EXHIBIT B

Rebuttal Report of Matthew G. Springer, Ph.D.

May 29, 2020

In Re Delaware Public Schools Litigation, C.A. 2018-0029-VCL

1. Introduction

This rebuttal report addresses specific allegations regarding the Delaware school funding system, as set forth in the Plaintiffs' expert reports. In particular, the Jackson Report asserts that Delaware's funding system is regressive once school-level per-pupil expenditure (PPE) is adjusted for the share of students with disabilities (SWD) when examining only state funding. The Gehlbach Report argues for the importance of low student-to-counselor ratios while the Rothstein and Jackson Reports highlight capital spending as an important aspect of state funding mechanisms.

Based on my experience in education finance, analysis of local, state, and national data, and review of relevant literature and reports, I have formed the following opinions in response to these reports, to a reasonable degree of professional certainty:

- Delaware's school funding system includes local, state, and federal revenue streams, and any comprehensive examination of the state's funding system should consider all three streams;
- The disability-adjusted measure of school-level PPE used in the Jackson Report is not a valid spending adjustment;
- The Jackson Report inappropriately converts state school-level spending estimates into per-pupil terms using a duplicated, and not a unique, student count;
- The idea of a known optimal student-to-counselor ratio, such as 250:1, as highlighted in the Gehlbach Report, is an unsupported position advocated by a professional organization for school counselors with a vested interest in promoting the interests and prevalence of school counselors;
- Delaware maintains a student-to-counselor ratio that is better than the national average and has considerably decreased its student-to-counselor ratio in the past decade. Additionally, a more general examination of the student-to-support-staff ratio in Delaware shows that this ratio also decreases as the share of low-income students increases; and

- Delaware allocates substantial outside-the-formula funding in support of capital projects.

2. Critique of Jackson Report

A. Delaware's school funding system includes local, state, and federal revenue streams, and any comprehensive examination of the state's funding system should take all three streams into consideration

The Jackson Report focuses solely on state-level spending despite substantial revenue coming from local, state, and federal sources (Jackson, 2020, pp. 57, 61). My expert report and the Plaintiffs' second amended complaint note that for each dollar of Delaware's school funding in 2018, 33.1 cents came from local revenue generation, 58.9 cents from state revenue generation, and 8.0 cents from federal sources (Springer, 2020; Sec. Am. Compl., ¶ 27). Therefore, examining only state-level spending ignores local and federal sources, which account for over 40 percent of revenue. Also, school funding decisions are not made in a vacuum. As discussed in my expert report, a broad array of actors and principles (i.e., equity, adequacy, efficiency, and liberty) influence school funding decisions, making it impossible to fully understand one funding stream without also considering the others. When analyzing what resources are available to students (including low-income and disadvantaged student subgroups), examining only state revenue provides an incomplete and misleading picture. In my report, I chose to examine both local and state funding and local, state, and federal funding together because I believe it is the best way to capture a comprehensive picture of how Delaware's funding system is delivering resources to students.

B. The disability-adjusted measure of school-level PPE used in the Jackson Report is not a valid spending adjustment

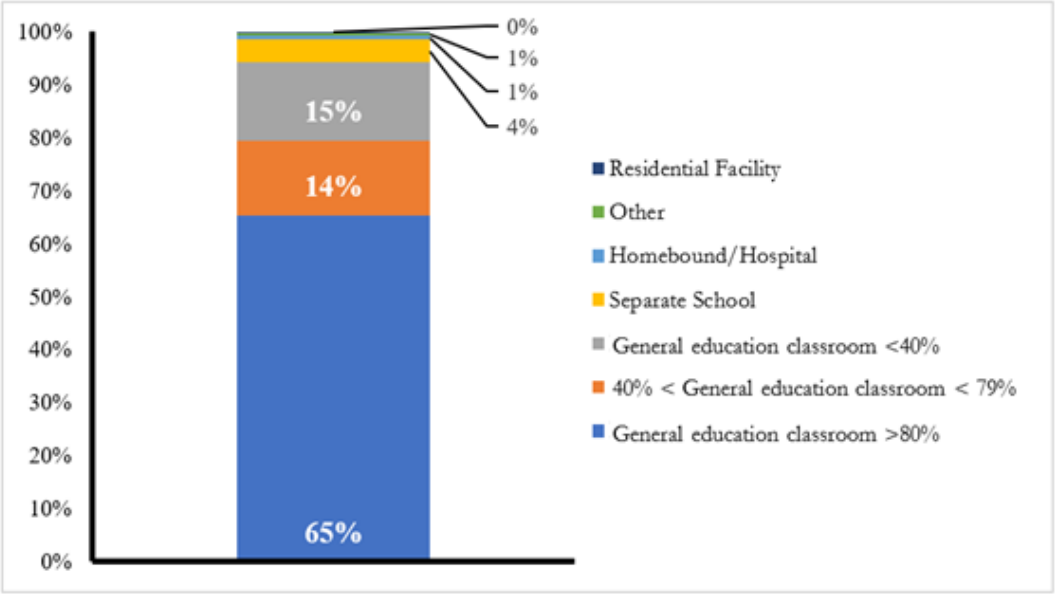
The Jackson Report uses a school-level disability-adjusted measure of PPE. To make the adjustment, the Jackson Report uses a two-step process. First, it predicts the amount of PPE due to the share of SWD in the school. The prediction is implemented by estimating the relationship

between school-level total PPE and the share of SWD in a regression model that also includes the share of SWD squared, the share of low-income students, and average PPE in the district. Then, the predicted PPE from the share of SWD is subtracted from the total PPE in each school. The main idea behind this adjustment is to subtract the PPE for SWD from the total PPE to calculate the amount of PPE that is not intended for SWD. Below, I detail several reasons why this approach is not a valid spending adjustment: (1) it does not account for different categories of SWD; (2) the regression model is under-specified; and (3) it uses end-of-year enrollment, which is a duplicated, and not a unique student count.

Categories of students with disabilities. The Individuals with Disabilities Education Act (IDEA) requires public schools to provide special education services to eligible students. However, the range of special education services can vary widely depending on student needs. The Jackson Report treats all SWD as requiring the same resources even though SWD categories and subsequent funding choices vary by category. Figure 1 below helps illustrate this point by showing the percent of SWD in various educational settings in Delaware for the 2017-18 school year. Figure 1 shows that 65% of SWD in Delaware are in general education classrooms for more than 80% of the school day, and 29% are in general education classrooms for less than 79% of the school day. Students who spend most of the day in general education classrooms require very different resource investments from students who receive more specialized education services, such as self-contained learning environments. Assuming that all SWD need the same resources would result in an overcorrection if the majority of SWDs in a school are in general education classrooms for most of the school day. This overcorrection would lead to lowered estimates of PPE available for students without disabilities. Moreover, additional funding for SWD who spend most of their time in general education classrooms is likely to have spillover benefits for general education students in the same school or classroom as a result of additional staffing and related resources. Subtracting additional

funding for SWD who spend most of the day in general education classrooms would under-estimate the benefits to all students. (Section 3.B. of this report further explores the relationships between the student-to-support staff ratio and the percentage of disadvantaged students in a school.)

Figure 1. Percent of Students with Disabilities in Different Educational Settings (Delaware, 2017-18)



Source: Delaware Department of Education (N.D.a).

Underspecified regression models. The validity of the disability adjustment in the Jackson Report requires an accurate estimate of the relationship between total PPE and the share of SWD in a school. This means that the regression model used to estimate this relationship should account for everything that affects both total PPE and the share of SWD in a school. However, the regression model used in the Jackson Report is highly unlikely to fully account for everything that affects both total PPE and the share of SWD. Important factors that are not addressed in the model include parent/student sorting and the ability to separate individual student characteristics.

With regard to parent/student sorting, often times there are specific schools in a district that are particularly good at working with specific student subgroups, such as SWD. These schools tend to spend more to hire experienced teachers, acquire instructional materials, or obtain other resources

to support their students. These schools also tend to enroll more SWD because parents want to send their kids to the schools with the best services. In this situation, the true relationship between total PPE and the share of SWD will not be accurately estimated if the model does not account for parent/student sorting where schools that enroll more SWD also tend to spend more. Since the Jackson Report fails to account for parent/student sorting in estimating the relationship between the share of SWD and total PPE, it over-predicts the amount of PPE for SWD (i.e., the amount of PPE for SWD will appear larger than it really is). Then, if the estimate of PPE for SWD is too large, subtracting it from total PPE will leave a too-small estimate of PPE that is not intended for SWD. This means the relationship between PPE and share of low-income students in a school will appear more regressive than what is true in reality – the reality being that Delaware's finance system is progressive not only as shown in my own analysis (Springer, 2020) but also as frequently cited in national comparisons of state funding mechanisms (Baker, Di Carlo, and Weber, 2019).

Concerning individual student characteristics, the Jackson Report uses school-level data; therefore, the disability-adjusted PPE it estimates does not separate students who have a disability but are not low-income from students who are low-income but do not have a disability. As noted in the Jackson Report, "schools that have high shares of students with disabilities are disproportionately attended by low-income students" (Jackson, 2020, p. 65). Since many students have disabilities and are also low-income, it is difficult to determine whether the relationships that the Jackson Report estimates are coming from the fact that students have disabilities or whether it is because they are low-income. Separating these differences is crucial to making an accurate adjustment for SWD. This is difficult to do without data on individual students (i.e., data that identifies each student in a school and separates them into SWD, low-income students, and students who both have disabilities and are low-income). Since the data used in the Jackson Report capture characteristics of schools and not characteristics of individual students, one cannot ascertain whether

the predicted PPE for SWD used as the adjustment is actually because these students have disabilities or may be due to them being low-income. For low-income students with disabilities, the money designated towards schools for their identified disabilities may be effectively providing additional resources to help address the challenges they face because they come from low-income backgrounds. Because the connection between having disabilities and being low-income is so entangled for many students, the adjustment in the Jackson Report is unlikely to accurately separate additional funding for SWD from extra funding for low-income students.

To illustrate this point, Table 1 shows estimates from Table 7 of the Jackson Report. The point estimates in the table show relationships between student characteristics and PPE. For example, Model 1 shows that a unit increase in the share of low-income students reduces PPE by about $160. However, this result is not statistically significant at conventional levels, meaning we cannot be absolutely sure that this estimate of $160 is genuinely different from $0. Statistically significant results are usually the focus of our analyses because we want to have some level of confidence that the estimated relationships are true differences (i.e., not random differences).

In Models 2 and 3, the share of low-income students and the share of SWD are both included. The difference between Models 2 and 3 is that Model 3 adjusts for average PPE in the district. Notice that in Model 2, the result for share of low-income students is not statistically significant, and the result for share of SWD is statistically significant. Then, the results are flipped in Model 3 where the result for share of low-income students is statistically significant, but the result for share of SWD is not. Generally speaking, when results are not statistically significant, we lack the statistical confidence to conclude that there are any real differences, and the fluctuating significance levels between Models 2 and 3 is a sign that the two characteristics are so closely linked that we cannot separate the two types of student characteristics from one another. Although we may be able to separate out the effects of being low-income from the effect of having a disability on PPE

through a more robust analytic strategy using data on individual students, it is likely impossible without that data that can separate SWD from low-income students and students who are both low-income and have disabilities. Thus, the results in Table 7 of the Jackson Report are difficult to interpret as presented because we cannot determine whether the adjustment for SWD is really because these students have disabilities or whether at least part of it is coming from them also being low-income.

Table 1. Reproduction of Table 7 in the Jackson Report which Estimates the Relationship between Student Characteristics and PPE

	Model 1	Model 2	Model 3
Outcome:	State Per-Pupil Spending Incl. Div I		
Share Low-Income	-160.0	-1074.1	-1180.5*
	(-0.29)	(-1.68)	(-2.43)
Share with Disability		8661.9*	7588.3
		(2.53)	(2.05)
Share with Disability Squared		-3629.9	-2517.4
		(-0.77)	(-0.53)
Constant	8178.9***	7195.3***	7384.1***
	(31.53)	(18.38)	(14.31)
Number of Schools Included	162	162	162

Notes: t-statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Model 3 adds an adjustment for average district-level PPE.

End-of-year student enrollment is not a unique student count. The biggest concern about the Jackson Report's disability-adjusted measure of school spending is that it relies on end-of-year student enrollment, which artificially inflates the adjustment for SWD and misrepresents the state's finance system as spending more on schools with fewer lower-income students relative to the rest of the state.

My expert report relies on *Fall student enrollment* from Delaware's Report Card data. Fall enrollment is a count of all students enrolled in the school on September 30th of each school year, so each individual student contributes to the Fall enrollment count for only one school. This Fall enrollment count is used "to help the state properly allocate resources to schools," meaning it

determines school funding and informs budgets for future years (Delaware Department of Education, 2019). Fall enrollment is also the official enrollment count used for federal reporting requirements.

By contrast, the Jackson Report relies on *end-of-year student enrollment* count from Delaware's Open Data Portal. End-of-year enrollment is quite different from Fall enrollment because it does not attempt to count unique students. Instead it:

> "*Contains any actively enrolled student in a Delaware public school for at least one day. Since end-of-year enrollment allows for student movement between schools, students entering schools from out of state, and students leaving schools, the total number of students are not meant to reflect the actual number of students enrolled at any point-in-time. End-of-year enrollment is meant to show the total number of students being educated within the public-school system within a school year*" (Delaware Department of Education, 2019).

This means that the end-of-year student enrollment counts an individual student as being enrolled in as many schools as they attended in the state for at least one day from the first day of the school year through mid-June. For example, if a student moves to three different schools in one year, all three schools will count that same student as part of its end-of-year enrollment. End-of-year student enrollment is used for measures like accountability, discipline, absenteeism, and whether students are on-track in 9th grade. A duplicated count ensures that every student who ever attends the school is captured for these statistics, which when calculated, will typically assign duplicated students to the school they were enrolled in for the greatest number of days. Unlike these other statistics, an accurate PPE is calculated using the school's total expenditures divided by an unduplicated count of total enrollment, like Fall enrollment. Therefore, calculating PPE using the duplicated end-of-year enrollment would result in a too-small estimate of PPE because end-of-year enrollment is inflated. The Fall enrollment count is more accurate and relevant because Fall enrollment does not duplicate students.

To better understand how the Jackson Report's use of end-of-year enrollment influences the disability-adjusted measure of spending, I first examine the magnitude of the difference in school-

level student enrollment between (a) Jackson's duplicated end-of-year enrollment as provided by the Plaintiffs on May 6, 2020 in an excel file labeled, "Student_Enrollment" and (b) the unduplicated Fall enrollment count from the Report Card data.

As displayed in Table 2, I find that the average school-level enrollment in the Jackson Report is inflated, on average, by about 71 students (about 668 students when using Report Card data versus 739 students when using data from the Jackson Report). This inflated end-of-year enrollment count leads to a lower estimate of PPE. For example, if a school with 668 students spent $15,153.52 per-pupil (which is the average per-pupil expenditure in 2018 based on Delaware's Report Card data), a school with 739 students would spend $13,697.63, or $1,455.89 less per student.

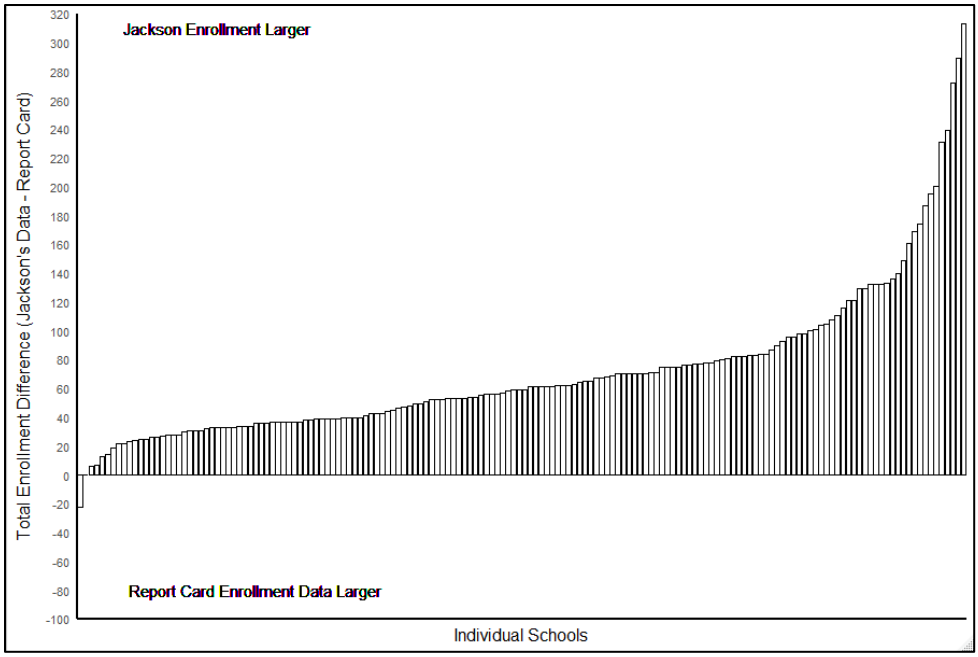
Table 2. Summary of Student Enrollment Counts Using End-of-year Enrollment (Jackson Report Data) and Fall Enrollment (Report Card Data), 2017-18 School Year

Data	Number of Schools	Mean	Standard Deviation	Min	Max
End-of-year Enrollment from Jackson Report	162	739.41	347.54	238	2270
Fall Enrollment from Report Card Data	162	668.34	323.96	134	2070

Source: Data from the Jackson Report and Report Card Data.

