

Acquisition to Fluency via Systematic Instruction



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Introduce yourself.

Describe your role as an educator.

Describe the mathematics you support.



Share your Twitter handle!



ACQUISITION
Student is learning a
skill but is not
accurate or fluent

FLUENCY
Student can do a skill
but often works
slowly

GENERALIZATION
Student is accurate
and fluent with a skill
but does not transfer
to other skills

ADAPTATION
Student is accurate
and fluency and
transfers skill



Instructional Platform

INSTRUCTIONAL DELIVERY

Systematic
instruction

Precise
language

Multiple
representations

INSTRUCTIONAL STRATEGIES

Fluency building

Problem solving
instruction



Evidence-Based Practice: Systematic Instruction



MODELING

Step-by-step
explanation

Planned examples

PRACTICE

Guided practice

Independent practice

SUPPORTS

Ask high-level and low-level questions

Eliciting frequent responses

Providing affirmative and corrective feedback



Modeling is a
dialogue
between the
teacher and
students.

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Modeling includes a step-by-step explanation of how to do a math problem.

A teacher may do 1 modeled problem or several.

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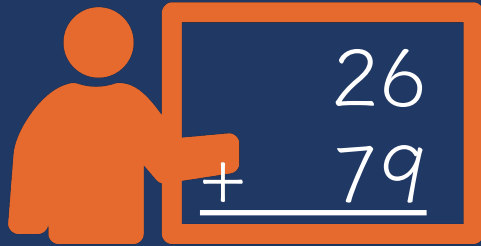
SUPPORTS

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Eliciting frequent responses

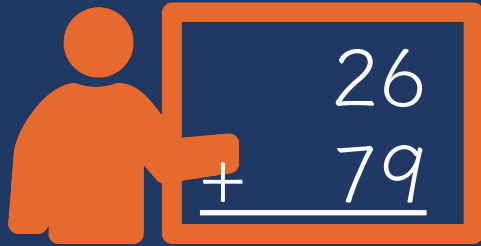
Providing affirmative and corrective feedback





“Today, we are learning about addition. This is important because sometimes you have different amounts – like money – and you want to know how much money you have altogether.”





“Let’s solve this problem. What’s the problem?”

“26 plus 79.”



“To solve 26 plus 79, first decide about the operation. Should we add, subtract, multiply, or divide?”

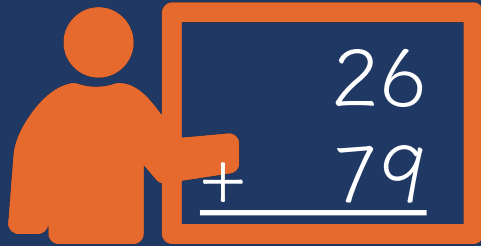
“Add.”



“How did you know we want to add?”

“There’s a plus sign.”





“The plus sign tells us we want to add. To add, let’s use the partial sums strategy. What strategy?”

“Partial sums.”



“With the partial sums strategy, we start adding in the greatest place value. What’s the greatest place value in this problem?”

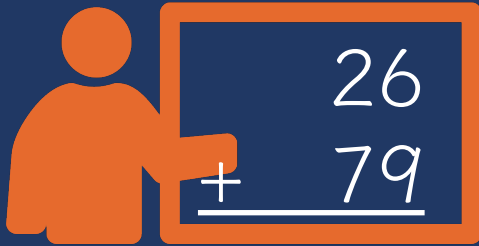
“The tens.”



“So, let’s add the tens. What’s 20 plus 70?”

“90.”





"20 plus 70 equals 90. Let's write 90 right here below the equal line. What will we write?"

"90."



"90 is the partial sum when you add the tens. What does 90 represent?"

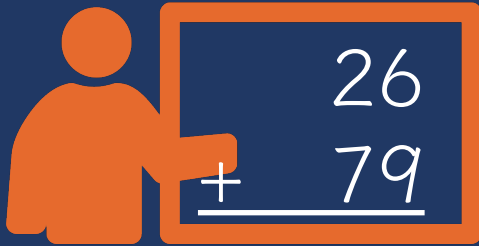
"It's the partial sum of adding 20 plus 70."



"Now, let's add the ones. What should we add?"

"6 plus 9."





“6 plus 9 equals what?”

“15.” 

