

Five Components of Math Intervention



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Introduce yourself.

Describe your role as an educator.

Describe the mathematics you support.



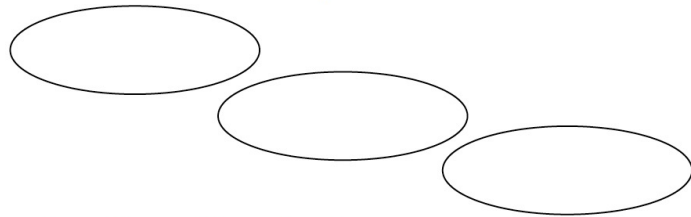
Five Components of Math Intervention

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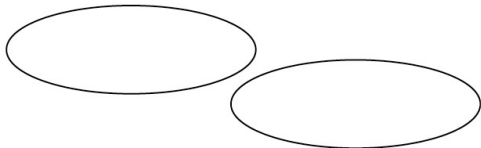
Evidence-Based Practices

Instructional Platform

Instructional Delivery



Instructional Strategies



evidence-based practice

A practice that
has shown
consistent and
positive results



evidence-based practice



evidence-based intervention

An intervention
(i.e., packaged
program) that
has shown
**consistent and
positive** results



evidence-based practice



evidence-based intervention

evidence-based strategy

A method or strategy that has shown **consistent and positive** results



Instructional Platform

INSTRUCTIONAL DELIVERY

Explicit
instruction

Precise
language

Multiple
representations

INSTRUCTIONAL STRATEGIES

Fluency building

Problem solving
instruction



Evidence-Based Practice: Explicit Instruction



Instructional Platform

INSTRUCTIONAL DELIVERY

Explicit
instruction

INSTRUCTIONAL STRATEGIES



Explicit Instruction

MODELING

PRACTICE

SUPPORTS



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.

MODELING

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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.

MODELING

Step-by-step explanation

Planned examples

PRACTICE

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Independent practice

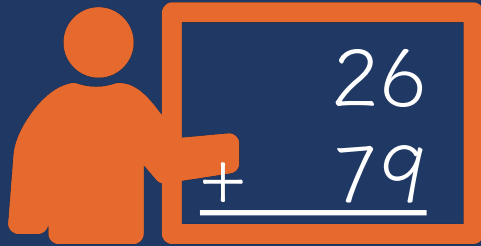
SUPPORTS

Ask high-level and low-level questions

Eliciting frequent responses

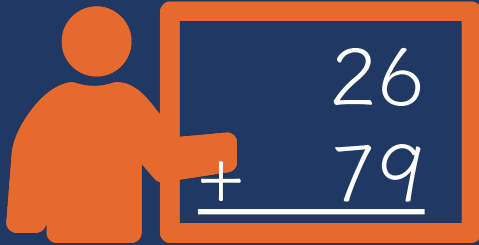
Providing affirmative and corrective feedback





“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?”

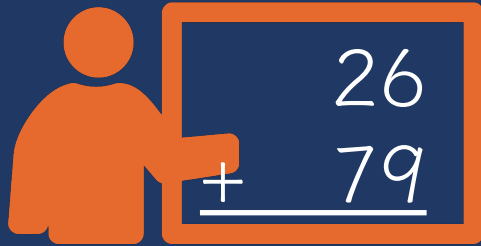
“Add.”



“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?”

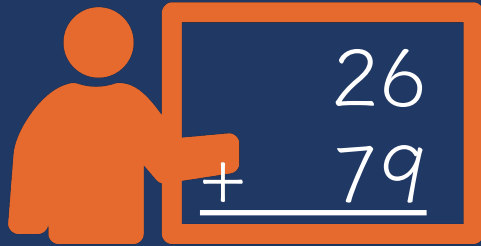
“The tens.”



“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?"

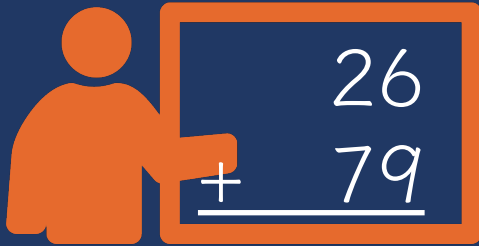
"It's the partial sum of adding 20 plus 70."



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

"6 plus 9."





"6 plus 9 equals what?"

"15." 

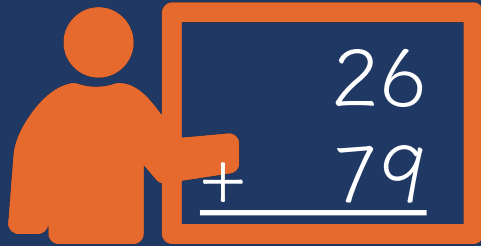
"Let's write 15 below the 90.
Where do we write the 15?"

"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.

MODELING

Step-by-step
explanation

Planned examples

PRACTICE

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Ask high-level and low-level questions

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



MODELING

Step-by-step
explanation

Planned examples

PRACTICE

Guided practice

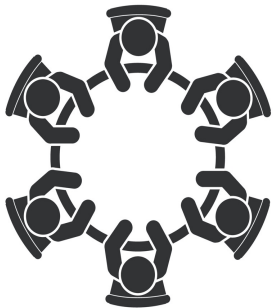
Independent practice

SUPPORTS

Ask high-level and low-level questions

Eliciting frequent responses

Providing affirmative and corrective feedback



What's the math that you
model with your students?



MODELING

Step-by-step
explanation

Planned examples

PRACTICE

Guided practice

Independent practice

Practice continues as a dialogue between the teacher and students.

SUPPORTS

Ask high-level and low-level questions

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MODELING

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



“Let’s work on a problem together.”



MODELING

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Independent practice

SUPPORTS

Ask high-level and low-level questions

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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!”



MODELING

Step-by-step
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PRACTICE

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Ask high-level and low-level questions

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How do you engage students
in guided practice?



MODELING

Step-by-step
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Planned examples

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SUPPORTS

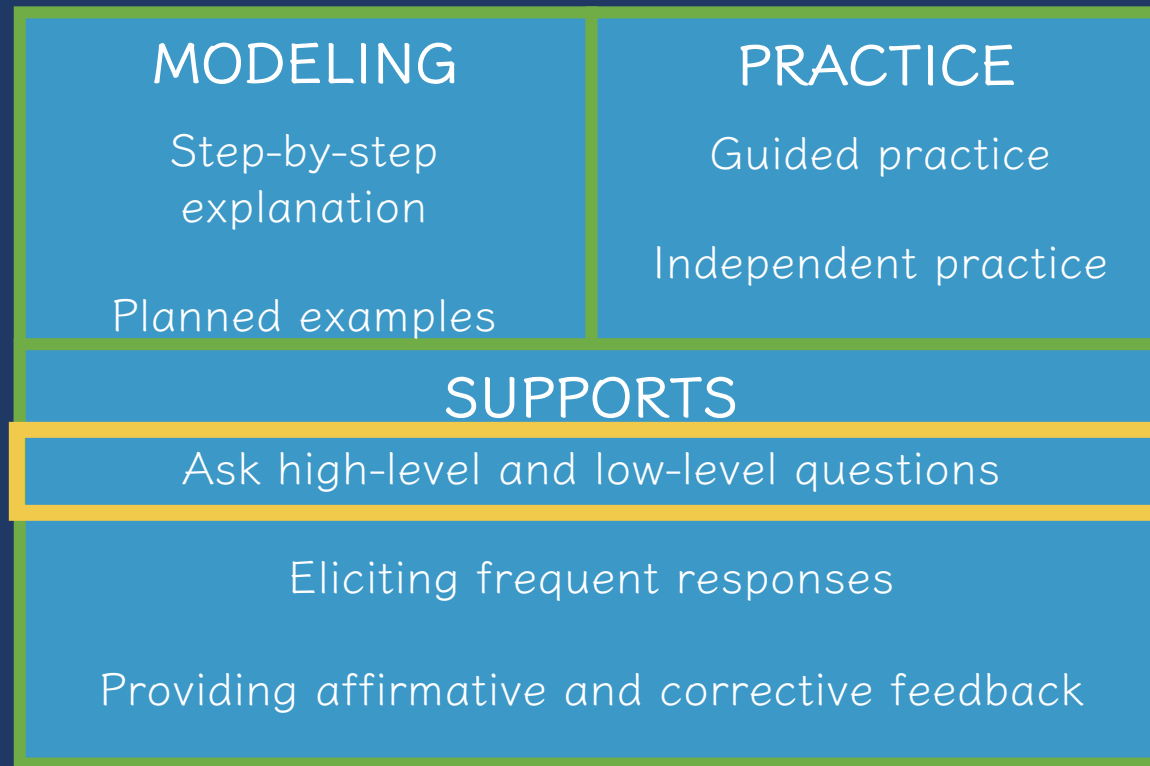
Ask high-level and low-level questions

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.



MODELING

Step-by-step
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Ask high-level and low-level questions

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Providing affirmative and corrective feedback



“What is 7 times 9?”

“63.”



