

2018-19 Evaluation of the STEM Academy for Science Teachers and Leaders

Department of Evaluation and Assessment

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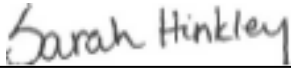
2018-19

Evaluation of the STEM Academy for Science Teachers and Leaders

Approved Report of the Department of Evaluation and Assessment

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December 2019

Nolan Rett Mickelson, B.S.



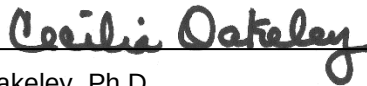
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2018-19

Evaluation of the STEM Academy for Science Teachers and Leaders

Project Evaluator: Nolan Rett Mickelson, B.S.

ABSTRACT

Primarily funded by a Texas Instruments Foundation grant, the Science, Technology, Engineering, and Mathematics (STEM) Academy for Science Teachers and Leaders was a partnership between Southern Methodist University and the Dallas Independent School District to help middle school science teachers integrate active learning experiences in lessons, cultivate professional growth, increase science achievement, and promote STEM coursework in high school. Cohort 1, 15 grade-seven and grade-eight teachers, began attending summer academies in 2017. Cohort 2 began in summer 2018 with 32 grade-six through grade-eight teachers. Participating teachers received coaching and professional development during the regular school year. The budget for the program was \$605,057, a decrease from 2017-18 (\$720,030). Primary findings are as follows:

- Over 53 percent of Cohort 1 teachers remained with the program after two years; 47 percent of Cohort 2 remained with the program after one year.
- Favorable response rates for Cohort 1 teachers on all five subsections of the Student Experience Survey increased after one year of participation but decreased after year two. After one year of participation, the favorable response rates for Cohort 2 teachers increased on two subsections, remained the same on one subsection, and decreased on two subsections.
- Students taught by STEM Academy teachers passed the fall 2018 *Science 7 Assessment of Course Performance (ACP)* at a higher rate (71%) than matched-comparison students (55%). Two-year students of STEM Academy teachers passed the *Science 8 ACP* at a higher rate (77%) than one-year students (70%) and matched-comparison students (67%).
- Though not statistically significant, two-year students of STEM Academy teachers in Sheltered Science 8 Pre-Advanced Placement met the three standards on the spring 2019 *State of Texas Assessments of Academic Readiness* at higher rates than one-year students and matched-comparison students.
- The percentage of former students of STEM Academy teachers enrolling in rigorous high school mathematics or science courses increased from 41 percent in 2018-19 to 45 percent in 2019-20.

This evaluation recommended continuing to monitor Student Experience Survey results, academic achievement, and rigorous-course enrollment rates for students taught by STEM Academy teachers.

PROGRAM DESCRIPTION

Funded primarily through a Texas Instruments Foundation, the Science, Technology, Engineering, and Mathematics (STEM) Academy for Science Teachers and Leaders was a partnership between the Dallas Independent School District (ISD) STEM Department and Southern Methodist University (SMU).¹ The partnership goals were to grow the abilities of middle school science teachers to integrate active learning experiences in lessons, foster professional growth and leadership, increase student science achievement, and promote student pursuit of STEM coursework.

Intended to run for four years, the program started with a planning year in 2016-17 followed by the first intensive three-week academy during summer 2017. The summer training was supplemented by direct coaching and professional learning communities during the 2017-18 school year. Cohort 1 consisted of grade-seven and grade-eight teachers from six campuses.² This cohort started the program in summer 2017 and will complete three program years. Cohort 2 included new teachers from the original six campuses, and grade-six through grade-eight teachers from seven new campuses.³ This cohort attended STEM Academy training in summer 2018 and will complete two program years. The last year of the program for both cohorts will be the 2019-20 school year.

As compensation for their program participation, Cohort 1 participants received four SMU graduate credits and discounted tuition for any further credit hours toward a degree. Recruiting challenges for Cohort 2 led program administrators to offer new and continuing participants a \$1,000 stipend in addition to graduate credit for attending the academies in summer 2018 and 2019.

The STEM Academy also included a campus-level science instructional leader program meant to support the teacher academy and promote professional growth among teacher participants. Instructional leaders assisted teachers with pedagogy and content and supported teachers in self-reflection and change implementation. Instructional leaders attended a one-week training during summer 2017, summer 2018, and summer 2019. Following the summer training, leaders at campuses with more than one participating teacher received on-campus training from SMU instructional coaches throughout the school year.

PURPOSE AND SCOPE OF THE EVALUATION

The purpose of this report was to provide the district and program funders with data to evaluate the effectiveness of the STEM Academy for Science Teachers and Leaders. Regarding participating science teachers, this report addressed participant characteristics, program retention, and professional growth. For

¹ SMU partners included the Caruth Institute for Engineering Education, Lyle School of Engineering, and Annette Caldwell Simmons School of Education & Human Development.

² William H. Atwell Law Academy, Billy Earl Dade Middle School, Young Men's Leadership Academy at Fred F. Florence Middle School, Francisco F. "Pancho" Medrano Middle School, Ann Richards Middle School, and Seagoville Middle School.

³ Hector P. Garcia Middle School; W.E. Greiner Middle School; Robert T. Hill Middle School; Harold W. Lang, Sr. Middle School; H.W. Longfellow Career Exploration Academy; Thomas C. Marsh Preparatory Academy; and Piedmont G.L.O.B.A.L. Academy Middle School.

students of program teachers, this report addressed Student Experience Survey outcomes, middle school assessment outcomes, and enrollment in rigorous courses when entering high school.

MAJOR EVALUATION QUESTIONS AND RESULTS

What was the source and amount of funding for the STEM Academy for Science Teachers and Leaders?

Methodology

The STEM Science and Wellness Department provided 2017-18 and 2018-19 budget information for this report.

Results

As shown in Table 1, the 2018-19 budget was \$605,057, a decrease from \$720,030 in 2017-18. A Texas Instruments Foundation grant supported 85 percent of the 2018-19 budget and 90 percent of the 2017-18 budget.

