The Impact of the Frog Street Pre-K Curriculum on 2021-22 Pre-K Gains and Kindergarten Readiness

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Contents

EXECUTIVE SUMMARY:
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Program Background

Frog Street Pre-K is a comprehensive, research-based curriculum that integrates instruction across developmental domains and is aligned to state and national standards. The bilingual curriculum is organized into five domains and five skill/content areas that support integration and builds connections between and among all disciplines. The program empowers teachers to know not only what to teach but also the how and why of instructional strategies. The five cornerstones of the curriculum are:

- Integration of Themes, Disciplines, and Learning Domains
- Social and Emotional Development
- Differentiated Instruction
- Equity of English and Spanish Instruction and Materials
- Child-centered approaches toward learning

Founded in 1989, Frog Street released their Pre-K curriculum in 2011, with the earliest studies taking place in Nashville, San Antonio, Houston, and Beaumont (TX) school districts. Frog Street eventually captured 47% of the market share in Texas state adoption of pre-K curriculum and has continued to expand across the United States. A revised version of the Pre-K curriculum was released in 2020 and is the focus of the current study.

Description of Services

The Frog Street Pre-K curriculum covers literacy, math, and content domains and is intentionally designed to support student development across four domains: physical, social and emotional, cognitive, and language. Math content is based on recommendations from the National Council of Teachers of Mathematics and additionally integrates STEM approaches. The curriculum is multi-lingual and available in English, Spanish, and dual-language formats. It also includes strategies for cultural responsiveness and differentiated instruction, along with adaptations for special needs and English Language Learners. A fully integrated digital assessment tool informs instruction, and professional development tips at point-of-use help to build teacher capacity. As part of the child-centered approach to learning, the curriculum encourages a "joyful" approach to learning. In addition to the literacy and math content, Frog Street includes support for social-emotional development. Specifically, Frog Street features content based in Conscious Discipline, a set of strategies designed to build a strong

social-emotional foundation from which children can learn to solve conflicts and manage their emotions.

The Present Study

The purpose of the present study was to examine Frog Street Pre-K curriculum efficacy by comparing learning outcomes for pre-K students in schools with access to Frog Street in Texas during the 2021-22 school year to outcomes for pre-K students in Texas schools without Frog Street.

This study is designed to replicate and extend those employed by NORC (the National Opinion Research Center) at the University of Chicago in 2018, using data from the same assessment (CIRCLE). The NORC studies yielded mixed results, some favoring the Frog Street Pre-K curriculum (particularly for kindergarten readiness) and some not, but a concern was that classifications of schools as users or non-users of the curriculum were not sufficiently accurate for the 2017-18 school year. This limitation is not expected to occur with the present, 2021-22 classifications.

In this analysis, we specifically examined the association between Frog Street access (at the district level) and student learning gains. More specifically, this study compares fall 2021 to spring 2022 learning gains on the CIRCLE assessment for pre-K students in Texas districts with access to Frog Street during the 2021-22 school year against those who were in Texas districts with access to another curriculum. The main research question for this study includes:

1. What is the relationship between access to Frog Street and learning gains on the CIRCLE assessment in the following areas:
   a. Mathematics?
   b. Emergent Literacy – Reading?
   c. Language and Communication?
   d. Health and Wellness?
   e. Emergent Literacy – Writing?

Results and Conclusions

The study sample consisted of about 78,000 students in pre-K from the state of Texas. Students in districts who received Frog Street curriculum materials during the 2021-22 school year were compared to similar students in other Texas districts that used curriculums other than Frog Street.

Key findings of the current study include:

- Access to the Frog Street Pre-K curriculum is associated with learning gains in reading on the Spanish language version of the assessment, when comparing students in Frog Street districts to similar students in districts using another curriculum.
- No significant associations were found between Frog Street access and learning gains in the Language, Writing, Mathematics, and Health subjects in either language version.

Overall, there was generally a positive association between Frog Street and student learning gains. Figure 6 shows that in most subjects across languages, Frog Street students had larger learning gains than similar peers who used other curriculum. This result was particularly consistent and larger on the Spanish language subject scores where the two largest effect sizes of Frog Street on CIRCLE scores were on the Reading and Health assessments. However, as reported above, the only statistically significant impact was for Reading on the Spanish language assessment.

Access to the Frog Street Pre-K Curriculum is associated with greater learning gains in Reading for Spanish language students

Access to the Frog Street Pre-K curriculum during the 2021-22 school year was linked with improved outcomes in reading (both on CIRCLE assessment scores and being kindergarten ready) for students who took the Spanish language version of the assessment. Although this result was consistent across both language versions, it was only significant for Spanish language students.

Frog Street access had more consistently positive associations with learning gains for Spanish language students

Access to Frog Street had a more positive relationship with learning gains for students who took the Spanish language versions of the CIRCLE assessment across all subjects: reading, language, writing, mathematics, and health. Although not always significant, this relationship was consistently more positive than for students taking the English language assessments. This positive relationship for Spanish language students suggests that the program should continue to target this learner group and that in its current form it was most impactful for this group.

Limitations of the Current Study

Given the many unknowns regarding program implementation, the characteristics of the sample, and the curricula and interventions to which comparison students were exposed, many unobserved factors could attenuate Frog Street impacts.

The lack of information on contextual factors means that statistically, a lot of unexplained variation in the outcome remains. This resulted in less precise estimates of Frog Street impacts due to the unavailability of other explanatory covariates (such as student race/ethnicity, economic status, and district urbanicity, to name a few). Practically, this inflates the errors of our estimates and can also contribute to a lack of statistical significance.

The Impact of the Frog Street Pre-K Curriculum on 2021-22 Pre-K Gains and Kindergarten Readiness

Program Background

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- Social and Emotional Development
- Differentiated Instruction
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In addition to the literacy and math content, Frog Street includes support for social-emotional development. Specifically, Frog Street features content based in Conscious Discipline, a set of strategies designed to build a strong social-emotional foundation from which children can learn to solve conflicts and manage their emotions. The seven skills, or core components, include composure, assertiveness, encouragement, choices, empathy, positive intent, and consequences. Conscious Discipline is based around the idea of developing a School Family that includes routines (e.g., Hand-washing Routine, Lining Up Routine), rituals (e.g., Greeting/Goodbye Ritual, Safe Keeper Ritual), classroom structures (e.g., creating an environment where children do not ask: am I safe, or am I loved, but what can I learn?). The Conscious Discipline

model posits that such an environment can be achieved when teachers help students learn about emotions and what to do with emotions.

The Frog Street Pre-K curriculum is advertised to include the following components and materials:

- Nine Thematic Teacher Guides following a weekly instruction format
- Welcome Guide
- Conscious Discipline® Manual
- Songs and Stories Resource Guide
- Extensive Literature Library – including fiction, nonfiction, poetry, trade titles, and developmental storybooks
- Little Books
- Listening Library
- Posters
- Programmable Frog-E Robot & Mat
- Fanny Frog with Clothing Changes & House
- Balance Scale
- Letter Builder Set
- Tabletop Pocket Chart
- Math & Science Manipulatives
- Other Manipulatives for Literacy and Social Emotional Development
- Digital Resources (Teacher Portal, ABCmouse® for Frog Street Pre-K, AIM Assessment, and Pre-K at Home)
- Extensive Card Sets: Letter Cards, Cut-Apart Cards, Sound Cards, Syllable Cards, Compound Word Cards, Letter Wall Cards, Vocabulary Cards, Photo Cards, and Strategy Cards

A revised version of the Pre-K curriculum was released in 2020 and is the focus of the current study.