To illustrate the variation in enrollment, and how this can further affect the Jackson Report's special education adjusted PPE measure, Figure 2 displays enrollment differences in end-of-year enrollment and Fall enrollment by school. Values greater than 0 mean that the enrollment count for end-of-year enrollment is larger than the Fall enrollment count, while values less than zero indicate that the Fall enrollment count is greater than the end-of-year enrollment count. I find that in all but one school, the measure of enrollment is larger in data used by the Jackson Report relative to the Report Card data, which is an obvious anomaly in light of the definition of end-of-year enrollment.

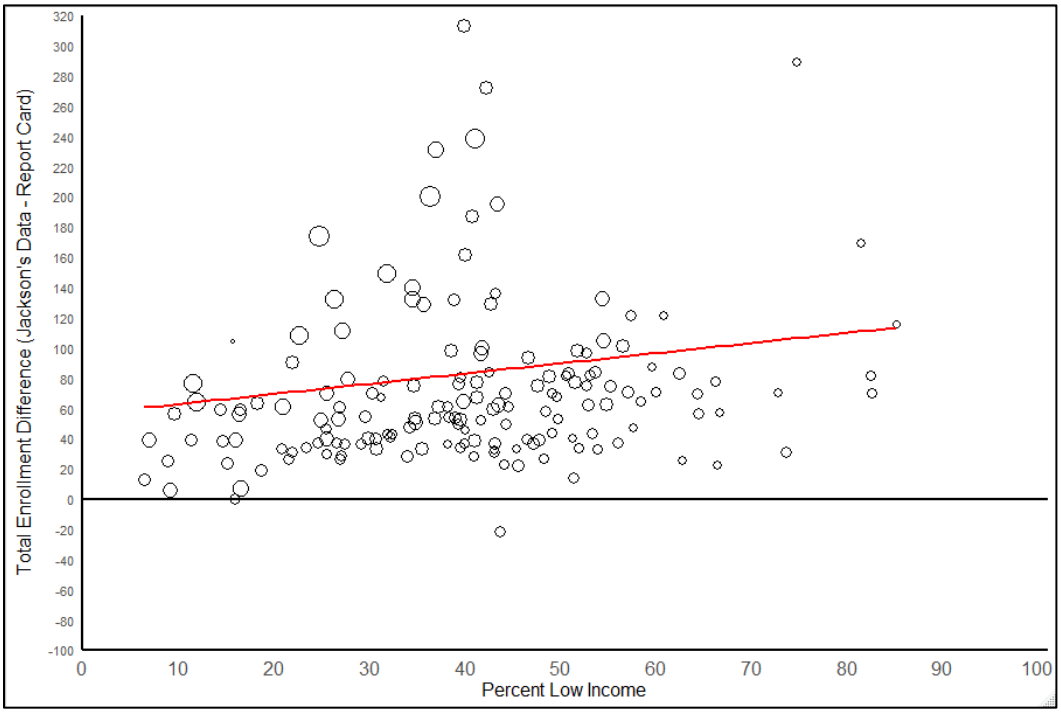
Figure 2. Difference in Enrollment for Each School between Delaware's Report Card Data and Data used in the Jackson Report, 2017-18 School Year



Source: Data from the Jackson Report and Report Card Data.

To illustrate how using end-of-year enrollment to calculate the disability-adjustment artificially produces a regressive relationship in school-level spending patterns, Figure 3 displays the relationship between a school's percentage of low-income students (horizontal axis) and the enrollment difference between datasets (vertical axis). Each circle represents a school. The red line is the line of best fit. The line of best fit expresses the relationship between the percentage of low-income students and PPE in schools across the state. The line's upward slope means that the total enrollment difference, on average, increases in tandem with the percentage of low-income students in a school. That is, there is more within-year mobility of students in low-income schools, and more students in these settings are counted multiple times in different schools. As a result, the Jackson Report's disability-adjustment underestimates PPE in almost all schools, but the underestimation is even worse in schools with a higher percentage of low-income students.

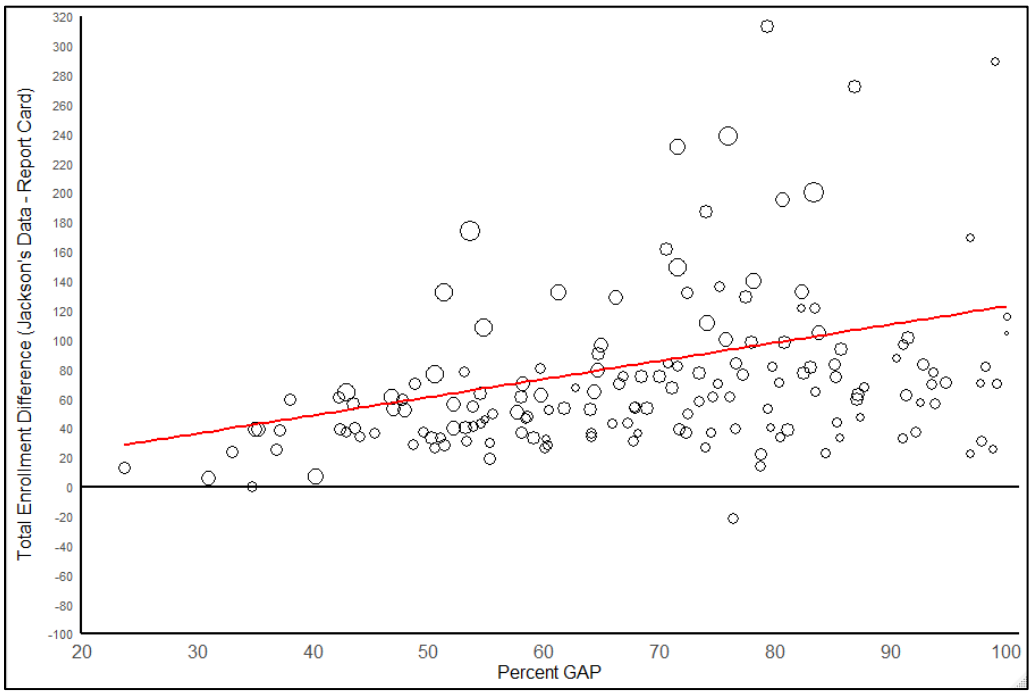
Figure 3. Difference in Enrollment between the Report Card Data and the Jackson Report Data, by Percent of School Enrollment Identified as Low Income (weighted by enrollment), 2017-18 School Year



Source: Data from the Jackson Report and Report Card Data.

Figure 4 displays the same relationship between the school-level enrollment difference and the percent of students in a school that are identified as "GAP" students. GAP is a unique measure to Delaware. It is defined as "an aggregate, unduplicated count of students that are in groups that have historically had achievement gaps (i.e., African American, Hispanic, Native American, English Language Learners, Economically Disadvantaged, and Students with Disabilities)" (Delaware Department of Education, N.D.b, p. 9). Once again, each circle represents a school, and the red line is the line of best fit. The line's upward slope means that the total enrollment difference, on average, increases in tandem with the percentage of GAP students in a school. This means that more students are counted multiple times in these settings, which causes the Jackson Report's adjustment to more severely underestimate PPE in schools that have a higher percentage of GAP students.

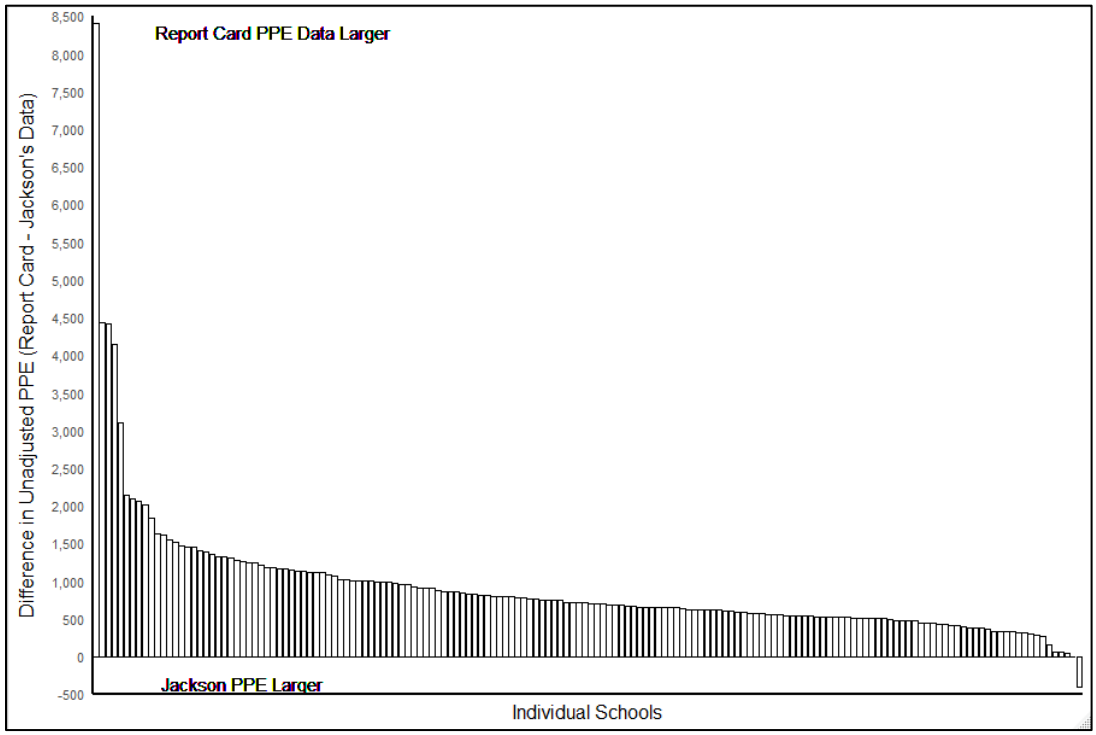
Figure 4. Difference in Enrollment between Report Card Data and the Jackson Report Data, by Percent of School Enrollment Identified as GAP (weighted by enrollment), 2017-18 School Year



Source: Data from the Jackson Report and Report Card Data.

To further demonstrate how using a duplicated student enrollment count affects the calculation of PPE, Figure 5 shows the difference in PPE by school when using end-of-year enrollment versus Fall enrollment as the denominator to calculate PPE. It is also important to remember this measure of PPE only takes into consideration state expenditures and excludes local and federal contributions. Each bar represents a single school. Figure 5 shows that PPE calculated using Fall enrollment is consistently larger than PPE calculated using end-of-year enrollment. The difference stems from Jackson's use of duplicated student counts, which inflate enrollment and therefore underestimate PPE.

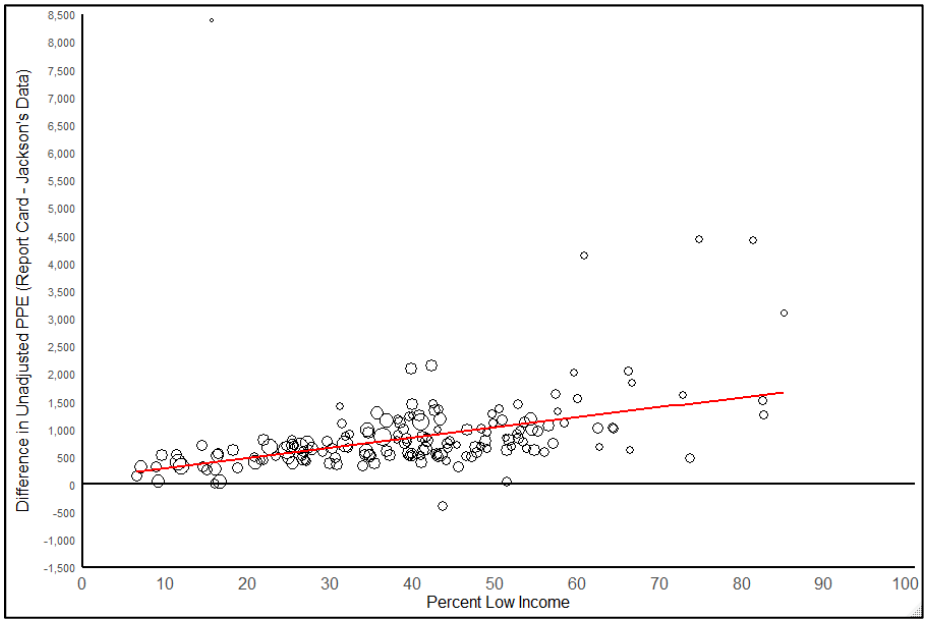
Figure 5. Difference in PPE for Each School between the Report Card Data and the Jackson Report Data, 2017-18 School Year (State dollars only)



Source: Data from the Jackson Report and Report Card Data.

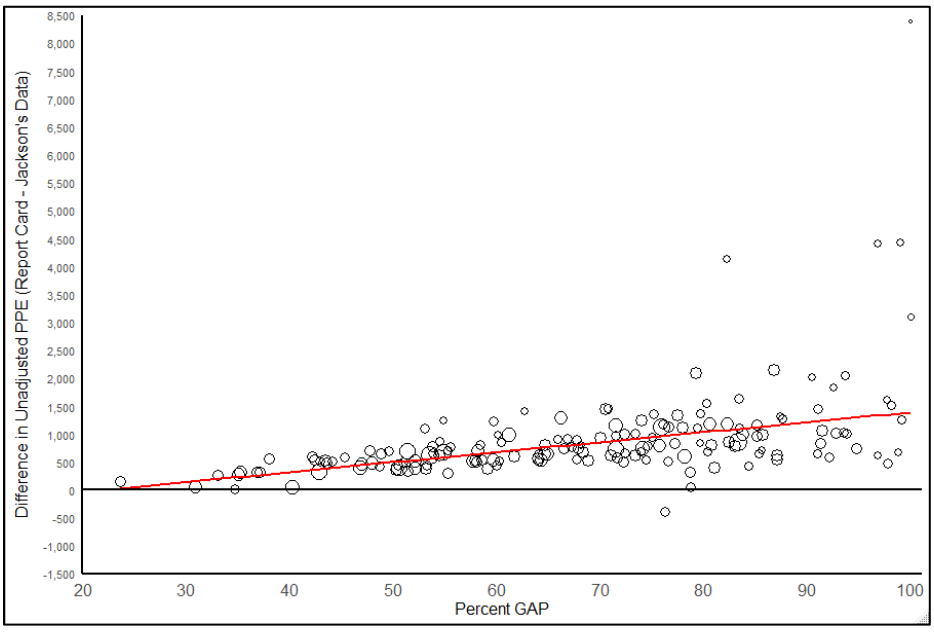
Figures 6 and 7 present the relationship between the difference in enrollment and percent of students in a given school that are identified as low income or GAP, respectively. Again, there is a strong trend indicating that the difference between the Report Card data and the Jackson Report data is larger in schools that have a higher percentage of their enrollment made up of low-income students (Figure 6) or GAP students (Figure 7). Not only does using end-of-year enrollment underestimate PPE, Figures 6 and 7 show that the under-estimation of PPE is even more pronounced in schools that serve more low-income or GAP students.

Figure 6. Difference in Unadjusted PPE between the Report Card Data and the Jackson Report Data, by Percent of School Enrollment Identified as Low Income (weighted by enrollment), 2017-18 School Year (State dollars only)



Source: Data from the Jackson Report and Report Card Data.

Figure 7. Difference in Unadjusted PPE between the Report Card Data and the Jackson Report Data, by Percent of School Enrollment Identified as GAP (weighted by enrollment), 2017-18 School Year (State dollars only)



Source: Data from the Jackson Report and Report Card Data.

I also examine if the different datasets reveal different patterns in school spending. To do so, I replicate the disability-adjusted PPE approach in the Jackson Report using the Report Card data. Table 3 reports the estimates from Table 7 of the Jackson Report, which I scale so that coefficients are interpreted as the change in per-pupil funding associated with a one percentage point increase in share of low-income students. Next, I apply the exact same regression formulas used for the Jackson Report on the Report Card data for the same sample of 162 schools used in the Jackson Report analysis. Note that the exact same methods are applied on the exact same sample of schools in the exact same school year (2018). The only difference in inputs is the chosen dataset.

In Model 1, Table 3 suggests that a one percentage point increase in the share of low-income students in a school is correlated with a $1.60 *decrease* in PPE using state spending data from the Jackson Report. However, applying the same method to the Report Card data finds a different relationship: a one percentage point increase in the share of low-income students is correlated with a $16.89 *increase* in PPE. Model 2 adds an adjustment for SWD, and Model 3 then adds an adjustment for average PPE in the district. Notice that even after these additional adjustments are made, the relationship between the share of low-income students and PPE continues to trend in opposite directions across the two datasets. That is, the relationship between PPE and the share of low-income students is negative when using data from the Jackson Report but positive when using the Report Card data.