MODELING

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Independent practice

SUPPORTS

Ask high-level and low-level questions

Eliciting frequent responses

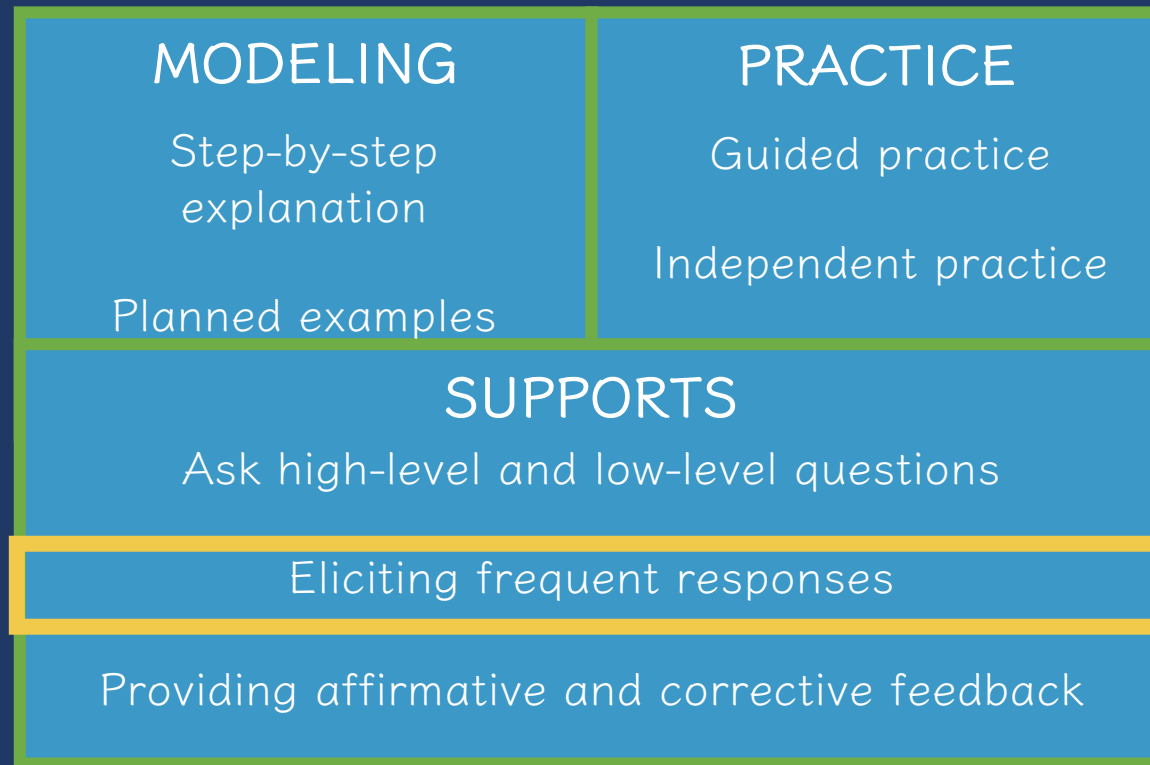
Providing affirmative and corrective feedback



“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.



MODELING

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SUPPORTS

Ask high-level and low-level questions

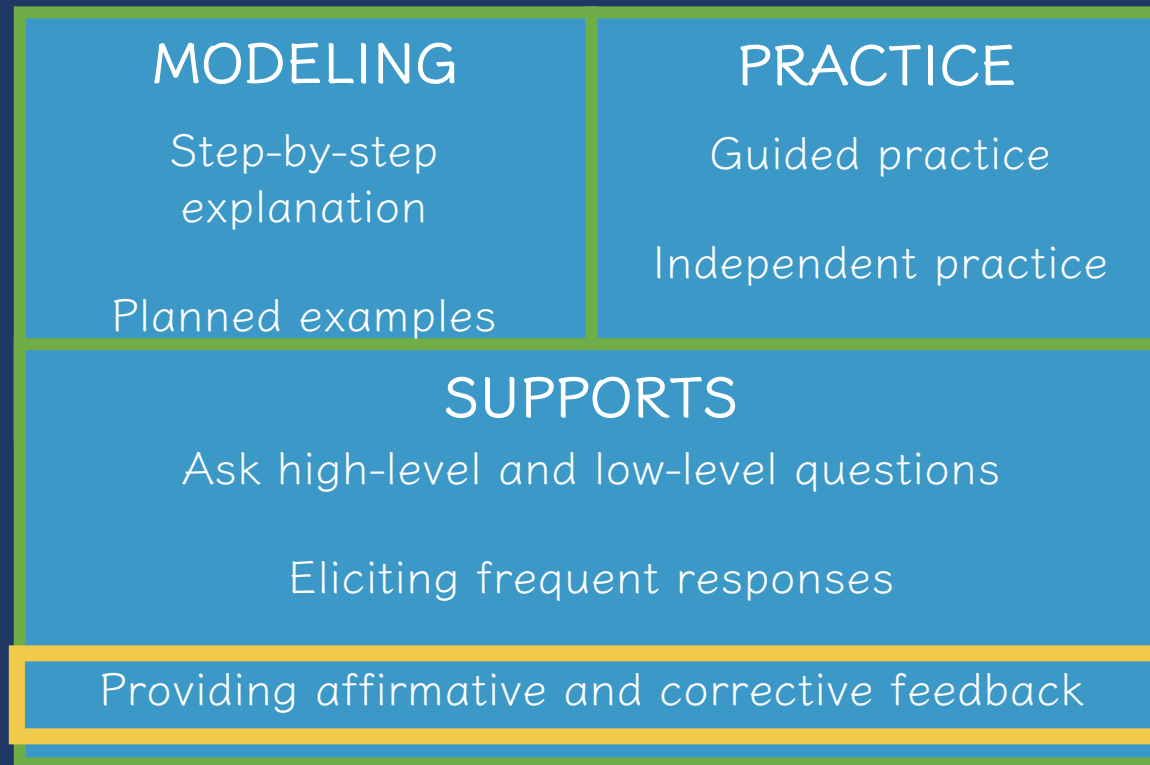
Eliciting frequent responses

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.



MODELING

Step-by-step
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“Nice work using your
word problem attack
strategy.”



MODELING

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



MODELING

Step-by-step
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SUPPORTS

Ask high-level and low-level questions

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Which of these supports
should you use more often?