Table 1: 2017-18 and 2018-19 Funding for the STEM Academy for Science Teachers and Leaders

Source	2017-18 \$	2018-19 \$
Texas Instruments Foundation	644,430	512,057
Dallas Education Foundation	0	43,000
Dallas Independent School District	75,600	50,000
<i>Total</i>	<i>720,030</i>	<i>605,057</i>

Source: STEM Science and Wellness Department on September 16, 2019.

Note: STEM = Science, Technology, Engineering, and Mathematics.

What were the characteristics and program retention rates of STEM Academy teachers?

Methodology

The evaluator received Cohort 1 participant data from SMU on May 19, 2018 and Cohort 2 participant data from SMU on November 2, 2018. To determine teacher characteristics, these data were matched with the district personnel files dated May 20, 2018 (Cohort 1) and September 16, 2018 (Cohort 2). The evaluator conducted frequency analyses to summarize participant gender, race/ethnicity, and grade level taught.

Using the cohort data provided from STEM Academy staff members, the evaluator calculated the percentage of Cohort 1 participants that remained in the program through the second and third STEM

Academies. For Cohort 2, the evaluator calculated the percentage of participants that remained in the program through the third STEM Academy.

Results

STEM Academy teacher characteristics are shown in Table 2. Cohort 1 consisted of grade-seven and grade-eight teachers, and Cohort 2 expanded to include grade-six, grade-seven, and grade-eight teachers. Eighty percent of Cohort 1 teachers and 67 percent of Cohort 2 teachers were female. A smaller proportion of Cohort 1 teachers (20%) than Cohort 2 teachers (30%) were white, and a greater proportion of Cohort 1 teachers (27%) than Cohort 2 teachers (7%) were Hispanic.

Table 2: Cohort 1 and Cohort 2 Participating Teacher Characteristics by STEM Academy Cohort

	Cohort 1 (N = 15)		Cohort 2 (N = 30)*	
	n	%	n	%
Gender				
Female	12	80.0	20	66.7
Male	3	20.0	10	33.3
Race/Ethnicity				
Asian	0	0.0	2	6.7
African American	8	53.3	17	56.7
Hispanic	4	26.6	2	6.7
White	3	20.0	9	30.0
Grade Level Taught*				
Six	0	0.0	15	50.0
Seven	11	73.3	12	40.0
Eight	10	66.6	11	36.7

Source: Teacher data from Southern Methodist University on May 19, 2018 (Cohort 1) and November 2, 2018 (Cohort 2). District personnel files dated May 20, 2018 (Cohort 1) and September 16, 2018 (Cohort 2).

Note: *Teachers may have taught multiple grade levels. STEM = Science, Technology, Engineering, and Mathematics. Percentages may not sum to 100 percent because of rounding.

*A previous report included two duplicate participants.

Participant retention data is presented in Table 3. A greater percentage of Cohort 1 participants returned for their second year (75%) than Cohort 2 participants (47%). For Cohort 1, 75 percent of the original cohort returned for the second STEM Academy and 53 percent returned for the third STEM Academy (Table 3). Cohort 2 first attended the second STEM Academy in 2018, and 47 percent of the original cohort returned for the third STEM Academy during the following summer.

Table 3: Cohort 1 and Cohort 2 STEM Academy Retention Rates by Year

	Cohort 1		Cohort 2	
	<i>n</i>	Original Cohort %	<i>n</i>	Original Cohort %
Academy 1 (2017)	15	100.0	-	-
Academy 2 (2018)	12	75.0	30	100.0
Academy 3 (2019)	8	53.3	14	46.7

Source: Teacher data from SMU on May 19, 2018 (Cohort 1), November 2, 2018 (Cohort 2), and September 30, 2019 (cohorts one and two).

Note: STEM = Science, Technology, Engineering, and Mathematics. - = no teachers in this category.

What were the results of the Student Experience Survey for students of STEM Academy teachers?

Methodology

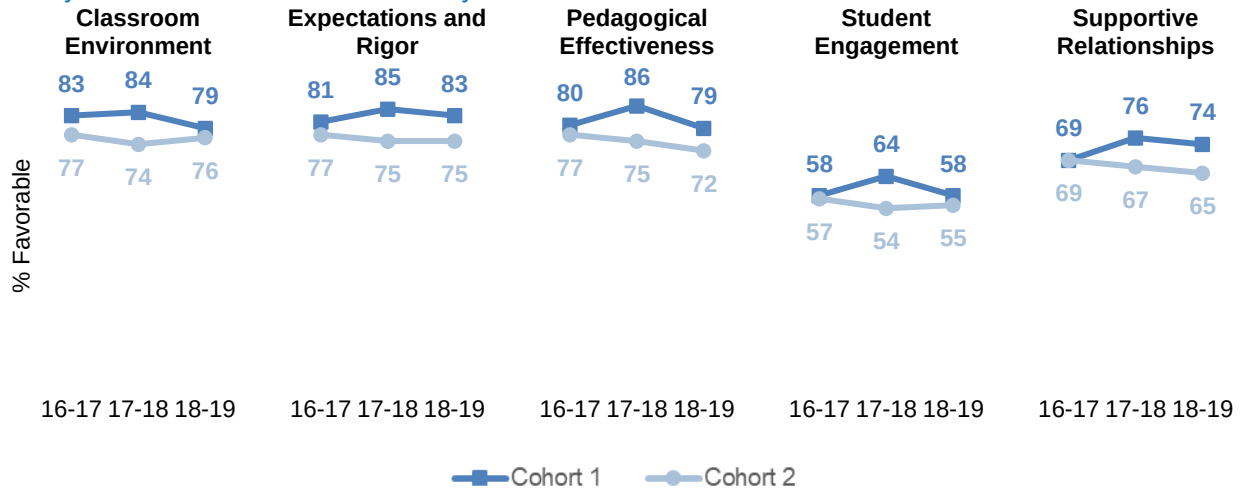
The evaluator compared favorable response rates on the five Student Experience Survey⁴ subsections (Classroom Environment, Expectations and Rigor, Pedagogical Effectiveness, Student Engagement, and Supportive Relationships) for STEM Academy teachers one school year prior to program initiation (2016-17) and during the program school years (2017-18 and 2018-19). The evaluator also compared overall favorable response rates from 2016-17 to 2018-19 (one pre-program and two program years) for STEM Academy participants and other district middle school science teachers.

