RESEARCH BRIEF

Frax Proven Effective in Developing Fraction Proficiency for Multilingual Language Learners

STUDY AT A GLANCE

Study Sample:

- 651 3rd-grade students identified as MLLs and 1,446 3rd-grade students not identified as MLLs
- Large Suburban School District in Florida, USA
- All students placed *"Well Below Grade Level"* (level 1 out of 5) on the statewide beginning of year progress monitoring math assessment

Research Methodology:

- 2023-2024 school year
- Benchmark math assessments completed at the beginning of the year and the end of the year
- Analysis of math achievement for students who completed Frax Sector 1 compared to students with no Frax usage, by MLL status

Main Findings:

- Students using Frax showed greater math growth compared to similar peers with no Frax usage, with equal gains for MLL and English-proficient students
- Frax usage resulted in an increase in the number of academically at-risk MLLs who met both overall grade-level math standards as well as fractions specific grade-level standards compared to matched MLLs with no Frax usage

"*Frax* has made a difficult concept more accessible for our MLL students who needed more practice."

-Third Grade Teacher, Los Angeles County, California

Introduction

Educators in districts with high populations of Multilingual Learners (MLLs), also referred to as English Language Learners (ELLs), often face a critical question when considering new programs: ***Will this work for our students?*** In math, language barriers can pose significant hurdles—limiting access to academic vocabulary and the ability to follow word problems or instructional cues. Concerns are heightened when a program is only available in English.

ExploreLearning's Frax was designed for a broad range of learners and includes several key features that research suggests are particularly beneficial for MLLs. Concepts are introduced and reinforced through multiple exposures in visual and interactive formats to support deep understanding and retention. The program also scaffolds math vocabulary, for instance, by delaying the introduction of key terms until students have developed a solid conceptual foundation. Vocabulary is then reinforced through visuals and context-rich examples, helping students connect language to meaning. These supports work together to make complex fraction concepts more accessible for all students—regardless of English language proficiency.

To better understand how Frax supports MLLs in real-world settings, we conducted a study in a district where nearly one in four 3rd-grade students is classified as MLL. **Results showed that MLLs demonstrated learning gains that were comparable to those of their non- MLL peers.** These findings suggest that the program's design features may help mitigate some of the challenges MLLs typically face in math. Frax's emphasis on conceptual understanding through multiple representations provides meaningful access to fractions content for students developing English proficiency.

Methods

This study was conducted in a large, diverse school district where approximately 25% of 3rd grade students are classified by their district as English Language Learners (ELLs), referred to here as Multilingual Learners (MLLs). To examine the impact of Frax usage on math learning outcomes for MLLs, we analyzed student growth on the Florida Assessment of Student Thinking (F.A.S.T.), a statewide diagnostic math assessment administered in both the fall and spring. A two-by-two comparison was conducted based on MLL status (MLL vs. English-proficient) and Frax usage level (minimal vs. high), **allowing us to evaluate whether MLLs experienced comparable or differential gains when using the program at a high level of fidelity.**

To ensure baseline equivalence, we focused on a subsample of 3rd graders who scored within Achievement Level 1 ("Well Below Grade Level") on the Fall 2023 administration of the math assessment. This decision was based on the district's data showing that 92% of their 3rd-grade MLLs began the year at Level 1.

All students had access to the Frax program through their classroom teachers; however, implementation varied across classrooms. For the purposes of analysis, students were grouped based on their level of program usage during 3rd grade:

Frax users are those who completed at least 90% of Sector 1 (24 - 27 missions completed).
Control users are those who completed fewer than five missions in Frax Sector 1.

Students' math growth was assessed using two outcome measures from the F.A.S.T. spring administration (PM3): overall scale scores (ranging from 140–260) and math achievement levels (on a 1–5 scale, with Level 3 indicating on-grade-level performance). Performance on fraction-related items was also reported using a three-level scale: below standards, at/near standards, and above standards.