The Present Study

The purpose of the present study was to examine Frog Street Pre-K curriculum efficacy by comparing learning outcomes for pre-K students in schools with access to Frog Street in Texas during the 2021-22 school year to outcomes for pre-K students in Texas schools without access to Frog Street.

This study is designed to replicate and extend those employed by NORC (National Opinion Research Center) at the University of Chicago in 2018, using data from the same assessment (CIRCLE). CIRCLE is a standardized set of assessments designed to measure pre-K students' growth in skills across multiple content areas. The NORC studies yielded mixed results, some favoring the Frog Street Pre-K curriculum (particularly for kindergarten readiness) and some not, but a concern was that

classifications of schools as users or non-users of the curriculum were not sufficiently accurate for the 2017-18 school year. This limitation is not expected to occur with the present 2021-22 school year classifications.

In this analysis, we specifically examined the association between Frog Street access (at the district level) and student learning gains. More specifically, this study compares fall 2021 to spring 2022 learning gains on the CIRCLE assessment for pre-K students in Texas districts who received the Frog Street curriculum during the 2021-22 school year against those who were in Texas districts with access to another curriculum. The research question for this study was:

1. What is the relationship between receipt of the Frog Street curriculum and learning gains on the CIRCLE assessment in the following areas:
   a. Mathematics?
   b. Emergent Literacy – Reading?
   c. Language and Communication?
   d. Health and Wellness?
   e. Emergent Literacy – Writing?

Method

Research Design

The study used a quasi-experimental design (QED) to compare achievement gains from fall 2021 to spring 2022 between students in districts who received the Frog Street curriculum and students in districts who did not receive that curriculum and used other pre-K curricula. This design used regression modeling to compare Frog Street students to those exposed to other curricula on the four domains of the CIRCLE Assessment (language, reading, writing, and math) at two time points (fall 2021 and spring 2022). Specifically, scores in spring 2022 were analyzed, adjusting for fall 2021 scores, to examine the relationship between program participation and learning gains. In addition to typical regression adjustments, the analysis used propensity score weighting so that the scores of comparison students were weighted, based on prior achievement, to be more similar to students in Frog Street districts. Multiple regression analyses were conducted to examine this association.

Program Description & Participants

The current study examines statewide data from Texas pre-K students in public school programs during the 2021-22 school year. Within this statewide sample, we focus on how pre-K students in districts receiving access to the Frog Street curriculum varied in skills from their peers in districts that used other pre-K curricula.

The Frog Street curriculum is designed for use during the entire school year for the majority, or entirety, of the school day to cover all instructional needs and subjects. Specifically, the nine thematic guides each cover four weeks, for a total of 36 weeks.

For the 2021-22 school year, 316 districts in Texas contracted to receive the Frog Street Pre-K curriculum. Within these districts, 603 schools and their pre-K students are included as "treatment" students who had access to Frog Street as the primary curriculum for that school year.

A total of 37,963 students attended schools in the districts that participated in Frog Street during the 2021-22 school year; 1,623 participants were excluded from the analysis due to not having both a pre and posttest score in at least one subject test, resulting in an analytic sample of 36,340 Frog Street (treatment) students.

Additionally, 64,915 students in Texas districts using other pre-K curricula, and who had a pre and posttest CIRCLE score in one or more subjects, were included in the study as a comparison group. This resulted in a total of 101,255 unique students and 356,179 observations (i.e., test scores) because each student had multiple test scores across time points (pre and post), subjects, and languages.

Accordingly, the sample size varied by subject and language with the most test observations in mathematics (78,431 across languages) and the fewest in writing (58,876). Table 1 shows the number of students in each analytic sample, from largest subject sample to smallest, including only students with both a pretest and a posttest score for that subject in that language. It is worth noting that even the smallest sample, Spanish language writing, still had a very large sample (n = 13,800).

Table 1
Analytic Sample by Subject and Language

	English	Spanish	Total
Mathematics	63,423	15,008	78,431
Reading	56,130	20,694	76,824
Language	56,223	20,508	76,731
Health	50,535	14,782	65,317
Writing	45,076	13,800	58,876
Total	271,387	84,792	356,179

Measures

Data sources for the current study include CIRCLE assessment scores, location variables, and district-level participation in Frog Street.

CLI CIRCLE Assessment. The CIRCLE scores come from the CIRCLE Progress Monitoring System developed by the Children's Learning Institute (CLI) specifically for pre-K students. The CIRCLE Progress Monitoring System is a technology-driven tool to capture the growth in pre-K children's (aged 3 and 4 years old) skills throughout the pre-K timeframe. The measure has been standardized, is criterion-referenced, and relates well to established standardized tests. CLI has conducted several research studies of CIRCLE to demonstrate its reliability and validity in Texas and other U.S. states.

The CIRCLE assessment includes a direct assessment that is administered one-on-one by a student's teacher using a computer with access to the online platform for administration. The student and teacher look at the assessment together on the screen and the teacher records the student's responses using the keyboard. In addition to the direct assessment, teachers also complete observational checklists based on students' behaviors and other documentation of their work for domains such as physical development and health and writing. The time estimated for completion of all assessment measures is 86.5 minutes.

CIRCLE scores represent a student's skill level at any given time and can be used to compare skill growth over time during the prekindergarten year, as scores are vertically scaled. This assessment tool is provided to all public prekindergarten teachers and programs in Texas and is designed to be collected three times a year (beginning of year, middle of year, and end of year). In this analysis, we look at beginning of year (BOY) scores from the fall of 2021 as a pretest to adjust for differences in prior skills and to be used as a weighting variable. We then look at end of year (EOY) scores from the spring of 2022 as the posttest, and dependent variable. CIRCLE assessment scores for this study were provided by the Texas Education Agency (https://tea.texas.gov/).

The CIRCLE assessment includes multiple components and subtests. In this analysis we focus on five subject scores, which are composites of individual tests: Emergent Literacy Reading, Emergent Literacy Writing, Health and Wellness, Language and Communication, and Mathematics. Emergent Literacy Reading includes measures of Rapid Letter Naming, Letter-Sound Correspondence, Phonological Awareness, and Motivation to Read. Emergent Literacy Writing combines scores on the Early Writing Skills and Book and Print Knowledge tests. Health and Wellness scores combine the Social and Emotional and Approaches to Learning subtests. The Language and Communication score combines scores on the Rapid Vocabulary Naming, Story Retell and Comprehension, and Speech Production and Sentence Skills subtests. Finally, the Mathematics subtest includes 27 items across multiple domains including rote counting, shape discrimination, and patterns.