Results

As shown in Figure 1, favorable response rates for Cohort 1 STEM Academy teachers on all five survey subsections trended upward during the first year of program participation (2017-18). During the second year of program participation, however, the favorable response rates on all five survey subsections trended downward. Favorable response rates for Cohort 2 teachers increased during program participation (2018-19) on the Classroom Environment and Student Engagement subsections, remained the same on the Expectations and Rigor subsection, and decreased on the Pedagogical Effectiveness and Supportive Relationships subsections. Cohort 1 participants, in general, received higher favorable response rates than Cohort 2 participants during the 2017-18 and 2018-19 program years.

⁴ For more information, see Chawla (2018).

Figure 1: 2016-17, 2017-18, and 2018-19 Percentage of Favorable Ratings on the Student Experience Survey Subsections for STEM Academy Teachers

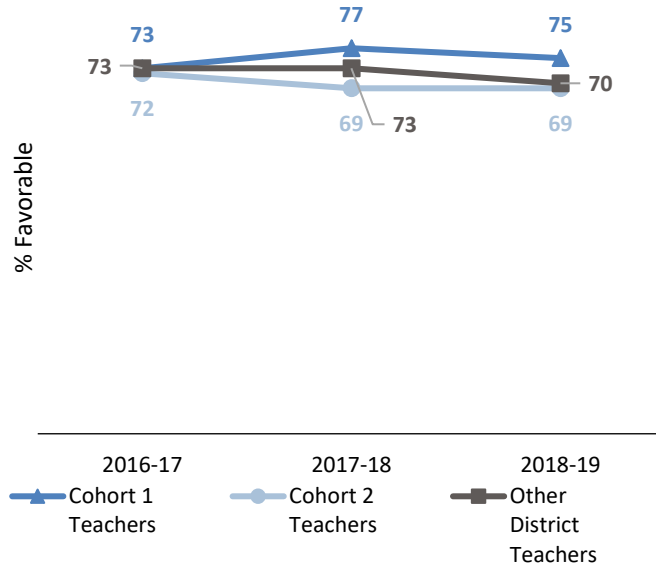


Source: Student Experience Survey data received from the district Office of Institutional Research on November 13, 2018 (2016-17 and 2017-18) and June 19, 2019 (2018-19).

Note: Cohort 1 began participation in 2017-18. Cohort 2 began participation in 2018-19. Cohort 1: $N(2016-17) = 270$, $N(2017-18) = 233$ students, $N(2018-19) = 240$ students. Cohort 2: $N(2016-17) = 459$ students, $N(2017-18) = 741$ students, $N(2018-19) = 782$ students. STEM = Science, Technology, Engineering, and Mathematics.

While Cohort 1 teachers, Cohort 2 teachers, and other district middle school science teachers received similar favorable response rates on the Student Experience Survey overall in 2016-17, Cohort 1 teachers received a higher percentage of favorable ratings than Cohort 2 teachers and other district middle school science teachers during the 2017-18 and 2018-19 STEM Academy program years (Figure 2). The favorable response rate for Cohort 1 teachers increased by four percentage points after their first year of program participation; the favorable response rate for Cohort 2 teachers did not increase after their first year of participation. The rates of favorable ratings for Cohort 2 teachers were about the same as other district teachers in 2016-17 and 2018-19 and lower in 2017-18.

Figure 2: 2016-17, 2017-18, and 2018-19 Overall Percentage of Favorable Ratings on the Student Experience Survey for STEM Academy and Other District Teachers



Source: Student Experience Survey data dated November 13, 2018 (2016-17 and 2017-18) and June 19, 2019 (2018-19).

Note: Cohort 1 Teachers: $N(2016-17) = 270$ students, $N(2017-18) = 233$ students, $N(2018-19) = 240$ students. Cohort 2 Teachers: $N(2016-17) = 459$ students, $N(2017-18) = 741$ students, $N(2018-19) = 782$ students. Other District Teachers $N(2016-17) = 3,525$ students, $N(2017-18) = 4,160$ students, $N(2018-19) = 6,187$ students. STEM = Science, Technology, Engineering, and Mathematics.

How did STEM Academy teachers grow professionally during the program?

Methodology

The evaluator used descriptive statistics to compare the Teacher Excellence Initiative (TEI)⁵ evaluation ratings of STEM Academy participants and other district science teachers for 2015-16, 2016-17, 2017-18, and 2018-19. These years represent two pre-program years and two program years for Cohort 1, and three pre-program years and one program year for Cohort 2.

Results

Generally, as shown in Table 4, greater percentages of STEM academy teachers than other district science teachers earned Proficient I or higher evaluation ratings during the program years. The percentage of Cohort 2 teachers that received a Proficient I or higher evaluation rating during the pre-program 2017-18 school year (56%) was lower than Cohort 1 teachers during the first year of the STEM Academy (75%) and other district science teachers not participating in the STEM Academy (66%). During 2018-19, the first

⁵ For more information on TEI, see <http://tei.dallasisd.org>.

program year for Cohort 2, the percentage at Proficient I or higher (62%) was slightly lower than Cohort 1 (67%) and higher than other district science teachers (53%).

Table 4: 2015-16 through 2018-19 Percentages of Middle School Science Teachers Receiving Proficient I or Above TEI Evaluation Rating

	Cohort 1		Cohort 2		Other Science Teachers	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
2015-16	6	50.0	12	50.0	73	67.1
2016-17	8	62.5	16	56.3	94	64.9
2017-18 ¹	8	75.0	25	56.0	132	65.9
2018-19 ²	9	66.7	26	61.5	202	53.0

Source: District TEI data files for academy participants identified by district staff members received October 30, 2018 (2015-16 through 2017-18) and November 12, 2019 (2018-19).

Note: The overall TEI target distribution rated approximately 60 percent of teachers as Proficient I or higher each year. Teachers shown received TEI evaluation ratings all three years. ¹First year after the STEM Academy for Cohort 1. ²Second year after the STEM Academy for Cohort 1 and first year after the STEM Academy for Cohort 2.

