

Frax and Reflex Improve Student Math Achievement

Evidence from a District's First-Year Implementation

STUDY AT A GLANCE

Study Sample:

- Grandville Public Schools in Michigan
- Large, suburban locale
- 1,430 2nd-5th grade students
- District Student Diversity: 16% non-white, 14% Economically disadvantaged, 17% academically at-risk (scored below-average)

Research Methodology:

- District first implemented Reflex and Frax in the 2023-2024 school year
- Reflex usage (number of days of usage, growth in fluency scores) and Frax usage (number of Missions completed) were reported from the software platform
- NWEA MAP Growth Math data was compared from pre-implementation (2022-2023) to post-implementation (2023-2024) for users and non-users

Main Findings:

- Reflex usage was correlated with student improvement when controlling for baseline performance
- Frax usage was also associated with student improvement
- Students who scored in the “Low” achievement categories and used Frax were significantly more likely than similar non-users to move to “Average” or higher achievement categories

Introduction

Math facts and fractions are two areas where young math students struggle the most. They are also strong predictors of future success in math, uniquely predicting students' standardized test scores and participation in career and college-prep math coursework, such as Algebra. Given their importance for academic success, targeted practice and support in these areas have the potential to impact district-wide success in math.

ExploreLearning's Reflex and Frax are game-based programs that are both accessible and engaging to early learners. Reflex is an adaptive and individualized system for mastering basic math facts in addition, subtraction, multiplication, and division for students in grades 2 and up. Frax is a standards-aligned program designed to support early fractions learning. The two levels of Frax, Sector I and Sector II, are broadly aligned to grade 3 and grade 4 fractions standards.

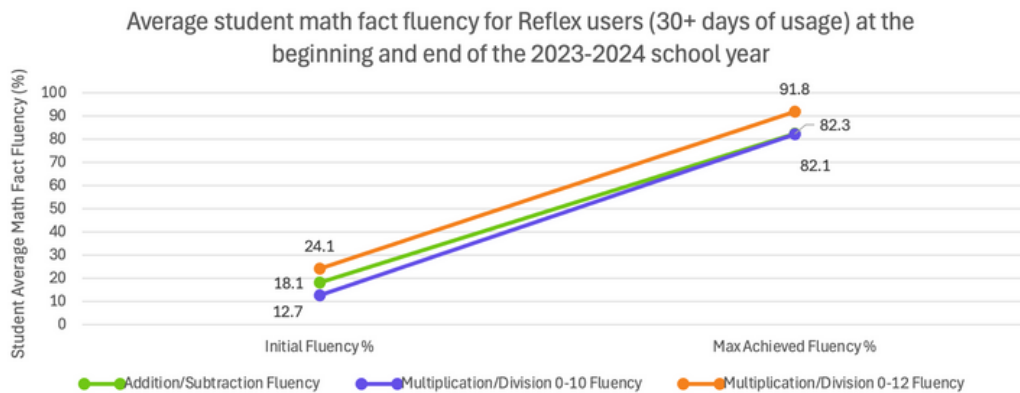
The current study analyzed the impact of Reflex and Frax usage on math achievement on the NWEA MAP Math Growth Assessment for students in grades 2-5. The data comes from a district that implemented the programs in the 23-24 school year. Statistical analyses compared student growth pre-implementation to post-implementation, and correlated product usage with student math growth.

Methods

The district partnered with ExploreLearning to evaluate student growth in math achievement from Fall 2022 to Spring 2024. The analysis here included data from 1,430 students in grades 2-5. Scores on the NWEA Math MAP Assessments at the beginning and end of the school year were used to calculate student growth as it related to Frax and Reflex Usage. The Appendix contains detailed information about the specific variables for both usage and outcomes data analyzed here.

