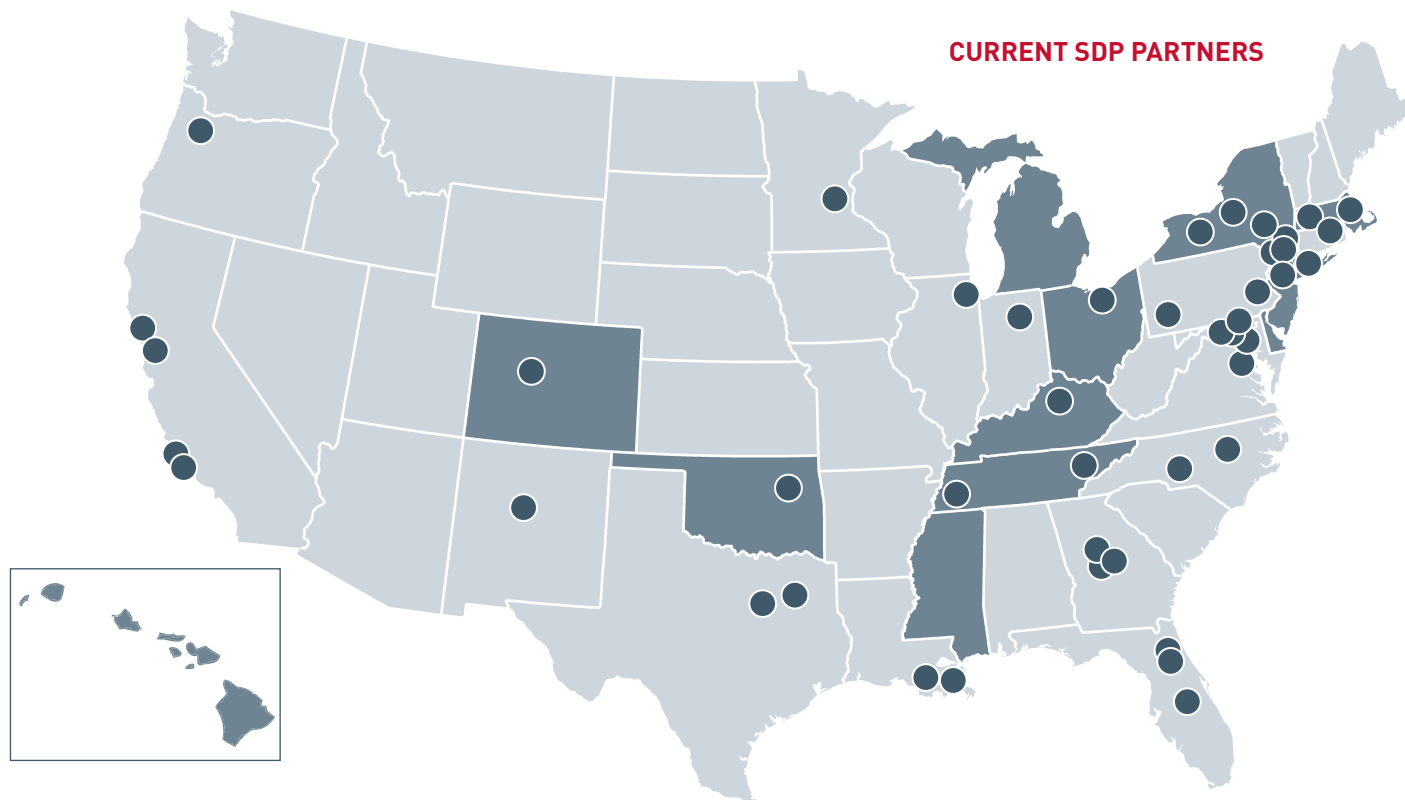# STRATEGIC DATA PROJECT

SDP HUMAN CAPITAL DIAGNOSTIC

Albuquerque Public Schools

May 2014

THE STRATEGIC DATA PROJECT (SDP)

Since 2008, SDP has partnered with 56 school districts, charter school networks, state agencies, and nonprofit organizations to bring high-quality research methods and data analysis to bear on strategic management and policy decisions. Our mission is to transform the use of data in education to improve student achievement.

Part of the Center for Education Policy Research at Harvard University, SDP was formed on two fundamental premises:

1. Policy and management decisions can directly influence schools' and teachers' ability to improve student achievement.

2. Valid and reliable data analysis significantly improves the quality of decision making.

SDP's theory of action is that if we are able to bring together the right people, assemble the right data, and perform the right analysis, we can help leaders make better decisions—ultimately improving student achievement significantly.

To make this happen, SDP pursues three strategies:

1. building a network of top-notch data strategists who serve as fellows for two years with our partners (e.g., school district, charter management organization, nonprofit, or state education agency);

2. conducting rigorous diagnostic analyses of teacher effectiveness and college-going success using agency data; and

3. disseminating our tools, methods, and lessons learned to the education sector broadly.

The project is supported by the Bill & Melinda Gates Foundation.

SDP HUMAN CAPITAL DIAGNOSTIC

Introduction

Teachers play a critical role in student learning and achievement. Research shows that teachers have the greatest impact on student achievement—more so than any other factor controlled by school systems, including class size or the school a student attends.[1] Only recently, however, has data become available to measure teacher effectiveness in ways that can inform education policy and practice.

To this end, we at the Strategic Data Project (SDP) designed the Human Capital Diagnostic as a means to

1) better inform district leaders about patterns of effectiveness among their teachers and

2) identify potential areas for policy change that could leverage teacher effectiveness to improve student achievement.

