



WHAT DRIVES STUDENT ACHIEVEMENT ACROSS STATES?

HIGHER EDUCATION APPROPRIATIONS SUBCOMMITTEE
STAFF: JESS ESPLIN AND JILL L. CURRY, PH.D.

ISSUE BRIEF

EXECUTIVE SUMMARY

A strong education system can confer many benefits on a society. One way to measure the strength of an education system is through K-12 student achievement. This state-level analysis across time finds that educational attainment of adults has the largest and most consistent impact on K-12 student achievement. The percent of children living in single parent households also produces relatively consistent effects. Other measures such as spending per student and student-teacher ratio fail to reach statistical or substantive significance in this study. This study and other academic works consistently find that spending alone does not drive improved academic achievement. Further research should examine student achievement within Utah to determine which inputs, including areas of spending, produce the greatest impact on student achievement in an intra-state analysis.

THE IMPORTANCE OF EDUCATION

“Inclusive, good-quality education is a foundation for dynamic and equitable societies.”

-Desmond Tutu

Education is the bedrock of society. Societies that are more educated tend to experience increased prosperity from a more productive workforce,¹ less crime,² better overall health,³ and increased civic engagement.⁴ The most direct path toward an educated society is a strong primary education system. The simplest way to assess the strength of a primary education system is by examining student achievement. Thus, student achievement can give us insight into the core of a society.

BACKGROUND AND LITERATURE REVIEW

Despite the importance of student achievement, there is not unanimous agreement on what factors drive student success. Many studies produce conflicting results and anecdotal data muddy the water even further. Class size is one indicator that produces varying results. Using data from Tennessee’s Project STAR—a randomized experiment in the 1980s that assigned students to a small class (13 to 17 students), a regular-sized class (22 to 25 students), or a regular-sized class with a teacher’s aide—Krueger (1999)⁵ finds that the students in small classes score higher on standardized tests than the students in both regular-sized classes. In contrast, Hoxby’s (2000)⁶ study of class size in Connecticut does not find a statistically significant effect of class size on student achievement. Teaching experience is another indicator with a varying effect on student achievement. Teacher experience significantly affected reading test scores in Rockoff (2004),⁷ but Staiger and Rockoff (2010)⁸ find that student achievement rises rapidly with teacher experience, but only for the first few years of a teacher’s career before the effect flattens out.

Spending on education is one of the most debated predictors of student achievement. Currently, the most prominent support for increased spending is Jackson, Johnson, and Persico (2016)⁹ who find that significant and sustained increases in public education funding (in the form of court-mandated school finance reforms) lead to increased educational attainment and income in adulthood. In contrast, Hanushek is one of the most-cited critics of the general impact of school spending on student outcomes (e.g. Hanushek 2003).¹⁰

Case studies produce similarly conflicting results. Advocates for increased school spending often point to Massachusetts. A 1993 law transformed the Massachusetts school funding system to give more state money to districts with large populations of low-income students. The Revere School District alone, comprised of mostly low-income students, saw a 20 percent increase in high school graduation rates after additional funding was spent on hiring more teachers and paying for training, new textbooks, reading coaches, and a technology team. Paul Reville,

Harvard professor and former Massachusetts state education secretary, said, “When you look at Massachusetts’ overall performance nationally, we have gone from the middle of the pack to the top of the pack.”¹¹

Critics of increased school spending often point to the case of New Jersey. In 1985, the New Jersey Supreme Court’s ruling in *Abbott v. Burke* led the state to increase spending in its poorest districts. The Camden School District spent roughly \$23,000 per student in the 2015-2016 school year—about 2.5 times the national average—but “there’s no real evidence that they’re closing the achievement gap or that they’re doing significantly better,” Hanushek argues.¹²

Utah spends at, or near the bottom, per student of all states in the country. The U.S. Census Bureau recently released 2014 data that show Utah spends \$6,500 per pupil, in comparison to New York’s \$20,610 per pupil, the highest amount nationally. The national average for per pupil spending is \$11,009.¹³ In terms of student outcomes, among the states Utah fares better than its per pupil spending. Most recently Utah’s fourth graders scored seven points above the national average on the NAEP 4 Science test and the state’s eighth graders scored 13 points above the national average on the NAEP 8 Science test. Similarly, Utah fourth and eighth grade students perform above the national average on NAEP Reading and Mathematics tests.

With so many conflicting results regarding what impacts student achievement, it is difficult to say with confidence what factors will produce gains in student outcomes. Interestingly, despite differences in their findings, Jackson et al. and Hanushek do come to some similar conclusions. Jackson et al. note “increased school funding alone may not guarantee improved outcomes, but our findings indicate that provision of adequate funding may be a necessary condition. Importantly, we find that how the money is spent may be important” (214).¹⁴ Likewise, Hanushek (2003) states that his study “does not mean that money and resources never matter” (89). He further notes that “no good description of when and where these situations occur is available, so that broad resource policies such as those legislated from central governments may hit some good uses but also hit bad uses that generally lead to offsetting outcomes” (89).¹⁵ Thus, despite different results regarding the impact of school funding, both studies are careful to note that for funding to have an impact it must be targeted. However, due to the multitude of studies producing a variety of results, the question remains about how funding for public education should be targeted. To gain further insight into this question, we conducted an analysis of student achievement across the states.

METHODOLOGY

INDICATORS

The state-level analysis of student achievement is based on a panel dataset with observations for all 50 states from 2003 to 2013 (the District of Columbia is excluded). The data utilized in the analysis include measures of student outcomes and achievement, spending on public education, relevant demographics, and various educational inputs for each state across time. This study includes three measures of student outcomes and 11 indicators predicted to impact them. The descriptive statistics and sources for each measure are in Table A.1. in the appendix. Each indicator is described below.

NAEP 4 Index is a student outcome measure. It is the average of the aggregated scores for fourth grade students on the NAEP mathematics and reading tests.¹⁶ The indexed score was created for each state by averaging the NAEP mathematics and NAEP reading scores (both range from zero to 500) for fourth grade students. If either the mathematics or reading score was missing then the available score was used for the index rather than an average.