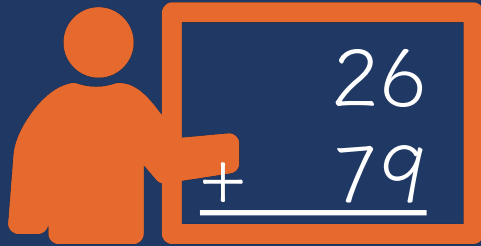
“Let’s write 15 below the 90.
Where do we write the 15?”

“Below the 90.” 

“15 is the partial sum when you add the ones.
Now, let’s add the partial sums together. What will we add?”

“90 plus 15.” 





“What’s 90 plus 15?”

“How did you add those numbers?”

“So, when you add 26 plus 79, the sum is 105. Who can share how we solved this problem?”

“105.”



“I added 90 plus 10 then added 5 more.”



“We used the partial sums strategy. We added the tens then added the ones. Then we added the partial sums.”



Modeling
needs to
include
planned
examples.

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These
examples
should be
sequenced so
easier skills
lead to more
difficult
skills.



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Select a math problem.

Work with a partner to outline a
step-by-step explanation.





Select a math problem.

Work with a partner to outline a step-by-step explanation.

Systematic Instruction

Problem

Step-by-Step Explanation

MODELING

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Practice continues as a dialogue between the teacher and students.

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Guided practice is practice in which the teacher and students practice problems together.



“Let’s work on a problem together.”



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Independent practice is practice in which the students practice independently with teacher support.



“Now, you’ll practice a problem on your own. Use your attack strategy!”



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Describe the practice opportunities you would use.

Systematic Instruction

Problem

Practice Opportunities

High-Level Questions

Low-Level Questions

Affirmative Feedback

Corrective Feedback



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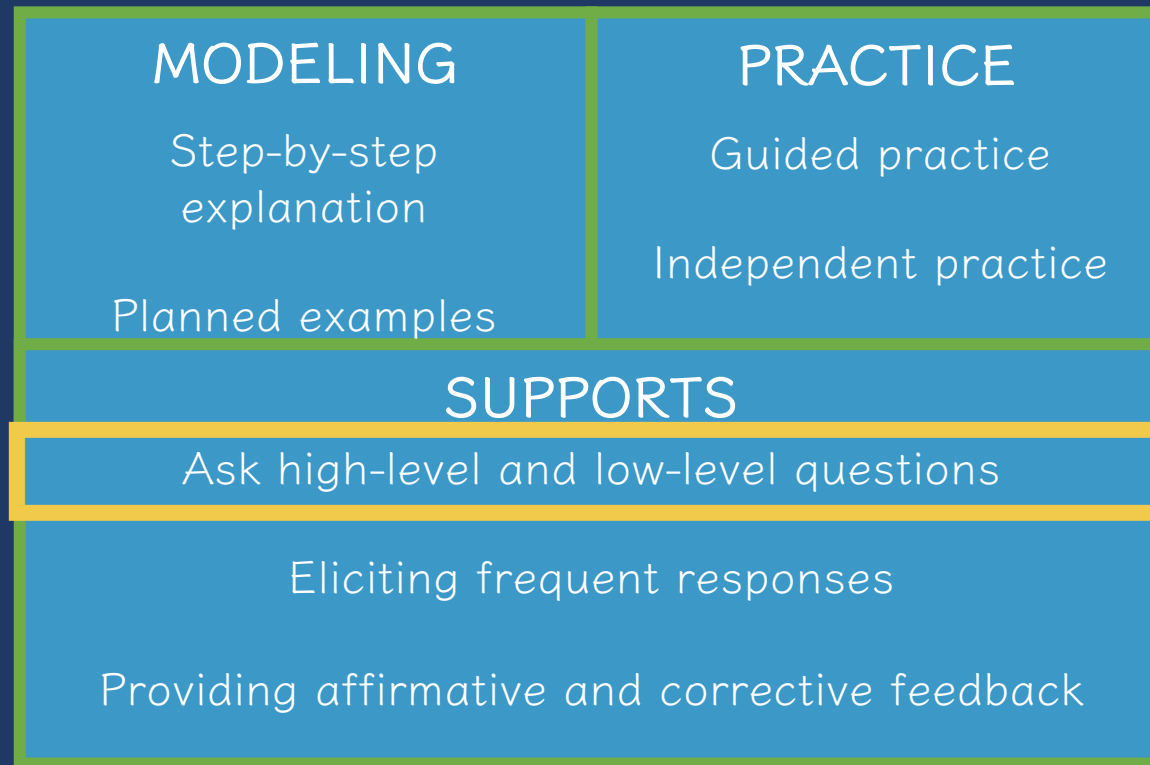
Ask high-level and low-level questions

Eliciting frequent responses

Providing affirmative and corrective feedback

These **Supports** should be used in
both **Modeling** and **Practice**.