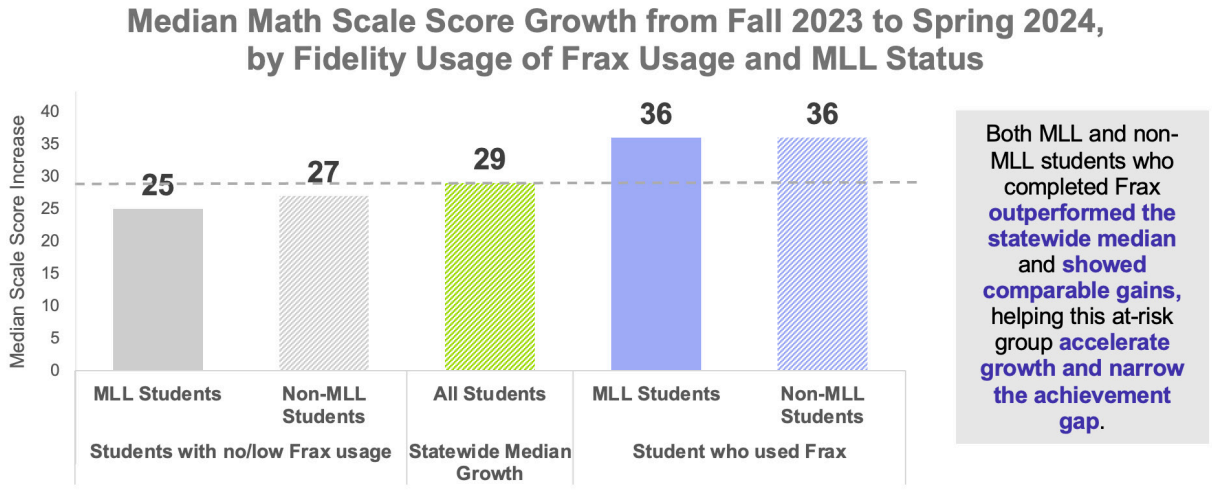
By comparing spring outcomes across MLL status and Frax usage level, this study aimed to assess whether high usage of Frax was associated with greater math gains for students with the most significant initial learning needs.

Table 1: Student demographics by usage group

	MLL Students		Non-MLL Students	
	Frax Users	Control	Frax Users	Control
Total N's	178	473	509	937
Demographics: n (%)				
Male	109 (61.2%)	200 (42.3%)	274 (53.8%)	405 (43.2%)
Female	69 (38.8%)	273 (57.7%)	235 (46.2%)	532 (56.8%)
Hispanic/Latino	152 (85.4%)	404 (85.4%)	162 (31.8%)	335 (35.8%)
Black/African American	16 (9%)	36 (7.6%)	65 (12.8%)	207 (22.1%)

FINDING 1: Students Using Frax Show Greater Math Growth—With Equal Gains for MLL and non-MLL Status Students

Across the state, the median growth from PM1 to PM3 in the 2023–2024 school year for students within Achievement Level 1 was found to be 29 points. Both MLLs and non-MLLs without Frax showed lower growth than the statewide median, with MLL students experiencing the least growth overall. Only 41% of MLLs and 47% of non-MLLs in our sample with no Frax usage met or exceeded the statewide median growth. In contrast, **75% MLL and 75% of non-MLL students in our sample who used Frax met or exceeded the statewide median.** Both MLLs and non-MLLs who completed Frax outperformed the statewide median growth, with equivalent median learning gains (+36 scale score points) observed in both groups.



