# Designing and Delivering Effective Middle School Mathematics

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**Instruction**

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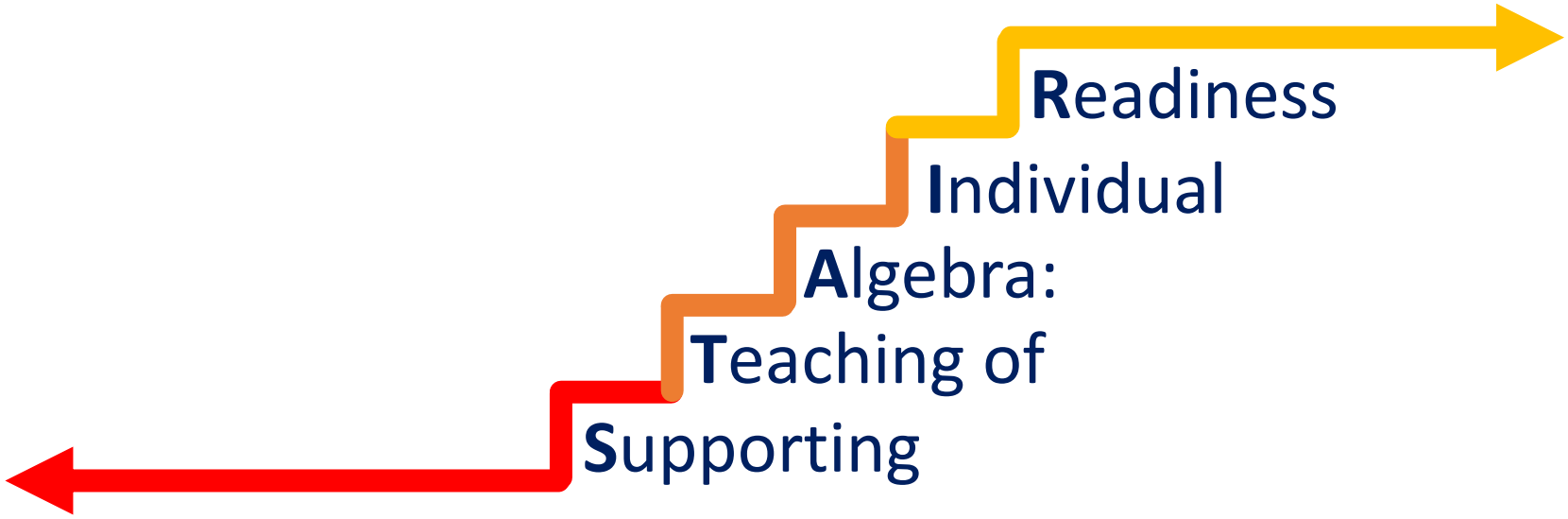


# Agenda

- Assessment of Teacher Instructional Practices
- Adapting Instruction
- Effective Mathematics Instruction
- Data-Based Individualization
- Key Components of STAIR Coaching
- Study Overview
- Introductions

# Introductions

# Study Overview

**S**upporting

**T**eaching of

**A**lgebra:

**I**ndividual

**R**eadiness

U.S. Office of Special Education Programs

# Study Overview

Improve student outcomes related to algebraic reasoning

# Key Components

STAIR Coaching Support

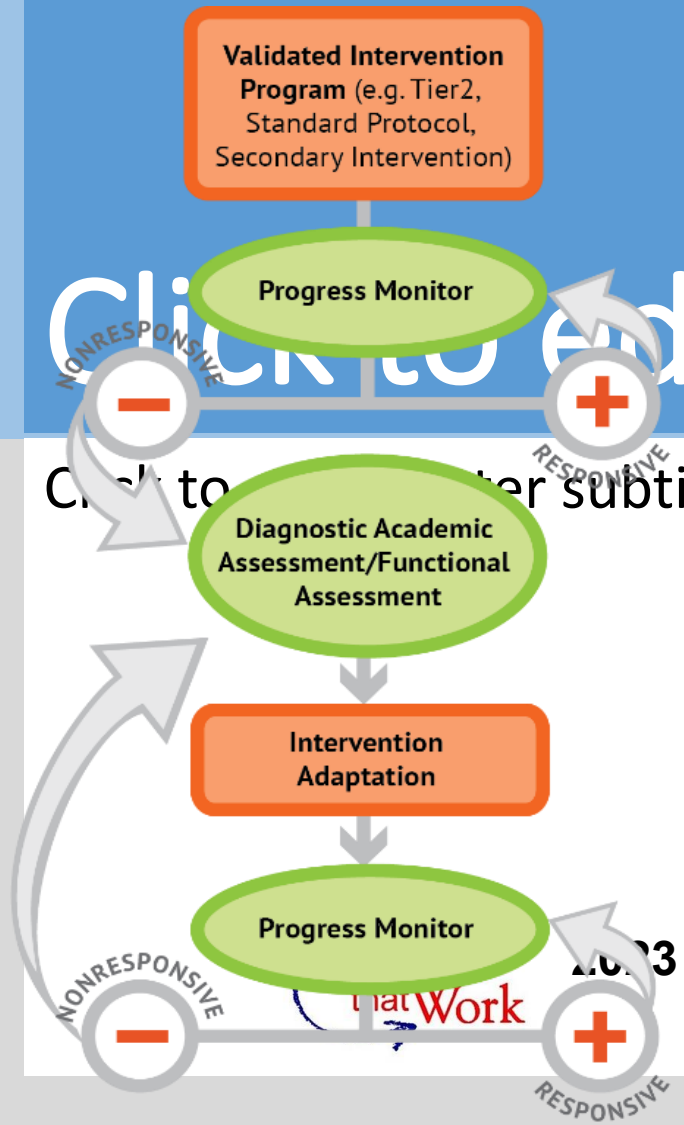
Data-Based Individualization

Designing Effective Instruction

Adapting Instruction

# Data-Based Individualization (DBI)

# Data-Base Individualization

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National Center on Intensive Intervention

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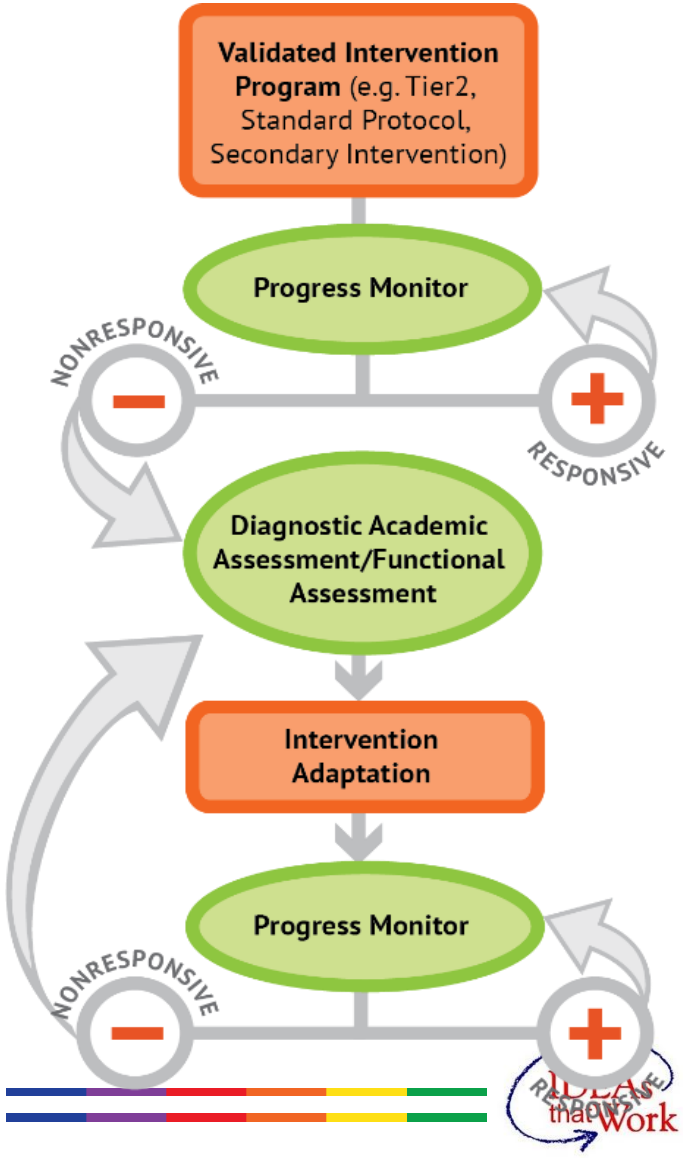
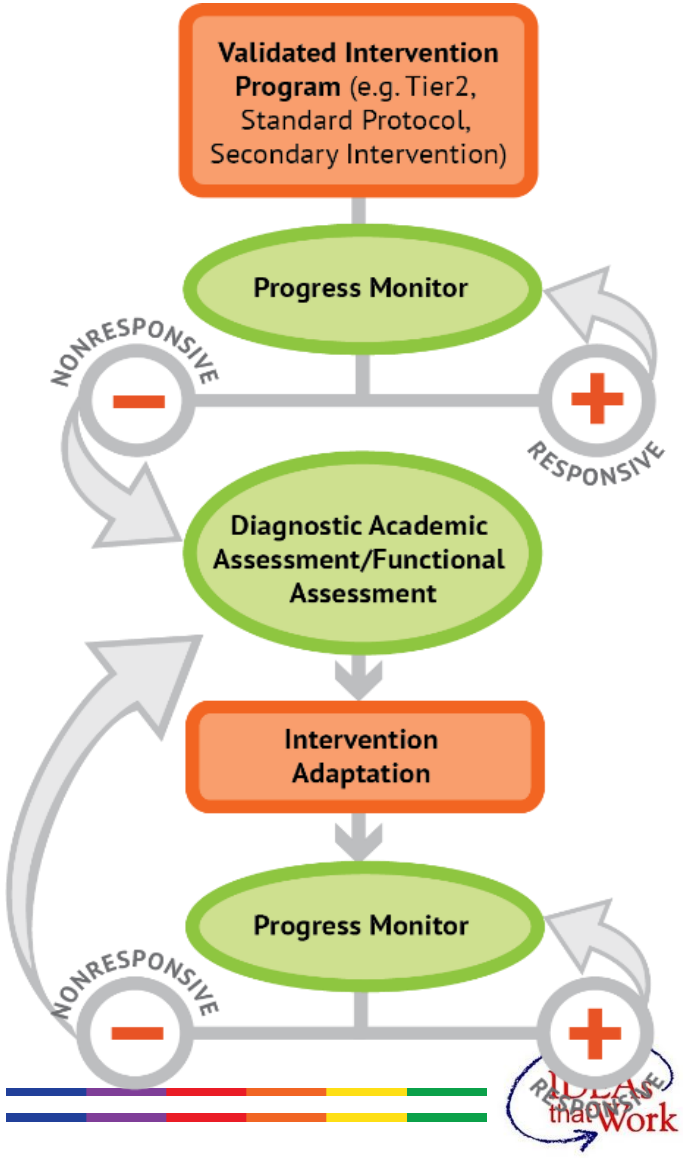
# Data-Base Individualization