During **Modeling** and **Practice**, it is essential to engage students and check for understanding.



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“What is 7 times 9?”

“63.”



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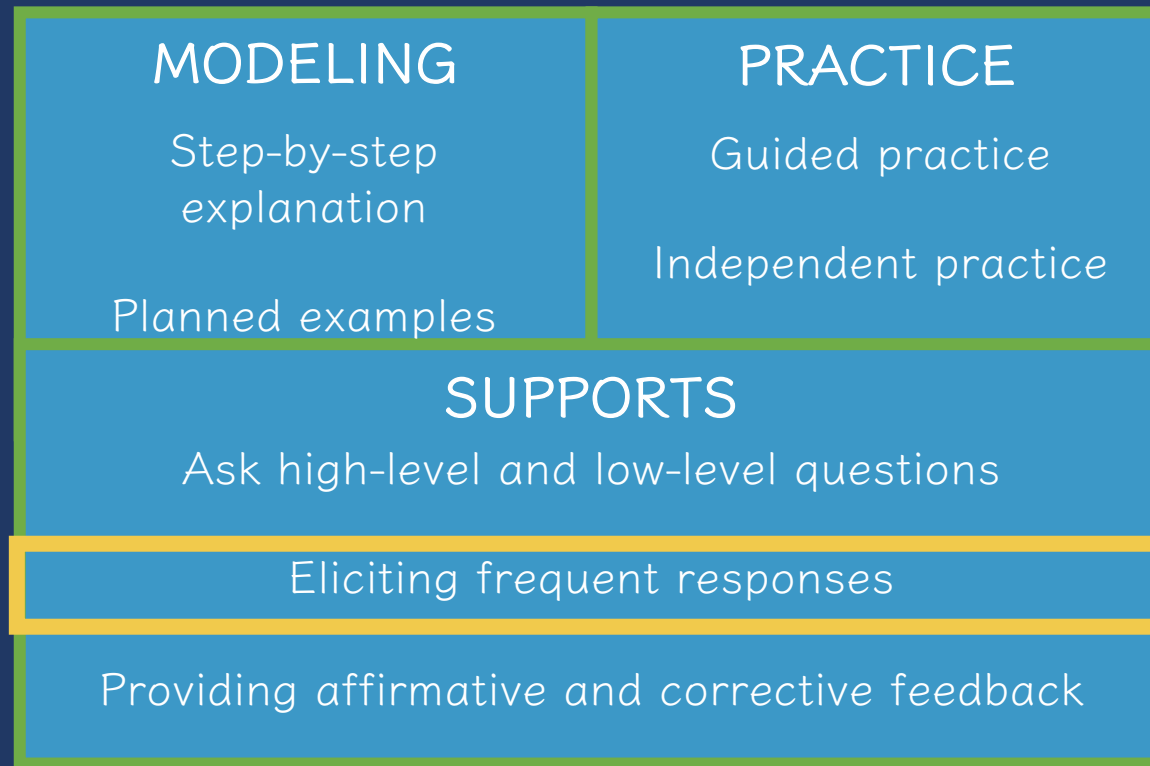
Providing affirmative and corrective feedback



“Why do you use
zero pairs?”

“Because a positive 1
and a negative 1 equal
0. I use the zero pair
to help me subtract.”





During **Modeling** and **Practice**, students should frequently respond. The frequent responses keeps student attention and keeps student learning active.



