

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

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At-a-Glance

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) and was predominantly funded by the Texas Instruments Foundation.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. The 2018-19 budget was \$605,057, a decrease from \$720,030 in 2017-18.

Middle school science teachers attended three-week training academies during the summers of 2017, 2018, and 2019. The trainings were supplemented by direct coaching and professional development during the school year. Cohort 1 consisted of grade seven- and grade-eight teachers from six campuses.² Cohort 2 began during summer 2018 and included new teachers from the original six campuses, and grade six through grade-eight teachers from seven new campuses.³ For participation each summer, teachers received four SMU graduate credits and discounted tuition for future courses. Recruiting challenges for Cohort 2 led program administrators to offer \$1,000 stipends for attending the academies in summer 2018 and 2019.

The purpose of this evaluation was to report demographic characteristics (analyzed using frequencies and descriptive statistics) and teacher and student outcomes for Cohort 1 and Cohort 2 (analyzed using Chi-squared tests for statistical significance and Cramer's V tests for practical significance).⁴

Teacher Characteristics and Retention

Teacher characteristics are shown in Table 1. 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 1: Cohort 1 and 2 Participating Teacher Characteristics

	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

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: STEM = Science, Technology, Engineering, and Mathematics. Percentages do not sum to 100 because of rounding. *A previous report included two duplicate participants.

Exactly 75 percent of Cohort 1 participants (initial N = 15) returned for their second year and 53 percent returned for a third year, a rate higher than the percentage of Cohort 2 participants returning for a second year (47%; initial N = 30).

Student Experience Survey

The evaluator compared favorable response rates on the five Student Experience Survey⁵ subsections for teachers one pre-program school year (2016-17) and during the program school years (2017-18 and 2018-19).

As shown in Table 2, favorable response rates for Cohort 1 STEM Academy teachers on all five survey subsections and overall trended upward during the first year of program participation (2017-18) but trended downward during the second year of participation. Favorable response rates for Cohort 2 teachers during program participation (2018-19) were mixed. Cohort 1

¹ 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.

⁴ Cramer's V values of 0.1, 0.3, and 0.5 equate to small, medium, and large effect sizes, respectfully (see Cohen, 1988).

⁵ For more information, see Chawla 2018.

participants, in general, received higher favorable response rates than Cohort 2 participants during the 2017-18 and 2018-19 program years.

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

Subsection	Cohort 1			Cohort 2		
	2016-17	2017-18	2018-19	2016-17	2017-18	2018-19
	%	%	%	%	%	%
Class Env	83	84	79	77	74	76
Expect Rig	81	85	83	77	75	75
Ped Effect	80	86	79	77	75	72
Stu Engage	58	64	58	57	54	55
Sup Relat	69	76	74	69	67	65
Overall	73	77	75	72	69	69

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. Class Env = Classroom environment. Expect Rig = Expectations and rigor. Ped Effect = Pedagogical effectiveness. Stu Engage = Student engagement. Sup Relat = Supportive relationships. Cohort 1: $N(2016-17) = 270$ students, $N(2017-18) = 233$ 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.

Professional Growth

The evaluator compared the Teacher Excellence Initiative (TEI)⁶ evaluation ratings of STEM Academy participants and other district science teachers for the program years (2017-18 and 2018-19) and two pre-program years (2015-16 and 2016-17). Prior to the program, cohort teachers received fewer Proficient I or higher ratings than other district teachers (Table 3). However, during the program years, greater percentages of STEM academy teachers than other district science teachers earned Proficient I or higher evaluation ratings.

Table 3: 2015-16 through 2018-19 Percentages of Science Teachers Receiving Proficient I or Above TEI Evaluation Rating

	Cohort 1		Cohort 2		Other Science Teachers	
	n	%	n	%	n	%
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 program staff members received October 30, 2018 (2015-16 through 2017-18) and November 12, 2019 (2018-19) and November 12, 2019.

Note: 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.