Establish that there is a Tier 2 validated instructional platform in place

# Data-Base Individualization




Establish that there is a Tier 2 validated instructional platform in place

Progress monitor:

- Establish a present level of performance
- Set an ambitious long-term goal
- Collect frequent assessment data
- Use decision rules

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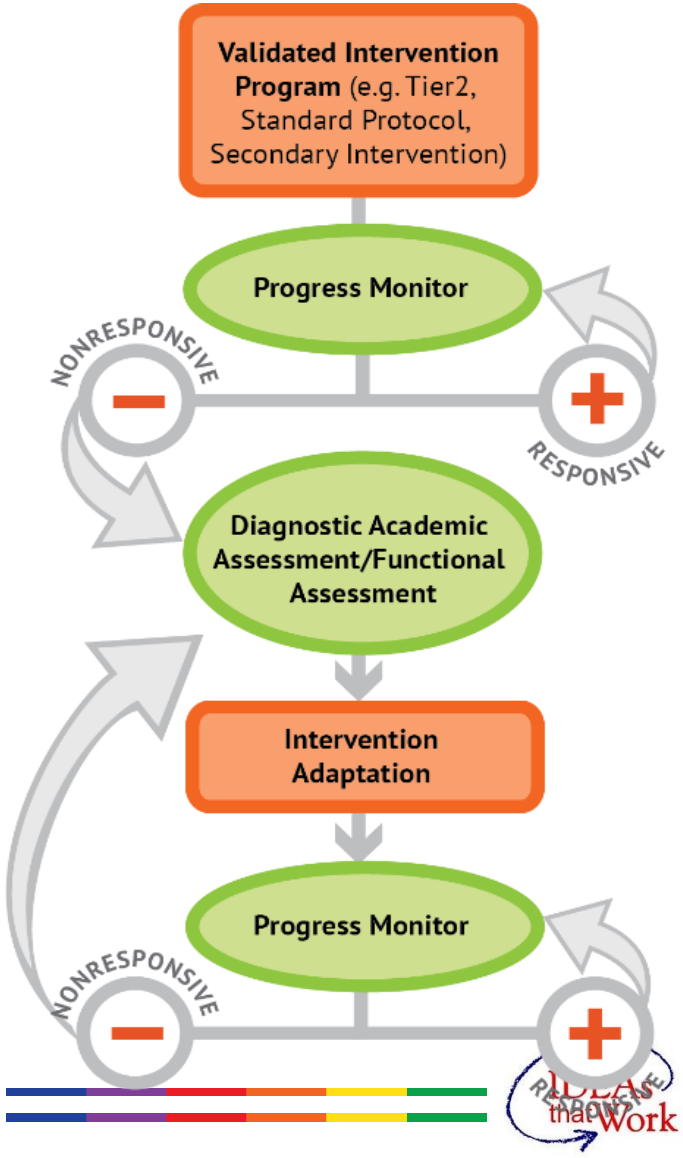


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Based on student response:

- Continue the Tier 2 program with progress monitoring OR
- Collect diagnostic data

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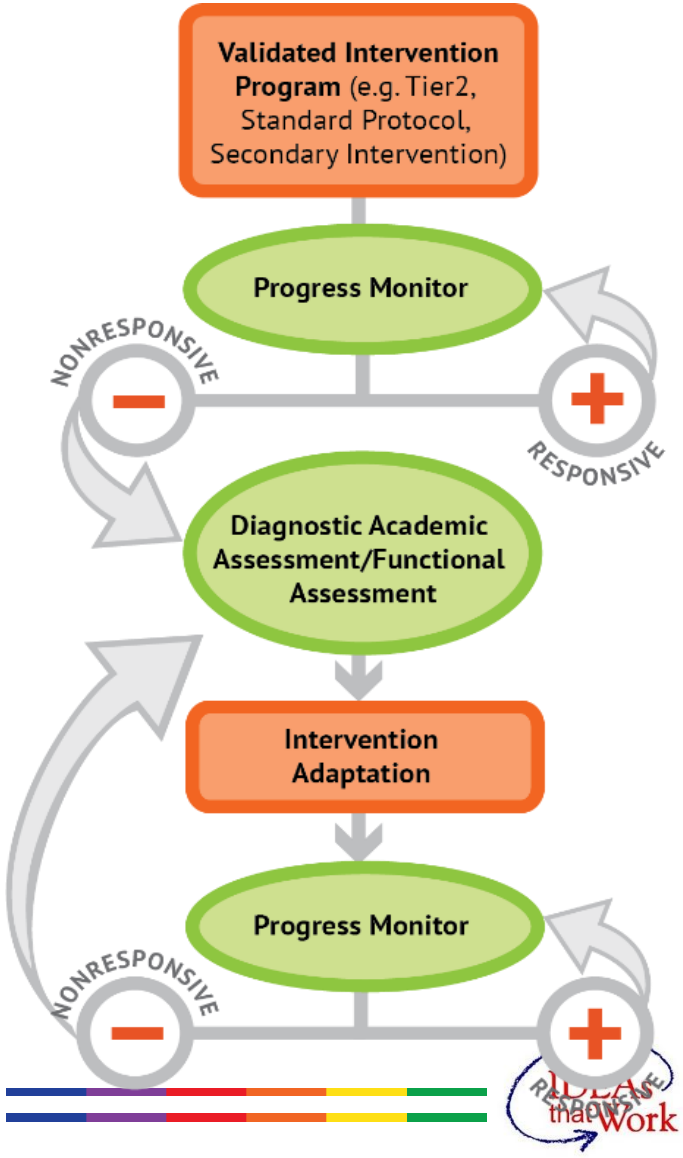


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Make instructional adaptations based on a hypothesis

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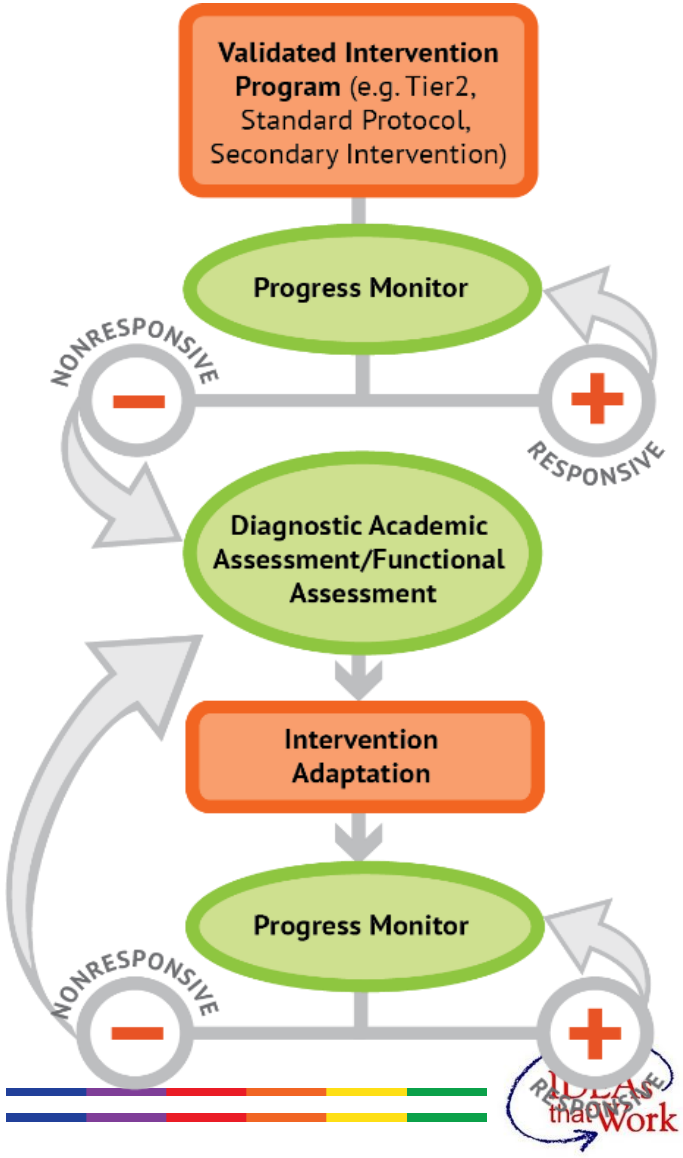


