MEMORANDUM January 11, 2019

TO: Board Members

FROM: Grenita Lathan, Ph.D.
Interim Superintendent of Schools

SUBJECT: **TEACHER INCENTIVE FUND STEM GRANT: PROGRAM EVALUATIONS**

CONTACT: Carla Stevens, 713-556-6700

The fourth cohort of the Teacher Incentive Fund federal grant competition (“TIF4”) included special consideration for projects that would identify, develop, and utilize master teachers as leaders of STEM education (science, technology, engineering, and mathematics). In September 2012, HISD was awarded a TIF4 grant for $15.9 million over five years. The TIF4 project schools were among the HISD schools serving grades K–8 with the highest student economic disadvantage and the most risk factors for chronic absenteeism.

Attached are the three program evaluation reports associated with the TIF4 grant. A human capital approach to strengthening STEM education addressed the TIF4 project schools’ need for high-quality supports for student learning, and the systemic challenges to teacher retention, development, and recruitment in hard-to-staff subjects. The first report in this series provided a descriptive overview of the grant-funded activities and interventions unique to the TIF4 project schools, setting the context for a meaningful discussion of programmatic impact.

The second report in the series addressed student outcomes for State of Texas Assessments of Academic Readiness (STAAR) Mathematics (grades three through eight) and STAAR Science (grades five and eight), during the grant period of 2012–2013 to 2016–2017. The TIF4 programming produced substantive, statistically significant results for science and for secondary mathematics.

Key findings include:

- **STAAR Science, Grades 5 and 8.** Over the grant period, the cumulative impact of the TIF4 program on Grade 5 Science was an increase in student achievement of about a fifth of a standard deviation (0.20 SD). The impact on Grade 8 Science was about a quarter of a standard deviation (0.24 SD). Both estimates are statistically significant, although the evidence in eighth-grade science is less compelling. With a fifth of a standard deviation of improvement, a student initially at the 50th percentile would improve to the 58th percentile.
- **STAAR Math, Grade 6.** The point estimates suggest a cumulative impact over the grant period of about a fifth of a standard deviation (0.21 SD). These estimates were not considered statistically significant at conventional levels.
- **STAAR Math, Grades 7 and 8.** Over the grant period, the cumulative impact of the TIF4 program on Grade 7 Math was about half of a standard deviation of student achievement (0.49 SD). The impact on Grade 8 was about four-tenths of a standard deviation (0.39 SD). Both estimates were statistically significant at conventional levels. A half-standard-deviation increase would improve the achievement of a student at the 25th percentile to the 43rd percentile, or a student at the 50th percentile would then grow to the 69th percentile.

- **STAAR Math, Grades 3 to 5.** In grades three through five, the TIF4 program did not appear to have a large effect on mathematics achievement in any year of the grant period.

The third and final report overviews the performance-based compensation strategies implemented through the TIF4 grant, as well as situates that work in the context of HISD's challenges for teacher retention and mobility.

Key findings include:

- The TIF4 schools paid out about ten $5,000 retention bonuses for each $10,000 recruitment bonus (178 Retention vs. 18 Recruitment). This suggests that effective math and science teachers at hard-to-staff HISD schools find retention bonuses to be meaningfully more compelling than larger recruitment bonuses.
- In Years Three, Four, and Five, the TIF4 schools retained 75 percent of their Effective and Highly Effective math and science teachers.
- During the grant period, HISD directed $3,330,781 of federal, state, and local resources into the ASPIRE Award at the TIF4 project schools. Over a thousand (1,012) ASPIRE Awards were paid to educators at the TIF4 campuses during this time. Every TIF4 school had at least one educator who received an ASPIRE Award during the grant.
- By the start of the third year after their initial hire, 46 percent of new teachers had left the HISD school where they started. This attrition rate is higher for new math (60.8 percent) and new science (61.2 percent) teachers.
- During this period, the top ten percent of HISD schools (90th percentile and upward) annually retained over 80 percent of all their high TADS teachers, regardless of subject area or years of experience.

Taken together, these findings strongly suggest that the high turnover among HISD's math and science teachers can be mitigated through investment in retention bonuses for effective and highly effective teachers already working at specific campuses.

Should you have any further questions, please contact Carla Stevens in Research and Accountability at 713-556-6700.

Grenita Lathan GL

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HOUSTON INDEPENDENT SCHOOL DISTRICT

RESEARCH

Educational Program Report

TEACHER INCENTIVE FUND STEM GRANT IN HOUSTON ISD: A HUMAN CAPITAL APPROACH TO IMPROVING STEM EDUCATION

HISD | Research and Accountability

ANALYZING DATA, MEASURING PERFORMANCE.

2018 BOARD OF EDUCATION

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The opinions expressed are those of the authors and do not represent the views of the HISD Board of Education, or the U.S. Department of Education.

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Teacher Incentive Fund STEM Grant in Houston ISD: A Human Capital Approach to Improving STEM Education

Executive Summary

Program Description

The fourth cohort of the Teacher Incentive Fund federal grant competition ("TIF4") included special consideration for projects that would identify, develop, and utilize master teachers as leaders of STEM education. In September 2012, HISD was awarded a TIF4 grant for $15.9 million to implement a human capital approach to improving STEM education. The TIF4 project schools were among the HISD schools serving grades K–8 with the highest student economic disadvantage and the most risk factors for chronic absenteeism. A human capital approach to strengthening STEM education addressed the TIF4 project schools' need for high-quality supports for student learning, and the systemic challenges to teacher retention, development, and recruitment in hard-to-staff subjects.

The first report in this series provided a descriptive overview of the grant-funded activities and interventions unique to the TIF4 project schools, setting the context for a meaningful discussion of programmatic impact. The second report in the series addressed student outcomes for State of Texas Assessments of Academic Readiness (STAAR) Mathematics (grades three through eight) and STAAR Science (grades five and eight), during the grant period of 2012–2013 to 2016–2017. This report overviews the performance-based compensation strategies implemented through the TIF4 grant, and situates the TIF4 schools in the context of HISD's historic challenges for new teacher retention, effective teacher retention, and the retention of math and science teachers.

Highlights

Key findings in this third report include:

- Overall, HISD paid about ten $5,000 teacher retention bonuses for each $10,000 teacher recruitment bonus (178 Retention vs. 18 Recruitment). In Years Three, Four, and Five, the TIF4 schools retained 75% of their Effective and Highly Effective math and science teachers.
- During the grant period, HISD directed $3,330,781 of federal, state, and local resources into the ASPIRE Award at the TIF4 project schools. Over a thousand (1,012) ASPIRE Awards were paid to educators at the TIF4 campuses during this time. Every TIF4 school had at least one educator who received an ASPIRE Award during the grant.
- By the start of their third year, 46% of new teachers had left the HISD school where they were initially hired. This attrition rate is higher for new math (60.8%) and new science (61.2%) teachers.
- During this period, the top ten percent of HISD schools (90^{th} percentile and upward) annually retained over 80% of all their Effective and Highly Effective teachers, regardless of subject area or years of experience.

This suggests that effective math and science teachers find retention bonuses to be meaningfully more compelling than recruitment bonuses that are twice as expensive and require a longer time commitment. Critically, these are teachers who have already shown success in meeting the needs of students at HISD's hard-to-staff schools. Taken together, these findings strongly suggest that the high turnover among HISD's math and science teachers can be mitigated through investment in retention bonuses for effective and highly effective teachers already working at specific campuses.

Table of Contents

Figures

Tables

Introduction

Since established by an Appropriations Act in 2006, the Teacher Incentive Fund (TIF) competitive grant program in the U.S. Department of Education (USDE) has supported human capital strategies “to ensure that students attending high-poverty schools have better access to effective teachers and principals, especially in hard-to-staff subject areas” such as science and math. Responding to the national agenda to improve STEM education, in 2012, the fourth cohort of the Teacher Incentive Fund federal grant competition (TIF4) included special consideration for projects designed to improve STEM education by identifying, developing, and utilizing master teachers as leaders of broader improvements (OESE, 2012a).

In September 2012, Houston Independent School District (HISD) was awarded a TIF4 grant for $15.9 million over five years (Award #S374B120011). The human capital strategies supported through TIF4 in Houston continue the successes and strategies of HISD’s previous TIF grants (Price & Stevens, 2017), and resemble the strategies undertaken by the other 35 TIF4 grant recipients nationwide (OII, 2015). For more information about the Teacher Incentive Fund grant, see **Appendix A** (p. 25).

HISD was one of six TIF4 grantees to support a “comprehensive approach to improving STEM instruction” as part of their overall human capital strategy (OESE, 2012b). These STEM-specific TIF4 grants were frequently described by USDE staff as TIF4-STEM grantees. A human capital approach to strengthening STEM education addressed the project schools’ need for high-quality supports for student learning, and the systemic challenges to teacher retention, development, and recruitment in hard-to-staff subjects. Through the TIF4 grant, HISD supported some activities that addressed teaching and learning across all content areas, and some activities that addressed teaching and learning only within the STEM content areas.

This report is the third in a series, each assessing an aspect of the TIF4 programming at the project schools. The first report provided a descriptive overview of activities and interventions unique to the TIF4 project schools, setting the context for a meaningful discussion of programmatic impact (Price, Provencher, & Stevens, 2018). Under the assumptions guiding the TIF grant program, student outcomes are a function of human capital management inputs — educator recruitment, retention, selection, assessment, professional development and supports, and performance-based compensation (Miller et al., 2015) — as mediated by teaching and learning behaviors. Therefore, the second report addressed student outcomes for the State of Texas Assessments of Academic Readiness, or STAAR, Mathematics (grades three through eight) and STAAR Science (grades five and eight), during the grant period of 2012–2013 to 2016–2017 (Price, Christian, & Stevens, 2018).

This report overviews the performance-based compensation strategies implemented through the TIF4 grant, as well as situates that work in the context of HISD’s challenges for teacher retention and mobility. Several factors inform a teacher’s decision about where and what to teach — compensation, working conditions, and student characteristics such as race, prior achievement, and economic disadvantage status (Hanushek, Kain, & Rivkin, 2002; Hanushek & Rivkin, 2007). Among the major factors influencing teachers’ decisions in the labor market, *compensation* is one of the inputs that can be manipulated programmatically by school or district leadership. Performance-based compensation systems (abbreviated to PBCS in TIF grant documentation) are designed to recognize and financially reward teachers for student metrics associated with their instruction. Compensation strategies are an important component of achieving the district’s goals around teacher retention and development.

Within education, it is generally accepted that on average, a more experienced teacher should be considered a more effective educator than a teacher with less experience (Hanushek, Kain, & Rivkin, 2004).

In this context, the exit of an experienced teacher from a specific school will ripple outward to other schools: if experienced teachers do not stay in HISD, then they are often replaced by less-experienced or new teachers. These new teachers, in turn, may not remain in HISD long enough to become experienced teachers themselves, resulting in a cycle where even the highest-need students may frequently be taught by individuals who do not have sufficient expertise to meet their instructional needs. The final components of this report delve into these specific outcomes: new teacher retention, effective teacher retention, and the retention of math and science teachers.

Methods

In July 2012, HISD leadership identified specific schools to receive STEM programming through the TIF4 grant (HISD, 2012). Located in almost every quadrant of Houston (see **Appendix Figure 1**, p. 26), each year, these schools served approximately 7,500 students from pre-kindergarten through eighth grade. Like most of the schools in HISD, the TIF4 project schools were considered "high-need" under the definitions in the U.S. Department of Education's Request for Application (OESE, 2012a). Additionally, the TIF4 project schools each had a persistent track record of underperforming on the science STAAR exams required under the Elementary and Secondary Education Act (NCLB, 2002). Their inclusion in the TIF4 grant was intended to address student learning and achievement in both math and science. The TIF4 project schools were identified based on their need for supports, rather than randomly. Consequently, HISD project staff were precluded from conducting randomized controlled trials, which is considered the most rigorous research design for making causal inferences (Murnane & Willett, 2011).

As a result, these analyses serve as descriptive models of historical behavior, and as explorations of existing trends. None of these analyses are appropriate for supporting causal inference statements about the impact of the TIF4 grant. The datasets, methodology, limitations, and findings for each of these components are described in each section below.

Performance Based Compensation at TIF4 Schools

As part of the grant, specific performance-based compensation strategies for recruitment and retention were implemented for STEM teachers at the TIF4 campuses. These represented a major investment of public resources, and they were an important aspect of the comprehensive TIF4–STEM programming at the project schools that yielded such remarkable effects for student achievement in math and science as presented in the second report of this series.

ASPIRE Award

In January 2007, the Houston Independent School District (HISD) inaugurated the Teacher Performance-Pay Model 2005–2006, becoming the first school district in the nation to implement a performance-pay system of this magnitude based on individual teacher effectiveness. The experience gained in the first year and consultations with national experts and teachers provided the impetus for recommending the improvement and enhancement of the model, which became the ASPIRE Award under the "Recognize" component of the district's comprehensive education-improvement model, Accelerating Student Progress Increasing Results and Expectations (Hui, Mosier, & Bigner, 2018). The HISD Research and Accountability team published an annual program overview and evaluation of the ASPIRE Award during the TIF4 grant period (Zimmerman, Hui, & Mosier, 2017a, 2017b; Zimmerman, Hui, Mosier, & Chang, 2015; Zimmerman, Mosier, & O'Brien, 2014). From 2007 through 2016, the ASPIRE Award program was available to educators, school leaders, and support staff at all HISD schools. The model underwent updates over the years, staying relevant to changes in state assessments, state accountability measures, and available metrics of teacher performance. For the 2016–2017 school year, this Award was available only to educators and school leaders at HISD schools participating in the TIF4 grant.

The outcomes of the ASPIRE Award program at the TIF4 schools can be measured three ways: in cumulative number of awards, in the consistency with which a school had an award paid, and in the sum of performance-based compensation received by educators at TIF4 project schools.

While the schools represent a wide range of performance along this metric, every TIF4 school had at least one educator who received an ASPIRE Award during the grant period. Over a thousand[(i)] (1,012) ASPIRE Awards were paid to educators at the TIF4 campuses during this time. This represents an average of 44 Awards per school. As shown in **Figure 1** (p. 7), nine schools saw a more-than-average number of Awards during this period: Garden Oaks Montessori (105), Braeburn ES (102), Southmayd ES (100), Fondren MS (95), Eliot ES (83), Herrera ES (78), Wilson Montessori (67), Burrus ES (50), and Fleming MS (50). The other schools had fewer Awards than the group average of 44. (See **Appendix Table 1**, p. 27, for details.)

The TIF4 grant period covered five ASPIRE Awards. On average, a specific school saw an ASPIRE Award in 3.7 years, or 75% of the time. In none of these five years did an educator at every TIF4 school earn an Award; the number of schools with an Award ranged from 14 schools for 2016–2017 to 20 schools for 2014–2015. A measure of a school's consistency in earning ASPIRE Award-level-metrics, then, is the fraction of these five years in which at least one their educators earned an ASPIRE Award. Thirteen schools were above this group average.

- At 100%, 11 Schools with Awards in five years: Braeburn ES, Burrus ES, Eliot ES, Fleming MS, Fondren MS, Foster ES, Garden Oaks Montessori, Herrera ES, Southmayd ES, Sugar Grove Academy, Wilson Montessori
- At 80%, two schools with Awards in four years: Durkee ES and Law ES

The remaining ten project schools were below the 75% group average in terms of consistency. Not surprisingly, many of the schools whose educators consistently earned an ASPIRE Award are also above the group's per-school average of 44 Awards during the project period. The notable exceptions with below-average performance and above-average consistency are Foster ES (32 Awards in 5 years), Looscan ES (24 Awards in 5 years) and Sugar Grove Academy (14 Awards in 5 years).

As illustrated in **Figure 2** (p. 7), cumulative ASPIRE Award payouts at each school over the five-year grant period range from $403,350 and $330,854 (Fondren MS and Southmayd ES, respectively) to $16,500 and $3,750 (Codwell ES and Mading ES, respectively). Details on each school's payout for each year can be found in **Appendix Table 2** (p. 28). The HISD Research and Accountability team published extensive details on the Awards payout for each year of the TIF4 grant (Hui & Carney, 2016; Hui & Mosier, 2015; Hui, Mosier, & Bigner, 2017, 2018; Mosier & LaSage, 2014). The 2018 analysis covered exclusively the TIF4 project schools.