Evidence-Based Practice: Mathematical Language



Instructional Platform

INSTRUCTIONAL DELIVERY

Explicit
instruction

Precise
language

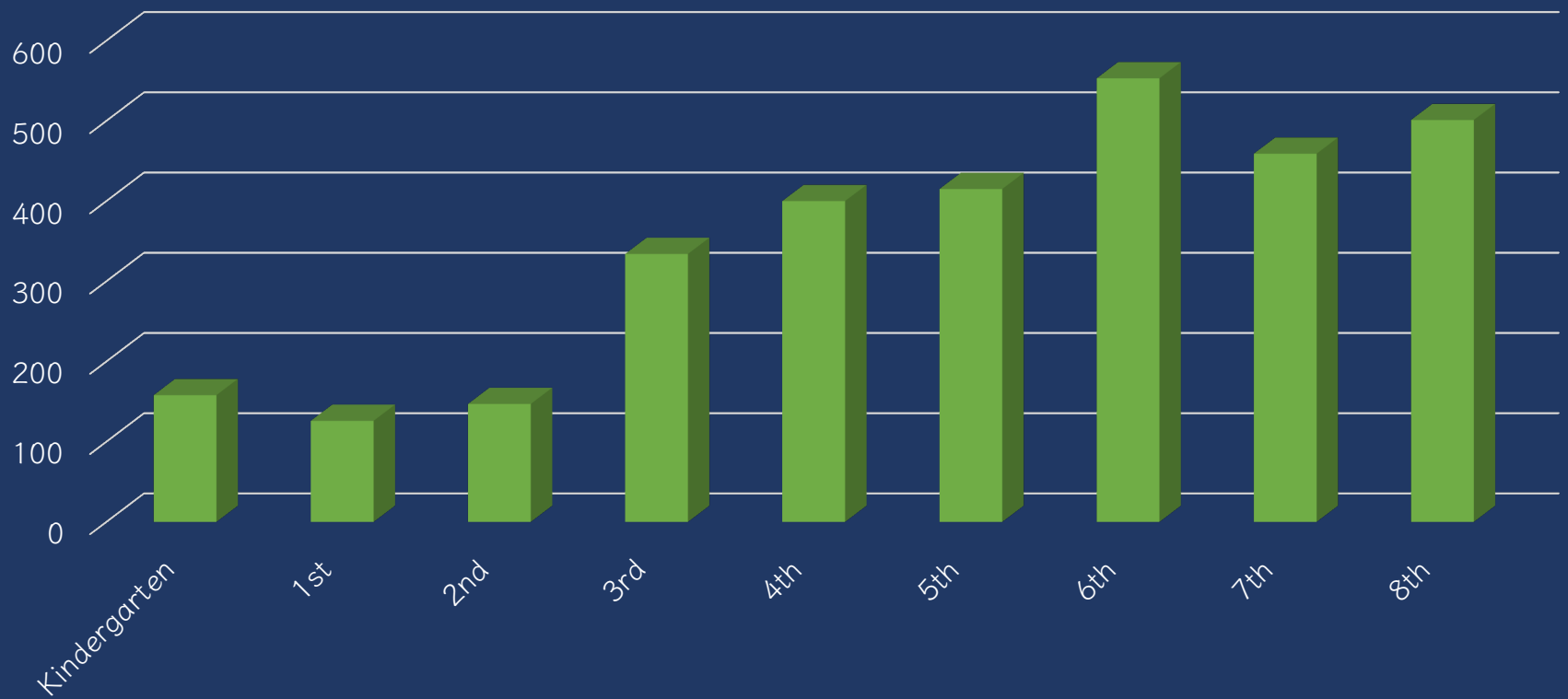
INSTRUCTIONAL STRATEGIES

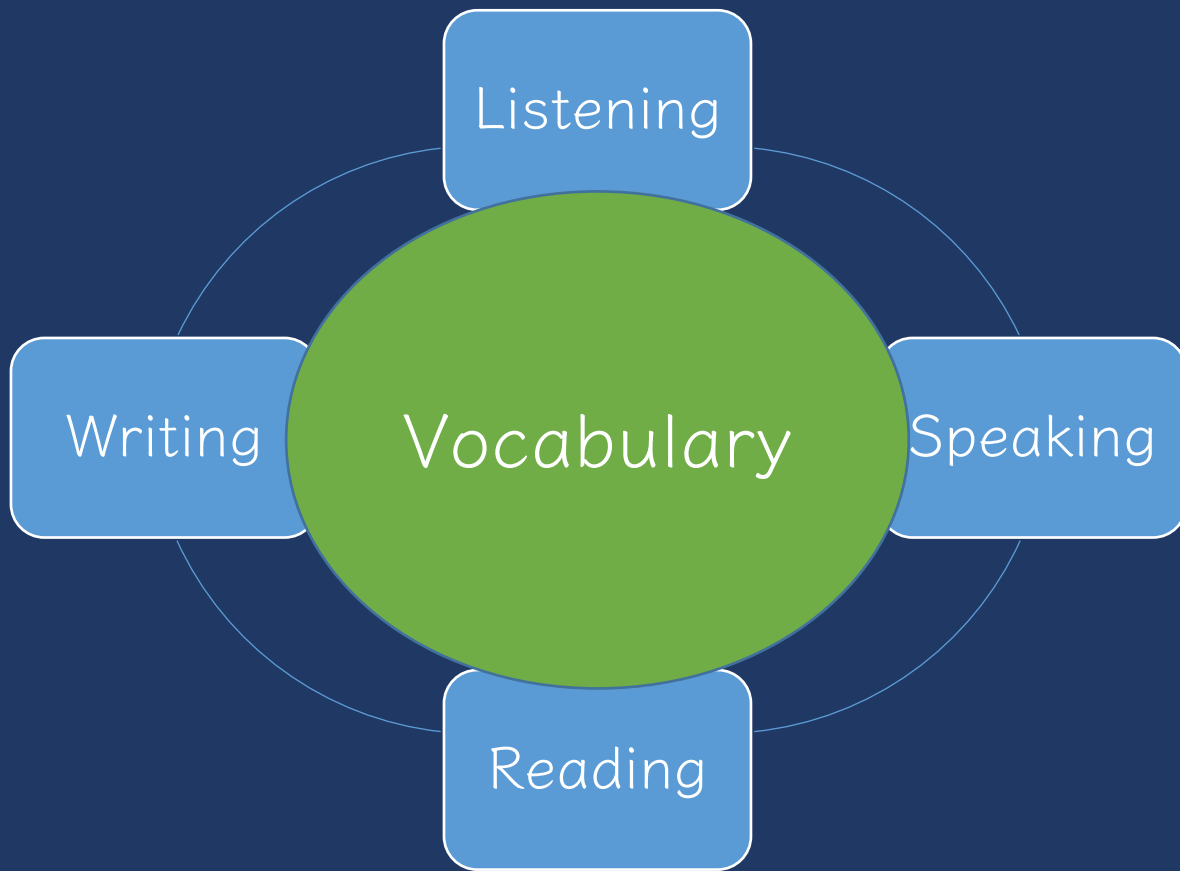


Mathematical Language

Instead of that...	Say this...



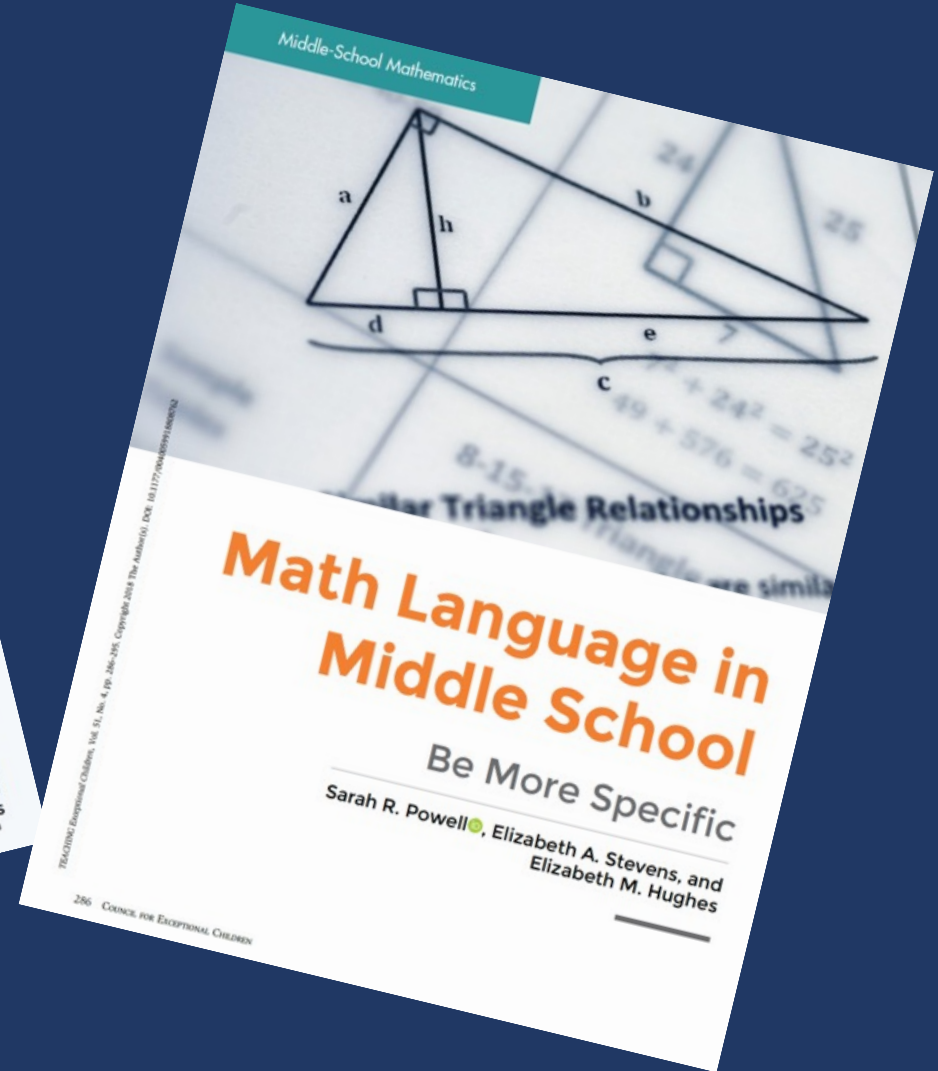
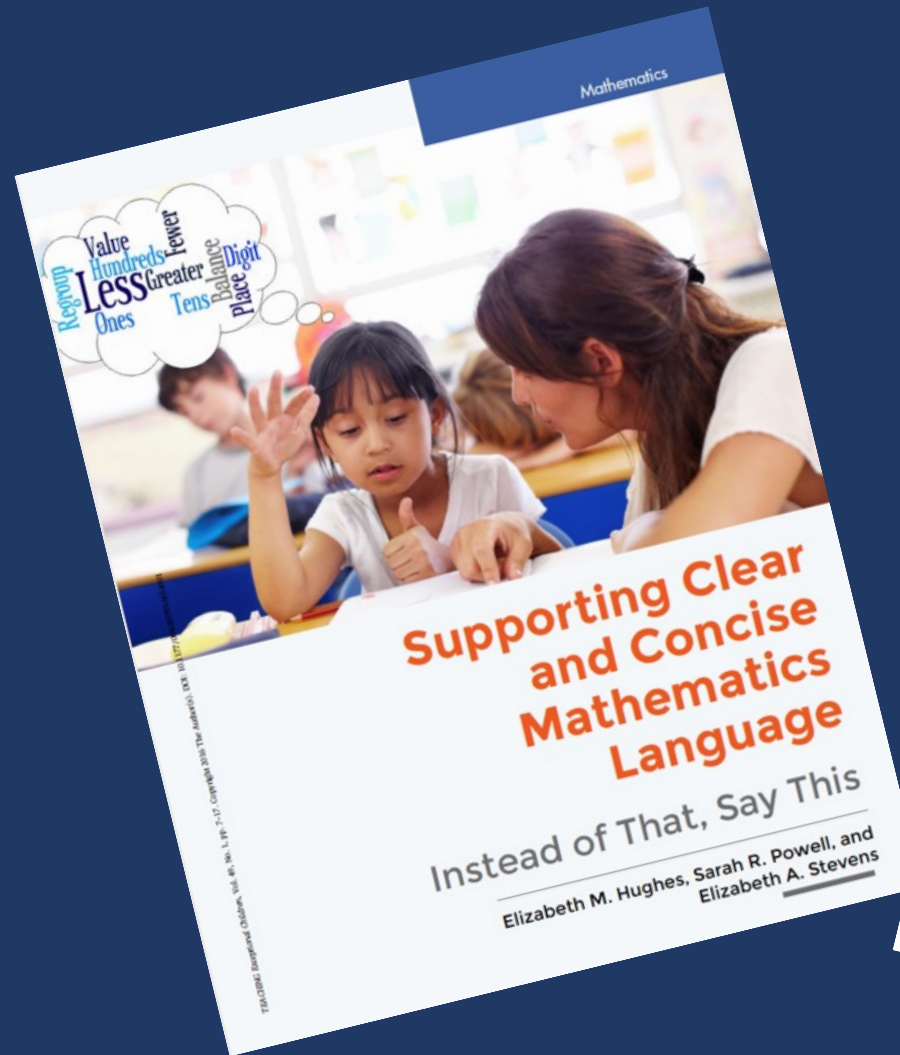





Use formal math language


Use terms precisely







What number is in
the tens place?




What digit is in the tens place?
What is the value of the digit in
the tens place?

135


Why this is important...

- A number refers to the entire amount.
- The 3 in the tens place value is not a number, but rather a digit in the number 135.
- Reinforces conceptual understanding of place value.
- Emphasizes that 3 is part of the number 135 with a value of 30.





The alligator eats the
bigger number



is less than
OR
is greater than

Why this is important...

- Students must learn how to read and write the inequality symbols.
- Students must learn to read equations correctly from left to right because $<$ and $>$ are two distinct symbols.





carry OR borrow

regroup OR
trade OR
exchange





$$\begin{array}{r} 167 \\ + 294 \\ \hline \end{array}$$

Why this is important...

- “Carry” or “borrow” is procedural.
- The other terms reinforce the conceptual understanding or regrouping ones into tens, tens into hundreds, and so on (i.e., the total amount does not change) *or* ungrouping hundreds into tens, tens into ones, and so on.





top number and
bottom number



numerator and
denominator

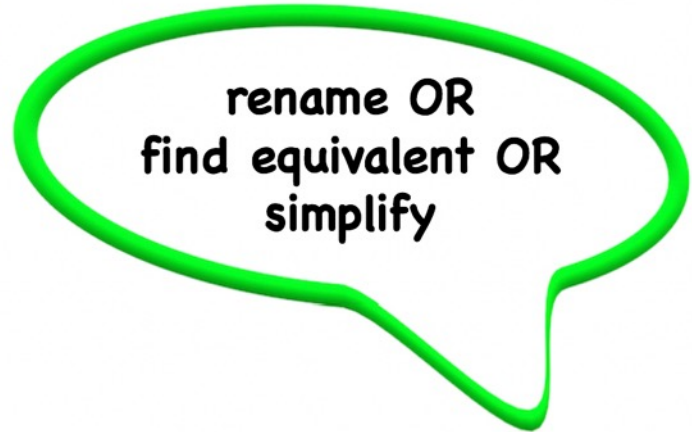

Why this is important...