The CIRCLE assessment is available in both English and Spanish. Teachers are directed to select the language for the specific sub-test which is most relevant for a

student. The majority of students in this study took the English language assessment; 76.7% of the test observations were English language scores. Although most students took the assessment in one language, 1,109 students (1.1% of the total sample) had scores on both English and Spanish language tests. As each language-subject score was analyzed separately, both scores were analyzed in these cases.

Table 2 shows the average CIRCLE scores by subject and language for the pretest (BOY) and the posttest (EOY) for the analytic sample (sub-sample sizes are provided in Table 1). Beside each average, in parentheses, is the standard deviation for that average score, showing how much the average score varied across the sample. Each subject test had a different range of possible scores, as shown in the second column in Table 2; the range was the same across language versions.

Table 2
Average CIRCLE scores by wave and subject and language

		English				Spanish			
Subject	Range	BOY		EOY		BOY		EOY	
Mathematics	0 – 28	15.25	(6.76)	23.85	(4.50)	11.48	(6.49)	24.08	(4.57)
Reading	0 – 52	10.18	(11.58)	28.00	(14.14)	3.97	(7.03)	28.98	(14.57)
Language	0 – 55	15.17	(6.97)	22.30	(8.02)	7.62	(6.60)	19.08	(9.05)
Health	0 – 62	38.14	(15.38)	51.54	(12.09)	33.22	(15.56)	53.16	(10.38)
Writing	0 – 20	8.23	(5.34)	16.32	(4.27)	6.60	(5.07)	16.83	(3.91)

Notes. 1. *N* (analytic sample) = 356,179 scores. 2. Standard deviations provided in parentheses besides averages.

Comparing language versions, the averages in Table 2 show that pretest scores are higher for English language tests. However, scores are more even at the posttest time point, where Spanish language scores are, on average, higher than English in three of the five subjects. This shows that Spanish language students made larger gains during the year (from 10-25 points by subject, on average) than English language students (from 7-17 points). The standard deviations (in parentheses) were also similar across the languages, showing there was a similar variation in scores of individual students. This variation varied by subject because subjects had different size ranges of possible scores; for example, Writing scores maximized at 20 points, but Health scores could reach 3-times higher, up to 62 points. From time point BOY to EOY, the average student increased in scores across all subjects and languages.

Additionally, for each subtest, CIRCLE has established benchmark scores at each time point to indicate whether a student is kindergarten ready in that domain, so as to indicate if they are on track to be kindergarten ready by the time they leave pre-K. Table 3 presents these benchmark scores, which also vary by language.

Table 3
Kindergarten Readiness Cutoffs by wave and subject and language

	English		Spanish	
	BOY	EOY	BOY	EOY
Mathematics	9	18	6	17
Reading	7	14	4	14
Language	16	19	6	20
Health	9	37	5	38
Writing	1	10	1	12

Based on these benchmarks, CIRCLE then assesses whether students are kindergarten ready. Table 4 provides the percentages of students assessed as kindergarten ready at each time point, in each subject and across languages (according to the benchmarks provided in Table 3) within the analytic sample. The sub-sample sizes for this are the same as the count provided in Table 1.

Table 4
Proportion of Students Kindergarten Ready by wave and subject and language

	English		Spanish	
	BOY	EOY	BOY	EOY
Mathematics	80.7%	90.6%	79.6%	92.4%
Reading	45.0%	81.2%	28.9%	83.4%
Language	48.3%	70.9%	55.1%	44.1%
Health	96.4%	87.3%	96.5%	90.6%
Writing	93.3%	91.7%	88.8%	89.0%

*Note. N* (analytic sample) = 356,179 scores.

Per Table 4, the proportion of students who were kindergarten ready generally increased from pretest to posttest. However, this was not the case in Health for either language group, for Language in the Spanish-language group and for Writing in the English-language group. On the pretest, in both languages, the fewest students were kindergarten ready in Reading. On the posttest, by contrast, in both languages, the fewest students were kindergarten ready in Language. Overall, readiness levels were highest in Health, Writing, and Mathematics at both pretest and posttest. In particular, readiness rates on the Health subject test were so high on the pretest (over 96% in both languages), that there may have been a "ceiling effect" meaning that the scale or threshold of the measure was not able to pick up on further growth in this subject; in other words, the cut score was "too easy" for this sample.

Location variables. The CIRCLE assessment data included information about each student's school and district site during the testing time. In the cases of students who moved school sites between assessment periods, the EOY school site was used. No further individual student demographic data was available for the full sample.

Districts varied greatly in the score growths observed from pretest to posttest. Across subjects there was a similar distribution of district-level growth. For example, in Reading (for English language test takers), as shown in Figure 1, there was a normal distribution of growth from pretest to posttest, shown by the bell curve shape. In most districts the average student gained between 10 and 25 points, but a few districts averaged growth at the extreme ends of the range, at either 0 points or up to 50 points.

Figure 1
CIRCLE Growth by District – Reading Subject test (English language)
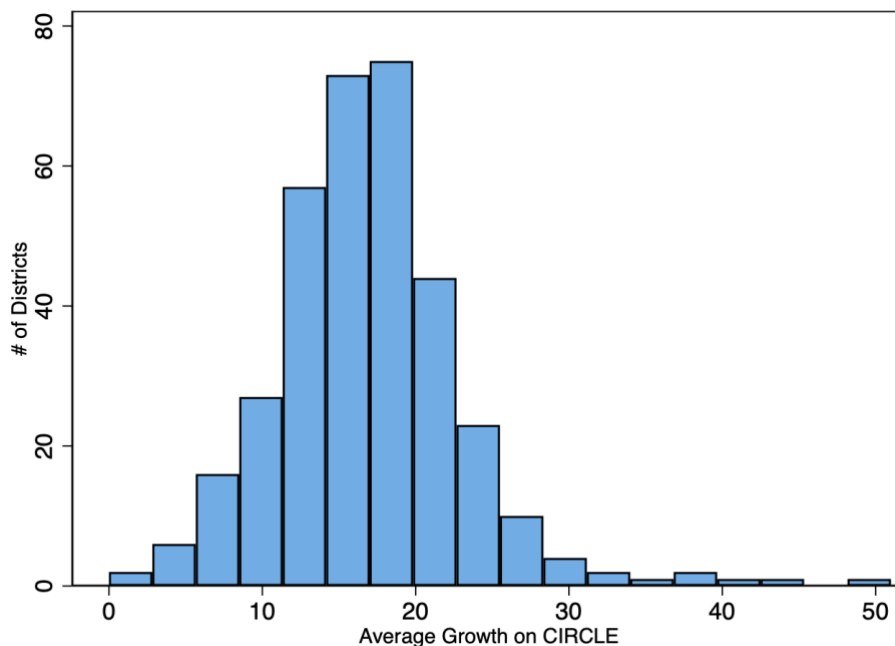
Program participation. Frog Street provided the list of school districts in Texas who received the Frog Street Pre-K curriculum for the 2021-22 year. No information was provided on observed usage.

