2018-19 Evaluation of the Jonesville Pathway to Science Education

Nolan Rett Mickelson, B.S. EA19-624-4

At-a-Glance

The Dallas Independent School District (ISD) partnered with the Dallas Arboretum and Botanical Garden (DABG) to deliver science instruction through the Jonesville Pathway to Science Education (JPSE) to students at nine elementary schools in the Bryan Adams feeder pattern and one elementary school in the Woodrow Wilson pattern.[1] From September through April, the DABG provided four lessons in every grade three, four, and five classroom at each campus followed by a field trip to the DABG for all participating classes.

Each lesson lasted approximately 50 minutes and was conducted by a pair of educators from the DABG. Each lesson topic and relevant *Texas Essential Knowledge and Skills* (*TEKS*)[2] are presented in Table 1.

Table 1: 2018-19 JPSE Lesson Topics and *TEKS* by Grade

Lesson	Grade 3	Grade 4	Grade 5
One	Traveling Seeds 3.5(A)	Matter Over Time 4.5(A)	Landform Formation 5.7(B)
Two	Energy in the Garden 3.6(A)	Pickle Powered 4.6(A)	Exploring Day and Night 5.8(C)
Three	Rapid Changes 3.7(B)	Disappearing Act 4.9(B)	Ecosystem Interactions 5.9(A)
Four	Models: Sun, Earth, & Moon 3.8(C)	All About Ants! 4.10(B)	Amazing Adaptations: Plants 5.10(A)

Source: Data received from the Dallas Arboretum and Botanical Garden on June 15, 2019.
Note: JPSE = Jonesville Pathway to Science Education. *TEKS* = *Texas Essential Knowledge and Skills*.

The JPSE was initially funded through a $100,000 grant from the Jonesville Foundation and supplemented with a $50,000 grant from the Sammons Corporation.

The purpose of this evaluation was to report the characteristics of students at campuses served by the JPSE program, report student participation, and examine the science-related academic achievements of students who received JPSE instruction.

Demographics and Participation

The evaluator summarized data from the district student demographic file for grade three, grade four, and grade five students at participating campuses (Table 2). Students at JPSE campuses were more likely to be Hispanic and less likely to be African American than other Dallas ISD students in the same grades. The percentages of JPSE students with other characteristics were similar to the percentages for other district students.

Table 2: 2018-19 JPSE Campus Student Characteristics

	JPSE Students (*N* = 2,773)		Other District Students (*N* = 33,190)	
	n	%	*n*	%
Race/Ethnicity				
Asian	24	0.9	381	1.1
African American	358	12.9	7,384	22.2
Hispanic	2,153	77.6	23,168	69.8
Native American	6	0.2	89	0.3
Hawaiian/PI	0	0.0	16	<0.1
Two or More Races	32	1.2	364	1.1
White	200	7.2	1,691	5.1
Not Available	0	0.0	97	0.3
Sex				
Female	1,322	47.7	16,187	48.8
Male	1,451	52.3	17,003	51.2
Special Student Populations				
EL	1,420	51.2	16,634	50.1
SPED	275	9.9	3,650	11.0
Eco Dis	2,400	86.5	29,411	88.6

Source: District Public Education Information Management System demographic file dated October 26, 2018.
Note: JPSE = Jonesville Pathway to Science Education. EL = English learner. SPED = special education. Eco Dis = economically disadvantaged. PI = Pacific Islander. Totals may not sum to 100 percent because of rounding. Includes students in grades three through five enrolled on the 2018-19 Public Education Information Management System snapshot date.

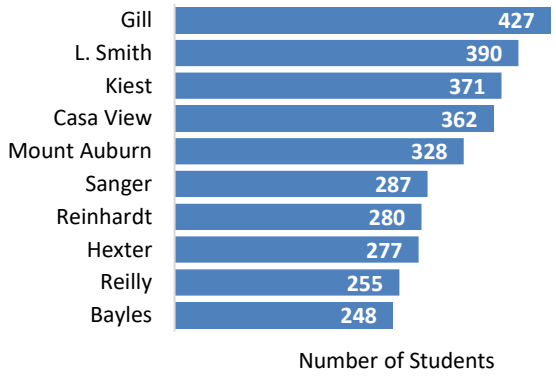
Throughout the school year, students may have enrolled at JPSE campuses and begun participating in lessons at any time. Overall, 3,225 students participated in at least one JPSE lesson or field trip. The number of student participants by campus is shown in

[1] Participating schools included Bayles Elementary School, Casa View Elementary School, Charles A. Gill Elementary School, Victor H. Hexter Elementary School, Edwin J. Kiest Elementary School, Mount Auburn STEAM Academy, Martha Turner Reilly Elementary School, Reinhardt Elementary School, Alex Sanger Preparatory School, and Larry G. Smith Elementary School.

[2] Descriptions of all science *TEKS* can be found at https://tea.texas.gov/curriculum/teks/.

Figure 1. Participation ranged from 248 students at Bayles Elementary to 427 students at Gill Elementary.

