

WHY NUMBER LINES SHOULD BE BUILT, NOT BORROWED

In today's edition, we explore:

- **The Research:** Why drawing number lines builds deeper conceptual understanding
- **The Structural Advantage:** How construction strengthens measurement, fractions, and graphing
- **Classroom Application:** Practical routines that transform reasoning
- **Parent Partnership:** Simple ways families can support number sense at home

Educators!

Have you noticed that some students can place numbers on a number line—but struggle to explain why they placed them there? Or that they can graph a point, but don't really understand the spacing on the axis? This isn't a coincidence. Research shows that when number lines come pre-drawn, students often rely on guessing, memorized landmarks, or isolated procedures.

But when students construct their own number lines—choosing endpoints, spacing ticks, and labeling units—they engage the spatial, proportional, and measurement reasoning that deepens understanding across K–8. Constructing number lines is not an “extra.” It's a powerful cognitive action essential for building the flexible, connected thinkers we want in mathematics.

Why Pre-Made Number Lines Don't Build Flexible Thinkers

Many worksheets and digital tools give students a fully drawn number line: endpoints, tick marks, spacing—all predetermined. This saves time, but it also removes the thinking.

Here's what research shows:

- Students rely on visual cues rather than mathematical reasoning (Cohen et al., 2014).
- Scaling decisions—where the real learning happens—are bypassed (Barth & Paladino, 2011).
- Students adopt rigid ideas (zero must be centered, tick marks always equal 1) that limit proportional reasoning (Ünal et al., 2024).

When the structure is already built, students rarely grapple with: How far apart should the units be? Where does 1 go? What about $\frac{1}{2}$? 75? How do we ensure equal spacing? What changes when the endpoint changes from 1 to 2? Or 50 to 100? These decisions are where conceptual understanding grows.

The Strategy Solution: Let Students Build the Line

When students construct number lines, they practice essential mathematical actions:

- **Unit Iteration & Partitioning:** Students choose a unit and repeat it, physically and visually modeling equal spacing.
- **Proportional Reasoning:** They determine how far a number is relative to the whole—core to fractions, measurement, and algebra.
- **Mapping Number to Space:** Students internalize that numbers represent distances, not just symbols.
- **Scaling Across Contexts:** A point's meaning changes when the interval changes—building flexible reasoning needed for graphing.

Research across cognitive science shows that these spatial and scaling actions activate brain regions used in magnitude and measurement reasoning (Leibovich et al., 2014) and help students connect numerical, visual, and motor systems for deeper understanding. When students create number lines, they are not drawing—they are thinking structurally.

Try This Tomorrow: Classroom Shifts That Work

1. **Start With a Blank Line:** Give students a simple segment—no ticks, no numbers. Ask: Where should 0 go? What about 10? How do you know your spacing is equal?
2. **Vary the Endpoints:** Use 0–50, 0–1, or even 3–7. Changing the scale forces proportional reasoning, not memorization.
3. **Move Into Fractions and Measurement:** “Partition this meterstick line into sixths.” “Show $\frac{3}{4}$ and $\frac{5}{8}$.” Students build fraction sense through spatial reasoning, not rules.
4. **Build the Axes Before You Graph:** Instead of giving students a ready-made grid, have them draw the x-axis; choose the scale; label the intervals. Suddenly, graphing becomes scale-making before point-plotting.
5. **Use Quick Reflection Prompts:** “How did you choose your unit?” “What would change if the endpoint doubled?” “How do you know your spacing is equal?”

These prompts strengthen metacognition and structural understanding.

Get Inspired—Share Your Story!

When we let students build number lines, we build thinkers, not guessers. How are your students using number-line construction in the classroom?

Share your tip or story—you might be featured in our next Math Success with DMTI newsletter!

For the complete DMT Insight and classroom resources, visit: mathsuccess.dmtinstitute.com

Keep inspiring mathematical minds!

More Information

This newsletter is just a preview—there is more to explore! For the complete research overview and additional videos, visit the “DMT Insights” page at dmtinstitute.com/research. You will find deeper insights, classroom strategies, downloadable resources, and more ways to expand your math teaching.

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