

Multiplication Fact Fluency: A School-Wide Solution

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My students don't know their basic facts.

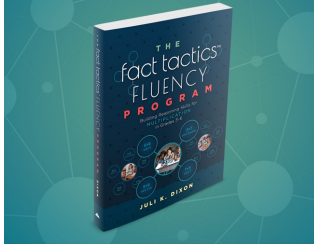
If my students just knew their basic facts, they would be so much more successful.

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Is there something better than the mad minute?

There's not enough practice.

Support all learners
with **math fact fluency**



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Goals

- Examine structures for developing fact fluency grounded in multiplicative reasoning.
- Make sense of the Six Fluency Tactics
- Examine the Fact Tactics[™] Fluency Program as a school-wide solution

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What is the current focus of fluency instruction?

```

    graph TD
      A(Push to learn basic facts) --> B(Prioritize drill and kill)
      B --> C(Use timed tests)
      C --> D(Create math anxiety)
      D --> A
      E(Struggle with quick recall) --> A
  
```

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Why is this a problem?

“Evidence strongly suggests that timed tests cause the early onset of math anxiety for students across the achievement range” (Boaler, 2014, p. 469).

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Why does this current practice miss the point?



Readiness for algebra requires “a grasp of the meaning of the basic operations of addition, subtraction, multiplication, and division. It must also include use of the commutative, associative, and distributive properties; computational facility; and the knowledge of how to apply the operations to problem solving” (NMAP, 2008, p. 17).

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How do we bring sense making to multiplication?



It starts with word problems.

Write a word problem for 6×7 .

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Consider 3×4



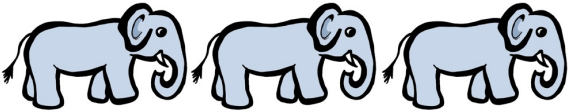
I have 3 elephants. Each elephant has 4 legs. How many legs are there in all?

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Consider 3×4

I have 3 elephants. Each elephant has 4 legs. How many legs are there in all?



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Now consider 4×3

I have 4 elephants. Each elephant has 3 legs...

When the focus is on sense making, the order of the factors matters.

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How do we bring sense making to multiplication?

Re-examine the word problem you wrote.

Is your word problem modeled by 6×7 or 7×6 ?

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What strategies might students use to determine the product of 6×7 if they did not know it?

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What mathematics is involved in each strategy?

- Drawing
- Counting Strategies
- Multiplicative Reasoning

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Developing Multiplicative Reasoning

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6 x 7

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Developing Multiplicative Reasoning

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$6 \times 7 = 7 + 7 + 7 + 7 + 7 + 7$

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Developing Multiplicative Reasoning

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$6 \times 7 = (6 \times 5) + (6 \times 2)$

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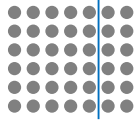
How would we get to the strategies symbolically?

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$6 \times 7 = (6 \times 5) + (6 \times 2)$

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How would we get to the strategies symbolically?



$$6 \times 7 = (6 \times 5) + (6 \times 2)$$

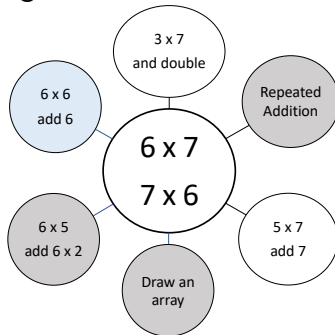
$$6 \times 7 = 6 \times (5 + 2) = (6 \times 5) + (6 \times 2)$$

The distributive property of multiplication over addition.

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Developing Multiplicative Reasoning

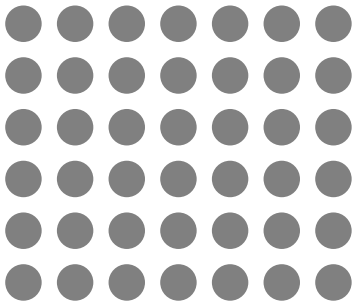
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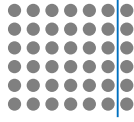
$$6 \times 7 = (6 \times 6) + 6$$



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Now you try. Show the symbolic pathway for this strategy.

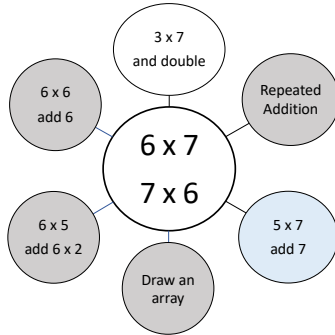


$$6 \times 7 = (6 \times 6) + 6$$

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Developing Multiplicative Reasoning

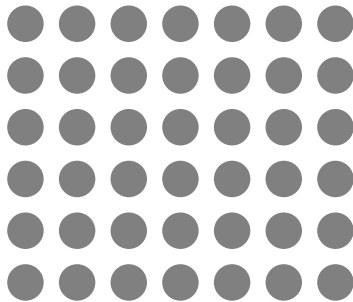
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$$6 \times 7 = (5 \times 7) + 7$$



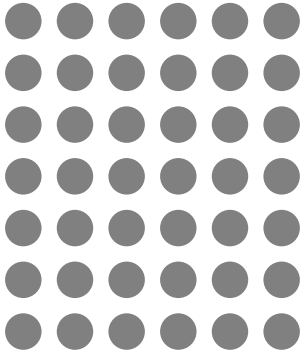
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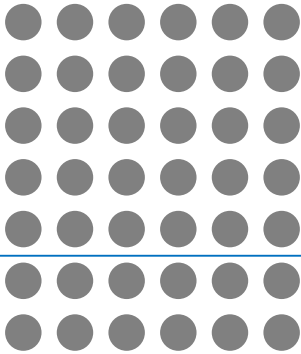
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What if a student uses a property based on 7×6 ?