Table 3. Relationship between PPE (the Outcome) and Student Characteristics using the Report Card Data and the Jackson Report Data, 2017-18 School Year (State dollars only)

	Model 1		Model 2		Model 3	
	Jackson Report Data	*Report Card Data*	*Jackson Report Data*	*Report Card Data*	*Jackson Report Data*	*Report Card Data*
Share low-income (0-100)	-1.6	16.89	-10.74	18.91	-11.80*	15.02
	(0.03)	(1.32)	(-1.68)	(1.40)	(-2.43)	(1.16)
Share disability (0-100)			86.61*	24.64	75.88	19.77
			(2.53)	(0.72)	(2.05)	(0.75)
Share disability squared			-0.3629	.886*	-0.2517	.892*
			(-0.77)	(2.79)	(-0.53)	(3.28)
Constant	8178.9***	8351.0***	7195.3***	7675.4***	7384.1***	7898.8***
	(31.53)	(16.43)	(18.38)	(22.61)	(14.31)	(15.41)
District Fixed-Effects	No	No	No	No	Yes	Yes
Number of Schools	162	162	162	162	162	162

Note: The original coefficients in the Jackson Report indicate that the 'share statistics' were coded in a 0-1 range. To put coefficients in the same scale as mine, they were all divided by 100, so that a one percentage point increase in any share characteristic is associated with an increase in PPE that equals the coefficient. *t*-statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Next, I re-create the disability-adjusted PPE measure as reported in the Jackson Report (2020, p. 66) using the following formula: $adjustedPPE = PPE - ((\beta_1 * ShareSWD) + (\beta_2 * ShareSWD\hat{}2))$.

Table 4 summarizes the unadjusted PPE and disability-adjusted PPE measure, using both the Jackson Report data and the Report Card data. When using data from the Jackson Report, average PPE is $8,114.24 (without adjustment) and $6,918.76 (after adjusting for SWD). In contrast, when using the Report Card data, average PPE is $9,024.33 (without adjustment) and $8,497.48 (after adjusting for SWD). On average, the SWD adjustment is smaller for the Report Card data, with an average decrease in PPE of about $500 ($9,024 – $8,498), whereas applying the disability-adjustment to the data from the Jackson Report produces an average decrease of about $1,200 in PPE ($8,114 – $6,918). This confirms the trends above, showing that the disability adjustment is more exaggerated when using duplicated end-of-year enrollment from the Jackson Report data relative to unduplicated Fall enrollment from the Report Card data.

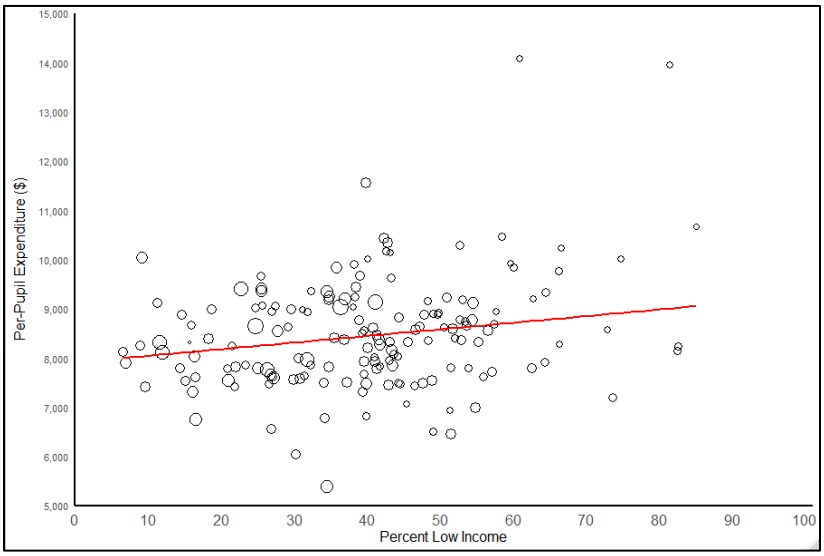
Table 4. Summary of Unadjusted and Adjusted PPE from the Jackson Report Data and Report Card Data, 2017-18 School Year (State dollars only)

	Number of Schools	Mean	Standard Deviation	Min	Max
Jackson Report Data					
Unadjusted PPE	162	8114.24	919.00	5604.02	10815.84
Disability-adjusted PPE	162	6918.76	837.23	4341.93	9743.09
Report Card Data					
Unadjusted PPE	162	9024.33	1443.63	5604.02	19210.18
Disability-adjusted PPE	162	8497.48	1149.92	5392.84	14075.27

Source: Data from the Jackson Report and Report Card Data.

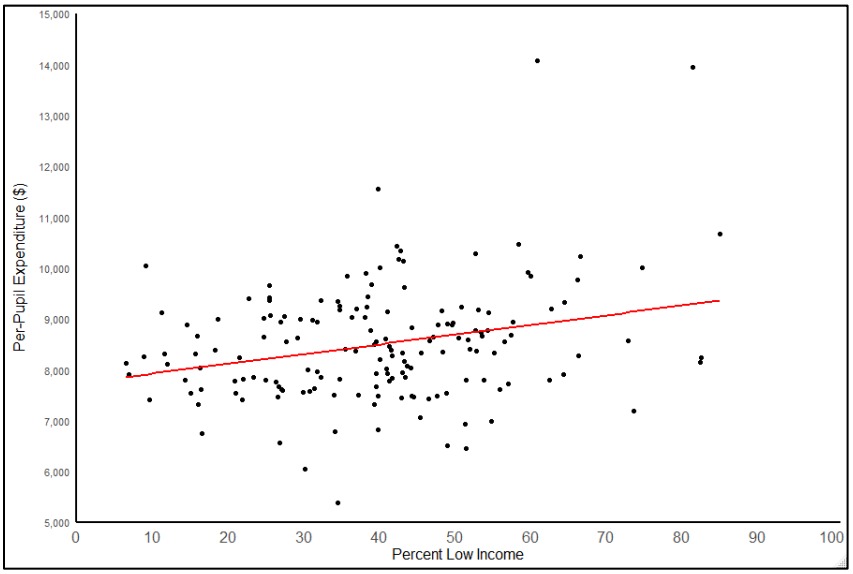
Since averaging across all schools can obscure relationships for individual schools, Figures 8 and 9 show disability-adjusted PPE for each school in Delaware. Figure 8 weights the results by school size, and Figure 9 does not. When I apply the Jackson Report's disability adjustment to the Report Card data, the relationship between disability-adjusted PPE and the share of low-income students in each school remains positive. Although I firmly maintain that the disability-adjusted PPE measure proposed in the Jackson Report is not a valid spending adjustment, applying this adjustment to the Report Card data, which does not duplicate student counts, still shows the Delaware funding system to be progressive.

Figure 8. Disability-adjusted PPE by Percentage of Low-Income Students (weighted by enrollment), 2017-2018 School Year (State Dollars Only)



Source: Data from the Jackson Report and Report Card Data.

Figure 9. Disability-adjusted PPE by Percentage of Low-Income Students, 2017-2018 School Year (State Dollars Only)

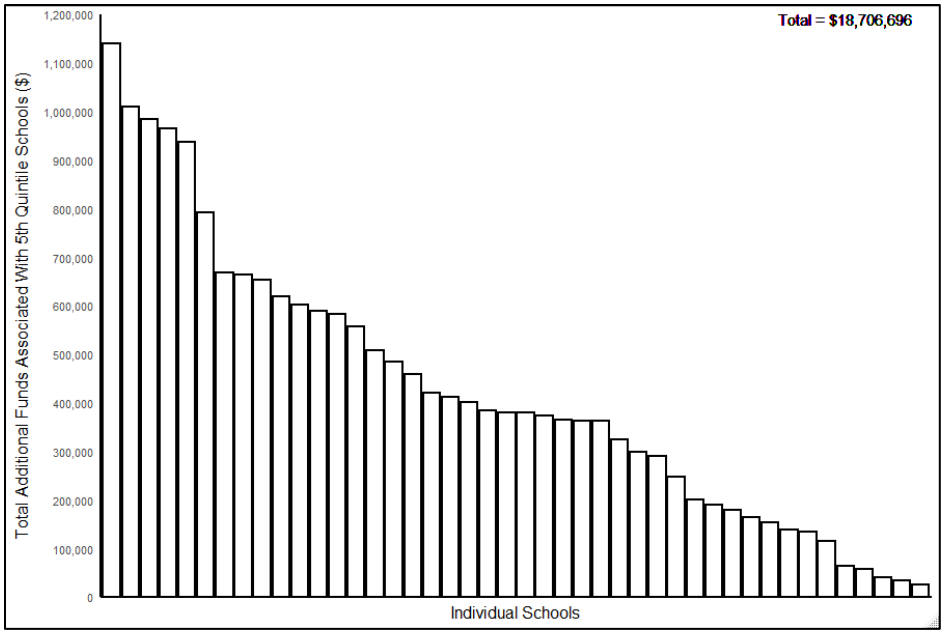


Source: Data from the Jackson Report and Report Card Data.

Delaware spends more on disadvantaged students. As highlighted in my expert report dated March 13, 2020, Delaware's funding system is highly progressive, meaning that districts and schools with larger shares of disadvantaged students spend more per pupil on average than districts and schools with a smaller share of such students. To further illustrate this point, Figures 10 and 11 below show the total dollar amount difference between the 1st and 5th quintile schools, as reported in Figures 8 and 9 in my expert report dated March 13, 2020. I generate quintiles using the proportion of either low-income or GAP students, and the PPE amount is based on local and state dollars or local, state, and federal dollars. I took the difference between the weighted average PPE in the 5th quintile and the weighted average PPE in the 1st quintile. I then multiplied it by the number of students in a school, effectively converting the PPE into a rough approximation of the total expenditure differences between 5th and 1st quintile schools. Figures 10 and 11 present each school in the 5th quintile on the x-axis, with the total additional funding relative to a 1st quintile school on the y-axis using local and state dollars. The figures show that schools serving more low-income and GAP

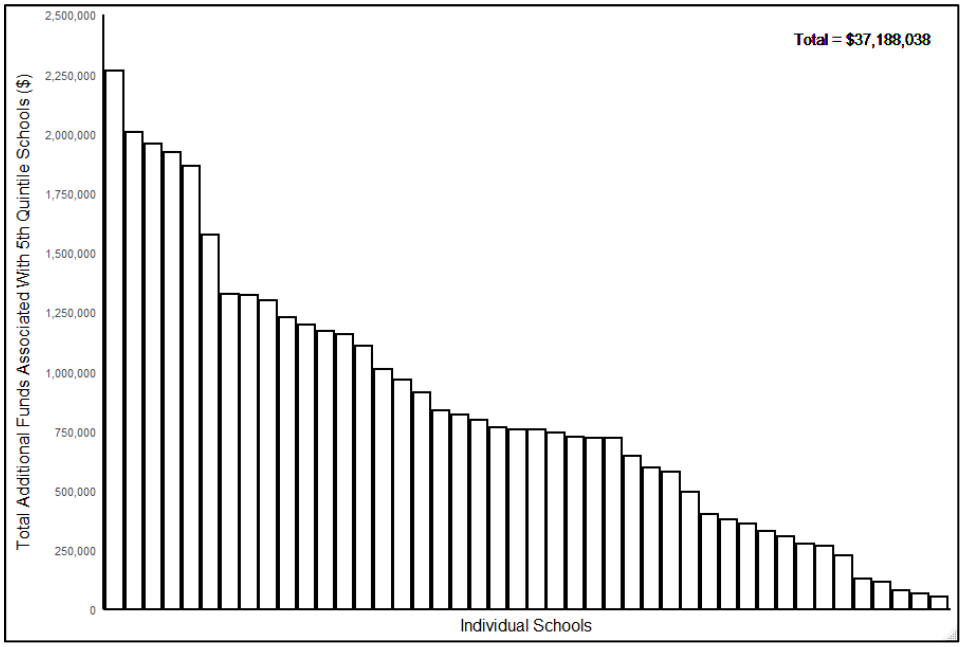
students have $18,706,696 and $37,188,038 in higher expenditures, respectively. Figures 12 and 13 present the same estimates but this time using local, state, and federal dollars. The figures show that schools serving more low-income and GAP students have $26,700,393 and $63,424,530 in higher expenditures, respectively.

Figure 10. Total Additional Funding in 5th Quintile Percent Low Income Schools Relative to 1st Quintile Percent Low Income Schools (weighted median), 2017-18 School Year (Local and State dollars)



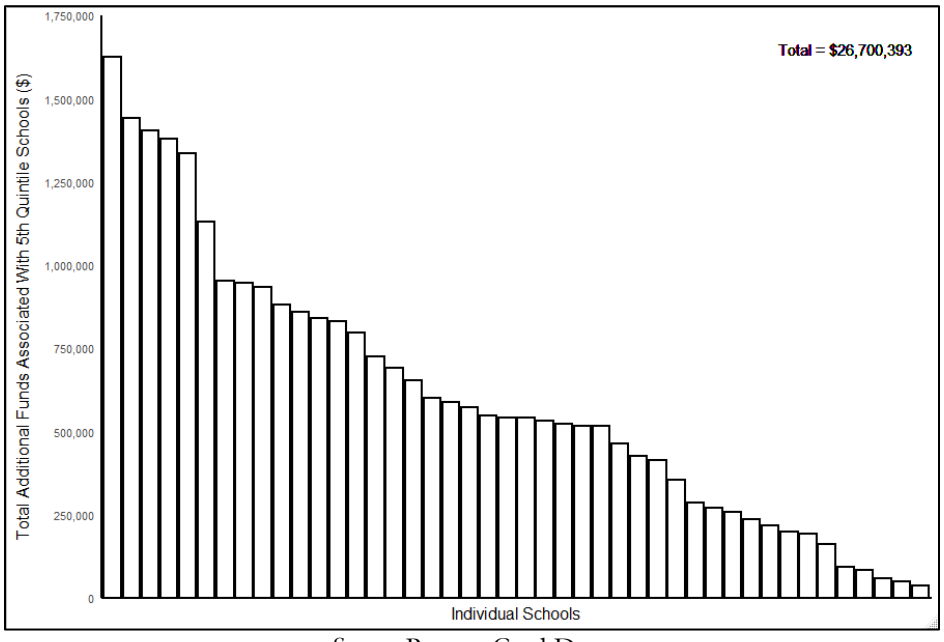
Source: Report Card Data.

Figure 11. Total Additional Funding in 5th Quintile Percent GAP Schools Relative to 1st Quintile Percent GAP Schools (weighted median), 2017-18 School Year (Local and State dollars)



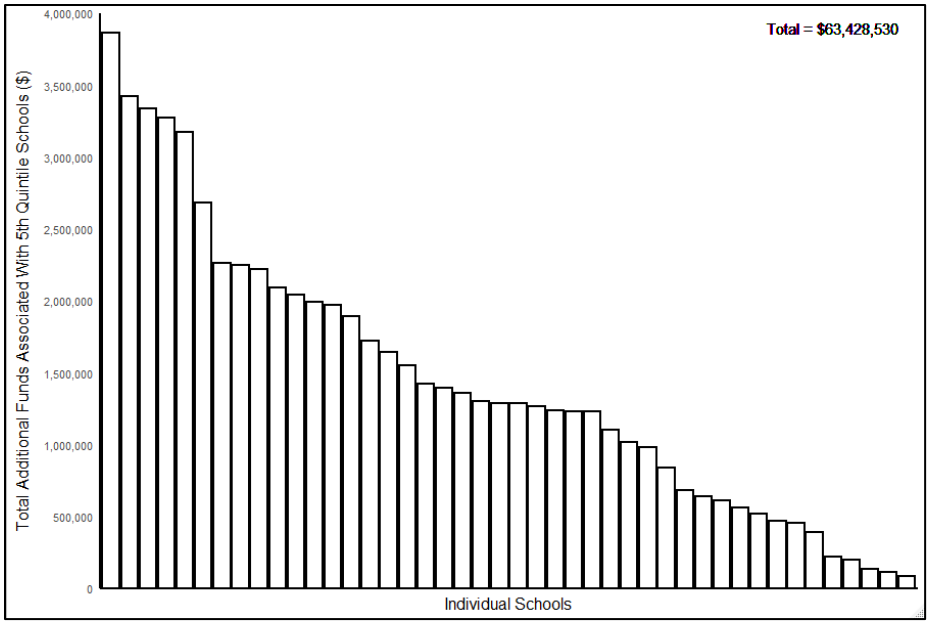
Source: Report Card Data.

Figure 12. Total Additional Funding in 5th Quintile Percent Low Income Schools Relative to 1st Quintile Percent Low Income Schools (weighted median), 2017-18 School Year (Local, State, and Federal dollars)



Source: Report Card Data.