NAEP 8 Index is also a student outcome measure. It is an index score created for each state by averaging the aggregated scores for eighth grade students on the NAEP mathematics and reading tests.¹⁷ Like the NAEP 4 index, both the NAEP mathematics and reading scores for eighth grade students range from zero to 500. If either the mathematics or reading score was missing then the available score was used for the index rather than an average.

Graduation rate is the third student outcome measure. The graduation rate used in this study is the Averaged Freshman Graduation Rate (AFGR) or the Adjusted Cohort Graduation Rate (ACGR) depending on the year. The AFGR is used for 2003 through 2010. The Adjusted Cohort Graduation Rate (ACGR), which states were required to

use beginning in 2011, is used from then to 2013.¹⁸ The ACGR is the percentage of students who graduate in four years with a regular high school diploma. This measure is an adjusted rate because students are added who subsequently transfer into the cohort for the graduating class and students are subtracted who transfer out of the cohort.¹⁹

Current spending per student is the total annual spending on public education (local, state, and federal) divided by the total number of students enrolled in the public education system by state.

Single parent household is a measure of the percent of children living in single parent households.

Median household income is the median household income by state in 2015 dollars and measured in the thousands.²⁰

Educational attainment is the percent of the population age 25 and older with a bachelor's degree or higher.

Student-teacher ratio is the number of students divided by the number of teachers in public education.

English language learners is a measure of the percent of public school students in programs for English language learners.²¹

High quality teachers measures the percent of core academic classes in all schools taught by highly qualified teachers. Highly qualified is defined and used here as it is in No Child Left Behind. In general, to be deemed highly qualified teachers must have a bachelor's degree, full state certification or licensure, and demonstrate competency in each subject they teach.²²

Teacher experience²³ (< 4 years) is an indicator of the percent of teachers with less than four years²⁴ of teaching experience.

Teacher experience (≥ 15 years) is the percent of teachers with 15 or more years²⁵ of teaching experience.

Crime rate is the number of crimes as reported in the Uniform Crime Reports per 100,000 in the population.

Volunteer hours per capita measures the average number of volunteer hours per capita per state.

ANALYSIS

As discussed above, this analysis includes three measures of student outcomes: an index of NAEP 4 Scores, an index of NAEP 8 Scores, and the Graduation Rate. As an initial assessment, a comparison was done between all states and Utah for all three of these measures. First, in figure 1 is a plot of the NAEP 4 Index scores over time. Any chart feature in blue represents values for all 50 states whereas the chart features in orange represent values for the state of Utah. The blue lines (inside the blue boxes) represent the median NAEP 4 Index Scores and the blue X's represent the mean NAEP 4 Index Scores for those years. The orange lines and orange X's represent the NAEP 4 Index Scores for Utah for those years. The blue top and bottom lines (beyond the blue boxes) are the local maximum and minimum, respectively, and the blue dots are outlying data points.²⁶

In examining the NAEP 4 Index Scores, the figure demonstrates that, for each year, Utah's score is equal to or higher than the mean score for all states except in 2009 where Utah has a NAEP 4 Index Score of 229.76 and the mean score for all states is 230.22 (a difference of 0.46 points). Utah's score is equal to or higher than the median score for all states except in 2007 and 2009. In 2007, Utah's score is 230.33 and the median score for all states is 231.47 (a difference of 1.14 points). In 2009, the median score for all states is 231.83 which is higher than Utah's score that year by 2.07 points.

Figure 1. NAEP 4 Index Scores, 2003-2013

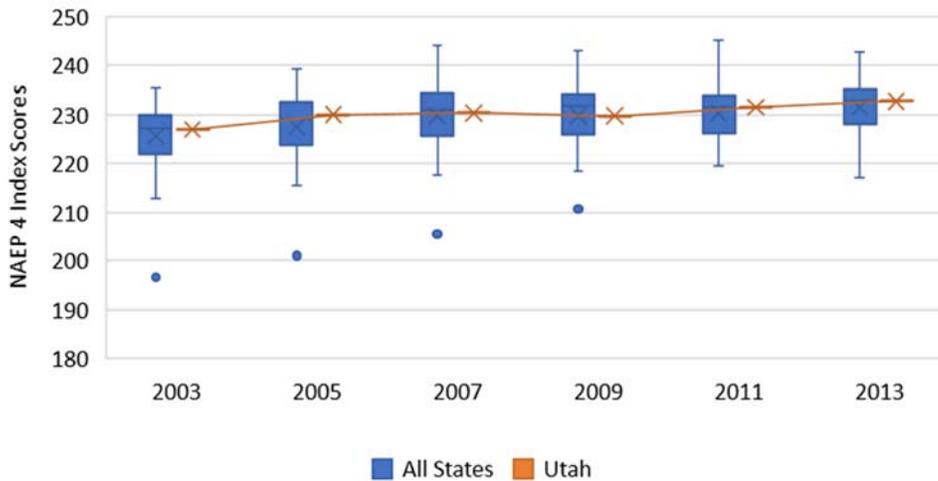
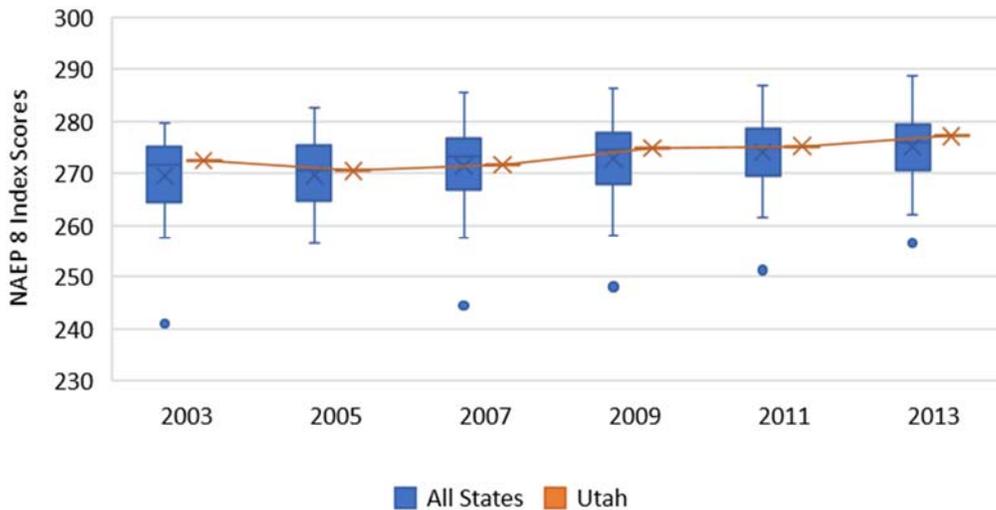