Analytical Approach

Hierarchical regression analyses were conducted to examine the relationship between Frog Street curriculum receipt and student skill level. Dependent variables (outcomes) were individual students' spring 2022 CIRCLE scores. Independent variables included Frog Street receipt (at the district level) and individual students' fall 2021 CIRCLE scores. These models allowed us to estimate the effect of curriculum receipt on learning growth, adjusting for students' prior skills. Program receipt (at the district level) was included as a dichotomous treatment variable indicating whether or not a student attended a school in a district that received the Frog Street curriculum in the

2021-22 school year. Separate models were estimated for each subject-language outcome for a total of 10 analytic models.

The models also incorporated a hierarchical modeling approach to adjust for the clustering of students in schools—and, further, of schools within districts—to reduce potential bias from the clustering of similar students in these groupings.[1] Accounting for both of these levels of clustering has the practical impact of increasing the size of the standard errors to avoid committing a Type I error (i.e., erroneously finding a significant finding that is not real).

An additional 10 models (for each subject and language combination) were estimated predicting the outcome of whether or not students were kindergarten ready at the spring 2022 time point (i.e., whether or not their CIRCLE score exceeded the established benchmark). These models were identical to those for the CIRCLE scores but used logistic regression (with a logarithmic link) because the readiness outcome was binary (values of 0 or 1) rather than continuous.

Sampling equivalence. Before estimating program impact, we examined the similarity of students on the BOY (baseline) CIRCLE score in Frog Street districts and comparison students in districts that did not receive Frog Street.

Table 5 shows unadjusted mean CIRCLE scores on each subject test, in Spanish and English separately, for Frog Street and comparison students, respectively. Baseline equivalence is defined as being met if the standardized mean difference between treatment and comparison groups is less than 0.25 SD (WWC, 2020).

Table 5
Unadjusted treatment and comparison pretest CIRCLE means and standard deviations (in parentheses)

		Frog Street	Comparison	Stan. Mean Diff.
English language				
Mathematics		14.64 (6.75)	15.59 (6.74)	.141
	n	22,593	40,830	63,423
Reading		9.45 (11.31)	10.59 (11.72)	.100
	n	20,284	35,846	56,130
Language		14.67 (7.09)	15.46 (6.89)	.113
	n	20,598	35,625	56,223
Health		37.06 (15.73)	38.72 (15.16)	.107
	n	17,619	32,916	50,535

[1] Intraclass correlations (ICCs), reflecting the amount of variation in each outcome due to the grouping of students by either school or district, for all CIRCLE outcomes were above standard thresholds (0.05 – 0.10) suggesting the need for a hierarchical model. ICCs ranged from 0.14 – 0.40 at the school level and 0.10 – 0.30 at the district level. ICCs were generally higher for the Spanish language outcomes.

Writing		7.81 (5.23)		8.47 (5.39)	.125
	n	16,544		28,532	45,076
Spanish language					
Mathematics		10.40 (6.09)		12.17 (6.64)	.087
	n	5,794		9,214	15,008
Reading		3.19 (6.10)		4.40 (7.46)	.179
	n	13,284		7,410	20,694
Language		7.41 (6.49)		7.41 (6.67)	.050
	n	7,498		13,010	20,508
Health		32.62 (15.55)		33.64 (15.56)	.066
	n	6,179		8,603	14,782
Writing		6.06 (4.90)		7.01 (5.16)	.189
	n	5,953		7,847	13,800

Notes. 1. Means are unadjusted. 2. Standard deviations provided in parentheses besides averages.

As Table 5 shows, the standardized mean differences between Frog Street and comparison students ranged from 0.05 to 0.19 SDs, indicating that baseline equivalence was potentially met but that differences between groups were non-negligible (and all were statistically significant). Although it is not necessary to use statistical weighting procedures at this baseline difference level, we can create stronger (more robust causal) inferences by adjusting for observable differences using weighting rather than only including these factors as covariates. Specifically, we have reason to believe that there are substantial differences between students in districts using Frog Street and those not using Frog Street based on knowledge about participant selection. It would thus be unreasonable to expect that the baseline differences in Table 5 are due to random variation. To correct for these non-random differences, propensity score weighting was used in all analyses for the purpose of creating a comparison group that was as similar as possible to Frog Street students. Frog Street students were each given a weight of one, and comparison students were each given a weight of:

$$Weight_i = \frac{Probability_i}{1 - Probability_i}$$

where $Probability_i$ is a comparison student's likelihood of participating in Frog Street, based on their pretest score. We adjusted for prior skills because certain kinds of students (i.e., lower skilled students) were more likely to be in a district that received Frog Street. Because we analyzed the outcomes at the individual student level, we estimated the analytic weights at the individual level also, to ensure a balance at the level of analysis (in contrast to the level of treatment assignment, the district level).[2]

The result was that comparison students who were most similar to Frog Street students (in terms of pretest scores) were weighted more heavily in the analyses, and

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[2] Additionally, without other school-level covariates, individual student scores were more relevant for predicting student-level likelihoods of being in treatment. Specifically, on average across the outcomes, pretest differences were smaller when adjusted for at the individual rather than the district level.

comparison students who were less similar to Frog Street students were weighted less. This approach resulted in a weighted comparison group that was as similar as possible to the present group of Frog Street students. Our models thus estimate the impact of Frog Street on students who are in districts more likely to participate in the program (i.e., the average treatment effect on the treated) and may not generalize to students who are unlikely to be in a district that received Frog Street. Finally, no students were excluded due to being "off common support," i.e., all students had pretest scores that were comparable to at least one student in the other treatment group.

After weights were applied to comparison students, baseline equivalence, as determined by fall 2021 CIRCLE scores, was improved. Table 6 shows the mean pretest CIRCLE scores for Frog Street and comparison students, by subject and language, after applying these weights that adjust for baseline differences.

Table 6
Adjusted (weighted) treatment and comparison pretest CIRCLE means and standard deviations (in parentheses)

		Frog Street	Comparison	Stan. Mean Diff.
English language				
Mathematics		14.64 (6.75)	14.63 (6.81)	.001
	n	22,593	40,830	63,423
Reading		9.45 (11.31)	9.47 (10.99)	.002
	n	20,284	35,846	56,130
Language		14.67 (7.09)	14.69 (6.83)	.003
	n	20,598	35,625	56,223
Health		37.06 (15.73)	37.09 (15.37)	.002
	n	17,619	32,916	50,535
Writing		7.81 (5.23)	7.81 (5.26)	.001
	n	16,544	28,532	45,076
Spanish language				
Mathematics		10.40 (6.09)	10.35 (6.32)	.008
	n	5,794	9,214	15,008
Reading		3.19 (6.10)	3.23 (5.69)	.007
	n	13,284	7,410	20,694
Language		7.41 (6.49)	7.41 (6.50)	.0001
	n	7,498	13,010	20,508
Health		32.62 (15.55)	32.62 (15.58)	.0001
	n	6,179	8,603	14,782
Writing		6.06 (4.90)	6.07 (4.86)	.001
	n	5,953	7,847	13,800

Notes. 1. Means are unadjusted. 2. Standard deviations provided in parentheses besides averages.