This report contains a selection of findings on teacher effects for Albuquerque Public Schools (APS).

The Human Capital Diagnostic is the result of a partnership between SDP and APS designed to bring data to bear on policy and management decisions to improve student outcomes. As such, it is neither an exhaustive set of analyses nor does it contain specific recommendations. It is, however, a set of standardized analyses that can help the district better understand its current performance, set future goals, and plan strategic responses.

Researchers connected student demographics and test scores to teacher human resource data and calculated objective measures of teacher effectiveness that are linked to teacher characteristics. The diagnostic analyses leverage these measures of effectiveness to explore their relationship with characteristics of teachers, schools, and students. They are not intended to draw conclusions about the contribution made by any individual teacher but rather to understand overall district trends.

These analyses were completed by members of the research team at the Center for Education Policy Research at Harvard University with the support of APS staff, the APS SDP Fellows, and faculty advisors.

SDP HUMAN CAPITAL DIAGNOSTIC

The SDP Diagnostic Pathway for Human Capital

We use the SDP Pathway for Human Capital to examine teacher employment in APS from recruitment to separation. Five key phases of a teacher's career are included in this framework:

HUMAN CAPITAL DIAGNOSTIC PATHWAY	
RECRUITMENT	The recruitment process is the district's first opportunity to secure a high-quality teaching force for its students. Understanding the pace of hiring and how new hires are allocated across the district can inform the development of strategies to attract effective educators.
PLACEMENT	Examining teacher placement patterns across and within district schools can highlight opportunities to raise student achievement and reduce achievement gaps by equitably distributing the most effective teachers across the system and within schools.
DEVELOPMENT	Throughout their careers many teachers encounter opportunities to develop their teaching skills and increase their instructional effectiveness. In the development phase, we explore the extent to which methods of development commonly accessed by teachers—such as earning graduate degrees or learning from experience—are associated with student achievement gains.
EVALUATION	Most teacher evaluation systems are based on infrequent observation of classroom teaching rather than student achievement growth. The lack of rich outcome-based information hampers a district's ability to support underperforming teachers, target professional development, or counsel out poor performers. SDP examined the extent to which teachers' past classroom effectiveness predicts their future effectiveness.
RETENTION/ TURNOVER	National turnover rates imply that 40 to 50 percent of new teachers leave the classroom within their first five years of teaching.[2] High attrition rates among new teachers may lower student achievement; current research finds that teachers improve most in their first few years in the classroom.[3] SDP explores overall retention patterns by teacher characteristics, including classroom effectiveness, to understand how attrition impacts student achievement.

SDP HUMAN CAPITAL DIAGNOSTIC

Understanding Teacher Effects

What is a teacher effect and how is it estimated?

A teacher effect is an estimate of an individual teacher's impact on the amount his or her students learn from one year to the next, as measured by students' performance on a standardized test of student achievement. Teacher effects are also commonly referred to as value-added measures. In the APS Human Capital Diagnostic, teacher effects are based on students' performance on the New Mexico Standards Based Assessment (SBA). Teacher effects are estimated by statistically isolating the portion of each student's test score growth attributable to that student's primary teacher from other factors such as prior achievement, demographic characteristics, and the influence of peers. In other words, a teacher effect is the learning growth an APS student would be expected to have as a result of being assigned to a particular teacher. Teacher effects are relative measures—meaning individuals are compared to the average teacher in APS. Even if APS teachers as a group were among the most effective in the nation, some would still be categorized as "least effective" for the purposes of this diagnostic.

How should you interpret teacher effect estimates?

Throughout this report we present findings in terms of student test score standard deviation units, or effect sizes. Effect estimates greater than 0.20 standard deviations are often considered large for educational interventions.[4] We convert these units into a "months of learning" measure in this report. On nationally normed standardized tests, research has shown that an effect size of 0.40 is roughly equivalent to learning in math in one year's time for grades three through eight. Hence, an effect estimate of 0.20 is equivalent to half a year or about six months of learning.[5] While the SBA is not a nationally normed assessment, we use these estimates as an approximation to translate teacher effect estimates into a months-of-learning measure.

Which teachers are included in this report?

Teacher effects can only be estimated for teachers who are linked to a classroom roster of students in grades for which information is available on student test performance the previous year. In this report, we primarily present results for math teachers tied to students in Grades 4–8 using the school years 2006–07 to 2010–11. We conducted similar analyses for English/language arts (ELA) teachers in those grades and years. We do not present results among ELA teachers because, in most instances, they are very similar to our findings concerning math teachers. We explicitly make note in the text of instances where ELA and math results diverge.

What are the limitations of teacher effects?

Teacher effects are a uniquely valuable performance measure, objectively capturing the impact individual teachers have on students while taking into account the most important ways in which teachers and students are assigned to classrooms (i.e., teachers being assigned to classrooms with lower- or higher-achieving students). As with any measure of performance, however, they come with several caveats:

- Teacher effects measure teachers' performance only as it relates to student achievement on the SBA. Teacher effects are only as good as the assessments used to formulate them. Assessments that are insufficiently challenging or that are poorly aligned to the curriculum the district expects its teachers to cover will not yield accurate estimates.

- Some students receive supplemental instruction from reading specialists or math tutors that influences their academic progress. This is not accounted for in the measure.

SDP HUMAN CAPITAL DIAGNOSTIC

Understanding Teacher Effects

- Care is required when interpreting results concerning group averages of teacher effects. Although we often report findings concerning differences in average effectiveness of teachers from different groups, there is often far more variation in teacher effects within these groups than between them. For example, while novice teachers are, on average, less effective than their more experienced peers (as shown in Summary Analysis 4), many novice teachers outperform more experienced teachers. SDP's model for estimating teacher effectiveness is meant for understanding aggregate trends, not for the evaluation of individual teachers.