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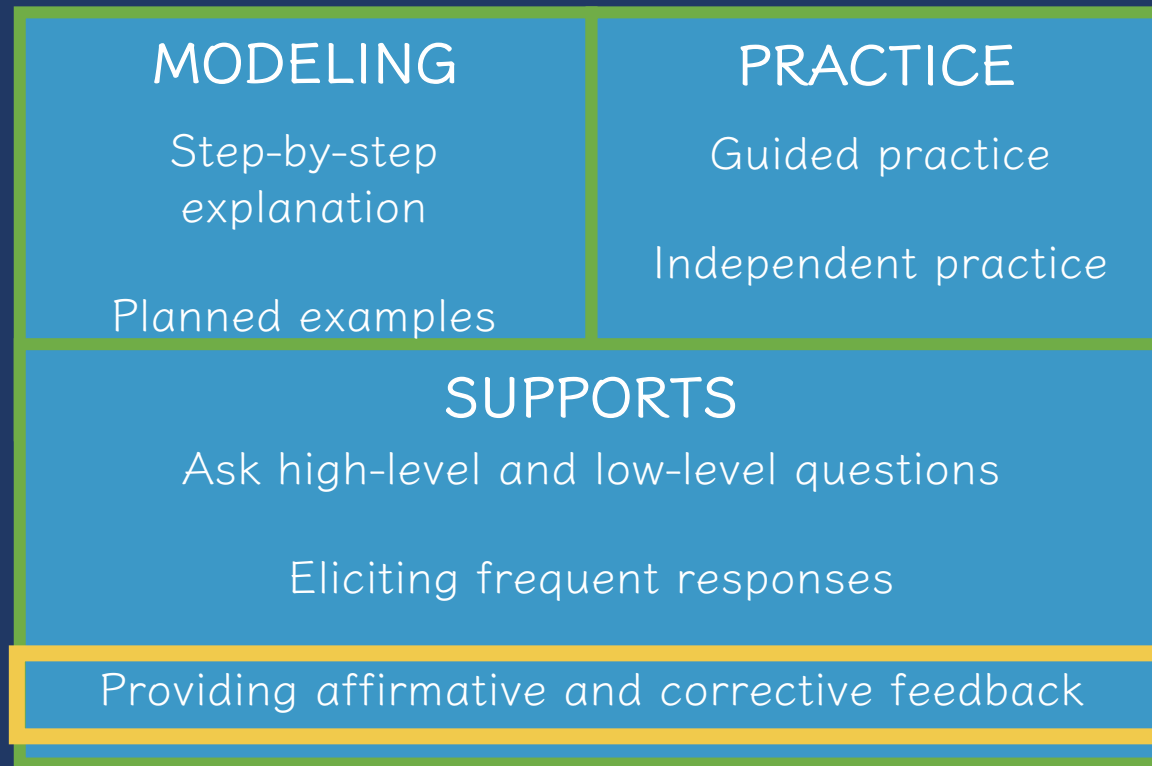
Eliciting frequent responses

Providing affirmative and corrective feedback



- Oral
- Written
- With manipulatives
- With drawings
- With gestures





During **Modeling** and **Practice**, students should receive immediate feedback on their responses.



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“Nice work using your
word problem attack
strategy.”



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“Let’s look at that again. Tell me how you added in the hundreds column.”



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Provide example
questions.
Provide example
feedback.

Systematic Instruction

Problem

Practice Opportunities

High-Level Questions

Low-Level Questions

Affirmative Feedback

Corrective Feedback



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Move around the room.

Share your systematic instruction example with a partner.



Evidence-Based Practice: Building Fluency with Facts and Computation



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Precise
language





Multiple
representations

INSTRUCTIONAL STRATEGIES

Fluency building



Fluency	
Addition	Subtraction
<div></div>	<div></div>
Multiplication	Division
<div></div>	<div></div>



Building Fluency

Addition	Subtraction
Multiplication	Division

- Fluency is doing mathematics easily and accurately.
- Fluency in mathematics makes mathematics easier.
- Fluency provides less stress on working memory.
- Fluency helps students build confidence with mathematics.



Addition	Subtraction
Multiplication	Division

- With fluency, it is important to emphasize both conceptual learning and procedural learning.
- Fluency is not strictly procedural!



