Imagine Math Facts® Builds Total Math Fact Fluency Faster

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Achieve **94%** fluency in **less than five hours**

THE IMPORTANCE OF MATH FACT FLUENCY

Prior research has demonstrated that achieving fluency in basic math facts, including addition, subtraction, multiplication, and division, is imperative for later mathematics achievement (Geary, 2011). Indeed, students who achieve math fact fluency in early elementary grades are more likely to succeed in later math topics such as algebra and geometry (Nelson et al., 2016; Steel & Funnell, 2001). By definition, students who are fluent in basic math facts are capable of quickly and automatically recalling the solutions to single-digit mathematical operations (Musti-Rao et al., 2015).

The development of fact fluency is important for liberating the mental resources necessary for learning other math concepts. A student who becomes more fluent leaves behind old methods of calculation, such as finger counting, and eventually relies entirely on semantic memory (Baroody, 2006; Lemaire & Siegler, 1995). In fact, from a cognitive psychology perspective, by achieving math fact fluency and automaticity, a student frees up the cognitive resources necessary to make simple computations and redirects those resources towards more difficult concepts and tasks (Fuchs et al., 2005; Parkhurst et al., 2010).

In 2008, the National Mathematics Advisory Panel reported decreases in mathematics proficiency across the nation (NMAP, 2008). That same report suggested that knowledge of and fluency in basic math facts may be at the core of the deficits in math proficiency. Therefore, methods, programs, or resources aimed at improving math fact fluency may ultimately improve overall national math proficiency.

BUILDING FLUENCY WITH IMAGINE MATH FACTS

Imagine Math Facts is a digital education program designed to increase math fact fluency in addition, subtraction, multiplication, and division. The program, designed as multiple educational video games, differentiates instruction for each user and focuses practice on previously unlearned math facts. The program provides several opportunities to practice each unlearned math fact. By focusing on unlearned facts, the program meets students where they are and saves valuable instructional time.

Focused Practice and Intensive Curriculum

To achieve math fact fluency, several opportunities to practice each fact are required (Burns et al., 2015; Hawkins et al., 2017). As students first engage with the Imagine Math Facts program, they are presented with multiple practice opportunities with lenient response windows. However, as progress is made and mastery improved, the program automatically shortens response times, increases the number of distractors, and generally raises the stakes thus motivating students to rely more on automatic recall instead of computation.

Further, the Imagine Math Facts program provides automatic feedback with every problem worked. Without such feedback, students may incorrectly assume that their answers are correct and unintentionally build fluency on false information (Hawkins et al., 2017). Such immediate and frequent feedback is difficult for a single teacher to provide for every student they serve. Therefore, digital programs such as Imagine Math Facts may be particularly helpful in addressing each error for each student.

Adaptive Placement and Differentiated Instruction

As with many other subjects, students learn and gain fluency in math facts at different rates. For example, upon entrance to third grade (the grade in which multiplication facts instruction typically begins), some students may already be fluent in some facts whereas others may be completely naïve to the concept of multiplication. Due to these initial differences in skill or academic preparedness, the amount, pace, and content of math fact practice should differ by student. Again, such differentiation can be difficult for a single teacher to provide to a full class of students.

Imagine Math Facts provides differentiated instruction and practice for students of all skill levels. Specifically, when students first begin using the program, a pre-test is administered to assess prior knowledge and skill. The data retrieved from the pre-test is used to inform the program which math facts should receive the most practice and in what order they should be presented. As students progress and develop fluency for some math facts, the program adjusts to focus on unlearned facts ultimately leading to fluency for all math facts.

Increased Motivation and Engagement Through Gamification

Motivating students to spend the time and effort necessary to achieve math fact fluency can be difficult for students of all ability levels. However, motivation and engagement, which influence attention and focus, are important for learning success (Kebritchi et al., 2010). As such, teaching methods that increase motivation and engagement are more likely to improve learning outcomes (Fuchs et al., 2005).

The Imagine Math Facts program is designed in the style of modern video games. With this design and format, student attention is immediately captured, and engagement is continuously preserved through interesting and challenging gameplay.

ACHIEVING FLUENCY FASTER

With consistent drill and practice, all students are expected to eventually achieve math fact fluency. However, due to differences in prior knowledge and skill, the amount of practice time required to achieve total fluency can differ substantially from student to student. Unfortunately, many students are not able to achieve fluency by the time their teachers need to move on to instruction on other math concepts and skills.