It is important to note that while teacher effectiveness measures have limitations, none of the other widely used measures that are used as proxies for teacher effectiveness are strongly related to improvement in student outcomes. The most commonly rewarded indicators of teacher quality—years of experience and advanced degrees—account for little of the variation in teachers' performance in improving student achievement. Until very recently, most teacher evaluation systems used in the vast majority of school districts did a very poor job of differentiating teachers at all—with up to 99% of teachers rated as "satisfactory."[6]

SDP HUMAN CAPITAL DIAGNOSTIC

Key Findings

Human Capital Pathway

1 There are large differences in effectiveness among APS math teachers, as measured by SDP's value-added estimates. Students assigned to a teacher in the 75th percentile learn approximately six more months of math content than students assigned to a teacher in the 25th percentile. The differences are substantially smaller among ELA teachers (approximately three months).

Recruitment

2 Newly hired teachers are more likely to be assigned to higher-poverty schools.

Placement

3 First-year teachers are more likely than their experienced colleagues to be assigned to students who are academically behind. This finding is true for math and ELA teachers both across and within APS middle schools.

Development

4 On average, APS math teachers increase their effectiveness in the first five years of teaching. There are no noticeable returns to teaching experience for ELA teachers.

5 Provisional (Tier 1) teachers can submit a dossier to transition to professional status (Tier 2) after three years and must do so by their fifth year to retain their teaching license. Most novices transition from provisional (Tier 1) to professional (Tier 2) status in less than five years. Tier 2 teachers are slightly more effective than Tier 1 teachers.

6 After obtaining a master's degree or National Board Certification and teaching as a professional teacher for a minimum of three years, a Tier 2 teacher can submit a dossier to advance to instructional leader (Tier 3) status. There is no difference in the effectiveness of Tier 2 and 3 teachers in math or ELA.

7 National Board and bilingual/TESOL certified math teachers serving bilingual students are more effective than their noncertified colleagues, on average. Students of bilingual/TESOL certified math teachers learned the equivalent of nearly two more months of math content while students assigned to National Board certified teachers learned about one additional month of material, on average.

8 APS teachers holding advanced degrees are no more effective than their colleagues without such degrees.

Evaluation

9 Prior teacher effectiveness is predictive of future teacher effectiveness.

Retention/Turnover

10 One third of novice teachers leave APS in the first five years. Turnover is not consistently related to teachers' effectiveness.

Analyses: Human Capital Pathway

1. How much does teacher effectiveness vary among APS math teachers?

> There are large differences in effectiveness among APS math teachers.

Historically, while standard systems of teacher evaluation showed little variation in teacher effectiveness, value-added measures reveal substantial variation. Nationwide, where estimated, teacher effects have been found to vary widely and can account for differences in the academic progress made by students. Figure 1 presents the distribution of teacher effect estimates for teachers of mathematics in APS. While the figure presents results in terms of standard deviation units, we additionally translate these effects into months of learning.[7] Students assigned to a teacher at the 90th percentile of teacher effectiveness in math achieve standardized test performance levels that are 0.37 standard deviations higher than their peers who are taught by teachers at the 10th percentile of teacher effectiveness. A difference of this magnitude is equivalent to approximately 11 months more math content, on average, for students taught by the highest-performing teachers. Comparing teachers at the 25th and 75th percentiles also reveals a substantial difference on the order of a six-month differential in mathematics instruction. To further put these estimated teacher effects of 0.19 and 0.37 in context, the achievement gap between Hispanic and white students in APS is 0.60 standard deviations in fifth-grade math, or roughly eighteen months of student learning. These findings are similar to other districts and states for which similar analyses have been conducted.[8]

Figure 1. Distribution of Math Teacher Effects
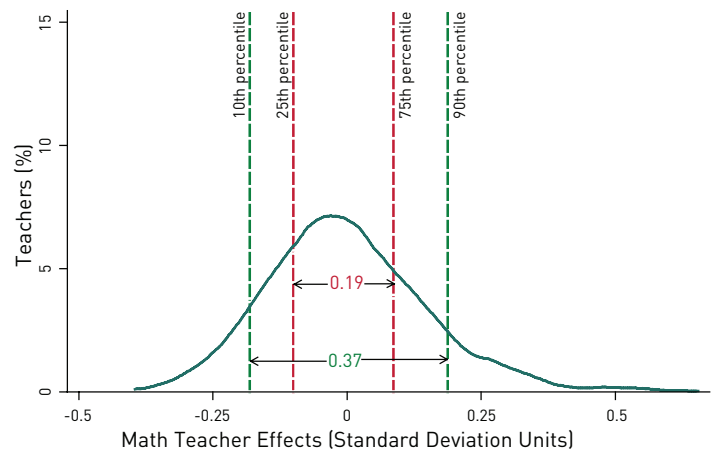
Note. Sample includes 1,016 fourth- to eighth-grade math teachers in school years 2006–07 through 2010-11. All data are from APS administrative records.

Analyses: Recruitment

2. What proportion of teachers are new hires in schools, by school poverty level?

> New hires are more likely to be assigned to higher-poverty schools.

New teachers, both those with and without prior teaching experience, make up an important share of the teaching force, particularly in schools serving disadvantaged students. In Figure 2, we define the low-poverty quartile as the 25% of schools with the smallest share of students qualifying for free or reduced-price school meals. In contrast to these schools, schools with the greatest proportion of students qualifying for free or reduced-price lunch have 37% more newly hired teachers and 46% more novice teachers. Analyses of retention by school poverty levels (not shown) and hiring trends find that APS schools with more economically disadvantaged students experience higher levels of teacher turnover than more affluent schools.

