

# Frax Use Results in Improved Fractions Knowledge and Grade-Level Math Achievement for All Learners

## STUDY AT A GLANCE

### Study Sample:

- Large suburban US school district
- 2022-2023 school year
- 3702 3rd-grade students
- District Student Racial Diversity: 43% Hispanic/Latino, 13% Black/African American, 36% White, 78% Economically disadvantaged

### Research Methodology:

- Retrospective analysis was conducted with groups of third-grade students based on their relative placement on a Spring 2022 End-of-Course (EOC) math standards achievement test
- Students either had no Frax usage (0-5 missions) or high Frax usage (20-27 missions) in 3rd grade
- Outcome measure was the student's scores on Spring 2023 EOC math test, including both Fractional Reasoning scores and overall Math scores

### Main Findings:

- Frax users showed larger improvements compared to similar peers who did not use Frax on math performance
- Frax usage resulted in higher fractions performance, with significantly more students meeting or exceeding standards
- Frax was found to be a universal support for math achievement: All groups of Frax users showed significant improvement, regardless of their baseline achievement

## Introduction

Proficiency with fractions is an important foundational skill, correlating highly with standardized mathematics test scores. One study found that 6th grade math achievement was, making early interventions to support the building blocks of fractions crucial for overall success in math.

ExploreLearning's Frax is a standards-aligned program designed to support early fractions learning for students. Frax: Sector I, broadly aligned to grade 3 fractions standards, is a game-based and zero-entry program, accessible and engaging to early learners.

**The current report presents the findings from a study of the impact of Frax usage on fractions knowledge and math achievement for 3rd-grade students, comparing year-over-year growth for students who completed the program and similar students who did not.**

## Methods

The district partnered with ExploreLearning to evaluate student growth in math achievement from Spring 2022 to Spring 2023. Frax Sector I consists of 27 consecutive 30-minute Missions. Students in this sample had either (1) no/low usage group (completed less than 5 missions) or (2) high Frax usage (20 or more missions completed).

Math achievement was based on their scores on diagnostic math benchmark assessments that were administered at the end of the school year in both 2nd and 3rd grade. Progress was assessed by changes in normative percentile rank as well as categorical relative grade-level placements (e.g., on-grade level or below grade-level). Fractions knowledge was assessed by scores on the "Fractional Reasoning" section of the test and grade-based standards achievement (below standards, at/near standards, above standards).

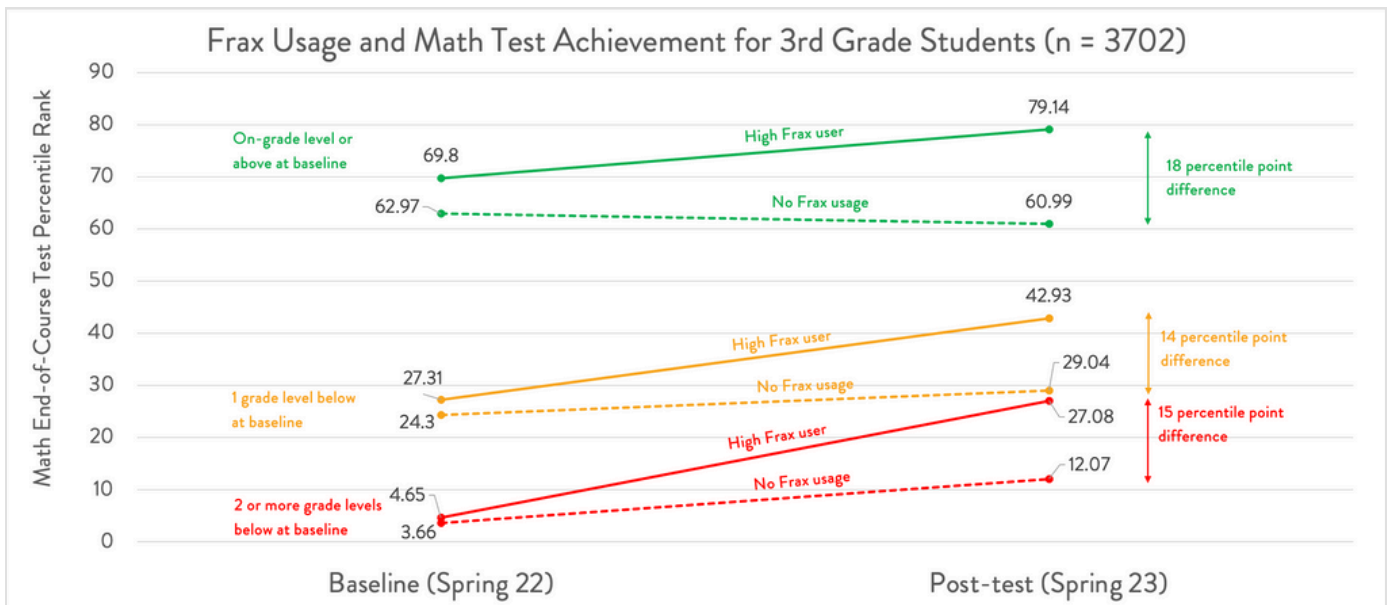
## Results

The current study included 3,702 students. 895 of these students used the Frax program in 3rd grade (20+ missions completed) and 2,807 students had no or very low Frax usage (0-5 missions completed). Student progress for similar groups of students was analyzed by splitting students into three relative achievement levels based on their math test scores at the end of second grade: on-grade level or above, 1-grade level below, and 2 or more grade levels below.