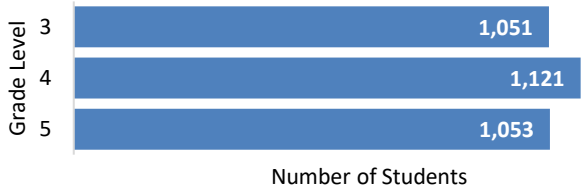
Figure 1: 2018-19 Number of Students Receiving JPSE Instruction by Campus (*N* = 3,225)



Source: Data received from the Dallas Arboretum and Botanical Garden on June 15, 2019.
Note: Includes students who participated in at least one lesson or field trip. JPSE = Jonesville Pathway to Science Education.

The number of students who participated in a JPSE lesson or attended a field trip by grade level is presented in Figure 2. The largest number of participating students was in grade four.

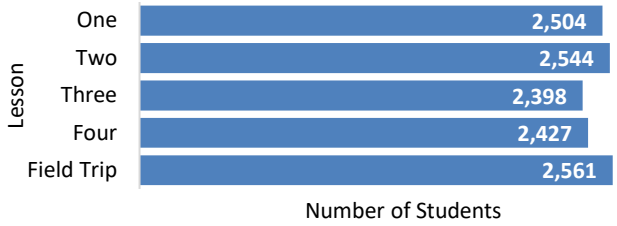
Figure 2: 2018-19 Number of Students Receiving JPSE Instruction by Grade Level (*N* = 3,225)



Source: Data received from the Dallas Arboretum and Botanical Garden on June 15, 2019.
Note: Includes students who participated in at least one lesson or field trip. JPSE = Jonesville Pathway to Science Education.

The number of students per lesson ranged from 2,398 students for lesson three to 2,544 students for lesson two (Figure 3). More individual students attended a field trip to the DABG than participated in any one lesson.

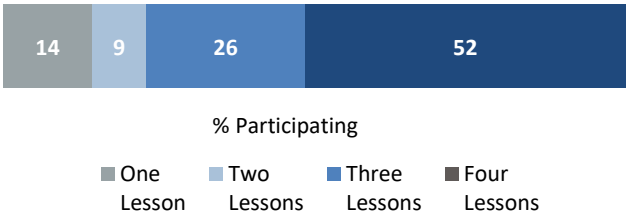
Figure 3: 2018-19 Number of Students Instructed by JPSE Lesson (*N* = 3,225)



Source: Data received from the Dallas Arboretum and Botanical Garden on June 15, 2019.
Note: JPSE = Jonesville Pathway to Science Education.

Of the 3,143 students who participated in at least one of the four JPSE lessons, 52 percent (*n* = 1,618) participated in all four lessons (Figure 4). Additionally, 1,528 students participated in all four lessons and attended the field trip.

Figure 4: 2018-19 Cumulative JPSE Classroom Instruction Received by Students (*N* = 3,143)



Source: Data received from the Dallas Arboretum and Botanical Garden on June 15, 2019.
Note: Includes students who participated in at least one lesson and excludes students who only attended the field trip. JPSE = Jonesville Pathway to Science Education. Totals do not sum to 100 percent because of rounding.

Academic Achievement

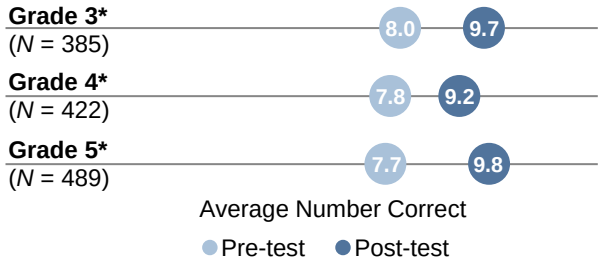
Pre- and Post-Lesson Assessments

DABG staff members developed a pre- and post-test for each lesson. Each test consisted of three multiple choice questions and was administered either on paper or online. Tests were available in English, but not Spanish. The questions and answer choices were re-ordered on the post-test.[3] After four lessons in each classroom, students could have answered 12 pre-test and 12 post-test questions. For students who completed all test questions, the evaluator used a repeated-measures *t* test (statistical significance) and calculated Cohen's *d* (practical significance) at each grade level to compare the average number of correct answers on the pre-tests to the average number of correct answers on the post-tests.

[3] Fifty-four Gill Elementary students received the lesson one pre- and post-test questions in the same order.

As shown in Figure 5, students in all three grades answered significantly more post-test than pre-test questions correctly. Grade five student performance increased most strongly of the grade levels by answering 2.1 more questions correctly on post-tests than on pre-tests, on average, $t(488) = 24.05$, $p < .01$. Grade three students averaged 1.7 more correct answers on post-tests than on pre-tests, $t(384) = 15.90$, $p < .01$, and the grade four average student gain from pre- to post-test was 1.4 more correct answers, $t(421) = 14.68$, $p < .01$. These gains were practically significant at all three grade levels (grade three: $d = 0.81$; grade four: $d = 0.71$; and grade five: $d = 1.09$).

