

NEWSLETTER

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ADDING MORE IS NOT THE SAME AS SCALING UP

DMT Insight 52 · Scaling & Comparing: From Additive to Multiplicative Reasoning

In today's edition, we explore:

- Why adding more is not the same as scaling up
- Four important ideas in scaling and comparing
- How this reasoning connects Multiplication & Division with Patterns & Equality
- Classroom strategies and insights from research

Educators!

Scaling and comparing mark an important shift in Grades 3–6: students begin coordinating quantities through a multiplicative factor rather than only comparing them by a difference. When students enlarge a shape, double a recipe, or extend a ratio, the question is whether they add the same amount to each quantity or scale both by the same factor. Adding more is not the same as scaling up, and the difference shapes what follows, from fractions and percent to slope and algebra.

When students learn to track the factor that links two quantities, how many times as much one is as another, rather than the difference between them, they can tell whether an answer is reasonable and whether two ratios are equivalent without a rule. Reading a multiplicative situation as an additive one is common. This additive bias is not unreasonable: it is a conception that worked in earlier situations and is now being used where the relationship is multiplicative.

Scaling and comparing bring together ideas that students develop across mathematics: scaling a quantity, comparing quantities multiplicatively, reasoning with composite units, and coordinating rates. In DMTI's Math Learning Profiles (MLPs), these ideas connect most directly to Multiplication & Division and Patterns & Equality. The throughline is the same: identify the factor, coordinate the quantities, preserve the relationship, and use that relationship to reason.

Classroom Tips

1. **Ask what stays the same.** Enlarge or shrink a quantity by a factor. Ask what changed and what relationship was preserved. A 4-by-6 rectangle scaled to 6-by-9 keeps its shape; adding 2 to each side changes it.
2. **Ask how many times, not only how many more.** Put the additive and multiplicative comparisons side by side, and ask which one the situation calls for.
3. **Treat the relationship as one unit.** For 3 cups to 2 batches, hold 3:2 together and iterate or partition that composite unit.
4. **Coordinate the two units.** For 4 pounds costing \$20, ask what 1 pound corresponds to in dollars and use that relationship to reason about other quantities.

Across all four, keep asking: What changed? What stayed the same? What relationship was preserved?

Bar models, ratio tables, and double number lines all have a place. Use a model to make the relationship visible, then connect the model to the notation. A model earns its place when it makes the factor and the relationship between the quantities visible.

What Does the Research Say?

Research has documented the difficulty students have distinguishing additive from proportional situations. Van Dooren and colleagues (2010) found that students may overapply either form of reasoning when they attend to the numbers in a problem rather than the relationship between the quantities. Research on multiplicative and proportional reasoning also emphasizes coordinating quantities and attending to the factor that relates them (Lamon, 2007; Lobato & Ellis, 2010). The instructional goal is not simply to teach a proportion procedure, but to help students recognize and reason about the multiplicative relationship.

Keep developing mathematical thinkers.

More Information

For the full research overview and the accompanying video, visit the DMT Insights page at mathsuccess.io/dmtinsights. To explore the Multiplication & Division and Patterns & Equality MLPs, Targeted Activities, and more, visit mathsuccess.io.

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