

MathFacts in a Flash is 3 tools in 1—ideal for intervention, progress-monitoring, and math facts practice.

## MathFacts in a Flash Leads to Growth in Computational Fluency

### Introduction

In a pilot study, MathFacts in a Flash software was shown to significantly contribute to student growth in computational fluency in grades 1–5. The results of the study closely coincide with current literature on appropriate goals for automaticity and mastery of mental computation.

Post-instruction practice using MathFacts in a Flash at appropriate levels led to growth in computational fluency at all grade levels. Teachers and students reported that math practice was more productive and enjoyable. Students commented that they liked being able to work at their own pace, and teachers found it easy to have students working at many different levels.

### Study Description

MathFacts in a Flash is a computerized database of mathematical problems designed to provide practice in mental computational skills in 44 levels of addition, subtraction, multiplication, division, squares, and fraction-to-decimal conversion. It targets specific areas of student need in the elementary and secondary grades, and provides concentrated practice at the right level of challenge.

In spring 2002, a 4-week study of approximately 1,500 students in grades 1–5 was undertaken to evaluate the concept and effectiveness of MathFacts in a Flash. An additional goal of the study was to establish appropriate mastery time criteria for future releases of the product.

During the study, teachers established initial practice levels for students by using paper pretests determined to be closest to each student’s current performance level. The pretests were one-minute timed, constructed-response worksheets; students completed as many of the items on the worksheet as possible. Pretests were scored for speed (number of problems answered) and accuracy (number of problems correct). If students did poorly on the pretest, they were retested at a lower level.

Once teachers determined a student’s appropriate practice level, the student used MathFacts in a Flash to practice problems at that level. Each MathFacts in a Flash session consisted of 40 assisted-response items; students were instructed to work through the problems with a goal of 100% accuracy in 2 minutes or less. Students could work as many sessions at a given level as they wanted, but were asked to complete at least three sessions for each level. When a student repeatedly answered all questions correctly in a consistent amount of time, they were given a paper posttest. Posttests were conducted in the same fashion as pretests. Achievement on posttests determined whether the student advanced to the next level or received additional MathFacts in a Flash practice at the same level.

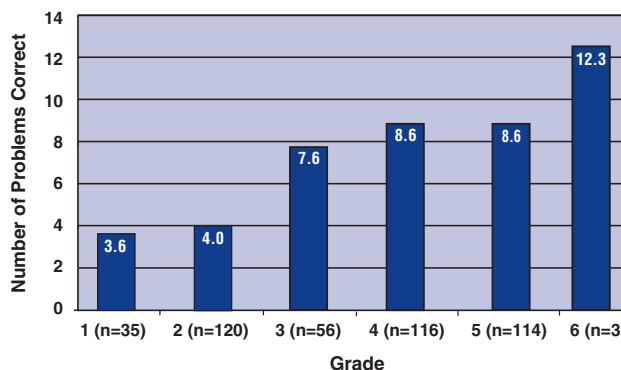
### Results

Analysis of the study data supports many of the findings of the literature on computational fluency. Only student records that included pre- and posttest scores and at least three MathFacts in a Flash practice sessions were included in the statistical analysis (n=444).

#### Growth

On average, students at all grades improved by 6.9 correct problems between pre- and posttests (see below).

**Gain on One-Minute Timed Worksheet for First- through Sixth-Grade Students Using MathFacts in a Flash (n=444)**



(more information on back)

Students in grades 3–5 showed the most growth, averaging 8.4 additional problems correct versus 3.9 additional problems correct for grades 1 and 2. This is most likely explained by age differences in conceptual understanding and motor-skill development.

### *Mastery Time*

To determine mastery time goal (the default time limit on the tests), students' average response time per item on posttests was compared to their average response time per item on their last perfect MathFacts in a Flash session. For all levels, the average response time per item on posttests was strongly correlated with the average response time per item for MathFacts in a Flash ( $r=.651$ ;  $p<.001$ ). Average response time per item on posttests was 2.4 seconds. Based on these findings and in concordance with the literature (Isaacs & Carroll, 1999), a mastery time goal of 3 seconds per problem, or 2 minutes per 40-problem test, was established as the mastery time goal in MathFacts in a Flash.

It should be noted that mastery goals are designed to be age appropriate, as recommended by many academic standards (NCTM, 2000; California Department of Education, 1999). In general, students in first and second grade should be working toward the baseline time goal for addition and subtraction levels, whereas students in third and fourth grade should work toward the mastery time goals for multiplication and division levels.

### *Teacher Surveys*

Teachers participating in the study completed questionnaires regarding their satisfaction with MathFacts in a Flash and the program's capacity to accelerate student learning. Most teachers felt MathFacts in a Flash was easily integrated with and had levels aligned to the existing curriculum used in their classrooms. They commented that the short practice sessions kept students engaged and prevented boredom—especially for students working above or below what

would be considered grade-level material.

Teachers were also asked their opinions on some of the research-based features of MathFacts in a Flash. The results show a great deal of support for the foundations of computational fluency included in the program:

- 93% agreed a time goal helps students develop automaticity of math facts.
- 97% agreed combined time and accuracy goals motivate students to continue to improve.
- 94% felt student scores and achievement on the combined time and accuracy goals provide a strong indicator of basic math facts mastery.

Students' attitudes toward MathFacts in a Flash, as assessed by their teachers, were similarly positive. All teachers reported their students had little difficulty understanding MathFacts in a Flash. And, 97% reported their students enjoyed using the program. Student comments indicated their favorite features included the ability to work at their own pace and the immediate feedback provided on areas for improvement.

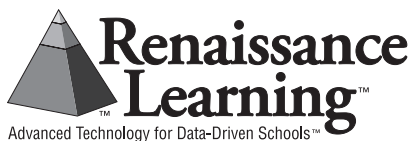
## **Conclusion**

The study results show promise for mathematics educators looking for tools to help students master math facts at appropriate levels without increasing teacher paperwork. For math teachers at all levels, developing a curriculum and structuring classroom time to provide each student with individualized instruction and practice are time consuming. With MathFacts in a Flash, every student can work within a level that is challenging yet leads to success while progressing through material at an individual pace. This individualization is nearly impossible to provide using a traditional paper-and-pencil practice and assessment model. With MathFacts in a Flash, however, teachers can provide the appropriate level of challenge to each student and have more time for individual and small-group instruction.

California Department of Education. (1999). *Mathematics content standards for California Public Schools*. Sacramento, CA: Author.

Issacs, A., & Carroll, W. (1999). Strategies for basic-facts instruction. *Teaching Children Mathematics*, 5(9).

National Council of Teachers of Mathematics (NCTM). (2000). *Principles and standards for school mathematics*. Reston, VA: Author.



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