

Reflex Supports Achievement of Grade-Level Math Proficiency

Evidence from over 35,000 Elementary School Students' State Math Scores

Study Sample:

- 2023-2024 school year
- 35,000+ students in Grades 3, 4, and 5 from 150+ elementary schools within a single, large district in the US
- Minority-majority student demographics: 90% non-white, 30% economically disadvantaged

Research Methodology:

- Independent Variable: Schools were categorized as high users of Reflex or low users of Reflex based on (1) high percentage of students using Reflex and (2) student's average 30+ days of Reflex usage
- Dependent Variables: (1) Overall average fluency growth for each school was calculated from Reflex reports. (2) The percentage of students meeting grade-level proficiency on the End-of-Year state math test

Main Findings:

- Students at schools with higher Reflex usage improved their math fact fluency by 64 percentage points
- Students at schools with high Reflex usage were significantly more likely to meet or exceed grade-level proficiency compared with students at schools with low Reflex usage
- Reflex usage was correlated with achievement even when controlling for socio-economic status

Reflex is an adaptive, online program that helps students develop math fact fluency—the automatic (quick and effortless) recall of basic math facts. When students use Reflex, we observe gains in fluency, with the individual student goal of achieving full fluency in the grade-appropriate level (i.e., addition/subtraction or multiplication/division). This improvement in fluency contributes to students' ability to solve more difficult problems quicker and more accurately, building confidence in students' math ability and helping them succeed in more advanced mathematics with less effort.

The current study empirically tests the impact of years of usage of Reflex on student math performance. Here we compare schools with high and low usage of Reflex within one of the largest school districts in the United States. We expect to see higher rates of students achieving grade-level proficiency in mathematics in schools where more students are using Reflex more frequently and with higher fidelity.

Methodology

The sample included 35,000+ students at 150+ elementary schools. The district student demographic is Minority-majority, with 90% of the students classified as non-white, and 30% of families are economically disadvantaged.

Student usage of Reflex in the 2023-2024 school year was used to categorize schools as having High Reflex Usage or Low Reflex Usage.

- High Reflex Usage (n = 63 schools): 80% of students in Grades 3 and 4 used Reflex, with an average of 30+ days of usage per student.
- Low Reflex Usage (n = 88 schools): fewer than 30 days of average student usage in Grades 3 and 4.

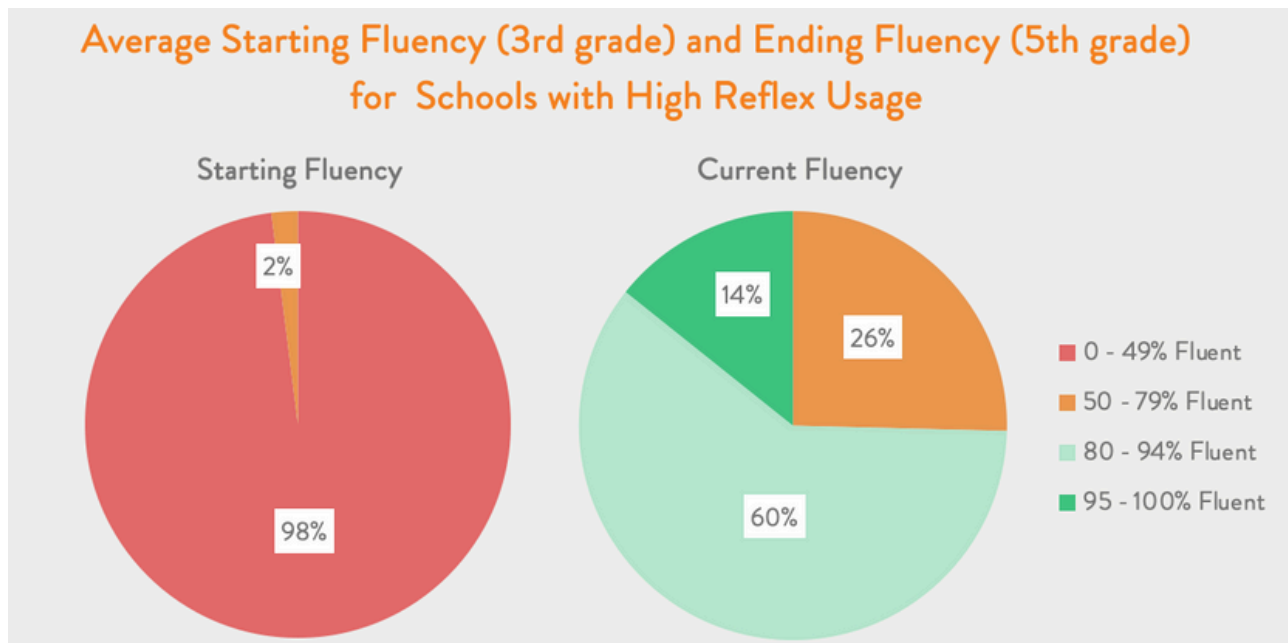
Methodology (continued)

Student fluency growth was assessed via performance in-app, with average starting fluency and ending fluency reported per grade and per school. The amount of overall fluency growth at each school was estimated by comparing the average starting fluency for 3rd graders at the beginning of the school year to the average ending fluency for 5th graders at the end of the school year.

