DALLAS ARBORETUM Education

2023-2024 Evaluation of the Jonesville Pathway to Science Education Program

Program Overview and Research Design

Program Overview. The Jonesville Pathway to Science Education (JPSE) is an exploration-based science education initiative the Dallas Arboretum and Botanical Gardens delivers in partnership with Dallas Independent School District (DISD). Through this program, Arboretum educators partner with elementary teachers at ten DISD neighborhood schools to provide six in-school lessons on life and earth science (each lasting approximately 50 minutes) to all students in Grades 3-5. Each lesson is aligned with the Texas Essential Knowledge and Skills (TEKS) standards, as summarized in Table 1. During the school year, all students participating in the program take a field trip to the Arboretum for hands-on learning at the Rory Meyers Children's Adventure Garden.

Table 1. JPSE Lesson Topics and TEKS Alignment, by Grade Level (2023-2024)

Lesson	Grade 3	Grade 4	Grade 5
1	Diving Into Physical Properties 3.5(A)	Matter Over Time 4.5(A)	Sorting Out Mixtures 5.5(B)
2	Energy in the Garden 3.6(A)	Pickle Powered 4.6(A)	Garden Art: Reflections and Refractions 5.6(C)
3	Rapid Changes 3.7(B)	Stories from the Soil 4.7(A)	Landform Formation 5.7(B)
4	Models: Sun, Moon, & Earth 3.8(C)	Earth's Water Cycle 4.8(B)	Exploring Day and Night 5.8(C)
5	A Tour of Texas: Exploring Environments Across Our State 3.9(A)	Ecosystems in Action 4.9(B)	Eco Flow 5.9(A)
6	Life Cycles 3.10(B)	All About Ants! 4.10(B)	Amazing Adaptations: Plants 5.10(A)

Source: Dallas Arboretum schedule of JPSE program curriculum for 2023-2024.

An initial three-year JPSE pilot program ran from fall 2018 through spring 2021. Due to the COVID-19 pandemic, opportunities for Arboretum educators to deliver lessons and guide students on field trips were unavailable from spring 2020 through summer 2021. Beginning with the 2021-2022 school year, the program resumed. Therefore, the results presented for 2023-2024 represent the first-time outcomes are observed for fifth graders who have participated in the program consecutively for three years (third, fourth, and fifth grade).

Research Design. The Arboretum engaged CNM to evaluate the psychosocial (i.e., interest and confidence in doing science) and academic outcomes (i.e., formal science assessment scores and end-of-year course grades) of students who participate in the program, comparing their academic outcomes to a sample of similar DISD students who did not participate in the program. CNM also looked at changes in educator confidence to deliver science instruction (Table 2).

Table 2. Expected JPSE Program Outcomes

Outcome	Measurement Approach
Students	
• Increased confidence in doing science	• Student pre-/post-program questionnaire
• Increased interest in science	• Student pre-/post-program questionnaire
• Science concept mastery*	• Student pre-/post-lesson quizzes (6) • Science STAAR performance, end course grades
Educators	
• Increased confidence teaching science concepts	• Retrospective program survey

** Student concept mastery is determined through formal science assessment and interpreted relative to mastery among a comparison group of similar DISD students who did not participate in JPSE.*

When comparing academic outcomes, this evaluation relies on propensity-score matching[1] to create a synthetic comparison group. The propensity score is calculated using student characteristics (grade level, sex, race/ethnicity, socioeconomic status, English proficiency status, gifted/talented designation, special education status, and school attendance status in 2022-2023). This report summarizes outcomes for participating students in grades third through fifth and their teachers during the 2023-2024 school year.

Summary of Findings

Demographics Participation:

1. **JPSE serves a higher proportion of Hispanic/Latino and White students, compared to DISD as a whole.** Students who participated in at least one JPSE session were more likely to be Hispanic/Latino or White and less likely to be African American compared to their district peers.

Academic Improvements:

2. **Students participating in the JPSE program showed improved science knowledge, with significant increases in assessment scores from pre- to post-lessons across grades.** Among students who participated in all six lessons and completed both pre- and post-assessments, increases were seen for third, fourth, and fifth graders.

3. **Students gain stronger knowledge of science concepts the longer they are exposed to the JPSE program (2 or 3 years).** Students who participated for 2 years (fourth and fifth grade) and those who participated for 3 years (third, fourth, and fifth grade) demonstrated significantly higher science knowledge scores than fifth grade students in their first year of the program.

4. **JPSE students achieve higher end-of-year science course grades compared to their non-participating peers, with consistent improvements across grades three, four, and five.** JPSE students showed significantly higher end-of-year course grades (provided by DISD) in science compared to students in a demographically comparative control group of other DISD students not supported by JPSE.

5. **Students with at least two years of exposure to the JPSE program had, on average, higher end-of-year science course grades compared to students with less exposure and to demographically comparable peers.** Fifth grade students showed significantly higher end-of-year course grades (provided by DISD) in science compared to fifth grade students in their first year of exposure to the JPSE program and compared to students in a demographically comparative control group of other DISD students not supported by JPSE.

Interest and Confidence in Science:

6. **By the end of participation in the JPSE program, students initially disinterested or lacking confidence in science developed stronger interest and/or confidence in science.** Although a majority of students were already interested in science and/or indicated confidence in doing science activities, growth was seen among students reporting low interest in science before starting the program.

Educators Confidence:

7. **The JPSE program led to 87% of educators reporting increased confidence in teaching science concepts.** After participating in the program, educators report that their confidence has increased as a result of their participation.

[1] *Propensity score matching was used to simulate an experimental design, allowing meaningful comparisons between JPSE and non-JPSE students. Since DISD tracked science outcomes for JPSE students, comparisons with the district as a whole were possible, however, any significant differences couldn't be solely attributed to JPSE participation, as initial group differences were unclear. To address this, a matched comparison group of non-JPSE students with similar participation likelihood was created.*

Demographics and Participation

Evaluation Question #1: Who participated in the JPSE program?

School/Student Participation. Ten elementary schools[2] located in geographically diverse areas across Dallas participated in JPSE. The Dallas Independent School District (DISD) maintains comprehensive demographic records for all enrolled students.

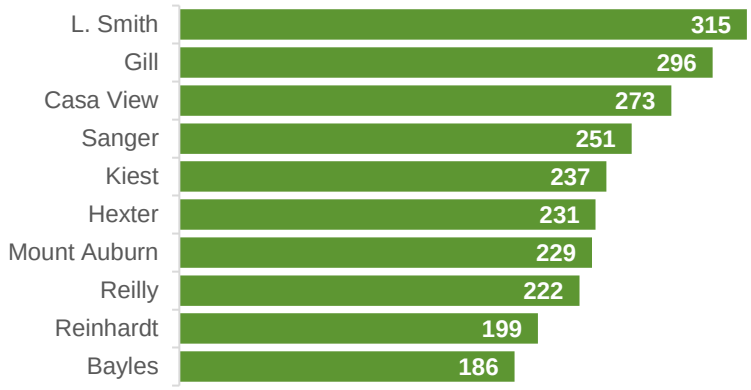
An analysis of DISD demographics data for students in grades three, four, and five revealed that students who participated in at least one JPSE session were more likely to be Hispanic/Latino or White and less likely to be African American compared to their peer's district-wide (Table 3). JPSE participants were otherwise demographically comparable to other DISD students across all other characteristics.