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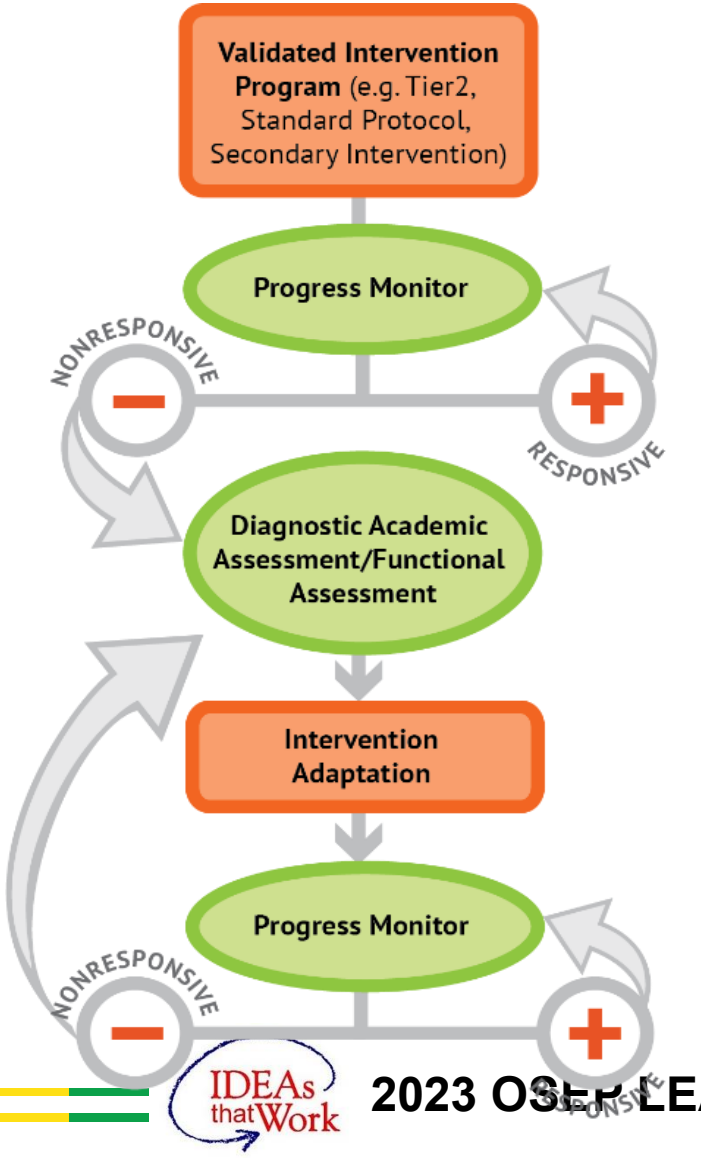
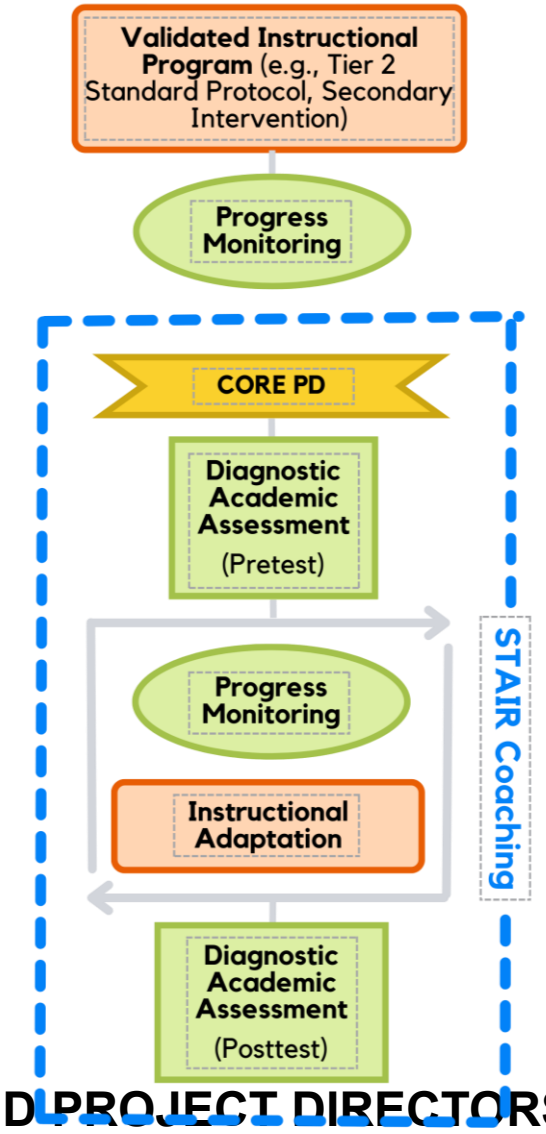
Make instructional adaptations based on a hypothesis

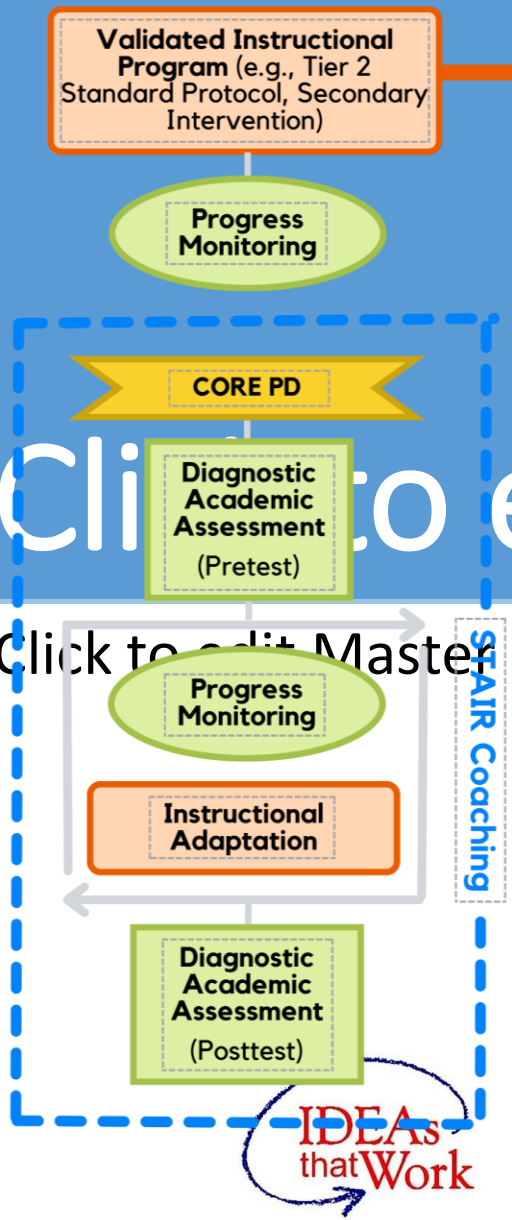
Continue to monitor progress to determine if student is responding adequately

# Data-Base Individualization



# Designing Effective Mathematics Instruction




Let's focus on this instructional program

# Cli to edit Maste

What is important to consider when designing an instructional program?

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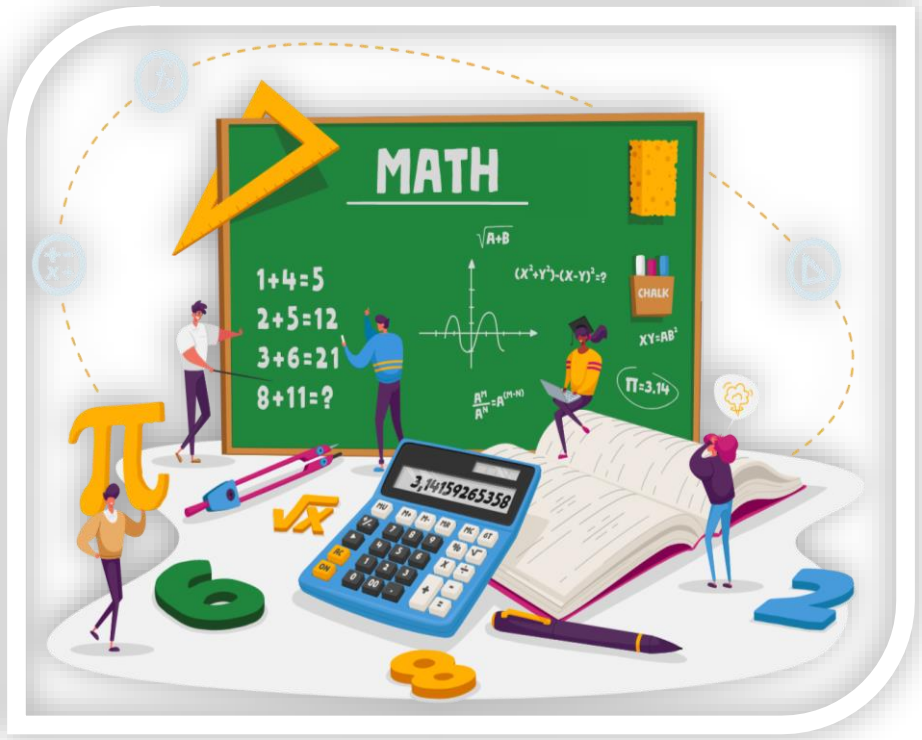
**Evidence-Based Practices!**