While the differences in Figure 2 may seem small, it is important to consider the implications that these differences could have over the course of students' educational careers. It may be worthwhile to track the likelihood of being taught by a novice teacher over the 13 years of students' elementary and secondary education and understand how this differs for students enrolled in schools with different poverty levels.

In recent years, however, newly hired teachers have accounted for a shrinking portion of all teachers across APS, as shown in Figure 3. Their share declined by 40% from 2006–07 to 2010–11 due to a hiring freeze resulting from the Great Recession budgeting constraints.

Figure 2. Proportion of Newly Hired Teachers, by School Poverty Quartile
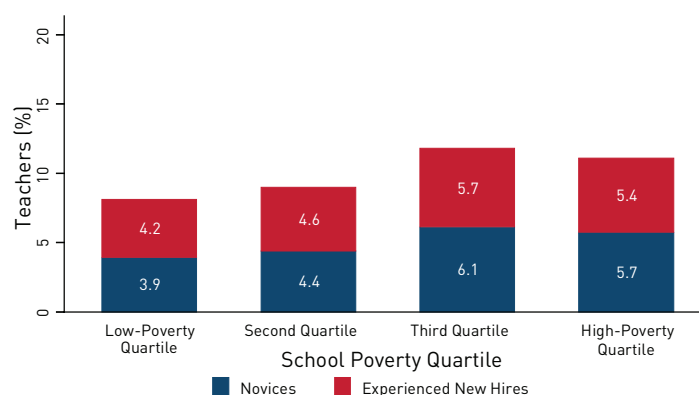
Note. Sample includes 2,881 low-poverty quartile teachers, 2,997 second quartile teachers, 2,912 third quartile teachers, and 2,316 high-poverty quartile teachers. All data are from APS administrative records.

Figure 3. Proportion of Newly Hired Teachers, by Prior Teaching Experience
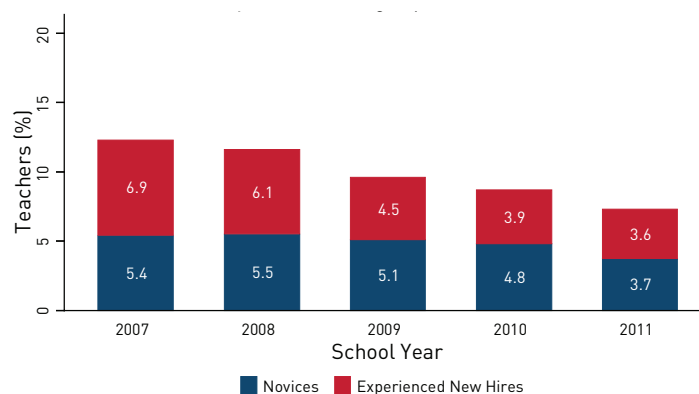
Note. Sample includes 6,314 2006–07 teachers, 6,424 2007–08 teachers, 6,364 2008–09 teachers, 6,457 2009–10 teachers and 6,401 2010–11 teachers. All data are from APS administrative records.

3. How academically prepared are students who are placed with inexperienced teachers?

Within APS middle schools, novice math teachers tend to be placed with students who are already academically behind.

In Figures 4 and 5, we present information on the prior achievement of students assigned to teachers with differing levels of teaching experience. Here, we consider teachers in their first through fifth years in the classroom. The results presented here compare the average achievement of students taught by these teachers with the average achievement of students taught by teachers with six or more years of experience. The difference in student achievement is measured in standard deviation units. Again, as a metric for comparison, a difference of 0.4 standard deviations is equivalent to approximately one year of learning.

Across APS, middle school students with lower prior-year math scores are disproportionately placed with novice and early-career math teachers (Figure 4). This finding results, in part, from higher turnover rates in schools with lower-performing students. However, even within individual schools, novice teachers and early career teachers are more likely to be assigned to struggling students (Figure 5). Within middle schools first-year teachers are assigned students who are, on average, nearly six months behind while second-year teachers are assigned to students who are almost three months behind.

These placement trends have important implications for both students and staff. From a student perspective, both previous research and SDP analyses of administrative data show that students placed with novice teachers tend to achieve less academic growth (as measured by value-added scores) than do peers assigned to more experienced teachers.[9] From the standpoint of teacher retention, existing research suggests that new teachers with more challenging assignments are more likely to leave their schools while the same is not true for more experienced teachers. Therefore, it may be worth considering whether placing earlier-career teachers (relative to experienced teachers) in highly challenging teaching situations is the best path to improvements in student achievement, teacher development, and teacher retention.[10]

Figure 4. Proportion of Newly Hired Teachers, by School Poverty Quartile
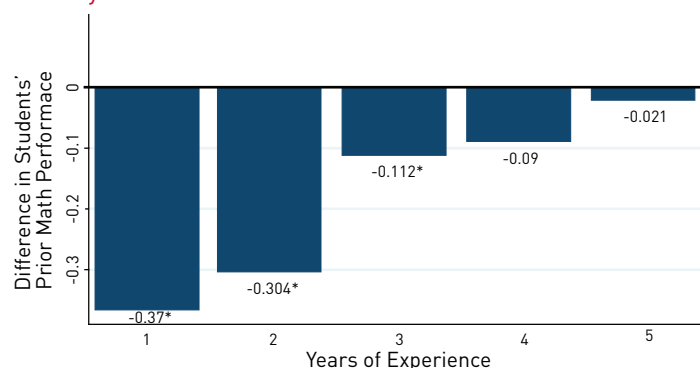
* p < .05 compared to sixth- or later-year teachers.
Note. Sample includes 327 2006–07 through 2010–11 Grade 6-8 math teachers. All data are from APS administrative records.