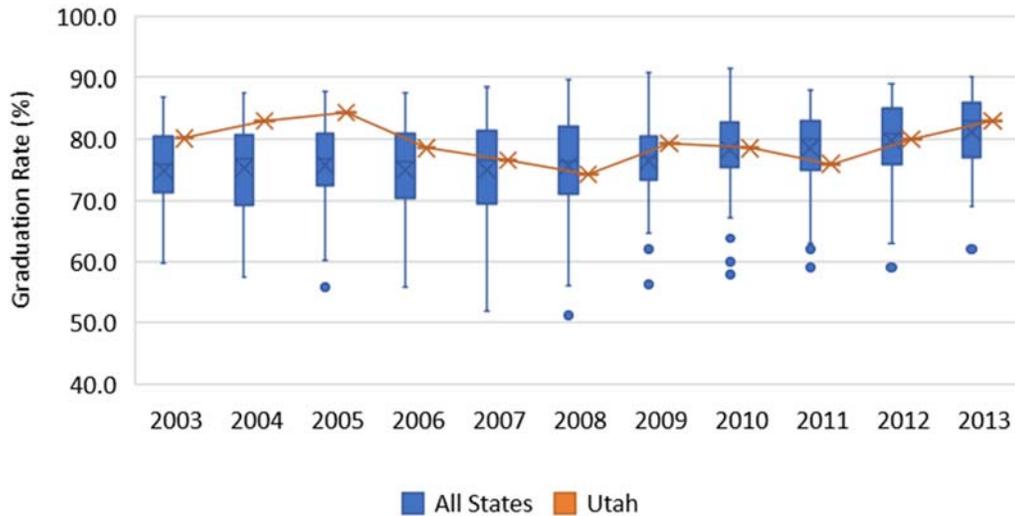
Figure 2 provides a similar figure for the NAEP 8 Index Scores. In analyzing these scores, Utah's score is equal to or higher than the mean score for all states except in 2007. In 2007, Utah's score is 271.66 and the median score for all states is 273.56 (a difference of 1.90 points).

Figure 2. NAEP 8 Index Scores, 2003-2013



The graduation rate for all states compared to Utah was also examined over time. Figure 3 indicates that the graduation rate in Utah is equal to or higher than the mean and median graduation rate for all states in every year analyzed except 2008 and 2011. In 2008 the graduation rate for Utah was 74.3 percent while the mean and median graduation rate for all states were 76.1 and 76.4 percent, respectively. In 2011, Utah's graduation rate was 76 percent while the mean graduation rate for all states was 78.9 percent and the median graduation rate was 80 percent.

Figure 3. Graduation Rate, 2003-2013



As measured by the three student outcome indicators, the performance of students in Utah is either equal to or exceeds the average performance across all states in most years. However, the figures above do not shed light on what factors significantly impact student success. To analyze what is driving student achievement, a state-level analysis was conducted using a random effects panel regression with the panel composed of states over time. The random effects model is used because we expect the variation across states to be random. In other words, differences across states may impact student outcomes.

Along with the measures of student achievement, we have 11 indicators theorized to affect student achievement. These factors, which are defined above, include spending on public education, relevant demographics (percent of children in single parent households; median household income; educational attainment; English language learners; crime rate; and volunteer hours per capita), and various educational inputs (student-teacher ratio; high quality teachers; teacher experience (< 4 years); and teacher experience (≥ 15 years)) for each state across time. We expect that increases in the percent of children in single parent households, student-teacher ratio, percent of English language learners, percent of teachers with fewer than four years of experience, and crime rate will lead to decreased student achievement. Concurrently, we expect increases in current spending per student, median household income, educational attainment, the percent of high quality teachers, teachers with 15 or more years of experience, and volunteer hours per capita will lead to increases in student achievement.

RESULTS

Table 1 presents the results of each of the three student achievement analyses. Each column evaluates the impact of the indicators on one of the three student achievement measures.

4TH GRADE TEST SCORES

The first column assesses the impact of our indicators on NAEP 4 Index Scores. Six of the indicators are not statistically significant including current spending per student, median household income, student-teacher ratio, percent high quality teachers, teachers with less than four years of experience, and crime rate. The five remaining indicators produce statistically significant results. These measures include percent of children in single parent households, educational attainment, percent English language learners, teachers with 15 or more years of experience, and volunteer hours per capita.

As expected percent of children in single parent households and percent English language learners lead to decreased NAEP 4 Index Scores. Also, as expected, increases in educational attainment lead to increases in NAEP 4 Index Scores.

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Teachers with 15 or more years of experience and volunteer hours per capita were expected to have a positive impact on student achievement, but, in this analysis, they lead to lower NAEP 4 Index Scores although the magnitude of their impact is small.

In the analysis of NAEP 4 Index Scores, the three significant indicators with the greatest impact are educational attainment, percent of children in single parent households, and English language learners. Educational attainment is positive with a value of 0.659, meaning that as the population aged 25 and older with a bachelor's degree or higher (hereafter referred to as the college-educated population) increases by one percent, the NAEP 4 Index Scores increase by 0.7 points on average across time and between states. In other words, as the college-educated population increases by 10 percent, the NAEP 4 Index Score increases by about seven points on average across time and between states which is greater than the standard deviation of about six for the NAEP 4 Index Score.