- Identifying that there are two separate (whole) numbers suggests that whole number properties can be applied to fractions.
- Emphasizing that a fraction is ONE number with ONE magnitude on a number line that is communicated with a numerator and denominator is important.





reduce the fraction




rename OR
find equivalent OR
simplify

Why this is important...

- Reducing suggests that the quantity or magnitude of the new number will be less than the original number.





Four point seven
Four point oh seven

Four and seven tenths
Four and seven hundredths



4.7
4.07

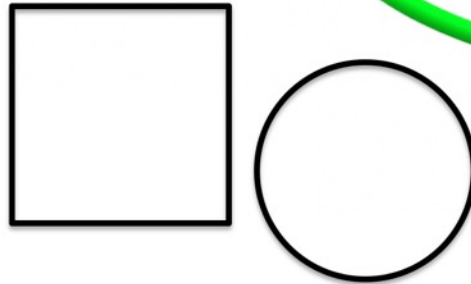
Why this is important...

- Accurately shares the magnitude of the decimal.
- Emphasizes place value.



box OR ball

square OR
circle



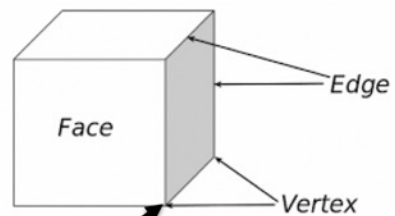
Why this is important...

- Use the formal language of shapes to confirm informal language.



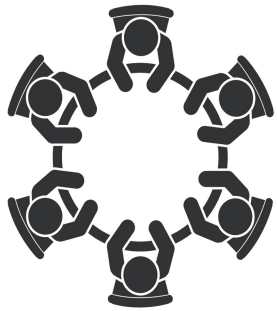
point

vertex



Why this is important...

- This is the endpoint where two or more line segments or rays meet.



What are examples of,
“Instead of ____, Say ____?”



Use formal math language

Use terms precisely



Factor

$$1 \times 8 = 8$$

$$2 \times 4 = 8$$

factor factor

Multiple

$$8 \times 1 = 8$$

$$8 \times 2 = 16$$

multiples of 8

E

Improper fraction

$$\frac{8}{5}$$

Mixed number

$$1\frac{3}{5}$$

Proper fraction

$$\frac{2}{9}$$

Proportion

$$\frac{2}{5} = \frac{8}{20}$$

Ratio

$$4:3$$

Unit fraction

$$\frac{1}{6}$$

D



Coefficient
Constant
Term
Variable

$$\overbrace{2x^2}^{\text{term}} + \overbrace{x}^{\text{term}} - \overbrace{3}^{\text{term}}$$

$2x^2$ variable coefficient
 x variable
 3 constant

A

Equation $9x - 4 = 7x$

Expression $9x - 4$

Formula $a^2 + b^2 = c^2$

Function $f(x)$

Inequality $9x - 4 > 6x$

C

Quadrilaterals

Kite



Rhombus



Parallelogram



Square



Rectangle



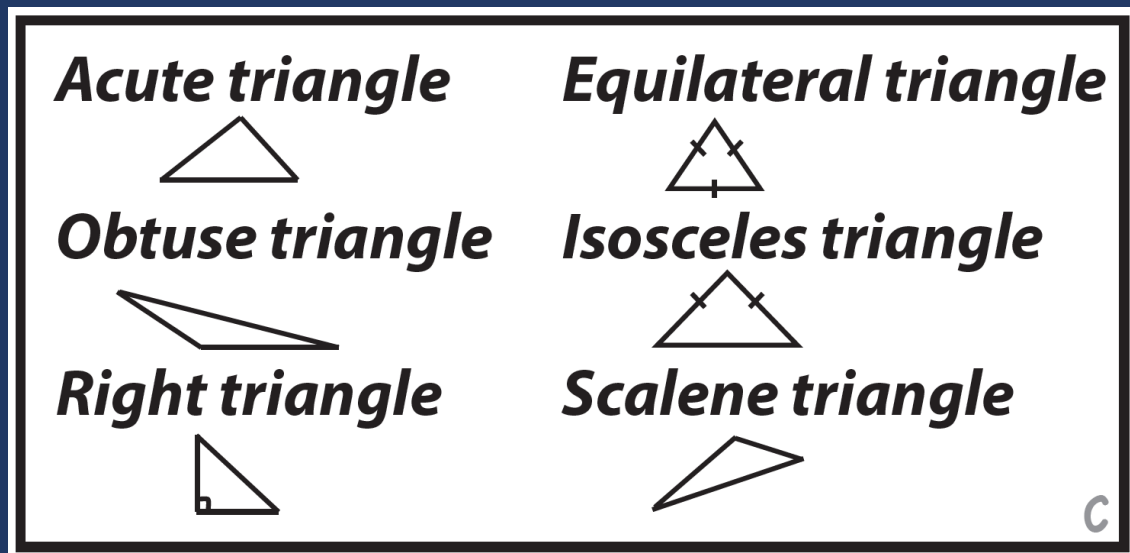
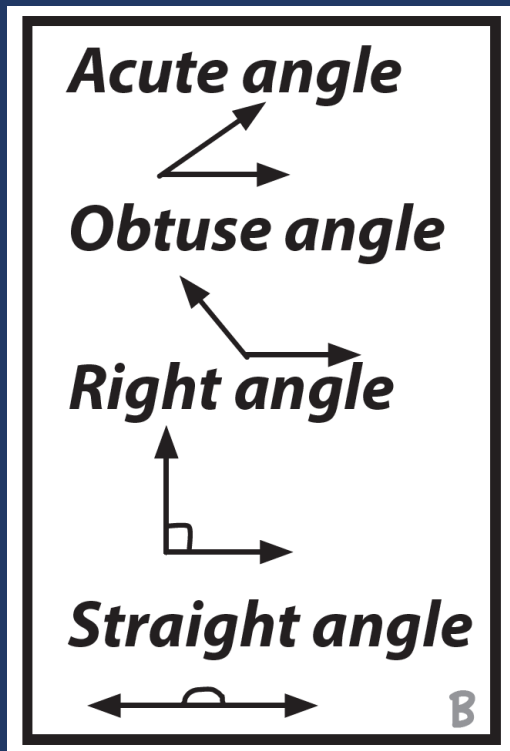
Trapezoid



A

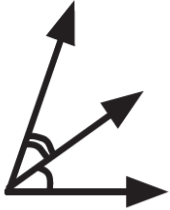
Rubenstein & Thompson (2002)



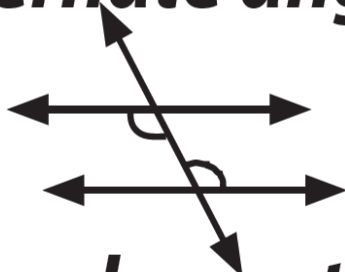


Rubenstein & Thompson (2002)

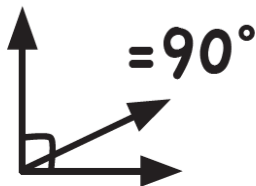
Adjacent angles



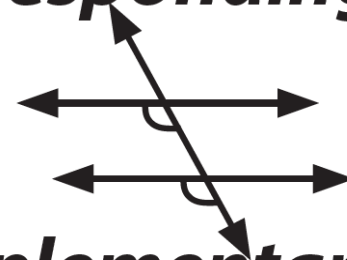
Alternate angles



Complementary angles



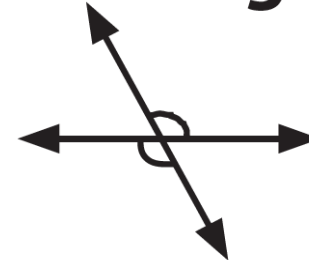
Corresponding angles



Supplementary angles $= 180^\circ$



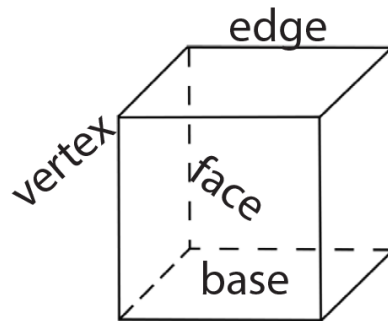
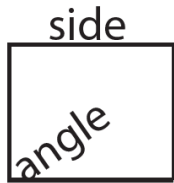
Vertical angles



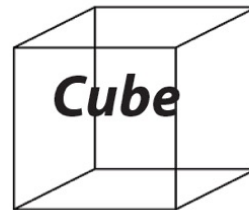
D

Rubenstein & Thompson (2002)

Angle
Base
Edge
Face
Side
Vertex



#



1

Rubenstein & Thompson (2002)





Which terms do your students not use precisely?