During the grant period, HISD directed $3,330,781 of federal, state, and local resources into the ASPIRE Award at the TIF4 project schools. As shown in **Figure 3** (p. 8), these resources varied by Award year — from $265,625 in Year Four to $933,508 in Year Two. Aggregated across the five ASPIRE Award payouts, three percent came from state funds ($100,517 from the District Awards for Teacher Excellence Program, or DATE, for Award 2012–2013), 31.2% from federal funds ($1,038,467 from TIF4), and 65.8% from local district funds ($2,191,797 from HISD's general fund). This breakdown is cumulative across all five years, and it does not reflect the sum of HISD's locally funded investment in the TIF4-STEM project.

Figure 1. Cumulative Count of ASPIRE Awards at TIF4 Project Schools, 2012–2013 to 2016–2017

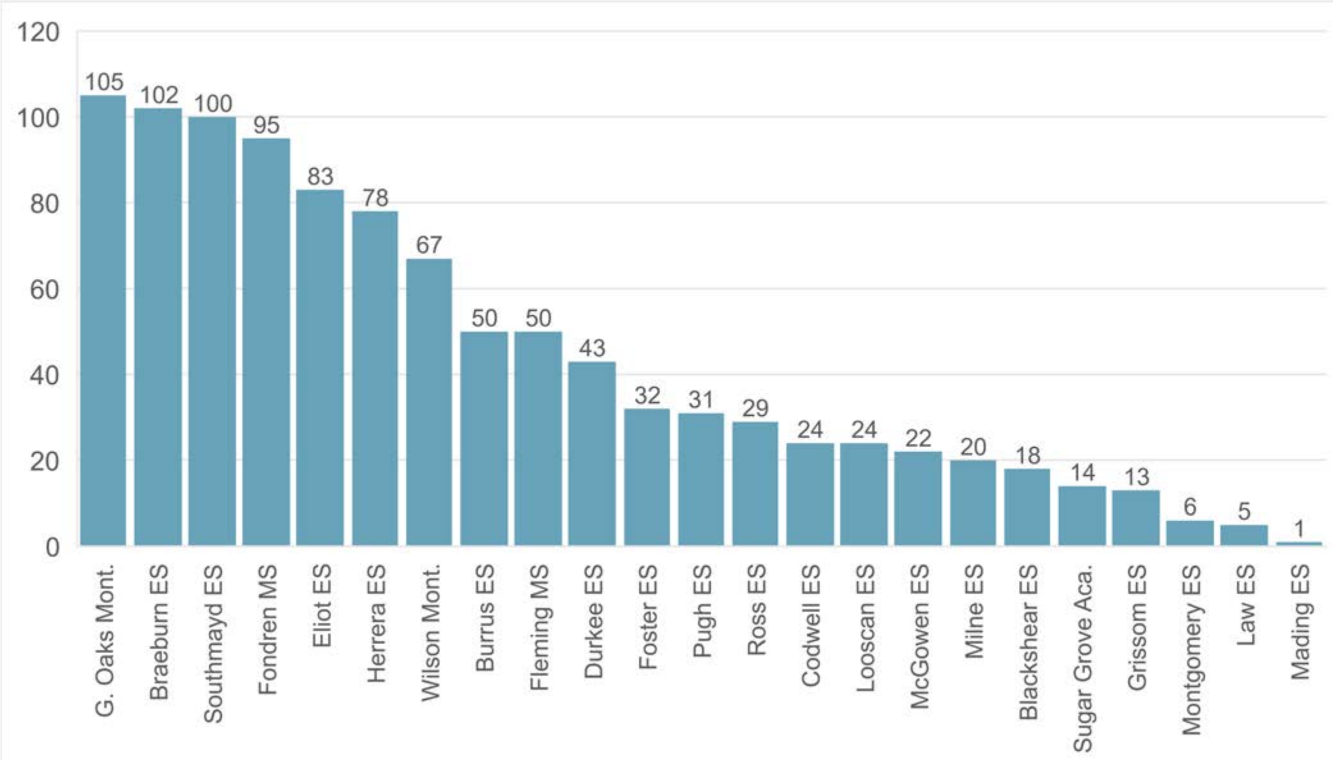


Figure 2. Cumulative ASPIRE Award Payout at TIF4 Project Schools, Awards 2013–2017

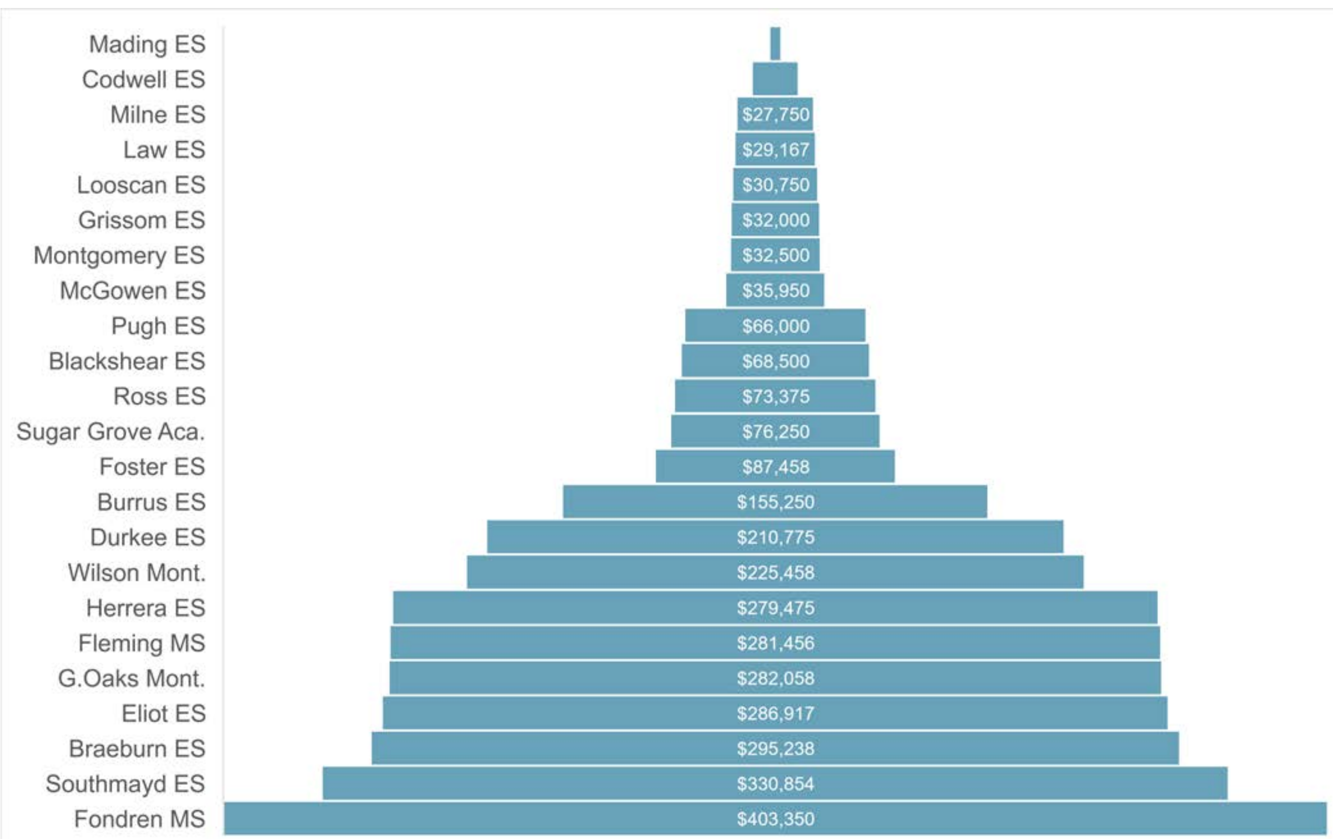
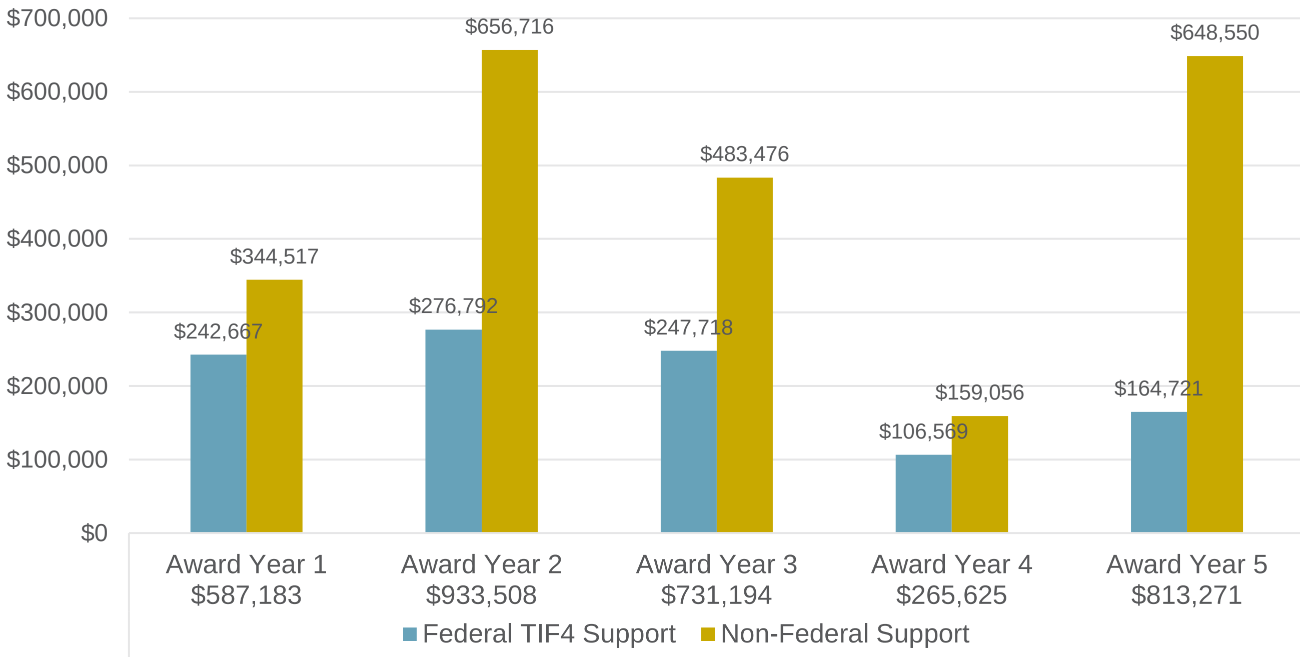


Figure 3. Cost Division of ASPIRE Awards at TIF4 Project Schools, Awards 2012–2017



Note: These totals include neither the fringe benefits on this compensation, nor the payout of ASPIRE Awards to campus-based support staff who were not eligible for TIF4 funding. See Appendix B (p.27).

Recruitment and Retention Bonuses for STEM Teachers at TIF4 Project Schools

As noted above, HISD was one of just six TIF4 grantees to support a "comprehensive approach to improving STEM instruction" as part of their overall human capital strategy (OESE, 2012b) — including recruitment and retention bonuses paid to qualifying math and science teachers.

Teachers already at a specific TIF4 project school were eligible for a retention bonus of up to $5,000 if the teacher returned to the same TIF4 campus by the first duty day of the following fall semester; ***and,***

- The teacher was scheduled to teach core foundation courses[ii] for either math or science or both in a STAAR or End of Course (EOC) tested grade and subject for the following academic year; ***and,***
- The teacher was considered Effective or Highly Effective according to the HISD Teacher Appraisal and Development System (TADS) for the most recently available data; this summative rating must include measures of Student Performance; ***and,***
- The teacher had a Student Growth (Education Value-Added Assessment System, or EVAAS) Cumulative Gain Index score for either math or science at or above 1.0 for the most recently available academic year in a STAAR/EOC tested grade and subject; ***or,*** the teacher has at least one teacher-level Comparative Growth metric in the top two quintiles for math or science for the Academic Year 2015–2016 in a STAAR/EOC tested grade and subject (Year Five only).

Teachers working in HISD at a school other than a TIF4 campus were eligible for a Recruitment bonus of up to $10,000 by (a) moving to a TIF4 campus as of the first duty day of the following academic year, (b) meeting the three criteria outlined above, and (c) making a verbal commitment to work at the campus for a five-year period.

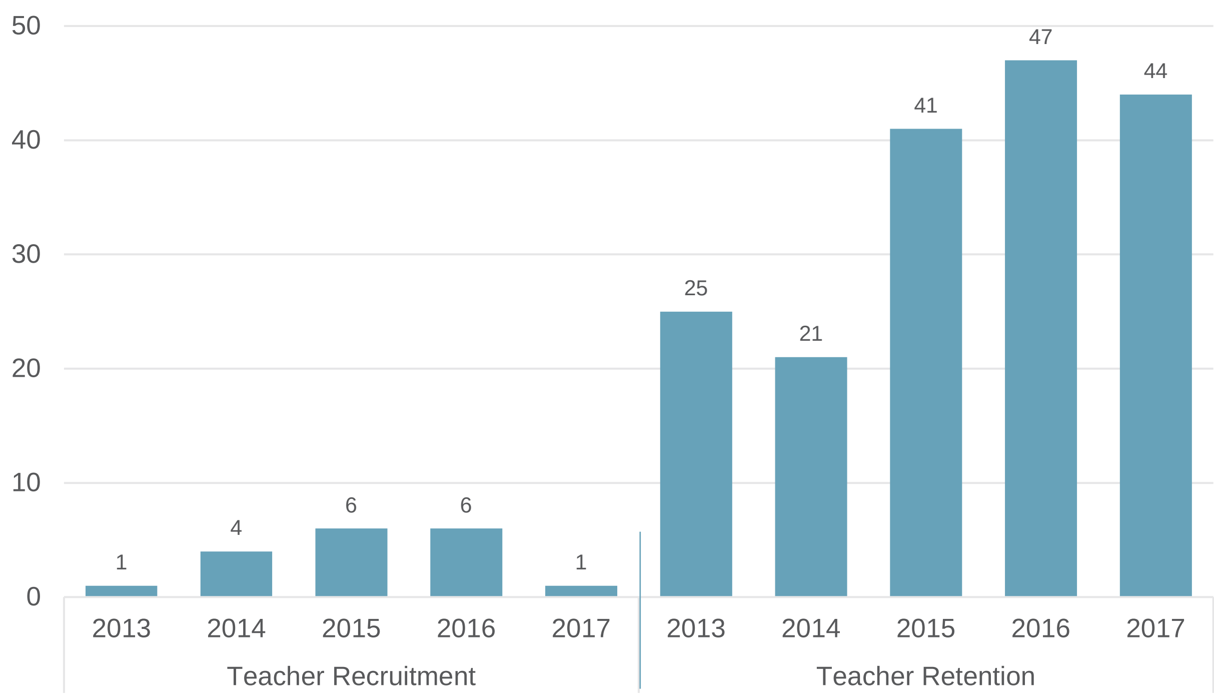
Due to the timing of metrics availability vis-à-vis the hiring cycle, new science and math teachers would not have the student-level data required for bonus eligibility until after the conclusion of their second full year in the classroom. To illustrate: in March 2016, HISD administrators identified and notified those HISD teachers whose documented effectiveness and evaluation criteria indicated they would be eligible for a bonus should they return to their TIF4 campus to teach for the 2016–2017 school year. These teachers were identified before TADS or EVAAS metrics for the current school year were completed, but in time to be relevant to their decisions about where to teach in the following school year. Consequently, the bonuses paid in September 2016 were based on the most recent data available at the time of the identification in March 2016: data from 2014–2015 (finalized in December 2015 for all HISD teachers). Performance metrics from the 2015–2016 school year drove the bonuses paid to teachers identified in March 2017, for bonuses to be paid in September 2017 in support of staffing for the 2017–2018 school year.

In the first two annual cycles of the bonus program, a total of five recruitment and 46 retention bonuses were paid through the TIF4 grant (**Figure 4**). These numbers were meaningfully higher in Years Three, Four, and Five:

- In September 2015, HISD paid six Recruitment and 41 Retention bonuses to eligible TIF4 teachers, or retention of 74.5% of the 55 eligible teachers.
- In September 2016, HISD paid six Recruitment and 47 Retention bonuses to eligible TIF4 teachers, or retention of 85.5% of the 55 eligible teachers.
- In September 2017, HISD paid one Recruitment and 44 Retention bonuses to eligible TIF4 teachers, or retention of 74.6% of the 59 eligible teachers.