Figure 13. Total Additional Funding in 5th Quintile Percent GAP Schools Relative to 1st Quintile Percent GAP Schools (weighted median), 2017-18 School Year (Local, State, and Federal Dollars)



Source: Report Card Data.

3. Student-to-Counselor and Other Support Staff Ratios

The Gehlbach Report argues for the importance of counselors on long-term student outcomes, emphasizing their role in behavioral interventions, mental health, and post-secondary guidance. For example, Gehlbach writes, "School counselors are a primary, professional support for students when they encounter mental health challenges at school" (p. 5) and "school counselors can benefit students through a range of different types of counseling interventions" (p. 7). Gelhbach specifically cites to the American School Counselor Association (ASCA) recommended ratio of one counselor for every 250 students (p. 6). While empirical evidence generally supports the finding that counselors can positively affect students (Carrell and Carrell, 2006; Carrell and Koekstra, 2014), there is no evidence to substantiate the idea that there is a known student-to-counselor ratio that optimally serves students' needs. Additionally, a recent working paper has proposed a rival hypothesis, finding that the association between counselor interventions and student outcomes may

be attributed to better professional development for existing counselors and not to a reduction in the student-to-counselor ratio (Mulhern, 2020).

A. Validity of the 250:1 student-to-counselor ratio and other staffing ratios

The validity of the 250:1 student-to-counselor ratio is suspect, at best. I am unaware of any rigorous academic evidence supporting this ratio. For all intents and purposes, the ratio appears to be a benchmark championed by the ASCA, a professional organization for school counselors with a vested interest in promoting the interests and prevalence of school counselors. ASCA publications routinely recommend a 250:1 student-to-counselor ratio, whether it be in public facing press releases (ASCA, N.D.a), a state-by-state report on school counselors (ASCA, N.D.b), or their 2012 national framework for school counseling programs that proclaims: "To achieve maximum program effectiveness, the American School Counselor Association **recommends** a school counselor to student ratio of 1:250 and that school counselors spend 80 percent or more of their time in direct and indirect services to students" (ASCA, 2012: p. 1).

The only evidence I was able to locate regarding this claim comes from a 2018 article published in ASCA's flagship journal, *Professional School Counseling*. The article by Lapan and colleagues (2018) concludes "…schools that met the ASCA criteria of having at least one professional school counselor for every 250 students had better graduation and school attendance rates, and lower disciplinary infractions." However, this conclusion is based on a simple comparison of graduation rates, attendance and ACT scores between schools with student-to-counselor ratios below 250 and schools where the ratio is above 250. A simple mean difference between two groups of schools is insufficient evidence to claim that the lower student-to-counselor ratio was the reason why graduation, attendance, and ACT scores improved because these two groups of schools may have other, unobserved differences that explain both the smaller student-to-counselor ratio and improved student outcomes. In rigorous research aimed at making a causal claim between the

student-to-counselor ratio and improved student outcomes, there should be additional tests or more sophisticated statistical models that rule out the myriad potential alternative explanations. In this case, a simple comparison between two groups of schools ignores a host of alternative explanations and is insufficient evidence to conclude that reducing the student-to-counselor ratio *caused* the improvements in student outcomes.

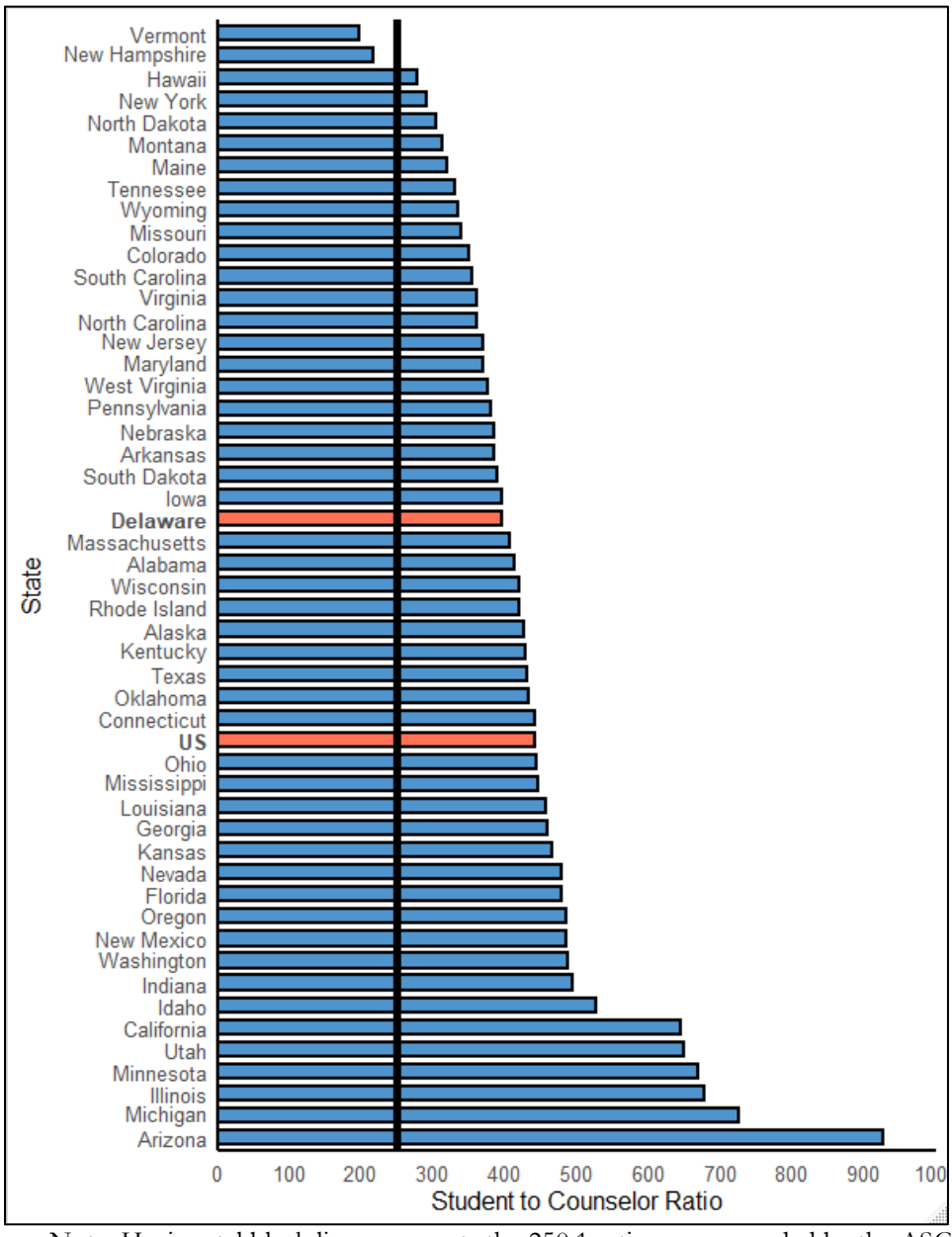
This is not to say that reducing the student-to-counselor ratio may not have beneficial impacts on schools (Carrell and Carrell, 2006; Carrell and Koekstra, 2014). Rather, it is to emphasize the absence of rigorous empirical evidence that validates the 250:1 ratio as the optimal level. Additionally, simply citing ratios assumes that all counselors are equally skilled and are all performing efficiently. This is not the case. For example, one recent study in Massachusetts finds that increasing the effectiveness of school counselors by a standard deviation would have larger benefits than hiring an additional counselor in each school (Mulhern, 2020). Moreover, hiring enough counselors to reach ambitious ratio targets could potentially decrease the average effectiveness of counselors in schools, as has been observed when districts make largescale increases in teacher hiring in order to reduce class size (Jepsen and Rivkin, 2009).

B. *Delaware maintains a favorable student-to-counselor ratio and has invested significantly in school counselors over time*

Delaware maintains a student-to-counselor ratio that is considerably better than the national average. As shown in Figure 14, Delaware ranks 23rd in the nation in 2017, and only two states – Vermont and New Hampshire – maintain ratios under 250:1. Most states do not have ratios that are even close to the ASCA's recommendation, making this ratio an ambitious assertion relative to the current state of counseling. Delaware has also invested significantly in school counselors over time. As displayed in Figure 15, Delaware has made dramatic improvements in the student-to-counselor

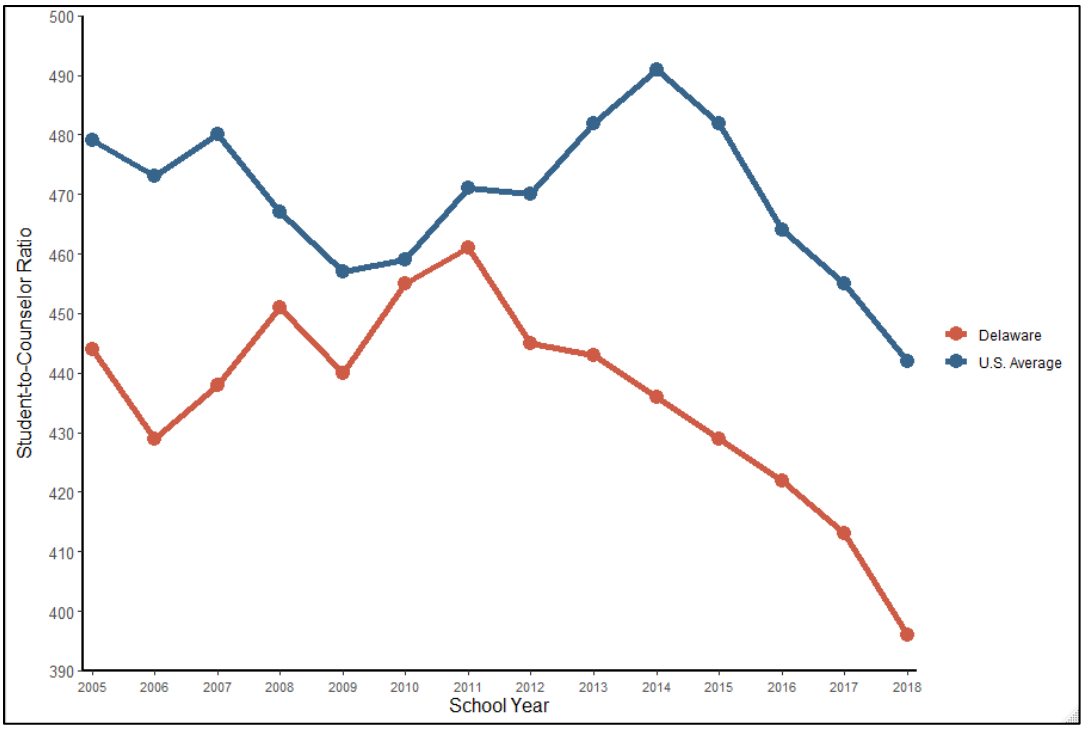
ratio over the last decade, reducing the ratio from 461:1 in 2010 to 396:1 in 2017. Delaware has also maintained a ratio that is lower than the national average since 2004.

Figure 14. Student-to-Counselor Ratio by State in 2017



Note: Horizontal black line represents the 250:1 ratio recommended by the ASCA.
Data Source: ASCA (N.D.c)

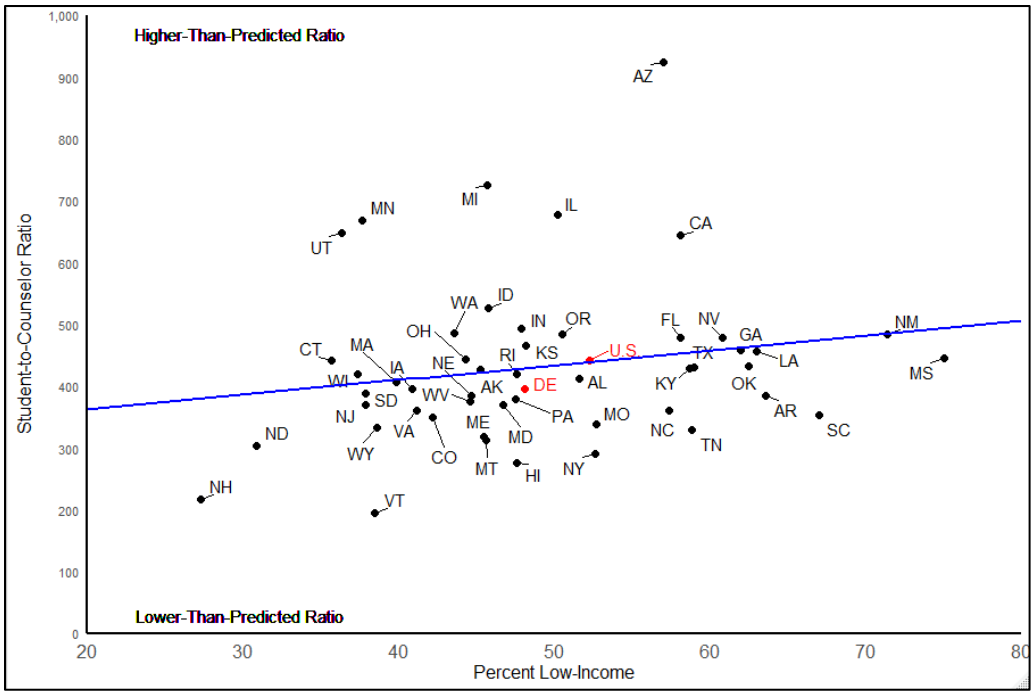
Figure 15. Student-to-Counselor Ratio Over Time for Delaware and the U.S. Average



Note: Years represent school years, so 2005 is the 2004-05 school year.
Data Sources: ASCA (N.D.b; N.D.c; N.D.d; N.D.e).

Another way to evaluate investments in school counselors is to examine the relationship between the proportion of low-income students in a state and its student-to-counselor ratio. Figure 16 below graphs the relationship between proportion low-income and student-to-counselor ratio for each state relative to the national average, and includes a simple regression line (blue line). States above the blue line have a higher than predicted student-to-counselor ratio, given their level of poverty, and those states below the blue line, like Delaware, have lower than predicted student-to-counselor ratios.

Figure 16. Relationship between the Proportion of Low-Income Students and the Student-to Counselor Ratio for Each State, 2016-2017

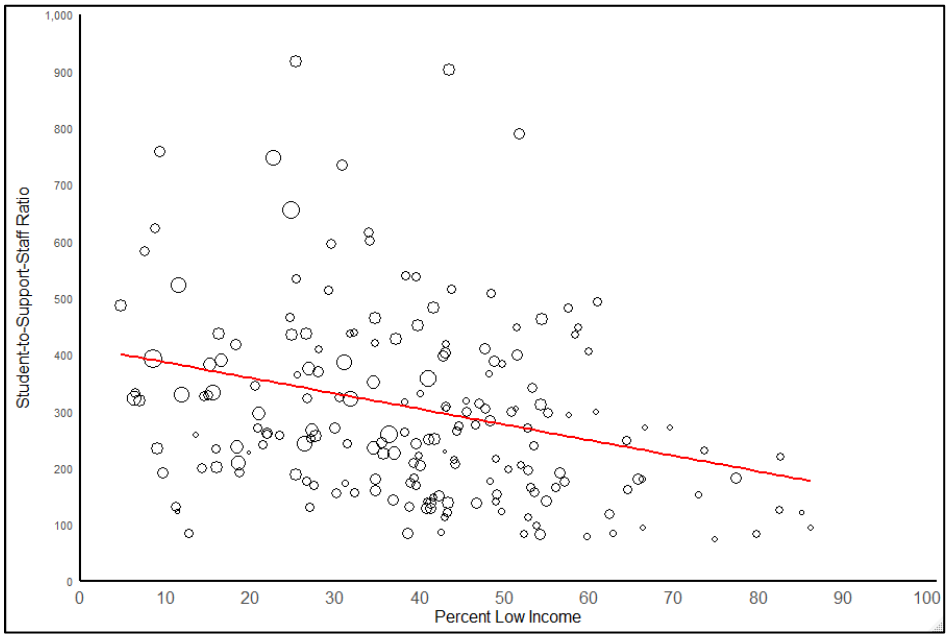


Data Source: NCES (2019) and Delaware Open Data Portal (2020).