Use formal math language

Use terms precisely



Evidence-Based Practice: Multiple Representations



Instructional Platform

INSTRUCTIONAL DELIVERY

Explicit
instruction

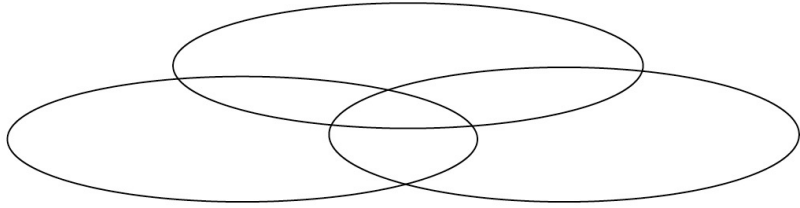
Precise
language

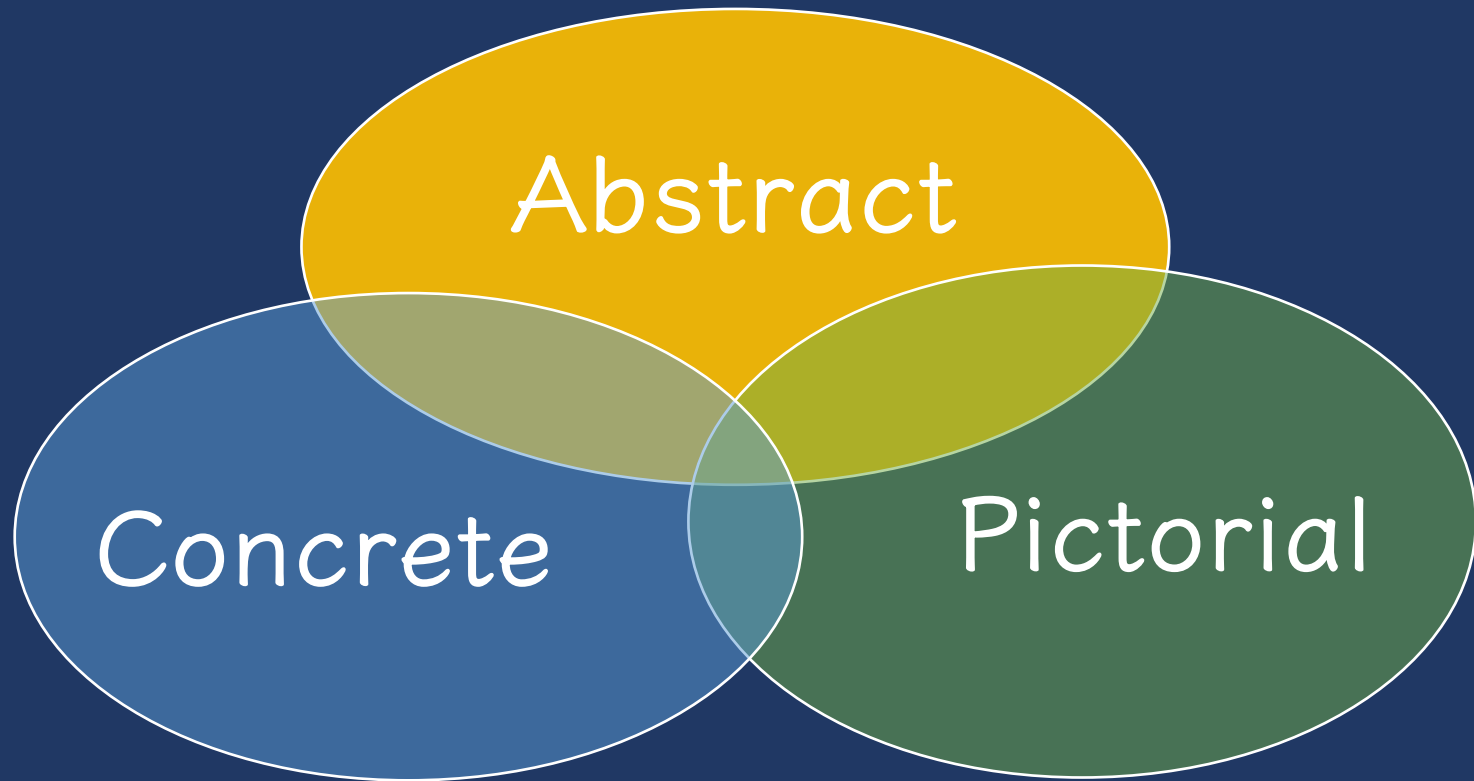
Multiple
representations

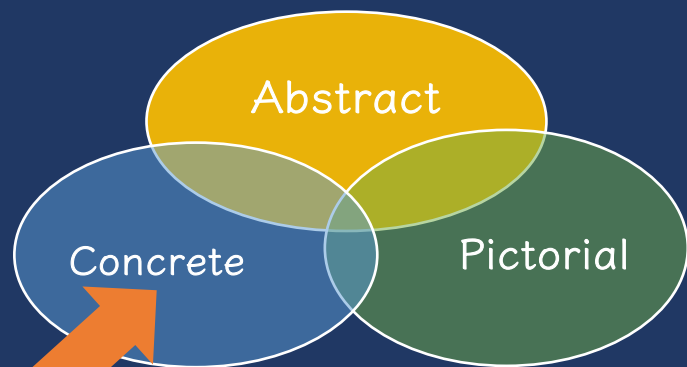
INSTRUCTIONAL STRATEGIES



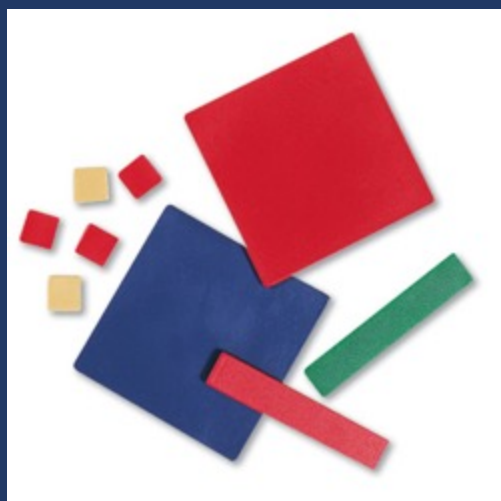
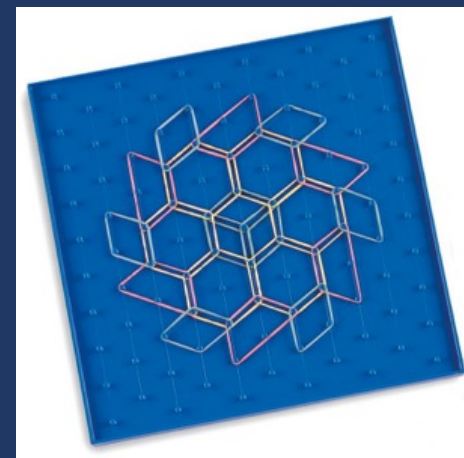
Multiple Representations

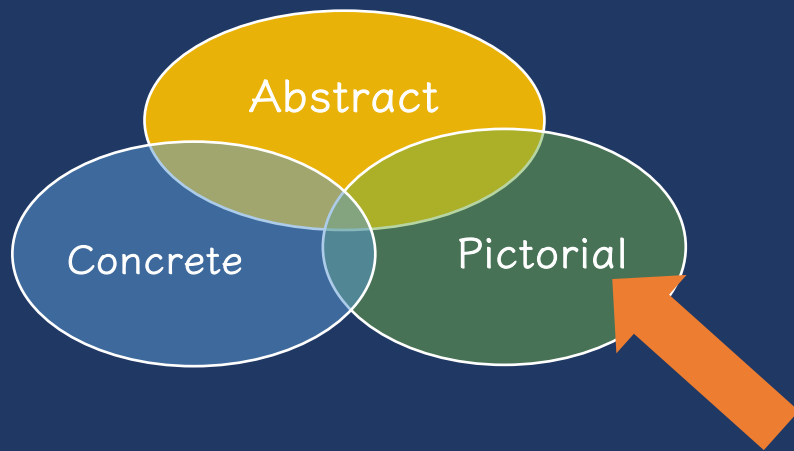




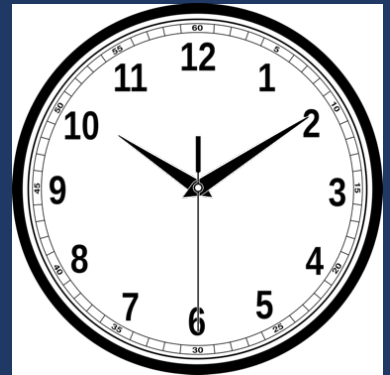
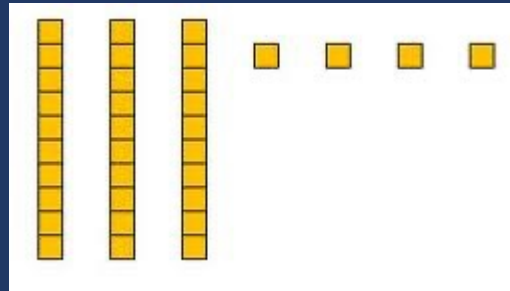
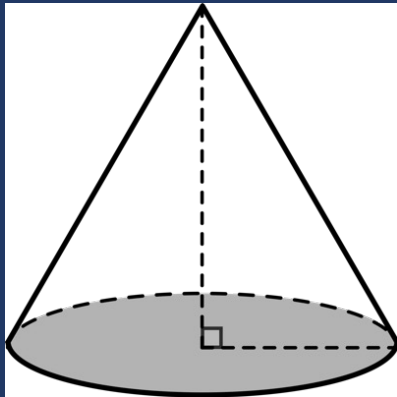