What were the science assessment outcomes for students of STEM Academy teachers?

Methodology

The evaluator used propensity score matching (PSM) to match students taught by STEM Academy teachers to other district students and allow for comparison among groups: students taught one year by STEM Academy teachers, students taught two years by STEM Academy teachers, and other district students. Small numbers of students received two years of instruction from STEM Academy teachers in the same course and were not included in analyses. Teachers were identified using a participant file received from STEM Academy staff members on November 2, 2019. To determine the courses and students taught by participants, these data were matched with student course files dated September 11, 2019. For ten science courses with large enrollment, the evaluator included the following covariates to determine comparison students: student attendance for the 2017-18 and 2018-19 school years, number of years identified as English Learners (EL), socio-economic status, special education status, talented and gifted participation, and 2018 *State of Texas Assessments of Academic Readiness (STAAR)* performance on the reading and mathematics subtests.⁶

For Fall 2018, the evaluator used *chi-square* analyses (statistical significance) and Cramer's *V*⁷ (practical significance) to compare passing rates for students taught by STEM Academy teachers to comparison students on the fall 2018 *Assessments of Course Performance (ACPs)* for ten courses.

⁶ Additional student data necessary for the PSM process were matched with the student course files as follows: student characteristics from student demographic file dated May 28, 2019, 2017-18 attendance from the student attendance file dated June 11, 2018, 2018-19 attendance from the student attendance file dated June 4, 2019, 2017-18 STAAR performance from the district STAAR file dated September 6, 2018, and 2018-19 STAAR performance from the district STAAR file dated September 11, 2019.

⁷ Cramer's *V* values of 0.1, 0.3, and 0.5 equate to small, medium, and large effect sizes, respectfully (see Cohen, 1988).

Students in three courses (Science 8, Sheltered Science 8, and Physics) may have received instruction from a STEM Academy teacher for two years. For these courses, the evaluator compared *ACP* passing rates for students that received one year of instruction from STEM Academy teachers, students that received two years of instruction from STEM Academy teachers, and comparison students.

For Spring 2019, the evaluator compared *ACP* passing rates for all student groups in seven courses.⁸ The evaluator also compared the rates of STEM Academy and comparison group students who met the Approaches Grade Level or Above (Approaches+), Meets Grade Level or Above (Meets+), and Masters Grade Level (Masters) performance standards on the spring 2019 *STAAR* science subtest. Students in three courses (Science 8, Sheltered Science 8, and Physics) may have received instruction from a STEM Academy teacher for two years. For these courses, the evaluator compared outcomes for students that received one year of instruction from STEM Academy teachers, students that received two years of instruction from STEM Academy teachers, and comparison students.

Results

Complete results for the fall *ACP*, spring *ACP*, and spring *STAAR* for all one-year students of STEM Academy teachers, two-year students of STEM Academy teachers, matched one-year students of STEM Academy teachers, matched two-year students of STEM Academy teachers, matched comparison students, and all district students are presented in Appendix A.

The percentages of students taught by STEM Academy teachers for one year, students taught by STEM Academy teachers for two years, and comparison students passing the fall 2018 *ACPs* are presented in Table 5. Overall, *ACP* results were varied, with students of STEM Academy teachers passing five exams at higher rates and five exams at lower rates, on average, than comparison students. However, analyses indicated significant relationships between having a STEM Academy teacher and passing the *ACP* in four courses. For Science 7, students taught by STEM Academy teachers for one year passed at a higher rate (71%) than the comparison students (55%), $\chi^2(1, N = 1,259) = 35.13, p < .01$, but the practical effect was relatively small (Cramer's $V = .17$). Similarly, for Science 8, students taught by STEM Academy teachers for two years passed at a higher rate (77%) than students taught for one year (70%) and comparison students (67%), $\chi^2(2, N = 2,190) = 6.35, p = .04$. However, the practical effect was small (Cramer's $V = .05$). One-year students of STEM Academy teachers passed the Sheltered Science 8 *ACP* at a lower rate (49%) than two-year students of STEM Academy teachers (64%) and comparison students (60%), $\chi^2(2, N = 570) = 8.77, p = .01$, and the practical effect was relatively small (Cramer's $V = .12$). For Physics students, two-year students of STEM Academy teachers passed at a lower rate (43%) than one-year students of STEM Academy teachers (70%) and comparison students (70%), $\chi^2(2, N = 376) = 12.19, p = .01$, but the practical effect was relatively small (Cramer's $V = .18$).

⁸ Students in Science 7 Pre-AP, Science 8, and Sheltered Science 8 took the *STAAR* science subtest in the spring and did not take a Science *ACP*.

Table 5: Fall 2018 Science ACP Percent Passing for One-Year Students of STEM Academy Teachers¹, Two-Year Students of STEM Academy Teachers², and Matched-Comparison Students by Course

Group	Tested N	Passed %
Science 6		
One-Year STEM Academy	880	56.4
Comparison Group	880	52.7
District Overall	5,150	56.5
Sheltered Science 6		
One-Year STEM Academy	125	40.0
Comparison Group	125	42.4
District Overall	1,117	48.4
Science 6 Pre-AP		
One-Year STEM Academy	370	78.1
Comparison Group	370	77.6
District Overall	2,655	78.8
Science 7*		
One-Year STEM Academy	629	71.1
Comparison Group	630	55.1
District Overall	5,087	62.4
Sheltered Science 7		
One-Year STEM Academy	110	64.5
Comparison Group	110	53.6
District Overall	1,205	55.4
Science 7 Pre-AP		
One-Year STEM Academy	430	84.9
Comparison Group	430	85.3
District Overall	2,492	86.0
Science 8*		
One-Year STEM Academy	964	69.7
Two-Year STEM Academy	131	77.1
Comparison Group	1,095	66.6
District Overall	5,268	69.0
Sheltered Science 8*		
One-Year STEM Academy	243	49.4
Two-Year STEM Academy	42	64.3
Comparison Group	285	60.0
District Overall	1,361	56.2
Astronomy		
One-Year STEM Academy	217	65.4
Comparison Group	217	65.9
District Overall	1,219	67.9
Physics*		
One-Year STEM Academy	148	69.6
Two-Year STEM Academy	40	42.5
Comparison Group	188	70.2
District Overall	915	64.0

Source: District Fall 2018 ACP file dated May 13, 2019.