# Effective Mathematics Instruction

Explicit Instruction

Multiple Representations

Mathematics Language




Word Problem Instruction

Fluency Practice

# Effective Mathematics Instruction

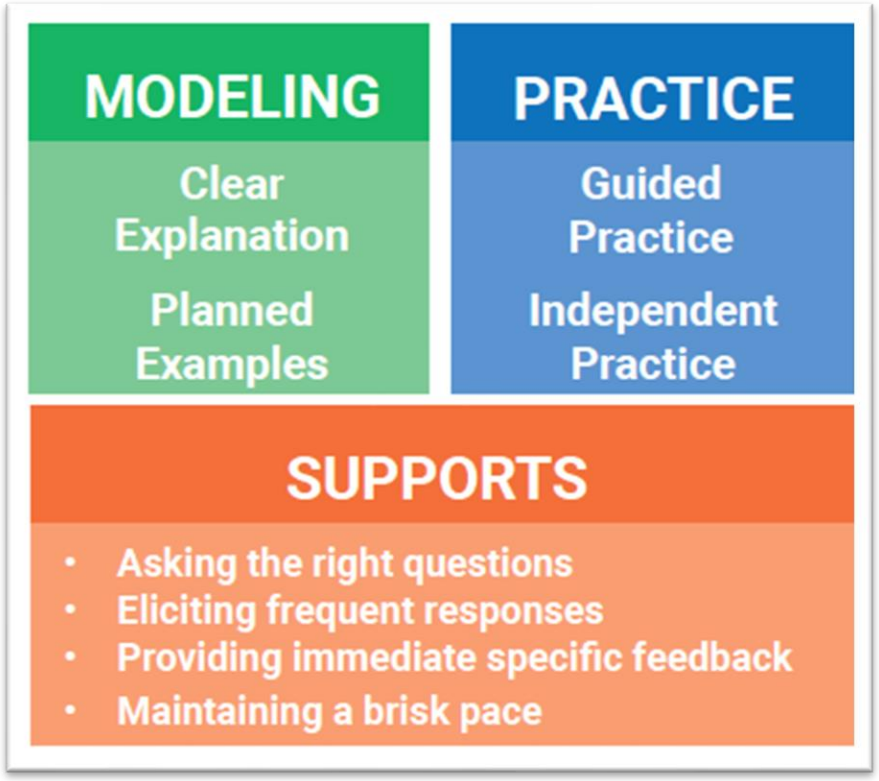
Explicit Instruction

***Teachers should be explicit in the modeling and practicing of math.***

**Modeling**

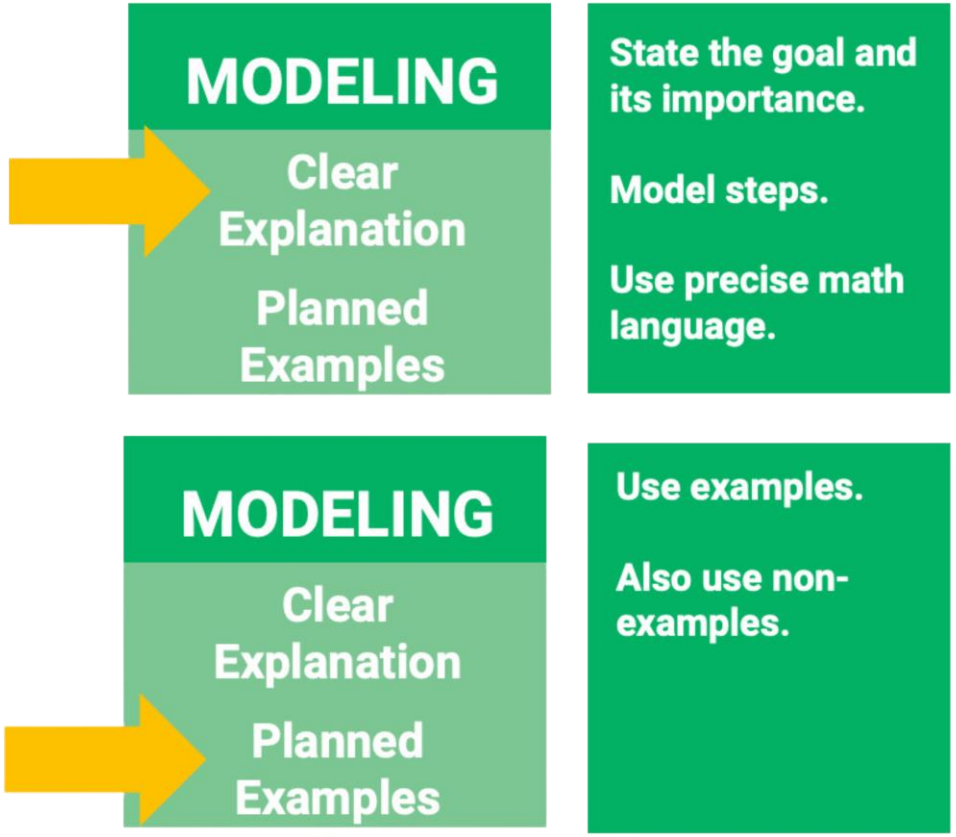
**Practice**

**supports**



# Effective Mathematics Instruction

Explicit Instruction

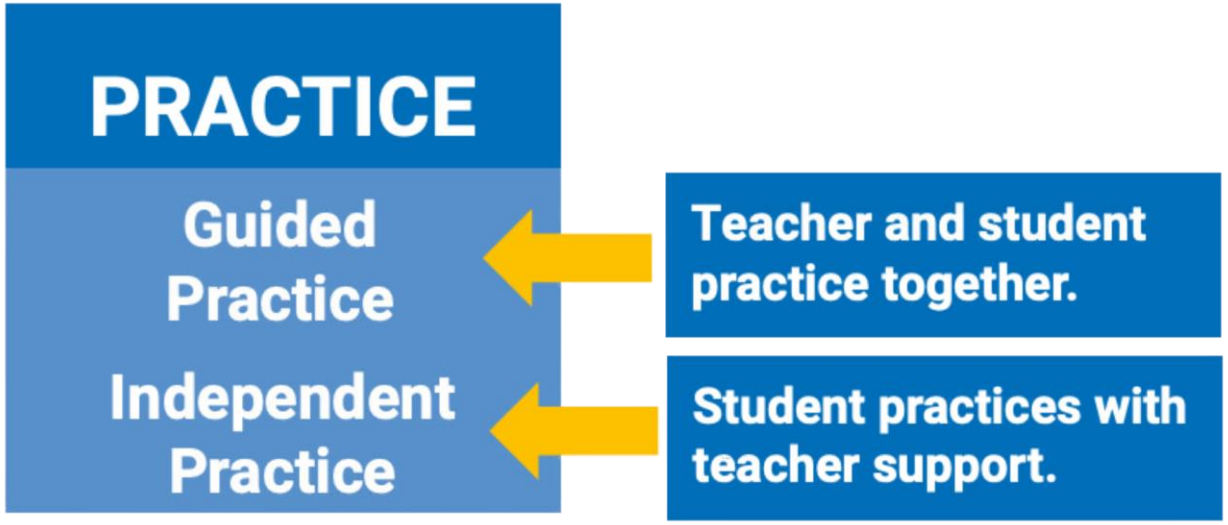



$24 / 6$ $28 \div 7$ $35\sqrt{5}$

$32 \div 8$ $42 \div 7$ $25 - 5$

# Effective Mathematics Instruction

Explicit Instruction



# Effective Mathematics Instruction

Explicit Instruction

| SUPPORTS |
| --- |
| Asking the right questions |
| Eliciting frequent responses |
| Providing immediate specific feedback |
| Maintaining a brisk pace |

# Effective Mathematics Instruction

Explicit Instruction

**SUPPORTS**

**Asking the right questions**

**Eliciting frequent responses**

**Providing immediate specific feedback**

**Maintaining a brisk pace**

**Ask low-level and high-level questions.**

# Effective Mathematics Instruction

Explicit Instruction

| SUPPORTS | |
|---|---|
| Asking the right questions | Ask low-level and high-level questions. |
| Eliciting frequent responses | Vary responses, such as: classwide, individual, partner, write on paper, write on whiteboard, thumbs up, etc. |
| Providing immediate specific feedback | |
| Maintaining a brisk pace | |

# Effective Mathematics Instruction

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# Effective Mathematics Instruction