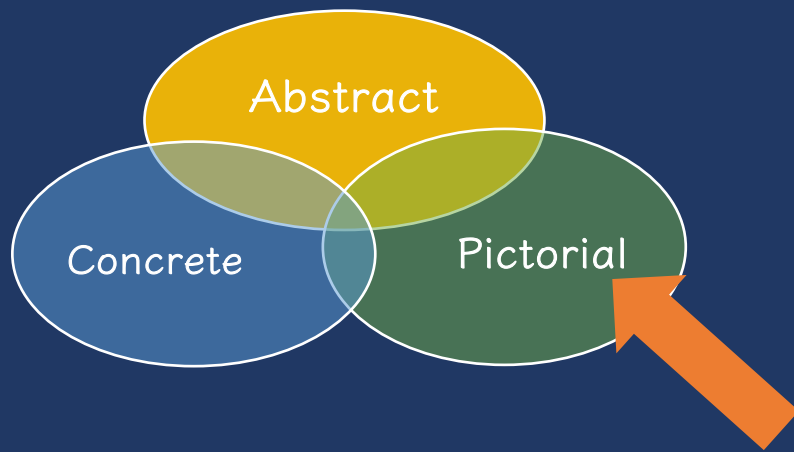
Three-dimensional objects



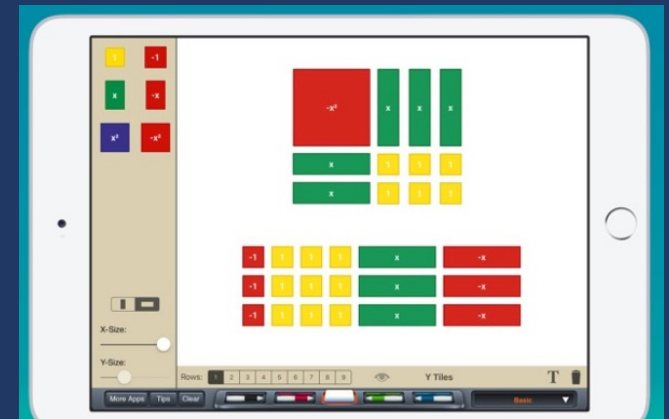
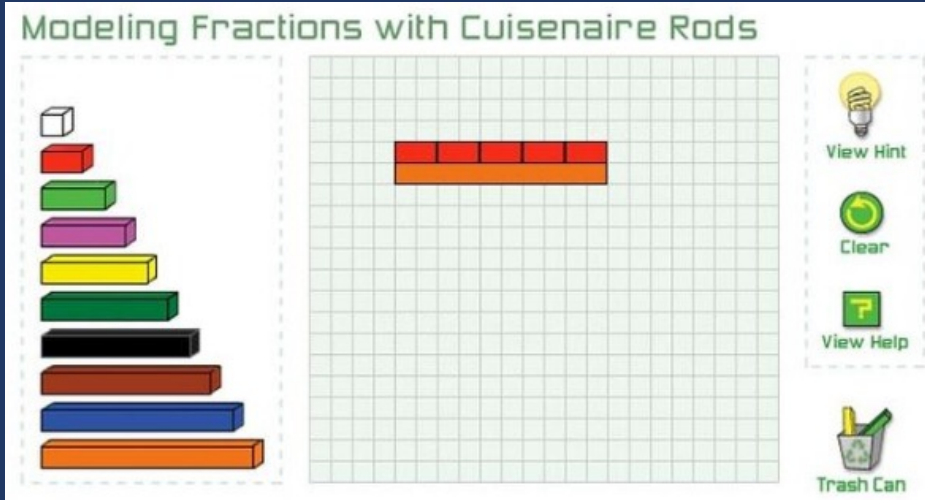
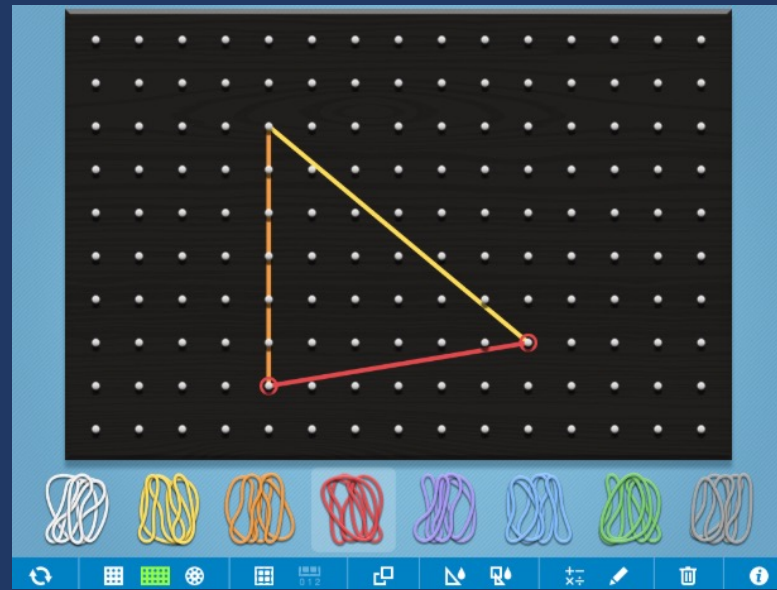


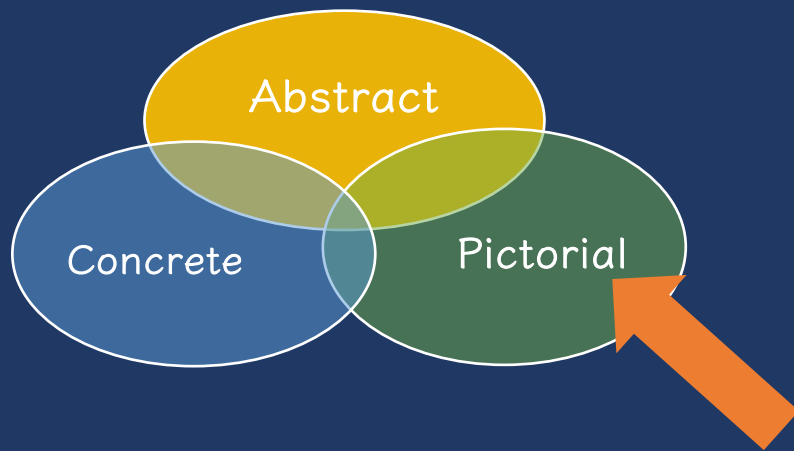
Two-dimensional images



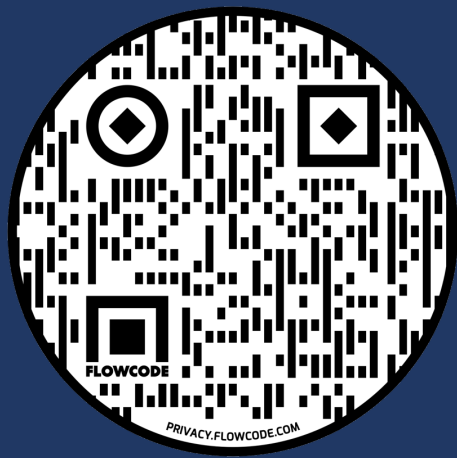


Two-dimensional images





Two-dimensional images



<https://bit.ly/srpowell>

Virtual Manipulatives

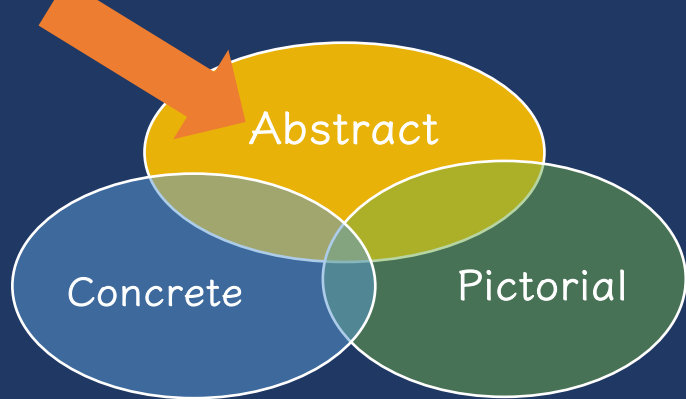
Help students see and learn math using different tools!

Number & Operations	Place Value
Fractions & Decimals	Integers & Algebra
Geometry	Time & Money
Data & Probability	Extras

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Fractions & Decimals				
	fraction strips	fraction strips	fraction strips	Cuisenaire rods
	fraction circles	geoboard	geoboard	geoboard
two-color counters	decimal strips	place value disks	percentage strips	pattern blocks





Numerals and symbols and words

$$2 + 8 = 10$$

$$34 = 3 \text{ tens and } 4 \text{ ones}$$

$$x - 6 = 8$$

$$\begin{array}{r} 4,179 \\ + \quad 569 \\ \hline \end{array}$$





If you are left handed:
What's one of your favorite
hands-on manipulatives?

If you are right handed:
What's one of your favorite
virtual manipulatives?



Evidence-Based Practice: Fluency Building



Instructional Platform

INSTRUCTIONAL DELIVERY

Explicit
instruction

Precise
language

Multiple
representations

INSTRUCTIONAL STRATEGIES

Fluency building



Fluency

Addition

No.	Name	Age	Sex	Religion	Caste	Occupation	Remarks
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
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68
69
70
71
72
73
74
75
76
77
78
79
80
81				

Subtraction

Case no.	Date of birth	Sex	Age at onset	Age at death
1	1970	M	10	15
2	1970	M	10	15
3	1970	M	10	15
4	1970	M	10	15
5	1970	M	10	15
6	1970	M	10	15
7	1970	M	10	15
8	1970	M	10	15
9	1970	M	10	15
10	1970	M	10	15
11	1970	M	10	15
12	1970	M	10	15
13	1970	M	10	15
14	1970	M	10	15
15	1970	M	10	15
16	1970	M	10	15
17	1970	M	10	15
18	1970	M	10	15
19	1970	M	10	15
20	1970	M	10	15

Multiplication

Date	Time	Location	Observations

Division

No.	Name	Sex	Age	Date	Time	Place	Height	Weight	Chest	Arm	Forearm	Hand	Foot	Head	Face	Eyes	Nose	Mouth	Throat	Lungs	Heart	Stomach	Liver	Spleen	Pancreas	Intestine	Bladder	Rectum	Uterus	Vagina	Cervix	Vulva	Clitoris	Labia	Perineum	Anus	Penis	Scrotum	Testis	Epididymis	Vas Deferens	Utricle	Prostate	Seminal Vesicle	Bladder Neck	Urethra	Penile Sheath	Prepuce	Glans	Foreskin	Corona	Mucosa	Epithelium	Subcutaneous	Muscle	Bone	Cartilage	Nerve	Blood Vessel	Lymphatic	Sweat Gland	Sebaceous Gland	Mammary Gland	Thyroid Gland	Parathyroid Gland	Adrenal Gland	Pituitary Gland	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland	Thalamus	Hypothalamus	Hypophysis	Pineal Gland
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Building Fluency

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.

With fluency, it is important to emphasize both
conceptual learning and procedural learning.