Addition	Subtraction
Multiplication	Division

- Build fluency with math facts.
 - Addition: single-digit addends
 - Subtraction: single-digit subtrahend
 - Multiplication: single-digit factors
 - Division: single-digit divisor

$$\begin{array}{r} 5 \\ + 8 \\ \hline \end{array} \quad \begin{array}{r} 9 \\ - 4 \\ \hline \end{array} \quad \begin{array}{r} 6 \\ \times 7 \\ \hline \end{array} \quad \begin{array}{r} 56 \\ \div 8 \\ \hline \end{array}$$



Cover, Copy, Compare

$$\begin{array}{r} 9 \\ \times 6 \\ \hline 54 \end{array}$$

$$\begin{array}{r} 7 \\ \times 8 \\ \hline 56 \end{array}$$

$$\begin{array}{r} 9 \\ \times 9 \\ \hline 81 \end{array}$$

$$\begin{array}{r} 6 \\ \times 7 \\ \hline 42 \end{array}$$

$$\begin{array}{r} 8 \\ \times 8 \\ \hline 64 \end{array}$$

$$\begin{array}{r} 8 \\ \times 6 \\ \hline 48 \end{array}$$

$$\begin{array}{r} 6 \\ \times 5 \\ \hline 30 \end{array}$$

$$\times \begin{array}{r} 6+4= \end{array}$$

$$7+3=$$

$$2+7=$$

$$5+6=$$

$$4+7=$$

$$7+8=$$

$$6+7=$$

$$7+9=$$

$$7+6=$$

$$8+7=$$

$$7+0=$$

$$9+6=$$

$$6+0=$$

$$6+8=$$

File Folder

$$6+3=$$

$$1+7=$$

Taped Problems

$$\begin{array}{r} 6 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ \times 6 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ \times 4 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ \times 7 \\ \hline \end{array}$$

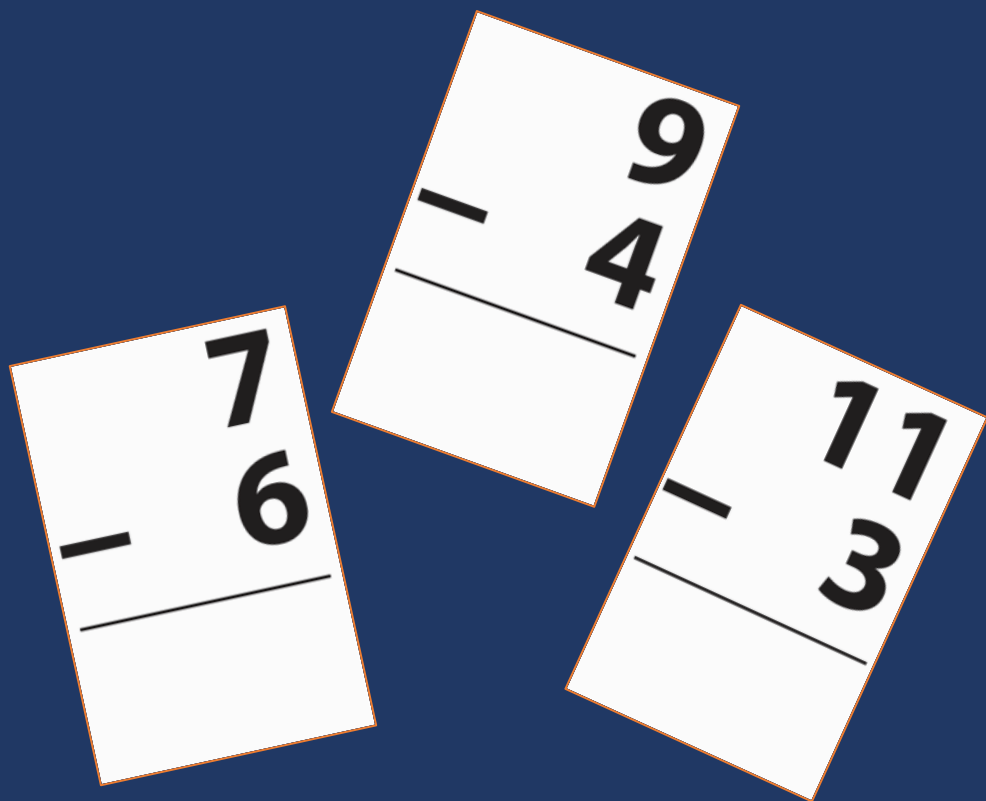
$$\begin{array}{r} 6 \\ \times 7 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ \times 8 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \\ \times 7 \\ \hline \end{array}$$