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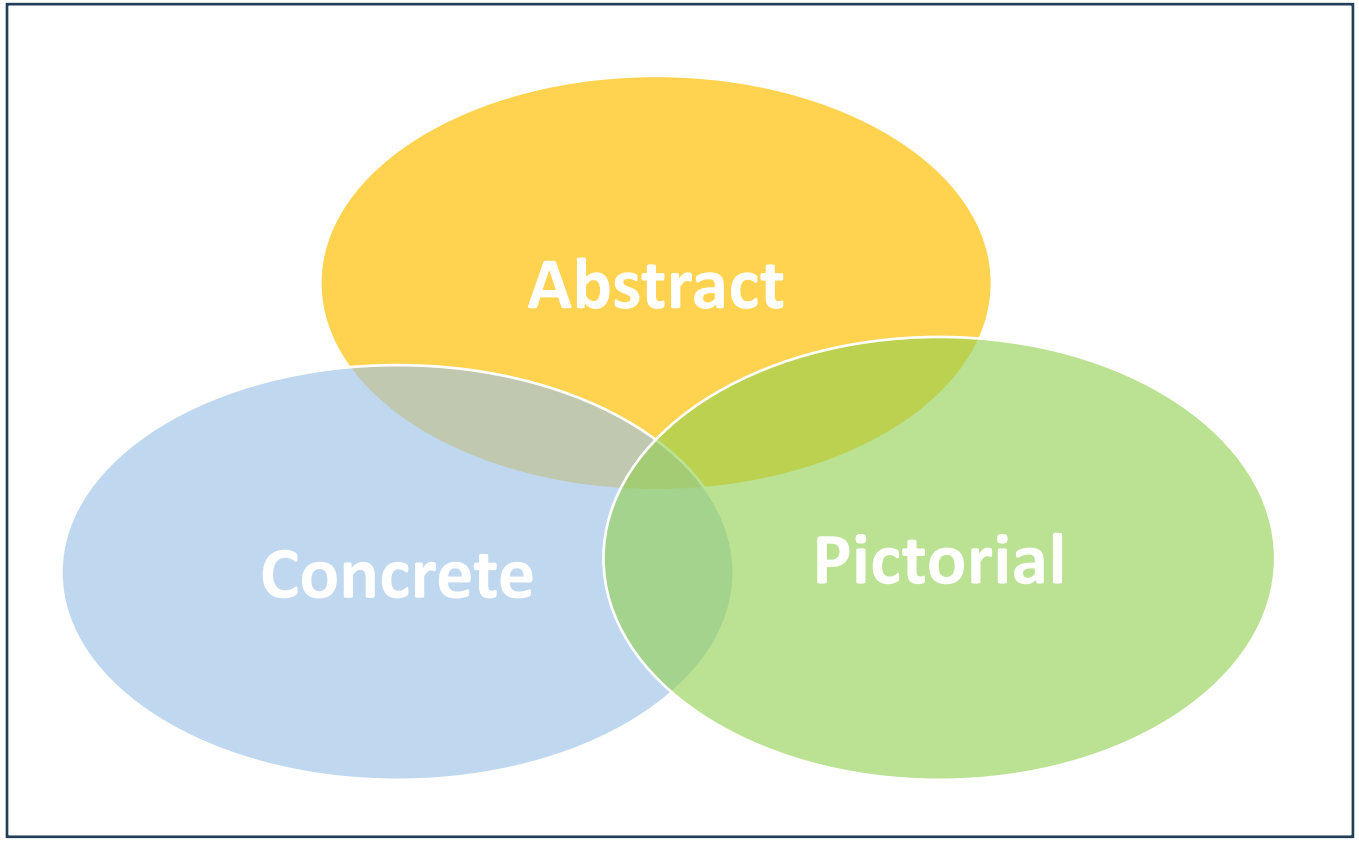
| Eliciting frequent responses | Vary responses, such as: classwide, individual, partner, write on paper, write on whiteboard, thumbs up, etc. |
| Providing immediate specific feedback | Provide affirmative and correct feedback. |
| Maintaining a brisk pace | Be planned and organized. |

"Grab your bag of manipulatives as you enter the classroom."

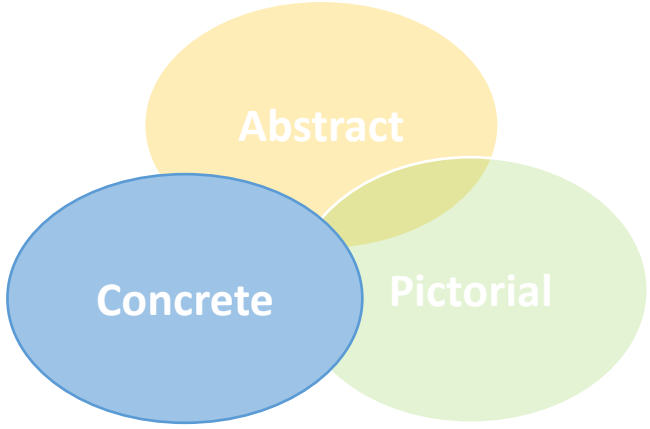
# Effective Mathematics Instruction

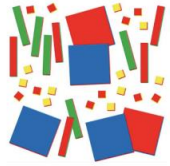
***Teachers should use multiple representations to help students understand different math concepts and procedures.***



# Effective Mathematics Instruction

## Concrete representations




| Operations | Whole Numbers | Fractions | Algebra | Geometry |
|---|---|---|---|---|
| | | |  | |
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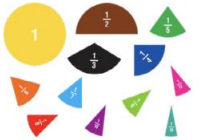
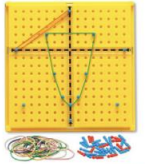
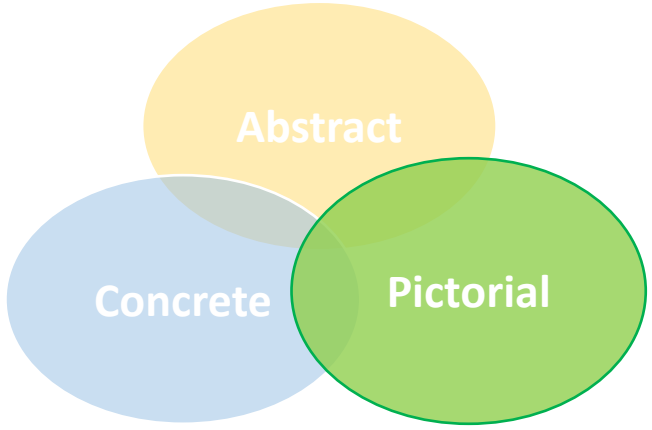
| | |  |  | |
| | | | | |

# Effective Mathematics Instruction

## Pictorial representations

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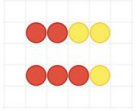
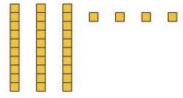
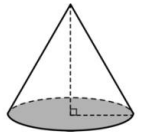
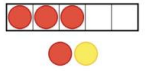
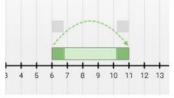
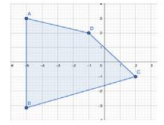
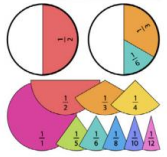
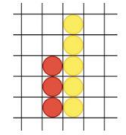
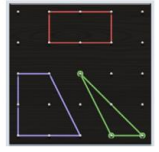
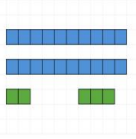
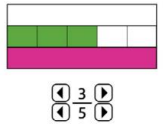
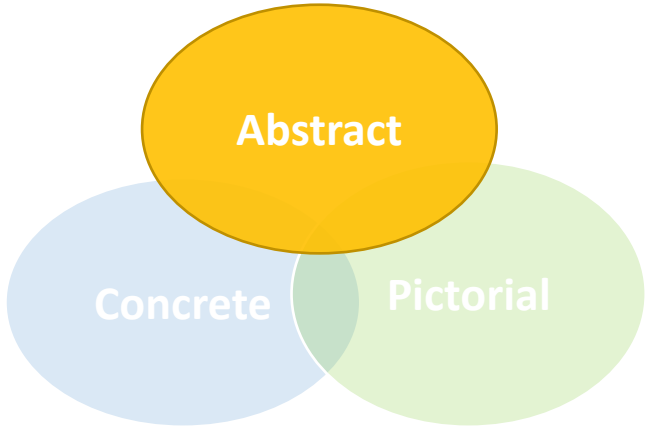
|---|---|---|---|---|
| | |  |  |  |
|  |  | | |  |
| | |  |  |  |
| |  |  | | |