To test the main hypothesis, student math performance was determined by achieving proficiency on the state math test (i.e., the percentage of students per grade level at each school who scored in the “Proficient” category or higher). Statistical t-tests were used to compare proficiency rates between schools with high Reflex usage and schools with and low Reflex usage. Additionally, correlational analyses were conducted to look at the impact of dosage (usage) at the school level on math standards performance.

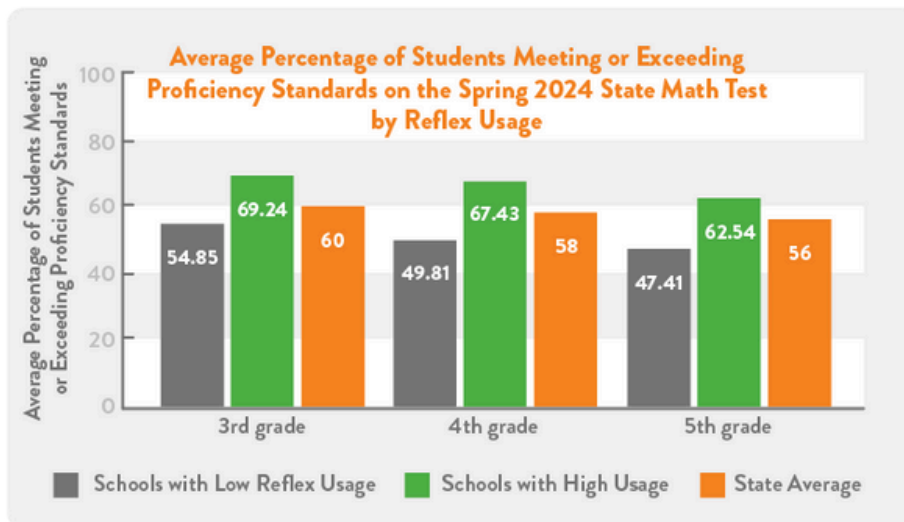
Results

Students attending schools with high Reflex usage averaged 67 days on Reflex (approximately 2 days per week) in 3rd grade and 57 days on Reflex in 4th grade, compared to an average of 13 and 11 days of usage, respectively, for students at low Reflex usage schools. Reflex usage at the high usage schools resulted in large fluency gains; on average, students at high usage schools improved 64 percentage points from a starting fluency at the beginning of 3rd grade of 20.4% to an average ending fluency at the end of 5th grade of 84.8%.



Results (continued)

The gains from Reflex usage were associated with higher rates of grade-level proficiency in mathematics. When comparing schools with higher Reflex usage to schools with lower Reflex usage, we find that across grades 3-5 schools with higher Reflex usage showed significantly higher performance on the end-of-year state math test compared to schools with lower Reflex usage, with a greater number of students meeting or exceeding grade-level proficiency¹. In fact, schools with high Reflex usage exceeded the state average passing rates, while low-usage schools underperformed.



Next, analyses were conducted looking at the number of days of Reflex usage (dosage) and grade-level proficiency in mathematics. Because differences in economic advantages typically explain a substantial amount of variation in students' math performance, the current analyses use SES indicators as a statistical control variable. Even when controlling for the impact of SES, for all three grade levels, schools that had higher usage of Reflex also had a greater percentage of students meeting or exceeding grade-level proficiency on the end-of-year state math standards test².

Conclusions

Across a large and diverse school district, we found evidence that high Reflex usage resulted in improved math fact fluency and higher achievement of grade-level proficiency on a statewide end-of-year mathematics summative assessment compared to students within the same district that had low Reflex usage. Additionally, schools where students used Reflex more were even more likely to achieve grade level proficiency, even when controlling for differences in economic advantages, which typically explains substantial variation in students' math achievement. Together, this evidence suggests that Reflex can be a useful tool for supporting the growth of all elementary level students, helping them to achieve grade-level proficiency.

Technical Notes

1. Independent samples t-tests were conducted to compare the percentage of students meeting or exceeding grade level proficiency on end-of-year state math test scores at low Reflex usage schools and high Reflex usage schools for grades 3, 4, and 5. All three differences were significant:
 - a. Grade 3: low Reflex ($M = 54.85$, $SD = 18.68$) vs high Reflex ($M = 69.24$, $SD = 14.75$), $t(149) = 5.081$, $p < .001$, Cohen's $d = .84$
 - b. Grade 4: low Reflex ($M = 49.81$, $SD = 17.26$) vs high Reflex ($M = 67.43$, $SD = 14.17$), $t(149) = 6.65$, $p < .001$, Cohen's $d = 1.10$
 - c. Grade 5: low Reflex ($M = 47.41$, $SD = 16.96$) vs high Reflex ($M = 62.54$, $SD = 15.34$), $t(149) = 5.62$, $p < .001$, Cohen's $d = .93$
2. Two-tailed partial correlations were conducted looking at the relationship between the number of days of Reflex usage and the percentage of students meeting or exceeding proficiency on the end-of-year state math test, controlling for the percentage of students at a school determined to be lower SES (per state reporting). Looking individually at each grade, all three partial correlations were significant:
 - a. Grade 3: $r(148) = .300$, $p < .001$
 - b. Grade 4: $r(148) = .301$, $p < .001$
 - c. Grade 5: $r(148) = .195$, $p = .017$