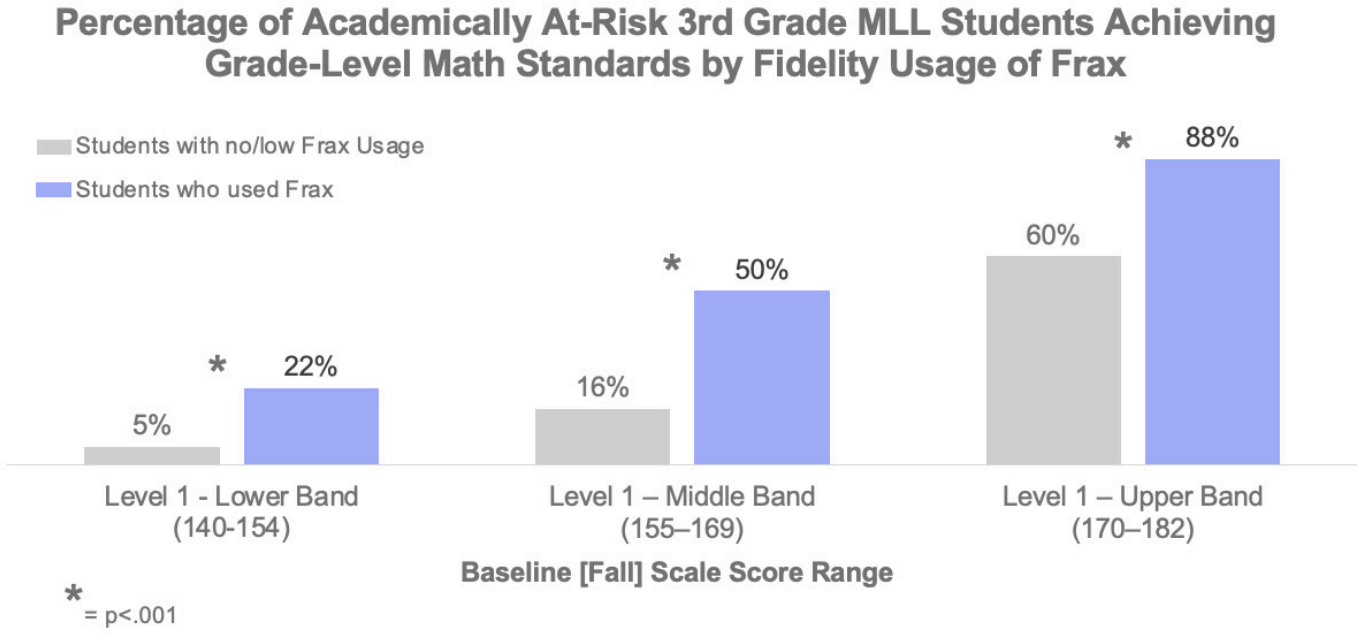
Notes: All students scored within Achievement Level 1 ("Well Below Grade Level") on the FAST Math PM1 assessment administered in fall 2023. "Median growth" is defined as the median of the scale score gain from PM1 to PM3 in the 2023–2024 school year. All students had no Frax usage prior to fall 2023. Fidelity usage of Frax is defined as 90% or more of Sector 1 (24+ missions) completed between fall 2023 and spring 2024 testing dates. Students with no or low Frax usage completed fewer than 5 missions in Frax.

To better understand the impact of Frax use on math outcomes, we conducted a statistical analysis that accounted for students' fall test scores. As expected, MLLs started the year with lower average scores than their non-MLL peers. However, after controlling for those initial differences, Frax usage remained a strong predictor of improved performance. **Students who used Frax had an adjusted average spring score of 197.3, compared to 186.9 for those who did not use Frax—a difference of more than 10 points,** even after accounting for where students began. The effect size indicated that Frax use explained nearly 9% of the variation in spring test scores after controlling for prior achievement, which is considered a medium effect size. There was also **no evidence that the effect of Frax differed for MLL and non-MLLs**. Both groups appeared to benefit equally, reinforcing the conclusion that Frax supports math growth across a diverse range of learners.

FINDING 2: Frax Usage is Associated with Higher Rates of On-Grade-Level Math Performance for At-Risk MLL students

Median growth does not guarantee that a student will achieve "On Grade Level" status. For students starting below grade level, higher growth is often needed to "catch up" to their peers. Here, we analyzed rates of these students, who are all at high risk for academic failure, meeting or exceeding "on grade level" performance on their end of year (PM3) standards achievement test by both MLL status and Frax usage. Because the Fall 2023 "Well Below Grade Level" category (scale scores 140–182) covered a wide range of performance and the distribution of scores differed between Frax users and non-users, we created matched samples by examining more restricted scale score ranges within this level. This allowed us to test whether the observed effect held across comparable groups of MLL students.