Student Academic Outcomes

To examine student outcomes, the evaluator used propensity score matching (PSM) to create matched-comparison groups of students in ten courses⁷ who were not taught by STEM Academy participants.⁸ Then, the evaluator compared passing rates for students of STEM Academy teachers to matched-comparison students on the fall 2018 and spring 2019 *Assessments of Course Performance (ACP)*. For students taking the spring 2019 *State of Texas Assessments of Academic Readiness (STAAR)* science subtest,⁹ the evaluator compared the percentage of students of STEM Academy teachers and matched-comparison students who met the Approaches Grade Level or Above (Approaches+), Meets Grade Level or Above (Meets+), and Masters Grade Level (Masters) performance standards.

Overall, fall 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 other district students (Table 4). Analyses indicated significant relationships between having a STEM Academy teacher and passing the ACP in four subjects. Students taught Science 7 by a STEM Academy teacher 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 $V = .17$). For Science 8, two-year students of STEM Academy teachers passed at a higher rate (77%) than one-year students of STEM Academy teachers (70%) and comparison students (67%), $\chi^2(2, N = 2,190) = 6.35$, $p = .04$. 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

⁶ For more information, see <http://tei.dallasisd.org>.

⁷ Science 6, Sheltered Science 6, Science 6 Pre-AP, Science 7, Sheltered Science 7, Science 7 Pre-AP, Science 8, Sheltered Science 8, Astronomy, and Physics.

⁸ A list of variables used to create comparison groups is available in the full report.

⁹ Science 7 Pre-AP, Science 8, and Sheltered Science 8.

practical effect was 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%), $\chi^2 (2, N = 376) = 12.19$, $p = .01$, and the practical effect was small (Cramer's $V = .18$).

Table 4: Fall 2018 Science ACP Percent Passing for Students of STEM Academy Teachers and Matched-Comparison Students by Course

Group	Tested N	Passed %
Science 6		
One-Year STEM Academy ^a	880	56.4
Comparison Group	880	52.7
Sheltered Science 6		
One-Year STEM Academy	125	40.0
Comparison Group	125	42.4
Science 6 Pre-Advanced Placement		
One-Year STEM Academy	370	78.1
Comparison Group	370	77.6
Science 7*		
One-Year STEM Academy	629	71.1
Comparison Group	630	55.1
Sheltered Science 7		
One-Year STEM Academy	110	64.5
Comparison Group	110	53.6
Science 7 Pre-Advanced Placement		
One-Year STEM Academy	430	84.9
Comparison Group	430	85.3
Science 8*		
One-Year STEM Academy	964	69.7
Two-Year STEM Academy ^b	131	77.1
Comparison Group	1,095	66.6
Sheltered Science 8*		
One-Year STEM Academy	243	49.4
Two-Year STEM Academy	42	64.3
Comparison Group	285	60.0
Astronomy		
One-Year STEM Academy	217	65.4
Comparison Group	217	65.9
Physics*		
One-Year STEM Academy	148	69.6
Two-Year STEM Academy	40	42.5
Comparison Group	188	70.2

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

Note: ACP = Assessments of Course Performance. ^aReceived STEM Academy teacher instruction for one year. ^bReceived STEM Academy teacher instruction for two years. *Indicates statistical significance, $p < .05$.

Results on the spring ACPs were also varied, with students taught by STEM Academy teachers passing at higher rates than comparison students on four of seven course assessments (Table 5). For Science 7, students taught by STEM Academy teachers passed at a higher rate (84%) than comparison students (72%), $\chi^2 (1, N = 1,259) = 27.40$, $p < .01$. The practical effect was small (Cramer's $V = .15$). For Sheltered Science 7, students taught by STEM Academy teachers passed at a higher rate (81%) than comparison students (66%), $\chi^2 (1, N = 220) = 6.00$, $p = .01$, and the practical effect was relatively small (Cramer's $V = .17$). For Physics, students of two-year STEM Academy teachers passed at a lower rate (55%) than students of one-year

teachers (80%) and comparison students (76%), $\chi^2 (2, N = 376) = 10.33$, $p = .01$, and the practical effect was relatively small (Cramer's $V = .17$).