Overall, HISD paid about ten retention bonuses for each recruitment bonus (178 vs. 18). Project staff have attributed the relative later success to the realignment of the cycle calendar that took place early in Year Three. Principals at project schools received the names of teachers who would be eligible for a retention bonus if they returned for the following year, as well as the names of all HISD teachers who would be eligible for a recruitment bonus if they were successfully recruited for the following year. Additionally, the teachers currently at TIF4 schools received a communication directly notifying them of their bonus eligibility, should they return for the following year. (See **Appendix C**, p. 29, for a sample.) In Year Three, this direct notification went out in May, in Year Four in April, and in Year Five in March.

Figure 4. TIF4 Recruitment (18) and Retention (78) Bonuses, September 2013 to September 2018



Teacher Retention and Mobility During the TIF4 Grant Period

How long do new teachers stay in HISD?

One of the goals of the TIF4 grant was to improve district-level human capital management systems — consequently, an assessment of district-wide measures is necessary to contextualize the human capital outcomes of the specific TIF4 schools. Project staff conducted a descriptive analysis that followed three cohorts of first-year(iii) teachers in HISD, from their entry into HISD during the 2012–2013, 2013–2014, and 2014–2015 school years. These cohorts of first-year teachers were followed from their first fall semester until the beginning of the 2018–2019 school year. Cohort 1 (originally n=1,581) first entered HISD in 2012–2013, Cohort 2 (originally n=1,666) first entered HISD in 2013–2014, and Cohort 3 (n=1,757) first entered HISD in 2014–2015. This gives a district-level perspective on the three types of movement available to newly hired teachers:

- Returned to Same School Next Year: These individuals were listed as teachers on the same HISD school's employee roster in the fall semester of the following academic year.
- Moved Schools for Next Year: These "mover" individuals were listed as teachers on a different HISD school's employee roster in the fall semester of the following academic year.
- Left District for Next Year: These "leaver" individuals were not listed as teachers on any HISD school's employee roster in the fall semester of the following academic year.

This methodology does obscure those movements that are the result of career development — for example, a teacher who takes on a new role at the same campus as an Assistant Principal is treated as a "leaver". This analytical choice was deliberate because from the district-wide perspective, the promotion creates a vacancy in an instructional position that would otherwise have been filled; even though the promotion may be a positive development for the teacher and for the campus, it is a negative development for the district-wide measures. This is one of the ways in which district-level goals for teacher retention and career development can be in tension with campus-level goals.

Table 1 (p. 11) shows how many cohort-member teachers were employed at the start of each year, and where they appeared in the following year's staffing data. This table can be interpreted as follows: for Cohort 1 in 2012–2013, there were 1,581 first year teachers in HISD. For example, for the year following their first full year of teaching, 1,209 teachers from Cohort 1 returned to teach in the same HISD school, 105 moved to a different school in HISD, and 267 were not employed as teachers on the roster of any HISD school.

These data can also be used to calculate the percentage of teachers in each cohort who returned in the following year to the school where they were initially hired. **Table 2** (p. 11) shows the cohorts' same-school retention for each additional year of their career. For example, 76.47% of teachers hired in the 2012–2013 cohort returned to teach in the same school in 2013–2014. This analysis presents HISD with several trends:

- One year after hiring, an average of 72% of teachers returned to the school where they were initially hired. Inversely, by the start of their second year, nearly 30% of teachers had left the school where they were initially hired.
- Two years after hiring, an average of 54% of teachers returned to the school where they were initially hired. Inversely, by the start of their third year, 46% or nearly half of teachers had left the school where they were initially hired.
- On average, a school that hires a teacher with no years of teaching experience who is also new to HISD has just slightly better than a 50/50 chance of benefiting from that teacher's third year of teaching.
- Across all three cohorts, teacher mobility retention leveled out four years after the initial hire.

These results are presented graphically below in **Figure 5** (p. 12), outlining the magnitude of the challenge at hand.

Table 2 (below) and **Figure 5** (p. 12) do not make the distinction between a teacher's promotion, a teacher's leave of HISD, and a teacher's movement to another school within HISD. While these are relevant distinctions for district-level objectives, from the school's perspective, they are all equally problematic since they each create a vacancy in an instructional position that would otherwise have been filled. This is another example of how campus-level and district-level goals for teacher retention and career development are not always in tight alignment.

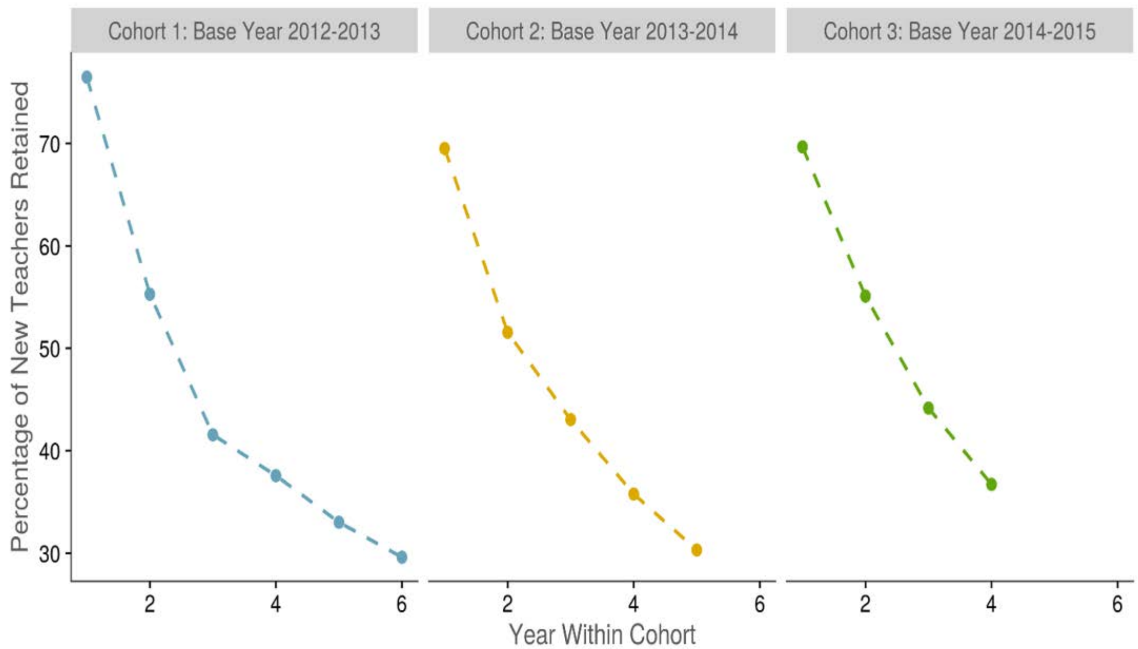
Table 1. Retention and Movement in HISD for Three Cohorts of New Teachers

School Year	Cohort	Count at Beginning of Year	Returned to Same School Next Year	Moved Schools for Next Year	Left Tchr. Roster for Next Year
2012–2013	1	1,581	1,209	105	267
2013–2014	1	1,274	874	111	289
2014–2015	1	930	657	94	179
2015–2016	1	753	594	59	100
2016–2017	1	672	522	54	96
2017–2018	1	572	468	34	70
2013–2014	2	1,666	1,158	120	388
2014–2015	2	1,205	859	116	230
2015–2016	2	973	717	70	186
2016–2017	2	785	596	70	119
2017–2018	2	662	505	63	94
2014–2015	3	1,757	1,224	162	371
2015–2016	3	1,296	968	79	249
2016–2017	3	1,045	776	73	196
2017–2018	3	834	645	68	121

Table 2. Same-School Retention of New Teachers in Three Cohorts, By Year

Years After Hire	Average Cohort SS Retention	Cohort 1 (2012–2013)	Cohort 2 (2013–2014)	Cohort 3 (2014–2015)
1 Year After Hire (a.k.a., start of 2nd year)	72.0%	76.47% (1,209/1,581)	69.51% (1,158/1,666)	69.66% (1,224/1,757)
2 Years After Hire (a.k.a., start of 3rd year)	54.0%	55.28% (874/1,581)	51.56% (859/1,666)	55.09% (968/1,757)
3 Years After Hire (a.k.a., start of 4th year)	42.9%	41.56% (657/1,581)	43.04% (717/1,666)	44.17% (776/1,757)
4 Years After Hire (a.k.a., start of 5th year)	36.7%	37.57% (594/1,581)	35.77% (596/1,666)	36.71% (645/1,757)
5 Years After Hire (a.k.a., start of 6th year)	31.7%	33.02% (522/1,581)	30.31% (505/1,666)	--
6 Years After Hire (a.k.a., start of 7th year)	--	29.60% (468/1,581)	--	--

Figure 5. Within-School Retention of New Teachers in HISD, for Three Cohorts



How long do new math and science teachers stay in HISD?

Research on the STEM teaching workforce has suggested that math and science teaching positions are more difficult to staff than other subject-specific roles. Each year of the TIF4 grant period, the Texas Education Agency (TEA) supported this conclusion by formally naming mathematics and science as "teacher shortage" areas (TEA, 2012, 2013, 2014, 2015, 2016). The next step of analysis repeated the analysis described above, focusing on new math and science teachers, districtwide.

Initial screening for math and science teachers relied solely on job coding in HISD's human resources information system. However, this excluded multi-subject teachers from elementary grades, and over-reported the outcomes of secondary math and science teachers. Ultimately, these teachers were identified by the content area of their courses, as listed in the district's student information system (Chancery). This approach did not exclude elementary teachers, and therefore provided a more comprehensive view of STEM instruction across the district than the initial strategy. There were two tradeoffs: (1) teachers assigned math *and* science courses (e.g., self-contained) were counted in both analyses, even though they only occupy one position, and; (2) the final course assignments for spring semester of 2018–2019 were not yet available, and so the overall analysis period excludes 2018–2019.

Overall, the retention for new math and science teachers is meaningfully less successful than the district-wide average for all subjects (outlined in previous section). The numbers in **Table 3** (p. 13) and **Table 4** (p. 13) show the percentage of new math and science teachers who returned to the same school and subject. Each year, the average cohort retention rate for math and for science teachers is nearly 10 percentage points lower than the cohort's overall same-school retention rate. Three years after hiring, a little over a quarter of the cohort's initial math teachers are still teaching math at their initial school. The rates are similar for new science teachers: less than a third are still teaching science at their original school.

However, even if they stay in the same school, it is possible that a person who is teaching math in their first year is teaching other subject areas in their later years. The school benefits from retaining the teacher in a different role, even if this mobility is considered a loss for subject-specific retention. Consequently, project

Table 3. Same-School and Same-Role Retention of New Math Teachers, by Cohort/Year

Years After Hire	Average Cohort Retention	Cohort 1 (2012–2013)	Cohort 2 (2013–2014)	Cohort 3 (2014–2015)
1 Year After Hire (a.k.a., start of 2nd year)	57.8%	62.91% (380/604)	54.59% (357/654)	56.00% (392/700)
2 Years After Hire (a.k.a., start of 3rd year)	39.2%	42.22% (255/604)	35.47% (232/654)	39.86% (279/700)
3 Years After Hire (a.k.a., start of 4th year)	28.8%	26.99% (163/604)	28.13% (184/654)	31.14% (218/700)
4 Years After Hire (a.k.a., start of 5th year)	23.3%	23.68% (143/604)	22.94% (150/654)	--
5 Years After Hire (a.k.a., start of 6th year)	--	22.85% (138/604)	--	--

Table 4. Same-School and Same-Role Retention of New Science Teachers, by Cohort/Year

Years After Hire	Average Cohort Retention	Cohort 1 (2012–2013)	Cohort 2 (2013–2014)	Cohort 3 (2014–2015)
1 Year After Hire (a.k.a., start of 2nd year)	57.7%	61.43% (336/547)	55.27% (341/617)	56.37% (376/667)
2 Years After Hire (a.k.a., start of 3rd year)	38.8%	40.77% (223/547)	36.14% (223/617)	39.58% (264/667)
3 Years After Hire (a.k.a., start of 4th year)	29.0%	27.79% (152/547)	29.01% (179/617)	30.28% (202/667)
4 Years After Hire (a.k.a., start of 5th year)	29.0%	23.95% (131/547)	21.07% (130/617)	--
5 Years After Hire (a.k.a., start of 6th year)	--	19.56% (107/547)	--	--

staff looked at both kinds of retention for math and science teachers: same-school and same-role, as well as same-school and different role. **Figure 6** (p. 14) shows the same-school retention of those individuals who taught math in their first year who taught math in the following years, while **Figure 7** (p. 14) shows the same-school same-role retention of new science teachers. In both, the rate shown is for Cohort 1. The rates of same-school retention regardless of content area are described in **Appendix Tables 3–4** (p. 30).

Same-school retention for new teachers is relatively low, but this is also the case for more experienced teachers. We also calculated the average number of years any HISD teacher who appeared in the data window stayed at any one school during that time. As shown in **Table 5** (p. 14), the average duration of a teacher's stay at one school over the five-year period was less than three years (2.51), and lower for math and science teachers. Note that this does not mean the average teacher in this window left in the middle of their second year. Rather, it means that the average teacher left either two or three years after initial hiring (for both math and science, more often two years rather than three).

Since project staff did not incorporate information on where the experienced teachers were employed before the beginning of the observation period, these figures underestimate the true total duration of the average HISD teachers' time in one school. However, this does suggest that the average HISD teacher moves relatively frequently, within a given five-year period, and therefore suggests that the stability of the faculty at the typical HISD campus is relatively low. This may hinder a school's ability to build a cohesive faculty that functions as a professional learning community.

Figure 6. Same-School Same-Role Retention for Three Cohorts of New Math Teachers

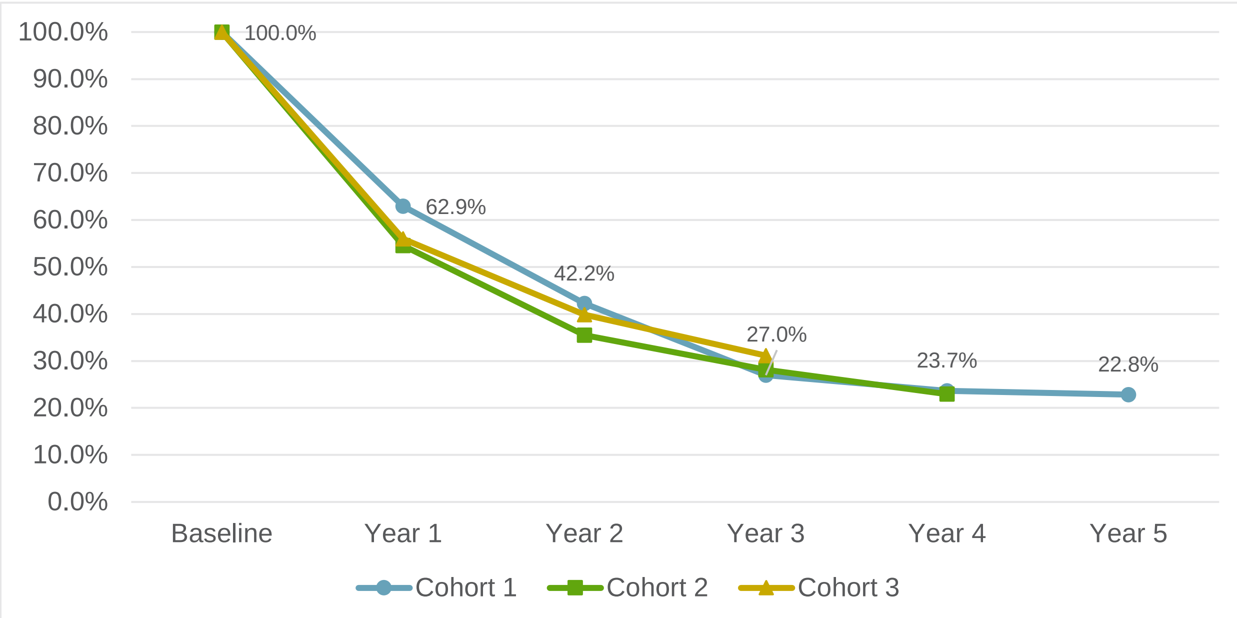


Figure 7. Same-School Same-Role Retention for Three Cohorts of New Science Teachers