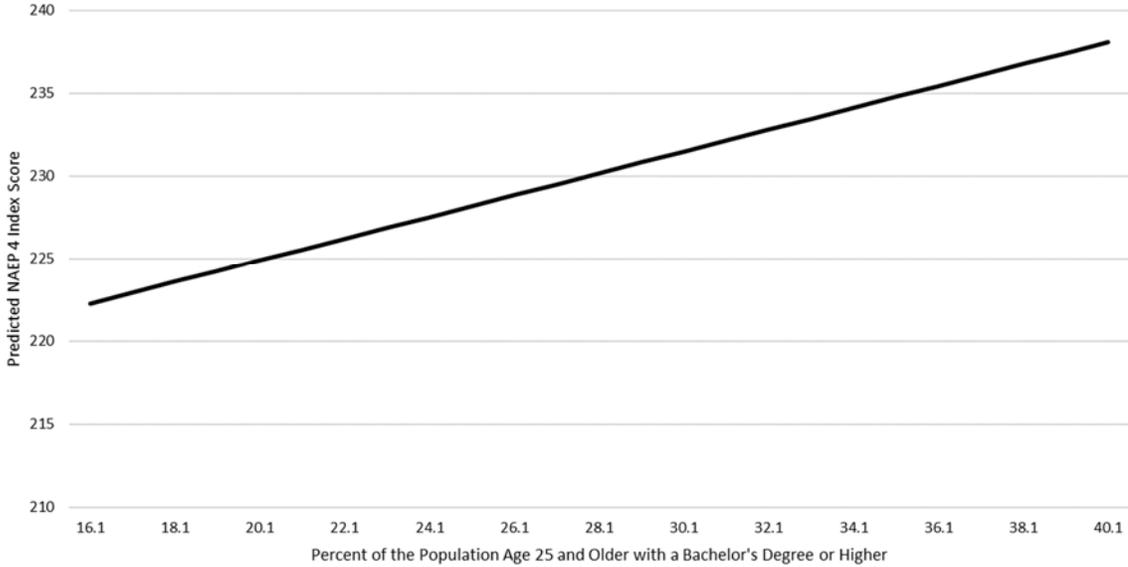
TABLE 1
Assessing Student Achievement Across the States, 2003-2013

	(1) NAEP 4 Index Scores	(2) NAEP 8 Index Scores	(3) Graduation Rate
Current spending per student	<0.001 (<0.001)	<0.001 (<0.001)	<0.001 (<0.001)
% children in single parent households	-0.244** (0.063)	-0.190** (0.062)	-0.125 (0.085)
Median household income	<-0.001 (<0.001)	-0.0001** (<0.001)	-0.0002** (<0.001)
Educational attainment	0.659** (0.097)	0.747** (0.104)	0.612** (0.135)
Student-teacher ratio	-0.227 (0.121)	-0.189 (0.121)	-0.211 (0.125)
English language learners	-0.265** (0.075)	-0.147 0.078	0.120 (0.105)
High quality teachers	0.023 (0.020)	0.036 (0.019)	0.050 (0.029)
Teacher experience (< 4 years)	-0.063 (0.037)	-0.110** (0.035)	-0.145** (0.050)
Teacher experience (≥15 years)	-0.058** 0.008	-0.035** (0.008)	-0.002 (0.011)
Crime rate	-0.001 (<0.001)	-0.001** (<0.001)	-0.002** (<0.001)
Volunteer hours per capita	-0.043* (0.021)	-0.011 (0.020)	0.009 (0.023)
constant	231.740** 5.087	273.364** 5.079	81.232** 6.695
N (observations)	300	300	550
N (groups)	50	50	50

Notes: **p<0.01; *p<0.05; two-tailed tests. Coefficients derived using random effects panel regression. Standard errors are in parentheses.

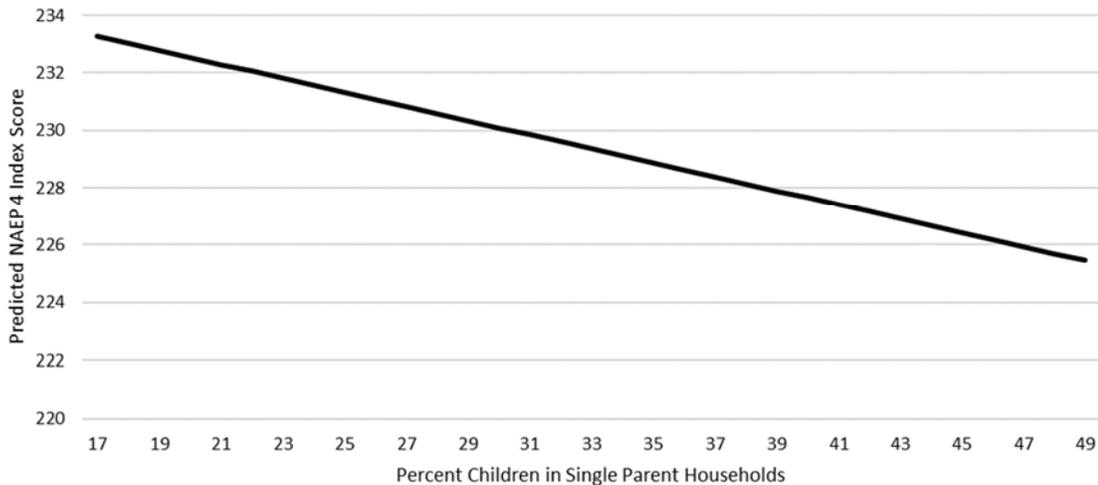
The effect of educational attainment on NAEP 4 Index Scores is illustrated in figure 4 which contains the predicted values of NAEP 4 Index Scores as educational attainment increases from about 16 percent to 40 percent. As the percent of the college-educated population increases from 16 to 40, the NAEP 4 Index Scores increase from 222 to 238.