Figure 5: 2018-19 Pre- and Post-Test Results for JPSE Students



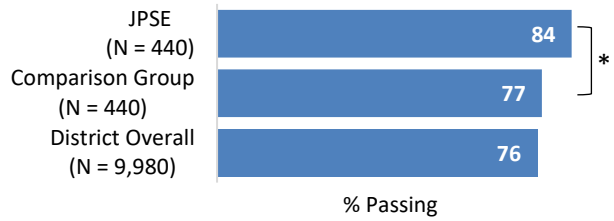
Source: Data received from the Dallas Arboretum and Botanical Garden on June 15, 2019.
Note: Includes students who completed all 12 pre- and post-test questions. JPSE = Jonesville Pathway to Science Education. * = Indicates statistically significant difference, $p < .01$.

Formal Science Assessments

The evaluator used propensity score matching (PSM) to match grade five students who participated in all four JPSE lessons with a comparison group who did not receive JPSE instruction. The evaluator included the following covariates to determine comparison students: student attendance for 2017-18 and 2018-19 school years, race, sex, English Learner status, socio-economic status, special education status, talented and gifted participation, whether retained the previous school year, and 2018 *State of Texas Assessment of Academic Readiness* (*STAAR*) performance on the reading and mathematics subtests. The evaluator then used *chi-square* analyses (statistical significance) and Cramer's *V* (practical significance) to compare passing rates for students who received JPSE instruction to comparison students on the fall 2018 Science *Assessment of Course Performance* (*ACP*). The evaluator also calculated the likelihood that JPSE students would answer all items addressing the grade five *TEKS* standard on landform formation correctly compared to matched students. Finally, the evaluator compared the rates of JPSE students 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.

The JPSE grade five students passed the fall science *ACP* at a significantly higher rate than comparison students, $\chi^2 = 6.98$, $p < 0.01$ (Figure 6). The practical effect was small (Cramer's $V = .09$). Prior to taking the *ACP*, JPSE students received a lesson on landform formation. Though the result was not significant, JPSE students were 1.12 times more likely than comparison students to correctly answer all *ACP* items that addressed the *TEKS* standard on landform formation.[4]

Figure 6: Fall 2018 Grade Five Science *ACP* Results

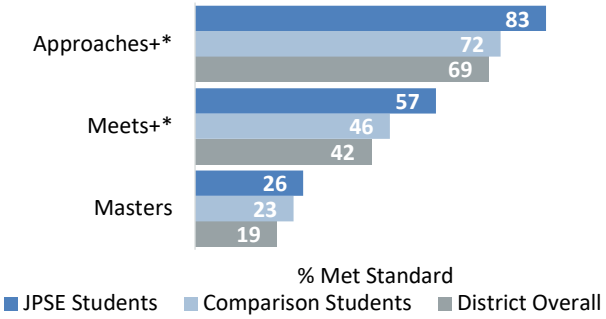


Source: District *ACP* files dated June 13, 2019.
Note: JPSE students include those who participated in all four lessons. JPSE =Jonesville Pathway to Science Education. *ACP = Assessment of Course Performance*. * = Indicates statistically significant difference between JPSE students and comparison students, $p < .01$. District rates are shown for informational purposes only.

Significantly higher percentages of JPSE students than comparison students met the Approaches+ and Meets+ performance standards on the *STAAR* science subtest (Figure 7). Nearly 83 percent of JPSE students and 72 percent of comparison students met the Approaches+ standard, $\chi^2 = 14.34$, $p < 0.01$. Fifty-seven percent of the JPSE students and 46 percent of the comparison students met the Meets+ standard, $\chi^2 = 10.48$, $p < 0.01$. The practical differences between groups in percentage of students meeting each standard were small (Approaches+: Cramer's $V = .13$; Meets+: Cramer's $V = .11$). Differences in the rates of JPSE students and comparison students at the Masters performance standard were not statistically or practically significant.

[4] Students were expected to recognize how landforms such as deltas, canyons, and sand dunes are the result of changes to the Earth's surface by wind, water, or ice (Texas Education Agency, 2018).

Figure 7: Spring 2019 Grade Five Science *STAAR* Results



Source: 2019 district *STAAR* data files dated May 13, 2019.
Note: JPSE students (*N* = 440), comparison students (*N* = 440), and district students overall (*N* = 11,494). JPSE students include those who participated in all four lessons. JPSE = Jonesville Pathway to Science Education. *STAAR* = *State of Texas Assessment of Academic Readiness*. * = Indicates statistically significant difference between JPSE students and comparison students, $p < .05$. District rates are shown for informational purposes only. Does not include *STAAR Alternate - 2*.

Recommendations

- **Offer Spanish versions of lesson pre- and post-tests.** Over half of the grade three, grade four, and grade five students at JPSE campuses were classified as English learners. These students should be offered Spanish versions of lesson pre-tests and post-tests to more accurately assess knowledge growth.

- **Expand the program beyond 10 elementary schools.** Grade five students who participated in all four JPSE lessons met science achievement standards on the *ACP* and *STAAR* at significantly higher rates than matched-comparison students. The program should consider involving additional campuses across the district.

Reference

Texas Education Agency (2018). *Texas Essential Knowledge and Skills* for Grade 5. Retrieved June 17, 2019, from https://tea.texas.gov/curriculum/teks/.

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.