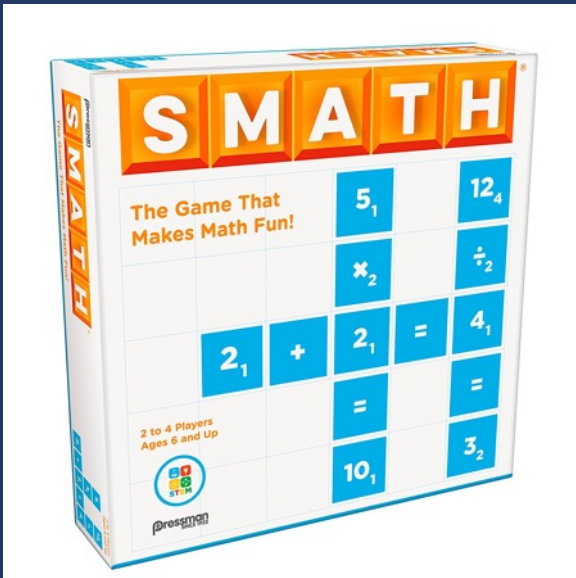
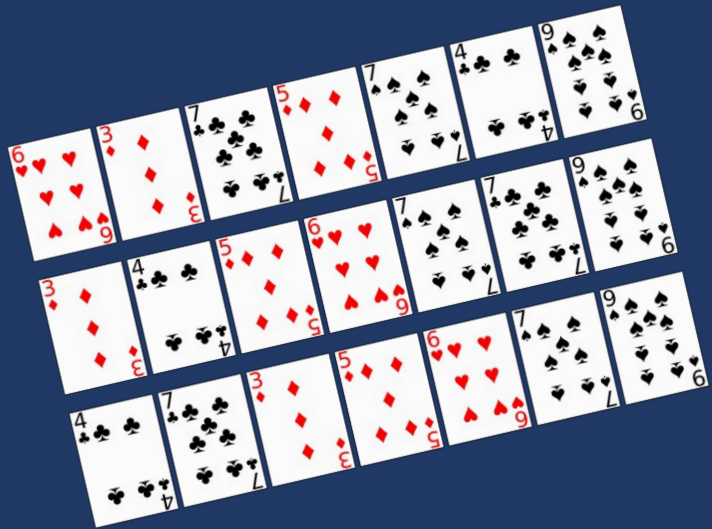


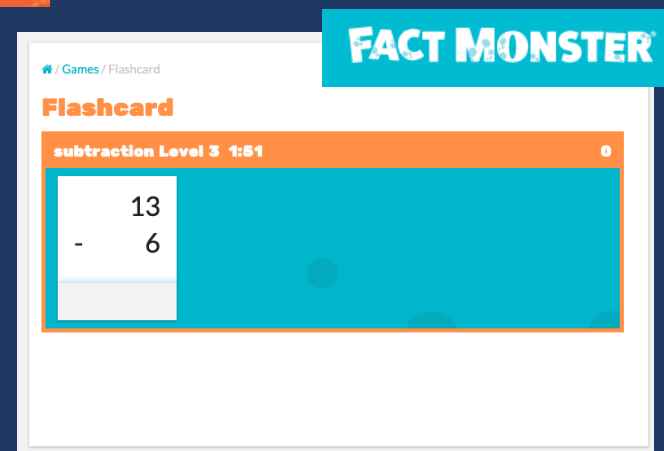
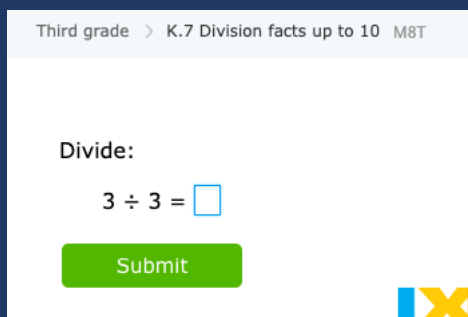
Flash Card Graph

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Addition	Subtraction
Multiplication	Division

- Build fluency with whole-number computation

$$\begin{array}{r} 15 \\ + 28 \\ \hline \end{array}$$

$$\begin{array}{r} 1009 \\ - 724 \\ \hline \end{array}$$

$$\begin{array}{r} 23 \\ \times 9 \\ \hline \end{array}$$

$$\begin{array}{r} 7250 \\ \div 15 \\ \hline \end{array}$$



Addition	Subtraction
Multiplication	Division

- Build fluency with rational-number computation

$$\begin{array}{r} 1.4 \\ + 3.9 \\ \hline \end{array}$$

$$\begin{array}{r} 7.892 \\ \div 0.14 \\ \hline \end{array}$$

$$\frac{2}{3} \times \frac{3}{4}$$

$$\frac{9}{4} - \frac{3}{8}$$



Addition	Subtraction
Multiplication	Division

- Build fluency with integer computation

$$-135 \div 2 =$$

$$\begin{array}{r} 6 \\ \times -12 \\ \hline \end{array}$$

$$-14 - (-7) =$$

$$\begin{array}{r} 1.4 \\ + -3.9 \\ \hline \end{array}$$





Describe ways you will model, practice, and develop fluency across the four operations.