The beneficial impact of Frax was found within all scale score ranges; even those at the lowest scale score range demonstrated substantial and statistically significant benefits from using Frax[2]. These findings suggest that while MLLs face systemic challenges in meeting grade-level expectations, targeted supports like Frax can play a meaningful role in closing those gaps. **MLLs who were well below grade level in the fall and used Frax, were more likely to meet or exceed grade-level math standards by the spring compared to matched MLL peers who did not use the program—helping to narrow the achievement gap for this academically at-risk group.**



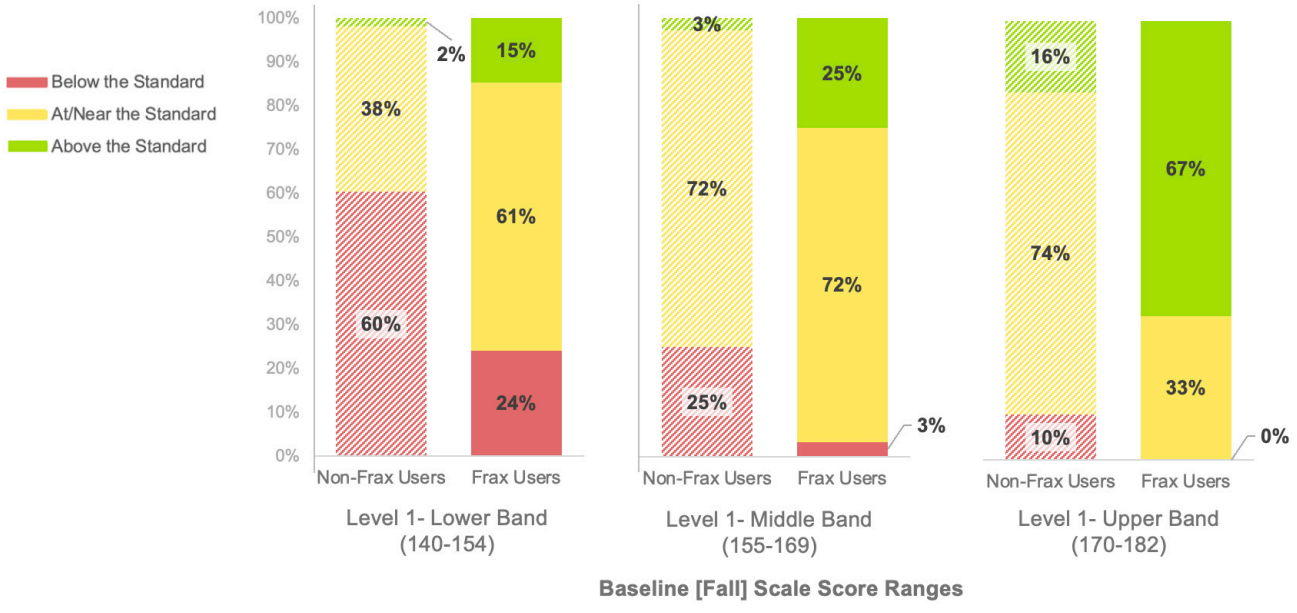
FINDING 3: Academically At-Risk MLL Students Using Frax Show Stronger Mastery of Fraction Standards than Non-Users

We also examined MLLs' performance on the fractions-specific subscore of the end-of-year assessment, which classifies results into three categories: **below standards, at/near standards, and above standards.** Across the full sample of at-risk MLLs, 42% of non-Frax users failed to meet fractions standards compared to just 8% of Frax users. Frax also led to at-risk MLLs exceeding grade-level fractions standards. 37% of academically at-risk MLLs who used Frax exceeded standards, compared to only 4% of MLLs who did not use Frax.