Table 3. Characteristics of Students at JPSE and non-JPSE DISD Neighborhood Schools (2023-2024)

	JPSE Students N=2,326		Other DISD Students N=28,037	
	n	%	n	%
Sex				
Male	1,217	52.3	14,409	51.4
Female	1,109	47.7	13,628	48.6
Race/Ethnicity				
American Indian or Alaska Native	3	0.1	107	0.4
Asian	26	1.1	378	1.4
African American*	242	10.4	5,252	18.7
Hispanic/Latino*	1,810	77.8	19,998	71.3
Hawaiian/Pacific Islander	1	0.0	9	0.0
Two or More Races	43	1.9	641	2.3
White*	200	8.6	1,647	5.9
Not Available	1	0.0	5	0.0
Special Populations				
Economically Disadvantaged	2,000	86.0	24,277	86.6
English Learners	1,250	53.7	15,221	54.3
Special Education	376	16.2	4,625	16.5
Talented & Gifted	591	25.4	7,389	26.4

Source: DISD Public Education Information Management System (PEIMS) demographic file dated August 13, 2024.
*Chi-square tests show the difference between JPSE and non-JPSE DISD students is statistically significant ($p<0.05$).

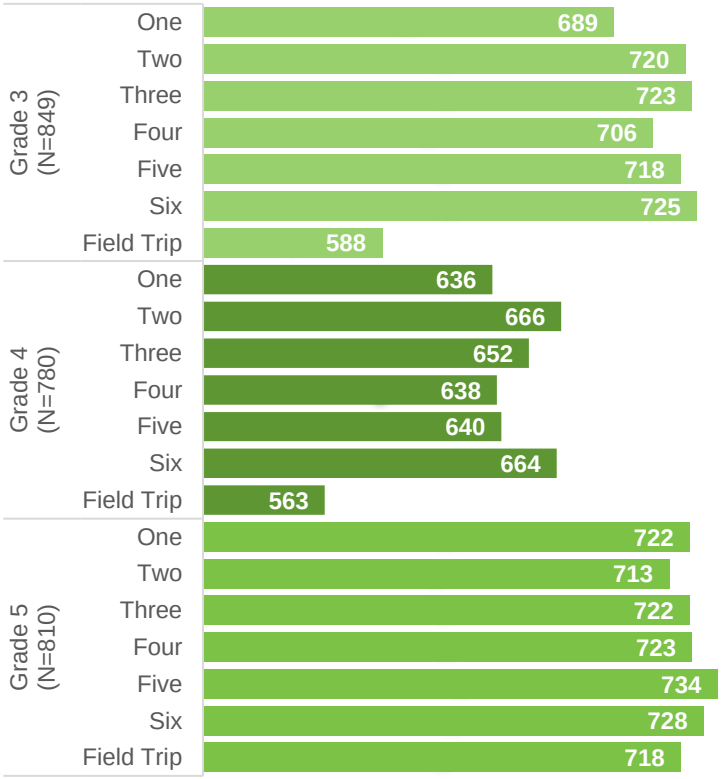
Figure 1. Students Receiving JPSE Instruction by Campus (2023-2024)



Students in grades three through five at any JPSE campus could participate in the program regardless of when they enrolled during the school year. Overall, a total of 2,439 students participated in at least one JPSE lesson, with participation ranging from 186 students at Bayles Elementary to 315 students at Larry Smith Elementary (Figure 1).

[2]*The ten participating DISD elementary schools are Bayles, Casa View, Charles A. Gill, Victor H. Hexter, Edwin J. Kiest, Mount Auburn STEAM Academy, Martha Turner Reilly, Reinhardt, Alex Sanger, and Larry G. Smith.*

Figure 2. Students Receiving JPSE Instruction by Grade Level (2023-2024)



Participation Rate and Field Trips. The participation rate for each lesson ranged from 81% to 91% of all students enrolled in the program (Figure 2). Cumulatively, 61% (1,486) of students participated in all six lessons throughout the school year, including 61% of third graders, 54% of fourth graders[3], and 68% of fifth graders (Table 4). This is consistent with trends over the last three years, during which an average of 61% of students have participated in all six lessons each year.

Through the JPSE program, students also have the opportunity to take a field trip to the Rory Meyers Children's Adventure Garden led by Dallas Arboretum educators. Fifth graders participated between September to December and third/fourth graders participated between February to May. Field trips were attended by 588 third graders (69%), 563 fourth graders (73%), and 718 fifth graders (89%).

Table 4. Cumulative Grade-Level JPSE Instruction Received by Students (2023-2024)

Cumulative Lessons	Grade 3 N=849		Grade 4 N=780		Grade 5 N=810		Overall N=2,439	
	n	%	n	%	n	%	n	%
One	54	6.4%	43	5.5%	26	3.2%	123	5.0%
Two	36	4.2%	37	4.7%	19	2.3%	92	3.8%
Three	74	8.7%	99	12.7%	74	9.1%	247	7.2%
Four	85	10.0%	91	11.7%	77	9.5%	253	10.4%
Five	86	10.1%	89	11.4%	63	7.8%	238	9.8%
Six	514	60.5%	421	54.0%	551	68.0%	1,486	60.9%

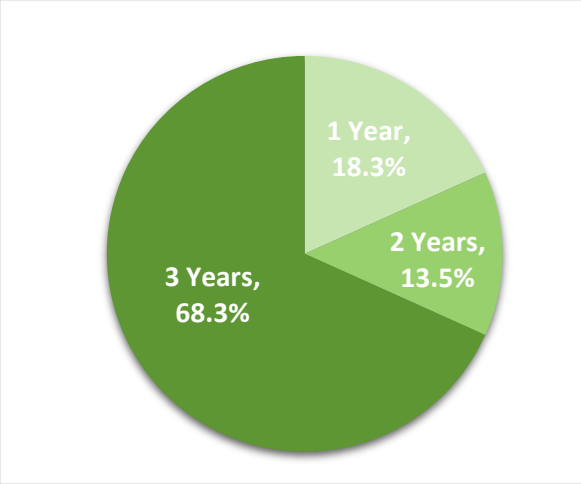
Source: Dallas Arboretum Student Participation Records, 2023-2024
Note: Includes every student with a valid DISD student ID number who participated in at least one JPSE lesson.

Family Admission Tickets. As a benefit of participation in the program, the Dallas Arboretum provided each participating student and teacher with family admission tickets and one parking ticket. These tickets allowed program participants to revisit the Dallas Arboretum with their families, offering further opportunities to explore and engage with science and nature. During the 2023-2024 program year, 184 family tickets were utilized by students and teachers, representing about 7.5% of the total tickets distributed (increase from 4.0% in 2022-2023). This opportunity allowed 698 individuals to experience the Dallas Arboretum, almost doubling from the 369 individuals who took advantage of the opportunity to visit the Dallas Arboretum the previous year. This increase is most likely attributed to improved

[3] *4.1 pre-scores at Keist and 4.5 post-scores at Sanger were missing due to unknown reasons. Since the missing data could not be retrieved, these schools are not representative of the students participating in all six lessons.*

communication about ticket benefits at the beginning of the school year. Additionally, starting in 2022-2023, tickets now cover whole families (up to two adults and four children) without the previous individual ticket limit.

