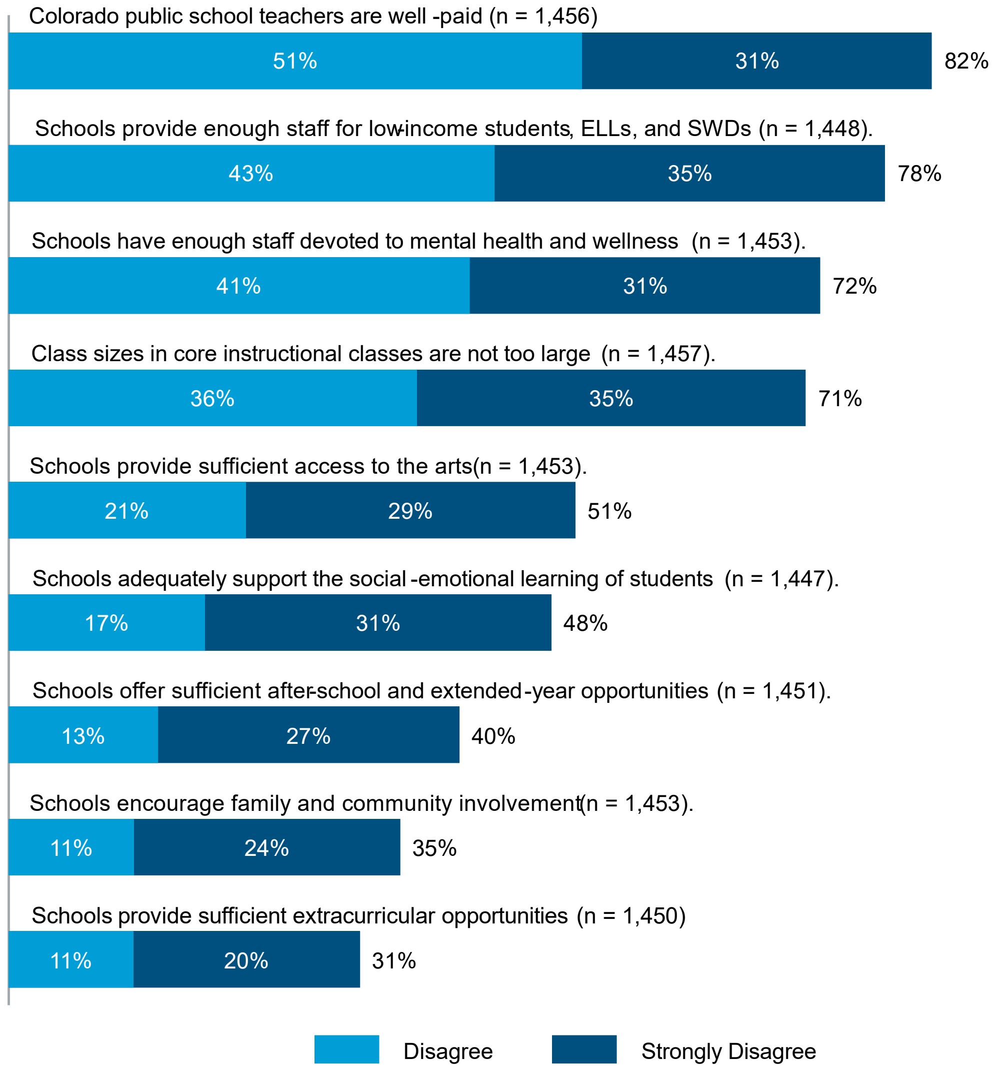
While high percentages of all respondents disagreed that public school teachers are well paid, White respondents were more likely than Hispanic/Latino respondents to disagree (86% versus 76%).

We saw greater differences between responding educators and non-educators. Educators were more likely than noneducators to disagree that:

- teachers are well paid (86% versus 79%);
- public schools provide enough staff and services to support students from low-income families, English language learners, and students with disabilities (86% versus 69%);
- public schools have enough staff devoted to student mental health and wellness (79% versus 65%); and
- class sizes are not too large (75% versus 66%).

In contrast, parents and guardians were less likely than those that are not parents or guardians to disagree that teachers are well paid than those that are not parents and guardians (81% versus 87%) and that there are enough staff and services to support higher needs students (76% versus 84%).