# Effective Mathematics Instruction

**Abstract representations**




**78 = 7 tens and 8**

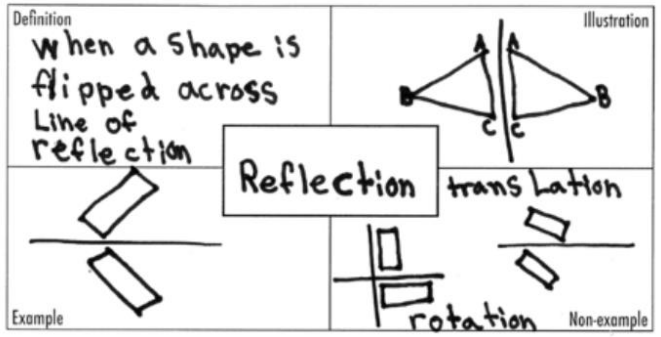
**4 + 9 = 13**

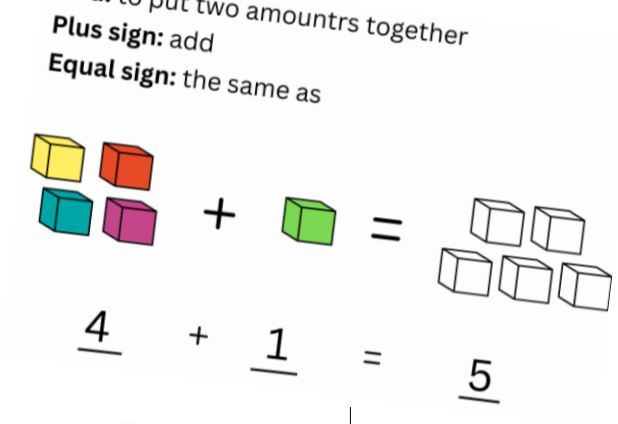
**4,156**
**+ 789**

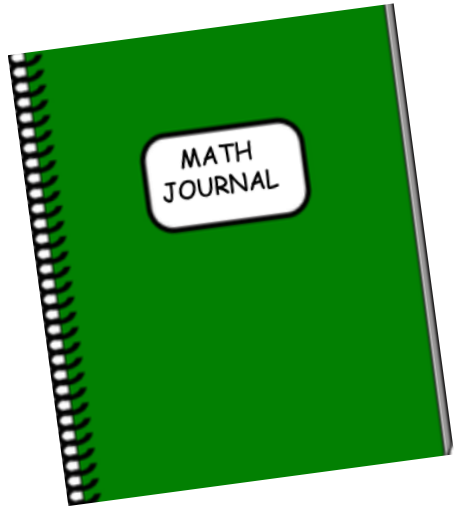
**x − 6 = 9**

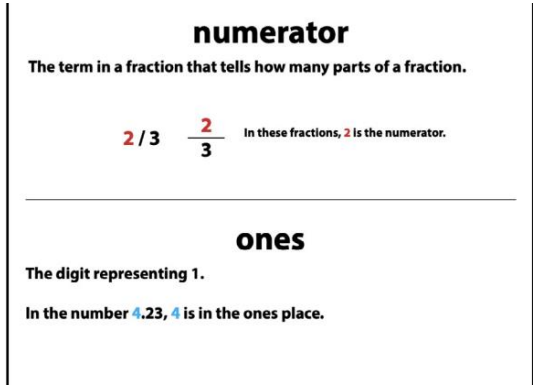
# Effective Mathematics Instruction

***Teachers should be sure to use precise and concise math language.***



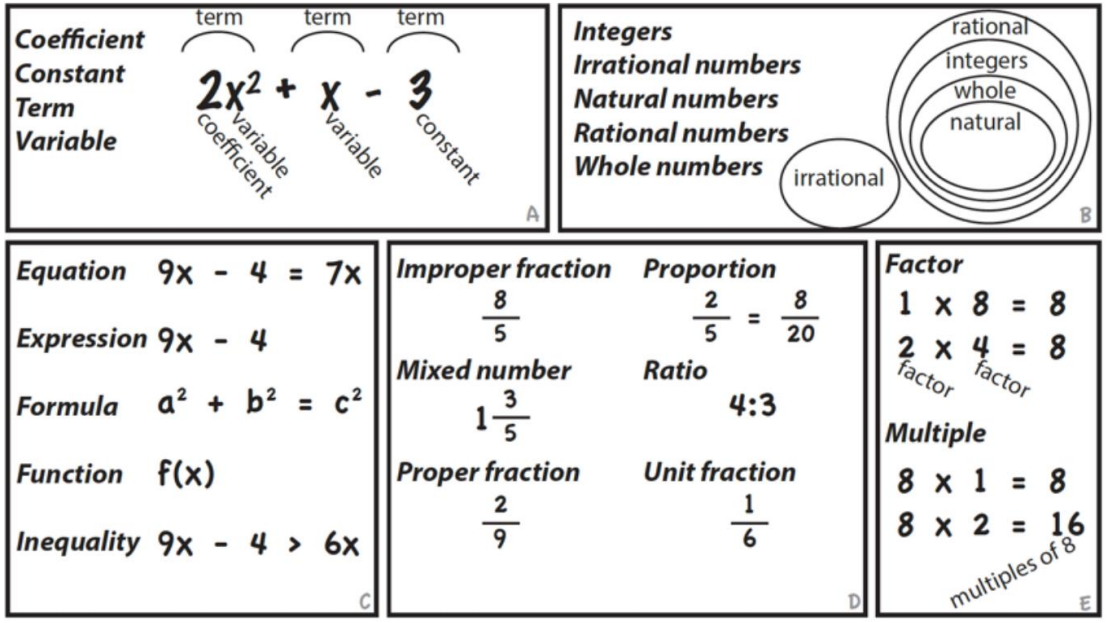



# Effective Mathematics Instruction

precise

concise




Powell, Stevens, & Hughes (2019)

# Effective Mathematics Instruction

**EXAMPLES: MNEMONICS**

**RIDE**

**R**ead the problem.
**I**dentify the relevant information.
**D**etermine the operation and unit for the answer.
**E**nter the correct numbers and calculate, then check the answer.

**UPS CHECK**

**U**nderstand: Read the problem.
**P**lan: Choose a strategy.
**S**olve: Show all your work.
**C**heck: Explain & justify your answer.

**SOLVE**

**S**tudy the problem.
**O**rganize the facts.
**L**ine up the plan.
**V**erify the plan with computation.
**E**xamine the answer.

**RIDGES**

**R**ead the problem.
**I** know statement.
**D**raw a picture.
**G**oal statement.
**E**quation development.
**S**olve the equation.

**ADDITIONAL RESOURCES**

IRIS Center Modules

LD Online Resources

**RICE**

**R**ead and Record the problem.
**I**llustrate your thinking.
**C**ompute.
**E**xplain your thinking.

# Effective Mathematics Instruction

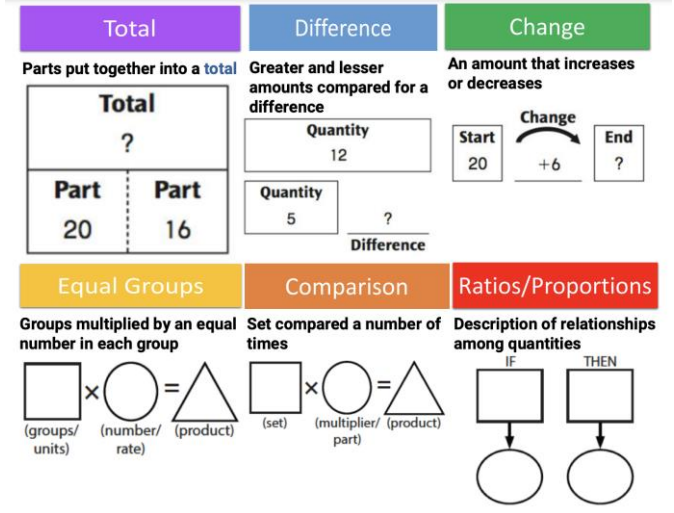
Matt bought 1 orange and 3 apples for a total of $2.25. The orange cost $0.60. The apples each cost the same amount. What amount did Matt pay to buy each apple?

U
P
S
✓

P1 + P2 = T
0.60 + ? = 2.25
? = $1.65 for apples

G x N = P
3 x ? = 1.65
? = $0.55 per apple

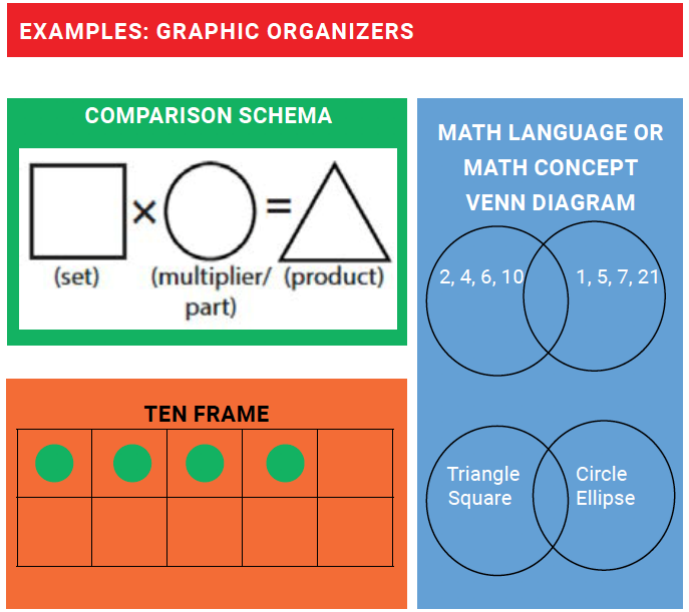
# Effective Mathematics Instruction




**EXAMPLE: SCHEMAS**

| | |
|---|---|
| Total | Max baked 40 cookies and 75 brownies. How many baked goods did Max bake? |
| Difference | The Brazos River is 840 miles. The Red River is 1,360 miles. How much longer is the Red River? |
| Change | There were 23 passengers on the bus. Then, 13 more passengers boarded the bus. How many passengers are on the bus now? |
| Equal Groups | Mark has 2 boxes of crayons. There are 24 crayons in each box. How many crayons does Mark have? |
| Comparison | Jill picked 6 apples. Meg picked 2 times as many apples as Jill. How many apples did Meg pick? |
| Ratios/Proportions | There are 176 slices of bread in 8 loaves. If there are the same number of slices in each loaf, how many slides of bread are in 5 loaves? |

# Effective Mathematics Instruction




| **Define:** | **Characteristics:** |
|---|---|
| **Example:** | Non-example: |

Fluency Building

# Click to edit Master title style

## Example: Fluency Practice

Fluency building activities provide opportunities for students to master math facts and other necessary math knowledge.

When students are fluent in math facts, they can spend more energy solving problems or tackling

Click to edit Master subtitle style

IDEAs that Wor

BRIEF (1-2 min)

DAILY (everyday)