Figure 3. Grade 5 Students Receiving JPSE Instruction by Years of Exposure to JPSE Programming (2023-2024)



Source: Dallas Arboretum student participation records, 2021-2022, 2022-2023, 2023-2024

Note: Includes 2023-2024 5th grade students with a valid DISD student number (merge by DISD student ID between years).

Years of Exposure to JPSE Programming. By 2023-2024, the JPSE program had been supporting the 10 participating schools for three years. Fifth grade students, in particular, had the potential benefit of receiving three years of outreach enrichment through the program. Of the 810 fifth graders, 68% participated for three years (third, fourth, and fifth grade), 14% participated for two years (fourth and fifth grade), and 18% were participating for the first time in fifth grade (Figure 3).

For each campus, the percentage of students receiving third, fourth, and fifth grade outreach enrichment programming ranged from 55% (at Bayles) to 79% (at Kiest). Reference Appendix A for the trend for each campus.

Student Academic Achievement

Evaluation Question #2: What were the academic achievements of participating students?

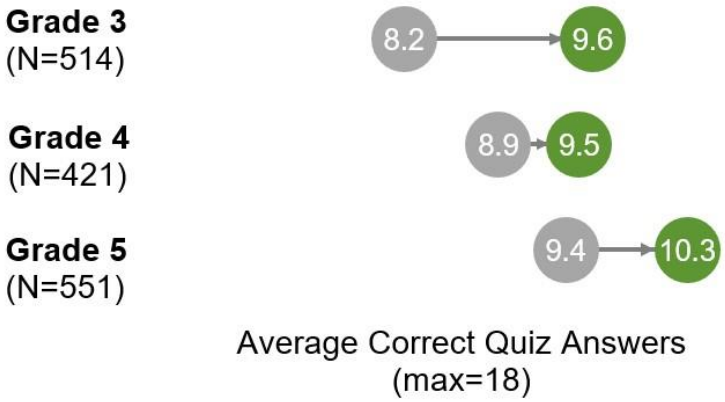
Student academic achievement was captured through measurement of (1) participants' knowledge of science concepts specific to each lesson and its associated TEKS standard and (2) participants' general science mastery in comparison to similar DISD students who did not participate in JPSE. Content-specific knowledge was assessed with pre- and post-lesson quizzes developed specifically for this program. General science knowledge was assessed based on performance in formal, standardized tests and end of year course grades in science

Participants' Knowledge of Science Concepts

Assessment Method. Arboretum staff prepared a three question, multiple-choice quiz to accompany each lesson for each grade level (i.e., six quizzes per grade level, for a total of 18 quizzes, appropriate to the grade level and TEKS content). Arboretum staff provided advanced notification and instructions for quiz administration to teachers in all participating schools and classrooms. Students primarily completed the assessments directly in Google Forms —choosing either the English or Spanish version—and paper forms were used as a backup option, when needed. Students who completed all questions for each available pre- and post-test (i.e., a total of 18 questions) were included in the assessment of content knowledge growth from beginning to end of the program. Assessments from students who did not complete all 18 questions was omitted.

Assessment Results in 2023-2024. Among students who completed all six pre- and all six post-quizzes, the average number of correct answers increased by about one point from pre-tests to post-tests (8.8 versus 9.8 points). The largest score increases occurred among third grade students (1.4 point average gain), and the highest cumulative post-lesson scores were among fifth grade students at 10.3 (Figure 4).

Figure 4. Student Pre- and Post-Lesson Assessment Score Changes (2023-2024)



Legend: Grey = pre-scores and Green = post-scores

Source: Dallas Arboretum student participation records, 2023–2024

Note: Includes students who completed all six lesson assessments. All differences are statistically significant (p<0.001).

Among students who completed quizzes for all six lessons, score increases were consistent and statistically significant across all three grade levels.

Both statistical and practical significance[4] of the students' change in science knowledge were considered as part of the evaluation, using paired t-tests and Cohen's D, respectively. The practical effect size considered the *strength* of the change in quiz scores and consistently found small to moderate effects on student science knowledge, with the weakest effect at fourth grade (0.18) and strongest effect on third grade (0.46) learning (Table 5). A small to moderate effect suggests that the program had a noticeable and significant (but not very large) impact on the science knowledge of students.

Table 5. Cumulative Quiz Scores by Grade Level (2023-2024)

Grade	Quiz	Quiz Score	*T-test Statistic*[5] Statistical Significance	*Cohen's d*[6] Practical Significance
Grade 3 (N=514)	Pre-test	8.2	10.45*	0.46**
	Post-test	9.6		
Grade 4 (N=421)	Pre-test	8.9	3.70*	0.18**
	Post-test	9.5		
Grade 5 (N=551)	Pre-test	9.4	7.18*	0.31**
	Post-test	10.3		
Overall (N=1,486)	Pre-test	8.8	12.22*	0.32**
	Post-test	9.8		

Source: Dallas Arboretum student participation records, 2023-2024

Note: Includes every student with a valid DISD student ID number who completed all six lesson assessments. *Statistical significance was determined using paired t-tests; all values p<0.001. **Practical significance was determined using Cohen's d; all effects can be considered moderately sized.

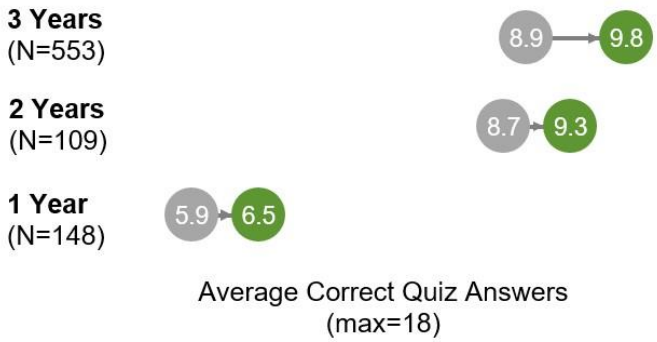
Assessment Results for 5th Graders by Years of Exposure to JPSE Programming. By 2023-2024, the JPSE program had been supporting the 10 participating schools for three years. Among students who participated for three years (third, fourth, and fifth grade), the average number of correct answers increased from 8.9 from pre-tests to 9.8 from post-tests (Figure 5). This is both statistically and practically significant, with a large effect indicating impact that is meaningful in real-world application.