To provide a more granular perspective, the chart below divides the full at-risk MLL sample into three subgroups (lower, middle, and upper) using the same starting score bands utilized in the prior analysis. **Within every band, users consistently outperformed non-users.**

These results suggest that Frax not only helps academically at-risk students reach proficiency in fractions but also promotes deeper learning. MLLs were both less likely to fail to meet standards and also more likely to exceed standards **when given access to conceptually grounded, visually supported fractions instruction.**

Percentage of Academically At-Risk MLL 3rd Grade Students Meeting Grade-Level Fractions Standards, by Fidelity Usage of Frax



Conclusions

This analysis provides compelling evidence that **the Frax program can support significant fractions and overall math learning gains for Multilingual Learners (MLLs)**, a group often at risk of falling behind due to language-related barriers in traditional instruction. We found that MLL students who started out the school year "well below grade level" standards compared to their peers, and used Frax in English, achieved learning and growth that exceeded statewide norms for students at the same achievement level and was equal to the growth achieved by their non-MLL peers within a single school year.

Frax use was also associated with much higher rates of meeting or exceeding grade-level proficiency standards in both fractions-specific standards and overall math performance. These findings suggest that Frax's visual, scaffolded, and concept-first approach to teaching fractions can help bridge gaps in language access, **making it an effective tool for advancing outcomes in elementary math classrooms for all students, including MLLs and academically at-risk students.**

For districts with large MLL populations, **this evidence underscores the potential of Frax to support the process of learning fractions and improve overall math outcomes in a way that meets the needs of linguistically diverse learners—without requiring translation or separate tracks of instruction**. As schools and districts seek scalable, evidence-based solutions to strengthen math learning and close persistent learning gaps, especially for their MLLs, Frax offers a promising approach to help students not only stay on track but thrive. **Investing in early, targeted support is essential for promoting long-term success in math—and the findings from this study demonstrate the potential of Frax to make a measurable difference for all learners.**

Statistical Analyses and Technical Notes

[1]A two-way ANCOVA was conducted to examine the effect of MLL status (yes/no) and Frax usage (yes/no) on 3rd grade math achievement (PM3 math scale score), controlling for prior math performance (PM1 math scale score). Overall, the model was significant, $F(4, 2092) = 702.73$, $p < .001$, $\eta p^2 = .573$. There was a large and significant effect of the covariate on post-test scores , $F(1, 2092) = 1705.60$, $p < .001$, $\eta p^2 = .449$, signaling that nearly 45% of the variance in post-test scores can be predicted by a student's pre-test scores. There was also a significant main effect of Frax usage after controlling for pre-test scores, $F(1, 2092) = 198.99$, $p < .001$, $\eta p^2 = .087$. Frax usage contributed to an additional 9% of the variance in student post-test scores, indicating a moderate effect size.

When controlling for pre-test scores, there was no significant effect of MLL status. This indicates that growth over the year did not differ between MLL and non-MLL students. Additional, there was no significant interaction between MLL status and Frax usage, indicating that both MLL students and non-MLL students experienced the same growth in scores from Frax.

Source	SS	df	MS	F	p	np2
Pre-Test	320533.75	1	320533.8	1705.6	<.001	0.449
MLL Status	159.37	1	159.37	0.848	0.357	0
Frax Usage	37396.12	1	37396.12	198.99	<.001	0.087
MLL Status * Frax Usage	98.67	1	98.67	0.525	0.469	0
Error	393150.38	2092	187.93			
Total	76973489	2097				

			Pre-test Scale Score		Post-test Scale Score (Adjusted)		Mean Post-Test Difference
		N	Mean	Std. Error	Mean	Std. Error	(compared to control)
MLL Students	Control	473	153.69	0.574	186.28	0.656	-
	Frax Users	178	161.79	0.974	197.24	1.028	+10.97
Non-MLL Students	Control	937	160.52	0.457	187.47	0.448	-
	Frax Users	509	170.22	0.48	197.4	0.641	+9.93

[2]2x2 chi-squares were conducted to analyze the rates of meeting or exceeding grade-level proficiency standards (yes/no) on the 3rd grade math achievement (PM3 math scale score) by Frax usage (yes/no) within each of the three scale score ranges. All three chi-squares were significant ($p<.001$).