Figure 4. Effect of Educational Attainment on NAEP 4 Index Scores



The percent of children in single parent households is also significant with a value of -0.244. Thus, as the percent of children living in single parent households increases by one percent, the NAEP 4 Index Scores decrease by 0.24 points on average across time and between states. In other words, a 10 percent increase in the percent of children living in single parent households leads to a decrease in NAEP 4 Index Scores of about 2.5 points on average. The effect of this indicator on NAEP 4 Index Scores is illustrated in figure 5. As the percent of children in single parent households increases from 17 to 49, the NAEP 4 Index Scores decrease from 233 to 225.

Figure 5. Effect of Percent of Children in Single Parent Households on NAEP 4 Index Scores



The effect of English language learners is similar to single parent households. The value for English language learners is -0.26 so as the percent of English language learners increases by one percent, the NAEP 4 Index Scores decrease by 0.26 points on average across time and between states. In other words, a 10 percent increase in the percent of English language learners leads to a decrease in NAEP 4 Index Scores of about 2.6 points on average.

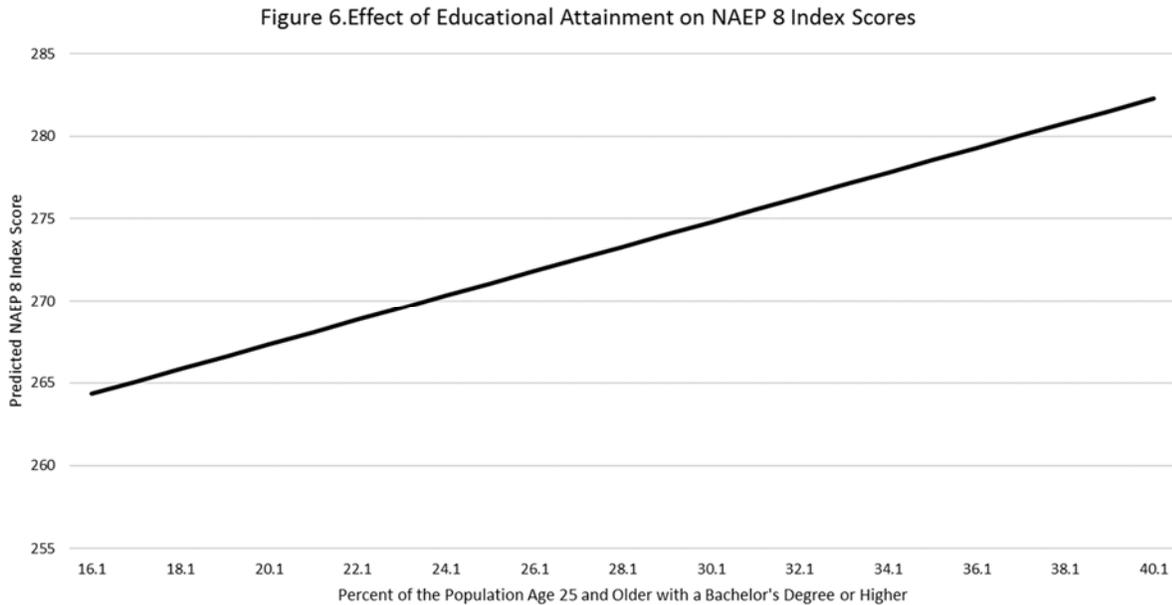
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8TH GRADE TEST SCORES

The second analysis uses NAEP 8 Index Scores and finds that five of the indicators are not statistically significant (current spending per student, student-teacher ratio, English language learners, percent high quality teachers, and volunteer hours per capita). Six of the measures produce statistically significant results. These measures include percent of children in single parent households, median household income, educational attainment, teachers with less than four years of experience, teachers with 15 or more years of experience, and crime rate (see table 1).

As expected percent of children in single parent households, teachers with less than four years of experience, and crime rate lead to decreased NAEP 8 Index Scores. Also, as expected, increases in educational attainment lead to an increase in NAEP 8 Index Scores. Teachers with 15 or more years of experience and median household income were expected to have a positive impact on student achievement, but, in this analysis, they lead to lower NAEP 8 Index Scores although the magnitude of their impact is small.

The effect of educational attainment is positive with a value of 0.747, meaning that as the college-educated population increases by one percent, the NAEP 8 Index Score increases by 0.75 points on average across time and between states. In other words, as the college-educated population increases by 10 percent, the NAEP 8 Index Scores increase by about 7.5 points on average across time and between states which is greater than the standard deviation of about 6.7 for the NAEP 8 Index Score. The impact of educational attainment on NAEP 8 Index Scores is illustrated in figure 6 which shows that as the college-educated population increases from 16 to 40 percent, the NAEP 8 Index Scores increase from 264 to 282.