Fluency

Addition

A large, empty rectangular box for practicing addition.

Subtraction

A large, empty rectangular box for practicing subtraction.

Multiplication

A large, empty rectangular box for practicing multiplication.

Division

A large, empty rectangular box for practicing division.

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National Center on
INTENSIVE INTERVENTION
at American Institutes for Research

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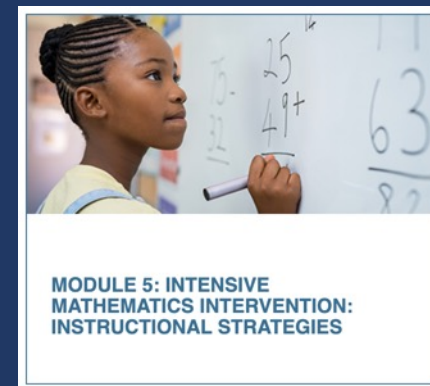
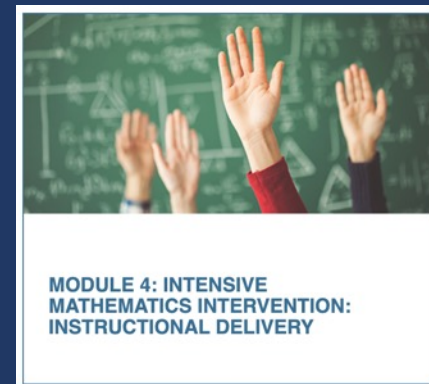
Information For... ▾