7×6



7×6



Implementing the Fact Tactics™ Fluency Program

```

    graph TD
      A[Build multiplicative reasoning skills.] --> B[Introduce facts in a strategic order.]
      B --> C[Practice facts through sense making.]
      C --> D[Challenge students who need more.]
      D --> E[Achieve automaticity.]
  
```

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Components

- The Grounding Tactic
- The Linking Tactic
- The Strategic Repetition Tactic
- The Review Tactic
- The Assessment Tactic
- The Extension Tactic

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The Grounding Tactic

Students will be more likely to make sense of their basic facts if they have already developed an understanding of the meaning of multiplication and can apply that meaning to strategies for multiplying basic facts.

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The Grounding Tactic

Where do we start?

What might be more informing is where we don't start!

We do not start with one and zero facts, but why?

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The Grounding Tactic

Where do we start?

Beyond making sense of multiplication, there are facts students need to know to make the most of Fact Tactics™.

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The Grounding Tactic

Foundations for Fact Fluency:

- ✓ Doubles
- ✓ Fives
- ✓ 3 x 3

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The Linking Tactic

The order of facts we use to build fact fluency has the power to support reasoning and sense making. It is about being Fact Tactical 😊.

The Linking Tactic

X	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9
2	2	4	6	8	10	12	14	16	18
3	3	6	9	12	15	18	21	24	27
4	4	8	12	16	20	24	28	32	36
5	5	10	15	20	25	30	35	40	45
6	6	12	18	24	30	36	42	48	54
7	7	14	21	28	35	42	49	56	63
8	8	16	24	32	40	48	56	64	72
9	9	18	27	36	45	54	63	72	81

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The Linking Tactic

How might students derive this fact as they develop fact fluency? Create a sample web to support your thinking.

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The Linking Tactic

Are your strategies modeled by 4×6 or 6×4 ?

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Connecting Strategies, Models, and Properties

What equation connects with this strategy? What property was applied? How could you model the strategy with an array?

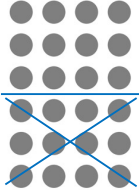
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3 x 4 and double

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$6 \times 4 = (2 \times 3) \times 4 = 2 \times (3 \times 4)$

The associative property of multiplication



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The Linking Tactic

6 x 6

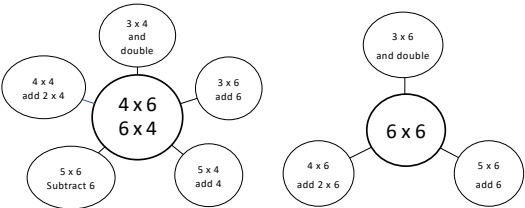
How is this focus fact connected to the one you just explored?

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The Linking Tactic



Notice how previous facts are used to derive the new focus fact. This is linking.

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The Strategic Repetition Tactic

Students should be provided many opportunities to verbalize *both* their strategies and the product. As students verbalize their strategies, they will approach automaticity with the focus and partner facts.

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The Strategic Repetition Tactic

Examine the Fact Tactics™ Web for 6×7 and the partner fact 7×6 . Choose your favorite strategy and record it on the Fact Tactics™ Card.

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The Strategic Repetition Tactic

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The Strategic Repetition Tactic

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1. Find someone with the same strategy as you and discuss why you chose that strategy.
2. Find someone with a different strategy and discuss how the strategies are the same and how they are different.

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The Review Tactic

Practice in the form of review is crucial for developing long term fact fluency. Review is strategic when it is connected to fact strategies..

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The Review Tactic

Share ways you might use the cards and experiences to engage in the review tactic.

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The Assessment Tactic

Timed tests are not encouraged. Instead, students should be given five facts at a time as mini assessments. Students should indicate the product of each fact and state if they “just knew it” or provide the Fact Tactics™ strategy they used.

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The Assessment Tactic

Examine the mini assessment scheduled for week 8 when the focus fact is 6×7 . What do you notice about the quiz? How might the results of this quiz support a formative assessment process?

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The Extension Tactic


Students who already “know” their basic facts, reason and connect concepts to procedures through extension tasks. These more complicated problems are solved by applying the same properties that are emphasized with the Fact Tactics™ Webs.

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The Extension Tactic: Supporting Students who Need More



4 x 6

Consider students who already know the product of this fact without using a strategy.

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The Extension Tactic:
Supporting Students who
Need More

How might you determine this product
using mental computation?

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The Extension Tactic:
Supporting Students who
Need More

Notice how this extension task connects
to the focus fact 4×6 .

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A School-wide Solution

- Set a schedule for the twenty-week program.
- Include all school personnel in professional development.
- Begin each Tuesday-Friday with a Fact Tactics strategy.
- Prioritize questioning students about their strategies throughout the week.

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