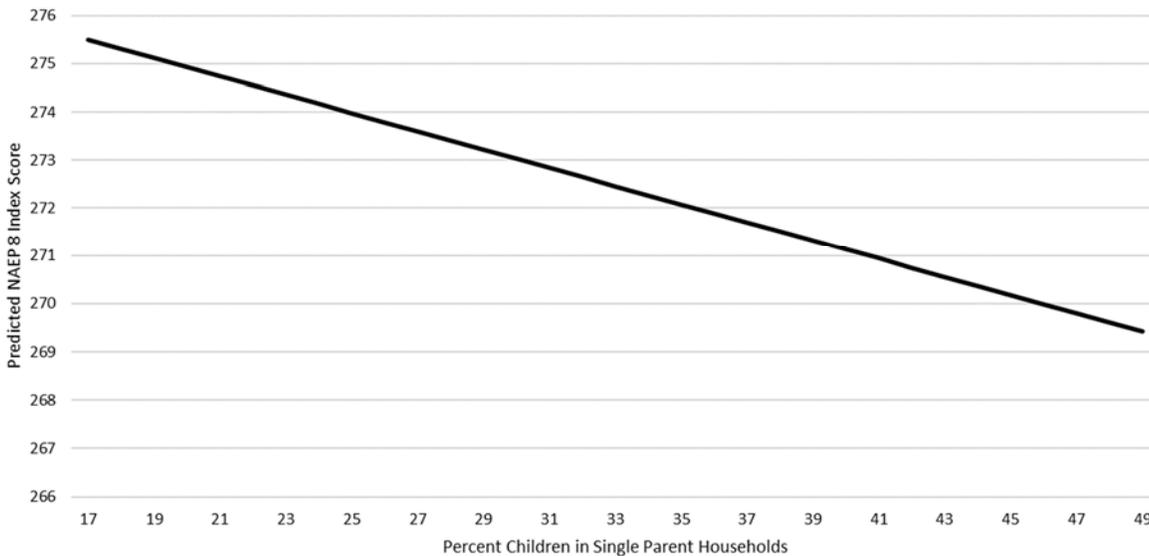


The percent of children in single parent households is also significant with a value of -0.190. Thus, as the percent of children living in single parent households increases by one percent, the NAEP 8 Index Score decreases by 0.19 points on average across time and between states. In other words, a 10 percent increase in the percent of children living in single parent households leads to a decrease in NAEP 8 Index Scores of about two points on average. The effect of this indicator on NAEP 8 Index Scores is illustrated in figure 7. As the percent of children in single parent households increases from 17 to 49, the NAEP 8 Index Score decreases from 275 to 269.

The effect of teachers with less than four years of experience is similar to single parent households. The value for inexperienced teachers is -0.11 so as the percent of teachers with less than four years of experience increases by one percent, the NAEP 8 Index Score decreases by 0.11 points on average across time and between states. In other words, a 10 percent increase in the percent of inexperienced teachers leads to a decrease in NAEP 8 Index Scores of

about one point on average.

Figure 7. Effect of Percent of Children in Single Parent Households on NAEP 8 Index Scores



HIGH SCHOOL GRADUATION

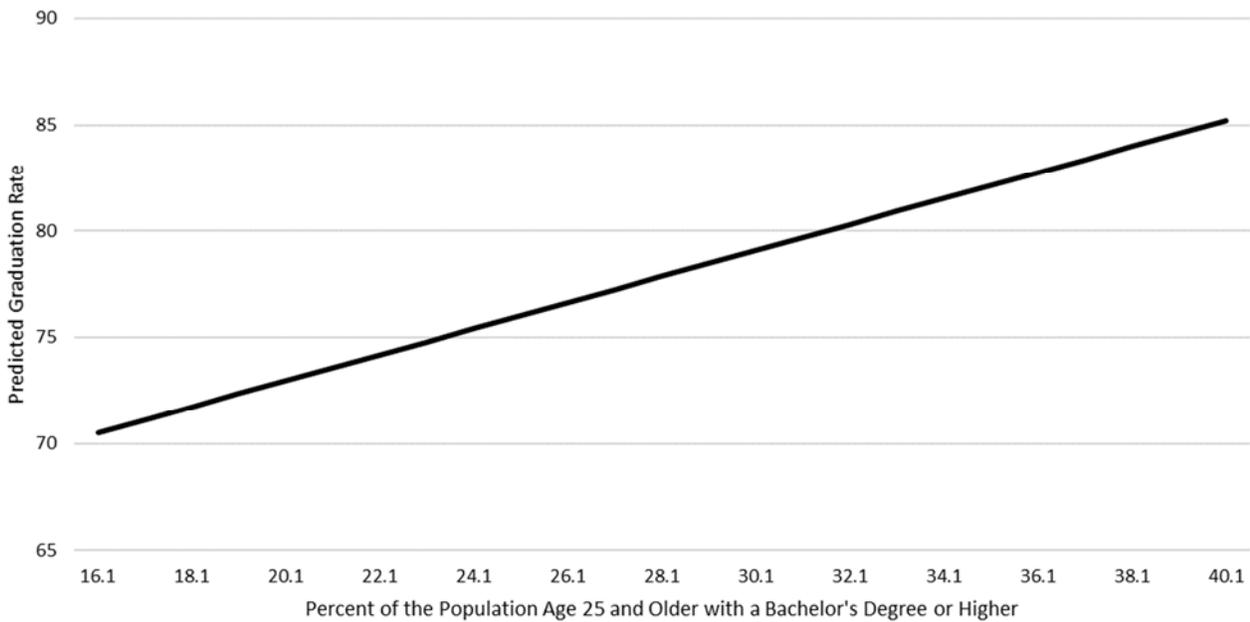
The third analysis uses graduation rate and finds that seven of the indicators are not statistically significant (current spending per student, percent of children in single parent households, student-teacher ratio, English language learners, percent high quality teachers, teachers with 15 or more years of experience, and volunteer hours per capita). Four of the measures produce statistically significant results. These measures include median household income, educational attainment, teachers with less than four years of experience, and crime rate (see table 1).

As expected, teachers with less than four years of experience and crime rate lead to decreased graduation rates. Also, as expected, increases in educational attainment lead to an increase in graduation rates. Median household income was expected to have a positive impact on student achievement, but, in this analysis, it leads to lower graduation rates although the magnitude of its impact is small along with the effect-size for crime rate.

The effect of educational attainment is positive with a value of 0.612, meaning that as the college-educated population increases by one percent, the graduation rate increases by 0.61 percent on average across time and between states. In other words, as the college-educated population increases by 10 percent, the graduation rate increases by about 6 percent on average. The impact of educational attainment on the graduation rate shown in figure 8 demonstrates that as the college-educated population increases from 16 to 40 percent, the graduation rate increases from 70 to 85 percent.

The effect of teachers with less than four years of experience is -0.15 so as the percent of teachers with less than four years of experience increases by one percent, the graduation rate decreases by 0.15 percent on average across time and between states. In other words, a 10 percent increase in the percent of inexperienced teachers leads to a decrease in the graduation rate of about 1.5 percent on average.

