The Relationship Between Schools' Costs Per Pupil and Nevada School Performance Framework Index Scores in Clark County School District

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Introduction

In 2014, Clark County School District (CCSD) commissioned a report for a subcommittee of the Superintendent's Executive Advisory Group that examined the relationship between expenditures and achievement in the district's schools. A report was produced (CCSD, 2015). Subsequently, the district asked REL West to re-analyze the data so that school expenditures would include additional information, namely, central office and transportation costs. The current research brief revisits the analyses from the previous report and includes additional analyses.

First, as in the previous report, REL West staff conducted analyses using a measure of unadjusted per-pupil costs. However, unlike the previous report, REL West staff also conducted the same analyses using a measure of adjusted per-pupil costs. This adjusted measure accounted for the fact that special populations of students are more costly to educate. This adjustment is explained in more detail in appendix A. Second, in addition to examining the relationship between schools' per-pupil costs and achievement year by year, REL West staff also examined changes in achievement over time and how these are associated with average per-pupil costs over the same period. Achievement was measured by the index score in the Nevada School Performance Framework (NSPF), as described below. Specifically, this brief addresses four questions pertaining to CCSD schools from 2012 to 2014. They are:

- *As the costs per pupil increase, do NSPF index scores also increase?*
- *Do schools with larger than predicted costs per pupil, based on school characteristics, have higher NSPF index scores?*
- *After accounting for school characteristics, is there a relationship between costs per pupil and NSPF index scores during a single school year?*
- *After accounting for school characteristics, is there a relationship between average costs per pupil over several years and changes to NSPF index scores over the same period?*

The Nevada School Performance Framework (NSPF)

The NSPF was rolled out in July 2012 upon the U.S. Department of Education's approval of Nevada's Elementary and Secondary Education Act flexibility request. NSPF index scores range from 0 to 100 for a school, and are comprised of the points earned across several indices. Elementary and middle school indices consist of a growth measure of achievement, status measure of achievement; reductions in achievement gaps between subgroups, and student average daily attendance. High school indices consist of a combination status/growth measure of achievement, reductions in achievement gaps between subgroups, student average daily attendance, and measures of graduation measures and college and career readiness.

Further details on how the NSPF is calculated can be found on the Nevada Department of Education website: http://nspf.doe.nv.gov.

Sample and data

Schools included in the analyses. Analyses included 211 elementary, 56 middle, and 46 high schools in CCSD. REL West excluded schools (n = 79) from the analyses when they met any of the following criteria:

- The school was a behavior, adult, or continuation school. These schools were excluded given the high proportion of exceptional or atypical students enrolled.
- The school covered multi-grade-spans (for example, 6–12 schools or K–12 schools). These schools were excluded given that data on student characteristics and expenditures could not easily be parsed between the elementary, middle, and high school levels.
- The school was missing NSPF index scores, or data on school characteristics or expenditures. These schools were excluded because these data were necessary to address the research questions.

Data included in the analyses. For schools in the analyses, REL West obtained the following data from CCSD for the 2012, 2013, and 2014 school years:

- NSPF index score[1]
- School type (comprehensive, magnet, College of Southern Nevada [CSN], or Career and Technical Academy [CTA])
- Percentage of students with limited English proficiency (LEP)
- Percentage of students with individualized education plans (IEPs)
- Percentage of students eligible for free and reduced-price lunch (FRPL)
- Unadjusted per-pupil expenditures; and adjusted per-pupil expenditures[2]

Unadjusted per-pupil expenditures for a school in a particular year were calculated by using the total cost divided by the total enrollment for that school in that year. REL West adjusted expenditures by school type, percentage of FRPL students, percentage of LEP students, and percentage of IEP students.[3]

All analyses were conducted separately for each question for elementary, middle, and high schools. Each analysis was performed twice, once using the unadjusted per-pupil expenditures and a second time using per-pupil expenditures that were adjusted to account for the increased costs of educating students from special populations. Details on the specific analytic method for each research question are in appendix A.

[1] The details on how the NSPF is calculated can be found on the Nevada Department of Education website: http://nspf.doe.nv.gov/Home/AboutEle.

[2] Per-pupil expenditures for this analysis included the following fund sources for each school: federal grants, general, special education, class size reduction, state grants, and food service.

[3] The details of how adjusted expenditures were calculated are in appendix A.

Findings

Presentation of findings. In some cases, findings are presented for the most recent year that data were available: 2014. In these cases, the findings for 2012 and 2013 are in appendix B.

Question 1: As the costs per pupil increase, do NSPF index scores also increase?