I also examine the relationship between the student-to-support-staff ratio in a school and the percent of low income or GAP students enrolled in a school. To examine these relationships, I use data on the number of support staff in a school from Delaware's Open Data Portal and restrict the sample of schools to the same set used in my expert report. Since these data are aggregated at the school level, any support staff that are not assigned directly to a school, like those who work in a district level office, will not be captured. The state's support staff indicator is defined as psychologists, psychometrists, speech and hearing therapists, social workers, home visitors, nurses, pupil support supervisors, pupil support specialists, and pupil support (other) working in a school (Delaware Open Data, 2020). The negative relationship as displayed in Figure 17 means that, on average, as the percent of enrollment that is low income increases in a school, the student-to-support-staff ratio decreases, i.e., becomes more favorable, in low income schools. In other words,

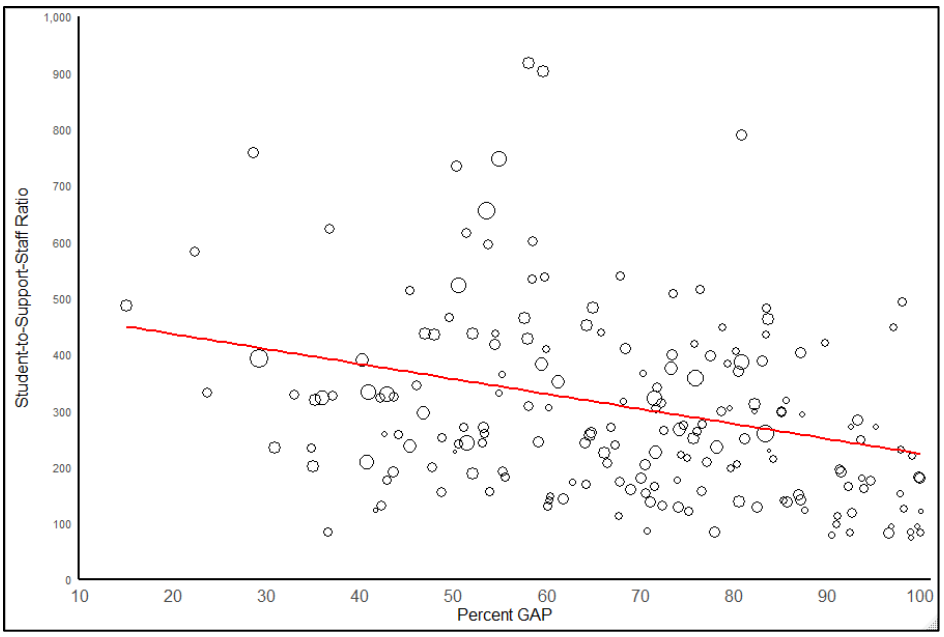
schools serving more low income students also tend to employ more support staff. I find a similar pattern when examining the relationship between the percent of GAP students enrolled in a school and the student-to-support staff ratio, as displayed in Figure 18.

Figure 17. Relationship between Student-to-Support-Staff Ratio and Percent Low Income Students at the School Level (weighted by school enrollment), 2017-18 School Year.



Source: Sample is the same sample of schools used in the PPE analysis in my expert report.
Data source: Delaware Open Data and Report Card Data

Figure 18. Relationship between Student-to-Support-Staff Ratio and Percent of GAP Students at the School Level (weighted by enrollment), 2017-18 School Year.



Source: Sample is the same sample of schools used in the PPE analysis in my expert report. Data source: Delaware Open Data and Report Card Data

In sum, there is not a strong basis for the 250:1 student-to-counselor ratio. Nevertheless, Delaware has a ratio that is lower than the national average and has consistently reduced it over the past decade. In addition, on average, there are more total support staff on a per-pupil basis in schools with high concentrations of low-income and GAP students.

4. Capital Investment in Schools – Rothstein and Jackson

The Rothstein and Jackson Reports note that capital investments in schools can raise student outcomes. The Rothstein Report cites studies which he concludes demonstrate "compelling" evidence that "improved facilities dramatically increase student achievement" (Rothstein, 2020, p. 15). Similarly, the Jackson Report states that prior research finds "capital spending does improve outcomes" (Jackson, 2020, p. 23). However, neither report directly examines Delaware's capital expenditures. Given the conclusions offered in the Jackson and Rothstein Reports, I examine both

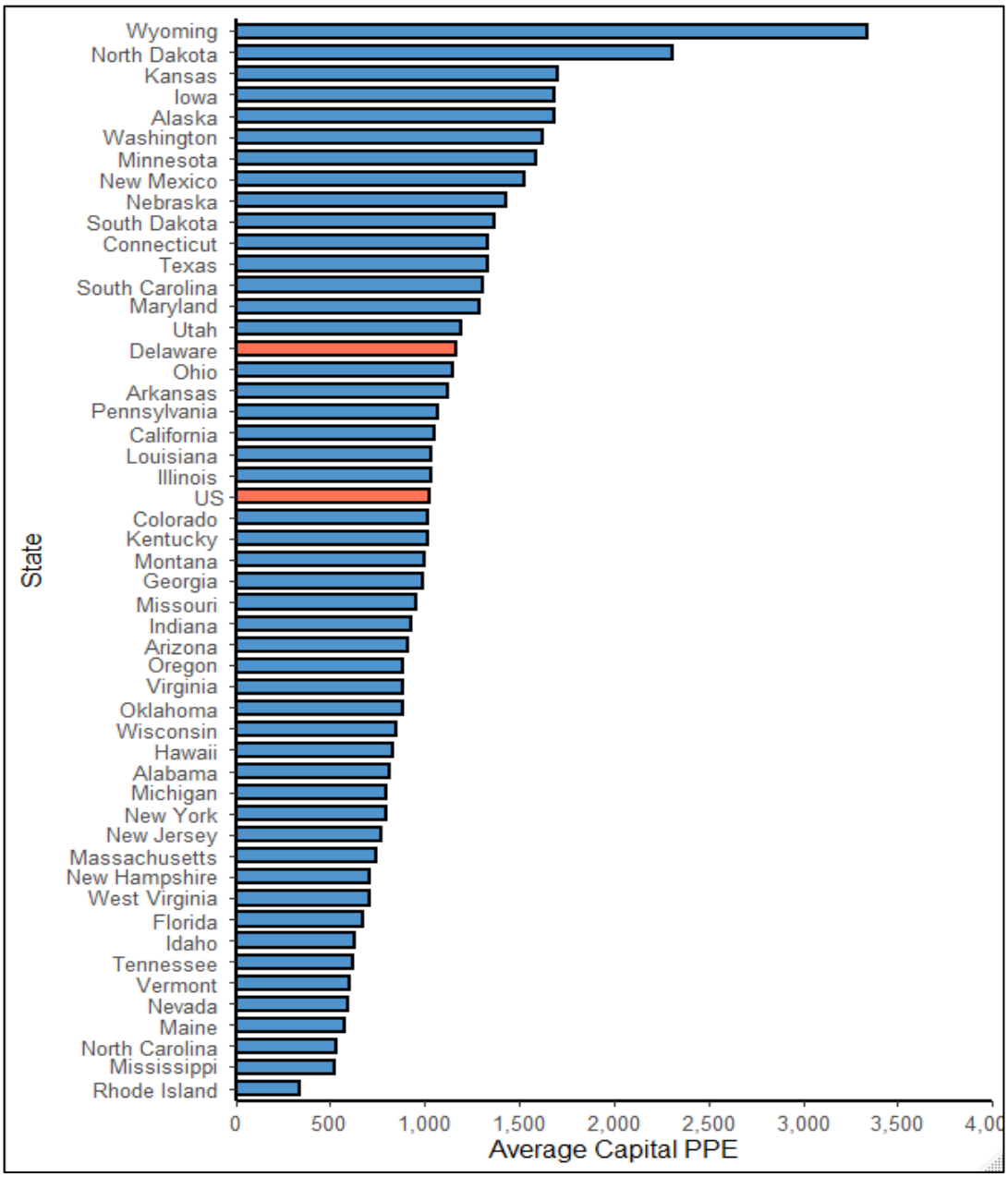
Delaware's capital expenditures over the past 20 years and the literature linking capital expenditures with student outcomes.

A. Delaware has placed an emphasis on capital investment in schools

A review of current capital investment in schools shows that Delaware is investing a significant amount of resources in new and improved facilities. For the 2020 fiscal year, Delaware appropriated a total of $134.3 million in K-12 school construction and renovation in the Cape Henlopen, Capital, Appoquinimink, Brandywine, and Indian River districts as an injection of one-time and bond funding. This amount is approximately 11 percent of all Division I, II, and III funding for the 2020 fiscal year and is all outside of the division-based funding system. This highlights the importance of outside-the-formula funding.

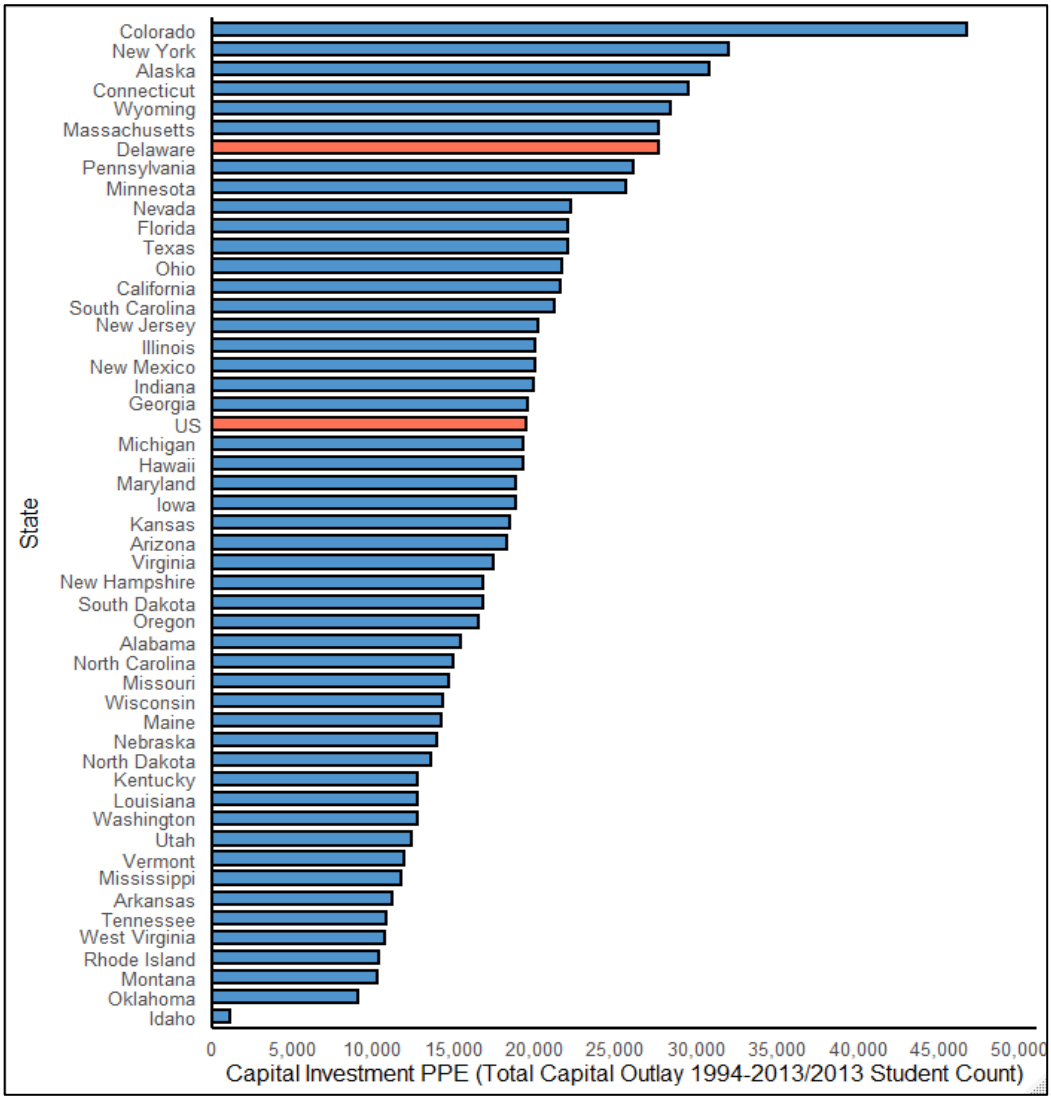
Delaware also has a demonstrated track record of investing in school facilities. As shown in Figure 19, as compared to other states, Delaware has averaged above average per-pupil capital expenditure from 2010-11 to 2016-17 school years. Additionally, Figure 20 shows the total school-construction capital expenditure from fiscal years 1994-2013, divided by the number of students in each state in 2013 to account for state size. This figure shows that relative to the size of its student population, Delaware was one of the top spending states in this two-decade time frame. These figures show that Delaware clearly invests heavily in capital expenditures relative to other states.

Figure 19. Average Capital Per-Pupil Expenditure by State from 2010-11 to 2016-17



Source: NCES (2019).

Figure 20. Total School-Construction Capital Outlay for Fiscal Years 1994–2013 (2014 Dollars), Divided by 2013 Student Count



Data Source: Filardo (2019)

B. Research on the relationship between capital investment in schools and student outcomes is not clear

While there is a dearth of high-quality research on the impact of capital investments in schools, there is some research showing that capital investments can have meaningful impacts on both students and communities in certain contexts. For instance, Neilson and Zimmerman (2014) investigated the effect of a school reconstruction project in New Haven, Connecticut, a high-

poverty district primarily composed of minority groups. The researchers found that, after six years, the construction had raised student reading scores by a substantial 0.15 standard deviations. Additional benefits were also seen in the surrounding neighborhoods where local home prices increased around 10 percent. Also, there was an overall increase in public school enrollment.

Similar findings were reported in a study on hundreds of school building improvement projects in the Los Angeles Unified School District by Lafortune and Schonholzer (2018). They found that the improved facility quality created through these construction projects led to a 0.1 standard deviation improvement in standardized math scores and a 0.05 standard deviation increase in English scores. They also found that neighborhoods where new schools were built saw a 6 percent increase in property value, and students in non-renovated schools also benefitted from the construction of new schools, in part because of a corresponding reduction in overcrowding when students moved towards the new school.

This research suggests that investments in school capital expenditures to improve facility quality may be associated with increased student performance and may also build wealth for families in these communities. However, consensus has not been reached in the literature. For instance, Martorell, Stange, and McFarlin (2016) sampled hundreds of bond funded school improvements and constructions and found little evidence to suggest that constructing school facilities led to improved student achievement. Cellini, Ferreira and Rothstein (2010), who originated the methodology used by Martorell, Stange, and McFarlin (2016), studied California capital investments and found that while home prices increased after capital investment, there was no evidence that this construction raised student achievement.

Given the lack of consensus in a relatively sparse area of research, and the fact that these study contexts may not generalize to other settings (i.e., schools and districts in Delaware), it is difficult to know how capital investments in facilities impact student performance. Therefore, while

the large investment that Delaware is making should be considered when analyzing how the state spends on its school system, any assumptions that this would raise student achievement should be tempered.

Compensation

As noted in my March 13 report, I am being compensated at a rate of $350 per hour and my research assistants at a rate of $50 and $75 per hour. As of May 2020, I have spent 235.5 hours and my research assistants have spent 375 hours on the project.

Matthew G. Springer

Matthew G. Springer

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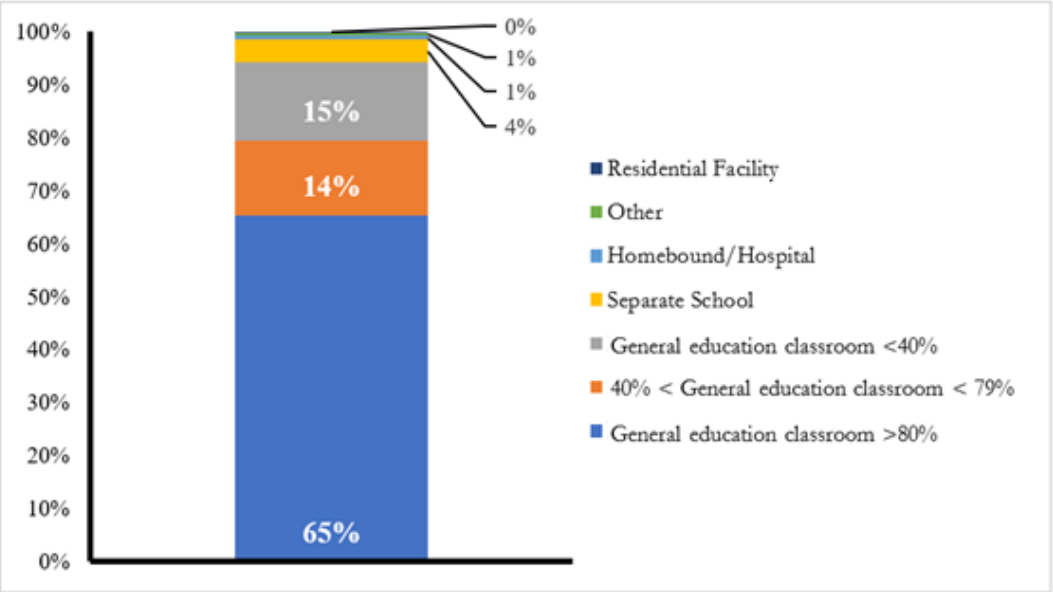
Figure 1. Percent of Students with Disabilities in Different Educational Settings (Delaware, 2017-18)



Source: Delaware Department of Education (N.D.a).