Figure 5. Difference in Average Prior Math Performance of Students Assigned to Early-Career Math Teachers Compared to Experienced Math Teachers, Within Middle Schools
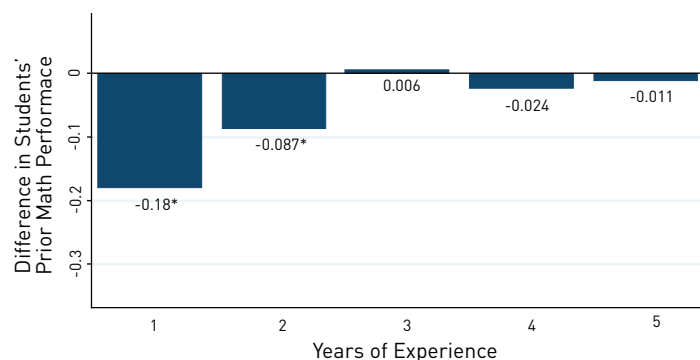
* p < .05 compared to sixth- or later-year teachers.
Note. Sample includes 327 2006–07 through 2010–11 Grade 6-8 math teachers. All data are from APS administrative records.
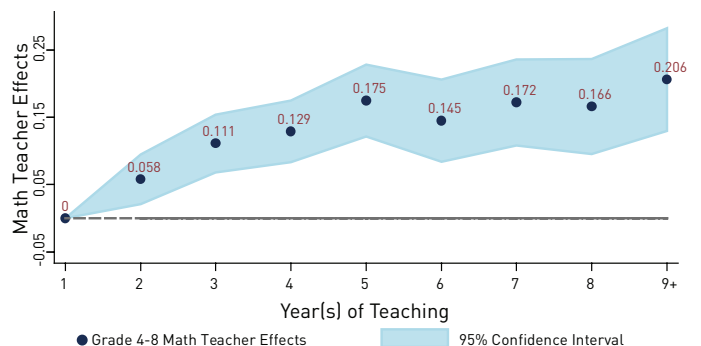
4. Are experienced teachers more effective than novice and early-career teachers?

APS math teachers show substantial growth in effectiveness during their first several years in the classroom with a near-0.13 standard deviation gain in their average teacher effect between the first and fourth years. This is roughly equivalent to an additional three months of instruction.

Figure 6. Math Teacher Effects Over Time, Compared to Impact in First Year of Teaching

Grade 4-8 Math Teacher Effects   95% Confidence Interval

Note. Sample includes 2,618 teacher-year observations for all 2006–07 through 2010–11 Grade 4-8 math teachers (985 distinct teachers overall). All data are from APS administrative records.

Studies in other agencies show that early-career teachers make gains in terms of their impact on students' test-based achievement as they accrue the first few years of teaching experience, while the returns largely plateau around the fourth year for the average teacher.[11] Figure 6 reveals a similar pattern for math teachers in APS. Here, experienced math teachers are, on average, more effective than their novice colleagues. APS teachers make substantial gains in their effectiveness in their first several years in the classroom with more modest gains demonstrated by midcareer teachers. Also consistent with other districts, ELA teachers do not exhibit such gains with regularity.[12]

Analyses: Development

5. Do teachers exhibit gains in effectiveness as they progress through the state's three-tiered licensure system?

> Most novices transition from Tier 1 to Tier 2 in less than five years. Tier 2 teachers are slightly more effective than Tier 1 teachers. On average, Tier 2 and 3 teachers are equally effective.

In 2003 the New Mexico Legislature established the three-tiered licensure system to comply with NCLB's highly qualified teacher requirement and to increase teacher quality and student achievement.[13] Following state legislation, Albuquerque's teacher salary schedule compensates teachers approximately $10,000 for achieving Tier 2 status and an additional $10,000 for advancement to Tier 3. A newly hired novice teacher is eligible to move from Tier 1 to Tier 2 after three years and must do so by the end of his or her fifth year through the submission of a dossier. The dossier is comprised of evidence that the teacher has met New Mexico's nine teacher competencies that are differentiated indicators for the three licensure levels and is evaluated by independent reviewers at the state level. While the move from Tier 1 to 2 is required to retain a teaching license, the move from Tier 2 to Tier 3 is optional. A Tier 2 teacher can transition to Tier 3 after completing three years of teaching at Tier 2, earning either a master's degree or National Board Certification, and submitting a dossier for review.

Figure 7 examines the relationship between teachers' salary tier and level of effectiveness among math teachers in APS. Because tier membership is highly related to years of experience, the analysis presented here limits the comparison to teachers with the same years of experience but who differ in their salary tier. Figure 7 illustrates that while, on average, Tier 2 math teachers are somewhat more effective than their Tier 1 colleagues, Tier 3 math teachers are no more effective than Tier 2 math teachers. This finding holds true for both math and ELA teachers.