Note: ACP = Assessments of Course Performance. STEM = Science, Technology, Engineering, and Mathematics. AP = Advanced Placement. ¹Received instruction from STEM Academy teacher for one school year. ²Received instruction from STEM Academy teachers for two school years. *Indicates a statistically significant relationship between having a STEM Academy teacher and passing the ACP, $p < .05$.

The percentages of students taught by STEM Academy teachers for one year, students taught by STEM Academy teachers for two years, and comparison students passing the spring 2019 ACPs are presented in Table 6. Statistically significant differences emerged for students in grade seven and in physics. For Science 7, students taught by STEM Academy teachers passed at a higher rate (84%) than the comparison students (72%), $\chi^2(1, N = 1,259) = 27.40, p < .01$, but the practical effect was small

(Cramer's $V = .15$). For Sheltered Science 7 ACP, students taught by STEM Academy teachers passed at a higher rate (81%) than the comparison students (66%), $\chi^2 (1, N = 220) = 6.00, p = .01$, and the practical effect was relatively small (Cramer's $V = .17$). On the Physics ACP, two-year students taught by STEM Academy teachers passed at a lower rate (55%) than one-year students taught by STEM Academy teachers (80%) and comparison students (76%), $\chi^2 (2, N = 376) = 10.33, p = .01$, but the practical effect was relatively small (Cramer's $V = .17$).

Table 6: Spring 2019 Science ACP Percent Passing for One-Year Students of STEM Academy Teachers¹, Two-Year Students of STEM Academy Teachers², and Matched-Comparison Students by Course

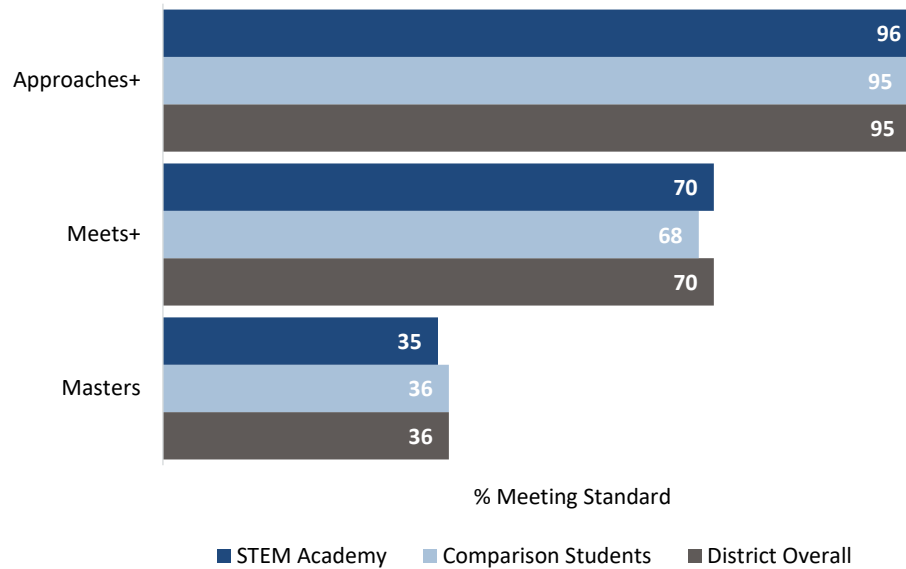
Group	Tested <i>N</i>	Passed %
Science 6		
One-Year STEM Academy	880	55.5
Comparison Group	880	53.1
District Overall	5,198	57.1
Sheltered Science 6		
One-Year STEM Academy	125	37.6
Comparison Group	125	40.8
District Overall	1,119	49.6
Science 6 Pre-AP		
One-Year STEM Academy	370	83.2
Comparison Group	370	88.1
District Overall	2,692	86.7
Science 7*		
One-Year STEM Academy	629	83.8
Comparison Group	630	72.4
District Overall	5,052	76.0
Sheltered Science 7*		
One-Year STEM Academy	110	80.9
Comparison Group	110	66.4
District Overall	1,208	76.1
Astronomy		
One-Year STEM Academy	217	68.7
Comparison Group	217	77.0
District Overall	1,219	73.3
Physics*		
One-Year STEM Academy	148	79.7
Two-Year STEM Academy	40	55.0
Comparison Group	188	75.5
District Overall	916	72.8

Source: District Spring 2019 ACP file dated May 13, 2019.

Note: ACP = Assessments of Course Performance. STEM = Science, Technology, Engineering, and Mathematics. AP = Advanced Placement. ¹Received instruction from STEM Academy teacher for one school year. ²Received instruction from STEM Academy teachers for two school years. *Indicates a statistically significant relationship between having a STEM Academy teacher and passing the ACP, $p < .05$.

As shown in Figure 3, although not statistically significant, STEM Academy Science 7 Pre-Advanced Placement (Pre-AP) students met the Approaches+ and Meets+ standards on the spring STAAR science test at slightly higher rates than comparison students, but met the Masters standard at a slightly lower rate than comparison students.