# Effective Mathematics Instruction

## EXAMPLES: FLUENCY BUILDING ACTIVITIES

**Roll the Dice**

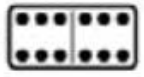
___ + ___ = ___ ___ + ___ = ___

___ + ___ = ___ ___ + ___ = ___

___ − ___ = ___ ___ − ___ = ___

___ − ___ = ___ ___ − ___ = ___

**Dominoes**



___ + ___ = ___ ___ + ___ = ___

___ + ___ = ___ ___ + ___ = ___

___ − ___ = ___ ___ − ___ = ___

___ − ___ = ___ ___ − ___ = ___

**Cards**

___ + ___ = ___ ___ + ___ = ___

___ + ___ = ___ ___ + ___ = ___

___ − ___ = ___ ___ − ___ = ___

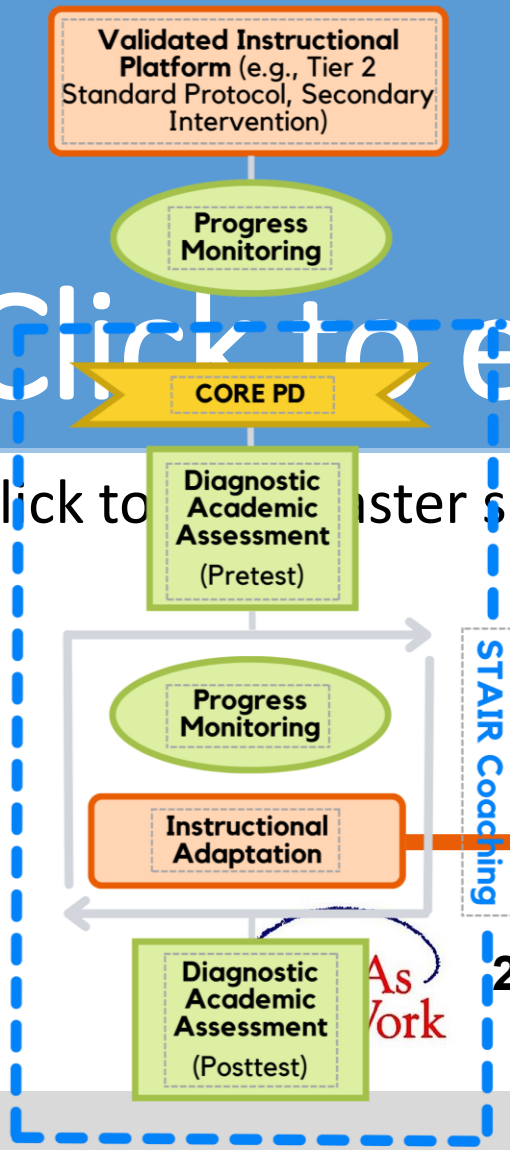
___ − ___ = ___ ___ − ___ = ___

**File Folder**

| | |
|---|---|
| 6+3= | 9 |
| 1+7= | 8 |
| 6+4= | 10 |
| 7+3= | 10 |
| 2+7= | 9 |
| 5+6= | 11 |
| 4+7= | 11 |
| 7+8= | 15 |
| 6+7= | 13 |
| 7+9= | 16 |
| 7+6= | 13 |
| 8+7= | 15 |
| 7+0= | 7 |
| 9+6= | 15 |
| 6+0= | 6 |
| 6+8= | 14 |

# Adapting Instruction

# Adapting Instruction

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How can we adapt instruction to meet the diverse needs of all learners?

instructional adaptations.

# Adapting Instruction

## WHOLE-CLASS ADAPTATIONS

### PROVIDE WORKED EXAMPLES

"Talk through this problem with me."
"Which is correct and why?"

| | |
|---|---|
| 405 | 405 |
| + 16 | + 16 |
| 411 | 421 |

### ENGAGE STUDENTS IN DISCOURSE

"Tell me how you solved this problem."
"What were you thinking about when you regrouped?"
"How would you teach this problem to another student?"
"Describe the word problem in 10 words or less."

### TEACH PROBLEM-SOLVING STRATEGIES

1. Don't tie key words to operations
2. Have an attack strategy
3. Teach word-problem schemas

# Adapting Instruction

## WHOLE-CLASS ADAPTATIONS

### USE MULTIPLE REPRESENTATIONS

Hands-on manipulatives or tools

Virtual manipulatives, drawings, or graphic organizers.

Math with the numbers, symbols, and words of math.

### TEACH ALTERNATE ALGORITHMS

$$\begin{array}{r} 34 \\ \times\ 27 \\ \hline 238 \\ +\ 680 \\ \hline 918 \end{array}$$

$$\begin{array}{r} 34 \\ \times\ 27 \\ \hline 600 \\ 80 \\ 210 \\ +\ 28 \\ \hline 918 \end{array}$$

$$\begin{array}{r} 34 \\ \times\ 27 \end{array}$$

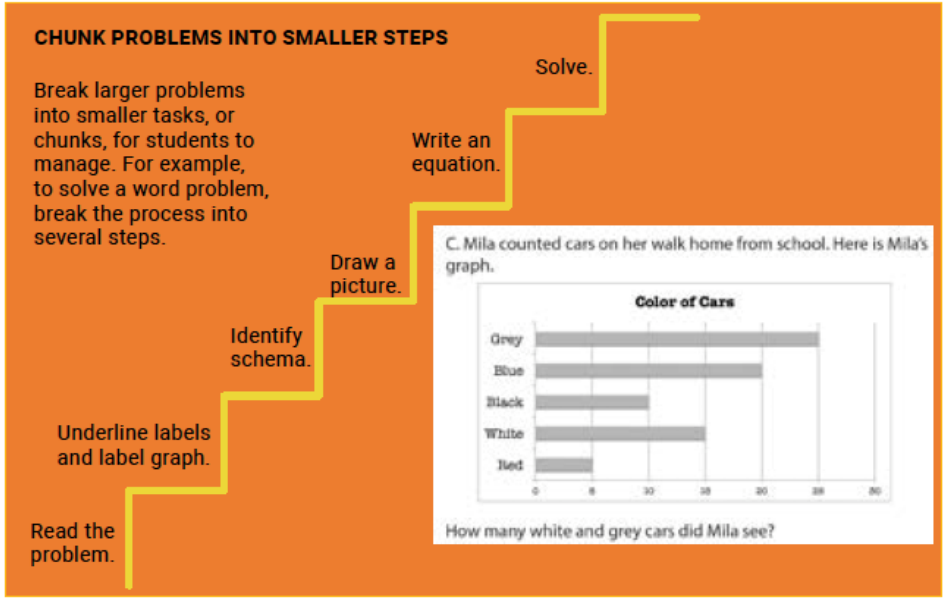
| | 30 | 4 |
|---|---|---|
| 20 | 600 | 80 |
| 7 | 210 | 28 |

### PRACTICE FACT FLUENCY

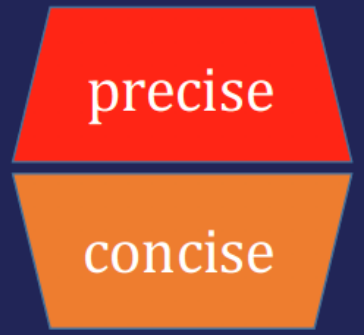
## WHOLE-CLASS ADAPTATIONS

### CHUNK PROBLEMS INTO SMALLER STEPS

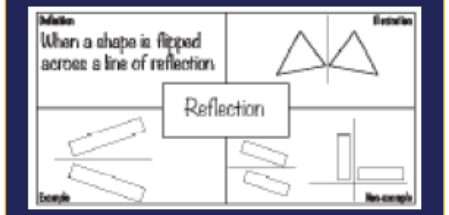
Break larger problems into smaller tasks, or chunks, for students to manage. For example, to solve a word problem, break the process into several steps.