Exhibit 46. Survey Respondents' Views on the Sufficiency of School Resources



Note. For the survey item on class size, the item was worded on the survey as "Class sizes in core instructional classes are too large." As such, agreeing with that item was an indication of a lack of resources to provide smaller classes. For the reporting of this item, we have reworded it as "class sizes are not too large" and recoded those who agreed or strongly agreed with the original statement as disagreeing or strongly disagreeing with the reworded statement to align with the directionality of other items. For further details, please see Appendix A in the Technical Appendix.

There was less variation across regions.

- We saw no variation in perceptions of teacher pay by region.

- Respondents who had lived in the Northeast region were more likely to disagree with the statement that public schools have enough staff devoted to mental health and wellness than those who had not lived in the Northeast region (60% versus 73%).
- Relative to other regions,
  - Respondents who had lived in the Metro and North Central regions were more likely to agree that class sizes are too large (73% versus 70% and 83% versus 70%, respectively).
  - Respondents who had lived in the Northwest or Southwest regions were less likely to agree that class sizes are too large (56% versus 72% and 69% versus 71%, respectively).

Those attending townhall meetings shared their views on school resources.

As a CFO of a district [dealing with] the challenges of trying to keep the school district funded adequately, [and] at the same time competing with salaries across the state of districts that, unfortunately or fortunately, have the ability to get a lot of overrides … It's getting harder and harder to compete. So, I've got a real concern about how to how to keep a district holding on that's one of the lowest funded in the State, has a high cost of living, and is trying to compete with those that can get more money from taxpayers.

—Statewide Townhall Attendee

I think it's important to remember that we've grown a lot in the area of education and have an understanding what certain students need. And so, I think the funding needs to have grown with that knowledge of what we know that kids need.

—Statewide Townhall Attendee

You have to make choices, and there are trade-offs that aren't fair. They're like choiceless choices. We're saying, 'I would move funds to art so that we could have a reading interventionist.' That's a conversation that's coming up … We really need a reading interventionist, but parents have been asking for music to come back. And we just shouldn't have to make that choice, you know, music helps with reading and math. And [we have] kids that are dyslexic and need a reading interventionist to support them. We need both.