Figure 3: Spring 2019 Percentages of Science 7 Pre-Advanced Placement Students Taught by STEM Academy Teachers, Comparison Students, and All District Students Meeting STAAR Standards

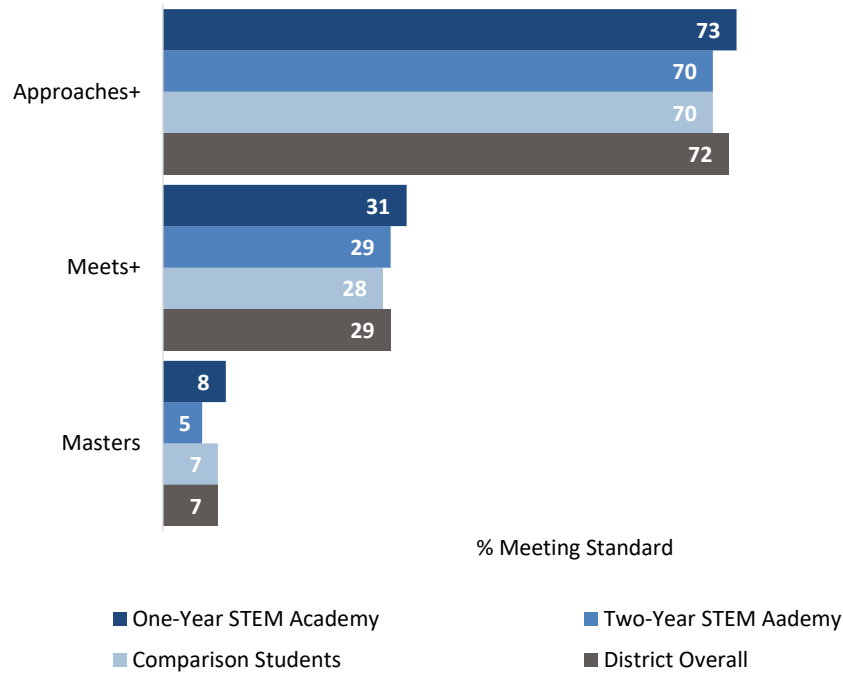


Source: Spring 2019 STAAR data files dated September 11, 2019.

Note: STAAR = State of Texas Assessments of Academic Readiness. Sample sizes are included in Appendix A Table 2.

Students who took the grade eight Science STAAR and were taught by STEM Academy teachers for one year met the Approaches+, Meets+, and Masters standards at higher rates than two-year students of STEM Academy teachers and comparison students, but the differences were not significant for any STAAR standard (Figure 4).

Figure 4: Spring 2019 Percentages of Science 8 Students Taught by STEM Academy Teachers, Comparison Students, and All District Students Meeting STAAR Standards

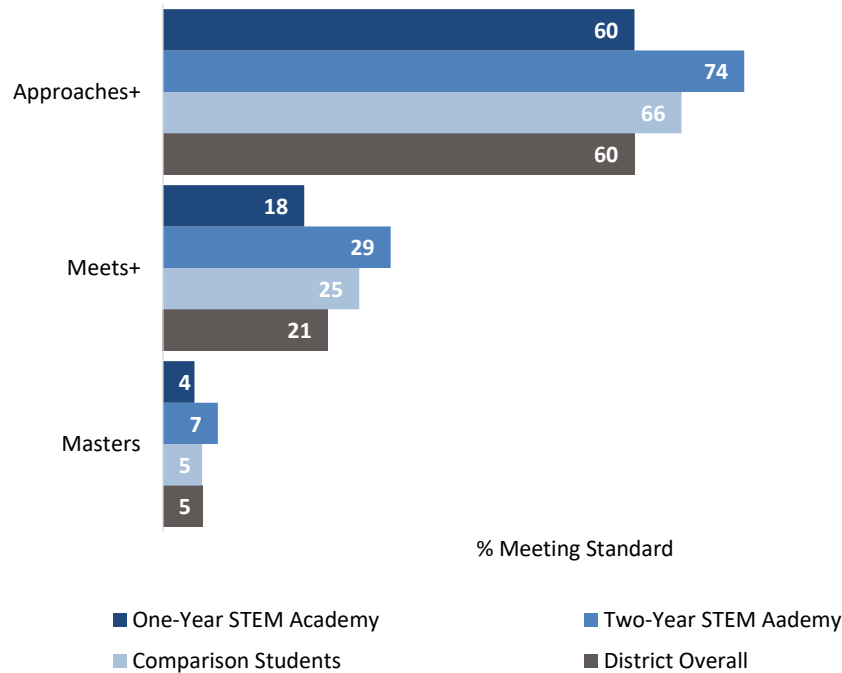


Source: Spring 2019 STAAR data files dated September 11, 2019.

Note: STAAR = State of Texas Assessments of Academic Readiness. Sample sizes are included in Appendix A Table 2.

EL students in Sheltered Science 8 who were taught for two years by STEM Academy teachers met the Approaches+, Meets+, and Masters STAAR standards at higher rates than EL students taught for one year by a STEM Academy teacher and matched-comparison students (Figure 5). However, the relationships between having a STEM Academy teacher and meeting each STAAR standard were not statistically significant.

Figure 5: Spring 2019 Percentages of Sheltered Science 8 Students Taught by STEM Academy Teachers, Comparison Students, and All District Students Meeting STAAR Standards



Source: Spring 2019 STAAR data files dated September 11, 2019.

Note: STAAR = State of Texas Assessments of Academic Readiness. Sample sizes are included in Appendix A Table 2.

What were the high school rigorous-course enrollment rates for students who were taught in middle school by STEM Academy teachers?

Methodology

The evaluator used PSM to create a matched comparison group of grade-nine students who were not taught by STEM Academy participants. For students in grade nine during each school year, years classified as EL, socio-economic status, special education status, talented and gifted participation, and 2018 STAAR performance on the reading and mathematics subtests were included as covariates during the PSM process.⁹ The evaluator used chi-square analyses (statistical significance) and calculated Cramer's V (practical significance) to compare the percentages of former STEM Academy participant students and comparison students who enrolled in grade-nine rigorous mathematics and science courses (pre-AP, AP, or dual credit) the following school year (2019-20).

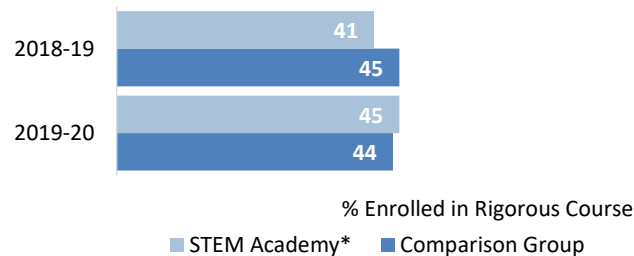
⁹ Additional student data necessary for the PSM process were matched with the student course files as follows: student characteristics from student demographic file dated May 28, 2019, 2017-18 attendance from the student attendance file dated June 11, 2018, 2018-19 attendance from the student attendance file dated June 4, 2019, 2017-18 STAAR performance from the district STAAR file dated September 6, 2018, and 2018-19 STAAR performance from the district STAAR file dated September 11, 2019.