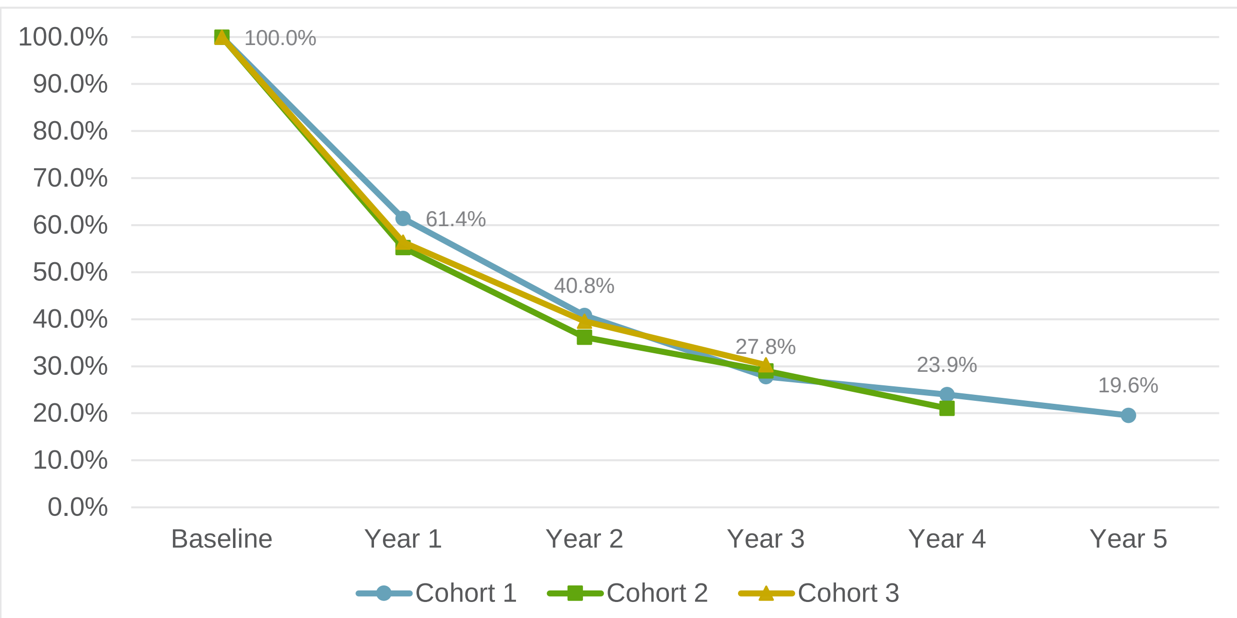


Table 5. Average Number of Years at Same School for HISD Teachers, 2012-2013 to 2017-2018

All Teachers	Math Teachers	Science Teachers
2.51 / 5	2.36 / 5	2.33 / 5

Which HISD schools are especially good at retaining their top teachers?

Teacher turnover has been shown to be detrimental to the quality of instruction, especially in low performing schools (Hanushek, Rivkin, & Schiman, 2016; Ronfeldt et al, 2013). While turnover is likely to be somewhat of an issue in most schools, there may be some schools in HISD that are substantially better at retaining the most effective teachers, even after controlling for those factors outside schools' control that influence teacher turnover. The former can provide HISD leadership with possible models for emulation, while the latter could be targeted for additional support. This is important because not all turnover has the same impact on instruction — because "if effective teachers are less likely to leave than less effective teachers, however, then high levels of teacher attrition may improve rather than decrease the overall quality of the teaching workforce" (Guarino, Santibanez, & Daley, 2006).

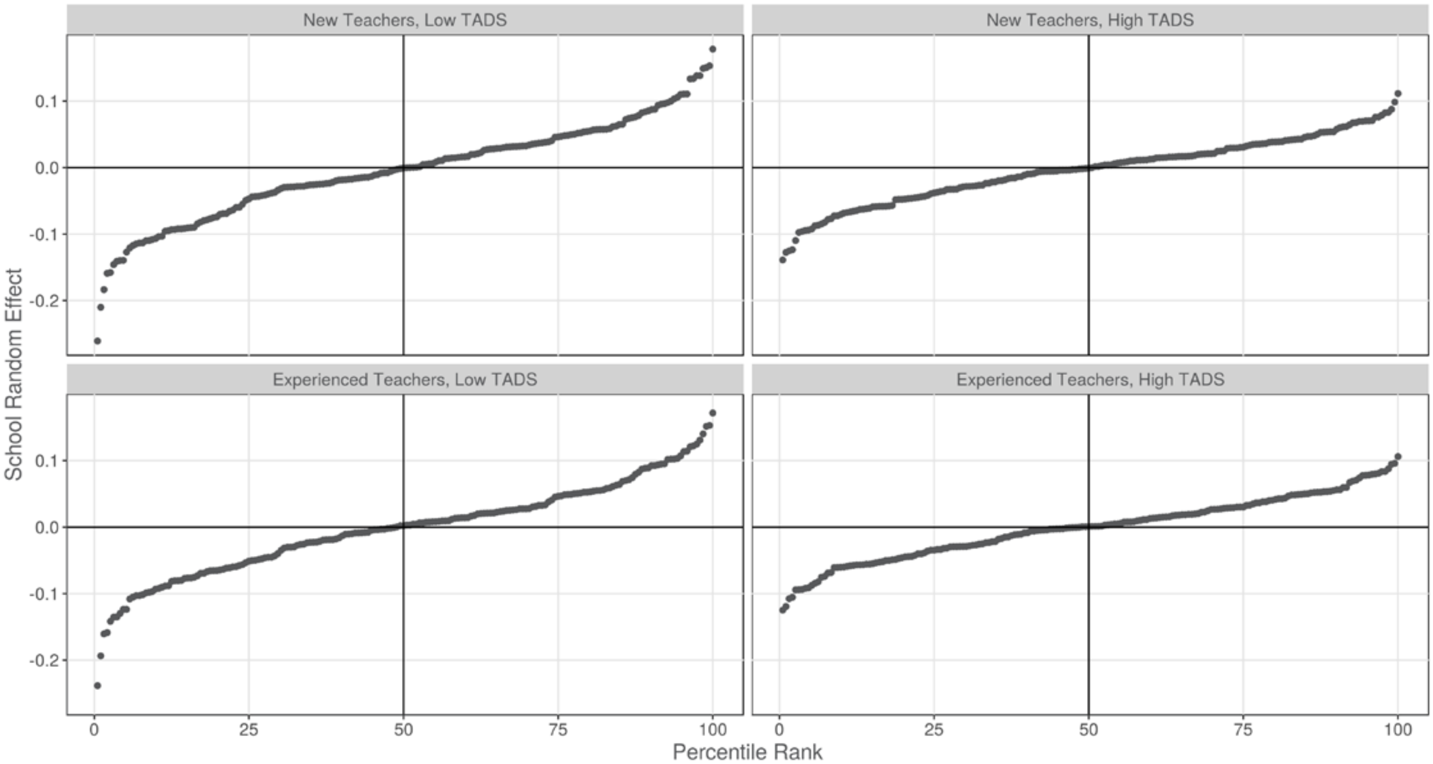
To identify which schools are better than expected at the task of retaining their effective and highly effective teachers, project staff first used five years of employee rosters, school demographics, and teacher appraisal (TADS) data to develop a quantitative model estimating the likelihood that a teacher is retained in that school the following year, given school (percent Hispanic, percent African American, percent economic disadvantage) and teacher (TADS rating, experience level) characteristics that are known from other research to influence teacher turnover (e.g., Borman & Dowling, 2008). This model estimated the unique contribution of the school to teacher retention after removing the effects of year to year variation[iv], and after controlling for the school's student characteristics known from other research to influence teacher turnover — the school's percentage of economically disadvantaged students, Black, Hispanic, Asian, and White students.

The school's random effect, then, is the school's distance from the expected level of retention for schools with similar student populations. Model results were used to derive an estimate of how schools compared to each other in terms of retaining each of the four categories of teachers: New and High TADS, New and Low TADS, Experienced and HIGH TADS, as well as Experienced and Low TADS. (For definitions of each term, see **Appendix E**, p. 31.) This modeling showed that HISD schools do differ substantially in their retention of teachers within each category. **Figure 8** (p. 16) shows the individual schools' random effect on retention, for each of the teacher types:

- Each school is represented on each panel by one dot. These dots are ordered by the size of the effect (vertical axis) and arranged visually from left to right according to their percentile rank (horizontal axis).
- Schools to the right of the 50th percentile on the horizontal axis had a positive effect on teacher retention — meaning that they retained that category of teachers at a higher rate than what was expected.
- Schools to the left of the 50th percentile had a negative effect on teacher retention — meaning that they retained that category of teachers at a lower rate than what was estimated for them.
- At the 50th percentile, the school effect is equal to zero — meaning that those schools retained that category of teacher at the same rate that was estimated for a school with their student characteristics.

Note that there is a greater difference between schools at or above the 75th percentile and those at or below the 25th percentile in retention of low TADS teachers compared to high TADS teachers — in both rows, the dots in the right-hand graphic (High TADS) are more tightly clustered than the dots in the left-hand (Low TADS) graphics.

Figure 8. Same-School Retention for Four Teacher Categories, School Effect and Percentile Rank



Additional analysis showed substantial variation of teacher retention across schools at most levels of these school characteristics, especially at high percentages of economic disadvantage, all percentages of Hispanic students, and low percentages of African American students. These findings are illustrated in **Appendix Figures 2**, **3,** and **4** (**Appendix E**, pp. 31–32). Schools whose dots are above the district-wide trend line are retaining teachers at a higher rate than expected for that demographic factor; schools below the trend line are retaining teachers at a lower rate than expected.

The district-wide trend line in **Appendix Figure 2** (p. 31) shows regardless of whether they are low or high TADS, new teachers are increasingly unlikely to be retained as economic disadvantage rate increases (negative slope), whereas this factor appears to have almost no relation to the retention of experienced high TADS teachers (minimal or totally flat slope). The district-wide trend line in **Appendix Figure 3** (p. 32) shows that the retention of teachers becomes less likely with the increase of each school's percentage of Hispanic students. This is true for all four categories of teachers (four negative slopes).

The district-wide trend lines in **Appendix Figure 4** (p. 32) show a different pattern: the school's percentage of African-American students has a weak relationship to the retention of new and low TADS teachers (minimal or totally flat slope), and a positive relationship to the retention of the three other categories of teacher (three positive slopes).

The left-hand columns of **Table 6** (p. 17) show the eight TIF4 project schools that are above the district average (50th percentile) for their retention of experienced high TADS teachers, as ranked by their estimated school effect on retention. The right-hand columns of the table show the six TIF4 project schools that are above the district average (50th percentile) for their retention of new high TADS teachers, when ranked by their estimated school effect on retention. These schools are represented among the dots above the 50th percentile line in the two High TADS graphs in **Figure 8** (above).

Table 6. Retention of High TADS Teachers: TIF4 Schools Above HISD Average (50th Percentile)

Experienced High TADS Teachers			New High TADS Teachers		
TIF4 School	Effect	Percentile	TIF4 School	Effect	Percentile
Burrus ES	0.043	80.7%	Ross ES	0.068	92.7%
Foster ES	0.035	76.0%	Fleming MS	0.047	84.9%
Ross ES	0.029	72.4%	Foster ES	0.045	84.4%
Law ES	0.029	71.9%	Wilson ES	0.025	70.3%
Braeburn ES	0.028	71.4%	Burrus ES	0.011	57.8%
Codwell ES	0.027	70.3%	Codwell ES	0.008	54.7%
Wilson ES	0.013	59.9%			
Blackshear ES	0.006	54.7%			

Table 7. HISD's Average Estimated Retention Rate by Year, TADS Rating, and Teacher Experience

	Low TADS		High TADS	
Year	Experienced Teachers	New Teachers	Experienced Teachers	New Teachers
2012–2013	0.68	0.69	0.82	0.75
2013–2014	0.64	0.53	0.80	0.72
2014–2015	0.57	0.55	0.79	0.73
2015–2016	0.60	0.56	0.82	0.76
2016–2017	0.63	0.59	0.82	0.75

Table 7 (above) shows the average estimated retention rate by low and high TADS and experienced and new teachers for each year. Overall, the average retention rate is higher for high TADS teachers in all years for both experienced and new teachers. Between experienced and new teachers, there are no measurable differences in the estimated retention rate between low and high TADS teachers. Additionally, the estimated retention rates do not vary significantly by year.

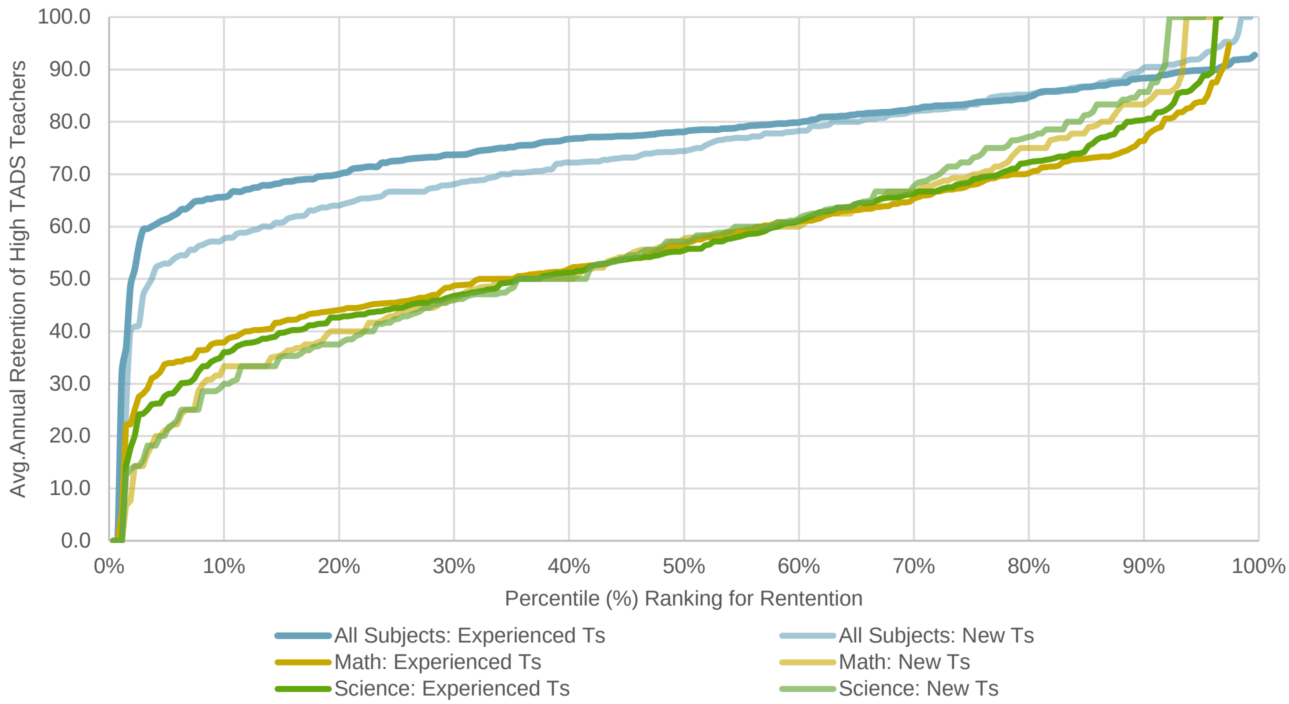
Which HISD schools are especially good at retaining their math and science teachers?

Earlier analysis of teacher mobility (reported above) required the identification of each school's average annual retention of effective and highly effective teachers across all subject areas during the five-year observation window. (See Appendix E for definitions.) This also yielded numbers for each school's average annual retention rates for effective and highly effective math and science teachers. In **Figure 9** (p. 18), these rates have been sorted from low to high (vertical axis), ranked as percentiles (horizontal axis), and plotted close together. The resulting dots illustrate the distribution of retention rates across the district:

- During this period, the top ten percent of HISD schools (90th percentile and upward) annually retained over 75% of all their high TADS teachers, regardless of subject area or years of experience.
- Nearly two-thirds (64%) of HISD's schools demonstrated an annual average retention over 50% for all six groups of high TADS teachers.

