Freckle Math Can Help Address Learning Loss

Avoiding the “COVID Slide”
A consistent finding across multiple research studies is that student mathematics achievement suffered because of the COVID-19 pandemic, which forced schools to shut down physical operations in the spring of 2020 and make abrupt changes to instructional delivery systems. By the time students began the 2020–2021 school year, students were, on average, the equivalent of 2–3 months behind in terms of their math achievement (see Renaissance Learning, 2020a). This deficit is often referred to as the “COVID slide.”

Why did students fall behind? A common explanation is that the hastily arranged distance learning programs in the spring of 2020 could not replicate the efficacy of more traditional in-person instruction. Moreover, many students participated minimally or not at all in the remote learning opportunities offered to them. Finally, many summer enrichment and remediation opportunities had to be either cancelled or scaled back, further reducing students’ opportunities to stay engaged or get caught up.

When the school building closures were announced, many districts adopted new technologies or placed a greater emphasis on existing ed tech programs to keep students engaged and moving forward. The purpose of this study is to explore whether the use of one program, Freckle Math, was effective in helping students avoid the COVID slide.

The Program

Freckle™ Math by Renaissance offers personalized, adaptive online practice. With over 65,000 items covering K–9 standards, students can engage with a variety of math problems all at their own skill level. Teachers help guide student practice by choosing specific standards or making use of optional lessons. Previous analyses have indicated that the intensity of Freckle Math practice is associated with student growth in general math ability (see Renaissance Learning, 2020b).

The Study

Students participating in this study are a subset of the national sample used for the How Kids Are Performing study (Renaissance Learning, 2020a) that documented impacts of the pandemic on achievement. The national How Kids Are Performing study involved more than 2 million students in the US. The dataset for this study included nearly two hundred thousand (n = 197,160) who were entering grades 2–8 at the start of the 2020–2021 school year. They came from 891 schools, within 95 school districts, across 31 states.

Students were selected for this study if they (a) took Star Math in the 2019–2020 and 2020–2021 school years, and (b) attended a district in which Freckle Math was used between March 2020 and October 2020. We limited the sample of Freckle users to those who achieved a reasonably high average percent correct on their assignments, indicating they were using the program with some degree of fidelity. Some of the selected students used Freckle regularly and for a long period of time, others used it more sparingly or for just a few days or weeks, and some never used it at all, most likely because they attended a school that had not purchased it, even if it was used at other schools in the district. Such usage patterns create a natural quasi-experiment and allow us to compare outcomes among non-users, light users, and heavier users.

All students completed Star Math tests both in the fall of 2019 and 2020. Researchers used historical, pre-COVID era growth norms drawn from tens of millions of student math assessment records to establish for each student an expected fall 2020 achievement score based on their grade and prior performance. Each student’s expected score was compared with their observed fall 2020 performance and differences were aggregated. Additional details on setting expected scores are provided in the How Kids Are Performing report.

Nationally, the How Kids Are Performing study documented an average deficit of 11 Star Math Scaled Score points between observed and expected performance. To contextualize that gap, it’s estimated that it would take most students about 2–3 months to cover that much ground. This study aims to determine whether

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1 Star Math is an adaptive test of general mathematics achievement. For more information, see Renaissance Learning (2019b).
Freckle Math was associated with smaller deficits, and whether there is a relationship between the intensity of Freckle Math use and achievement outcomes.

Findings: All Students

On average, students with any amount of Freckle Math usage experienced smaller deficits than other students in the same districts who did not use the program. There was a positive relationship between the duration of Freckle use and outcomes; the longer students used Freckle, the stronger their growth. Those using Freckle Math for a relatively short duration (<100 days during a ~200-day spring to fall period) experienced deficits, though those deficits were smaller than non-users. Those using the program for a longer duration (100 days or more during the same spring to fall period), beginning in the spring and continuing to the summer or fall, had a deficit of nearly zero Scaled Score points, meaning they began the school year approximately where they would have been expected to be, pre-pandemic. In other words, students using Freckle Math for more than a three-month period avoided the COVID slide.

Findings: Students Who Had Been Struggling in Math

We conducted a special analysis on those students who were scoring much lower than their peers prior to the pandemic. These students’ achievement was in the bottom quartile (the 25th percentile or below) in the fall of 2019. Within this group, the non-Freckle users experienced a deficit comparable in size to the overall average, but surprisingly, not only did the Freckle users avoid the COVID slide, they actually exceeded pre-COVID performance expectations by nearly 10 Scaled Score points coming into the 2020–2021 school year.
Discussion

Caveats: Because Freckle use was voluntary, the results of these analyses should be considered correlational, not causal. While the trends presented are helpful to understand the relationship between personalized digital math practice and achievement, more structured studies (involving recruitment and random assignment) would be needed to establish a causal relationship. Such studies are under development. Furthermore, we should bear in mind we lack comprehensive data on student experiences during this period, including whether they used other digital math practice programs in addition to Freckle Math, whether the comparison group (non-Freckle users) were using other personalized practice programs, and the nature of the remote instruction provided to students in participating districts during the spring of 2020.

Though not comprehensive, these and prior results suggest that Freckle’s personalized, adaptive math practice can play an important role in supporting student learning. Pre-pandemic studies (KnowProgress, 2016; Renaissance Learning, 2020b) demonstrated similarly positive outcomes between the intensity and duration of Freckle Math use and achievement outcomes.

The unprecedented disruption to in-person instruction in the spring and summer of 2020 resulted in students losing, on average, around 2–3 months’ worth of mathematics development (see Renaissance Learning, 2020a). The results of this study suggest that Freckle Math helped students largely avoid those deficits, even while normal classroom instruction was not possible. The longer students used Freckle Math during the spring to fall 2020 period, the more likely they were to avoid the “COVID slide.”

The benefits may be strongest for students who had experienced prior difficulties in mathematics. Not only did they avoid the “COVID slide” that set students back an average of 2–3 months in their development, they actually began the 2020–2021 school year ahead of pre-COVID performance expectations. Future research should focus on this subpopulation to better understand the role Freckle Math may play in reducing achievement gaps.

These findings should not be interpreted as indicating that Freckle Math or any other personalized practice program could replace core in-person instruction. But collectively this and prior studies do suggest that Freckle Math’s approach to adapting practice opportunities to each student can help accelerate learning in both typical and atypical instructional circumstances.

References and additional resources

KnowProgress. (2016). Freckle increases math scores in elementary students. Freckle Education.  

Renaissance Learning (2019a). Freckle Math meets the “Evidence-Based” requirements of ESSA.  

Renaissance Learning. (2019b). Star Math technical manual. Available by request to research@renaissance.com