- When not adjusting per-pupil costs for the additional costs of educating students in special programs, NSPF index scores decreased in elementary schools as costs per pupil increased. This was the case in 2012, 2013, and 2014 (exhibit 1).
- When adjusting per-pupil costs for the additional costs of educating students in special programs, NSPF index scores increased in elementary and middle schools as costs per pupil increased. This was the case in 2014, but not in 2012 or 2013 (exhibit 2).

Exhibit 1. In elementary schools in all three years, larger unadjusted per-pupil expenditures were significantly associated with lower NSPF index scores.

School level	Year		
	2012	2013	2014
Elementary (n = 211)	-0.26***	-0.37***	-0.24***
Middle (n = 56)	-0.28*	-0.13	0.18
High (n = 46)	0.05	0.07	0.06

Pearson's-r coefficients are statistically significant at *$p < 05$; ***$p < .001$.

Exhibit 2. In elementary and middle schools in 2014, larger adjusted per-pupil expenditures were significantly associated with higher NSPF index scores.

School level	Year		
	2012	2013	2014
Elementary (n = 211)	0.12	0.06	0.16*
Middle (n = 56)	0.07	0.18	0.36**
High (n = 46)	0.19	0.18	0.18

Pearson's-r coefficients are statistically significant at *$p < 05$; **$p < .01$.

Question 2: *Do schools with larger-than-predicted costs per pupil, based on school characteristics, have higher NSPF index scores?*

- As schools' costs per pupil grew larger than those predicted by school characteristics, NSPF index scores significantly decreased only for elementary and middle schools and only in 2013 (exhibits 3 and 4). This was the case whether or not costs per pupil were adjusted for costs of educating students in special programs.

Exhibit 3. In 2013, as elementary and middle schools had greater-than-predicted costs per pupil (based on school characteristics), they had lower NSPF index scores. Costs per pupil were not adjusted to account for the added costs of educating students in special populations.

School level	Year		
	2012	2013	2014
Elementary (n = 211)	-0.03	-0.41***	-0.01
Middle (n = 56)	0.00	-0.43**	0.14
High (n = 46)	0.07	-0.04	0.08

Pearson-r coefficients are statistically significant at $^{**}p < 01$; $^{***}p < .001$.

Exhibit 4. In 2013, as elementary and middle schools had greater-than-predicted costs per pupil (based on school characteristics), they had lower NSPF index scores. Costs per pupil were adjusted to account for the added costs of educating students in special populations.

School level	Year		
	2012	2013	2014
Elementary (n = 211)	-0.01	-0.42***	0.00
Middle (n = 56)	0.00	-0.54**	0.13
High (n = 46)	0.07	- 0.07	0.08

Pearson-r coefficients are statistically significant at $^{**}p < 01$; $^{***}p < .001$.

Question 3: *After accounting for school characteristics, is there a relationship between costs per pupil and NSPF index scores during a single school year?*

- After accounting for school characteristics, there was no relationship between costs per pupil and NSPF index scores during a single school year. This was the case whether or not costs per pupil were adjusted for the additional costs of educating students in special programs (exhibits 5 and 6).

The findings that follow are for 2014. The findings for 2012 and 2013 do not differ substantively and appear in appendix B.

Exhibit 5. In 2014, per-pupil costs (not adjusted for the additional costs of educating students in special programs) were not significantly associated with NSPF index scores in 2014, after accounting for school characteristics.

Variable	Coefficient (standard error)		
	Elementary (n = 211)	Middle (n = 56)	High (n = 46)
Unadjusted per-pupil expenditures [a]	-1.72 (6.09)	11.15 (10.12)	3.34 (2.70)
Magnet school	13.02 (4.77)**	11.26 (4.22)*	6.87 (2.91)*
CSN school	----	----	17.62 (4.51)***
CTA school	----	----	10.66 (3.76)**
% FRPL	-46.38 (6.81)***	-54.74 (12.16)***	-11.73 (9.39)
% IEP	-55.71 (32.91)	-20.41 (59.04)	-112.73 (35.25)**
% LEP	12.47 (9.56)	-14.29 (27.18)	-131.06 (33.71)***
Adjusted R^2	0.50***	0.70***	0.89***

[a] Due to the non-normal distribution of this variable, it was log transformed.
Linear regression coefficients are statistically significant at *p <.05; **p <.01; ***p <.001.

Exhibit 6. In 2014, per-pupil costs (adjusted for the additional costs of educating students in special programs) were not significantly associated with NSPF index scores in 2014, after accounting for school characteristics.

