

NEWSLETTER

Issue 55 · 2026 · Math Success with DMTI



Patterns and Equality: The Equal Sign Is Not an Instruction

DMT Insight 55 · Patterns and Equality

In today's edition, we explore:

- **The Classroom Reality:** Why students who add accurately still stall when an operation appears on both sides
- **The Structure:** What a student sees when both sides name the same quantity
- **Classroom Tips:** Three moves that put relational reasoning in front of you this week

Educators!

A fourth grader solves $8 + 5$ without hesitation and continues 3, 6, 9 without looking up. Then you write $8 + 4 = \underline{\quad} + 5$ and she puts 12 in the blank. Another student rejects $3 = 3$ as not a real sentence, because no answer follows the symbol. Neither student is weak at arithmetic. Both are reading the equal sign as an instruction to compute rather than as a statement that two expressions name the same quantity.

That reading is an important early signal of whether a student is beginning to reason algebraically, and ordinary classwork can hide it. A student who reasons about relationships and a student who only computes produce identical answers on a page of addition. They separate the moment an operation appears on both sides. The tips below follow the three Math Learning Profile understandings: Equality as a Relationship, Patterns, and Algebraic Reasoning.

Classroom Tips

1. **Put an operation on both sides.** One sentence a day, written so it cannot be settled left to right. Is $8 + 4 = 10 + 2$ true? Is $3 = 3$ a sentence? Ask for true or false, then ask why. The explanation is the assessment.
2. **Ask for a distant term, not the next one.** Here is a pattern: 3, 6, 9, 12. What is the tenth term, and how do you know? A student who lists 15, 18, 21 is extending. A student who says thirty because ten threes are thirty is generalizing.
3. **Block the computation.** Without finding both products, is $6 \times 4 = 3 \times 8$ true? Explain. Students who can only check by computing have the labels. Students who say the four doubled and the six halved are reasoning from the relationship.

A Teacher's Perspective

Maya wrote 13 in the blank and called it the answer. Devin told her the other side would be twenty-one. I asked Maya whether $6 + 7 = 13 + 8$ was true, and she read it again and said no. That was the whole lesson, and it took one question.

What Does the Research Say?

Understanding of the equal sign in middle school is associated with success in solving algebraic equations, and the association holds after accounting for general mathematics ability (Knuth, Stephens, McNeil, and Alibali, 2006). The operational reading is not carelessness. Years of successful arithmetic build it, which is why it resists a single correction (McNeil, 2014). What moves students is meeting the idea in more than one form, often, and early.

Keep developing mathematical thinkers!

More Information

For the full research overview and the Companion for this issue, visit the DMTI Insights page at mathsuccess.io/dmtinsights.

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