Table 5: Spring 2019 Science ACP Percent Passing for Students of STEM Academy Teachers and Matched-Comparison Students by Course

Group	Tested N	Passed %
Science 6		
One-Year STEM Academy ^a	880	55.5
Comparison Group	880	53.1
Sheltered Science 6		
One-Year STEM Academy	125	37.6
Comparison Group	125	40.8
Science 6 Pre-Advanced Placement		
One-Year STEM Academy	370	83.2
Comparison Group	370	88.1
Science 7*		
One-Year STEM Academy	629	83.8
Comparison Group	630	72.4
Sheltered Science 7*		
One-Year STEM Academy	110	80.9
Comparison Group	110	66.4
Astronomy		
One-Year STEM Academy	217	68.7
Comparison Group	217	77.0
Physics*		
One-Year STEM Academy	148	79.7
Two-Year STEM Academy ^b	40	55.0
Comparison Group	188	75.5

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

Note: ACP = Assessments of Course Performance. STEM = Science, Technology, Engineering, and Mathematics. ^aReceived STEM Academy teacher instruction for one year. ^bReceived STEM Academy teacher instruction for two years. *Indicates statistical significance, $p < .05$.

As shown in Table 6, STEM Academy Science 7 Pre-Advanced Placement (Advanced Placement) students met the Approaches+ and Meets+ standards on the STAAR science test at slightly higher rates than comparison students, but a slightly lower rate at the Masters standard.

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, though the differences at each STAAR standard were not significant (Table 6).

Finally, two-year students of STEM Academy teachers in Sheltered Science 8 met Approaches+, Meets+, and Masters STAAR standards at higher rates than one-year students and comparison students (Table 6), but the differences were not statistically significant.

Table 6: Spring 2019 Percentages of Students Taught by STEM Academy Teachers and Comparison Students Meeting STAAR Standards by Grade

Group	App+		Meets +		Masters	
	N	%	N	%	N	%
Science 7 Pre-Advanced Placement						
STEM Acad	428	96	428	70	428	35
Comparison Group	428	95	428	68	428	36
Science 8						
One-Year STEM Acad	961	73	961	31	961	8
Two-Year STEM Acad	130	70	130	29	130	5
Comparison Group	1,091	70	1,091	28	1,091	7
Sheltered Science 8						
One-Year STEM Acad	961	60	961	18	961	4
Two-Year STEM Acad	130	74	130	29	130	7
Comparison Group	1,091	66	1,091	25	1,091	5

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

Note: STAAR = State of Texas Assessments of Academic Readiness. STEM= Science, Technology, Engineering, and Mathematics. Acad = academy.

High School Rigorous Course Enrollment

The evaluator used PSM to create matched comparison groups of grade nine students who were not taught by STEM Academy teachers during middle school.¹⁰ The evaluator used *chi-square* analyses (statistical significance) and calculated Cramer's V (practical significance) to compare the percentages of former students of STEM Academy participants and comparison students who, in grade nine, enrolled in a pre-Advanced Placement (pre-AP), AP, or dual credit mathematics or science courses for the 2018-19 and 2019-20 school years.

During the 2018-19 school year, 41 percent of former students of STEM Academy teachers enrolled in a rigorous science or mathematics course compared to 45 percent of comparison students. During the 2019-20 school year, 45 percent of grade nine students who were taught by STEM Academy teachers enrolled in a rigorous mathematics or science course, a rate on par with matched-comparison students (44%). Results were not statistically significant.

Recommendations

- **Analyze downward trends in ratings on the Student Experience Survey.** 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 (2018-19) 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 in Sheltered Science 8 and taught for two years by STEM Academy teachers met STAAR standards at higher rates than one-year students and matched-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 enrollment rates of STEM Academy students continue to improve relative to the rates of matched-comparison students.

Reference

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.

An electronic version of this report as well as the full report can be found at www.dallasisd.org/Page/888. For more information, please contact Program Evaluation at evaluation@dallasisd.org.

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¹⁰ A list of variables to create the comparison group is available in the full report. 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).