Data from over 2,500 users of the Imagine Math Facts program reveals that students typically achieve fluency in as little as 4–5 hours (Figure 1). Therefore, by using Imagine Math Facts, teachers can assist students at all ability levels achieve math fact fluency faster and simultaneously free up valuable instructional time.

Importantly, by the time that students complete their average of 4 to 5 hours within the program, they achieve near perfect fluency across all math fact families. Relying upon internal pre-test and post-test data from the Imagine Math Facts program, we are able to visualize a drastic improvement in fact fluency (Figure 2). Use of the Imagine Math Facts program improves student fluency from an average of 30–50% at pre-test to well over 90% at post-test.

Figure 1. Distribution of hours in program by grade.

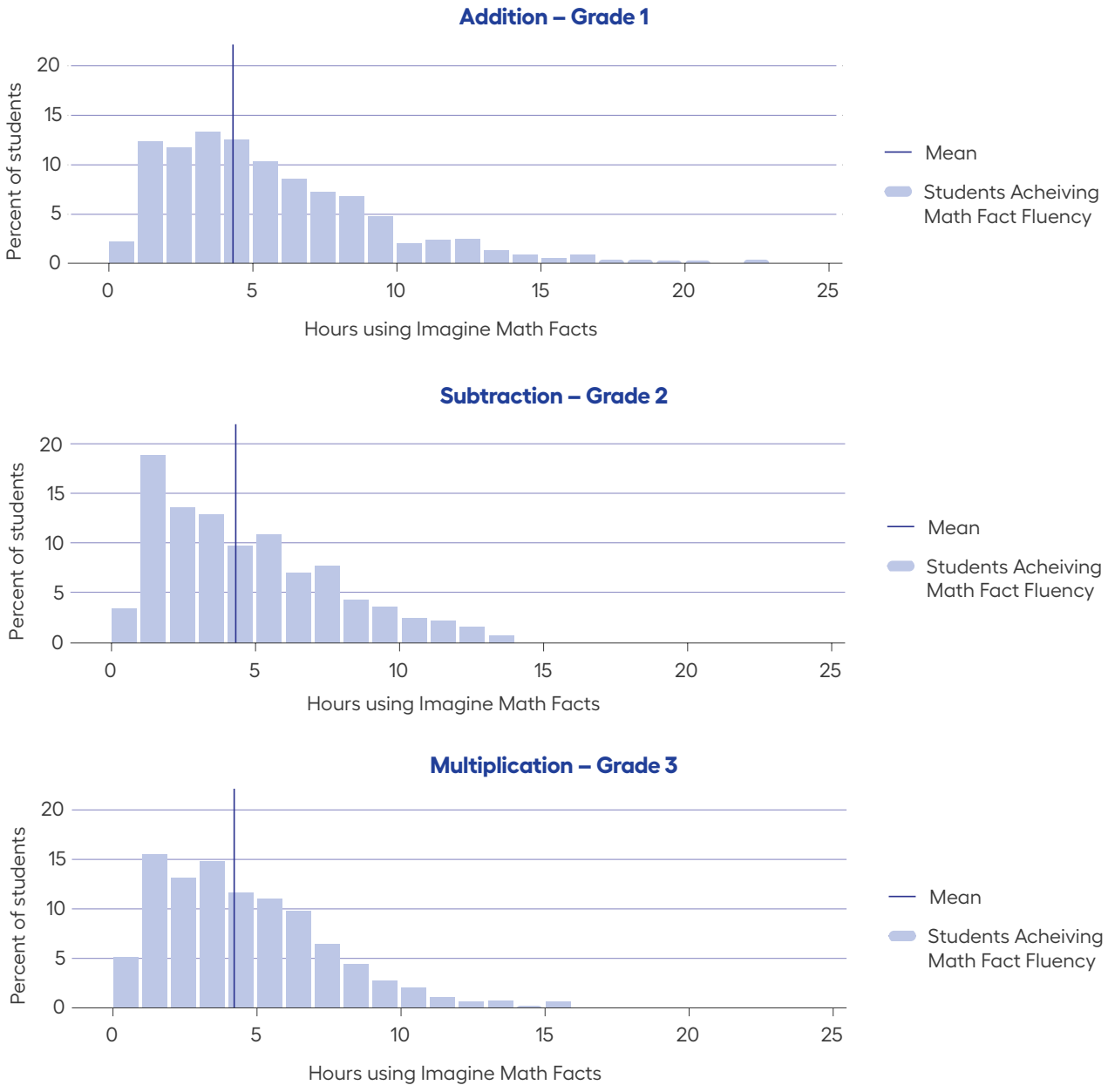
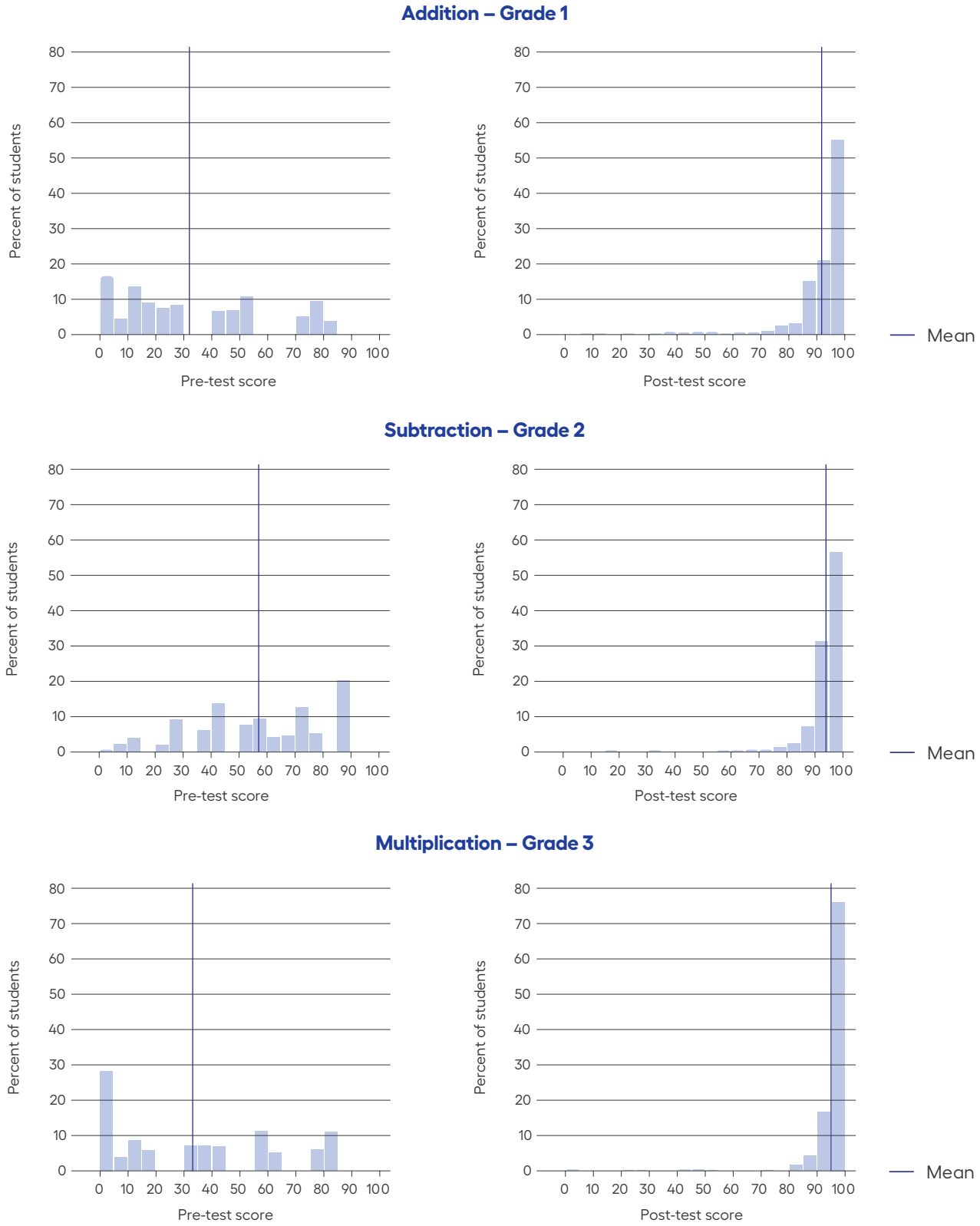


Figure 2. Distribution of pre-test and post-test scores by grade.



CONCLUSION

Ultimately, the Imagine Math Facts program is a highly valuable and effective educational tool specifically designed to quickly develop math fact fluency for students of all initial ability levels. By incorporating the Imagine Math Facts program into classrooms, students will achieve total fact fluency faster and teachers will enjoy increased availability of valuable instructional time needed to cover more difficult mathematical concepts.

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