Figure 7. Average Math Teacher Effects Relative to Tier 1 Teachers, by State Licensure Tier (Controlling for Years of Experience)
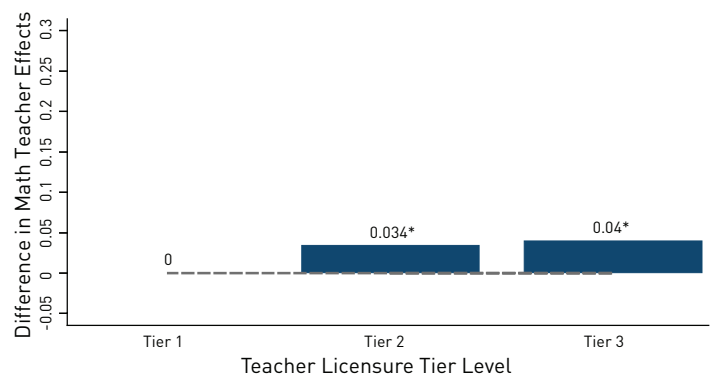
* $p < .05$ compared to Tier 1 teachers.
Note. Sample includes 2,618 teacher-year observations for all 2006–07 through 2010–11 Grade 4–8 math teachers (985 distinct teachers overall). All data are from APS administrative records.

Analyses: Development

6. Are some teacher certifications associated with gains in effectiveness?

National Board Certification and Bilingual/ TESOL certification for math teachers serving bilingual students is associated with higher effectiveness.

In addition to the three-tiered licensure system, APS teachers earn higher salaries for certain professional certifications. The largest programs that provide these salary increases are National Board Certification and TESOL/bilingual certification. Given this, it is important to understand whether teachers with these credentials demonstrate increased effectiveness. Figure 8 illustrates the effect of math teachers certified by the National Board for Professional Teaching Standards—a national in-service professional certification program—are more effective, on average, than their noncertified colleagues. This finding is consistent with studies in other districts nationwide, which also show higher effectiveness for National Board certified teachers.[14]

In addition, APS teachers earn high salaries after obtaining a TESOL/bilingual education certification from the state of New Mexico, with additional compensation for those teachers who actually serve speakers of other languages in their classroom. As shown in Figure 9, on average, TESOL/bilingual certified math teachers who serve targeted students are more effective than both teachers with no such certification and teachers who are certified but do not teach such students. No such differences are apparent for ELA teachers.

Figure 8. Math Teacher Effects of Teachers with National Board Certification, Relative to Teachers Without National Board Certification
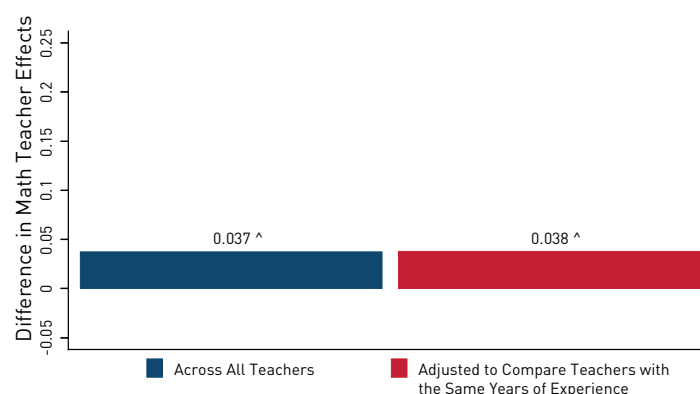
^ p < .10; * p < .05 compared to teachers with no certification.
Note. Sample includes 985 2006–07 through 2010–11 Grade 4-8 math teachers. Without National Board certification: 971 teachers; With National Board certification: 40. All data are from APS administrative records.

Figure 9. Math Teacher Effects of Teachers with TESOL Certification, Relative to Teachers Without TESOL Certification
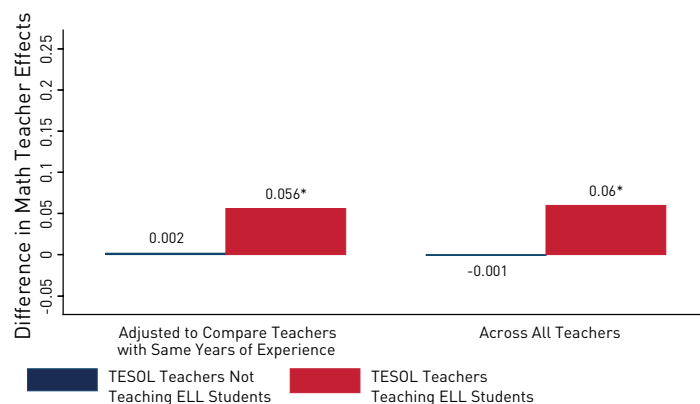
* p < .05 compared to teachers without any TESOL certificaion.
Note. Sample includes 985 2006–07 through 2010–11 Grade 4-8 math teachers. Without any TESOL: 732 teachers; TESOL certified, without ELL students: 134 teachers; TESOL certified, with ELL students: 380 teachers. All data are from APS administrative records.

Analyses: Development

7. How effective are teachers with advanced degrees?

APS teachers holding advanced degrees are, on average, no more effective than their colleagues without such degrees.

