Math Fluency Myths: How Bad Methods Make Learning Math Facts Harder

by Kate Gasaway, Product Marketing Manager for Mathematics, Curriculum Associates

Simplicity is a seductive idea in education.

Stripping skills down to their essential elements and getting distractions out of the way sounds like it should make for the best, most efficient process for teaching, well, pretty much anything.

It sounds plausible, but it's just not true.

For example, the simplest way for students to learn math facts would be to have students rewrite or repeat them in order until they can do so quickly, from memory, without errors.

Let's call this the "traditional" approach.

Some students might be successful with this method, and it's very easy to implement, but there are more effective, lasting, and fun ways to develop math fact fluency. Here are four common myths about developing procedural fluency and what research has to say about them.

MYTH 1 The best way for students to learn math facts is to memorize them in order.

Starting from the bottom and working your way up may work for climbing a mountain or building a house, but it's not the best approach to building fact fluency. Instead, starting with the most computationally accessible groups of facts—like twos, fives, and tens—and then using them to learn strategies to derive the facts that remain emphasizes the patterns and relationships between the facts. This paves the way for more advanced and flexible mathematical thinking.

Suppose that students who learn to multiply fives and tens then learn the subtract-a-group strategy for their fours and nines.

For example:

If a student knows that 8 x 10 = 80,

then 8 x 9 is 80 – one group of 8,

so 8 x 9 = 80 – 8 = 72.

With this approach, students not only learn the facts, but they also practice strategic thinking that can be applied to more complex math (like factoring polynomials) and ultimately helps them become more inventive, adaptable math thinkers.

> ***Learn more: Jennifer Bay-Williams and Gina Kling have an excellent book on strategically ordering math facts.***

© 2022 Curriculum Associates, LLC. All rights reserved. | 09/22 0K

MYTH 2

More is more when it comes to fluency practice.

Psychologists have been studying how people learn since the beginning of psychology as a modern science. The body of research on this topic is vast. However, one thing is clear—using a traditional "more is more" approach to developing fact fluency is ineffective.

One well-replicated finding is that spaced practice—when topics are separated by time or interspersed with other information—has been proven to be superior to massed practice—when topics are repeated without interruption. This is true whether learners are children or adults, studying declarative knowledge or procedural skills, and across academic disciplines.

Research also shows that spaced practice enhances short-term retention and decreases the time it takes to relearn forgotten items. So, if you used spaced practice to teach your students a set of math facts before winter break and then realized when they came back from vacation that the knowledge appears to have vanished into thin air, your students could relearn it more quickly than if you'd had them write out the math facts 100 times.

They'll also like you better, which is a separate, non-scientific, and not-insignificant finding (source: me).

> ***Learn more: Walsh et al. summarize the spacing effect on learning.***

MYTH 3

Developing fluency requires repetitive practice.

Let's be clear: It does take effort to develop fact fluency. It just doesn't have to be a boring slog. If you take a strategic approach based on number sense (such as Myth #1) and use thoughtfully timed practice intervals (as described in Myth #2), students can develop math fact fluency more efficiently than with repetitive or simplistic methods.

Instead, consider using a variety of practice opportunities. For example, fluency games can replace fluency worksheets, and digital programs can deliver practice opportunities in novel and engaging ways that remove the guesswork of presenting the right problems with the right frequency. Additionally, the ratio of new to reviewed facts and the frequency and type of feedback should also change as students' mastery grows. These options, combined with the improved efficiency gained by a strategic approach, make achieving math fact fluency more engaging and effective.

> ***Learn more: Patsy Kanter and Steven Leinwand's book, Developing Numerical Fluency, comes highly recommended as a source for in-class fluency activities and routines.***