Figure 8. Effect of Educational Attainment on Graduation Rate



DISCUSSION AND CONCLUSION

After conducting our analysis, we find that some measures affect student achievement. Across all three analyses, educational attainment—the percent of college-educated adults—maintains a significant and substantive impact on student achievement. This finding suggests that the educational attainment of adults impacts outcomes for K-12 students. The percent of children in single parent households has a significant impact on student achievement as measured by the NAEP 4 and NAEP 8 Index Scores. It is not a significant predictor of graduation rate.

The percent of teachers with less than four years of experience produces significant results for NAEP 8 Index Scores and the graduation rate. This finding supports the work of Staiger and Rockoff (2010)²⁷ who find that teacher experience matters most in the first few years of teaching. Two measures that do not produce any statistically significant results are current spending per student and student-teacher ratio. In this study, these indicators do not have a significant impact on student achievement. The remaining measures sometimes have a significant impact on student achievement and, for some of these, their impact is small in magnitude.

One objective in conducting this analysis was to illuminate how education funding should be targeted. This study suggests that funding to increase the college-educated population could produce significant gains in K-12 student achievement. The results also indicate that increasing support for children living in single parent households might significantly impact student achievement.

This study is limited in scope and magnitude. We could not include measures of long-term educational outcomes, such as students’ total educational attainment and their income in adulthood. This would provide more information on how spending affects long-term outcomes of student success, beyond test scores and high school graduation. We acknowledge the inadequacy of the teacher quality and experience variables included in this model. We used the best data available to us for this study and note that there are no large-scale data available on teacher practices within the classroom, as suggested in some studies²⁸ to be the most influential factors on student achievement. Future research should take this need into account and develop more reliable and accurate measures of teacher effectiveness.

Our state-level study has other limitations as well. Our research assesses overall academic proficiency, as measured by NAEP scores and high school graduation rates, generalizing results for the entire public school student population in the U.S. Therefore, this study cannot measure achievement gaps among different populations of public school

students. The examination of disparities in achievement among groups of students is part of a broader examination in education research of educational equality, but this study is not designed to address it.

Additional research is needed to comprehensively answer the compelling question that has captured national attention and attention in Utah—how do we improve educational outcomes? As a broad state-level analysis, this study finds that a statewide increase in public education funding would not guarantee better outcomes regardless of socioeconomic conditions. Our findings do suggest that the policy initiatives that will likely improve student achievement will require additional spending. These policy initiatives include increasing the number of college-educated adults and providing additional support to students who live in single parent households. However, as a consequence of its broad analysis, the results of this study likely conceal nuance in educational inputs and demographic differences between states. A closer analysis at the school district level within Utah may provide a more detailed prescription for funding Utah's public education system, tailored to its demographic characteristics and socioeconomic needs. An intra-state analysis of differential funding needs between school districts is necessary to determine whether targeted funding increases would have a significant effect on educational outcomes.

TABLE A.1
Descriptive Statistics and Sources of Measures

Indicators	Standard		Minimum	Maximum	N	Years
	Mean	Deviation				
NAEP 4 Index Scores ¹	229.55	5.97	212.85	245.09	300	2003, 2005, 2007, 2009, 2011, & 2013
NAEP 8 Index Scores ¹	272.60	6.67	256.49	288.79	300	2003, 2005, 2007, 2009, 2011, & 2013
Graduation Rate (percent) ²	77.26	7.36	51.30	91.40	550	2003 – 2013
Current spending per student ³	9,822.21	2,722.66	4,876.88	19,463.97	550	2003 – 2013
% children in single parent households ⁴	32.21	5.30	17.00	49.00	550	2003 – 2013
Median household Income (in thousands) ⁵	55,243.28	8,480.67	37,825.00	80,007.00	550	2003 – 2013
Educational attainment (percent) ⁶	27.13	4.79	16.30	40.29	550	2003 – 2013
Student-teacher ratio ⁷	15.62	2.77	10.69	30.02	550	2003 – 2013
English language learners (percent) ⁸	6.24	4.79	0.53	25.49	550	2003 – 2013
High quality teachers (percent) ⁹	93.65	8.02	34.30	100.00	550	2003 – 2013
Teacher experience (< 4 years) (percent) ¹⁰	16.31	4.27	6.00	28.30	550	2003 – 2013
Teacher experience (≥15 years) (percent) ¹⁰	55.42	21.39	29.50	89.80	550	2003 – 2013
Crime rate (per 100,000) ¹¹	3,473.22	851.72	1,788.43	6,224.14	550	2003 – 2013
Volunteer hours per capita ¹²	36.99	10.41	14.12	100.13	550	2003 – 2013

Sources:

¹National Center for Education Statistics; <http://nces.ed.gov/nationsreportcard/naepdata/>

²National Center for Education Statistics; Common Core of Data

³Moody's Analytics

⁴U.S. Census Bureau, American Community Survey, Kids Count Data Center (Annie E. Casey Foundation)

⁵U.S. Census Bureau, Current Population Survey, Annual Social and Economic Supplements. Accessed at <http://www.census.gov/data/tables/time-series/demo/income-poverty/historical-income-households.html>.

⁶U.S. Census Bureau (BOC): American Community Survey, Current Population Survey, and Population Estimates, Projections; Moody's Analytics Estimated

⁷U.S. Department of Education: National Center for Educational Statistics (NCES) - Common Core of Data (CCD) - Public Elementary/Secondary School Universe Survey; Moody's Analytics Calculated

⁸U.S. Department of Education, National Center for Education Statistics, Common Core of Data (CCD), "Local Education Agency Universe Survey," 2003-04 through 2013-14.