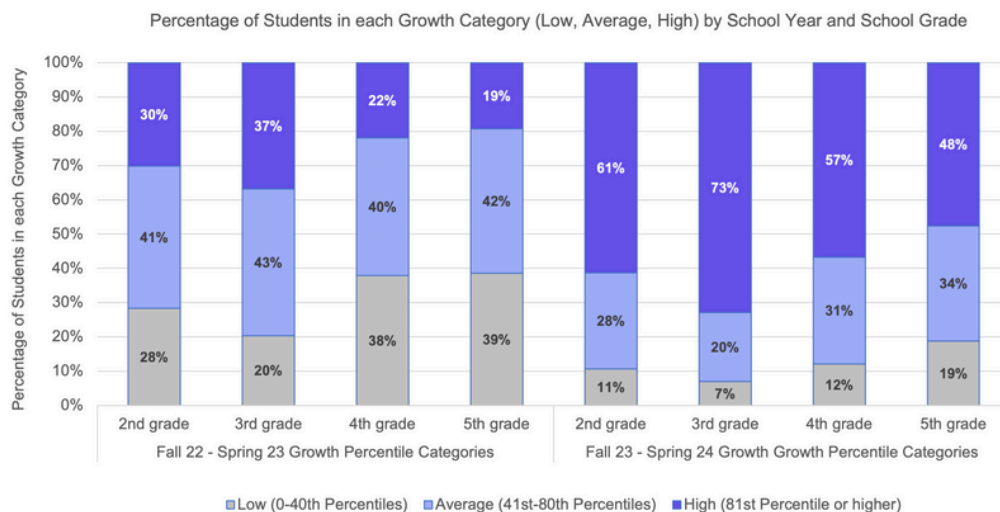
Results

The district had a very successful implementation in their first year. A large number of students had frequent and high fidelity usage of both Reflex and Frax. For instance, nearly all of their 2nd grade students (93%) actively used Reflex (addition/subtraction) with an average of 68 days, or approximately 2 days per week for the entire school year. Their 2nd grade students average initial fluency was 15% and the average max fluency achieved was 86%, with 71% of students reaching or exceeding 80% fluency. The graph below highlights the math fact fluency growth observed for all levels of learners who had significant usage of Reflex. Frax usage was also high, with almost half (46%) of 3rd-5th grade students completing 20+ missions in Frax Sector 1 and 20% of 4th and 5th grade students completing 20+ missions in Frax Sector 2.



Finding 1: District students demonstrated larger BOY-EOC math growth after implementing Reflex and Frax

The district saw significantly higher fall – spring growth achievement in the 23-24 school year, after district-wide implementation of Reflex and Frax, compared to 22-23. For instance, in 3rd grade, where most students used Reflex and Frax, 2x more students demonstrated High growth compared to the previous year.



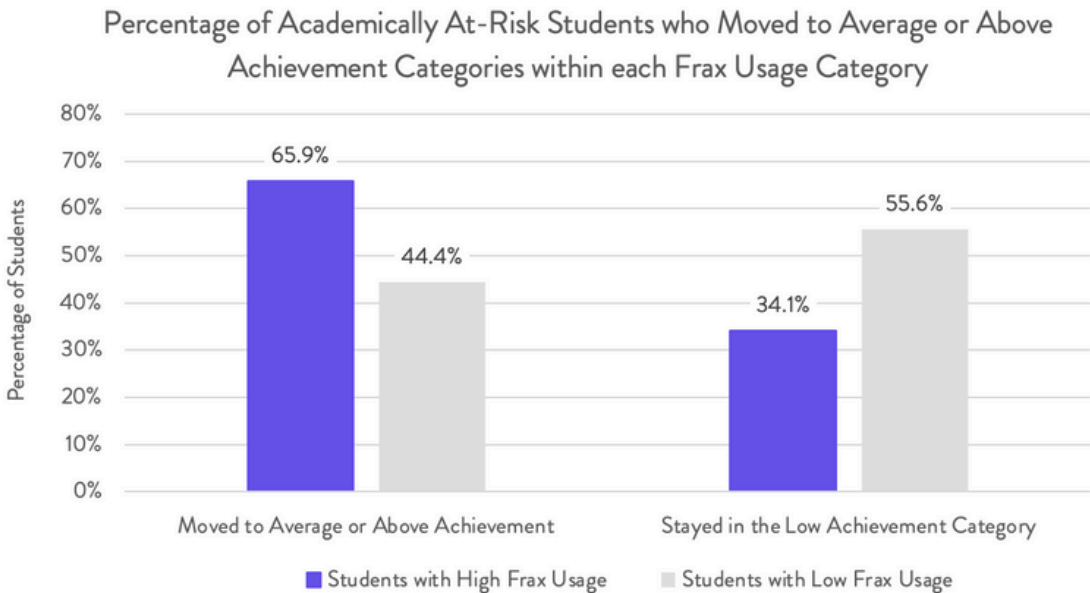
Finding 2: Improving math fact fluency with Reflex was correlated with math standards achievement, regardless of baseline achievement

Reflex usage in grades 2-4 was significantly correlated with math achievement scores. Partial correlational analyses were conducted using student fluency growth from fall to spring in the developmentally appropriate level and their NWEA MAP Growth spring assessment as correlation variables, with baseline (fall) achievement being used as a statistical control variable¹. Independent of baseline math abilities, larger improvements in fact fluency were significantly predictive of higher demonstrated math achievement.

Finding 3: Frax usage was associated with learning gains, especially for academically at-risk students

Analyses were conducted looking at the percentage of projected growth obtained by Frax users compared to non-users. Projected growth allows us to compare different students because it accounts for grade level and baseline achievement, making 100% an attainable and realistic growth goal for all students. Students in 3rd-5th grades with high Frax usage achieved a significantly higher percentage of projected growth between fall and spring testing than non-Frax users,² making Frax an important tool for student advancement.