Intensive Intervention in Mathematics Course Content

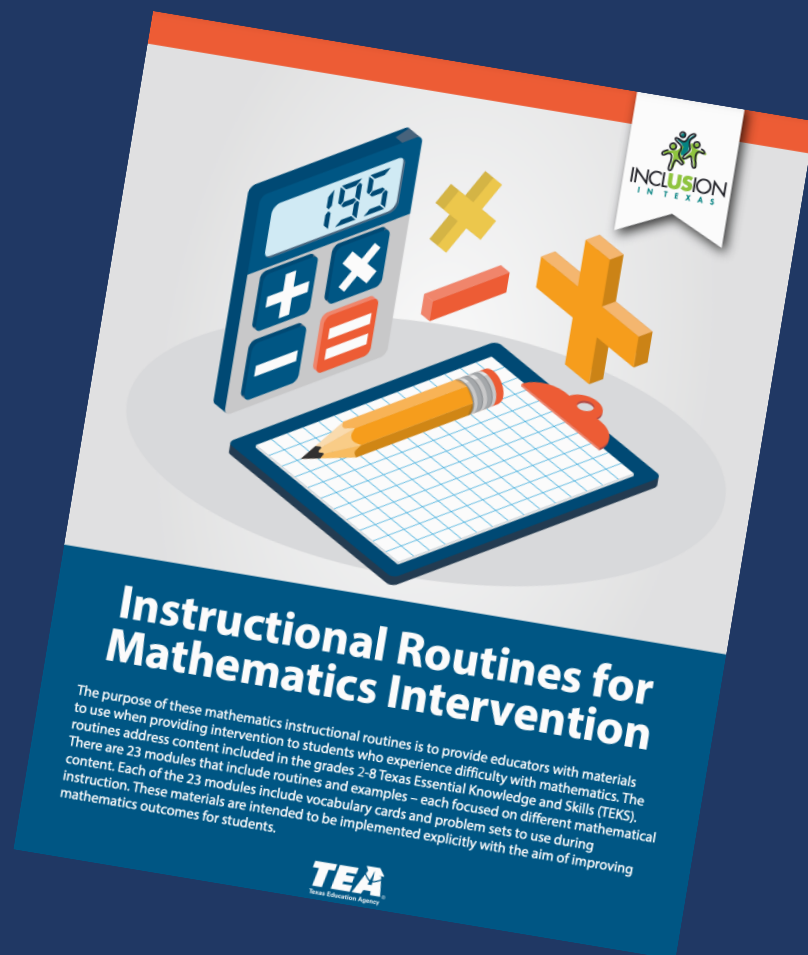
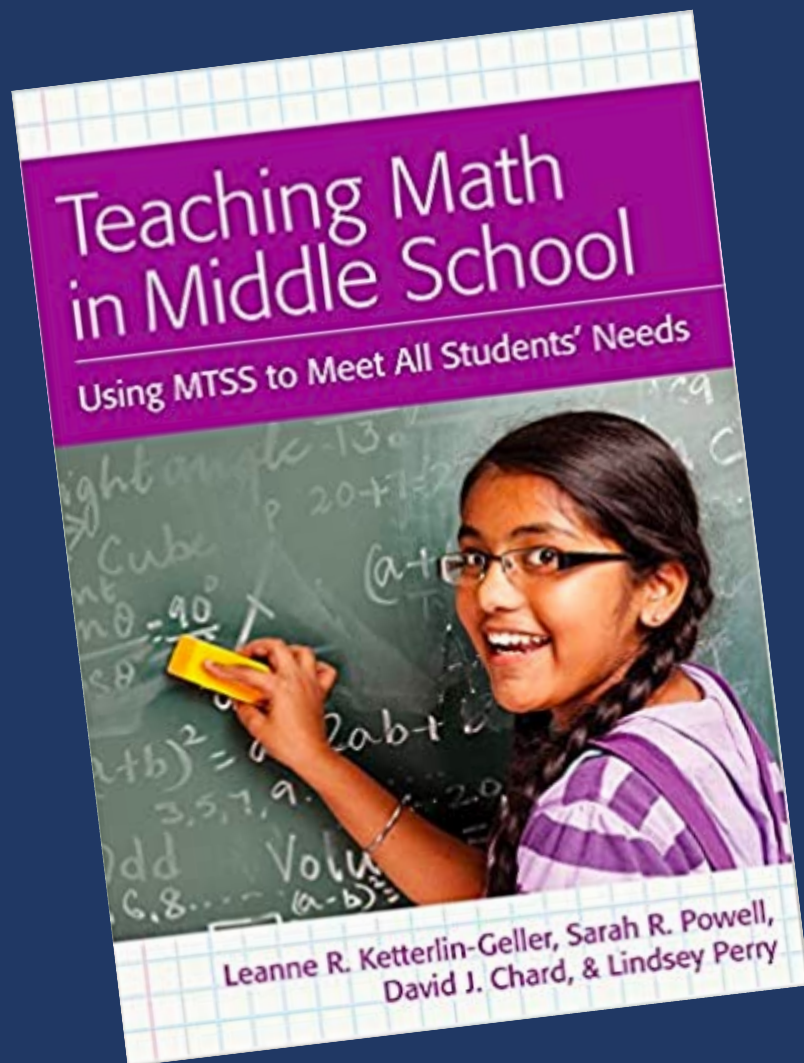
NCII, through a collaboration with the University of Connecticut, developed a set of course content focused on developing educators' skills in designing and delivering intensive mathematics instruction. This content is designed to support faculty and professional development providers with instructing pre-service and in-service educators who are developing and/or refining their implementation of intensive mathematics intervention.

Intensive instruction was recently identified as a [high-leverage practice in special education](#), and DBI is a research based approach to delivering intensive instruction across content areas (NCII, 2013). This course provides learners with an opportunity to extend their understanding of intensive instruction through in-depth exposure to DBI in mathematics, complete with exemplars from actual classroom teachers.

NCII, through a collaboration with the University of Connecticut and the [National Center on Leadership in Intensive Intervention](#) and with support from the [CEEDAR Center](#), developed course content focused on enhancing educators' skills in intensive mathematics intervention. The course includes eight modules that can support faculty and professional development providers with instructing pre-service and in-service educators who are learning to implement intensive mathematics intervention through data-based individualization (DBI). The content in this course complements concepts covered in the [Features of Explicit Instruction Course](#) and so we suggest that users complete both courses.



<https://www.amazon.com/Teaching-Math-Middle-School-Students/dp/1598572741>



https://www.inclusionintexas.org/apps/pages/index.jsp?uREC_ID=2155039&type=d&pREC_ID=2169859



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