Specifically, Table 6 shows that Frog Street students' scores remained the same, as they were given a weight of one. Comparison students' scores were weighted so

they are now closer to Frog Street students' scores. This reduced the standardized mean differences in the final column, which now range from 0.0001 to 0.008 SDs.

Results

Analyses Overview

We first provide descriptive results about the overall scores from pretest to posttest. Then, by each subject, we compared how Frog Street students performed on CIRCLE subject tests by language, relative to comparison students. Additionally for each subject and language outcome, we examined the differences in the proportion of students who were considered kindergarten ready.

All analyses examine how learning gains for students in districts that received Frog Street related to the gains of similar students in districts that did not receive Frog Street. All analyses weight the comparison group so that students who are most similar to Frog Street participants are given more weight in the analyses. All analyses adjust for prior skills and the clustering of students in schools and districts.

Descriptive Results

CIRCLE scores. Average growth scores varied by subject and language. Figures 2 and 3 plot the average student growth (from fall 2021 to spring 2022) by treatment group and by subject, before any statistical adjustments were made. Figure 2 displays results from the English language tests and Figure 3 the Spanish language exam.
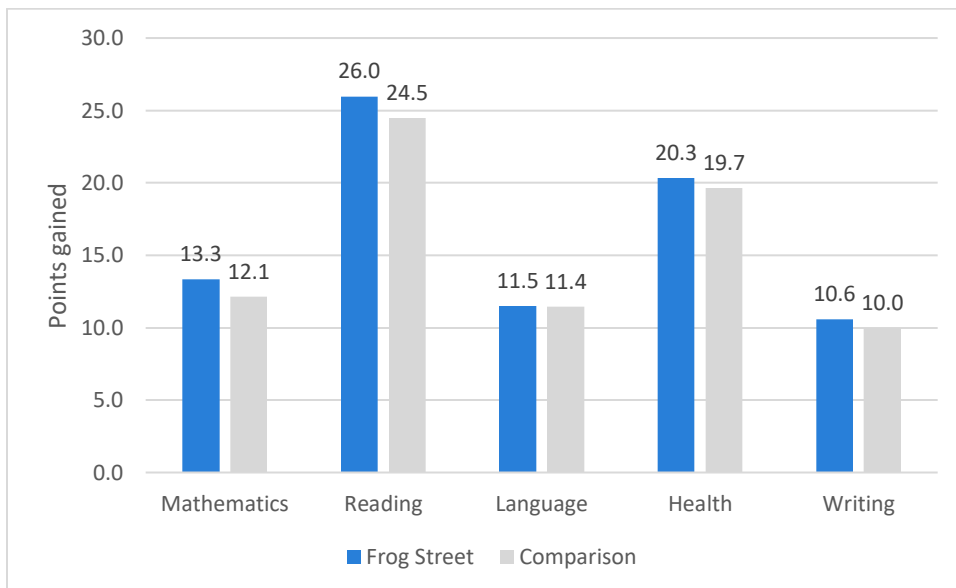
Figure 2
Unadjusted learning growth from pre to posttest, by CIRCLE subject and treatment group (English language)
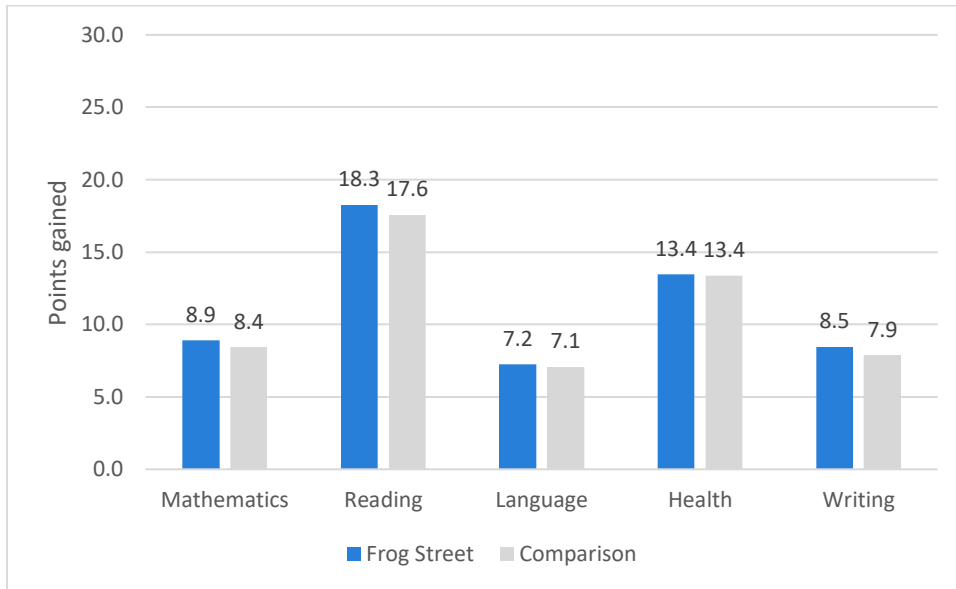
Note. Means are unadjusted.

Figure 3
Unadjusted learning growth from pre to posttest, by CIRCLE subject and treatment group (Spanish language)


Note. Means are unadjusted.

Figures 2 and 3 show that Frog Street students (blue bars) had greater learning gains than comparison students (gray bars) across all subjects and in both assessment languages. Before adjusting, we noticed that Frog Street students had noticeably greater gains in English language reading (0.7 points more growth), writing (0.6 points), and mathematics (0.5 points).

As previously discussed, students taking the Spanish language exam had greater gains overall. For example, in Reading—the subject with the largest gains—Spanish language students gained around 25 points on average, whereas English language students gained closer to 18 points. Prior to any adjustments, Frog Street students also had greater gains than comparison students on the Spanish language exams in reading (1.5 points), mathematics (1.2 points), health (0.6 points), and writing (0.6 points).

Next, Figures 4 and 5 plot the proportion of students whose scores classify them as kindergarten ready across each subject and by language, showing the pretest and posttest proportions in each.