Variable	Coefficient (standard error)		
	Elementary (n = 211)	Middle (n = 56)	High (n = 46)
Adjusted per-pupil expenditures [a]	-1.74 (6.06)	10.67 (10.19)	3.30 (2.70)
Magnet school	13.01 (4.76)*	11.37 (4.22)*	6.87 (2.91)*
CSN school	----	----	17.58 (4.52)***
CTA school	----	----	10.65 (3.76)**
% FRPL	-46.90 (6.67)***	-51.48 (13.38)***	-10.67 (9.50)
% IEP	-56.94 (31.26)	-9.59 (52.43)	-109.74 (34.49)**
% LEP	12.07 (9.72)	-11.76 (26.90)	-130.39 (33.85)***
Adjusted R^2	0.50**	0.70**	0.89**

[a] Due to the non-normal distribution of this variable, it was log transformed.
Linear regression coefficients are statistically significant at *p <.05; **p <.01; ***p <.001.

Question 4: *After accounting for school characteristics, is there a relationship between average costs per pupil over several years and changes in NSPF index scores over the same period?*

- After accounting for school characteristics, there is no relationship between costs per pupil and gains in NSPF index scores from 2012 to 2014. This was the case whether or not costs per pupil were adjusted for the additional costs of educating students in special programs (exhibits 7 and 8).

Exhibit 7. Average per-pupil expenditures from 2012 to 2014 (not adjusted for the additional cost of educating students from special populations) were not significantly associated with changes in NSPF index scores between 2012 and 2014, after accounting for other school characteristics.

Variable	Coefficient (standard error)		
	Elementary (n = 211)	Middle (n = 56)	High (n = 46)
Average per-pupil expenditures	0.64 (0.52)	1.96 (1.01)	0.14 (0.14)
NSPF index score 2012	-0.62 (0.06)***	-0.40 (0.15)**	-0.10 (0.13)
Magnet school	4.81 (4.62)	6.41 (4.50)	2.12 (2.17)
CSN school	----	----	5.50 (3.47)
CTA school	----	----	-0.35 (3.05)
% FRPL	-37.47 (6.76)***	-15.19 (16.45)	14.70 (7.83)
% IEP	-48.78 (30.76)	-41.01 (85.63)	-37.19 (32.96)
% LEP	14.16 (7.88)	-23.62 (21.67)	-39.13 (20.72)
Adjusted R^2	0.33***	0.38***	0.10

Linear regression coefficients are statistically significant at $^{**}p < .01$; $^{***}p < .001$.

Exhibit 8. Average per-pupil expenditures from 2012 to 2014 (adjusted for the additional cost of educating students from special populations) were not significantly associated with changes in NSPF index scores between 2012 and 2014, after accounting for other school characteristics.

Variable	Coefficient (standard error)		
	Elementary (n = 211)	Middle (n = 56)	High (n = 46)
Average adjusted per-pupil expenditures	1.04 (0.81)	2.43 (1.48)	0.15 (0.18)
NSPF index score 2012	-0.61 (0.06)***	-0.40 (0.15)**	-0.10 (0.13)
Magnet school	4.63 (4.64)	7.28 (4.51)	2.22 (2.16)
CSN school	----	----	5.59 (3.48)
CTA school	----	----	-0.26 (3.05)
% FRPL	-35.70 (6.67)***	-13.73 (17.84)	14.86 (7.87)
% IEP	-45.59 (29.34)	-8.81 (80.70)	-32.39 (31.41)
% LEP	15.44 (7.98)	-18.37 (21.25)	-38.93 (20.82)
Adjusted R^2	0.33***	0.36***	0.10

Linear regression coefficients are statistically significant at $^{**}p < 01$; $^{***}p < .001$.

Conclusion

When NSPF index scores were not adjusted for observed school characteristics, there were several significant associations between per-pupil costs and NSPF index scores. However, these associations were inconsistent. For example, spending more money per pupil was significantly associated with lower NSPF scores when spending was not weighted to account for the costs of educating students from special populations. However, per-pupil expenditures were associated with higher NSPF scores when spending was weighted to account for these populations. It is important to note that, for these analyses, NSPF index scores were not adjusted to account for factors that are often related to student performance, such as the proportion of students with IEPs attending a school. When NSPF index scores were adjusted to account for observed school characteristics, per-pupil expenditures were not significantly associated with either yearly NSPF scores or changes in NSPF scores over three consecutive years. This was the case whether or not per-pupil expenditures were weighted to account for the added costs of educating special populations. These findings do not provide evidence justifying policy recommendations revolving around per-pupil expenditures within CCSD.