Additionally, we tested the benefit of Frax specifically for those students who need the most assistance catching up to grade-level proficiency. Chi-square analyses were used to test movement towards proficiency for students who scored in the “lower” achievement quintiles in Fall 2023 (<41st percentile) based on Frax usage. 66% of the low-achieving students who used Frax moved to average or higher quintiles by the end of the year, compared to only 44% of low-achieving students with no-low Frax usage.³



Conclusions

This study analyzed student growth after implementing Frax and Reflex for the first time. The district had a high fidelity implementation, with many students showing high fact fluency growth in Reflex and completing a number of missions in Frax. Importantly, those students showed higher than expected growth on a math proficiency exam, and higher growth than non-users. At-risk students who used these programs were significantly more likely to reach grade-level proficiency and catch up to their peers in just a few months.

Together, Reflex and Frax help all students master foundational mathematical 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. This study highlights the benefit of Frax and Reflex for all students, and the potential of these programs to serve as both a universal teaching tool and a targeted intervention program.

APPENDIX: Detailed Methods

Math Achievement

Math achievement was based on student scores on NWEA MAP Growth math assessments administered at the beginning (BOY) and at the end (EOC) of each academic year. The following variables and metrics from the NWEA test were analyzed:

- **Student RIT Scores and RIT Score Percentiles:** RIT scores are stable, equal interval scales that use individual item difficulty to measure student achievement independent of grade level. The RIT scale ranges from 100–350. Percentile rank indicates how well a student performed compared to the students in the specific norm group.
- **Achievement quintiles:** A student's RIT score percentile places them into 5 equal achievement ranks (low, low-average, average, high-average, and high).
- **Percentage of Projected Growth:** NWEA calculates projected growth, which indicates the average growth for all students in the same grade and starting RIT score.
- **Growth quintiles:** The growth percentile is a normative statistic that indicates how much a student grew between fall and spring testing compared to similar students in the norm group; their percentile places them into 5 equal growth ranks (low, low-average, average, high-average, and high).

Reflex Usage

Reflex has three different levels for practicing basic math fact skills: addition/subtraction 0-10, multiplication/division 0-10, and multiplication/division 0-12. Two metrics of usage were analyzed here:

- **Number of days of usage:** The number of days of program usage before the date of their spring NWEA Map Math test was summed for each student.
- **Fluency Growth:** Each student's fluency growth was calculated by subtracting their starting fluency from their highest reached fluency (prior to the date of their spring NWEA Map Math test). This was calculated independently for each of the three math fact levels.

Frax Usage

Frax Sector 1 consists of 27 consecutive lessons ("Missions") broadly aligned to 3rd-grade fractions standards, and Sector 2 consists of 30 Missions broadly aligned to 4th-grade fractions standards. All teachers in the district had access to Frax in the 23-24 school year and could choose whether or not to implement the program in their classrooms. Based on prior research, the following metric was used to analyze fidelity usage:

- **Number of Missions Completed:** students were coded as "High (Fidelity) Frax Users" if they completed 20 or more missions in the appropriate Sector (Sector 1 only for Grade 3; Sectors 1 + 2 for Grades 4 and 5).

APPENDIX: Statistical Analyses and Technical Notes

¹ Three partial correlation analyses were conducted looking at the relationship between growth in math fact fluency from fall to spring (prior to testing date) and RIT scores on the spring NWEA MAP Growth math test, using fall NWEA MAP Growth math RIT scores as a control variable. For all three grades, these tests were significant (all p 's < .01).

	N	Pearson Correlation	
		r	p
2 nd grade (Addition/Subtraction)	318	.173	.002
3 rd grade (Multiplication/Division 0-10)	182	.305	<.001
4 th grade (Multiplication/Division 0-12)	222	.184	.006

² Independent samples t-tests were conducted separately for 3rd, 4th, and 5th grade students comparing the percentage of projected growth achieved by High Frax users (20+ missions in Frax) versus low Frax. For all three grades, these tests were significant (all p 's < .05).

	High Frax Users		Low Frax Users		t-test
	M	SD	M	SD	
3 rd Grade	192%	59.84	162%	59.75	4.3284**
4 th Grade	188%	63.96	166%	77.00	1.9234*
5 th Grade	182%	79.43	150%	89.32	2.5019*

* $p < .05$, ** $p < .01$

³ A 2x2 chi-square was conducted to analyze the rates of at-risk students meeting or exceeding grade-level proficiency standards (average, average-high, and high achievement quintiles) based on usage groups (20+ missions of Frax completed/no-low Frax usage). By the end of the spring, 66% of the low-achieving students who used Frax moved to average or higher quintiles by the end of the year, compared to only 44% of low-achieving students with no-low Frax usage. The chi-square was significant, $X^2(2, N = 272) = 10.81, p = .001$.