In most of HISD's schools, new and high TADS teachers were retained at a lower rate for each of the subject areas than their more experienced counterparts (the light lines are lower than the dark lines for all three subjects until near the 70% mark). This lends further support to the conclusion suggested by **Table 5**: even within the overall challenge of turnover, a school is more likely to experience turnover of their High TADS teachers for math and science than for a general subject.

Figure 9. Historical Retention of New and Experienced Teachers, Comparing Across Subjects



As with the retention of all teachers, the retention of both math (**Appendix Figure 5**, p. 32) and science (**Appendix Figure 6**, p. 33) teachers showed significant variation in the lowest and highest school effects. Again, while student demographics influenced retention, as shown in **Appendix Figures 7–12** (pp. 34–36), there was considerable variation in the retention estimates especially at high levels of school percentage of free/reduced price lunch, low levels of the percentage of African American students, and variation at all levels of Hispanic students. This again suggests that some schools are better at retaining High TADS math and science teachers even when school demographics are similar.

Table 8 (below) shows the nine TIF4 schools above the district average for their retention of experienced, high TADS mathematics teachers, as ranked by their estimated school effect on retention. The right-hand columns of the table show the five TIF4 project schools above the district average for their retention of new high TADS mathematics teachers, also ranked by school effect. **Table 9** (p. 19) shows the same for science.

Table 8. Retention of High TADS Mathematics Teachers: TIF4 Schools Above 50th Percentile

Experienced High TADS Math Teachers			New High TADS Math Teachers		
TIF4 School	Effect	Percentile	TIF4 School	Effect	Percentile
Eliot ES	0.106	85.0%	**Eliot ES**	0.140	94.7%
Codwell ES	0.093	82.9%	**Southmayd ES**	0.113	89.8%
Garden Oaks	0.067	74.9%	**Ross ES**	0.081	80.2%
Fondren MS	0.053	67.9%	**Garden Oaks**	0.069	76.5%
Sugar Grove Aca.	0.045	64.7%	**Fondren MS**	0.063	74.3%
Ross ES	0.038	61.5%			
Blackshear ES	0.036	59.4%			
Southmayd ES	0.009	55.1%			
Braeburn ES	-0.003	50.3%			

Table 9. Retention of High TADS Science Teachers: TIF4 Schools Above 50th Percentile

Experienced High TADS Science Teachers			New High TADS Science Teachers		
TIF4 School	Effect	Percentile	TIF4 School	Effect	Percentile
Fleming MS	0.124	87.0%	**Eliot ES**	0.125	95.1%
Sugar Grove Aca.	0.109	83.7%	**Sugar Grove Aca.**	0.107	88.6%
Codwell ES	0.107	81.5%	**Fleming MS**	0.107	88.0%
Ross ES	0.077	72.8%	**Garden Oaks**	0.056	72.8%
Garden Oaks	0.044	66.3%	**Ross ES**	0.056	72.3%
Burrus ES	0.013	57.1%	**Burrus ES**	0.048	67.9%
Eliot ES	0.002	51.6%	**Herrera ES**	0.047	67.4%
			Codwell ES	0.017	58.2%
			Southmayd ES	0.006	53.8%

Fifteen of the 23 TIF4 project schools appear on at least one of these six "above average" lists. As a point of interest, participation in the TIF4 grant might be expected to cause retention of math and science teachers to vary even among schools with similar student demographics. Since the TIF4 project focused on STEM teaching, providing performance-based compensation and retention bonuses to math and science teachers in tested grades and subjects in the grants schools, we might expect that if these interventions influenced math and science teachers' retention decisions, the TIF4 schools would have, on average, larger, more positive school effects.

We found that the differences between the average school random effects on the retention rate for high TADS of TIF4 and non-TIF4 schools were small, and in favor of the TIF4 schools only for math and science teachers with three or fewer years of experience. **Table 10** (below) shows the average school effects in percentage points for high TADS new and experienced teachers. A positive difference shows where TIF4 schools on average had higher retention, a negative difference shows where TIF4 schools had lower retention than non-TIF4 schools.

Note that this analysis is not a specific test of the effect of the TIF intervention on retention. An analysis at the teacher level (rather than the school level) might show different results for several reasons. First, schools are weighted the same regardless of size. Second, the retention rate includes both teachers that have received retention bonus or performance-based pay and those that did not. Third, this analysis does not control for other teacher-level characteristics that might affect retention, such as age or gender. While the present analysis does suggest that, over the years studied, TIF schools did not on average have very different retention rates than non-TIF schools, more analysis would be needed to estimate specific TIF4 effects on individual teacher retention.

Table 10. TIF4 and Non-TIF4 Average Effects on Retention: High TADS Math/Science Teachers

	TIF4 Schools	Non-TIF4 Schools	Difference
New Math Teachers	0.1%	-0.2%	0.3%
Experienced Math Teachers	-1.2%	0.2%	-1.0%
New Science Teachers	0.5%	-0.2%	0.7%
Experienced Science Teachers	-2.2%	0.1%	-2.3%

Another point of interest is whether schools' overall tendency to retain teachers varies by TADS ratings or teacher experience. First, we examined whether schools that tend to retain new teachers also retain experienced teachers. We found that there was a substantial correlation between schools' relative effects on retention for new and experienced teachers, both high TADS and low. **Table 11** (p. 20) shows the correlations of school effects for new and experienced teachers, for all teachers, math teachers, and science teachers at both performance levels. The positive correlations show that on average schools that are good at retaining inexperienced high TADS teachers are also good at retaining experienced high TADS teachers. It also seems that schools that retain inexperienced low TADS teachers also retain experienced low TADS teachers.

Table 11. Correlation of School Effects on the Retention of New and Experienced Teachers

Correlation of School Retention Effects for New and Experienced Teachers		
	High TADS	**Low TADS**
All Teachers	0.54	0.85
Math Teachers	0.72	0.60
Science Teachers	0.73	0.53

Another point of interest is whether schools' overall tendency to retain teachers varies by TADS ratings. Ideally, schools that are good at retaining high TADS teachers would also be good at exiting low TADS teachers, so that in such schools, retention rates for low TADS teachers would be lower. Correlations between retaining high and low TADS teachers would thus be negative. We found that, overall, correlations were substantial and positive, as shown in **Table 12** (below).

These correlations suggest that schools that are better at retaining high TADS teachers are likely also to be better at retaining low TADS teachers. This suggests that some schools are generally more likely to exit less effective teachers, regardless of the experience. This seems especially true of new math teachers. It is possible that if schools have a difficult time finding qualified math teachers, they may find it more expedient to retain less effective teachers and try to develop them rather than to try to hire new ones that are more effective.

Taken together, these correlations show that many schools are generally better or worse at retention, notwithstanding teacher effectiveness or experience. This seems especially true of retention of effective (high TADS) and less than effective (low TADS) math and science teachers.

Table 12. Correlation of School Effects on the Retention of Low TADS and High TADS Teachers

Correlation of School Retention Effects for High and Low TADS Teachers		
	New Teachers	**Experienced Teachers**
All Teachers	0.62	0.64
Math Teachers	0.88	0.80
Science Teachers	0.70	0.80

Conclusion

HISD staff and school leadership are grateful for the investment of federal TIF4 resources that enabled teachers and students to experience a comprehensive approach to improving STEM education. While we recognize that there are areas for continued improvement when it comes to the retention of math and science teachers across all experience levels, the lessons learned through the implementation of the TIF4 grant will continue to shape HISD's strategies moving forward. In this context, the district can point to three specific takeaways from the human capital approach to improving STEM education.

First, every TIF4 school had at least one educator who received an ASPIRE Award during the grant period. During the grant period, over a thousand ASPIRE Awards (1,012) were paid to educators at the TIF4 campuses. This illustrates HISD's commitment to identify and recognize teachers whose students are exceeding expectations; it reflects the reality that high-quality teaching happens in every school across HISD.

Second, for three consecutive years, the TIF4 schools retained 75% of their Effective and Highly Effective math and science teachers. Project staff attribute this in part to the realignment of the bonus calendar — by providing bonus-eligible teachers with relevant communications about their eligibility before most teacher choices were finalized. Additionally, anecdotal evidence collected by project staff suggests that teachers were also incentivized to stay in the TIF4 schools because of the meaningful STEM instructional resources and job-embedded professional supports provided through the grant.

Third, across the grant period, the TIF4 schools paid out about ten retention bonuses for each recruitment bonus. This suggests that effective math and science teachers find retention bonuses to be meaningfully more compelling than recruitment bonuses that are twice as expensive and require a longer time commitment. Critically, these are teachers who have already shown success in meeting the needs of students at HISD's hard-to-staff schools. Taken together, these two findings strongly suggest that the high turnover among HISD's math and science teachers can be mitigated through investment at specific campuses.

Whatever the exact reason for the increased retention among math and science teachers at TIF4 schools, the students of the TIF4 project schools were the ultimate beneficiaries of these teachers' decisions to stay — generating statistically significant and meaningful gains in their math and science achievement during the grant period (Price, Christian, & Stevens, 2018). HISD staff and school leadership look forward to building on these takeaways as we continue to serve the diverse needs of our students and families.

Endnotes

(i) Note that the figures in this report do not include ASPIRE Awards earned by campus-based support staff whose Awards were not supported by TIF4 funding. See details in Appendix B, Tables 1 and 2.

(ii) For the purposes of this STEM incentive, "Core Foundation Courses" included ONLY those courses identified by the Texas Education Agency under the Core Foundation areas of Mathematics and Science at the elementary and middle school level, and those math and science Core Foundation courses required for graduation credit in the 4x4 Recommended or Distinguished High School Diploma programs.

(iii) These individuals were identified by their contract type and their years of previous experience: a probationary contract, with zero years of experience.

(iv) In the model, the estimates are statistically "shrunk" towards the mean across the five-year window — this reduces the distortion that is possible from a single year that is very strong or very weak.

(v) While HISD's educator evaluation system makes a distinction between the two levels, both levels are considered "Ineffective" under the federal TIF grant reporting guidance.

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Appendix A: Teacher Incentive Fund in HISD

Since established by an Appropriations Act in 2006, the Teacher Incentive Fund (TIF) competitive grant program in the U.S. Department of Education (the Department) has supported human capital strategies for teachers and school leaders, "to ensure that students attending high-poverty schools have better access to effective teachers and principals, especially in hard-to-staff subject areas" such as science, math, and STEM (Science, Technology, Engineering, and Mathematics). While the specific programming supported through the TIF grant program has evolved since 2006 (Miller et al., 2015), TIF projects are supported by the Department to develop and implement sustainable performance-based compensation systems (PBCSs) for teachers, principals, and other personnel in high-need schools in order to increase educator effectiveness and student achievement. Houston Independent School District (HISD) was awarded over $43 million as part of the first and third cohorts of TIF grantees – $11.8 million in 2006, and $31.3 million in 2010. A recap of these program activities is available on HISD's website (Price & Stevens, 2017).

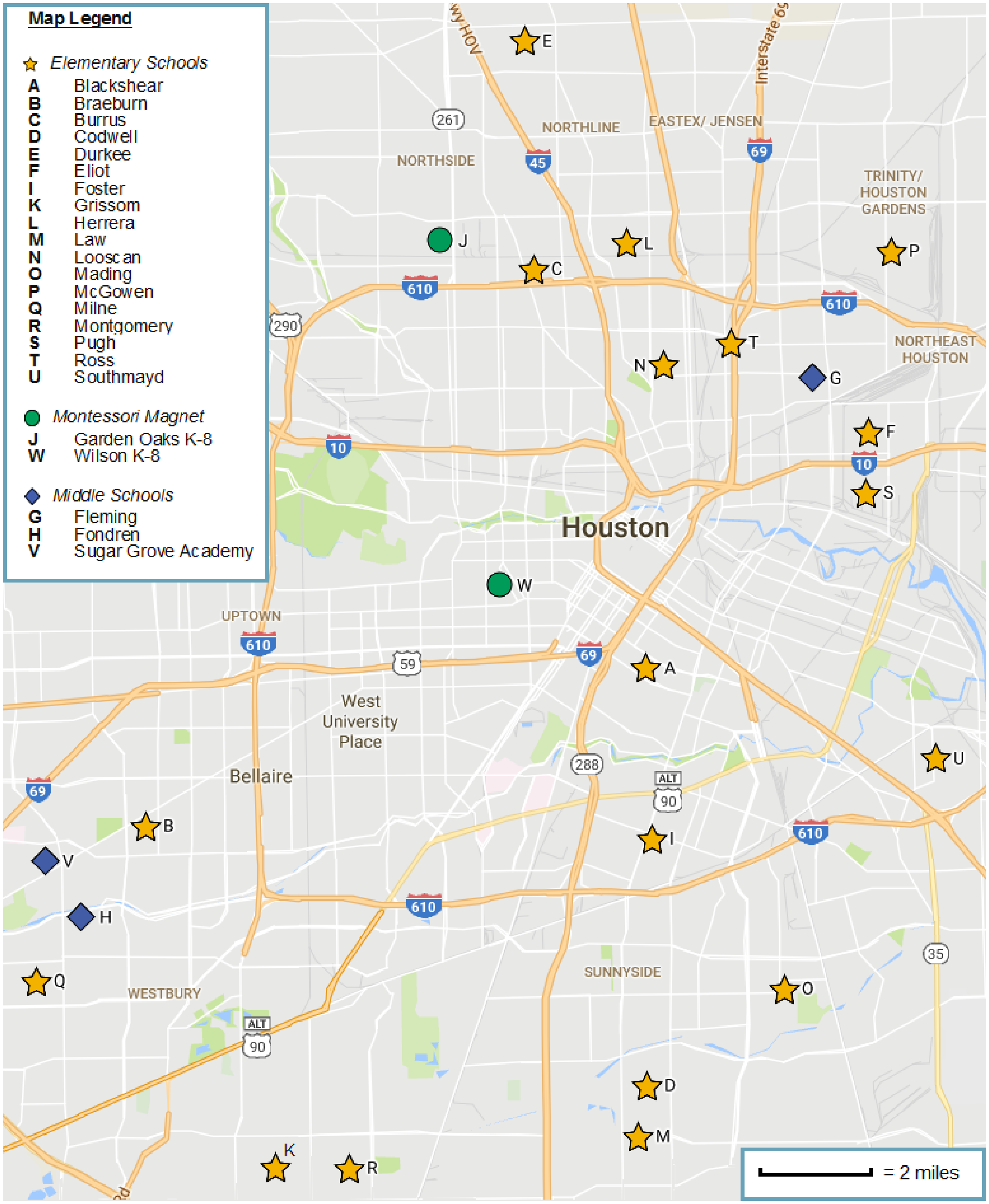
In September 2012, HISD was awarded a TIF grant for $15.9 million over five years (OESE, 2012b) — one of just six STEM projects funded among the fourth cohort of awards (TIF4-STEM): HISD, plus Calcasieu Parish (LA), National Institute for Excellence in Teaching (IA), Orange County (FL), Washoe County (NV), and the South Carolina Department of Education.

These grantees committed to the two Absolute Priorities required of all TIF grantees, as well as a third Priority that was specific to STEM programming:

- **Priority 1 (all grantees):** "An LEA-wide human capital management system (HCMS) with educator evaluation systems at the center that (a) is aligned with the local education agency's (LEA's) vision of instructional improvement and (b) uses information generated by the evaluation system to inform key human capital decisions, such as recruitment, hiring, placement, dismissal, compensation, professional development, tenure, and promotion."
- **Priority 2 (all grantees):** "An LEA-wide educator evaluation system based, in significant part, on student growth. The frequency of evaluation must be at least annually and the evaluation rubric should include at least three performance levels and (a) two or more observations during each evaluation period, (b) student growth for the evaluation of teachers at the classroom level, and (c) additional factors determined by the LEA. In addition, the evaluation system must generate an overall evaluation rating based, in significant part, on student growth and the evaluation system must be implemented within the timeframe specified in Priority 2."
- **Priority 3 (STEM grantees):** "Improving STEM achievement by developing a corps of skilled STEM master teachers by providing additional compensation to teachers who (a) receive an overall evaluation effectiveness rating of effective or higher under the evaluation system, (b) are selected based on criteria that are predictive of the ability to lead other teachers, (c) demonstrate effectiveness in one or more STEM subjects, and (d) accept STEM-focused career ladder positions. In addressing this priority, each LEA needs to identify and develop the unique competencies that, based on evaluation information or other evidence, characterize effective STEM teachers. Projects also need to identify hard-to-staff STEM subjects and use the HCMS to attract effective teachers, leverage community support and expertise to inform the implementation of its plan, ensure that financial and non-financial incentives are adequate to attract and retain persons with strong STEM skills in high-need schools, and ensure that students have access to and participate in rigorous and engaging STEM coursework."