Figure 4
Gains in Kindergarten Readiness Levels from pre to posttest, by CIRCLE subject and treatment group (English language)
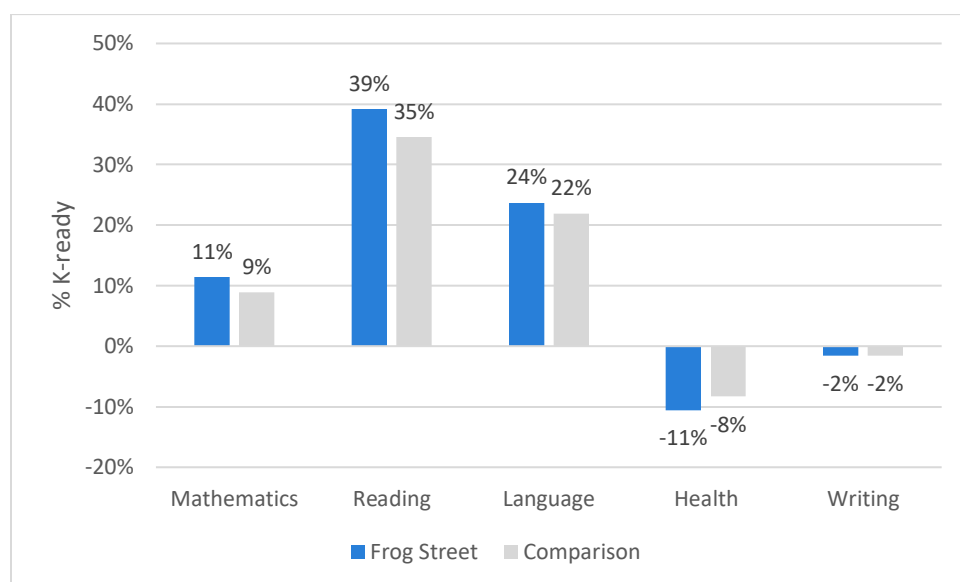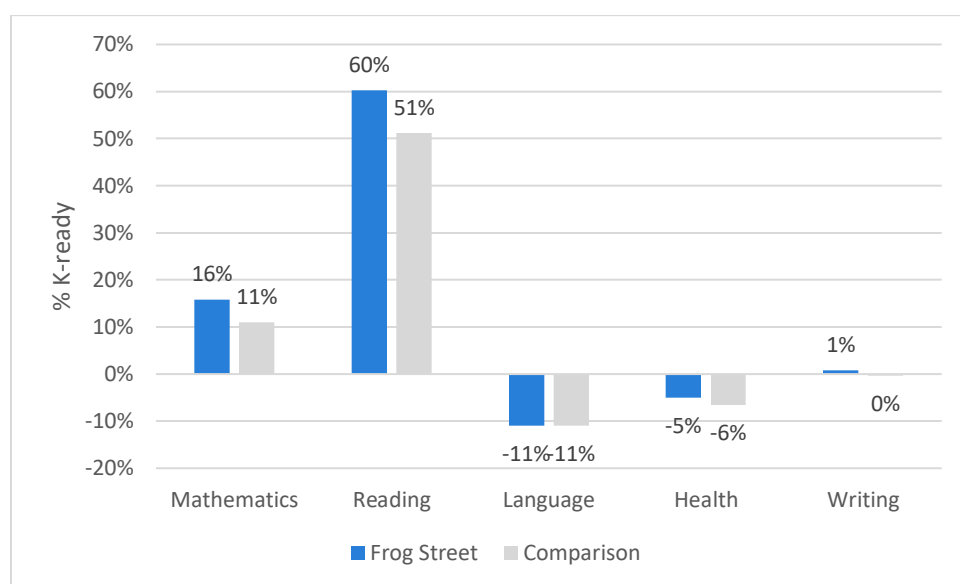

Notes. 1. FS = Frog Street (students). 2. Comp = Comparison (students).

Figure 4, of the English language readiness levels, shows that Frog Street students grew most in reading readiness: 39% more of Frog Street students were now ready in reading, compared to the 34% growth in the comparison group, prior to any adjustments. It is important to note once more that the benchmark scores to signal readiness are adjusted at each time point (see Table 2). Thus, the observed reductions in kindergarten ready students in Health and Writing is partially due to the fact that so

many students were already ready at the pretest (a ceiling effect) and may not have reduced in their scores over the year but may not have made the expected gains.

Figure 5 next presents the Spanish language readiness levels across subjects, time points, and treatment group. Here, the biggest gains are also in reading. Unlike for the English language assessment group, Spanish language students showed lower readiness levels on the Language assessment at the posttest time point compared to the pretest time point.

Figure 5
Gains in Kindergarten Readiness Levels from pre to posttest, by CIRCLE subject and treatment group (Spanish language)

Notes. 1. FS = Frog Street (students). 2. Comp = Comparison (students).

In both Figures 4 and 5, more Frog Steet students progressed from being classified as not ready at pretest to ready at posttest in the first two subjects across both language versions.

Primary Student Achievement Results

The results from the main analyses estimate the impact of Frog Street across CIRCLE assessments in each of the five subjects, on both English and Spanish language assessments. In each subject area, we first look at how students who attended pre-K in districts with Frog Street compared on their CIRCLE assessment score to otherwise similar comparison students who attended pre-K in districts that used another pre-K curriculum. Next, in each subject area, we look at the same comparison and the estimated impact on the proportion of students who are kindergarten ready at the end of the pre-K year.

Frog Street Curriculum Impacts

The analyses compared Frog Street students' learning gains to those of comparison students across five subjects: reading, language, writing, mathematics, and health during the 2021-22 school year. The results are presented in order from most promising evidence of program efficacy to least.

Reading. Table 7 shows the results of these analyses for reading skills as measured by CIRCLE scores and whether students were kindergarten ready in that subject, after adjusting for prior achievement, by assessment language.

Table 7
Association between Frog Street and Reading learning gains, by outcome and language

Outcome	Estimate	Standard error	*p* value	*ES*
English Language				
CIRCLE assessment score	0.861	0.521	.098	.06
Kindergarten ready	*OR* = 1.184	0.135	.139	
Spanish Language				
CIRCLE assessment score	3.163	1.203	.009	.21
Kindergarten ready	*OR* = 1.672	0.432	.047	

Notes. 1. English: N = 56,130, j = 1,623 schools k = 345 districts; Spanish: N = 20,694, j = 789 schools k = 103 districts. 2. *OR* = odds ratio.

These results show an overall positive association between Frog Street access and reading learning gains across languages and outcome measures. This association is only significantly positive for the Spanish language assessment ($p < .05$) although it approaches significance for the English language assessment ($p = .098$).

The regression estimates here (rows for CIRCLE assessment score) can be interpreted as the average gain in CIRCLE reading score from fall 2021 to spring 2022 associated with being in a Frog Street district, compared to similar non-Frog Street students, adjusting for prior skills and school and district. For example, access to the Frog Street curriculum is associated with a 3.2-point larger gain in the spring 2022 CIRCLE reading score on the Spanish language test from their fall 2021 score, compared to similar pre-K students who used another curriculum. On the Spanish language test this was statistically significant from zero.

The other rows of Table 7 (for kindergarten ready outcomes) show the impact of Frog Street on whether students were "kindergarten ready" according to their CIRCLE score in reading, according to their language version benchmarks. The odds ratio can be interpreted as the odds of being kindergarten ready in reading for Frog Street students compared to non-Frog Street students, who had an odds of 1, adjusting for

prior skills and school and district. For example, Frog Street students had 1.7 times higher odds of being kindergarten ready at the end of their pre-K year (versus not being ready) in their reading scores (on the Spanish language exam) compared to comparison students not using Frog Street. This relationship with kindergarten readiness was positive for both languages but was only statistically significant for Spanish language students. (Figure A1 in the Appendix further explores this relationship converting the odds ratios to probabilities).

Language. Table 8 shows the results of these analyses for language skills as measured by CIRCLE scores and whether students were kindergarten ready in that subject, after adjusting for prior achievement, by assessment language.