© 2022 Curriculum Associates, LLC. All rights reserved. | 09/22 0K

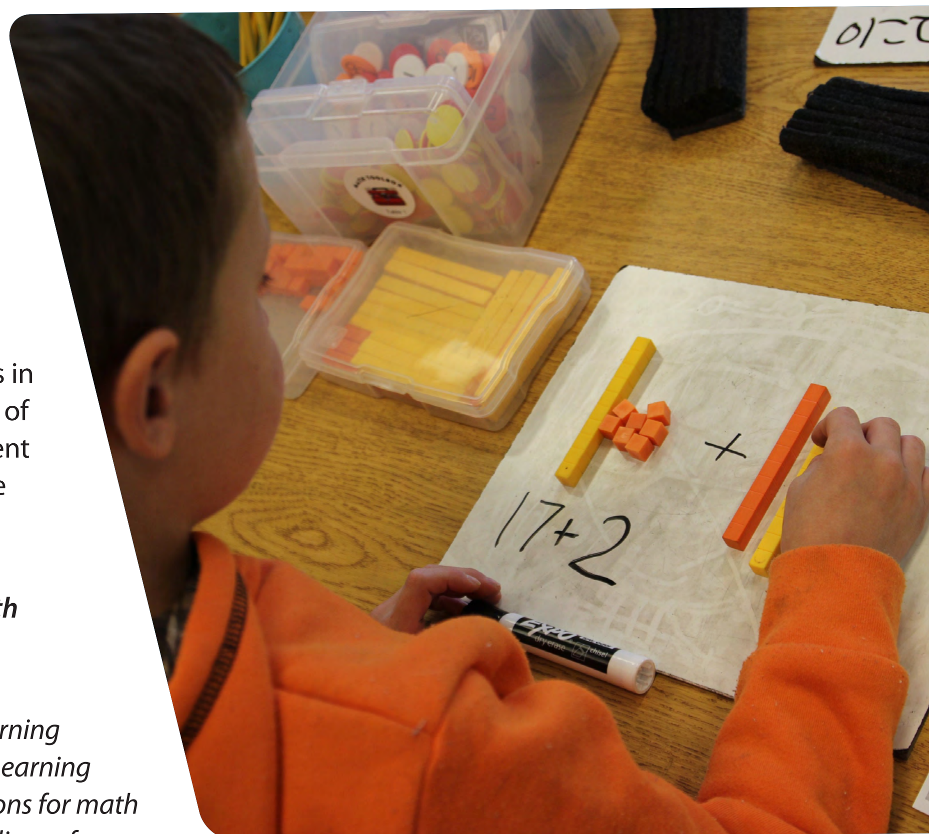
MYTH 4

Speed should be the first thing students focus on when learning math facts.

This is absolutely not true. When time pressure is introduced too early, it can discourage students from developing strategies, increase their math anxiety, and even make developing automaticity take longer. Instead, first focus on basic conceptual understanding, then accuracy without a time requirement—and only then, encourage speed.

Automaticity can be achieved only when students can effortlessly retrieve the information they've already learned. So, not only does research suggest postponing speed exercises, but so does common sense. After all, you can't quickly spit out facts when you don't know them.

It's clear from the research and our experience that the best math fact fluency program isn't the simplest one to implement, but the improvements in long-lasting learning, connection to other aspects of mathematical thinking, and consideration of student anxiety levels are worth the effort of taking a more complex approach.



> ***Learn more: Read this paper to learn about math anxiety from a psychological perspective.***

Note: Special thanks to Coram Bryant, director of Learning Games analytics, and Jacob Klein, senior director of Learning Games, for fact-checking this post, providing definitions for math fact fluency and math fact automaticity, recommending reference materials, and nerding out with me about cognitive psychology.

Learn about supporting your Grades 2–5 students' math fact fluency development with Fluency Flight by visiting CurriculumAssociates.com/FluencyFlight.

© 2022 Curriculum Associates, LLC. All rights reserved. | 09/22 0K

About Kate Gasaway

Kate Gasaway taught middle school math at the Neighborhood House Charter School in Dorchester, MA for six years before joining Curriculum Associates. Kate's professional experience includes writing assessments, analyses, and blog posts for Match Fishtank, an education company that creates and disseminates open-license, standards-aligned curricula. She holds a bachelor's degree in psychology from the Georgia Institute of Technology and a master's degree in effective teaching from the Sposato Graduate School of Education.

Kate is passionate about researching how students learn and tries to use her math powers for good.

To see how other educators are maximizing their *i-Ready* experience, follow us on social media!

@MyiReady Curriculum Associates @CurriculumAssoc iReady

© 2022 Curriculum Associates, LLC.
All rights reserved. | 09/22 0K

Curriculum Associates®