[4]*Statistical significance identifies whether an effect exists (not due to chance), while practical significance identifies whether the effect is large enough to be meaningful in a real-world application.*

[5]*A t-test statistic is a number that measures the difference between pre-test and post-test scores to determine if the difference is statistically significant (or likely due to chance). A t-value closer to zero suggest little to no difference.*

[6]*Cohen's d is a measure of effect size that identifies how big the difference between pre-test and post-test scores are (small=0.2, medium=0.5, large=0.8)*

Figure 5. Grade 5 Student Pre- and Post-Lesson Assessment Score Changes by Years of Exposure to JPSE Programming (2023-2024)



Legend: Grey = pre-scores and Green = post-scores

Source: Dallas Arboretum student participation records, 2021-2022, 2022-2023, 2023-2024

Note: Includes 2023-2024 5th grade students with a valid DISD student number (merge by DISD student ID between years). Students with 1 Year of exposure are statistically signification lower (p<0.001).

As seen in Figure 5, the evaluation identifies that fifth grade post-program science knowledge scores are highest among fifth grade students who have participated in the program for three years.

When comparing years of exposure, the highest significant impact is seen among students with three years of exposure as compared to students in their first year of the program (post-scores on average 3.3 points higher). Students with two years of exposure score on average 2.8 points higher than students in their first year, and although raw average scores are different, no significant difference is seen among students in their second versus third year of program duration (Table 6).

An F statistic of 33.84 (p-vlaue <0.001) shows that *continued exposure of program participation has a notable significant impact on student science knowledge by the end of fifth grade*. A medium to large effect size ($\eta^2 = 0.08$) indicates that exposure has a practical significance and concludes that continued exposure has a meaningful postive impact on student performance.

In addition, students with more years of exposure showed *stronger pre-scores* than students in their first year of programming. The average *growth* of *student scores* from pre- to post-assessment were generally consistent regardless of years of exposure (between +0.57-0.83 points). This indicates that students are retaining knowledge year over year and that students are gaining knowledge of science in fifth grade at the same rate regardless of previous exposure (Table 6).

Table 6. 5th Grade Student Pre- and Post-Lesson Assessment Scores by Years of Exposure to JPSE Programming (2023-2024)

Years of JPSE Exposure	Quiz	Quiz Score	*Average Growth*	*Post-Score Comparison*	*One-Way ANOVA*[7] F Statistic	*Eta-squared*[8] Practical Sig.
1 Year	Pre-test	5.9	+0.57	X	**33.84* (p-value <0.001)**	**$\eta^2 = 0.08$**
	Post-test	6.5		X		
2 Years	Pre-test	8.7	+0.62	+2.8 higher than 1st year post-scores		
	Post-test	9.3				
3 Years	Pre-test	8.9	+0.83	+3.3 higher than 1st year post-scores		
	Post-test	9.8				

Source: Dallas Arboretum student participation records, 2021-2022, 2022-2023, 2023-2024
Note: Includes 2023-2024 5th grade students with a valid DISD student number (merge by DISD student ID between years). Students with 1 Year of exposure are statistically signification lower (p<0.001).

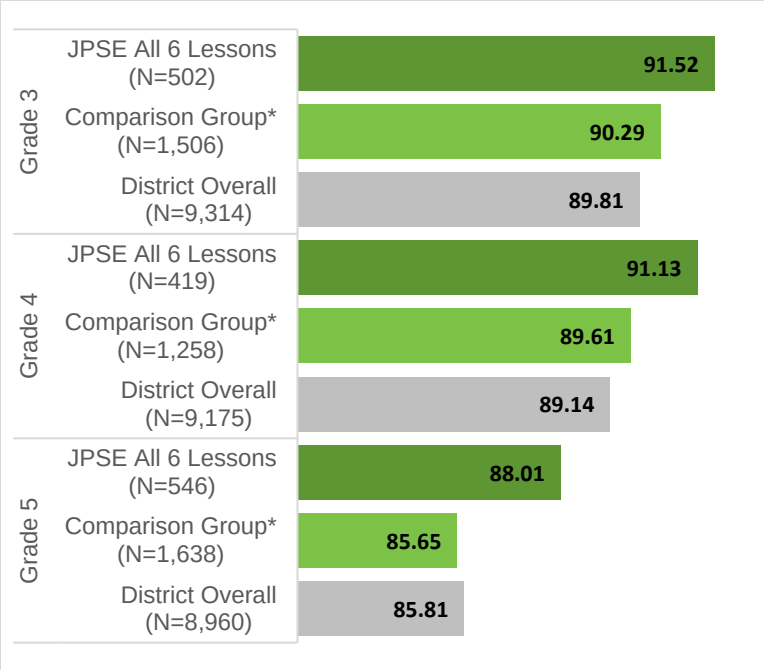
[7] *An F statistic in a One-Way ANOVA determine if there is significance between average post-scores between groups (1 Year, 2 Years, and 3 Years). The larger F-value suggests at least one group is significant (a smaller F-value would suggest groups are similar).*
[8] *Eta-squared identifies the effect of the group difference (small=0.01, medium=0.06, large=0.14)*

Participants' General Science Mastery Comparative to Similar DISD Participants

In addition to student science knowledge growth within the JPSE program, this evaluation compares general science mastery between students who participated in all six JPSE lessons and a comparable group of students in DISD who did not attend schools offering JPSE[9] in two ways: 1) reviewing end of the spring semester final course grade in science; A: 90-100, B: 80-89, C: 70-79, D: 60-69, or F: 0-59 and 2) a formal science assessment, the State of Texas Assessment of Academic Readiness (STAAR), administered each spring[10].

End of Year Science Course Grades. Utilizing t-tests for statistical significance and Cohen's D for practical significance, this evaluation finds that JPSE students who participated in all six JPSE lessons achieved, on average, higher science course grades than their demographically comparable peers across all three grades (Figure 6).

Figure 6. Average End-of-Year Course Grades in Science (Spring 2024)



Source: Dallas ISD COURSE files dated August, 13 2024.
*Statistical significance was determined using t-tests; p-values<0.05.

Among fifth graders, JPSE students averaged 88.01 for the end of year course grade compared to 85.65 for the comparison group. Considering Cohen's D for practical significance, 0.32 indicates a small to medium effect size, implying results are somewhat meaningful in real-world application. JPSE fourth graders averaged 91.13 for end of course grades as compared to 89.61 for their peers and JPSE third graders averaged 91.52 compared to 90.29 in the comparison group, both showing small effect sizes.

It is important to note that while the analysis compares the average course grades across groups, grading practices are not standardized across educators. Each educator has the discretion to apply their own criteria and methods for evaluating student performance. This variability in grading may introduce differences that are independent of the students' actual performance and could affect the comparability of the results.

Table 7. Average End-of-Year Course Grades in Science (Spring 2024)

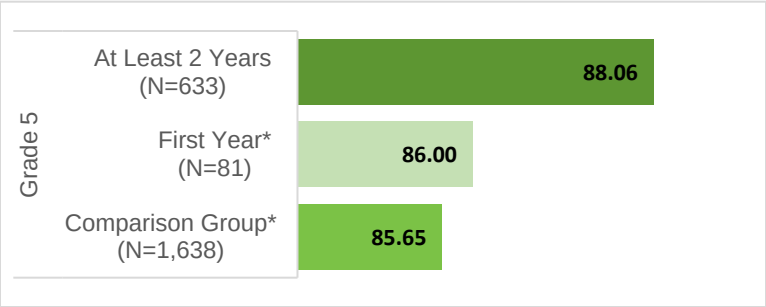
Grade	JPSE All 6 Lessons	Comparison Group	*T-Test Statistic*	*Cohen's D*
Grade 3	91.52	90.29	6.95*	0.32
Grade 4	91.13	89.61	4.13*	0.21
Grade 5	88.01	85.65	3.71*	0.17

Source: Dallas ISD COURSE files dated August, 13 2024.
*Statistical significance was determined using t-tests; p-values<0.05.