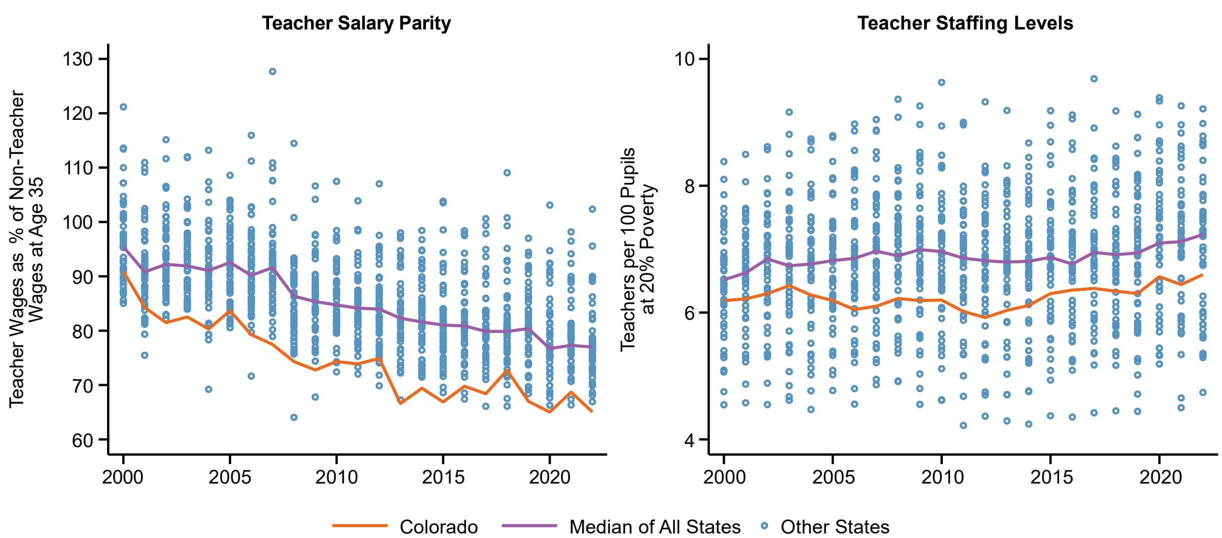
—Statewide Townhall Attendee

Investing in Teachers

As indicated in our analyses of efficiency and resource use, improving teacher pay, teacher retention, and hiring more teachers are potentially effective ways to improve student outcomes and efficiency. However, fewer than 1 in 10 Coloradans who took our survey believe that teachers in Colorado are well paid, and more than 7 of 10 survey respondents thought that class sizes in core classes are too large (Exhibit 24). Data from the *School Finance Indicators Database* (Baker, et al., 2023) confirm that teachers in Colorado have wages well below the wages of nonteachers with similar education at a similar point in their career. As shown in Exhibit 47, in 2022, teachers in Colorado at age 35 earned less than 70% of the wages of comparable nonteachers of the same age. This was the largest difference in wages of any state in the country. In addition, the wage gap between teachers and nonteachers in Colorado has steadily worsened during the past several decades.

A larger than typical wage gap might be justifiable if Colorado hired many more teachers for a given number of students than other states, resulting in fewer students per teacher and smaller class sizes. However, accounting for differences in student poverty rates across states, Colorado employs fewer teachers per 100 students than the national median. This means that, in addition to low pay, Colorado's teachers work with more students on a per-teacher basis than the typical state.

Exhibit 47. Teacher Salaries Compared With Non-Teachers and Teacher Staffing Levels Across States (2000–22)



Note. Data are from the School Finance Indicators Database, State Indicators (Baker et al., 2023).

Chapter Conclusion

Our analysis of resource use in relation to efficiency highlights the importance of teachers in producing higher student outcomes. In particular, more efficient schools were more likely to have higher paid and more experienced teachers. This was true even after using regression to account for multiple staffing variables and control for school demographics and characteristics. In addition, the regression results also suggested that improving student-to-teacher ratios also results in improved efficiency in producing outcomes when holding teacher pay and experience constant. Despite the importance of teachers, a preponderance of Coloradans who completed our survey do not believe that Colorado's teachers are well paid and feel that class sizes are too large. In addition, the survey respondents did not believe there were enough staff to meet the needs of low-income students, ELLs, and SWDs. An analysis of national data confirms that Colorado's teachers are among the worst-paid teachers in the nation when compared to nonteachers with similar education levels and of similar age. In addition, teacher staffing levels for a given number of students are also below the national median. With more adequate funding levels, Colorado could work to address teacher compensation and staffing levels, which would help the state attract better teachers and retain them longer.

7. Recommendations and Conclusions

Recommendations

Recommendation 1: Increase education funding to improve the overall level of student outcomes in the state.

Colorado's education system currently does not meet the state's goals for student outcomes. Well under half of Colorado's students achieve academic proficiency as defined by the state's performance benchmarks. Furthermore, most students do not achieve college and career readiness benchmarks based on the SAT. In addition, Colorado's academic achievement levels have steadily fallen during the past decade according to the state's performance on NAEP. Whereas Colorado was once leading its neighboring states on NAEP, it is now middle of the pack.

Although Coloradans generally believe the education system does a good job given the resources provided, 4 out of 5 Coloradans who completed our survey indicated that the education system does not have enough resources to meet students' needs. Based on our adequacy analyses using cost-function modeling, in order to provide a level of education more commensurate with the state's goals, an additional $4,600 per student in state and local funding is required, equating to an additional $4.1 billion, or a 33% increase in the state's education budget.

Although we find that more funding is needed, our model describing the cost of producing outcomes commensurate with the state's educational goals (the high-outcome model) suggests a base per-pupil amount of $8,443 in 2022–23 (inflated to $9,842 in 2025–26)—an amount only slightly higher than what is currently included in Colorado's funding formula. This suggests that most of the necessary increases in funding should occur through stronger funding weights as opposed to a higher base amount.

Recommendation 2: Distribute more resources based on student need to provide equal opportunity to all students regardless of background.

Student outcomes in Colorado, when aggregated at the school level, are strongly related to student need. Schools with higher proportions of students who are economically disadvantaged (as measured using FRL), SWDs, and ELLs have systematically lower student outcomes than schools with fewer students with additional needs. These patterns are evidence that equal educational opportunity is not being provided to all students.