See http://www2.ed.gov/programs/teacherincentive/2012-374ab.pdf for the full text of the application package for TIF4 (OESE, 2012a).

Appendix Figure 1. Geographic Location of the TIF4 Project Schools



Appendix B: Detailed Breakdown, ASPIRE Award at TIF4 Project Schools

Appendix Table 1. Count of ASPIRE Awards Paid at Each TIF4 Project School, 2012–2017

Number of Awards	2012–2013 n=18	2013–2014 n=18	2014–2015 n=20	2015–2016 n=16	2016–2017 n=14	*Total n=23*
Blackshear ES	12 + 5		1			**18**
Braeburn ES	6	29	18	3	46	**102**
Burrus ES	8	2	16	4	20	**50**
Codwell ES			24			**24**
Durkee ES	2	4	34	3		**43**
Eliot ES	23	23	3	4	30	**83**
Fleming MS	7	22	11	1	9	**50**
Fondren MS	2	9	11	33	40	**95**
Foster ES	9	3	3	3	14	**32**
Garden Oaks Montessori	25	28	34	9	9	**105**
Grissom ES			12		1	**13**
Herrera ES	33	2	3	2	38	**78**
Law ES	1	1	2	1		**5**
Looscan ES	17	7				**24**
Mading ES			1			**1**
McGowen ES		2	18		2	**22**
Milne ES	18	1	1			**20**
Montgomery ES		3		3		**6**
Pugh ES		16	14	1		**31**
Ross ES	10			1	18	**29**
Southmayd ES	32	26	1	15	26	**100**
Sugar Grove Academy	2	3	4	3	2	**14**
Wilson Montessori	12	26	23	5	1	**67**
Total Awards	**224**	**207**	**234**	**91**	**256**	**1,012**

Notes: The 12 Awards paid to Dodson staff in 2012–2013 are included in the cell with the five Awards to Blackshear ES. These counts do not include individuals who were not eligible for TIF4 funding. The ASPIRE groups eligible for TIF4 funding include Group 1, Group 2, Group 3, Group 4, Group 1L, and Group 2L. The ASPIRE groups not eligible for TIF4 funding included Group 5, Group 6, and Group 7. For more details about the ASPIRE Award groups, please see additional HISD reporting on the ASPIRE Award (e.g., Hui, Mosier, & Bigner, 2018; Zimmerman, Hui, & Mosier, 2017).

Appendix Table 2. Sum of ASPIRE Award Payout at Each TIF4 Project School, 2012–2017

ASPIRE Award Payout	2012–2013 n=18	2013–2014 n=18	2014–2015 n=20	2015–2016 n=16	2016–2017 n=14	*Total n=23*
Blackshear ES	$61,000.00		$7,500.00			$68,500.00
Braeburn ES	$8,000.00	$109,066.67	$56,212.50	$10,833.33	$111,125.00	$295,237.50
Burrus ES	$45,500.00	$10,000.00	$24,750.00	$13,125.00	$61,875.00	$155,250.00
Codwell ES			$16,500.00			$16,500.00
Durkee ES	$15,000.00	$25,000.00	$155,775.00	$15,000.00		$210,775.00
Eliot ES	$52,000.00	$122,333.33	$18,750.00	$15,833.33	$78,000.00	$286,916.67
Fleming MS	$55,000.00	$128,500.00	$57,956.25	$5,000.00	$35,000.00	$281,456.25
Fondren MS	$15,000.00	$56,575.00	$60,525.00	$91,625.00	$179,625.00	$403,350.00
Foster ES	$4,500.00	$13,500.00	$15,000.00	$4,583.33	$49,875.00	$87,458.33
Garden Oaks Montessori	$19,500.00	$110,750.00	$98,850.00	$27,125.00	$25,833.33	$282,058.33
Grissom ES			$27,000.00		$5,000.00	$32,000.00
Herrera ES	$109,100.00	$15,000.00	$22,500.00	$7,500.00	$125,375.00	$279,475.00
Law ES	$10,000.00	$10,000.00	$7,500.00	$1,666.67		$29,166.67
Looscan ES	$18,500.00	$12,250.00				$30,750.00
Mading ES			$3,750.00			$3,750.00
McGowen ES		$10,700.00	$19,500.00		$5,750.00	$35,950.00
Milne ES	$14,000.00	$10,000.00	$3,750.00			$27,750.00
Montgomery ES		$20,000.00		$12,500.00		$32,500.00
Pugh ES		$34,000.00	$27,000.00	$5,000.00		$66,000.00
Ross ES	$5,000.00			$5,000.00	$63,375.00	$73,375.00
Southmayd ES	$119,083.33	$113,500.00	$7,500.00	$29,583.33	$61,187.50	$330,854.17
Sugar Grove Academy	$15,000.00	$15,000.00	$26,250.00	$10,000.00	$10,000.00	$76,250.00
Wilson Montessori	$21,000.00	$117,333.33	$74,625.00	$11,250.00	$1,250.00	$225,458.33
Total Award Payout	**$587,183**	**$933,508**	**$731,1934**	**$265,625**	**$813,2701**	**$3,330,781**

Note: Total Award Payments (bottom row) are rounded to the nearest dollar. These figures do not include the fringe benefits on this compensation. These figures combine federal (TIF4), local (cost-sharing match, and local supplement), and state funds ($100,517 from the District Awards for Teacher Excellence program, or DATE, for ASPIRE 2012–2013). The monetary value of the 12 Awards paid to Dodson staff for 2012–2013 are included in the cell with the five Awards to Blackshear ES. Also, these figures do not include ASPIRE Awards paid from local funds to individuals who were not eligible for TIF4 funding. The ASPIRE groups eligible for TIF4 funding include Group 1, Group 2, Group 3, Group 4, Group 1L, and Group 2L. The ASPIRE groups not eligible for TIF4 funding included Group 5, Group 6, and Group 7. For more details about the ASPIRE Award groups, please see additional HISD reporting on the ASPIRE Award (e.g., Hui, Mosier, & Bigner, 2018; Zimmerman, Hui, & Mosier, 2017).

Appendix C: Sample Notice of Initial Eligibility for STEM Bonus

The following message was sent to the 59 teachers at TIF4 project schools who were notified in March 2017 that they met eligibility criteria for the STEM retention bonus supported by the TIF4 grant. Fields in `fixed width font` and enclosed with double-angle quotation marks indicate the MS Excel fields that were merged in MS Word to generate and send individual communications.

Email Date: March 24, 2017

Email Title: Notice of Initial Eligibility: STEM Bonus for «TEACHERNAME»

Email Body:

Dear «TEACHERNAME» («TITLE» at «SCHOOL1516»):

Thanks to a federal grant, select teachers in HISD can receive a STEM Retention bonus in September 2017 by meeting specific eligibility criteria. You are receiving this email because records show that you meet initial eligibility criteria for this bonus. (See Table below.)

Should you return to a TIF4 project school to teach there for the 2017–2018 academic year, you will meet all criteria to receive a bonus of up to $5,000. Please take this into consideration as you make your plans!

Teacher ID # «EMPL-ID»: Records

Employed at TIF4-STEM School for 2016–2017	☑ «SCHOOL1516»
2016 Summative Rating in TADS is 3 or 4	☑ «TADS1516»
2016 Subject is STEM-related	☑ «SUBJECT»
2016 Comparative Growth metric in the top quintile for math or science	☑ «CMPGRO1516»

Download and view the full award eligibility criteria here. Details about quintiles can be found at the [link], and information on Comparative Growth can be found at [link].

These retention incentives will be paid out on or before September 30, 2017.

Please note that Principal «P-LASTNAME» has also received this information about your initial eligibility. Let me know if you have any questions!

Thank you,

Lauren E. Price
Grant Manager, TIF4

** NOTE: Please note that the exact amount of any post-tax award will depend on your own individual financial situation — as bonuses can be taxed differently than other compensation. Also, this notice of bonus eligibility does not confirm or contradict any current or future offer of employment with HISD.

Appendix D: Retention and Mobility of New Math and Science Teachers

Appendix Table 3. Mobility and Retention in Three Cohorts of New Math Teachers

School Year	Cohort	Count at Start	Came Back Next Year in ___ Role:		Moved Schools Next Year in ___ Role:		Left District's Teacher Roster
			Same	*Different*	*Same*	*Different*	
2012–13	1	604	380	71	24	12	101
2013–14	1	487	255	63	20	16	115
2014–15	1	356	163	70	20	16	79
2015–16	1	284	143	76	16	8	36
2016–17	1	259	138	65	9	4	29
2017–18	1	225	-	-	-	-	-
2013–14	2	654	357	70	23	13	156
2014–15	2	464	232	82	25	15	97
2015–16	2	371	184	84	14	7	72
2016–17	2	299	150	69	13	8	48
2017–18	2	257	-	-	-	-	-
2014–15	3	700	392	74	32	20	147
2015–16	3	518	279	93	22	12	97
2016–17	3	420	218	80	18	10	77
2017–18	3	338	-	-	-	-	-

Appendix Table 4. Mobility and Retention in Three Cohorts of New Science Teachers

School Year	Cohort	Count at Start	Came Back Next Year in ___ Role:		Moved Schools Next Year in ___ Role:		Left District's Teacher Roster
			Same	*Different*	*Same*	*Different*	
2012–13	1	547	336	61	27	11	98
2013–14	1	435	223	73	23	9	94
2014–15	1	330	152	72	16	15	67
2015–16	1	267	131	76	8	13	36
2016–17	1	236	107	70	10	6	30
2017–18	1	203	-	-	-	-	-
2013–14	2	617	341	81	20	13	133
2014–15	2	456	223	84	23	17	95
2015–16	2	357	179	79	13	7	72
2016–17	2	286	130	79	8	9	48
2017–18	2	241	-	-	-	-	-
2014–15	3	667	376	70	32	19	143
2015–16	3	497	264	92	22	12	95
2016–17	3	404	202	81	16	12	78
2017–18	3	319	-	-	-	-	-

Appendix E: Same-School Teacher Retention and Student Demographics

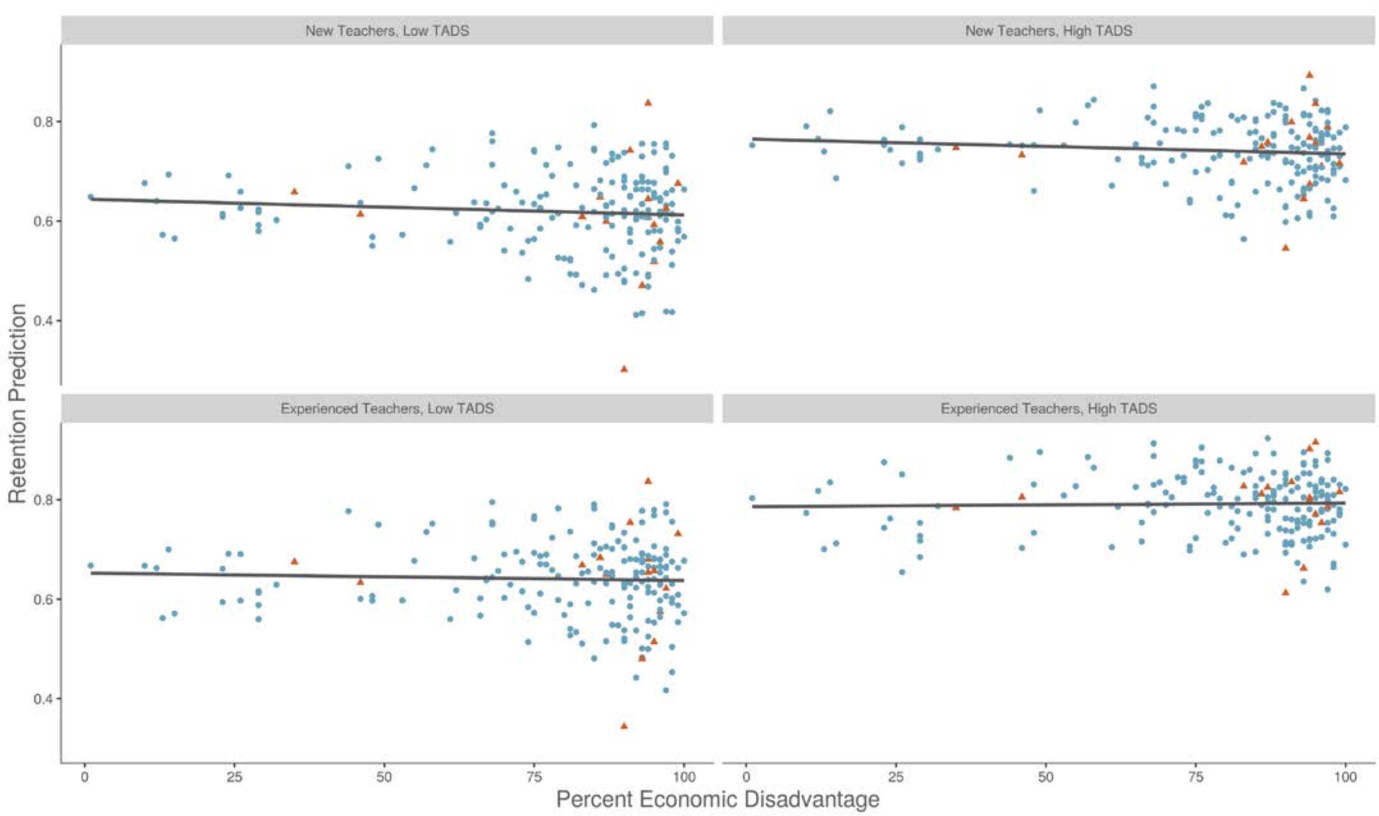
The school's random effect is the school's distance from the expected level of retention for schools with similar student populations. These model results were used to derive an estimate of how schools compared to each other in terms of in retaining each group: New and High TADS, New and Low TADS, Experienced and High TADS, as well as Experienced and Low TADS:

- *Teacher:* Coded in the human resources dataset as teachers according to their job function and salary plan (PeopleSoft, and SAP OneSource),
- *New*: Three or fewer years of teaching experience for a given year.
- *Experienced*: Four or more years of teaching experience for a given year.
- *High TADS:* Summative appraisal score of 3 or 4 in the TADS final dataset for the specific year.
- *Low TADS:* Summative appraisal score of 1 or 2 in the TADS final dataset for the specific year.(v)