[9]The comparison group consistent of a 3 to 1 matched sample of students using the covariates student grade, race/ethnicity, sex, English learner status, socioeconomic status, special education status, talented and gifted participation, and retention from 22-23.
[10]In 21-22 and 22-23 the Assessments of Course Performance (ACP) assessment was also considered, but in 23-24, DISD only assessed 6th-12th grade students with these assessments, therefore, results were unavailable for participating 3rd, 4th, or 5th graders.

End of Year Science Course Grades by Years of Exposure to JPSE Programming. Similar to the other results found in this evaluation, average end-of-year course grades in science indicate that JPSE students with at least two years of exposure to the JPSE program, on average, had higher end-of-year course grades in science than JPSE students who were in their first year of JPSE programming. Additionally, fifth graders with at least two years of exposure to the JPSE program averaged higher science course grades than their demographically comparable peers (Figure 7). These findings highlight the positive impact of sustained participation in the JPSE program on students' academic performance in science.

Figure 7. Grade 5 Average End-of-Year Course Grades in Science by Years of Exposure to JPSE Programming (Spring 2024)



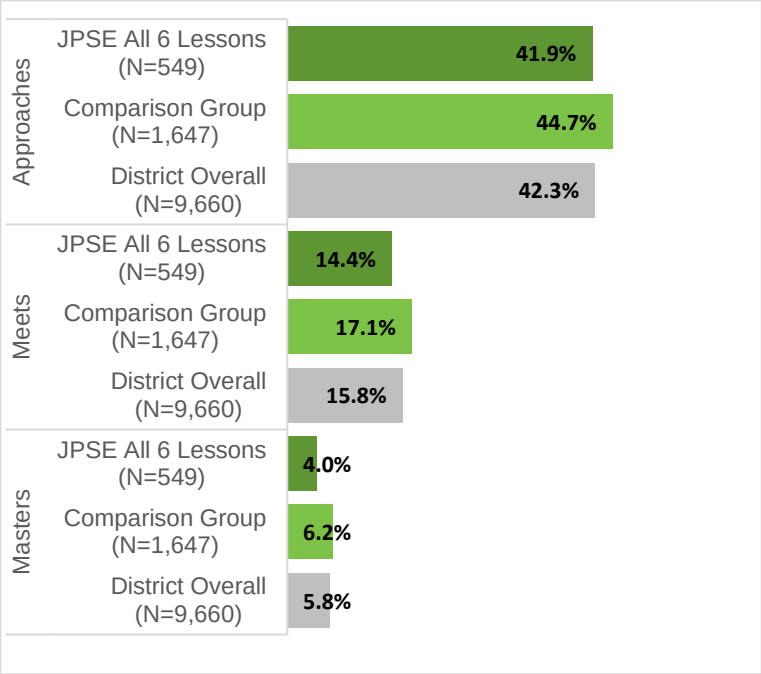
Source: Dallas ISD COURSE files dated August, 13 2024.
*Statistical significance was determined using t-tests; p-values<0.05.

STAAR Performance. STARR categories are measured from least to greatest performance as "Did Not Meet Grade Level", "Approaches Grade Level", "Meets Grade Level" and "Masters Grade Level". Starting in the 2022-2023 school year, the STAAR test saw several changes, moving predominantly online and reducing multiple-choice questions while incorporating more interactive, technology-enhanced question formatting. These revisions align with Texas Education Agency updates, which are aimed at better assessing student learning post-pandemic.[11] It is important to note that STAAR science scores across the district in Spring 2024 were noticeably lower than in Spring 2023.[12] The lower science scores are thought to be likely influenced by a combination of factors, including the increased emphasis on reading and math in recent years, as well as ongoing challenges from pandemic disruptions. With higher reading and math scores being prioritized, subjects like science and social studies saw declines as they were not receiving the same level of targeted support.

Using chi-square analyses for statistical significance, and Cramer's V for practical significance, the evaluation finds *no significant differences in STAAR science assessment performance between students who participated in all six JPSE lessons and a comparison group* (Figure 8).[13] Approximately 41.9% of JPSE students and 44.7% of comparison group students met the "Approaches Grade Level" standard. 14.4% of JPSE students and 17.1% of comparison group students met the "Meets Grade Level" standard. 4.0% of JPSE students and 6.2% of comparison group students achieved the "Mastered Grade Level" indicator.

[11] *https://tea.texas.gov/student-assessment/staar/staar-released-test-questions*
[12] *https://dallasexpress.com/education/staar-3-8-scores-show-drops-in-math-science/*
[13] *To avoid confusion, practical significance is not listed here for the comparison group due to lack of difference between groups.*

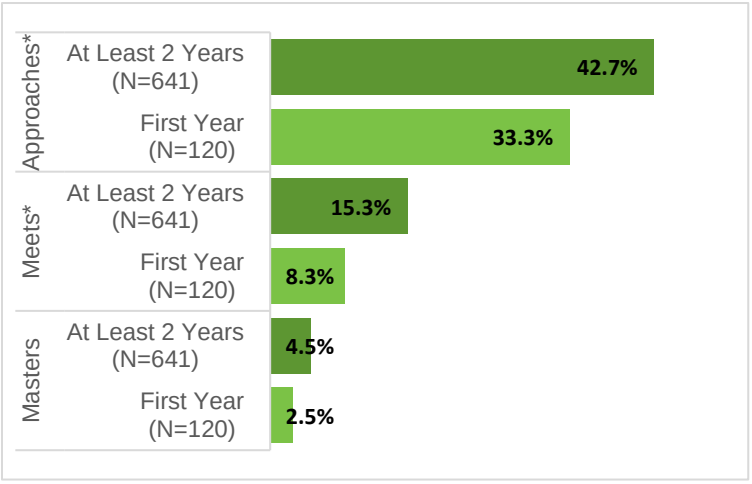
Figure 8. Grade 5 STAAR Science Outcomes (Spring 2024)



Source: Dallas ISD STAAR files dated August, 13 2024.

STAAR Performance by Years of Exposure to JPSE Programming. Figure 9 shows that participants with at least two years of exposure to JPSE programming tend to perform better compared to first-year participants across all performance categories. The majority of long-term participants fall under the "Approaches" category (42.7%), while fewer participants meet or exceed expectations in the "Meets" (15.3%) and "Masters" (4.5%) categories. First-year participants have lower performance percentages, with 33.3% in "Approaches," 8.3% in "Meets," and 2.5% in "Masters," indicating that longer retention may be linked to higher performance outcomes.