Demographics	No Frax Usage (0-5 missions)	High Frax Usage (20-27 missions)
<b>Sample Size</b>	2,807	895
<b>Female</b>	48%	37%
<b>Black</b>	18%	9%
<b>Hispanic</b>	49%	45%
<b>White</b>	29%	40%
<b>English Learner</b>	25%	18%
<b>504 Eligible</b>	5%	4%

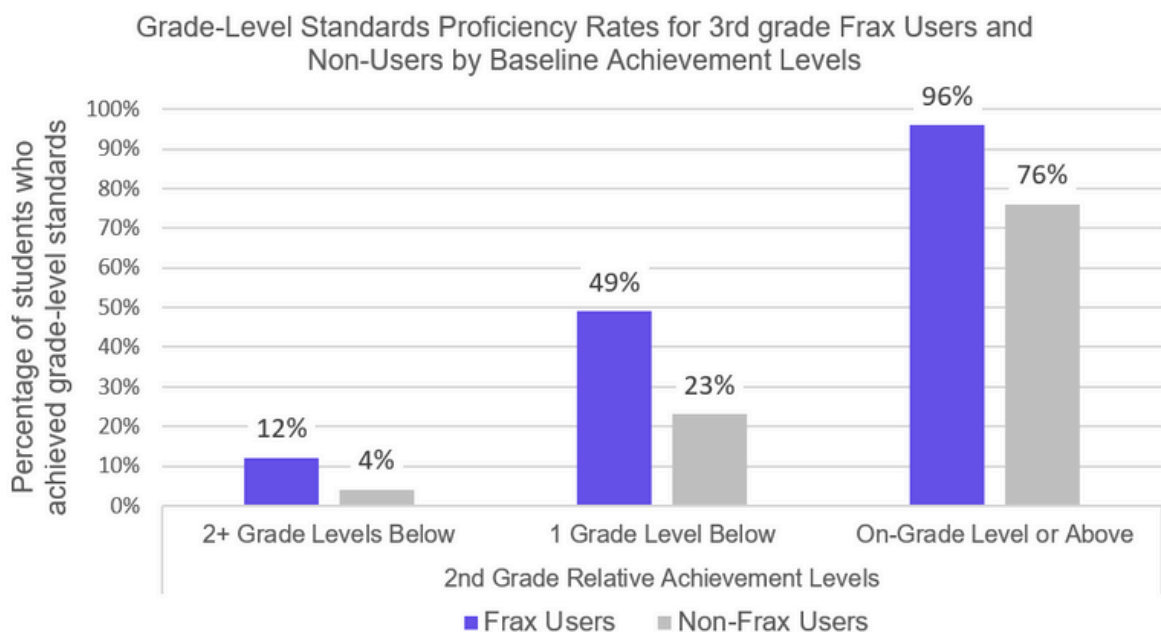
### Finding 1: Frax users of all levels experienced significant improvement compared to similar students who did not use Frax

Within all three achievement levels, students with high Frax usage showed statistically significantly greater gains in percentile rank from pre-test to post-test<sup>1</sup>. At the end of 3rd grade, Frax users outperformed similar students who did not use Frax by 14-18 percentage points.