⁹EDFacts/Consolidated State Performance Report, 2004-05: <http://www2.ed.gov/admins/lead/account/consolidated/index.html>

¹⁰National Center for Education Statistics; https://nces.ed.gov/surveys/sass/tables_list.asp

¹¹U.S. Federal Bureau of Investigation (FBI): Uniform Crime Reports; U.S. Census Bureau (BOC); Moody's Analytics Calculated

¹²Corporation for National and Community Service; Volunteering and Civic Life in America

- ¹ Eric A. Hanushek, Eric A., Jens Ruhose, and Ludger Woessmann, "It pays to improve school quality," *EducationNext*, 16, no. 3 (Summer 2016): 52-60.
- ² Dan Chiras and Dominic Crea, "The Effect of Education on Crime: Evidence from Prison Inmates, Arrests, and Self-Reports," *The American Economic Review*, 94, no. 1 (March 2004): 155-189.
- ³ David Cutler and Adriana Lleras-Muney, "Education and Health: Evaluating Theories and Evidence," in *Making Americans Healthier: Social and Economic Policy as Health Policy*, ed. Robert F. Schoeni, James S. House, George A. Kaplan, and Harold Pollack (New York: Russell Sage Foundation, 2008), 29-60.
- ⁴ Steven J. Rosenstone and John Mark Hansen, *Mobilization, Participation, and Democracy in America* (New York: Longman, 2002).
- ⁵ Alan B. Krueger, "Experimental Estimates of Education Production Functions," *Quarterly Journal of Economics*, 114, no. 2 (May 1999): 497-532.
- ⁶ Caroline M. Hoxby, "The Effects of Class Size on Student Achievement: New Evidence from Population Variation," *Quarterly Journal of Economics*, 115, no. 4 (November 2000): 1239-1285.
- ⁷ Jonah E. Rockoff, "The Impact of Individual Teachers on Student Achievement: Evidence from Panel Data," *American Economic Review*, 94, no. 2 (May 2004): 247-252.
- ⁸ Douglas O. Staiger and Jonah E Rockoff, "Searching for Effective Teachers with Imperfect Information," *Journal of Economic Perspectives*, 24, no. 3 (Summer 2010): 97-118.
- ⁹ C. Kirabo Jackson, Rucker C. Johnson, and Claudia Persico, "The Effects of School Spending on Educational and Economic Outcomes: Evidence from School Finance Reforms," *Quarterly Journal of Economics*, 131, no. 1 (February 2016): 157-218.
- ¹⁰ Eric A. Hanushek, "The Failure of Input-Based Schooling Policies," *The Economic Journal*, 113, no. 485 (February 2003): 64-98.
- ¹¹ Cory Turner, Kevin McCorry, Lisa Worf, Sarah Gonzalez, Kirk Carapezza, and Claire McNerny. "Can More Money Fix America's Schools?" *All Things Considered*, National Public Radio, April 25, 2016.
- ¹² Sarah Gonzalez, "What Happened When One of New Jersey's Poorest School Districts Increased Spending." WNYC News, April 24, 2016.
- ¹³ Educational Finance Branch. Economic Reimbursable Surveys Division. *Public Education Finances: 2014*. Washington, DC: U.S. Census Bureau, June 2016.
- ¹⁴ Jackson et al., 2016.
- ¹⁵ Hanushek, 2003.
- ¹⁶ The NAEP 4 Science scores are excluded because the tests were only administered in 2009, 2011 (2011 scores are not available), and 2015 and the NAEP Science scale ranges from zero to 300 rather than zero to 500 like the NAEP mathematics and reading scales.
- ¹⁷ The NAEP 8 Science scores are excluded because the tests were only administered in 2009, 2011, and 2015 and the NAEP Science scale ranges from zero to 300 rather than zero to 500 like the NAEP mathematics and reading scales.
- ¹⁸ In the following instances, the ACGR is not available so the AFGR is used: Idaho (2011, 2012, 2013); Kentucky (2011, 2012); and Oklahoma (2011, 2012).
- ¹⁹ The AFGR is not adjusted to account for students entering or exiting the cohort during high school so if there is out-migration the AFGR will understate the graduation rate compared to the ACGR (in-migration will overstate the graduation rate). Also, the diploma count in the AFGR may include students who took more than or less than four years to graduate which will overstate the graduation rate compared to the ACGR. In general, the ACGR measure provides more comparability across states. For any

states missing a data point, the average of the state's graduation rate from the prior year and the following year was used. This imputation was only used to derive five data points out of 600 total data points.

²⁰ Median household income is measured in 2015 Consumer Price Index for All Urban Consumers Research Series (CPI-U-RS) adjusted dollars to measure household income consistently over time.

²¹ For 2003 through 2004, 2003-2004 values were used. For 2005 through 2007, the average of the 2003-2004 and 2008-2009 figures was used. For 2008 and 2009, the 2008-2009 figures were used. The remaining years have data corresponding to the year.

²² The values for 2005 are used for 2003 and 2004 as well because data for those years are not available.

²³ All teacher experience data are from the School and Staffing Survey (SASS). The survey was administered for the 2003-2004, 2007-2008, and 2011-2012 school years. The 2003-2004 percentages are used for 2003 through 2006; the 2007-2008 percentages are used for 2007 through 2010, and the 2011-2012 percentages are used for 2011 through 2013. The National Teacher and Principal Survey (NTPS) has now replaced the SASS and the 2015-2016 data are not yet available.

²⁴ For 2003-2004, the data available are percent of teachers with three or fewer years of experience.

²⁵ For 2003-2004, the data available are teachers with four or more years of experience.

²⁶ Data points are outlying if they fall beyond 1.5 times the interquartile range (IQR) which is the difference between the 75th and 25th percentiles of the data. Utah does not have a box, maximum or minimum, or outlying points because its score is only one data point so these values cannot be calculated.

²⁷ Staiger and Rockoff, 2010.

²⁸ Eric A. Hanushek, "Education and the Nation's Future." In *Blueprint for America*, ed. George P. Shultz, (Stanford, CA: Hoover Institution Press, 2016), 89-108. Anya Kamenetz, "5 Big Ideas That Don't Work In Education." *National Public Radio*, 2015.