Figure 9. Grade 5 STAAR Science Outcomes by Years of Exposure to JPSE Programming (Spring 2024)



The evaluation finds that students with at least two years of JPSE programming exposure are *significantly more likely to either approach or meet STAAR grade-level standards in science than students in their first-year of participation.* No significant differences were found for students mastering science grade level standards.

Source: Dallas ISD STAAR files dated August, 13 2024.
*Statistical significance was determined using t-tests; p-values<0.05.

Student Interest and Confidence in Doing Science

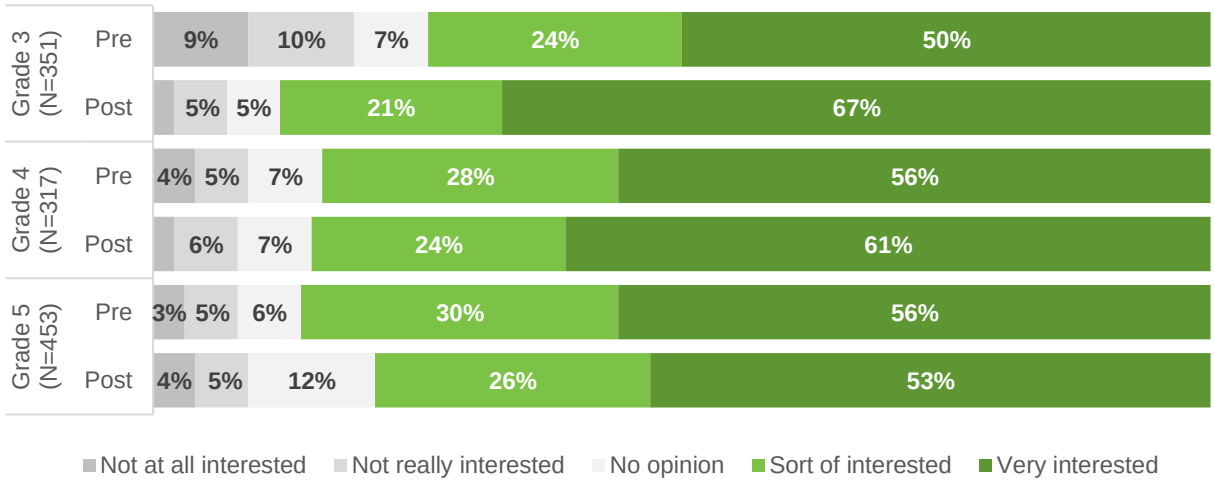
Evaluation Question #3: How did student interest and confidence in doing science change through participation in the program?

To measure the JPSE program's impact on students, the Dallas Arboretum measures student interest in science and confidence in conducting science activities before the first and after the last lesson of the program. Students rated their agreement with the statements "How interested are you in science?" and "How confident, or sure of yourself, do you feel when doing science?" on a five-point scale, ranging from "Not at all" to "Very interested" or "Very confident."

Interest in Science

Interest in Science 2023-2024. Student amount of participation in the program varied, and receiving the full dose of the program – six classes – was expected to influence student interest in science. At the start of the program, students expressed strong interest in science. Cumulatively, 81% of students indicated they were interested in science *before* they participated in any JPSE activities (n=916 of 1,121). This proportion increased slightly to 84% at the end of the program, but was not statistically significant. However, statistical significance was found for Grade 3 students participating in all six lessons, where 74% showed interest in the fall and 88% showed interest in the spring (Chi-square 26.79 and p-value <0.0001, Figure 10).

Figure 10. Student Pre- and Post-Program Interest in Science, Among Students Who Attended All Six JPSE Lessons (2023-2024)



Source: Dallas Arboretum Student Participation Records, 2023-2024
Note: Includes every student who completed the interest assessment before beginning lessons and after concluding lessons. Statistical significance of fall-spring change was determined using McNemar's Chi-square test.

Table 8. Heat Map Interest in Science from Pre to Post (2023-2024)

		Post	
		No Interest	Interested
Pre	No Interest (n=205)	35.6%	64.4%
	Interested (n=916)	12.2%	87.8%

Interest in Science Among Students Showing No Interest at Pre. While no statistical significance was found indicating that students increase their interest levels in science when participating in the program, it should be noted that 205 students (19% of all students assessed) indicated they were either not interested in or had no opinion regarding science at the beginning of the program; more than half of these students (64%) became interested in science in the spring (Table 8).

This suggests that the program appears to have a positive impact on increasing students' interest in science, specifically among students who were initially not interested.

Table 9. Heat Map of Interest in Science from Pre-3rd Grade (2021-2022) to Post-5th Grade (2023-2024)

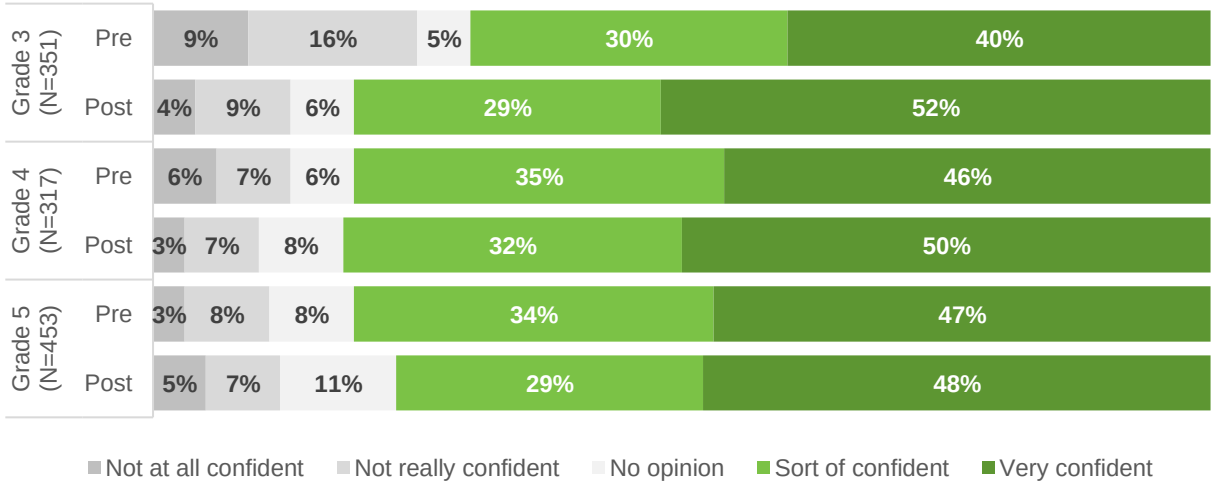
		Post Grade 5 in 2023-2024	
		No Interest	Interested
Pre 3rd Grade in 2021-2022	No Interest (n=65)	27.7%	72.3%
	Interested (n=303)	22.4%	77.6%

Interest in Science after 3 Years of Exposure. Similarly, no statistical significance was found to indicate that students increase their interest levels in science from Grade 3 through Grade 5 (n=368 students completed Pre-Grade 3 and Post-Grade 5 surveys). It should be noted, however, that of the 65 third grade students (18%) who indicated they were either not interested or had no opinion in science in the fall of 2021, almost three-fourths (72%) reported an interested in science in the spring of 2024 (Table 9). This aligns with the suggestions that the program appears to have a positive impact on increasing students' interest in science, specifically among students who were initially not interested.