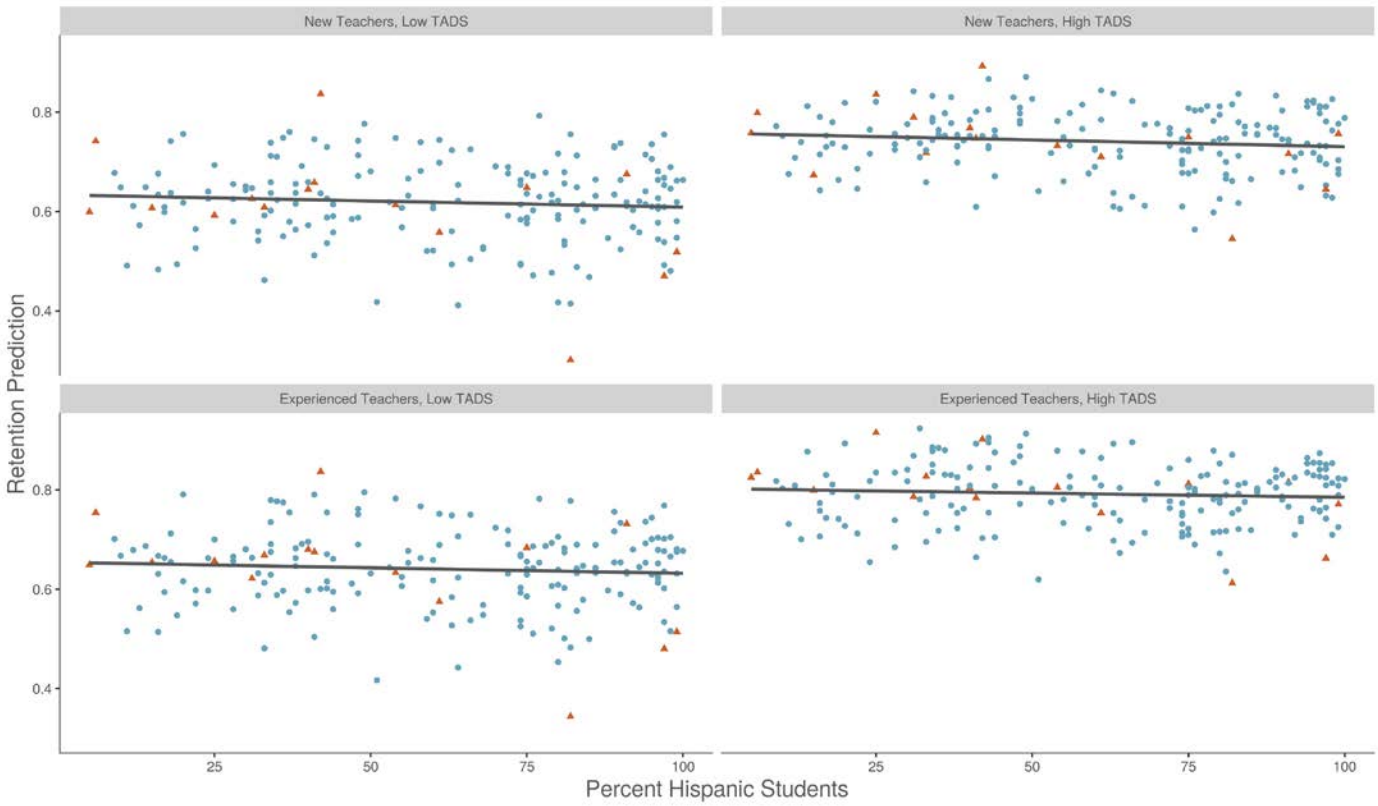
In each of these figures, the dark line represents the district-wide relationship between the likelihood that a teacher will return to the same campus for the following year, as a function of the school's demographics. Schools whose dots are above the district-wide trend line are retaining teachers at a higher rate than expected for that demographic factor; schools below the trend line are retaining teachers at a lower rate than expected. **Appendix Figures 2–4** (p. 31–32) address the retention of all teachers, while **Appendix Figures 5–12** (pp. 33–36) address math and science.

Schools participating in the TIF4 grant are represented by red triangles. All other schools are represented by blue dots.

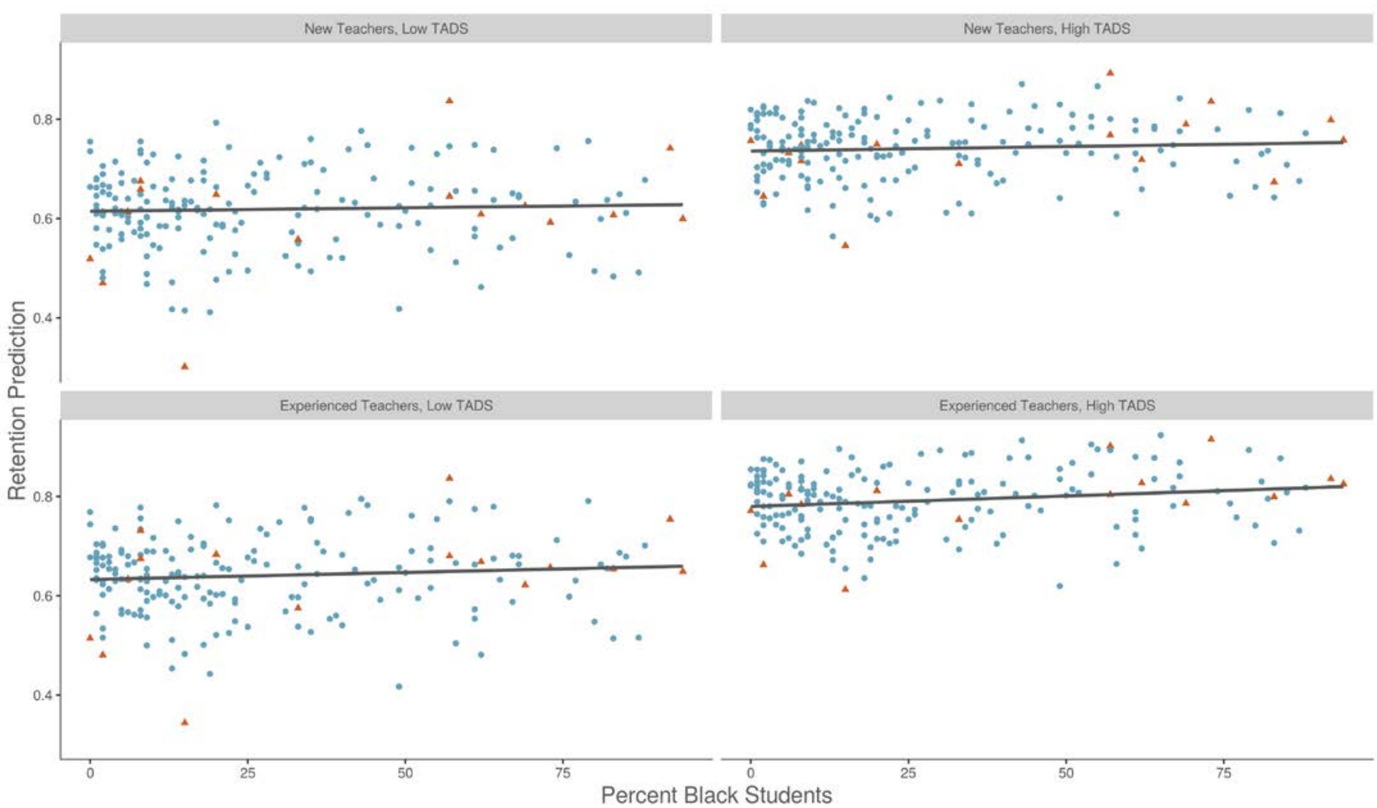
Appendix Figure 2. Same-School Retention for Four Teacher Categories, by School's Economic Disadvantage



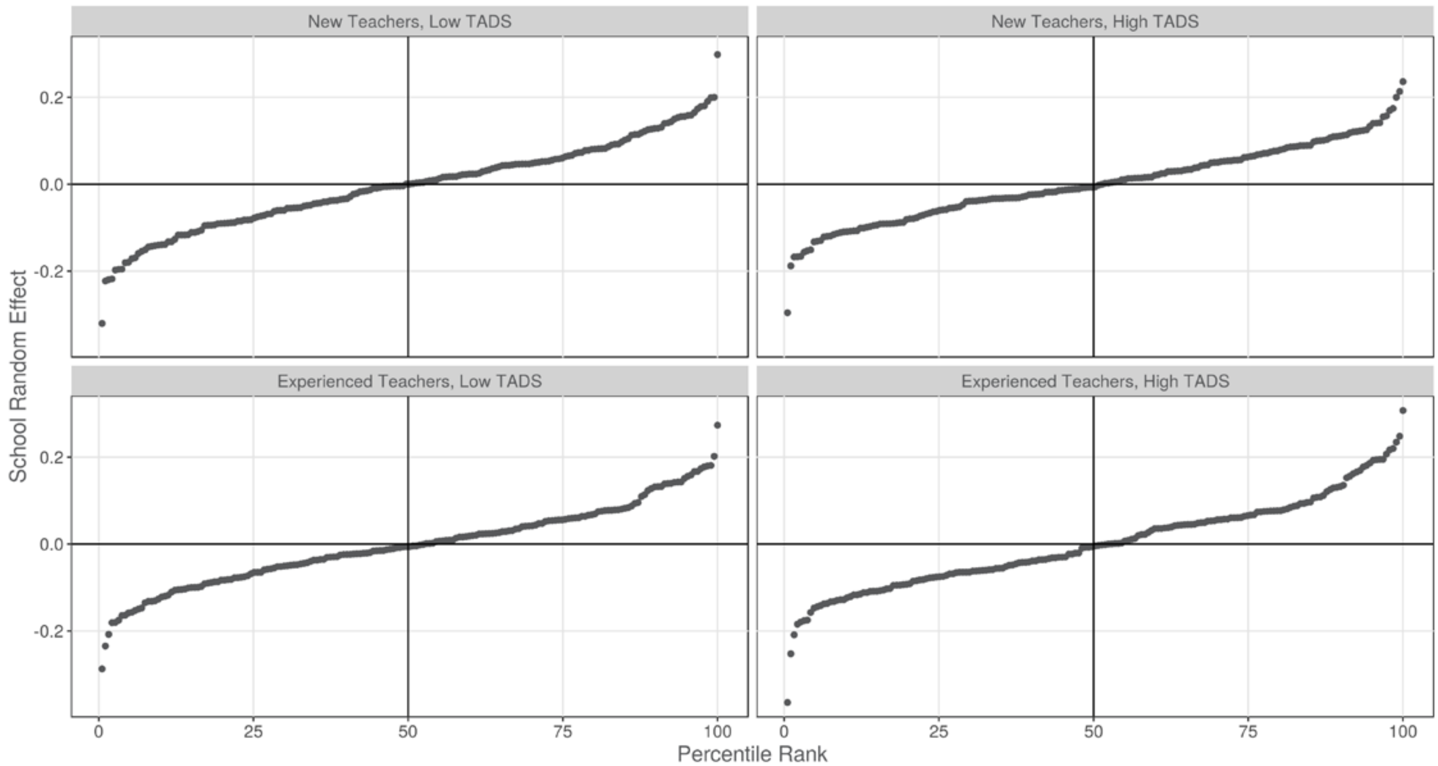
Appendix Figure 3. Same-School Retention for Four Teacher Categories, by School's Percent Hispanic



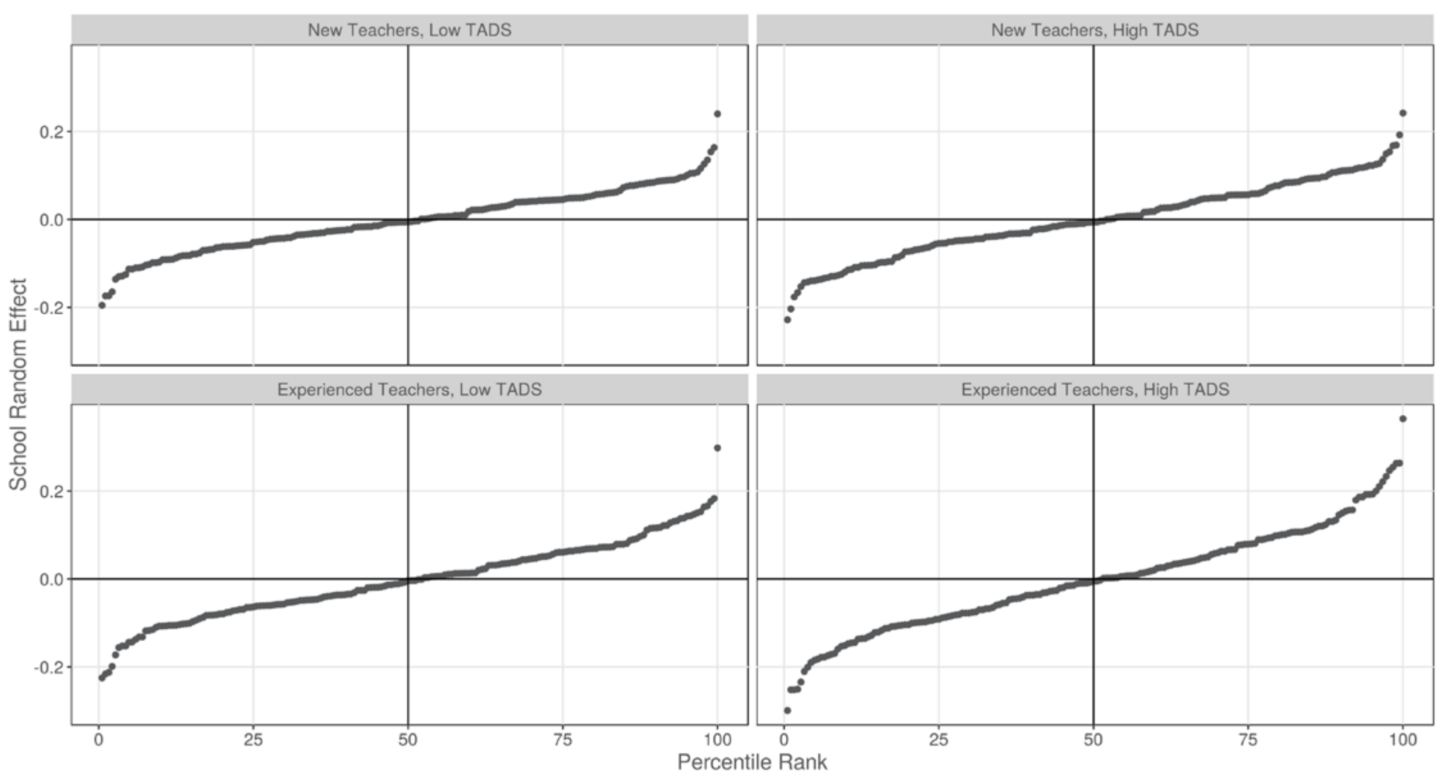
Appendix Figure 4. Same-School Retention for Four Teacher Categories, by School's Percent African-American



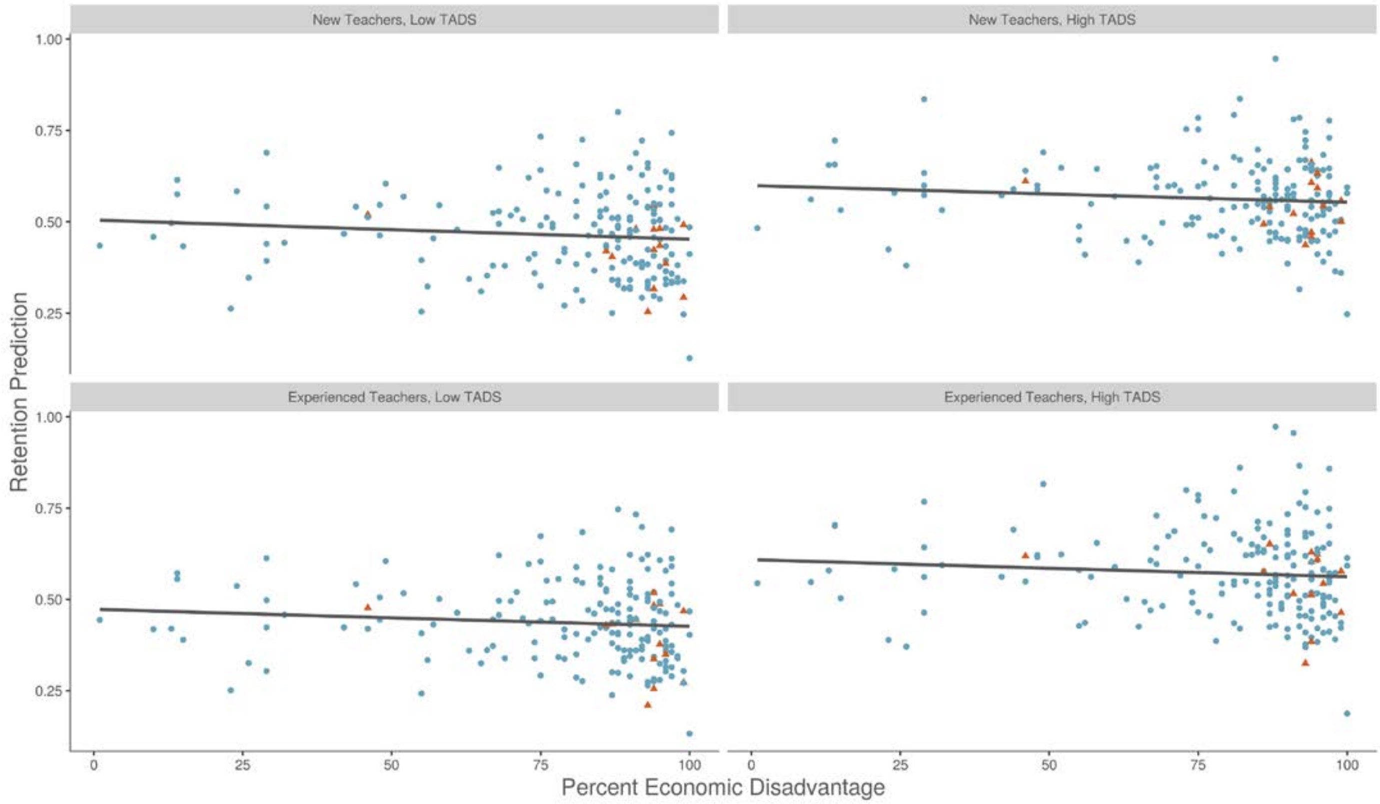
Appendix Figure 5. Math Teacher Retention for Four Categories, by School Effect and Percentile Rank