To examine longitudinal trends, the evaluator also used chi-square analyses and calculated Cramer's V to compare the rates of students of Cohort 1 STEM Academy participants who enrolled in rigorous courses in grade nine with all other grade-nine students in the district for fall 2016, fall 2017, fall 2018, and fall 2019.

Results

During the 2018-19 school year, 41 percent of the former students of STEM Academy teachers enrolled in a rigorous science or mathematics course (Figure 6). This rate was lower than the rate for matched-comparison students (45%), though the difference was not statistically significant. During the 2019-20 school year, the rigorous-course enrollment rate increased to 45 percent for students of STEM Academy teachers, one percentage point higher than the rate for matched-comparison students (44%).

Figure 6: 2018-19 and 2019-20 Grade-Nine Enrollment of STEM Academy Students and Comparison Students in Rigorous High School Mathematics or Science Courses



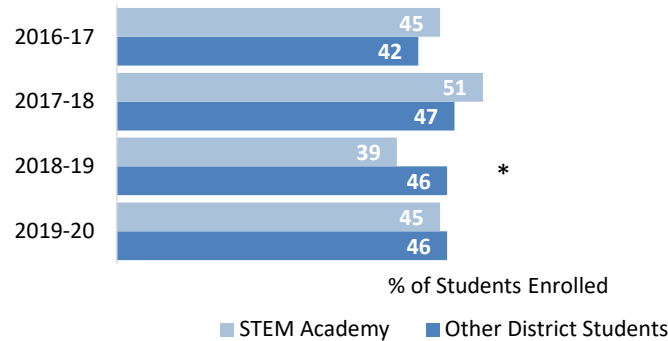
Source: District course files dated October 22, 2018 (2018-19) and October 28, 2019 (2019-20). District PEIMS files dated October 26, 2018 (2018-19) and October 28, 2019 (2019-20).

Note: Rigorous courses were defined as Advanced Placement, Pre-Advanced Placement, and Dual Credit courses. Data include only matched students.

*2018-19 includes students taught by Cohort 1 teachers; 2019-20 includes students taught by Cohort 1 or Cohort 2 teachers.

Prior to teacher participation in the STEM Academy, students taught middle school science by these teachers enrolled in high school rigorous mathematics or science courses at higher rates than other district students (Figure 7). This trend did not continue for students taught during the first program year. Former students of STEM Academy teachers enrolled in rigorous courses for the 2018-19 school year at a significantly lower rate than all other grade-nine district students, $\chi^2 = 33.33$, $p < .01$, but the practical effect was small (Cramer's $V = .06$). The rigorous-course enrollment rate for former students of STEM Academy teachers increased to 45 percent during the second program year, one percentage point lower than the rate for other district students.

Figure 7: 2016-17 through 2018-19 Grade-Nine STEM Academy and Other District Student Enrollment in Rigorous Math or Science Courses



Source: District course files dated October 31, 2016 (2016-17); October 30, 2017 (2017-18); October 22, 2018 (2018-19), and October 28, 2019 (2019-20). District PEIMS files dated October 31, 2016 (2016-17); October 30, 2017 (2017-18); March 8, 2019 (2018-19); October 28, 2019 (2019-20).

Note: Rigorous courses were defined as Advanced Placement, Pre-Advanced Placement, and Dual Credit courses. * = statistically significant difference. 2018-19 was the first school year that former students of academy teachers entered grade nine. 2018-19 includes students taught by Cohort 1 teachers; 2019-20 includes students taught by Cohort 1 or Cohort 2 teachers. Data include all students.

SUMMARY AND RECOMMENDATIONS

Summary

The goals of the STEM Academy for Science Teachers and Leaders were to grow the abilities of middle school science teachers to integrate active learning experiences in lessons, foster professional growth and leadership, increase student science achievement, and promote student pursuit of STEM coursework. A Texas Instruments Foundation grant supported 90 percent of the 2017-18 budget (\$720,030) and 85 percent of the 2018-19 budget (\$605,057).

The first cohort of teachers attended a summer academy in 2017 and a second cohort was added for summer 2018. After two program years, 53 percent of the original Cohort 1 attended a third academy in summer 2019; 47 percent of Cohort 2 attended the third academy (their second program year).

Teacher outcomes included the results of the Student Experience Survey and TEI ratings. Results from the Student Experience Survey indicated that, for Cohort 1 teachers, favorable ratings on all five subsections increased for year one of the program and decreased for their second year of the program. The ratings for Cohort 2, in their first year of the program, increased on two sections, remained the same on one section, and decreased on two sections. Additionally, nearly 67 percent of Cohort 1 teachers and nearly 62 percent of Cohort 2 teachers received a TEI rating of Proficient I or above for 2018-19 school year. This was higher than the rate for other middle school science teachers in the district (53%).

Student outcomes included *Assessments of Course Performance (ACP)* and *State of Texas Assessments of Academic Readiness (STAAR)* results and rigorous course enrollment. Results on the fall

2018 ACPs were mixed with higher passing rates for students of STEM Academy teachers than matched comparison students on five exams and lower passing rates on five exams. On the spring 2019 ACPs, students of STEM Academy teachers had higher passing rates than matched-comparison students on four exams and lower passing rates on three exams. STAAR results were mixed in Science 6 Pre-AP and Science 8, but Sheltered Science 8 Pre-AP students who had been taught by STEM Academy teachers for two years met the Approaches+, Meets+, and Masters standards at higher rates than one-year students and matched-comparison students.

The rigorous high school mathematics and science course enrollment rates of matched former students of STEM Academy teachers were lower (41%) than other district students (45%) in the 2018-19 school year. This increased to 45 percent in the 2019-20 school year, an enrollment rate similar to other district students (44%).