Addition	Subtraction
Multiplication	Division

Counting

Comparing
numbers

Counting
coins

Telling
time

Identifying
equivalent
fractions

Knowing
multiples

Identifying
shapes

Knowing
formulas



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

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

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

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

$$\begin{array}{r} 56 \\ \div 8 \\ \hline \end{array}$$



Cover, Copy, Compare

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

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

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

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

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

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

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

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

$$7 + 3 =$$

$$2 + 7 =$$

$$5 + 6 =$$

$$4 + 7 =$$

$$7 + 8 =$$

$$6 + 7 =$$

$$7 + 9 =$$

$$7 + 6 =$$

$$8 + 7 =$$

$$7 + 0 =$$

$$9 + 6 =$$

$$6 + 0 =$$

$$6 + 8 =$$

File Folder

$$6 + 3 =$$

$$1 + 7 =$$

Taped Problems

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

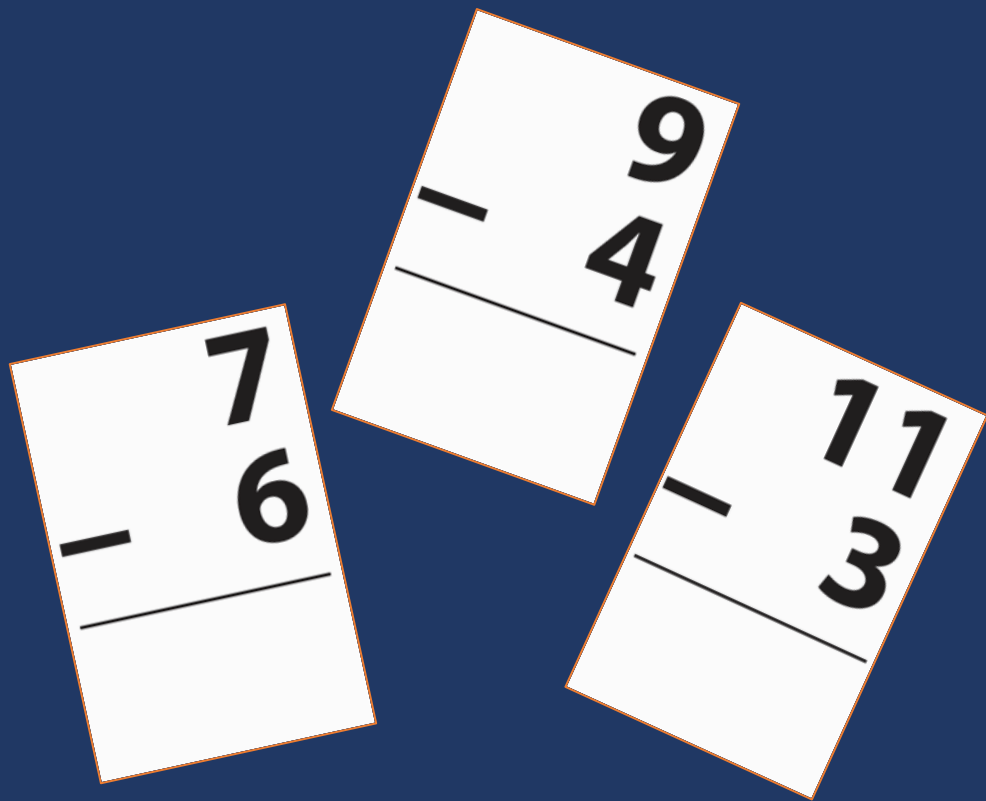
$$\begin{array}{r} 6 \\ \times 7 \\ \hline \end{array}$$

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

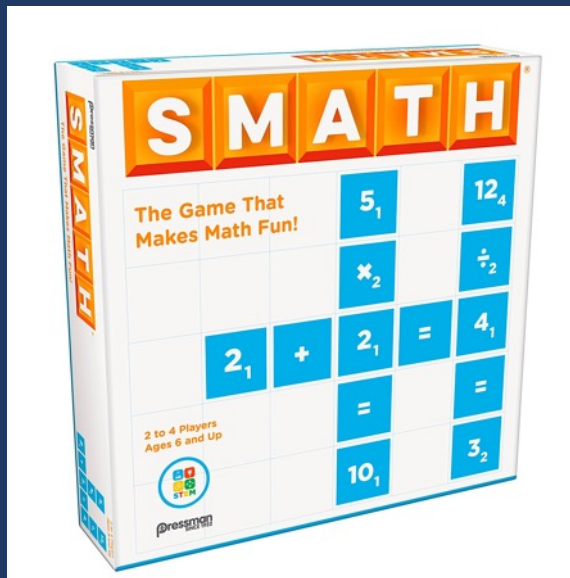
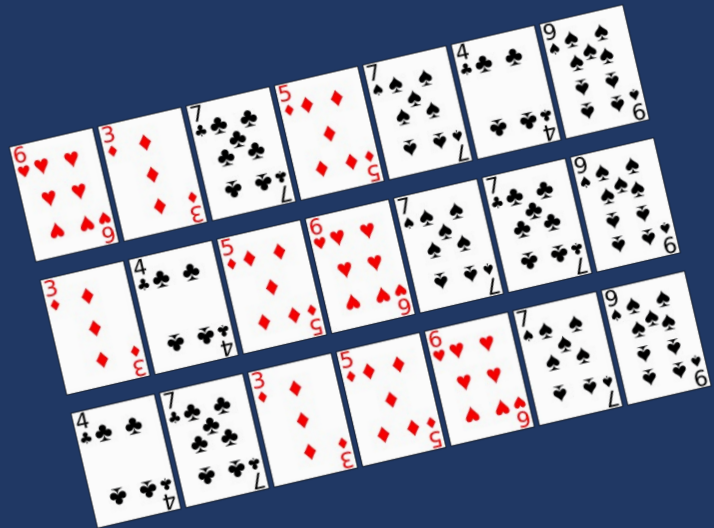
$$\begin{array}{r} 4 \\ \times 8 \\ \hline \end{array}$$

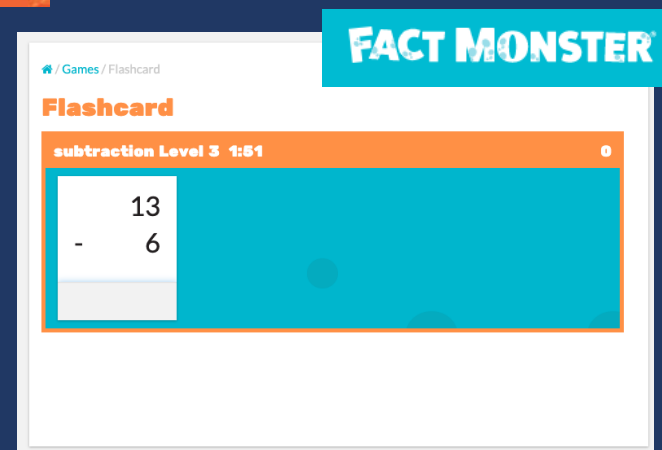
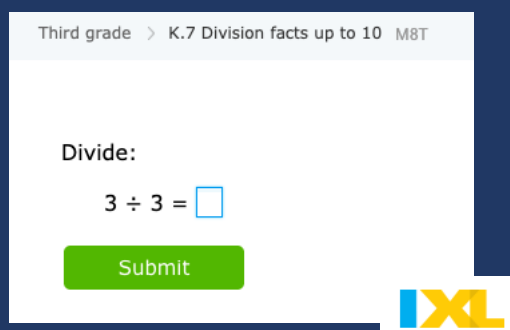
$$\begin{array}{r} 5 \\ \times 7 \\ \hline \end{array}$$





Flash Card Graph		Name: _____											
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DAILY and
BRIEF



Addition

Subtraction

Multiplication

Division

Build fluency with whole-number computation

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

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

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

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



Addition

Subtraction

Multiplication

Division

Build fluency with rational-number computation

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

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

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

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



Addition

Subtraction

Multiplication

Division

Build fluency with integer computation

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

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

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

$$-135 \div 2 =$$



Addition	Subtraction
Multiplication	Division



What are five ways you help students build fact fluency?



Evidence-Based Practice: Word-Problem Solving



Instructional Platform

INSTRUCTIONAL DELIVERY

Explicit
instruction

Precise
language

Multiple
representations

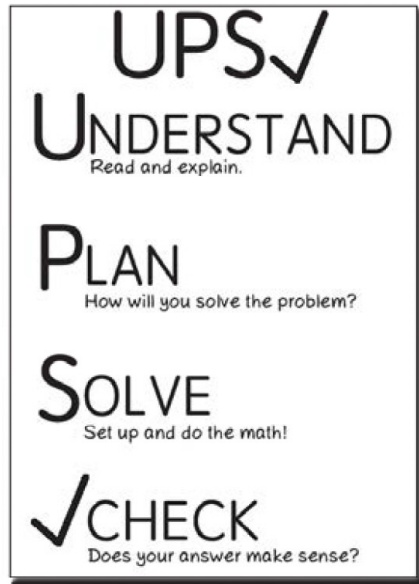
INSTRUCTIONAL STRATEGIES

Fluency building

Problem solving
instruction



Word-Problem Solving



Word-Problem Schemas



Teach an attack strategy

Teach about schemas



Teach an attack strategy

UPS✓

UNDERSTAND
Read and explain.

PLAN
How will you solve the problem?

SOLVE
Set up and do the math!

✓CHECK
Does your answer make sense?

Created by: Sarah Powell (spowell@austin.utexas.edu)



Teach about schemas

Total

Equal Groups

Difference

Comparison

Change

Ratios/Proportions



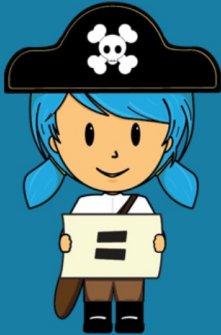


Pirate Math Equation Quest

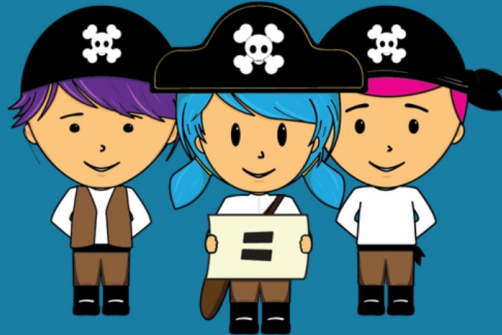
[About](#)[Research](#)[Individual](#)[Small Group](#)[STAAR](#)[Videos](#)

Welcome to Pirate Math Equation Quest!