Like other agencies, Albuquerque's teacher salary schedule provides additional compensation for teachers holding or making progress towards advanced degrees. However, the average impact of elementary and middle school teachers with advanced degrees is not substantially different from their counterparts lacking such degrees (Figure 10). In this figure, the result in blue is the difference in average teacher impact when comparing those teachers with and without advanced degrees. Because teachers with advanced degrees are also more likely to have more years of teaching experience, the result in red compares teachers with a similar level of classroom experience. In neither case do teachers with advanced degrees appear to outperform teachers without them. This result is consistent with the national literature and holds for both math and ELA teachers.[15]

Figure 10. Math Teacher Effects of Teachers with Advanced Degrees, Relative to Teachers With Bachelor's Degree Only
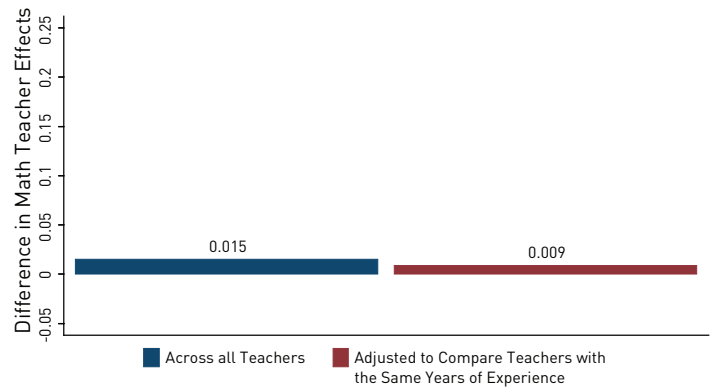
* p < .05 compared to teachers without advanced degrees.
Note. Sample includes 985 2006–07 through 2010–11 Grade 4-8 math teachers. Without advanced degrees: 616 teachers; With advanced degrees: 420. All data are from APS administrative records.

8. Do estimates of teacher effectiveness predict future performance?

Prior teacher effectiveness is predictive of future teacher effectiveness.

When considering an average novice teacher's performance, it is important to consider the stability of the teacher impact estimate in order to make decisions about professional development and strategic placement. Figure 11 groups third-year teachers into quartiles based on their teacher effect scores over the prior two years combined. Each bar represents the average teacher impact score in teachers' third year in the classroom. Teachers who ranked in the top quartile after the first two years (gold bar) continued to exhibit larger impact estimates in their third year than teachers ranked in the three lower quartiles. The difference between those in the top and bottom quartile is nearly 0.20 standard deviations, or the equivalent of about five months of classroom instruction. This result suggests that performance in the first few years of teaching is predictive of later performance, as measured by teacher impacts. Nevertheless, it is important to note that while these teacher impact estimates are informative, they are imperfect. Teacher impacts in the third year of teaching can vary widely for individual teachers. For example, some previously bottom-quartile teachers outperform previously top-quartile teachers in their third year.

Figure 11. Average Math Teacher Effects in Third Year, by Quartile Rank From Prior Two Years
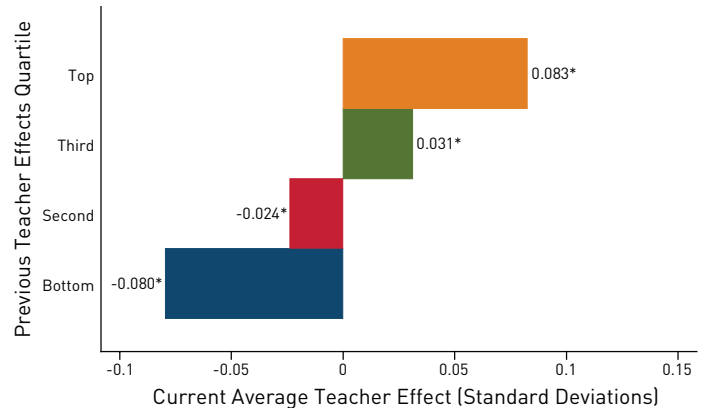
*p < .05 compared to mean of zero.
Note. Sample includes 423 fourth- to eighth-grade math teachers in school years 2006–07 through 2010–11. All data are from APS administrative records.

9. What is the retention rate for new teachers? Does it vary by teacher effectiveness?

> One third of novice teachers leave APS within five years. Turnover is not consistently related to effectiveness.

While there is substantial stability in the teaching force in APS overall, Figure 12 reveals that there is far less stability in retention patterns for newly hired teachers in the district. Approximately 14% of newly hired teachers do not return for a second year of teaching; by the fifth year, nearly one third of newly hired teachers have left APS classrooms. Of those that do remain, many also transfer to other APS schools, such that only four in 10 newly hired teachers remain in the same school by the fifth year. Given the investments required to identify, screen, and hire new teacher candidates, APS may want to consider efforts to increase retention rates for early-career teachers, particularly those that exhibit strong performance in their first several years in the classroom.

Figure 13 illustrates one-year retention rates by teacher effectiveness quartile. This figure reveals that top-quartile math teachers are more likely to remain teaching at APS but also more likely to transfer schools within the district than their less-effective peers. Overall, however, turnover among math teachers does not appear to be consistently related to their effectiveness.

Figure 12. Five-Year Retention Patterns for Novice Teachers
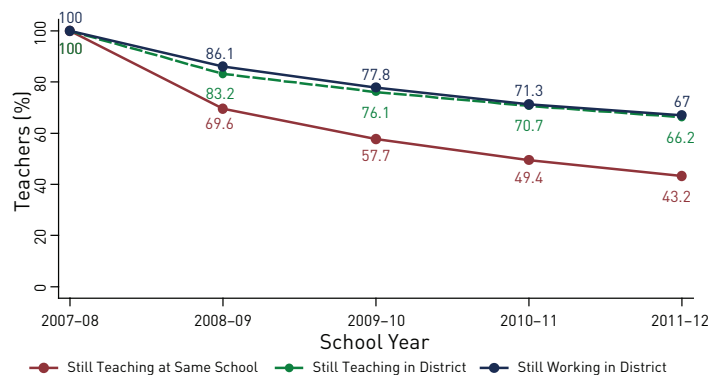
Note. Sample includes 352 2007–08 novice teachers. All data are from APS administrative records.