Coloradans were also less optimistic about the quality of education with respect to most student need groups than they were for all students. Whereas 74% of survey respondents thought the quality of education was good or very good for all students, only 51% felt similarly about the quality of education for at-risk/low-income students. Less than half felt the quality of education was good for ELLs, SWDs, and other student groups indicative of greater need. The disparities in outcomes that are strongly related to student needs reinforced by public sentiment suggests that more funding should be distributed on the basis of student need to provide more resources and richer opportunities for economically disadvantaged students, ELLs, and SWDs.

The results of our adequacy analysis and weight estimation confirm that funding should be more strongly distributed according to student need. In the new funding formula established by HB24-1448, which will begin being implemented in the 2025–26 school year, at-risk students, ELLs, and SWDs are provided additional funding at a rate of 25% of the base cost (a funding weight of 0.25). The results of our analyses indicate that weights of 1.07, 1.28, and 1.20 are needed for at-risk students, SWDs, and ELLs, respectively, resulting in funding amounts more than double the base cost for these student groups. If Colorado districts were funded using the proposed weights, high-need districts would receive substantial increases in funding relative to what they currently spend.[30]

Recommendation 3: Invest more in teachers.

Several of our findings corroborate the need for Colorado to increase investment in teachers. Comparing teacher pay and staffing levels across states shows that relative to the pay of nonteachers, Colorado's teachers are among the lowest paid in the nation. In addition, staffing levels of teachers (the number of teachers for a given number of students) are also below the national median among states. Our equity analysis examining teacher characteristics also revealed that within Colorado, schools with higher proportions of economically disadvantaged students (measured by FRL eligibility), had lower average teacher salaries, less experienced teachers, and higher student-to-teacher ratios.

Coloradans who completed our public engagement survey concurred that teachers are not paid well in Colorado, class sizes are too large, and there are not enough staff to meet the needs of low-income students, ELLs, and SWDs. Our analysis of efficiency and resource use pointed to teachers as being a key resource in producing higher student outcomes. More efficient schools tended to have higher paid and more experienced teachers. Once accounting for other resource variables, school demographics, and characteristics, these were the two staffing variables that were more strongly related to increased efficiency.

[30] Additionally, the funding weights suggested by our analyses align with differential funding amounts for those student groups suggested by prior research (Duncombe & Yinger, 2004; Chambers, Parrish, & Harr, 2004; Atchison et al., 2023; Kolbe et al., 2021).

With more adequate funding levels and funding more strongly distributed based on student needs, Colorado's school districts—and particularly those with high student needs—would be able to address issues of teacher pay and hire more teachers. Better compensation and working conditions (resulting from smaller class sizes and more staff in schools) should help retain teachers for longer and boost average teacher experience.

Recommendation 4: Address tax inequity in the local tax rates that go toward the local share calculations.

Our analyses of tax rates, property valuation, and education spending show inequity for taxpayers and a lack of wealth neutrality. Specifically, we find that districts with the highest property wealth have lower tax rates and achieve higher spending levels than districts with lower property wealth. The state allows for different tax rates across districts to satisfy their obligations for the local share of district funding amounts. In other words, the local share for one district may be met with a tax rate of 10 mills whereas the local share of many other districts requires a tax rate of 27 mills. Even though the two districts have dramatically different tax rates, based on the state's local share calculations, both districts are equally satisfying their local share, and the state will fill in the remaining funding gap between the local share and the target funding amount similarly for both districts.

For example, the Wiley and Norwood school districts both have total program funding amounting to just over $3 million. In both districts, the state funds about 87% of the total program funding amount. However, Wiley has a total program mill levy of 27 mills whereas Norwood's total program mill levy is only 6 mills. Norwood's assessed valuation on a per student basis is about four times that of Wiley. Because the state allows Norwood to satisfy its local share with such a low tax rate, the state aid is essentially subsidizing the district's low tax rates. In turn, Norwood also passed a voter approved mill levy larger than its total program mill levy, allowing it to more than double the amount of local revenue the district takes in without resulting in any decrease in state funding. In short, despite an overall tax rate half of what the residents of Wiley pay, Norwood raises more in combined state and local revenue. Although this is but one example, there are many examples throughout the state where state aid covers well over half of the total program funding amount for districts with property tax rates far below the 27-mill maximum.