Confidence in Science

Confidence in Science 2023-2024. At the start of the program, students expressed widespread confidence in science. Together, 77% of students expressed confidence in doing science before they participated in any JPSE activities. This proportion increased slightly to 80% at the end of the program, but was not statistically significant. *However, among Grade 3 students who participated in all six JPSE lessons, significant gains in science confidence were made from fall to spring* ($p<0.01$, Figure 11).

Figure 11. Student Pre- and Post-Program Confidence in Science (2023-2024)



Source: Dallas Arboretum Student Participation Records, 2023-2024
Note: Includes every student who completed the interest assessment before beginning lessons and after concluding lessons. Statistical significance of fall-spring change was determined using McNemar's Chi-square test.

Table 10. Heat Map Confidence in Science from Pre to Post (2023-2024)

		Post	
		No Confidence	Confidence
Pre	No Confidence (n=253)	35.2%	64.8%
	Confidence (n=868)	16.0%	84.0%

Confidence in Science Among Students Showing No Confidence at Pre. While no statistical significance was found to indicate that students increase their confidence in science when participating in the program, it should be noted that 253 students (23%) indicated they either had no confidence in or no opinion regarding science at the beginning of the program, and more than half (65%) increased confidence in science in the spring (Table 10). This suggests that the program appears to have a positive impact on increasing students' confidence in science, specifically among students who were initially without confidence.

Table 11. Heat Map of Confidence in Science from Pre-3rd Grade (2021-2022) to Post-5th Grade (2023-2024)

		Post Grade 5 in 2023-2024	
		No Confidence	Confidence
Pre 3rd Grade in 2021-2022	No Confidence (n=70)	32.9%	67.1%
	Confidence (n=295)	24.1%	75.9%

Confidence in Science after 3 Years of Exposure. Similarly, no statistical significance was found to indicate that students increase their confidence in science from Grade 3 through Grade 5 (n=365 students completed Pre-Grade 3 and Post-Grade 5 surveys), but it should be noted that of the 70 third grade students (19%) who indicated they either had no confidence or no opinion in science in the fall of 2021, 67% gained confidence in science in the spring of 2024 (Table 11). *This aligns with the suggestions that the program appears to have a positive impact on increasing students' confidence in science, specifically among students who were initially without confidence.*

Educator Confidence in Teaching Science Concepts

Evaluation Question #4: How did the program influence teacher confidence in teaching science concepts?

The final evaluation element for JPSE in the 2023-2024 school year was educators' self-reported change in confidence in teaching science concepts as a result of the program. A total of 33 educators (28 teachers and 5 school administrators) responded to a program reflection and satisfaction survey at the conclusion of the 2023-2024 program. Among the educators providing feedback were classroom teachers of all four core subjects (i.e., language arts, math, science, and social studies), principals/assistant principals, and instructional coaches. While science teachers were predominantly represented—with 82.1% of teachers reporting a current classroom role addressing science education—teachers with a primary focus on math, language arts, and/or social studies were also included in the program (Table 12).

Table 12. Educator Campus Roles (2023-2024)

	Teachers N=28			Administrators N=5	
Classroom Teaching Roles	**n**	**%**	**Administrative Roles**	**n**	**%**
Language Arts	20	71.4	Assistant Principal	1	20.0
Mathematics	14	50.0	Instructional Coach	2	40.0
Science	23	82.1	Principal	1	20.0
Social Studies	17	60.7	Other School Administrator	1	20.0

Source: Dallas Arboretum end of year educator survey

Overall, 87% of educators reported experiencing either "a little" or "a great deal" of increased confidence in teaching science concepts as a result of their involvement with JPSE (Figure 12).

Four educators felt their confidence remained about the same, but reported they had no issues implementing the curriculum in their classrooms, were given new ideas for things to do with their classes, and hope to see the program come back next year. When asked how the program impacted teaching practices, educators overall felt that the JPSE program significantly enhanced science education by increasing hands-on experiments and providing creative teaching strategies to implement in their classrooms, which boosted student engagement and personal confidence. Educators appreciated the new information, practical applications, and alignment with TEKS standards, fostering a deeper appreciation and regular incorporation of science into the curriculum.

Figure 12. Educator Self-Reported Change in Confidence Teaching Science Concepts (2023-2024)

Source: Dallas Arboretum end of year educator survey

Table 13. Educator Self-Reported Increase in Confidence Teaching Science Concepts (2023-2024)

Educators	% Increase
All Educators (n=31)	87.1%
Language Arts Educators (n=21)	90.5%
Mathematics Educators (n=16)	81.3%
Science Educators (n=24)	87.5%
Social Studies Educators (n=18)	88.9%
Grade 3 Educators (n=12)	66.7%
Grade 4 Educators (n=9)	100%
Grade 5 Educators (n=9)	100%
Teaching Experience 1-4 Years (n=7)	71.4%
Teaching Experience 5-12 Years (n=8)	87.5%
Teaching Experience 13+ Years (n=16)	93.8%

Source: Dallas Arboretum end of year educator survey

Although the sample size of 31 educators who responded to the survey about confidence in teaching science concepts is too small for drawing broad statistical conclusions, it is still valuable to explore how variation in educators' confidence may differ by subjects taught, grade levels taught, and years of teaching experience (Table 13). Language Arts educators (90.5%) and fourth/fifth grade teachers (100%) had the highest confidence gains, while Mathematics educators (81.3%) and third grade teachers (66.7%) reported lower increases. Educators with 13+ years of experience (93.8%) saw the most confidence growth, while those with 1-4 years reported the least (71.4%). These results suggest that the JPSE program has been broadly effective at increasing educator confidence in teaching science, though the small sample here indicates the possibility that some teachers may benefit from additional support.

Recommendations

1. **Continue providing science lessons and field trips to DISD students.** Students who participated in the program showed gains in their knowledge, interest, and confidence in doing science. Clear student benefit from the program supports program continuation and/or expansion to more schools.

2. **Work with school partners to support full program participation across more students.** The JPSE program is most effective among students who received all planned lessons. Approximately 40% of participating students received less than the six lessons.

3. **Work with school partners to encourage retention of program participation across three years of program offering.** JPSE students who participated for two years (fourth and fifth grade) and those who participated for three years (third, fourth, and fifth grade) demonstrated significantly higher science knowledge scores than fifth grade students in their first year of the program.

4. **Streamline outcomes questions.** Students are currently asked if they increase interest and confidence in doing science as a result of participating in the JPSE program. Data shows that students report a high level of interest at the beginning of the program and maintain that interest throughout program participation, resulting in a high score for this question, but little growth. Suggested approach is to modify the end-of-year questions to be “How has your interest in science changed as a result of participating in the JPSE program?” and “How has your confidence when doing science activities changed as a result of participating in the JPSE program?”