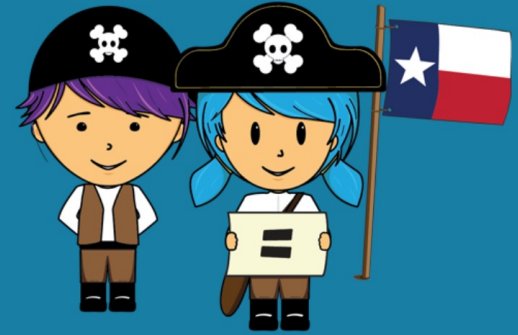
Individual Word-Problem Intervention



Small-Group Word-Problem Intervention



Small-Group Word-Problem Intervention for STAAR



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Instructional Platform

INSTRUCTIONAL DELIVERY

Explicit
instruction

Precise
language

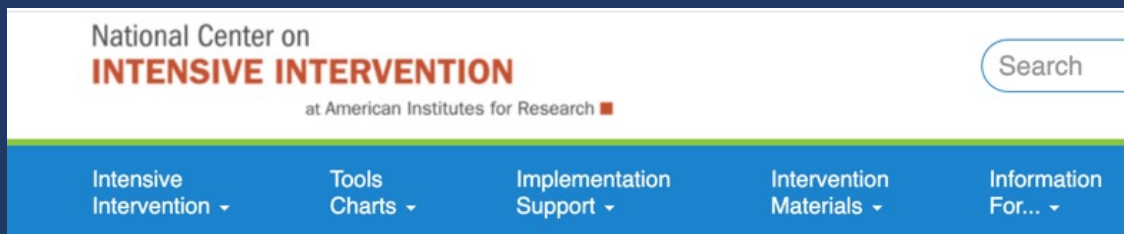
Multiple
representations

INSTRUCTIONAL STRATEGIES

Fluency building

Problem solving
instruction



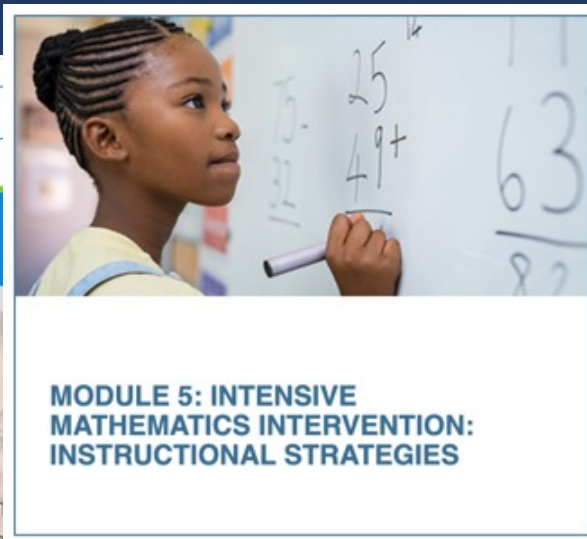


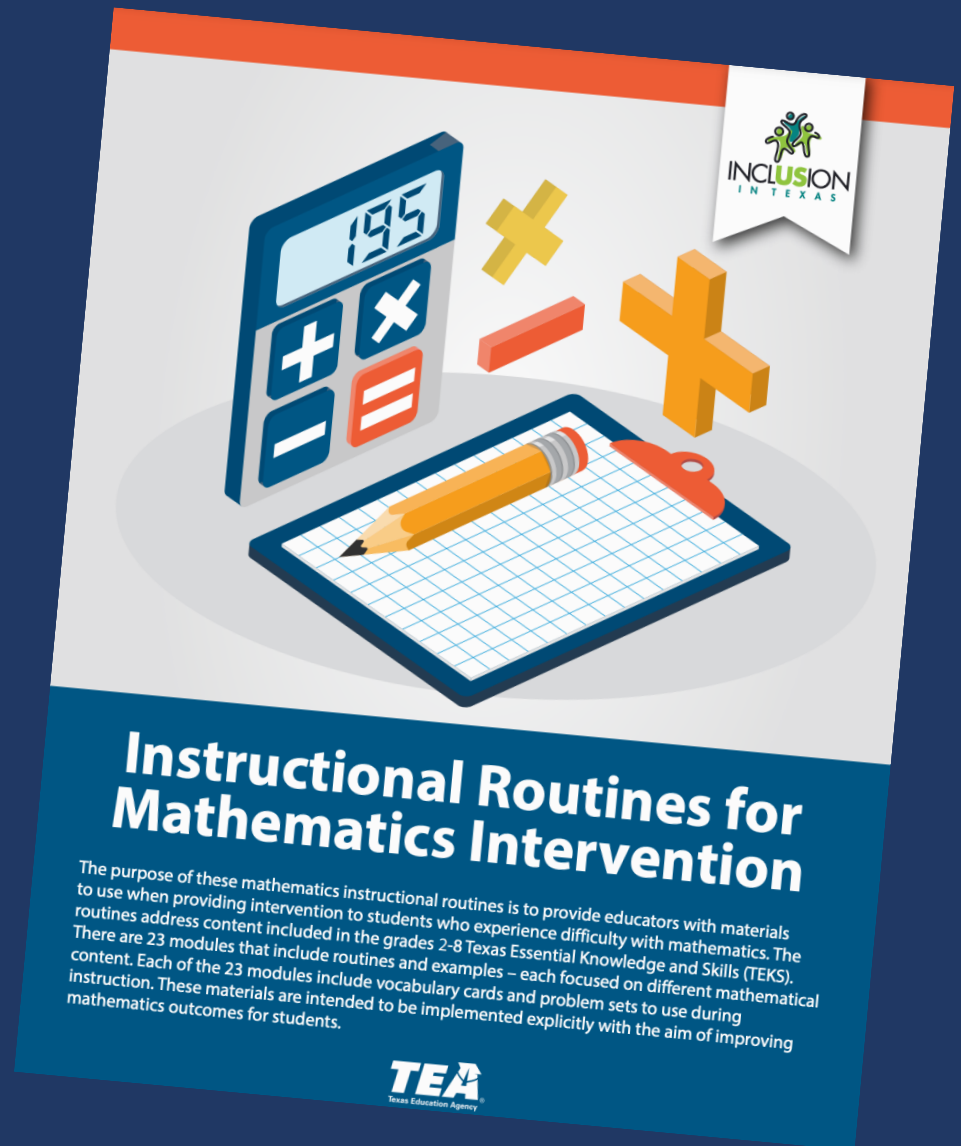
Intensive Intervention in Mathematics Course Content

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.

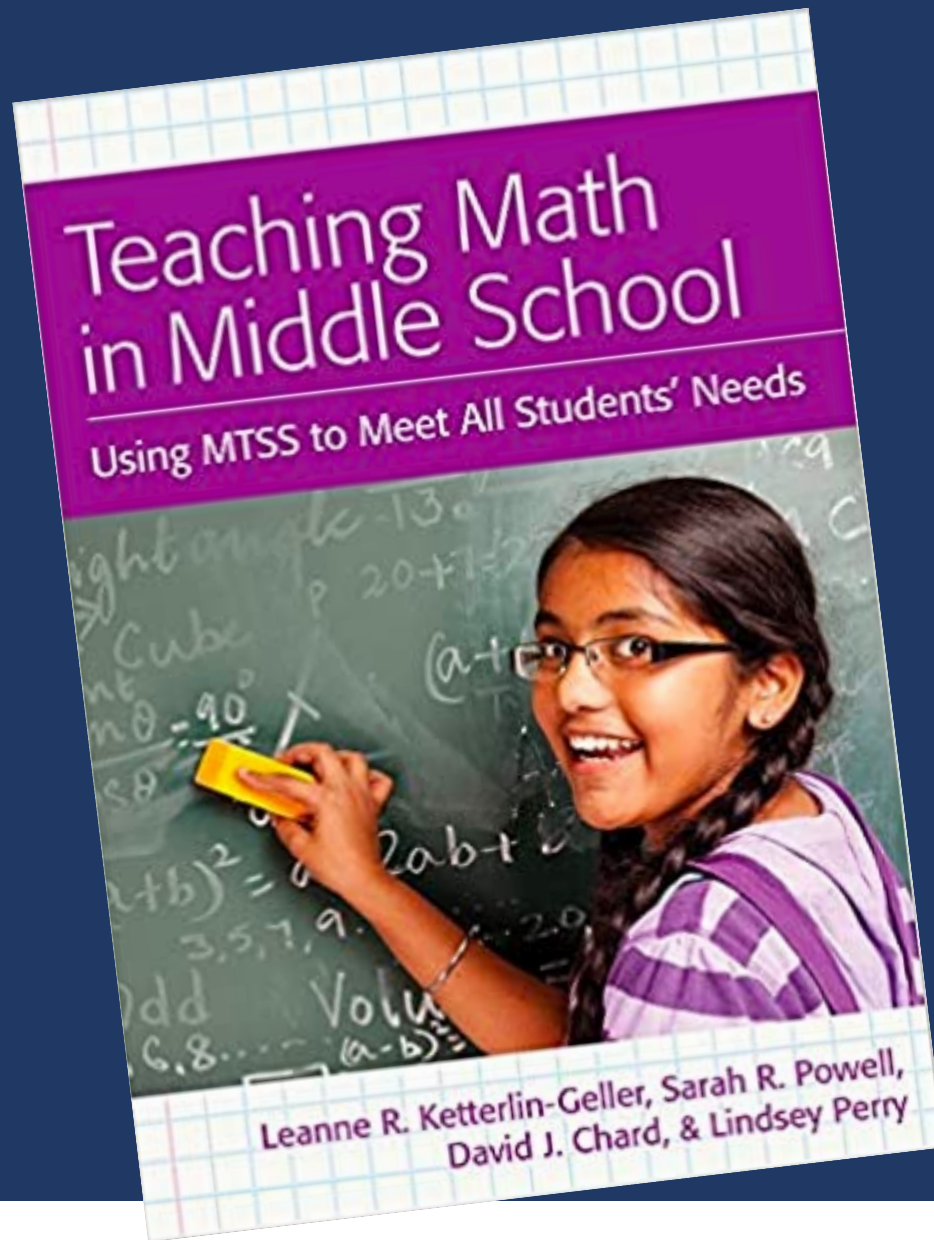
NCII, through a collaboration with the University of Connecticut and the [National Center on Leadership in Intensive Intervention](#) and with support from the [CEEDAR Center](#), developed course content focused on enhancing educators' skills in intensive mathematics intervention. The course includes 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.inclusionintexas.org/apps/pages/index.jsp?uREC_ID=2155039&type=d&pREC_ID=2169859







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