Table 8
Association between Frog Street and Language learning gains, by outcome and language

Outcome	Estimate	Standard error	*p* value	*ES*
English Language				
CIRCLE assessment score	0.205	0.316	.516	.03
% Student Kindergarten ready	*OR* = 0.980	0.086	.820	
Spanish Language				
CIRCLE assessment score	0.503	0.706	.476	.06
% Student Kindergarten ready	*OR* = 1.117	0.245	.615	

Notes. 1. N = 56,223, j = 1,628 schools k = 348 districts; N = 20,508, j = 792 schools k = 105 districts.
2. *OR* = odds ratio.

These results show small but nonsignificant ($p > .05$) positive associations between Frog Street access and language learning gains across languages and outcome measures for any outcome. Additionally, on the English language test, there was a small negative association with kindergarten readiness indicated by the odds ratio being less than 1, but this was not statistically significant. The odds ratio of 0.98 indicated that Frog Street students had slightly lower odds than comparison students (with odds of 1) of being ready for kindergarten in language, adjusting for prior skills and school and district.

Writing. Table 9 shows the results of these analyses for writing skills as measured by CIRCLE scores and whether students were kindergarten ready in that subject, after adjusting for prior achievement, by assessment language.

Table 9
Association between Frog Street and Writing learning gains, by outcome and language

Outcome	Estimate	Standard error	*p* value

				ES
English Language				
CIRCLE assessment score	0.114	0.169	.497	.03
% Student Kindergarten ready	OR = 0.937	0.113	.590	
Spanish Language				
CIRCLE assessment score	0.171	0.313	.584	.04
% Student Kindergarten ready	OR = 1.133	0.268	.597	

Notes. 1. *N* = 45,076, j = 1,478 schools k = 298 districts; *N* = 13,800, j = 561 schools k = 86 districts. 2. *OR* = odds ratio.

These results show an overall positive association between Frog Street access and writing gains across languages and outcome measures. This association is not statistically significant ($p < .05$) for any outcome. Additionally, on the English language test, there was a small negative association with kindergarten readiness, but this was not statistically significant.

Looking at the CIRCLE assessment scores, access to the Frog Street curriculum is associated with a 0.1-point larger gain in the spring 2022 CIRCLE writing score on the English language test (and 0.2-point larger gain on the Spanish language version) from the fall 2021 score, compared to similar pre-K students who used another curriculum.

Mathematics. Table 10 shows the results of these analyses for mathematics skills as measured by CIRCLE scores and whether students were kindergarten ready in that subject, after adjusting for prior achievement, by assessment language.

Table 10
Association between Frog Street and Mathematics learning gains, by outcome and language

Outcome	Estimate	Standard error	*p* value	ES
English Language				
CIRCLE assessment score	−0.037	0.187	.845	−.01
% Student Kindergarten ready	OR = 1.029	0.125	.816	
Spanish Language				
CIRCLE assessment score	0.106	0.658	.873	.02
% Student Kindergarten ready	OR = 1.564	0.460	.129	

Notes. 1. *N* = 63,423 students, j = 1,669 schools k = 346 districts; *N* = 15,008, j = 563 schools k = 83 districts. 2. *OR* = odds ratio.

The association between Frog Street and mathematics learning gains was not statistically significant ($p < .05$) for any outcome. These results show a mixed association between Frog Street access and mathematics learning gains across languages and outcome measures. Although this association is negative between Frog Street and the CIRCLE assessment score on the English language test, it is small in

magnitude and there was a positive association with kindergarten readiness in both languages and on Spanish CIRCLE scores.

The largest impact of Frog Street on mathematics occurred for kindergarten readiness on the Spanish language exam. The odds ratio of 1.6 indicated that Frog Street students had higher odds than comparison students (with odds of 1) of being ready for kindergarten in mathematics (on the Spanish language test), adjusting for prior skills and school and district.

Health. Table 11 shows the results of these analyses for health skills as measured by CIRCLE scores and whether students were kindergarten ready in that subject, after adjusting for prior achievement, by assessment language.

Table 11
Association between Frog Street and Health learning gains, by outcome and language

Outcome	Estimate	Standard error	p value	ES
English Language				
CIRCLE assessment score	−0.221	0.733	.763	−.02
% Student Kindergarten ready	OR = 1.012	0.169	.944	
Spanish Language				
CIRCLE assessment score	0.808	0.846	.340	.08
% Student Kindergarten ready	OR = 1.422	0.422	.235	

Notes. 1. N = 50,535, j = 1,549 schools k = 308 districts; N = 14,782, j = 595 schools k = 85 districts. 2. OR = odds ratio.

The association between Frog Street and health learning gains was not statistically significant ($p < .05$) for any outcome. Although this association is negative between Frog Street and the CIRCLE assessment score on the English language test, it is small in magnitude and there was a positive association with kindergarten readiness in both languages and on Spanish CIRCLE scores. Indeed, the second largest effect size among all outcomes (0.08) occurred for Frog Street on Health CIRCLE scores on the Spanish language test.

In summary of the above results, Figure 6 presents the effect sizes for all estimates of the impact of Frog Street on CIRCLE assessment scores, across the five subjects in each of the language versions. In this chart, each bar illustrates the difference in expected learning gains (in standard deviation units, to compare across the subjects due to their different ranges) attributable to access to Frog Street.

Figure 6
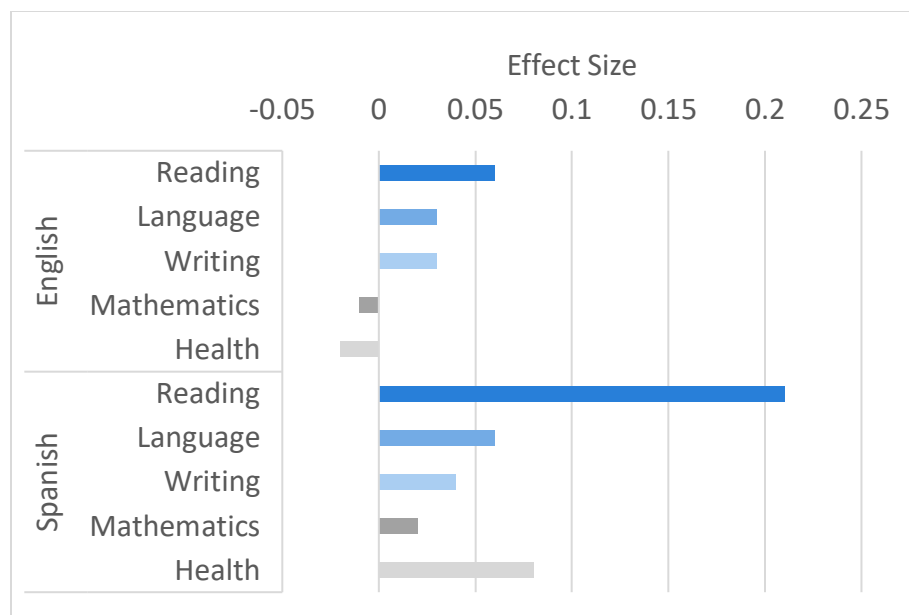*Summary of Frog Street Effect Sizes Across Subject Tests*

Figure 6 shows that in most subjects across languages, Frog Street students had larger learning gains than similar peers who used other curriculum. This result was particularly consistent and larger on the Spanish language subject scores where the two largest effect sizes of Frog Street on CIRCLE scores were on the Reading and Health assessments. However, as reported above, the only statistically significant impact was for Reading on the Spanish language assessment.