5. **Share results with the educators.** On the end-of-year survey for educators, some expressed interest in seeing the results of the pre- and post-assessment that are given to their students. Sharing results would allow educators to see the tangible impact of the program, reinforcing its value and effectiveness in enhancing student learning. Additionally, educators would gain clear understanding of their students’ growth, an enhanced sense of partnership, and empower them with actionable insights.

Appendix A:
Number of Years Receiving Outreach Enrichment Programming by Campus (2023-2024)

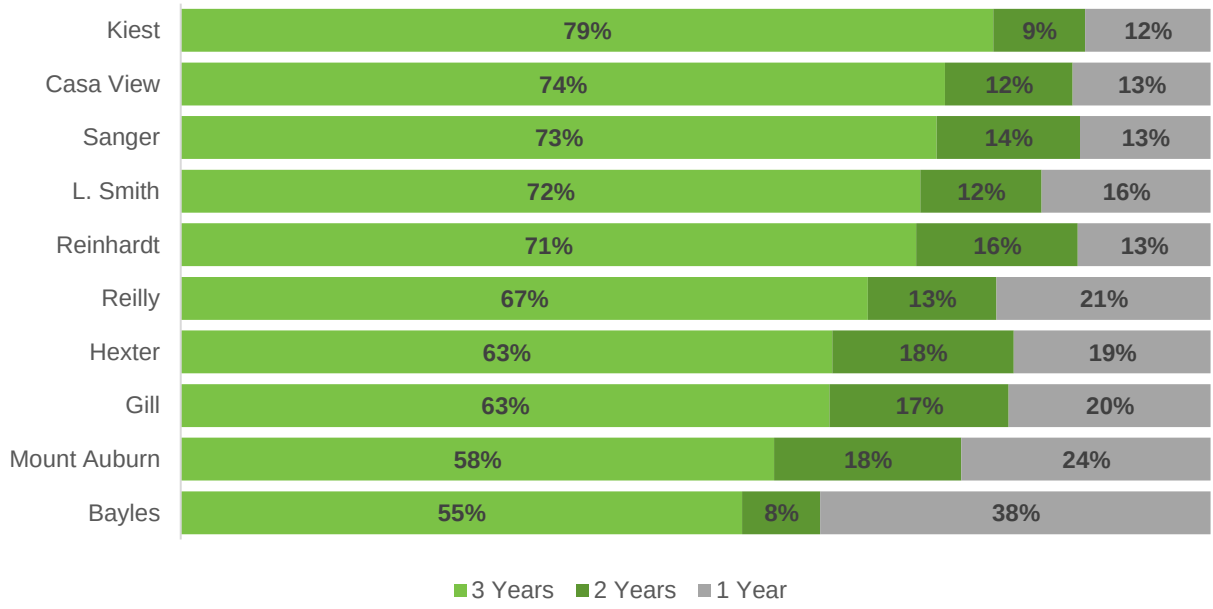
The table below shows the 10 participating schools and the number/percentage of fifth graders by number of years receiving outreach enrichment programming.

Table 14. Number of Years Receiving Outreach Enrichment Programming by Campus (2023-2024)

	%			N		
	3 Years	**2 Years**	**1 Year**	**3 Years**	**2 Years**	**1 Year**
Bayles	54.5%	7.6%	37.9%	36	5	25
Casa View	**74.2%**	12.4%	13.4%	72	12	13
Gill	63.0%	17.4%	19.6%	58	16	18
Hexter	63.2%	17.6%	19.1%	43	12	13
Kiest	**78.9%**	8.9%	12.2%	71	8	11
L. Smith	**71.8%**	11.8%	16.4%	79	13	18
Mount Auburn	57.6%	18.2%	24.2%	38	12	16
Reilly	66.7%	12.5%	20.8%	48	9	15
Reinhardt	**71.4%**	15.7%	12.9%	50	11	9
Sanger	**73.4%**	13.9%	12.7%	58	11	10
Total	**68.3%**	**13.5%**	**18.3%**	**553**	**109**	**148**

Source: Dallas Arboretum Student Participation Records, 2023-2024
*Percentages in green identify schools with over 70% students receiving 3 straight years of programming.

Figure 13. Number of Years Receiving Outreach Enrichment Programming by Campus (2023-2024)



Appendix B: Additional Educator Feedback on JPSE

Teachers and administrators generally reported strong satisfaction with JPSE and their partnership with the Arboretum. Educators expressed high agreement that the program impacted their teaching practice (89.3%), increased student interest in doing science (96.4%), and increased student confidence in doing science (96.4%).

Table 15. Percentage of Educators Expressing Satisfaction or Growth, by Position (2023-2024)

	Teachers N=28		Administrators N=5	
Statement	**n**	**%**	**n**	**%**
Overall experience rating	27	96.4	5	100
Field trip experience rating	23	82.1	5	100
Impacted teaching practice*	25	89.3	3	100
Classroom lesson rating	23	85.2	5	100
Students increased confidence	27	96.4	5	100
Students increased interest in doing science	27	96.4	5	100
I received the pre-assessments with enough time to implement	28	100	N/A	
The directions for implementing the pre-assessments were clear	28	100	N/A	
I was notified of the classroom program dates and times with enough notice	28	100	N/A	
I was notified of the field trip date with enough notice	28	100	N/A	

**Denominator is different from total teacher/administers surveyed because N/A selections are removed.*

In addition to feedback specific to their confidence in teaching science concepts and experience with the program, educators provided qualitative feedback on the experience for themselves and their students.

Feedback on Classroom Lessons. The classroom lessons were generally well-received, with teachers praising their engagement, exploratory nature, and positive student response. Some feedback highlighted the need for better differentiation for advanced students and more Spanish language support.

"The classroom lessons were wonderful and engaging. Thank you for offering them :)"

Feedback on Field Trips. The general feedback about field trips was largely positive, with teachers appreciating the organization, educational content, and overall experience, with many students enjoying the lessons and activities. Some issues were mentioned around scheduling conflicts, transportation issues, having enough materials for all students (like microscopes), and requests for making the lessons more relevant to the setting, like focusing on arboretum-related topics instead of other, unrelated science concepts.

Feedback on Impact on Students. Teachers felt the program had a positive impact on students, fostering excitement for hands-on science activities and increasing their motivation and confidence in learning science concepts. Teachers appreciated the engaging lessons, real-world applications, and noted that students were eager to participate. Some teachers showed interest in seeing the program's specific learning outcomes (pre/post scores) for their students to see how the program is impacting them.

Feedback on Impact to Teaching Practices. The JPSE program positively impacted teaching practices by increasing teachers' confidence in delivering science lessons, offering new strategies for student engagement, and emphasizing hands-on, real-life explorations in science. Teachers also gained ideas for incorporating creative and interactive approaches to science instruction, which helped align with curriculum objectives and fostered greater appreciation for science in the classroom.

"Being new to the grade level and subject this year, this program has helped me become more familiar with the science teks."

Additional Comments. The additional comments reflected overall satisfaction with the program, praising clear communication, the helpfulness of the staff, and the convenience of the pre- and post-assessment process. There was an emphasis on thankfulness for the assessments being in both English and Spanish. Teachers expressed enthusiasm for the program's return next year, highlighting its importance and positive impact on students.