Math Models Matter: From Organizing Quantities to Preserving Their Size

Math Success with DMTI

DMT Insight 59 · Math that Models Matter: Why Some Visual Models Build Mathematical Structure, and Others Reach Their Limit

In today's edition, we explore:

- Why a model that makes today's answer easy can still stop working later.
- What a durable model has to keep in view that an early one does not.
- Three moves that put magnitude in front of the symbols.
- What a correct answer can hide about a student's sense of size.

Educators!

Every model we hand students shapes what they can reason about later. A ten frame and a number bond work well in the first weeks of school, but they don't convey a sense of size. A bar model and a number line keep magnitude, distance, and relationship in view, so they continue to work from early number to algebra.

The shift this Insight asks for is from a model that organizes a quantity to one that preserves it. A student can compute 503 less 297 correctly and still not know that the answer sits a little past 200. When the numbers grow, and the relationships become proportional, the early model runs out of steam, and there is nothing underneath it.

Classroom Tips

1. **Place it on a number line first.** Before students compute, have them place the numbers on a number line and say which is larger and how far apart they are. Then write the equation to record what the line already shows.
2. **Show comparison with a bar model.** For a "how much more" question, draw two bars and mark the difference as a length that students can see. Use the visual model before the number sentence.
3. **Name the total and its quantities.** Say a total and its quantities, rather than a whole and its parts, so the size of the numbers stays in view as students compose and partition.

A Teacher's Perspective

IN THE CLASSROOM

"Once my students started placing fractions on a number line, I could finally see who understood size and who was only following steps. It slowed us down for about a week, and then it changed how they talked about numbers."

A Grade 4 Teacher

That is the whole shift in one sentence. When students can see how big a number is and where it belongs, the model tells you what they really understand.

What Does the Research Say?

Siegler, Thompson, and Schneider (2011) place a student's sense of magnitude at the center of how number understanding grows. In a large study, Nuraydin and colleagues (2023) found that how well ninth graders placed numbers on a line was strongly associated with their overall math achievement, and the tie was strongest for fractions. Bruner (1966) reminds us that a picture does different work than a symbol does, which is why a number bond, closer to a symbol, conveys no sense of size. Keep developing mathematical thinkers.

More Information

- Read the full research overview and watch the video at mathsuccess.io/dmtinsights.
- To access the Math Learning Profile (MLP), Targeted Activities, and more, visit mathsuccess.io.
- Have a teaching tip that works? Send it to contact@dmtinstitute.com, and we may feature it.
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