Table 1. Reproduction of Table 7 in the Jackson Report which Estimates the Relationship between Student Characteristics and PPE

	Model 1	Model 2	Model 3
Outcome:	State Per-Pupil Spending Incl. Div I		
Share Low-Income	-160.0	-1074.1	-1180.5*
	(-0.29)	(-1.68)	(-2.43)
Share with Disability		8661.9*	7588.3
		(2.53)	(2.05)
Share with Disability Squared		-3629.9	-2517.4
		(-0.77)	(-0.53)
Constant	8178.9***	7195.3***	7384.1***
	(31.53)	(18.38)	(14.31)
Number of Schools Included	162	162	162

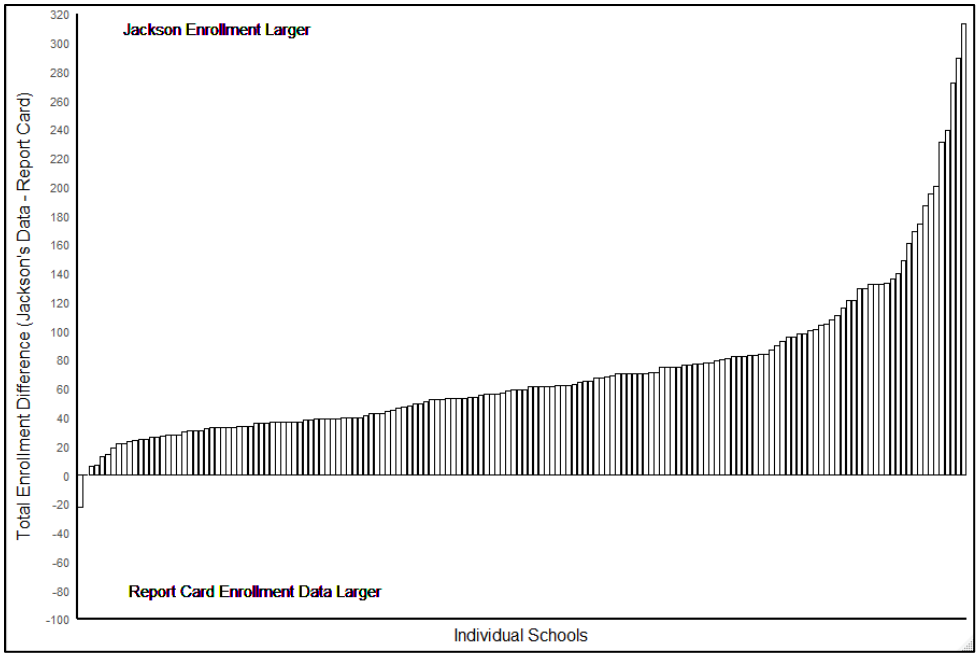
Notes: t-statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Model 3 adds an adjustment for average district-level PPE.

Table 2. Summary of Student Enrollment Counts Using End-of-year Enrollment (Jackson Report Data) and Fall Enrollment (Report Card Data), 2017-18 School Year

Data	Number of Schools	Mean	Standard Deviation	Min	Max
End-of-year Enrollment from Jackson Report	162	739.41	347.54	238	2270
Fall Enrollment from Report Card Data	162	668.34	323.96	134	2070

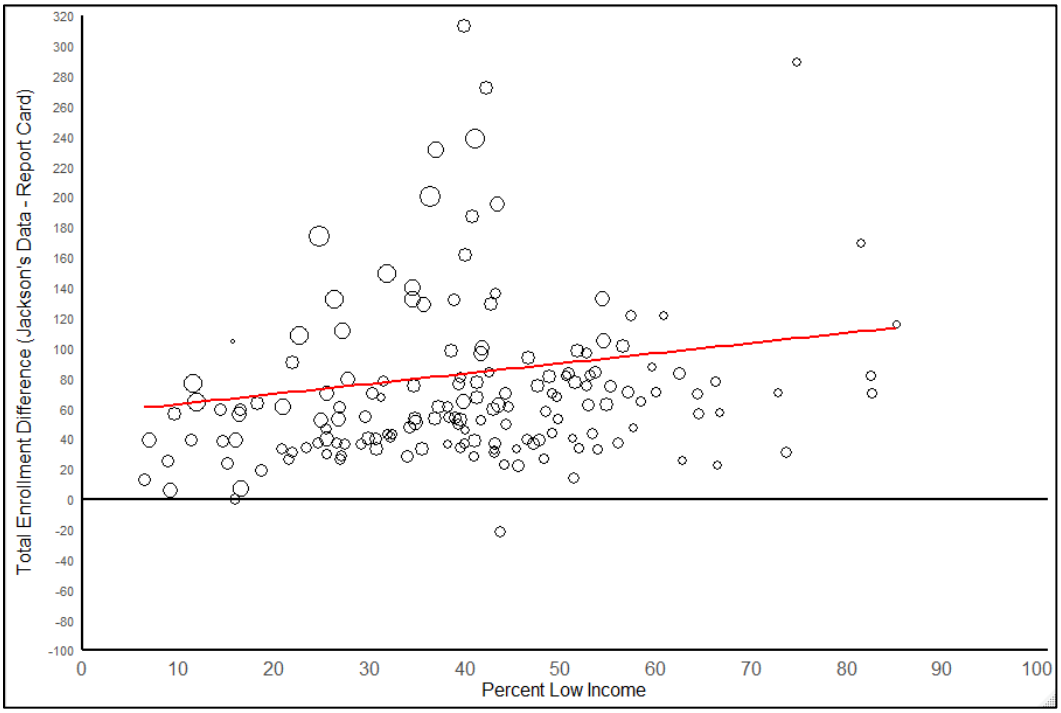
Source: Data from the Jackson Report and Report Card Data.

Figure 2. Difference in Enrollment for Each School between Delaware's Report Card Data and Data used in the Jackson Report, 2017-18 School Year



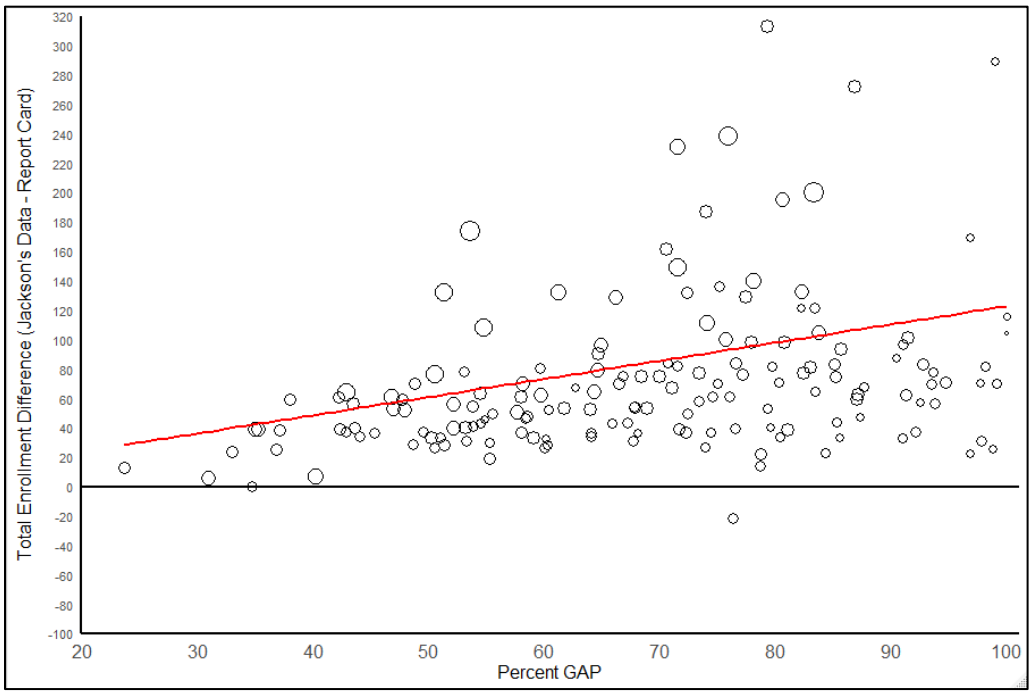
Source: Data from the Jackson Report and Report Card Data.

Figure 3. Difference in Enrollment between the Report Card Data and the Jackson Report Data, by Percent of School Enrollment Identified as Low Income (weighted by enrollment), 2017-18 School Year



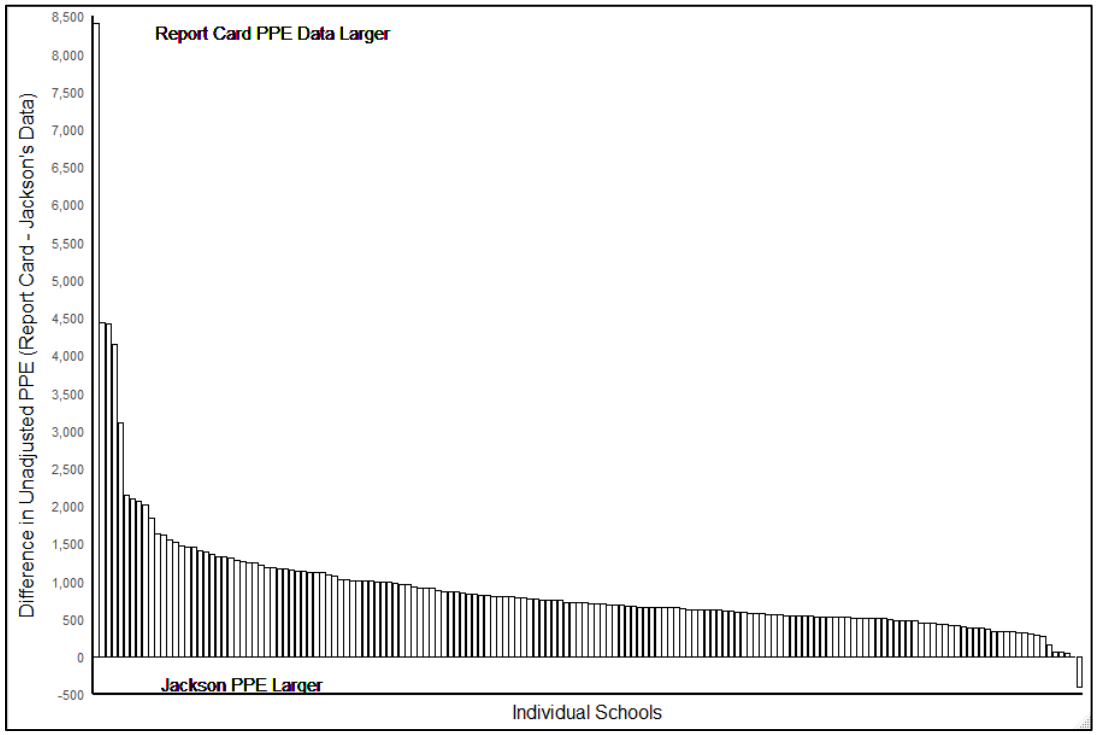
Source: Data from the Jackson Report and Report Card Data.

Figure 4. Difference in Enrollment between Report Card Data and the Jackson Report Data, by Percent of School Enrollment Identified as GAP (weighted by enrollment), 2017-18 School Year



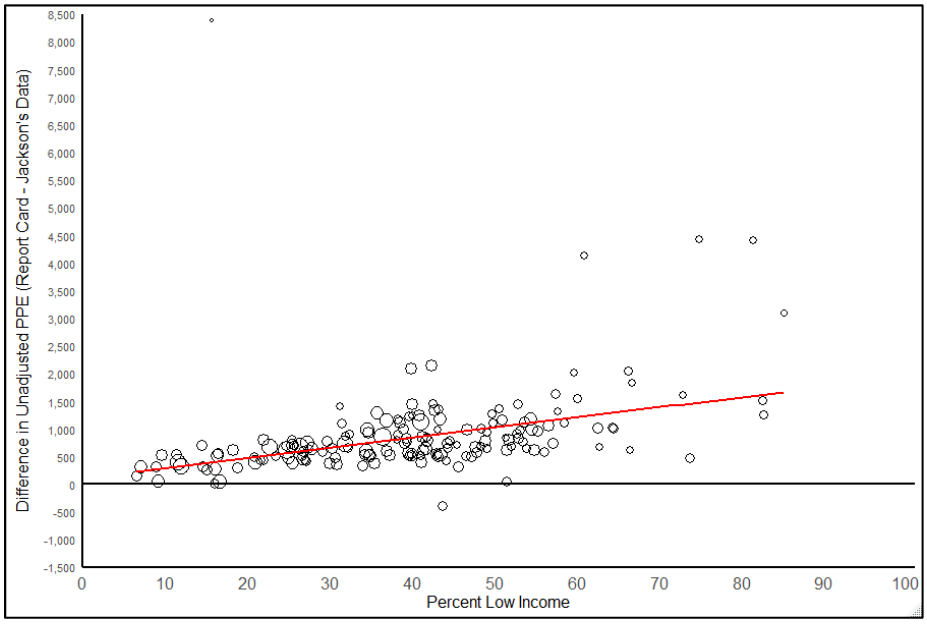
Source: Data from the Jackson Report and Report Card Data.

Figure 5. Difference in PPE for Each School between the Report Card Data and the Jackson Report Data, 2017-18 School Year (State dollars only)



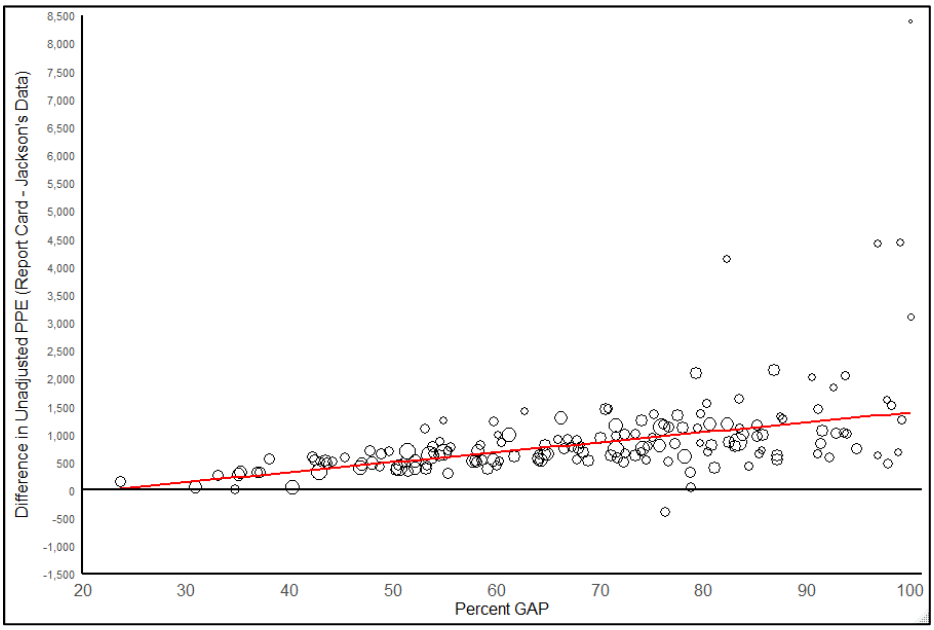
Source: Data from the Jackson Report and Report Card Data.

Figure 6. Difference in Unadjusted PPE between the Report Card Data and the Jackson Report Data, by Percent of School Enrollment Identified as Low Income (weighted by enrollment), 2017-18 School Year (State dollars only)



Source: Data from the Jackson Report and Report Card Data.

Figure 7. Difference in Unadjusted PPE between the Report Card Data and the Jackson Report Data, by Percent of School Enrollment Identified as GAP (weighted by enrollment), 2017-18 School Year (State dollars only)



Source: Data from the Jackson Report and Report Card Data.