Figure 13. One-Year Math Teacher Turnover, by Math Teacher Effectiveness Quartile
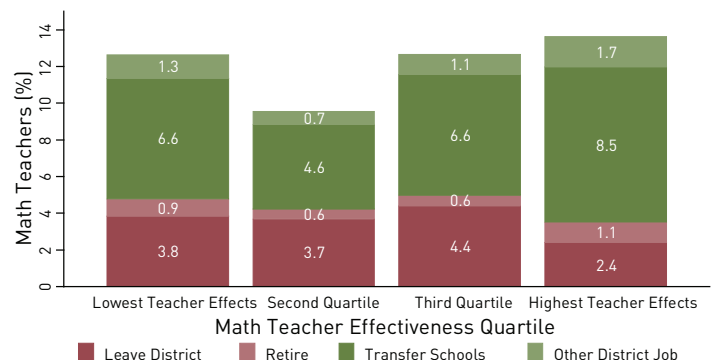
Note. Sample includes 903 distinct 2007–08 through 2010–11 teachers. Lowest Teacher Effects: 353 teachers; Second Quartile: 375 teachers; Third Quartile: 379 teachers; Highest Teacher Effects: 304 teachers. Retired teachers are those who leave with more than 25 years experience. All data are from APS administrative records.

Conclusion

How can findings from this brief help inform APS human capital strategies?

> Multiple human capital strategies will need to be pursued in order to reduce and eliminate the achievement gaps in APS.

Achievement gaps in APS are large: Hispanic students, on average, are approximately one and a half years behind their White peers in math. This achievement gap provides context for examining the findings presented in this brief (Figure 14). While no single group of teachers has large enough effects to eradicate the achievement gap between Hispanic and non-Hispanic White students within a single academic year, teachers are the crucial lever for accelerating student learning. APS can develop a multipronged human capital strategy to make a significant impact on student achievement. The findings in this brief point to opportunities APS can pursue in teacher placement, development, evaluation, and retention that together can make a significant dent in the achievement gap.

Figure 14. Overview of Relative Effect Sizes in APS, Findings from Human Capital Brief
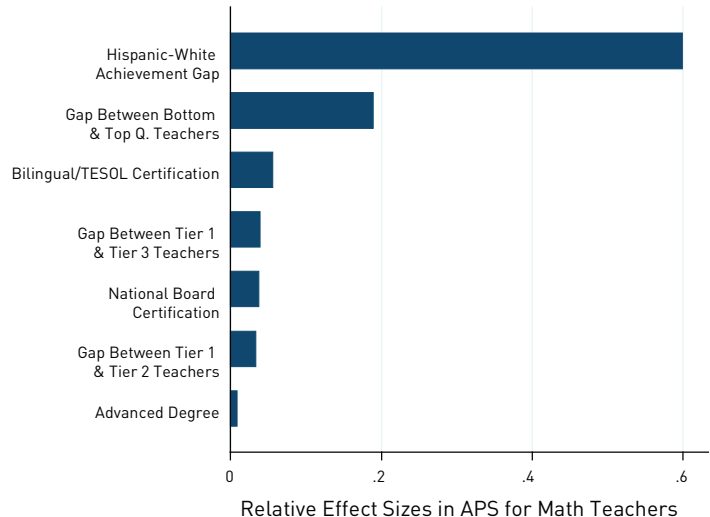
Relative Effect Sizes in APS for Math Teachers

Endnotes

[1] Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. *Econometrica, 73*, 417–458.

[2] Ingersoll, R. (2001). Teacher turnover and teacher shortages: An organizational analysis. *American Educational Research Journal, 38*(3), 499-534.

[3] Boyd, D. J. (2006). How changes in entry requirements alter the teacher workforce and affect student achievement. *Education Finance and Policy, 1*(2), 176–216.

[4] Hill, C. J., Bloom, H. S., Black, A. R., & Lipsey, M. W. (2008). Empirical benchmarks for interpreting effect sizes in research. *Child Development Perspectives, 2*(3), 172–177.

[5] The conversions of standard deviations of student achievement to months of learning reported in this document are based on Hill, C. J., Bloom, H. S., Black, A. R., & Lipsey, M. W. (2008). Empirical benchmarks for interpreting effect sizes in research. C*hild Development Perspectives, 2*(3), 172–177. Estimates are based on seven nationally normed assessments and represent changes based on one year's time, including learning time in school, development outside of school, and any summer learning loss.

[6] The 2009 New Teacher Project study, the Widget Effect, found that in evaluation systems with ratings of "satisfactory" and "unsatisfactory" 99% of teachers earned "satisfactory." In evaluation systems with more than two ratings, 94% of teachers received one of the top two ratings and less than 1% were rated unsatisfactory.

[7] Weisberg, D. Sexton, S. Mulhern, & J. Keeling, D. (2009). The Widget Effect: Our National Failure to Acknowledge and Act on Teacher Effectiveness Differences. New York: TNTP. Retrieved from http://tntp.org/assets/documents/TheWidgetEffect_2nd_ed.pdf;

[8] Hill et al., 2008.

[9] Several of the analyses featured in this brief are also available for other SDP partner districts. See http://cepr.harvard.edu/sdp/diagnostics/published-findings.php. SDP uses individual district analyses to provide comparative results in the form of Strategic Performance Indicators (SPI). SPI reports can be found online at http://www.cepr.harvard.edu/sdp/diagnostics/spi/.

[10] See for example: Strategic Data Project. (2012). SDP Human Capital Diagnostic: Los Angeles United School District. Cambridge, MA: Center for Educational Policy Research, Harvard University. Retrieved from http://cepr.harvard.edu/cepr-resources/files/news-events/sdp-lausd-hc.pdf.

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