

EXECUTIVE SUMMARY

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 and was predominantly funded by the Texas Instruments Foundation. 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 Texas Instrument Foundation, Dallas ISD, and the Dallas Education Fund provided funding of \$658,074 for the 2019-20 school year, an increase from \$609,869 in 2018-19.

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. After programming in summer 2019 ended, coaching and professional development should have continued throughout the 2019-20 school year. However, the STEM Academy ceased activities after the Dallas ISD transitioned to at-home learning on March 23, 2020 in response to the COVID-19 pandemic. This was considered the end of the program.

PURPOSE OF THE EVALUATION

The purpose of this evaluation was to report teacher characteristics, program retention rates, Student Experience Survey results, and Teacher Excellence Initiative (TEI) evaluation ratings for participating teachers, and academic outcomes and rigorous high school course

enrollment rates for students taught by STEM academy teachers. The Dallas ISD did not administer the Student Experience Survey during Spring 2020 and TEI ratings were held at ratings from the previous school year due to the district response to the COVID-19 pandemic. Thus, those data were unavailable. Data from prior years is available in previous evaluations (Mickelson, 2018, 2019).

This evaluation also typically assesses the academic outcomes of students taught by STEM Academy teachers. However, only outcomes from the fall 2019 were available. The spring 2020 *Assessments of Course Performance (ACP)* and the spring 2020 *State of Texas Assessments of Academic Readiness (STAAR)* were not administered because of the district⁴ and state⁵ responses to the COVID-19 pandemic. Data from prior years are available in previous evaluations (Mickelson, 2018; Mickelson, 2019).

EVALUATION QUESTIONS/OUTCOMES

What were the characteristics and program retention rates of participating teachers?

Methodology

The evaluator received the initial 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 and race/ethnicity. To calculate grade levels taught for science courses, the evaluator matched participant data with the district course file dated October 29, 2019 and calculated the frequency of participants teaching a science course to students at each grade level.

Using updated cohort data provided from STEM Academy staff members on April 22, 2020, the evaluator calculated the percentage of Cohort 1 and Cohort 2 participants that continued to receive program support through the end of program activities.

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 The Dallas ISD began at-home learning on 03/23/20 and continued through the remainder of the spring semester.

⁵ <https://tea.texas.gov/about-tea/news-and-multimedia/correspondence/taa-letters/cancellation-of-staar-testing-for-the-remainder-of-the-school-year>.

Results

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: Original Participating Teacher Characteristics by Cohort

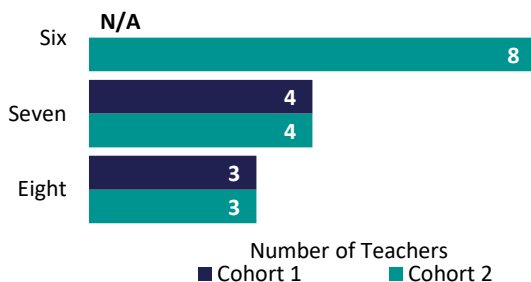
	Cohort 1 (N = 15)		Cohort 2 (N = 30)	
	n	%	n	%
Gender				
Female	12	80.0	20	66.7
Male	3	20.0	10	33.3
Race/Ethnicity				
Asian	0	0.0	2	6.7
African American	8	53.3	17	56.7
Hispanic	4	26.6	2	6.7
White	3	20.0	9	30.0

Source: Teacher data from Southern Methodist University on 05/19/18 (Cohort 1) and 11/02/18 (Cohort 2). District personnel files dated 05/20/18 (Cohort 1) and 09/16/18 (Cohort 2).

Note: Totals may not sum to 100 percent because of rounding.

During fall 2019, four Cohort 1 teachers taught science to grade-seven students and three Cohort 1 teachers taught grade-eight students (Figure 1). For Cohort 2 teachers, eight taught science to grade-six students, four taught grade-seven students, and three taught grade-eight students. One Cohort 2 teacher did not teach a science course during the fall 2019 semester.

Figure 1: Fall 2019 Science Grade Level Taught by STEM Academy Participants



Source: Teacher data from Southern Methodist University on 05/19/18 (Cohort 1), 11/02/18 (Cohort 2), and 04/22/20 (updated cohort data). Grade level data from district course file dated 10/29/19.

Note: Recruitment for Cohort 1 in 2017 did not include grade six teachers. Teachers may have taught multiple grade levels. One Cohort 2 teacher taught a Career and Technical Education course to grade six through grade eight students during fall 2019 and is not included.

Forty-seven percent of Cohort 1 teachers (initial $N = 15$, final $N = 7$) continued participation through the duration of the program. Fewer Cohort 2 teachers (40%, 12 of the 30 initial participants) completed the program.