Discussion

This report presents findings from the 2021-22 school year implementation of the Frog Street Pre-K curriculum across Texas pre-k programs, specifically looking at the impact on CIRCLE assessment scores and kindergarten readiness. The purpose of the study was to examine the association between access to the Frog Street Pre-K curriculum and learning growth across multiple subjects from the fall of 2021 to the spring of 2022. This report specifically compared students who attended pre-K programs in districts which received Frog Street materials and students in districts who did not participate in Frog Street. This analysis builds on prior evidence of the efficacy of Frog Street by using the most recent participant data and a large sample of all Texas preschoolers.

Overall, receipt of the Frog Street Pre-K curriculum had the most positive association with learning growth in reading. We found that this association was statistically significant for students taking the Spanish language assessment—Frog Street students had higher scores (by 3 points) and were more likely to be kindergarten ready in reading on the Spanish Language assessment (with 1.7 times higher odds ratios). In general, pre-K students experienced the most growth in reading (i.e., explanatory power) by Frog Street (and/or the potential curriculum chosen by schools).

It is encouraging that it was in the subject with the largest variation, and thus the greatest ability to detect an impact, that we found the only statistically significant finding.

More positive patterns of associations were also observed for literacy outcomes (including reading, language, and writing) and on the Spanish language tests of all subjects (compared to the English language tests). This positive trend on the Spanish language assessments is encouraging for Frog Street in its efforts to explicitly include English Language Learners and take a multilingual approach to instruction in certain contexts.

Although the effects were directionally favorable for students receiving the Frog Street curriculum compared to students in districts with other curricula, the effect sizes tended to be modest and nonsignificant. Given the many unknowns regarding program implementation, the characteristics of the sample, and the curricula and interventions to which comparison students were exposed, many unobserved factors could attenuate Frog Street impacts. For example, other curriculum changes and interventions were occurring at this time in Texas (such as a Mindfulness-infused curriculum). Second, this analysis used a conservative modeling approach, accounting for clustering at the school and district level, which seeks to prevent the over-estimation of significance where clustering is present.

Study Limitations

There are some important limitations in this evaluation that should be noted. First, this study consisted of descriptive and correlational analyses with limited variables for adjusting between treatment groups, meaning that causal inferences cannot be made. Thus, we cannot definitively state that access to the Frog Street Pre-K curriculum caused greater or lower growth in learning gains across subjects.

The lack of information on contextual factors means that statistically, a lot of unexplained variation in the outcome remains. This resulted in less precise estimates of Frog Street impacts due to the unavailability of other explanatory covariates (such as student race/ethnicity, economic status, and district urbanicity, to name a few). Practically, this inflates the errors of our estimates and can also contribute to a lack of statistical significance.

Additionally, the lack of information on participants limits our ability to identify a more truly equivalent comparison group. Although prior achievement—a variable we included—is the strongest predictor of future achievement, there could be other systematic differences between groups not accounted for that cloud our estimate of the relationship between Frog Street and student learning across subjects.

In particular, additional data on students and schools in the sample can provide more precise estimates of program impacts in the future; allowing analyses to program involvement may aid in understanding the pattern of results. The following sections highlight main takeaways from the study.

Conclusions

The key results and conclusions of this evaluation are as follows:

- Access to the Frog Street Pre-K curriculum is associated with learning gains in reading on the Spanish language version of the assessment, when comparing students in Frog Street districts to similar students in districts using another curriculum.
- No significant associations were found between Frog Street access and learning gains in the Language, Writing, Mathematics, and Health subjects in either language version.
- The association between Frog Street access and learning gains was more positive for students taking the Spanish language assessments, compared to those taking the English language assessments.

References

What Works Clearinghouse (2020). Standards handbook (Version 4.0). *Washington, DC: Institute of Education Sciences*.

Appendix

Figure A1
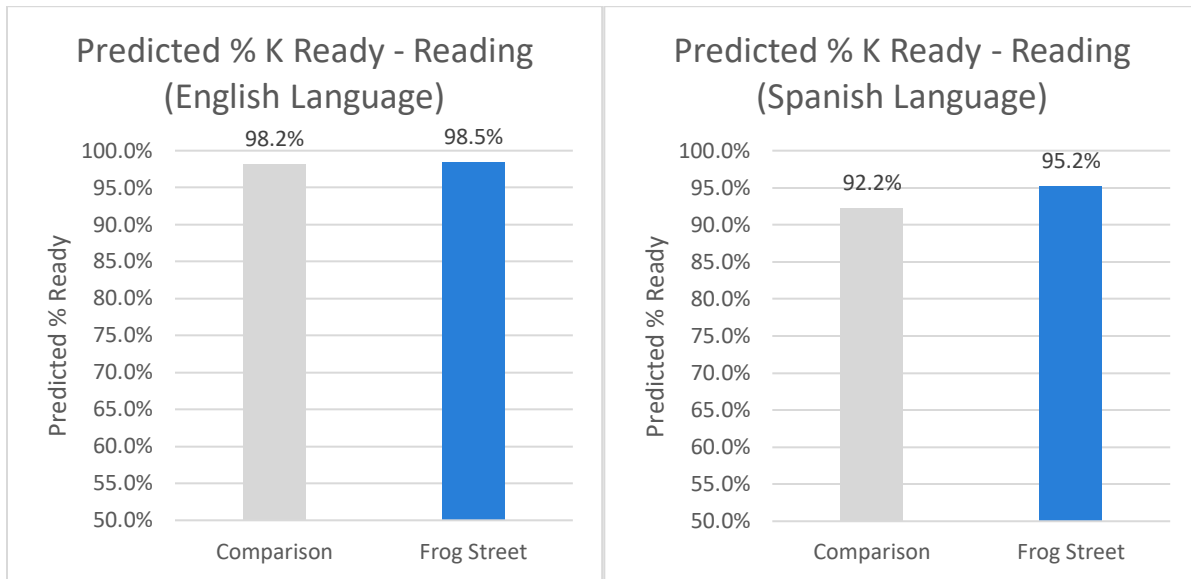*Predicted Readiness Levels in Reading, by treatment and language test*

Figure A1 shows the proportion of students estimated to be kindergarten ready in Reading at posttest, if they had an average pretest, by converting the odds ratio results to probabilities. Across language versions and adjusting for prior test scores and district and school clustering, Frog Street students are more likely to be kindergarten ready at the posttest, but this difference is larger (and statistically significant) on the Spanish language assessment than the English language assessment. Specifically, looking at the Spanish language test results in Figure 6, Frog Street students (with an average pretest score) have a 95% likelihood of being kindergarten ready on the posttest compared to a 92% likelihood for similar comparison students.