Two caveats are important to include. First, because the analyses were correlational, no causal attributions can be made based on the findings in this brief. The method used to analyze these data cannot be used to determine whether variations in school performance were caused by variation in per-pupil expenditures. Similarly, rather than school expenditures driving school performance, school performance may be driving school expenditures. Indeed, additional school funding, whether in the form of a categorical program or a one-time infusion of funds, is frequently provided in order to improve the academic outcomes of students in "low-performing" schools; thus, increased funding becomes linked with lower

performance. Second, measures for a number of unobserved characteristics of schools were not available for this analysis. These include such characteristics as teacher quality; or specific policies, programs, or practices implemented by schools with the funding they receive. The analyses in this report do not examine or control for these and other factors that could influence student academic performance.

References

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Appendix A. Details on the analytic methods

Calculation of adjusted per-pupil expenditures: REL West adjusted expenditures by school type, percentage of FRPL students, percentage of LEP students, and percentage of IEP students. Unadjusted per-pupil expenditures (PPE) for a school in a particular year were calculated by using the total cost divided by the total enrollment for that school in that year. REL West calculated the adjusted PPE using the method and weights used by Boser (2014) in a report for the Center for American Progress, which adjusts expenditure data for students in special populations given the additional costs to educate these students. Boser (2014) provides details on the assumptions behind the weighting scheme that were based on information from several studies (see endnote 44 in Boser [2014] for full citations for these studies). Although the weighting scheme used by Boser (2014) and adopted for this study is based on the most recently available information, it is possible that other assumptions (leading to alternative weighting schemes) could yield different findings for the current research questions.

The steps in the adjustment included: multiplying the number of students with FRPL, LEP, and IEP status by the specific weights (0.4 for FRPL, 0.4 for LEP, and 1.1 for IEP); dividing the weight by the enrollment to obtain the average additional percentage funding that a given school district should have received based on these weights; halving the average additional percentage plus 1 to obtain the weighted enrollment index; and dividing the raw per-pupil expenditure by the weighted enrollment index to produce the amount of money a district would have spent if it had no students in special programs. The formula appears in [1]:

[1] Adjusted PPE = raw PPE/weighted enrollment index

Where

Weighted enrollment index = 1 + (0.4 x number of students eligible for FRPL + 0.4 x number of students classified as LEP + 1.1 x number of students with an IEP) / total enrollment

Methods for question 1: REL West staff calculated Pearson product-moment correlation coefficients using NSPF index scores and unadjusted (or adjusted) per-pupil expenditure (exhibits 1 and 2).

Methods for question 2: REL West staff predicted the per-pupil expenditures through equation 1.

[1] $\ln(\text{per-pupil expenditure}) = \beta_0 + \beta_1 \%\ \text{FRPL} + \beta_2 \%\ \text{LEP} + \beta_3 \%\ \text{IEP} + \beta_4\ \text{Magnet} + \beta_5\ \text{CTA} + \beta_6\ \text{CSN} + \varepsilon$

Then, for each year, REL West staff obtained the residual of per-pupil expenditure for each school by subtracting the predicted expenditure from actual expenditure. REL West staff calculated a Pearson product-moment correlation coefficient using unadjusted PPE and NSPF scores (exhibits 3 and 4).

Methods for question 3: REL West regressed NSPF scores against school type, percentage of FRPL students, percentage of LEP students, and percentage of IEP students (equation 2). REL West staff obtained the residual in the NSPF index score for each school by subtracting the predicted NSPF index score from the actual NSPF index score.

[2] $(\text{NSPF index score}) = \beta_0 + \beta_1 \ln(\text{per-pupil expenditure}) + \beta_2 \%\ \text{FRPL} + \beta_3 \%\ \text{ELL} + \beta_4 \%\text{IEP} + \beta_5\ \text{Magnet} + \beta_6\ \text{CTA} + \beta_7\ \text{CSN} + \varepsilon$

Methods for question 4: REL West adjusted the change score of NSPF (that is, 2014–2012) by NSPF index score in 2012, school type, percentage of FRPL students, percentage of LEP students, and percentage of IEP students (equation 3).

[3] (2014 NSPF index score – 2012 NSPF index score) = β_0+ β_1 2012 NSPF index score + β_2 (average pupil expenditure/1000) + β_3 % free lunch + β_4 % ELL + β_5 %Special Ed + β_6 Magnet + β_7 CTA + β_8 CSN + ε

Appendix B. Additional analyses for question 3

Exhibit B1. Per-pupil expenditures from 2013 (not adjusted for the additional costs of educating students from special populations) were not significantly associated with NSPF index scores in 2013, after accounting for school characteristics.