What were the academic achievement outcomes for students taught by STEM Academy teachers?

Methodology

To examine student outcomes, the evaluator used propensity score matching (PSM) to create matched-comparison groups of students in ten courses⁶ who were not taught by STEM Academy participants. Then, the evaluator compared passing rates for students of STEM Academy teachers to matched-comparison students on the fall 2019 ACP using *chi-square* analyses (statistical significance) and Cramer's V (practical significance; Cohen, 1988).⁷

Results

Overall, fall ACP results varied, with one-year students of STEM Academy teachers passing four exams at higher rates, five exams at lower rates, and one exam at a similar rate, on average, than matched-comparison students (Table 2). For courses where students may have had a STEM Academy science teacher for two years⁸, two-year students of STEM Academy teachers passed four of the six exams at higher rates than matched-comparison students and three of the six exams at higher rates than one-year students of STEM Academy teachers. Analyses indicated significant relationships between having a STEM Academy teacher and passing the ACP in four courses. Students taught Science 6 by a STEM Academy teacher passed at a higher rate (64%) than comparison students (51%), $\chi^2(1, N = 1,330) = 21.7, p < .01$. Students in Science 7 who were taught by a STEM Academy teacher for two years passed at a higher rate (72%) than comparison students (67%) and one-year students of STEM Academy teachers (62%), $\chi^2(2, N = 2,170) = 8.6, p < .05$. Students in Science 8 who were taught by a STEM Academy teacher for one year passed the fall ACP at a higher rate (69%) than students taught by a STEM Academy teacher for two years (67%) and matched-comparison students (62%), $\chi^2(2, N = 1,558) = 7.2, p < .05$. Astronomy students who had been taught by a STEM Academy teacher for one year and two years passed the ACP at lower rates (36%, one year; 58%, two years) than matched-comparison students (76%), $\chi^2(2, N = 476) = 68.4, p < .01$. The practical effects of having a STEM Academy teacher and ACP passing rates were relatively small for the general science courses (Science 6 Cramer's $V = .12$,⁹ Science 7 Cramer's $V = .04$,

⁶ Science 6, Sheltered Science 6, Science 6 Pre-Advanced Placement (Pre-AP), Science 7, Sheltered Science 7, Science 7 Pre-AP, Science 8, Sheltered Science 8, Astronomy, and Physics.

⁷ The analyses intended to include results of the spring 2020 ACP and STAAR data, but those exams were not administered due to the district and TEA response during the COVID-19 pandemic.

⁸ Courses with students who had been taught science by a STEM Academy teacher for two years included Science 7, Science 7 Pre-Advanced Placement, Science 8, Sheltered Science 8, Astronomy, and Physics.

⁹ Cramer's V values of .10, .30, and .50 are considered small, medium, and large, respectively (Cohen, 1988).

and Science 8 Cramer's $V = .05$). The effect size was moderate for Astronomy (Cramer's $V = .27$).

Table 2: Fall 2019 Science ACP Percent Passing for Students of STEM Academy Teachers and Matched-Comparison Students by Course

Group	Tested <i>N</i>	Passed %
Science 6*		
One-Year STEM Academy ^a	665	63.5
Comparison Group	665	50.8
Sheltered Science 6^b		
One-Year STEM Academy	5	40.0
Comparison Group	6	33.3
Science 6 Pre-Advanced Placement		
One-Year STEM Academy	263	73.4
Comparison Group	263	76.4
Science 7*		
One-Year STEM Academy	932	61.7
Two-Year STEM Academy ^c	153	71.9
Comparison Group	1,085	66.5
Sheltered Science 7^d		
One-Year STEM Academy	162	50.0
Comparison Group	164	59.1
Science 7 Pre-Advanced Placement		
One-Year STEM Academy	459	85.8
Two-Year STEM Academy	28	85.7
Comparison Group	487	83.0
Science 8*		
One-Year STEM Academy	592	68.8
Two-Year STEM Academy	187	67.4
Comparison Group	779	62.0
Sheltered Science 8		
One-Year STEM Academy	37	51.4
Two-Year STEM Academy	11	18.2
Comparison Group	48	52.1
Astronomy*		
One-Year STEM Academy	179	35.8
Two-Year STEM Academy	59	57.6
Comparison Group	238	76.1
Physics		
One-Year STEM Academy	143	69.9
Two-Year STEM Academy	29	86.2
Comparison Group	172	72.7

Source: District fall 2019 ACP file dated 02/20/20 and district Public Education Information Management System (PEIMS) file dated 10/31/19.

