Imagine Math Facts: Significantly Improved Math Fact Fluency and Automaticity

Background

The development of math fact fluency and automaticity is a core requirement for later success in advanced mathematics (Nelson, Parker, & Zaslofsky, 2016; Steel & Funnell, 2001). To be considered fluent and automatic, a student must be able to rapidly recall the correct solutions to basic math operations including addition, subtraction, multiplication, and division (Geary, 2011). Despite the importance of developing these skills, several national groups, including the 2008 National Mathematics Advisory Panel, have found that "few curricula in the United States provide sufficient practice to ensure fast and efficient solving of basic fact combinations and execution of the standard algorithms." (NMAP, 2008)

Given this context, Imagine Math Facts is designed to improve math fact fluency and automaticity in elementary age students by differentiating instruction for each student. The game-based program provides repeated and focused practice on previously unlearned math facts with constant and immediate feedback while maintaining engagement through exciting and rewarding gameplay.

Study Procedures

During the 2018-2019 school year, a southern Texas school implemented Imagine Math Facts in first through third grades to help improve addition, subtraction, and multiplication fact fluency and automaticity. Since students typically need only 6-10 weeks to complete all Imagine Math Facts exercises for each math fact family (addition, subtraction, etc.), students practiced different math fact families in each semester. During the first semester, first and second grade students practiced addition while third grade students practiced subtraction in the program. In the second semester, first and second grade students practiced subtraction while the third graders worked on multiplication.
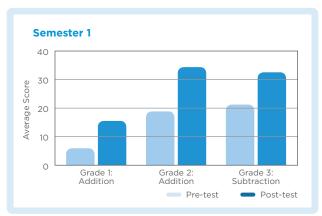
To determine the impact of using the Imagine Math Facts program, teachers administered 3-minute, 100-question math fact tests at the beginning and end of each semester. Students were instructed to complete as many problems as possible within the time limit. The number of correct responses was used as the final score.

Results

Students using Imagine Math Facts logged approximately two hours on average in the program during both the first and second semesters.

Figure 1 presents the average pre- and post-test scores by grade for students who used Imagine Math Facts during each semester of the 2018-2019 school year. Students in all three grade levels experienced significant improvements in math fact fluency and automaticity after using the program. Figure 2 demonstrates the positive correlation between progress within the Imagine Math Facts program and change in performance between the pre- and post-tests.
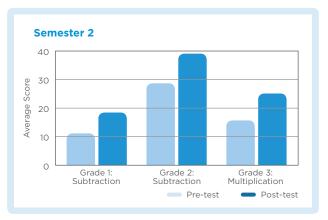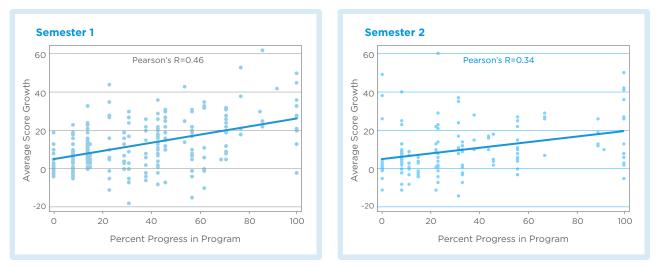
Figure 1. Average Pre- and Post-Test Performance by Grade.

Figure 2. Correlation between Percent Progress in the Imagine Math Facts Program and Average Post-Test Performance.

The results show students using the program in this Texas school during the 2018-2019 school year experienced signficant improvements in math fact fluency and automaticity as demonstrated by performance on the 100-question math facts assessments. Given these findings, we would expect comparable results for other students who use the Imagine Math Facts program with fidelity.

References

Geary, D. C. (2011). Cognitive predictors of achievement growth in mathematics: A 5-year longitudinal study. Developmental Psychology, 47(6), 1539-1552. doi:10.1037/a0025510

National Mathematics Advisory Panel (2008). The Final Report of the National Mathematics Advisory Panel. Washington, DC.

Nelson, P. M., Parker, D. C., & Zaslofsky, A. F. (2016). The Relative Value of Growth in Math Fact Skills Across Late Elementary and Middle School. Assessment for Effective Intervention, 41(3), 184-192. doi:10.1177/1534508416634613

Steel, S., & Funnell, E. (2001). Learning multiplication facts: a study of children taught by discovery methods in England. J Exp Child Psychol, 79(1), 37-55. doi:10.1006/jecp.2000.2579

Imagine Learning®