Variable	Coefficient (standard error)		
	Elementary (n = 211)	Middle (n = 56)	High (n = 46)
Unadjusted per-pupil funding [a]	-0.77 (4.94)	1.98 (5.97)	1.43 (3.58)
Magnet school	6.51 (4.72)	7.49 (3.25)*	8.77 (4.03)*
CSN school	----	----	27.57 (5.79)***
CTA school	----	----	23.00 (5.05)***
% FRPL	-44.78 (6.36)***	-47.48 (10.96)***	-36.00 (13.43)*
% IEP	-82.05 (28.78)**	-50.73 (50.01)	-20.40 (57.07)
% LEP	11.84 (7.57)	-5.88 (14.96)	-38.62 (34.66)
Adjusted R^2	0.48***	0.78***	0.84***

[a] Due to the non-normal distribution of this variable, it was log transformed.
Linear regression coefficients are statistically significant at *p<.05; **p <.01; ***p <.001.

Exhibit B2. Per-pupil expenditures from 2013 (adjusted for the additional costs of educating students from special populations) were not significantly associated with NSPF index scores in 2013, after accounting for school characteristics.

Variable	Coefficient (standard error)		
	Elementary (n = 211)	Middle (n = 56)	High (n = 46)
Adjusted per-pupil funding [a]	-2.04 (5.21)	0.79 (6.57)	1.06 (3.67)
Magnet school	6.83 (4.73)	7.76 (3.25)*	8.92 (4.05)*
CSN school	----	----	27.62 (5.82)***
CTA school	----	----	23.14 (5.07)***
% FRPL	-45.40 (6.58)***	-48.34 (12.08)***	-36.06 (13.67)*
% IEP	-80.54 (27.02)**	-41.51 (46.42)	-15.89 (55.06)
% LEP	11.26 (7.74)	-5.23 (14.87)	-39.29 (34.88)
Adjusted R^2	0.48***	0.78***	0.84**

[a] Due to the non-normal distribution of this variable, it was log transformed.
Linear regression coefficients are statistically significant at *p<.05; **p <.01; ***p <.001.

Exhibit B3. Per-pupil expenditures from 2012 (not adjusted for the additional costs of educating students from special populations) were not significantly associated with NSPF index scores in 2012, after accounting for school characteristics.

Variable	Coefficient (standard error)		
	Elementary (n = 211)	Middle (n = 56)	High (n = 46)
Unadjusted per-pupil expenditures [a]	1.17 (6.40)	1.33 (7.77)	3.21 (2.52)
Magnet school	14.69 (5.19)**	2.43 (3.82)	4.72 (2.78)
CSN school	----	----	13.52 (3.95)**
CTA school	----	----	13.29 (3.41)***
% FRPL	-37.38 (7.02)***	-41.74 (13.00)**	-28.73 (9.85)**
% IEP	-57.35 (31.79)	-160.91 (69.84)*	-115.92 (38.57)**
% LEP	6.88 (8.07)	4.23 (17.68)	-40.11 (23.92)**
Adjusted R^2	0.41***	0.71***	0.91***

[a] Due to the non-normal distribution of this variable, it was log transformed.
Linear regression coefficients are statistically significant at *p<.05; **p <.01; ***p <.001.

Exhibit B4. Per-pupil expenditures from 2012 (adjusted for the additional costs of educating students from special populations) were not significantly associated with NSPF index scores in 2012, after accounting for school characteristics.

Variable	Coefficient (standard error)		
	Elementary (n = 211)	Middle (n = 56)	High (n = 46)
Adjusted per-pupil expenditures [a]	1.56 (6.30)	1.81 (7.75)	-3.19 (2.52)
Magnet school	14.57 (5.16)**	2.46 (3.81)	4.73 (2.78)
CSN school	----	----	13.48 (3.96)**
CTA school	----	----	13.30 (3.41)***
% FRPL	-37.06 (6.62)***	-41.44 (13.98)**	-27.73 (9.99)**
% IEP	-57.20 (29.58)	-158.99 (65.60)*	-113.07(37.78)**
% LEP	7.30 (8.35)	4.57 (17.31)	-39.40 (24.03)
Adjusted R^2	0.41***	0.71***	0.91**

[a] Due to the non-normal distribution of this variable, it was log transformed.
Linear regression coefficients are statistically significant at *p<.05; **p <.01; ***p <.001.