Recommendation 5: Use a comparable wage index-based approach to adjust for geographic differences in staffing costs.

Colorado is one of few states that uses a cost-of-living index to adjust funding levels for geographic differences in the level of compensation required to recruit and retain qualified teachers. Two factors influence geographic differences in needed teacher compensation. One factor is the cost of living, and the other factor is the living conditions or the amenities that certain areas provide. Certain areas have high costs, in part, because they provide rich amenities that improve the quality of life. Because people want to live and work in more desirable locations with abundant amenities, they are willing to accept lower compensation than the cost-of-living index would indicate. In other words, a pure cost-of-living calculation ignores the presence of greater amenities in many high-cost areas, resulting in an overstatement of the compensation required to recruit and retain teachers in such locations. Colorado's Public School Finance Task Force recognized the problem of inflated cost differentials stemming from the cost-of-living index. Their solution was to cap the cost-of-living index to a certain value. A less arbitrary solution would be to use a comparable wage index-based approach. A comparable wage index calculates the differential wages required in certain areas by using the relative differences in actual wages of noneducators. In doing so, this approach captures both cost-of-living differences and differences in living conditions, both of which affect the wages that workers are willing to accept.

Conclusions

Colorado operates a foundation aid funding formula that uses a base per-pupil amount and a series of weights to allocate funding to school districts. The structure of Colorado's new funding formula contains much of what is needed for a strong funding formula. It is easy to understand, provides dollars to districts to be used flexibly, includes many legitimate weighting categories to adjust funding for the factors that influence the cost of education (including student needs, scale of operation, and geographic differences in staffing compensation), and embeds a process to help equalize funding across districts based on the capacity of districts to raise revenue locally.

Rather than a wholesale redesign, more equitable and adequate funding could be achieved through further modification of the already newly redesigned funding formula. Results of this study can help the state identify a target level of funding needed to meet state goals and select a set of empirical cost-based funding weights that will provide more funding to districts on the basis of student need. Our study also highlights the need to address loopholes and historical precedence in the determination of the local share that allows for widely varying property tax rates across the state.

References

Atchison, D., Levin, J., Baker, B., & Kolbe, T. (2020). *Equity and adequacy of New Hampshire school funding.* American Institutes for Research.

Atchison, D., Levin, J., Fatima, S., Traugh, A., Srikanth, A., Heberle, C., Gannon-Slater, N., Junk, K., Wallace, L., & Baker, B. (2023). *Assessment of Delaware public school funding.* American Institutes for Research.

Baker, B. D., Di Carlo, M, Srikanth, A., & Weber, M. A. (2023). *School finance indicators database: State indicators database 2024 (6th Release).* Albert Shanker Institute. https://www.schoolfinancedata.org/download-data/

Brundin, J. (2021). *It's been 30 years since Colorado redid its school funding formula. Some lawmakers hope now's the time.* Colorado Public Radio News. https://www.cpr.org/2021/06/05/its-been-30-years-since-colorado-redid-its-school-funding-formula-some-lawmakers-hope-nows-the-time/

Carey, M., & Gerstle, A. (2024). *School finance & property tax.* Legislative Council Staff. https://leg.colorado.gov/sites/default/files/images/school_finance_property_tax.pdf

College Board. (n.d.). *K–12 Educator brief: The college and career readiness benchmarks for the SAT Suite of Assessments.* https://satsuite.collegeboard.org/media/pdf/educator-benchmark-brief.pdf

Colorado Department of Education. (2024). *Consolidated state plan under the Every Student Succeeds Act (ESSA).* (Amended August 2024). https://www.cde.state.co.us/fedprograms/essa

Colorado School Finance Project. (n.d.). *Budget stabilization factor (Negative factor).* https://cosfp.org/school-finance/budget-stabilization-negative-factor/#gsc.tab=0

Colorado School Finance Project. (2023). *Budget stabilization factor statewide total: 2009–2010 to 2023–2024.* https://cosfp.org/wp-content/uploads/2009-to-2024-Chart-BSF-state.pdf

Cornman, S. Q., Nixon, L. C., Spence, M. J., Taylor, L. L., & Geverdt, D. E. (2018). *Education Demographic and Geographic Estimates (EDGE) Program: American Community Survey Comparable Wage Index for Teachers (ACS-CWIFT).* U.S. Department of Education. https://nces.ed.gov/programs/edge/docs/EDGE_ACS_CWIFT_FILEDOC.pdf

Duncombe, W. (2002). *Estimating the cost of an adequate education in New York* (Center for Policy Research Working Paper 44). Syracuse University.