Note: ^aReceived STEM Academy teacher instruction for one year.

^bOne student received two years of grade six instruction from a STEM Academy teacher, hence the difference in sample sizes.

^cReceived STEM Academy teacher instruction for two years. ^dTwo students received two years of instruction from STEM Academy teachers, hence the difference in sample sizes. *Indicates statistically significant difference, $p < .05$.

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

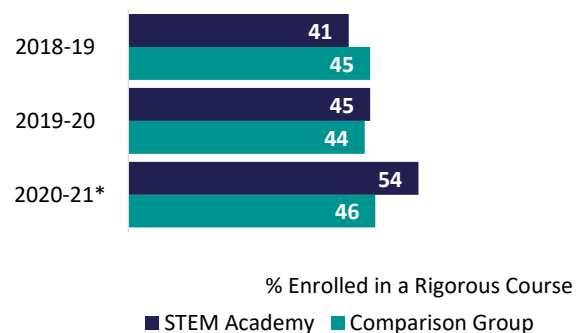
Methodology

The evaluator used PSM to create a group of grade-nine students who were taught by STEM Academy teachers and a group of matched-comparison students who were not taught by STEM Academy teachers during middle school. The evaluator used *chi-square* analyses (statistical significance) and calculated Cramer's V (practical significance; Cohen, 1988) to compare the percentages of former students of STEM Academy participants and comparison students who, in grade nine, enrolled in Pre-AP, AP, or dual credit mathematics or science courses for the 2018-19, 2019-20, and 2020-21 school years.

Results

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 (Figure 2). 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%). During the 2020-21 school year, 54 percent of grade-nine students who were taught by STEM Academy teachers enrolled in a rigorous mathematics or science course compared to 46 percent of matched-comparison students, a statistically significant difference, $\chi^2 (1, N = 2,544) = 15.0, p < .01$. The effect of having a STEM Academy teacher on advanced course enrollment in high school was small (Cramer's $V = .08$).

Figure 2: 2018-19 through 2020-21 Grade-Nine Enrollment of STEM Academy Students and Comparison Students in a Rigorous High School Mathematics or Science Course



Source: District course files dated 10/22/18 (2018-19), 10/28/19 (2019-20), and 10/30/20 (2020-21). PEIMS files dated 10/26/18 (2018-19), 10/28/19 (2019-20), and 10/30/20, (2020-21).

Note: Rigorous courses were defined as AP, Pre-AP, and Dual Credit courses. Data include only matched students. 2018-19 included students taught by Cohort 1 teachers; 2019-20 and 2020-21 included students taught by Cohort 1 and Cohort 2 teachers. *Indicates statistically significant difference, $p < .01$.

RECOMMENDATIONS

Continue to monitor student performance on 2020-21 ACP and STAAR exams in science. Students were not able to take the spring 2020 ACPs or STAAR due to the district and state responses to the COVID-19 pandemic. Results on the fall 2019 ACPs varied with students of STEM Academy teachers passing at higher rates than comparison students in some courses and lower rates in other courses. Analyses of 2020-21 exams should investigate the cumulative effect of having a STEM academy teacher for more than one school year.

Monitor the trend of increased enrollment in advanced mathematics or science courses as the students taught by STEM Academy teachers enter high school. Following the first year of the program, former students of STEM Academy teachers enrolled in advanced mathematics or science courses at a lower rate than matched-comparison students. The rate of enrollment for former students of STEM Academy teachers increased to a rate similar to comparison students following the second program year. Following the third year, the enrollment rate

increased by nine percentage points and was higher than the rate for matched-comparison students. Additional analyses of 2021-22 enrollment should be conducted to investigate the residual effect of having a STEM Academy teacher on the pursuit of STEM coursework as students taught science by STEM Academy teachers in grade six and/or grade seven enter high school.

REFERENCES

- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
- Mickelson, N. (2018). 2017-18 Evaluation of the STEM Academy for Science Teachers and Leaders. Dallas, TX. Dallas Independent School District.
- Mickelson, N. (2019). 2018-19 Evaluation of the STEM Academy for Science Teachers and Leaders. Dallas, TX. Dallas Independent School District.

EA20-610-4

Nolan Rett Mickelson, B. S., Evaluation Analyst I

©2020 Dallas Independent School District (Dallas ISD)

Mail a written request for permission to use or reproduce any part of this document to:

Dallas ISD Department of Evaluation and Assessment; H. B. Bell School Support Center; 2909 Buckner Blvd.; Box10; Dallas, TX 75228

An electronic version of this report can be found at www.dallasisd.org/Page/888.

For more information, please contact Program Evaluation at evaluation@dallasisd.org.