Table 3. Relationship between PPE (the Outcome) and Student Characteristics using the Report Card Data and the Jackson Report Data, 2017-18 School Year (State dollars only)

	Model 1		Model 2		Model 3	
	Jackson Report Data	*Report Card Data*	*Jackson Report Data*	*Report Card Data*	*Jackson Report Data*	*Report Card Data*
Share low-income (0-100)	-1.6	16.89	-10.74	18.91	-11.80*	15.02
	(0.03)	(1.32)	(-1.68)	(1.40)	(-2.43)	(1.16)
Share disability (0-100)			86.61*	24.64	75.88	19.77
			(2.53)	(0.72)	(2.05)	(0.75)
Share disability squared			-0.3629	.886*	-0.2517	.892*
			(-0.77)	(2.79)	(-0.53)	(3.28)
Constant	8178.9***	8351.0***	7195.3***	7675.4***	7384.1***	7898.8***
	(31.53)	(16.43)	(18.38)	(22.61)	(14.31)	(15.41)
District Fixed-Effects	No	No	No	No	Yes	Yes
Number of Schools	162	162	162	162	162	162

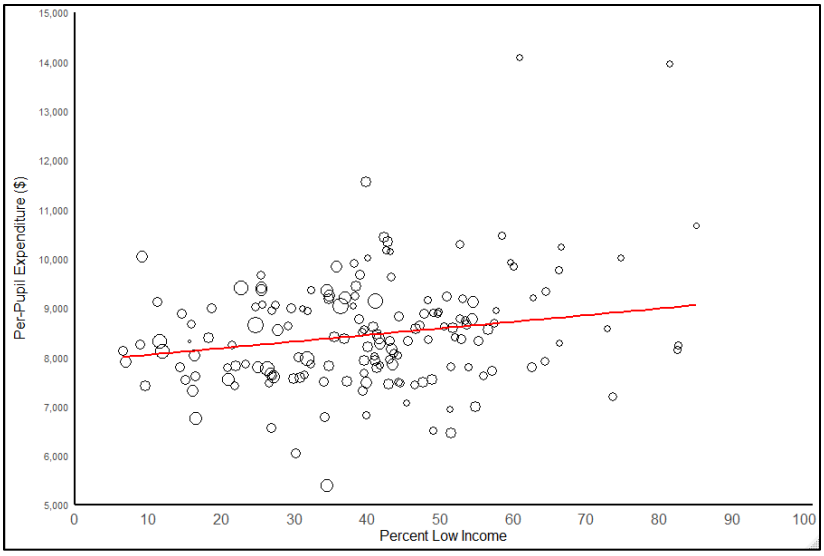
Note: The original coefficients in the Jackson Report indicate that the 'share statistics' were coded in a 0-1 range. To put coefficients in the same scale as mine, they were all divided by 100, so that a one percentage point increase in any share characteristic is associated with an increase in PPE that equals the coefficient. *t*-statistics in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4. Summary of Unadjusted and Adjusted PPE from the Jackson Report Data and Report Card Data, 2017-18 School Year (State dollars only)

	Number of Schools	Mean	Standard Deviation	Min	Max
Jackson Report Data					
Unadjusted PPE	162	8114.24	919.00	5604.02	10815.84
Disability-adjusted PPE	162	6918.76	837.23	4341.93	9743.09
Report Card Data					
Unadjusted PPE	162	9024.33	1443.63	5604.02	19210.18
Disability-adjusted PPE	162	8497.48	1149.92	5392.84	14075.27

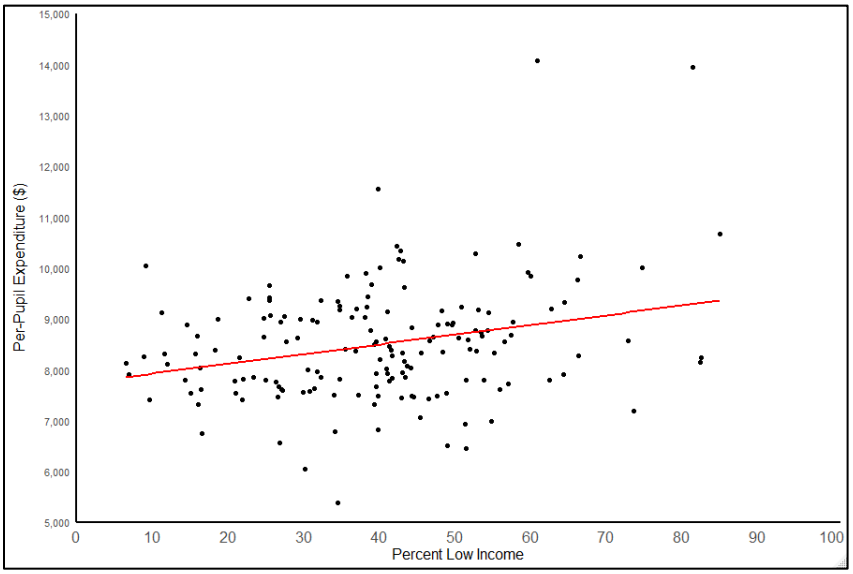
Source: Data from the Jackson Report and Report Card Data.

Figure 8. Disability-adjusted PPE by Percentage of Low-Income Students (weighted by enrollment), 2017-2018 School Year (State Dollars Only)



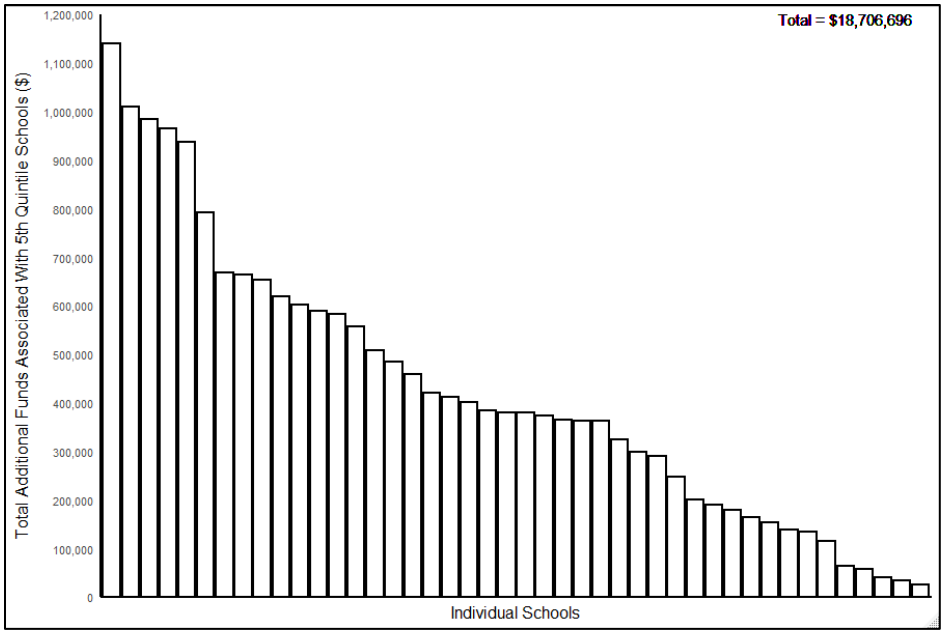
Source: Data from the Jackson Report and Report Card Data.

Figure 9. Disability-adjusted PPE by Percentage of Low-Income Students, 2017-2018 School Year (State Dollars Only)



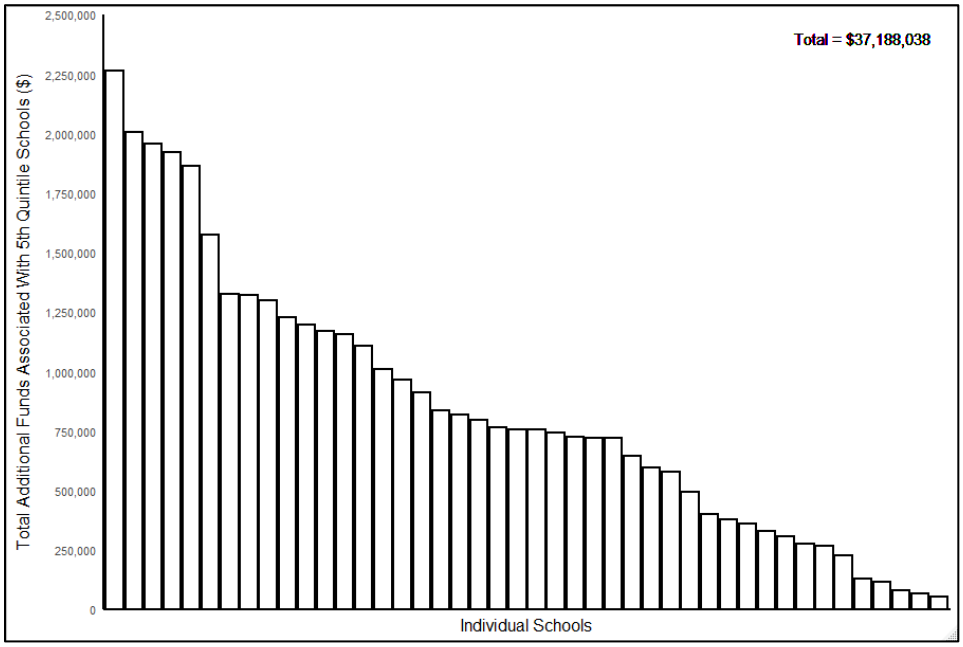
Source: Data from the Jackson Report and Report Card Data.

Figure 10. Total Additional Funding in 5th Quintile Percent Low Income Schools Relative to 1st Quintile Percent Low Income Schools (weighted median), 2017-18 School Year (Local and State dollars)



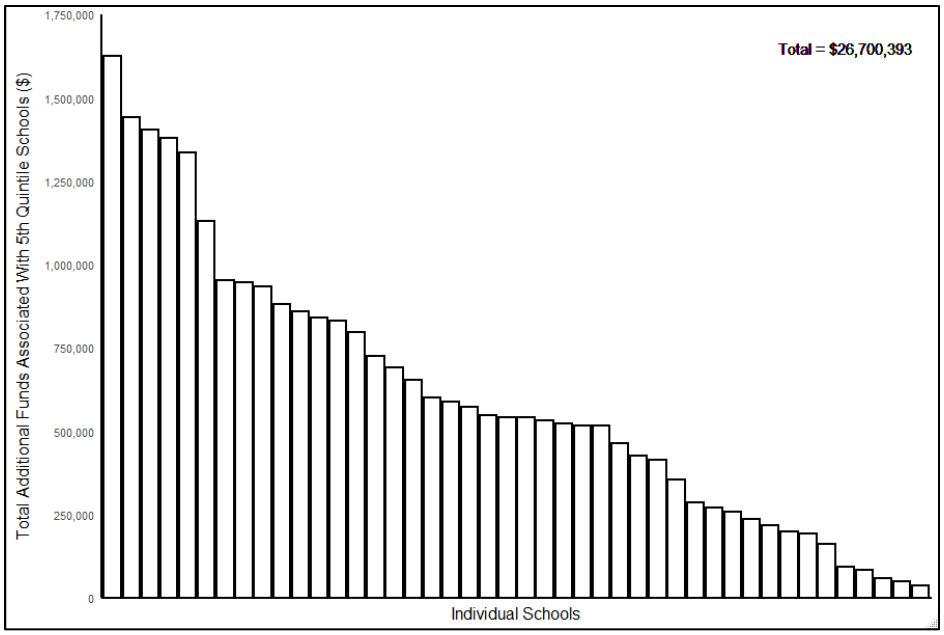
Source: Report Card Data.

Figure 11. Total Additional Funding in 5th Quintile Percent GAP Schools Relative to 1st Quintile Percent GAP Schools (weighted median), 2017-18 School Year (Local and State dollars)



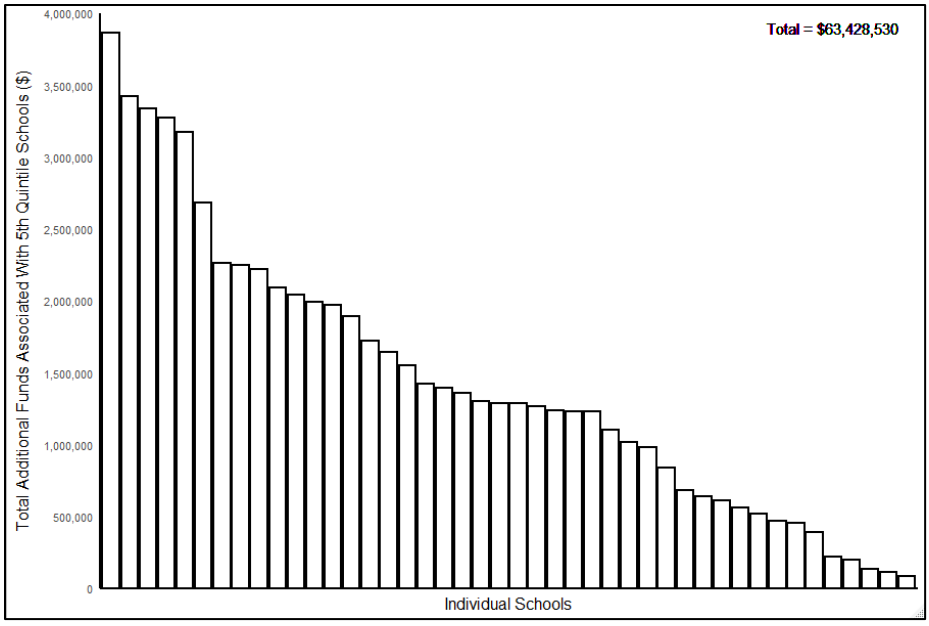
Source: Report Card Data.

Figure 12. Total Additional Funding in 5th Quintile Percent Low Income Schools Relative to 1st Quintile Percent Low Income Schools (weighted median), 2017-18 School Year (Local, State, and Federal dollars)



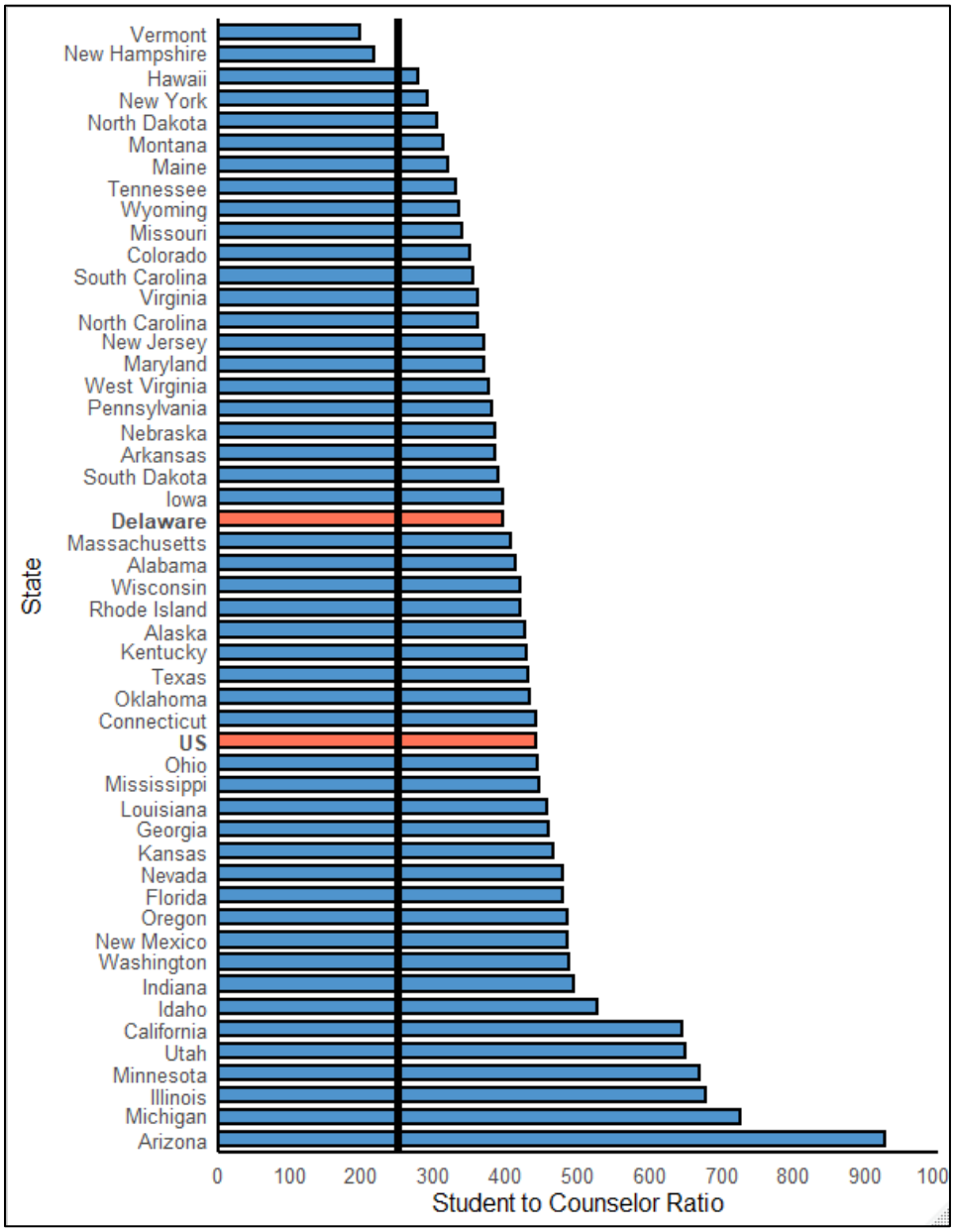
Source: Report Card Data.