Recommendations

- **Examine downward trends in favorable ratings on the five subsections of the Student Experience Survey for STEM Academy teachers.** Favorable ratings on the five Student Experience Survey subsections increased from the pre-program year (2016-17) for Cohort 1 teachers during the first year of the STEM Academy (2017-18), then decreased during the second program year (2018-19). Favorable ratings for Cohort 2 teachers in their first program year increased on two subsections, remained the same on one subsection, and decreased on two subsections compared to the pre-program year (2017-18).
- **Continue to monitor the academic achievement of EL students taught by STEM Academy teachers.** Overall, the ACP and STAAR results for students taught by STEM Academy teachers varied. However, EL students enrolled in Sheltered Science 8 taught for two years by STEM Academy teachers met the three STAAR standards at higher rates than one-year students and comparison students.
- **Continue to examine trends in high school rigorous mathematics and science course enrollment.** The percentage of matched former students of STEM Academy teachers enrolled in rigorous high school mathematics or science courses was lower (41%) than matched-comparison students (45%) for 2018-19. The percentage increased to 45 percent in 2019-20, comparable to matched-comparison students (44%). As more former students enter high school, analyses should be conducted to examine if the rigorous-course enrollment rates of STEM Academy students continue to improve relative to the rates of matched students.

REFERENCES

- Chawla, N. (2018). 2017-18 Student Experience Survey. Dallas, TX: Dallas Independent School District.
- Cohen, J. (1988). *Statistical power and analysis for the behavioral sciences* (2nd ed.), Hillsdale, N.J., Lawrence Erlbaum Associates, Inc.

APPENDICES

Appendix A

Appendix A Table 1: 2018-19 Percent Passing Fall and Spring ACPs for All Students Taught by STEM Academy Teachers, Matched Students Taught by STEM Academy Teachers, Matched Comparison Students, and All District Students

Course	All 1-Year STEM Academy		Matched 1-Year STEM Academy		All 2-Year STEM Academy		Matched 2-Year STEM Academy		Matched Comparison		District Overall	
	Tested N	Passed %	Tested N	Passed %	Tested N	Passed %	Tested N	Passed %	Tested N	Passed %	Tested N	Passed%
Fall 2018												
Science 6	915	56.5	880	56.4	-	-	-	-	880	52.7	5,150	56.5
Sheltered Science 6	126	31.7	125	40.0	-	-	-	-	125	42.4	1,117	48.4
Science 6 Pre-AP	374	77.3	370	78.1	-	-	-	-	370	77.6	2,655	78.8
Science 7	669	68.6	629	71.1	*	*	*	*	630	55.1	5,087	62.4
Sheltered Science 7	122	60.7	110	64.5	-	-	-	-	110	53.6	1,205	55.4
Science 7 Pre-AP	435	85.1	430	84.9	-	-	-	-	430	85.3	2,492	86.0
Science 8	1,010	68.4	964	69.7	149	74.5	131	77.1	1,095	66.6	5,268	69.0
Sheltered Science 8	248	48.4	243	49.4	43	65.1	42	64.3	285	60.0	1,361	56.2
Astronomy	220	65.0	217	65.4	-	-	-	-	217	65.9	1,219	67.9
Physics	151	68.9	148	69.6	44	38.6	40	42.5	188	70.2	915	64.0
Spring 2019												
Science 6	998	53.3	880	55.5	-	-	-	-	880	53.1	5,198	57.1
Sheltered Science 6	137	37.2	125	37.6	-	-	-	-	125	40.8	1,119	49.6
Science 6 Pre-AP	422	82.0	370	83.2	-	-	-	-	370	88.1	2,692	86.7
Science 7	670	80.4	629	83.8	*	*	*	*	630	72.4	5,052	76.0
Sheltered Science 7	122	74.6	110	80.9	-	-	-	-	110	66.4	1,208	76.1
Astronomy	220	67.7	217	68.7	*	*	-	-	217	77.0	1,219	73.3
Physics	151	78.1	148	79.7	44	50.0	40	55.0	188	75.5	916	72.8

Source: : District Fall 2018 ACP file dated May 13, 2019.

Note: ACP = Assessments of Course Performance. STEM = Science, Technology, Engineering, and Mathematics. AP = Advanced Placement. - = No students tested in this category.

* Indicates fewer than five students were tested.

Appendix A Table 2: 2019 Percent Meeting STAAR Standards for All Students Taught by STEM Academy Teachers, Matched Students Taught by STEM Academy Teachers, Matched Comparison Students, and All District Students

Course	All 1-Year STEM Academy		Matched 1-Year STEM Academy		All 2-Year STEM Academy		Matched 2-Year STEM Academy		Matched Comparison		District Overall	
	Tested N	Met Std %	Tested N	Met Std %	Tested N	Met Std %	Tested N	Met Std %	Tested N	Met Std %	Tested N	Met Std %
Approaches +												
Science 7 Pre-AP	433	95.4	428	96.0	-	-	-	-	428	94.9	2,483	95.2
Science 8	1,012	71.5	961	72.6	148	66.2	130	70.0	1,091	69.9	5,229	71.5
Sheltered Science 8	250	58.8	242	59.5	45	71.1	42	73.8	284	65.8	1,363	60.1
Meets +												
Science 7 Pre-AP	433	69.3	428	70.1	-	-	-	-	428	68.2	2,483	70.1
Science 8	1,012	29.1	961	30.5	148	26.4	130	29.2	1,091	28.3	5,229	28.7
Sheltered Science 8	250	17.6	242	18.2	45	26.7	42	28.6	284	24.6	1,363	20.8
Masters												
Science 7 Pre-AP	433	34.6	428	35.0	-	-	-	-	428	36.4	2,483	36.4
Science 8	1,012	7.9	961	8.2	148	4.1	130	4.6	1,091	6.8	5,229	7.1
Sheltered Science 8	250	4.0	242	4.1	45	6.7	42	7.1	284	5.3	1,363	5.3

Source: Spring 2019 STAAR data file dated September 11, 2019.

Note: STAAR = State of Texas Assessments of Academic Readiness. STEM = Science, Technology, Engineering, and Mathematics. Met Std = met performance standard. Approaches = Approaches Grade Level or Above. Meets+ = Meets Grade Level or Above. AP = Advanced placement. (-) = no students in this category.