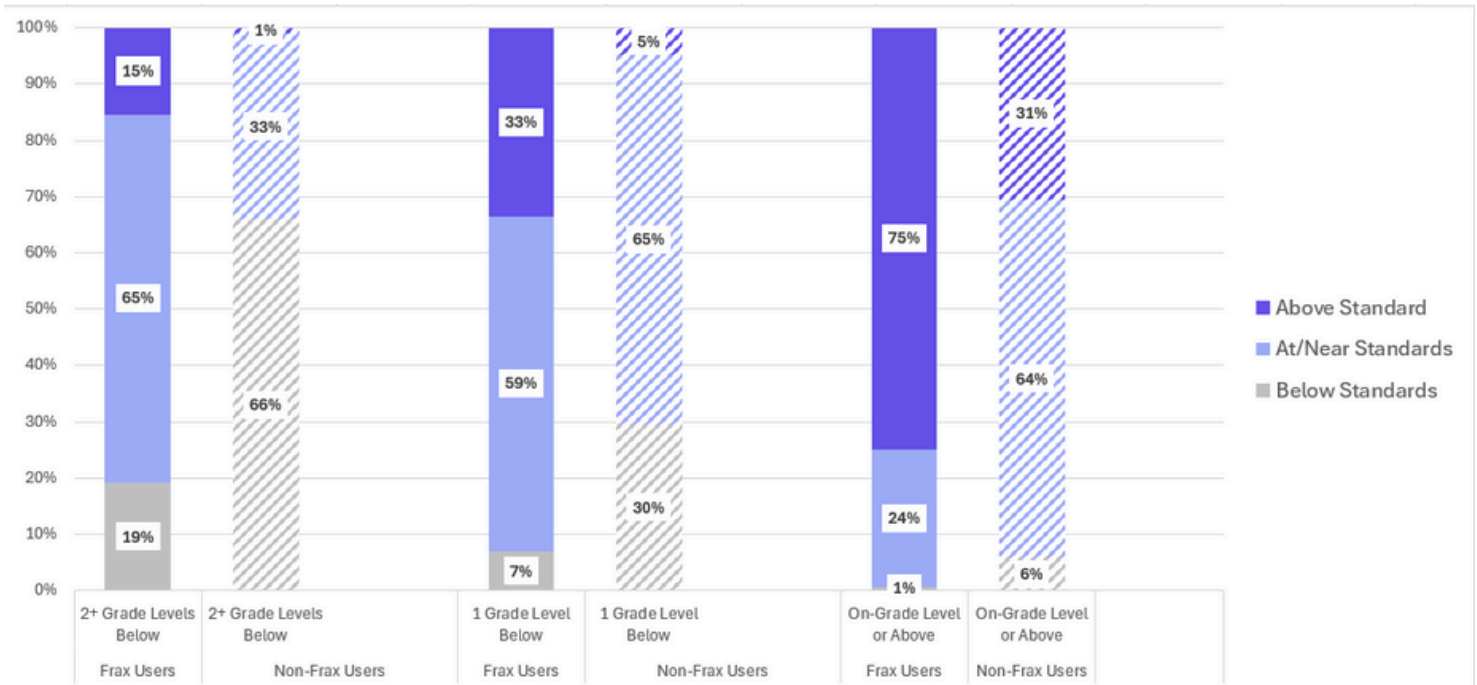
## Finding 2: Frax users of all levels were more likely to achieve grade-level math proficiency compared to similar students who did not use Frax

Within all three achievement levels, students who used Frax were significantly more likely to achieve grade-level proficiency by the end of 3rd grade<sup>2</sup>. For instance, nearly half of all students who were 1-grade level below their peers at the end of 2nd grade and used Frax in 3rd grade achieved proficiency in grade-level math standards by the end of the school year. In contrast, over 75% of similar students who did not use Frax remained below a grade level behind their peers after a year of instruction.



## Finding 3: Frax users of all levels showed higher fractions reasoning knowledge compared to similar students who did not use Frax

Finally, within all three achievement levels, students who used Frax were significantly more likely to meet or exceed 3rd-grade proficiency standards of fractional reasoning compared to similar baseline students who did not use Frax<sup>3</sup>. For instance, Frax users who entered third grade 2 or more grade levels below their peers in math were 2.4x more likely to meet or exceed grade-level standards in Fractional Reasoning compared to similarly at-risk students who did not use Frax. Even among students who were already on-grade level at baseline, students with Frax usage were 2.4x more likely to score “above standards” on the Fractional Reasoning test.



## Conclusions

For students of all achievement levels, high usage of Frax helped them to move closer to grade-level proficiency, as assessed by a standardized, district-wide benchmarking test. Completing Frax: Sector I, a zero-entry and game-based introduction to fractions, helps all students master the foundational fractions concepts that support achievement in math more broadly, moving students closer to meeting proficiency standards and setting them up for later STEM engagement and achievement.

## Statistical Analyses and Technical Notes

<sup>1</sup> Three independent samples t-tests were conducted looking at the difference in individual growth in percentile rank from end of 2nd grade testing to end of third grade testing for Frax users compared to non-Frax users. For all three groups of achievement levels, these tests were significant (all  $p$ 's < .001).

	No/low Frax usage	High Frax usage	Mean Difference
<b>On-grade level</b>	-1.98 (18.46)	9.34 (15.07)	11.32 (.79)***
<b>1 grade level below</b>	4.74 (18.69)	15.63 (18.66)	10.89(1.40)***
<b>2+ grade levels below</b>	8.4 (12.71)	22.42 (19.40)	14.02 (3.85)***
* $p$ <.05    ** $p$ <.01    *** $p$ <.001			

<sup>2</sup> 2x2 chi-squares were conducted to analyze the rates of students meeting grade-level proficiency (on-grade level or above/below satisfactory or lower) based on usage groups (Frax usage/no Frax usage) within each of the three baseline achievement level (on-grade level or above, 1 grade level below, 2+ grade levels below). All three chi-squares were significant (all  $p$ 's < .04).

<sup>3</sup>2x2 chi-squares were conducted to analyze the rates of students meeting or exceeding (at/near standards + above standards) grade-level proficiency standards based on usage groups (Frax usage/no Frax usage) within each of the three baseline achievement level (on-grade level or above, 1 grade level below, 2+ grade levels below). All three chi-squares were significant (all  $p$ 's < .001).