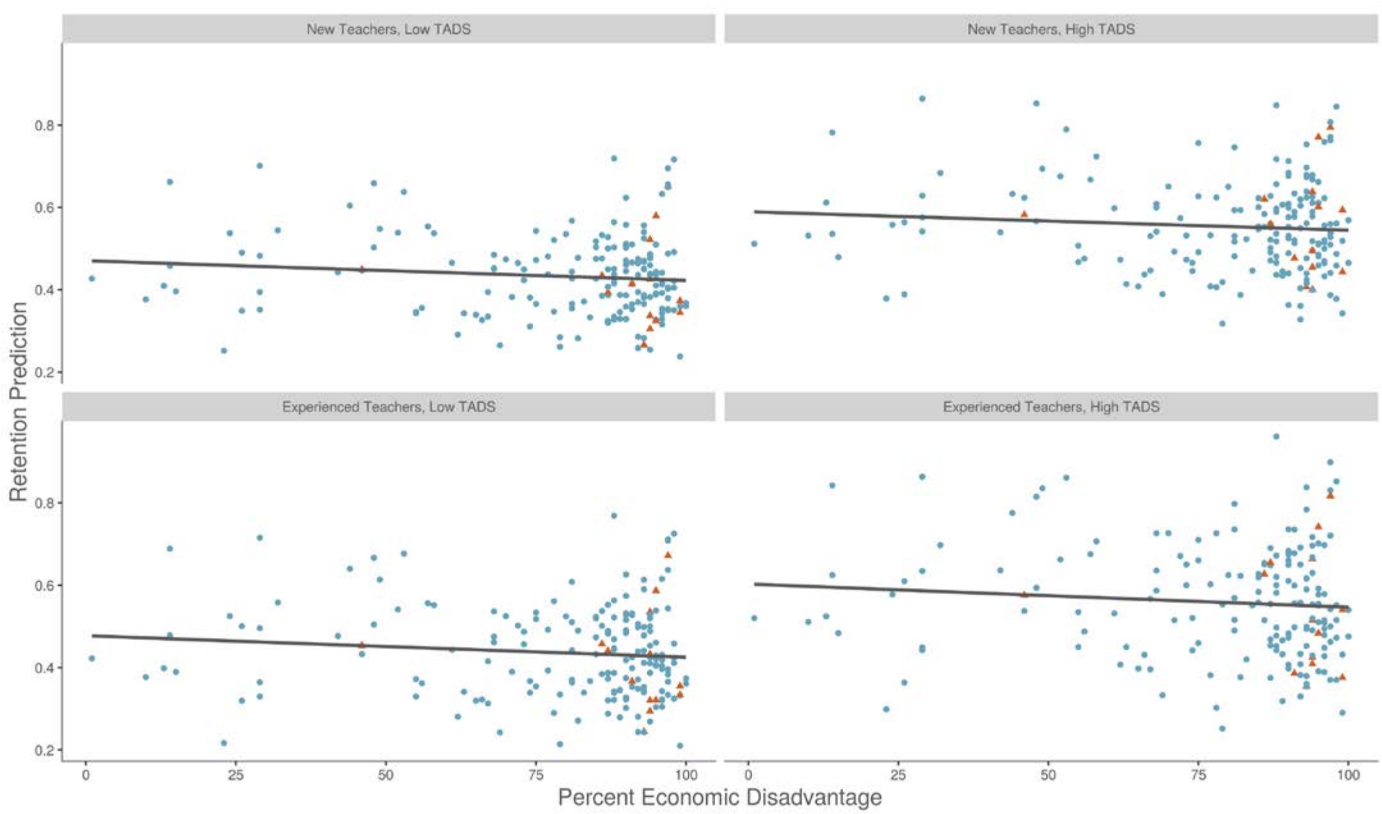
Appendix Figure 6. Science Teacher Retention for Four Categories, by School Effect and Percentile Rank



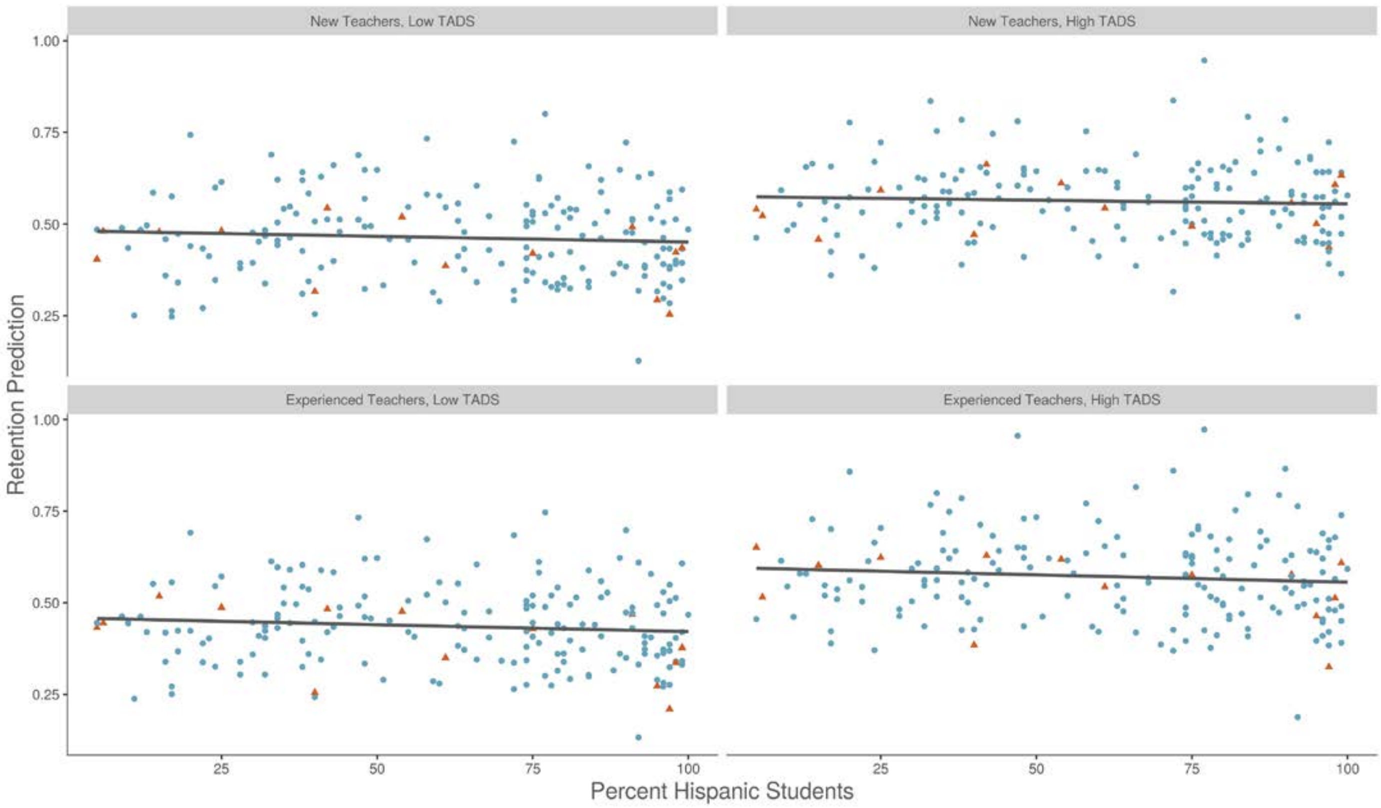
Appendix Figure 7. Math Teacher Retention for Four Categories, by School's Percent Economic Disadvantage



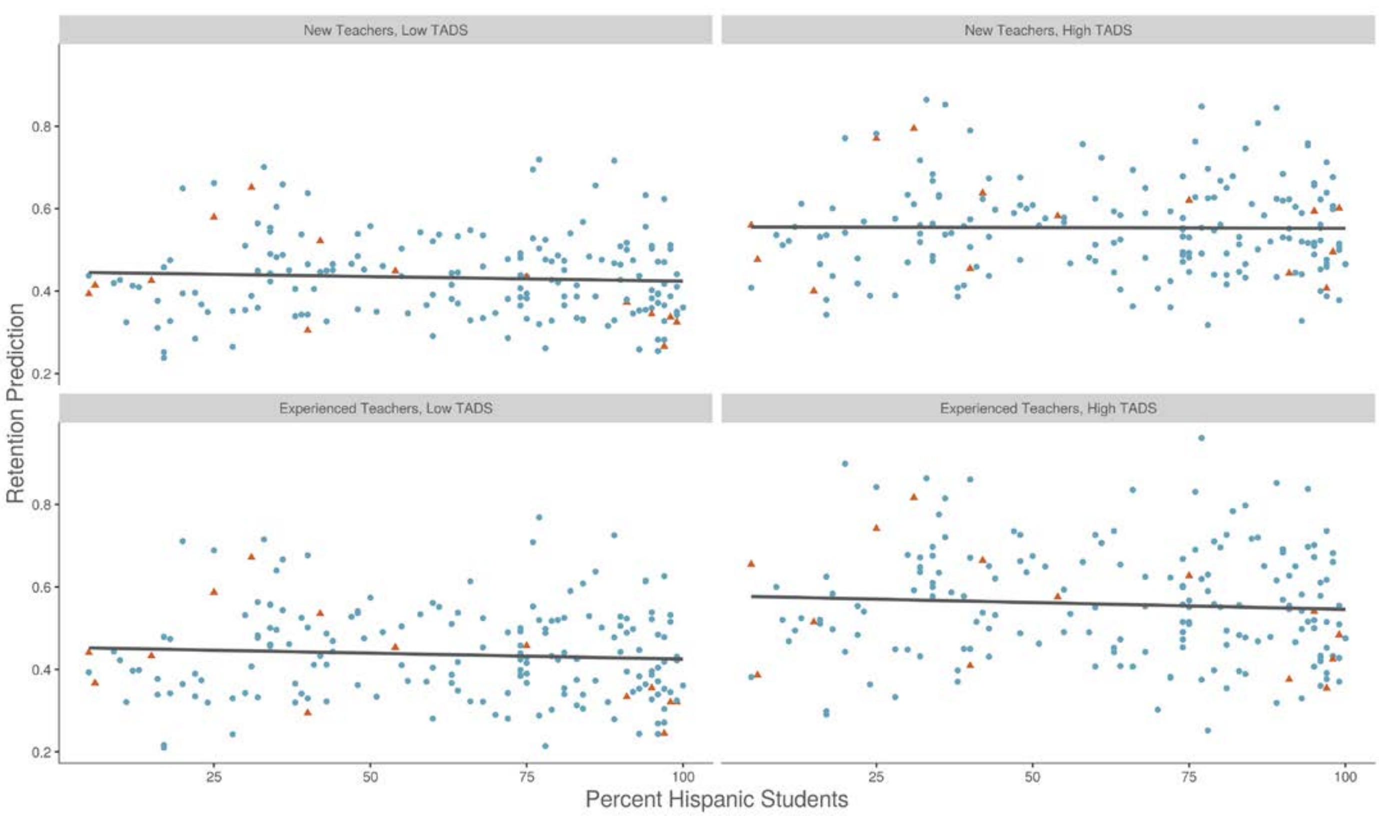
Appendix Figure 8. Science Teacher Retention for Four Categories, by School's Percent Economic Disadvantage



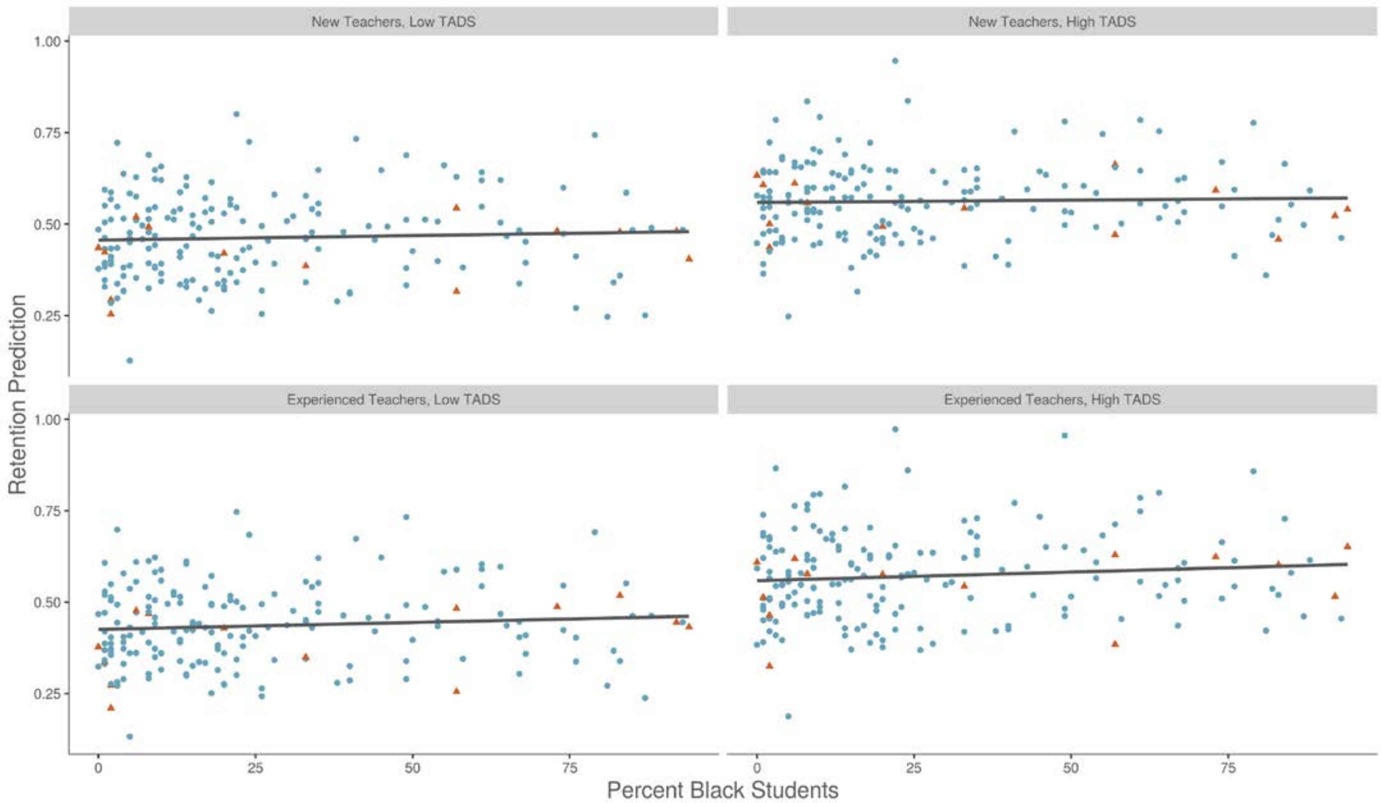
Appendix Figure 9. Math Teacher Retention for Four Categories, by School's Percent Hispanic



Appendix Figure 10. Science Teacher Retention for Four Categories, by School's Percent Hispanic



Appendix Figure 11. Math Teacher Retention for Four Categories, by School's Percent African-American



Appendix Figure 12. Science Teacher Retention for Four Categories, by School's Percent African-American