Duncombe, W., Lukemeyer, A., & Yinger, J. (2003). Financing an adequate education: A case study of New York. In W. Fowler (Ed.), *Developments in school finance: 2001–02* (pp. 127–154). U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics.

Duncombe, W., & Yinger, J. (1999). Performance standards and educational cost indexes: You can't have one without the other. In H. F. Ladd, R. Chalk, & J. S. Hansen (Eds.), *Equity and adequacy in education finance: Issues and perspectives* (pp. 260–297). National Academy Press.

Duncombe, W., & Yinger, J. (2004). *How much more does a disadvantaged student cost?* (Center for Policy Research Working Paper 60). Syracuse University.

Duncombe, W., & Yinger, J. (2011). Are education cost functions ready for prime time? An examination of their validity and reliability. *Peabody Journal of Education, 86*(1), 28–57.

Ji., C. S., Yee, D. S., & Rahman, T. (2021). *Mapping state proficiency standards onto the NAEP scales: Results from the 2019 NAEP Reading and Mathematics Assessments.* National Center for Education Statistics, U.S. Department of Education. https://nces.ed.gov/nationsreportcard/subject/publications/studies/pdf/2021036.pdf

Kolbe, T., Baker, B., Atchison, D., & Levin, J. (2019). *Pupil weighting factors report.* University of Vermont.

Legislative Council Staff. (2024). *School Finance in Colorado: 2024 | Research Publication No. 813.* https://leg.colorado.gov/sites/default/files/images/final-_2024_booklet.pdf

National Assessment Governing Board. (n.d.). *What are NAEP achievement levels and how are they determined?* https://www.nagb.gov/content/dam/nagb/en/documents/naep/achievement-level-one-pager-4.6.pdf

Public School Finance Task Force. (2024). *S.B. 23-287 Public School Finance Task Force report*. https://www.cde.state.co.us/cdefinance/publicschoolfinancetaskforcereport

Special Education Fiscal Advisory Committee. (2023). *2021–22 annual report by the Special Education Fiscal Advisory Committee.* https://www.cde.state.co.us/cdespedfin/sefaclegislativereport_2023

Special Education Fiscal Advisory Committee. (2024). *2022–23 annual report by the Special Education Fiscal Advisory Committee.* https://www.cde.state.co.us/cdedepcom/spedfiscaladvisorycommitteereport

Stoddard, C. (2005). Adjusting teacher salaries for the cost of living: The effect on salary comparisons and policy conclusions. *Economics of Education Review, 24*(3), 323–339. https://doi.org/10.1016/j.econedurev.2004.06.004

Taylor, L. L., Gronberg, T. J., Jansen, D. W., & Bartlett, C. S. (2021). *A study on geographic education cost variations and school district transportation costs.* Texas A&M University. https://tea.texas.gov/about-tea/government-relations-and-legal/government-relations/hb3-transportation-report.pdf

U.S. Department of Education. (2010). *An Introduction to NAEP: National Assessment of Educational Progress*. https://nces.ed.gov/nationsreportcard/pdf/parents/2010468.pdf

About the American Institutes for Research®

Established in 1946, the American Institutes for Research® (AIR®) is a nonpartisan, not-for-profit institution that conducts behavioral and social science research and delivers technical assistance both domestically and internationally in the areas of education, health, and the workforce. AIR's work is driven by its mission to generate and use rigorous evidence that contributes to a better, more equitable world. With headquarters in Arlington, Virginia, AIR has offices across the U.S. and abroad. For more information, visit AIR.ORG.

AIR® Headquarters
1400 Crystal Drive, 10th Floor
Arlington, VA 22202-3289
+1.202.403.5000 | **AIR.ORG**

26512_11/24