Figure 13. Total Additional Funding in 5th Quintile Percent GAP Schools Relative to 1st Quintile Percent GAP Schools (weighted median), 2017-18 School Year (Local, State, and Federal Dollars)



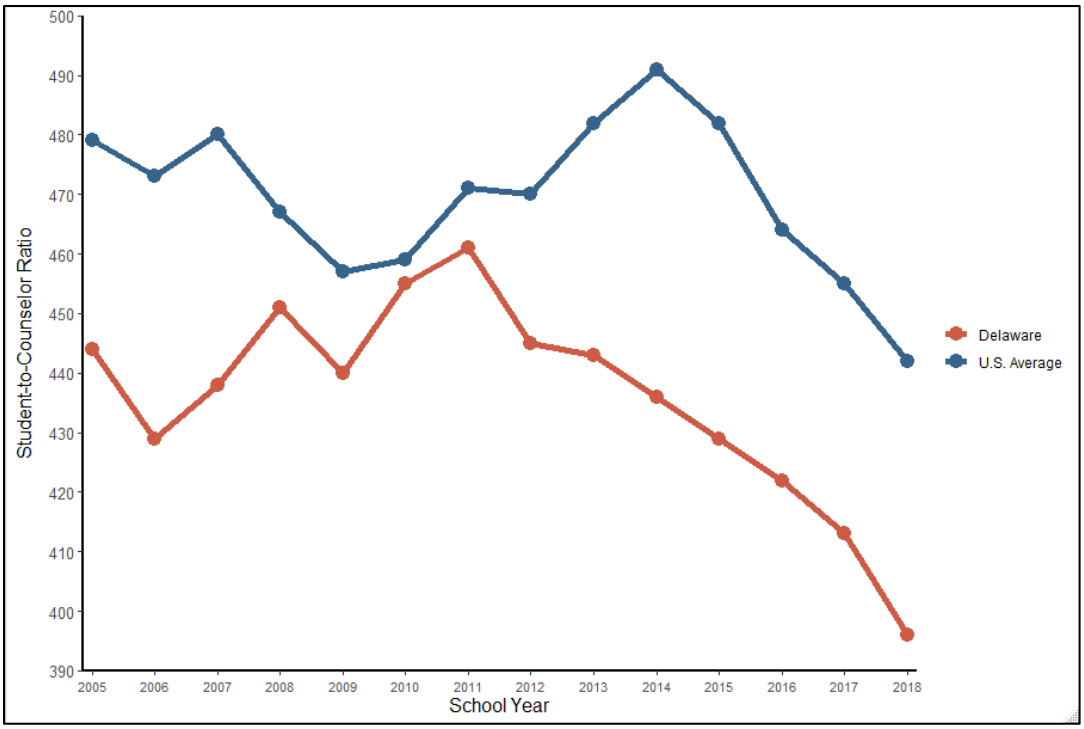
Source: Report Card Data.

Figure 14. Student-to-Counselor Ratio by State in 2017



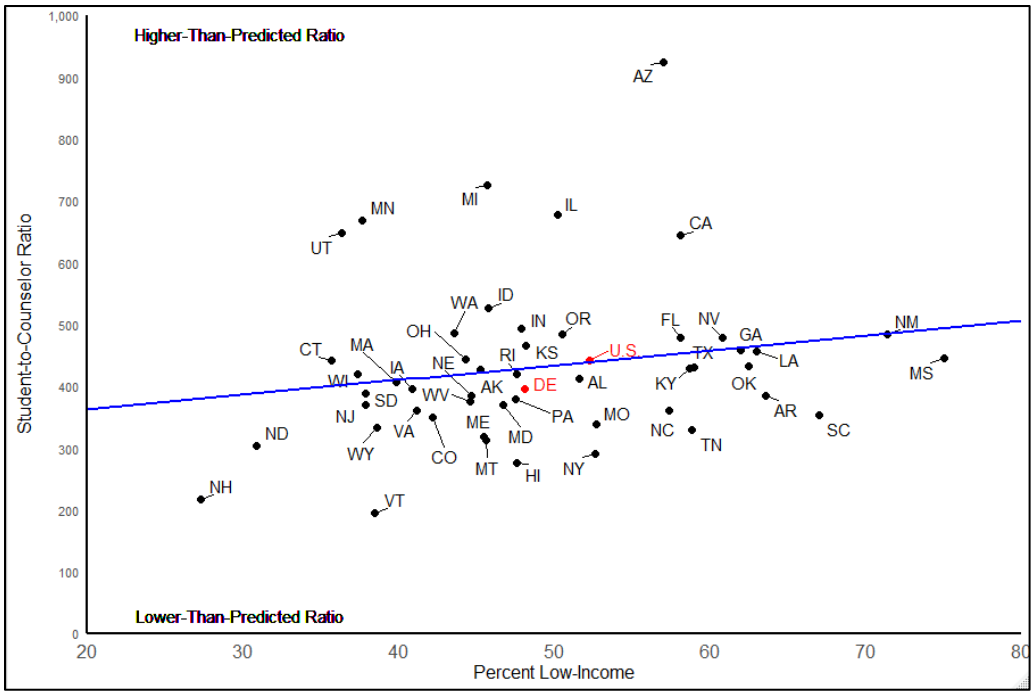
Note: Horizontal black line represents the 250:1 ratio recommended by the ASCA.
Data Source: ASCA (N.D.c)

Figure 15. Student-to-Counselor Ratio Over Time for Delaware and the U.S. Average



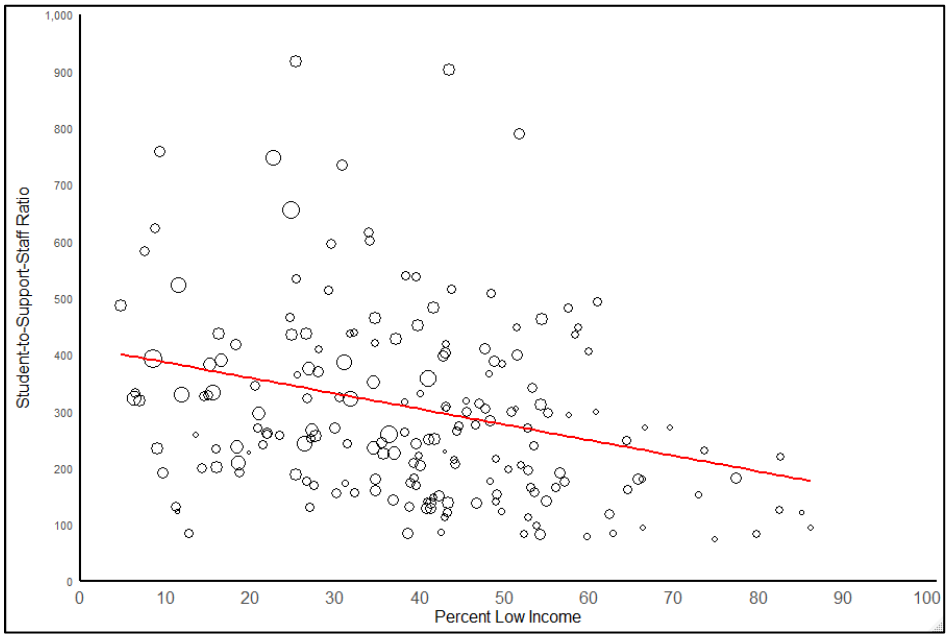
Note: Years represent school years, so 2005 is the 2004-05 school year.
Data Sources: ASCA (N.D.b; N.D.c; N.D.d; N.D.e).

Figure 16. Relationship between the Proportion of Low-Income Students and the Student-to Counselor Ratio for Each State, 2016-2017



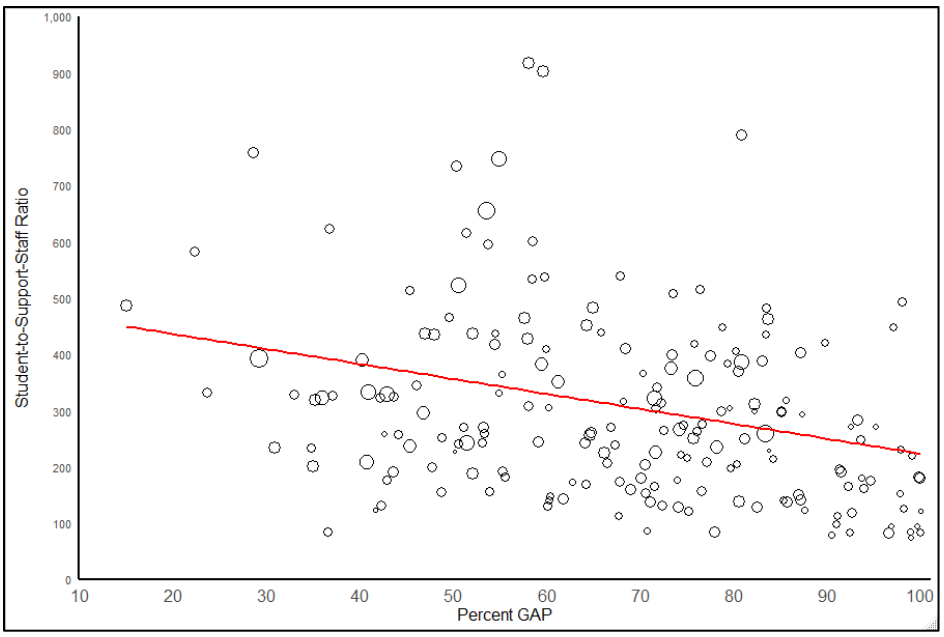
Data Source: NCES (2019) and Delaware Open Data Portal (2020).

Figure 17. Relationship between Student-to-Support-Staff Ratio and Percent Low Income Students at the School Level (weighted by school enrollment), 2017-18 School Year.



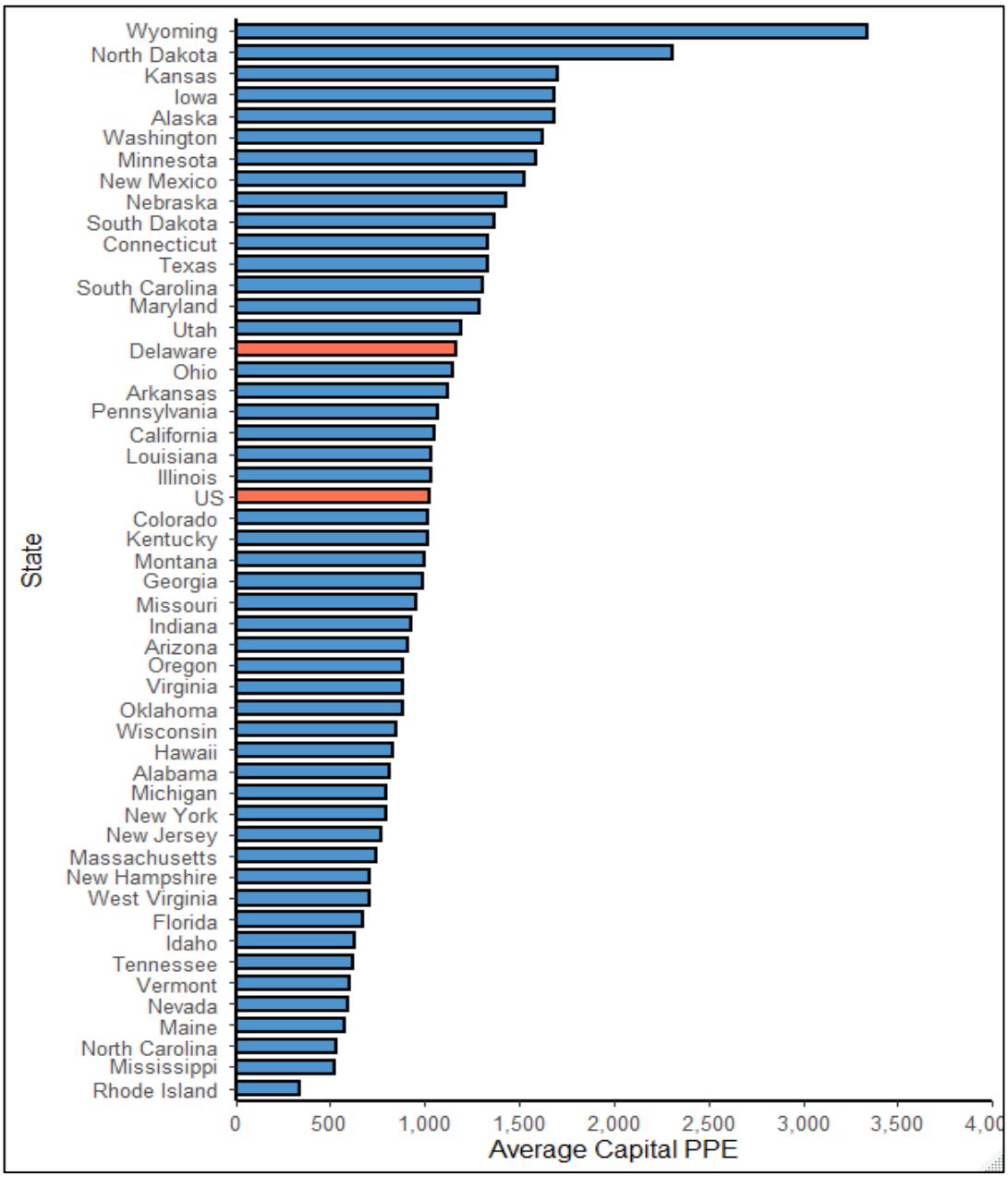
Source: Sample is the same sample of schools used in the PPE analysis in my expert report.
Data source: Delaware Open Data and Report Card Data

Figure 18. Relationship between Student-to-Support-Staff Ratio and Percent of GAP Students at the School Level (weighted by enrollment), 2017-18 School Year.



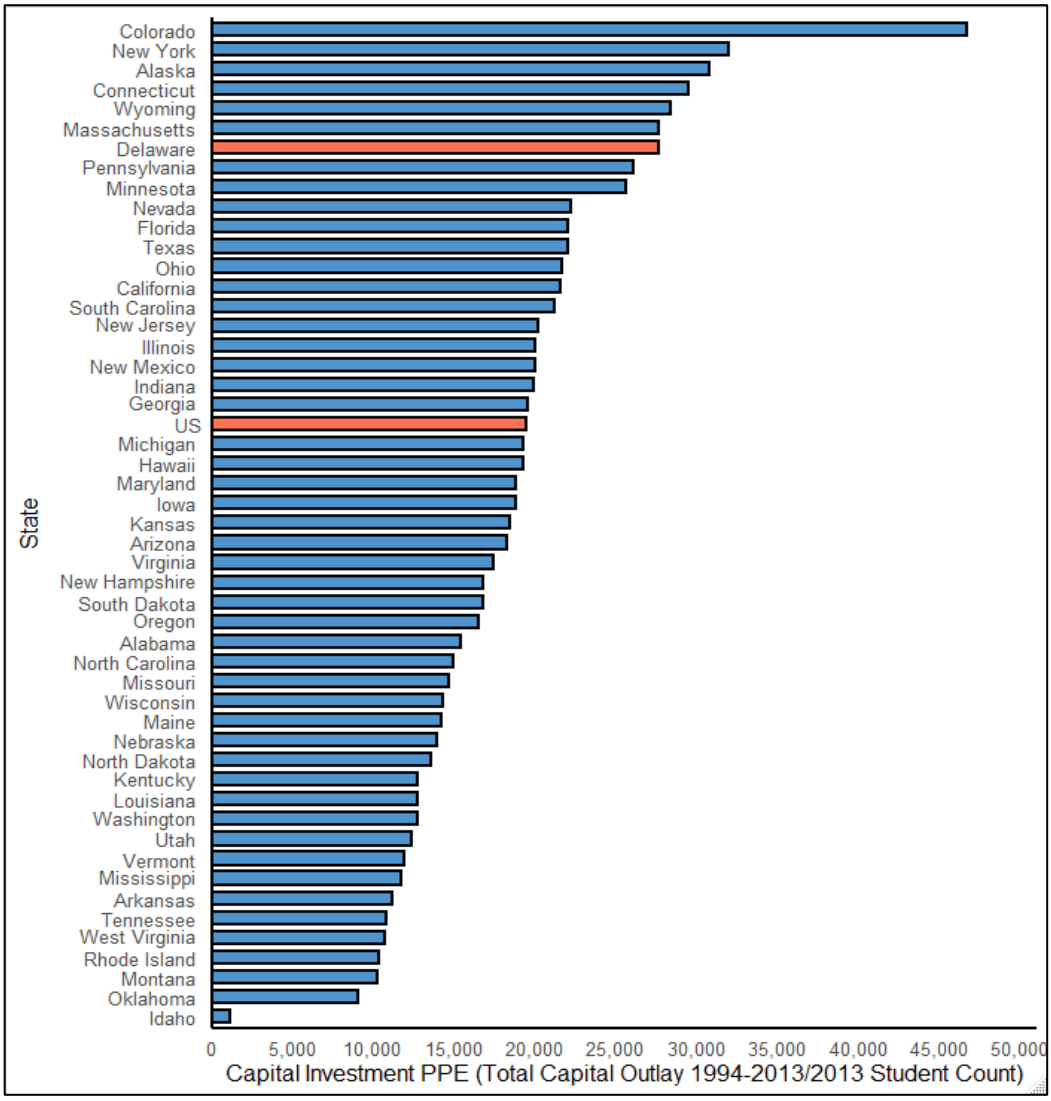
Source: Sample is the same sample of schools used in the PPE analysis in my expert report.
Data source: Delaware Open Data and Report Card Data

Figure 19. Average Capital Per-Pupil Expenditure by State from 2010-11 to 2016-17



Source: NCES (2019).

Figure 20. Total School-Construction Capital Outlay for Fiscal Years 1994–2013 (2014 Dollars), Divided by 2013 Student Count



Data Source: Filardo (2019)