### USE APPROPRIATE MATH LANGUAGE

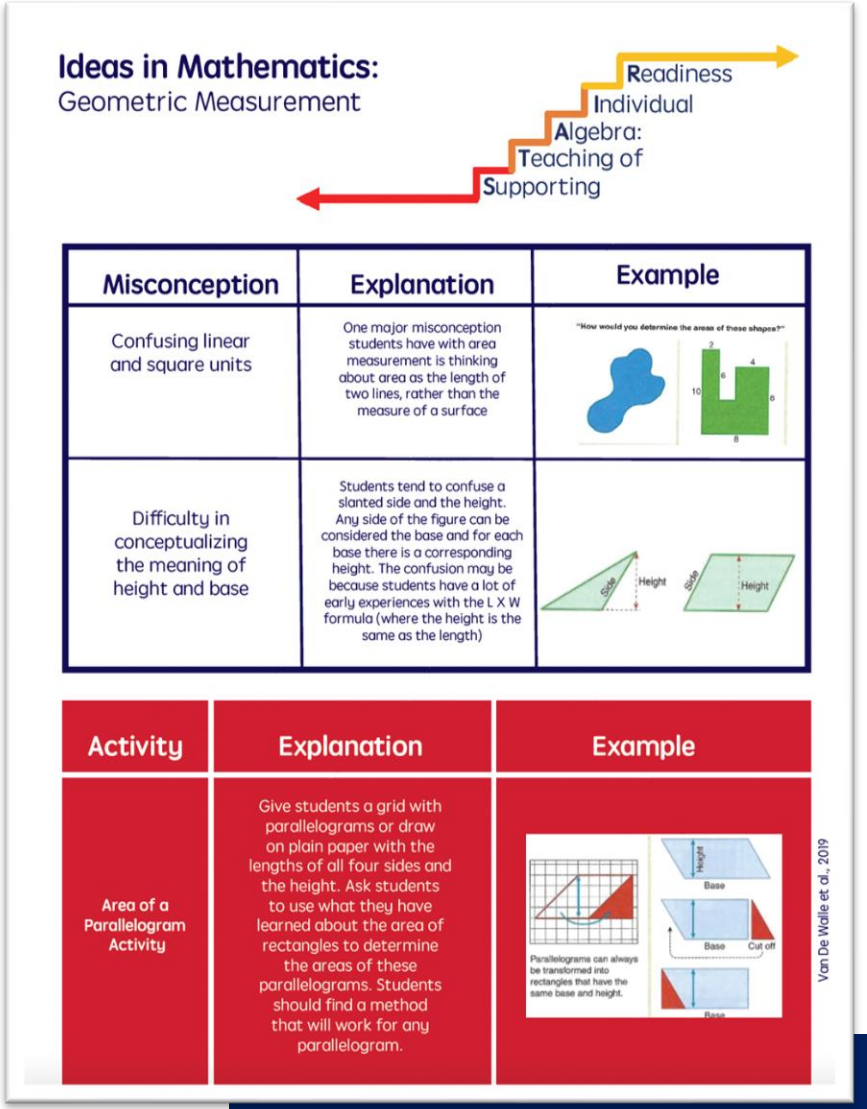



### TEACH MATH VOCABULARY



# Adapting Instruction

## Resources:



**Ideas in Mathematics:**
Geometric Measurement

Readiness
Individual
Algebra:
Teaching of
Supporting

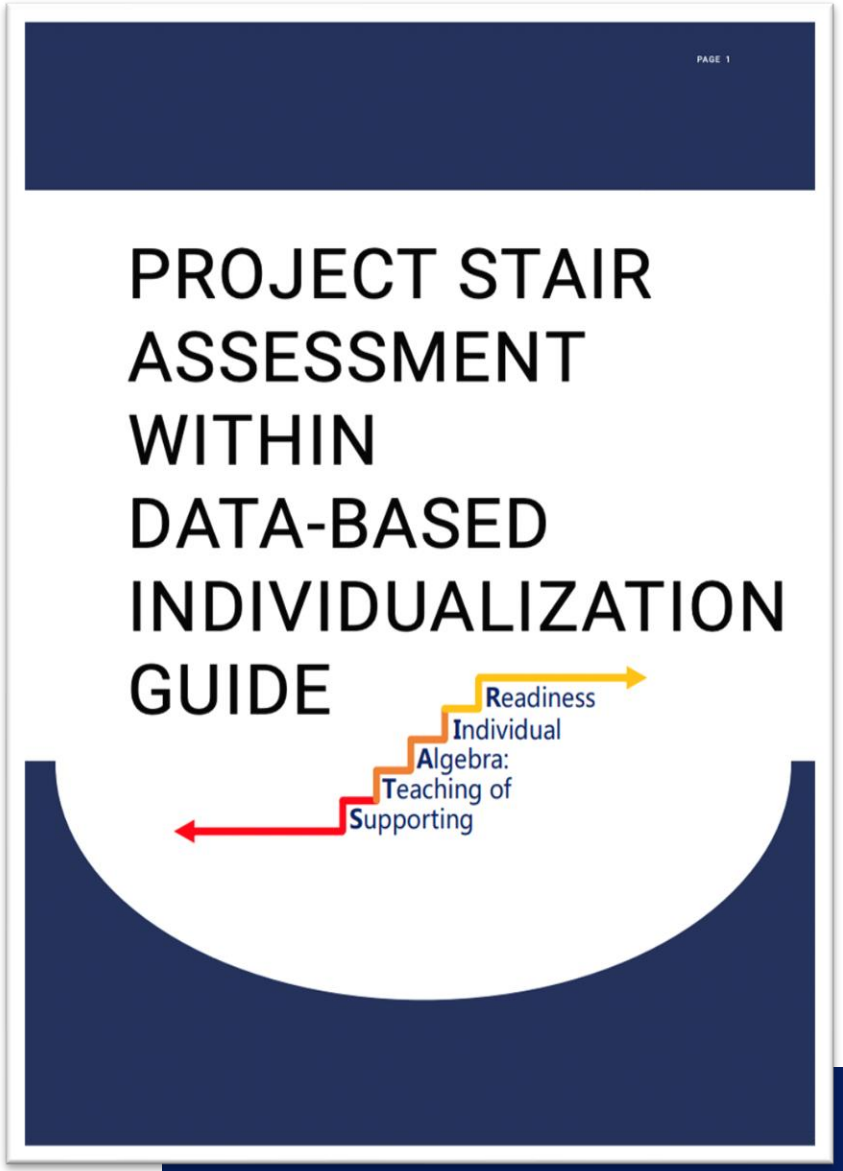
| Misconception | Explanation | Example |
|---|---|---|
| Confusing linear and square units | One major misconception students have with area measurement is thinking about area as the length of two lines, rather than the measure of a surface | "How would you determine the areas of these shapes?" |
| Difficulty in conceptualizing the meaning of height and base | Students tend to confuse a slanted side and the height. Any side of the figure can be considered the base and for each base there is a corresponding height. The confusion may be because students have a lot of early experiences with the L X W formula (where the height is the same as the length) | Side Height Side Height |

| Activity | Explanation | Example |
|---|---|---|
| Area of a Parallelogram Activity | Give students a grid with parallelograms or draw on plain paper with the lengths of all four sides and the height. Ask students to use what they have learned about the area of rectangles to determine the areas of these parallelograms. Students should find a method that will work for any parallelogram. | Parallelograms can always be transformed into rectangles that have the same base and height. Height Base Base Cut off Base |

Van De Walle et al., 2019

# Adapting Instruction

Resources:



# Adapting Instruction

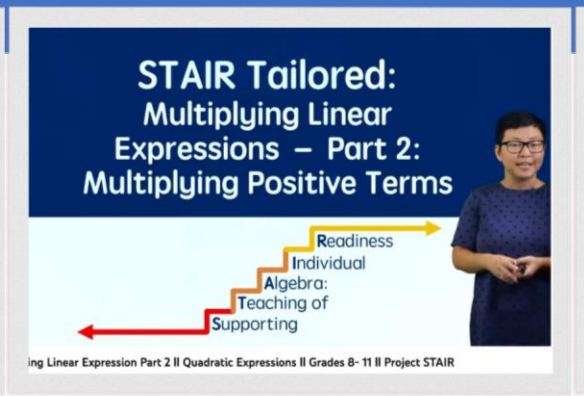
## Resources:

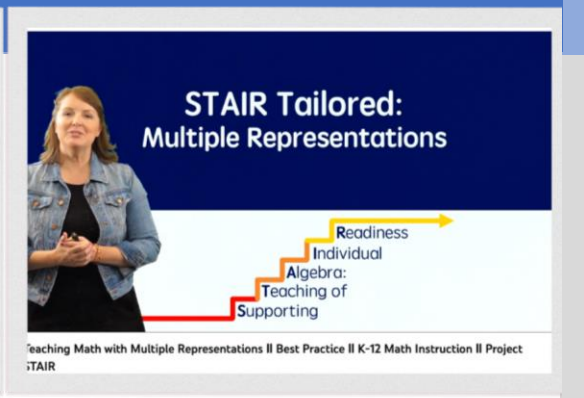
**Webinar 1: Don't Panic, Pivot! Tips for Implementing Data-Based Individualization (DBI) for the Synchronous and Asynchronous Learner**

# Adapting Instruction

## Resources:

→ **Project STAIR YouTube Channel**



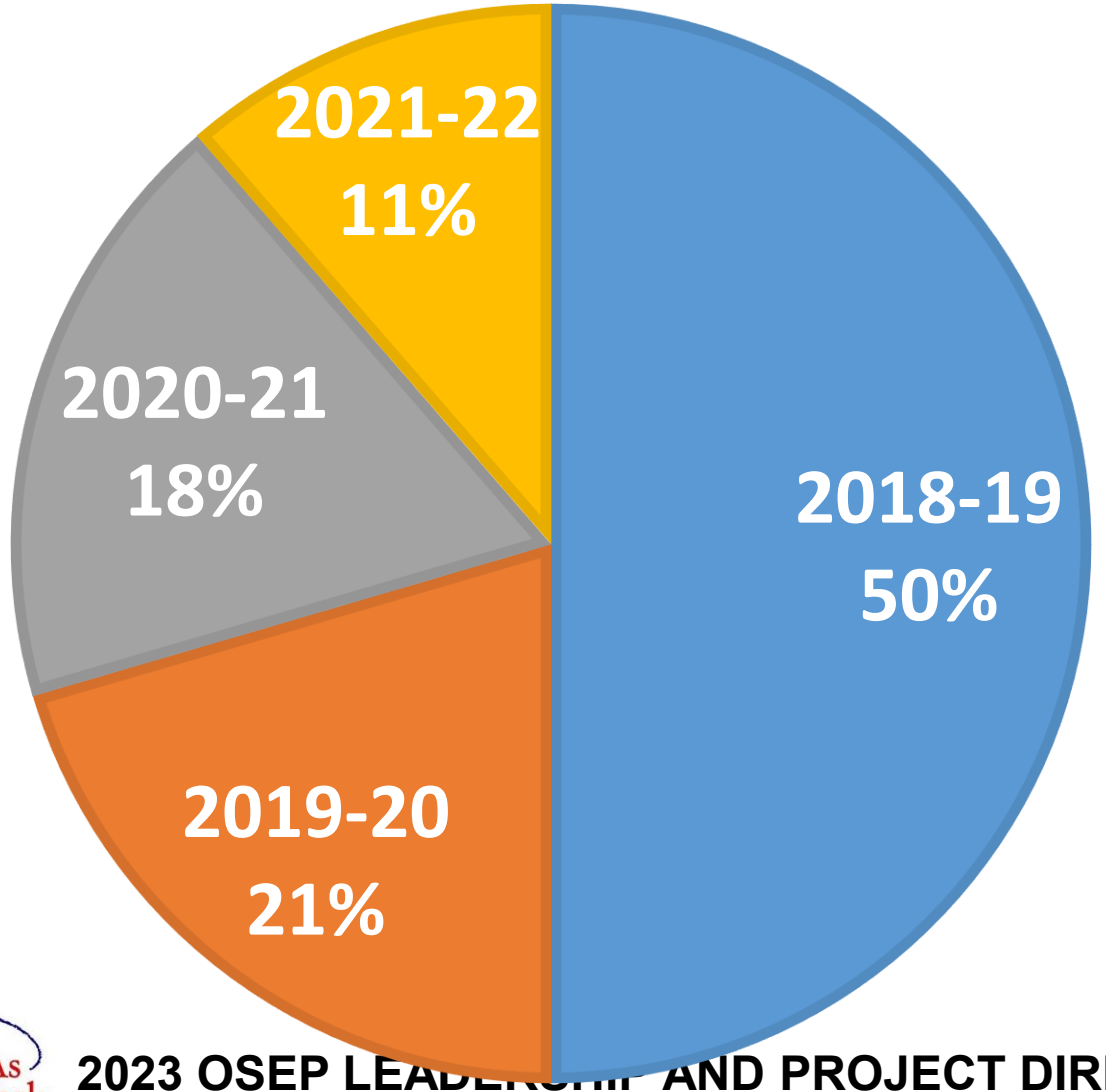

*https://www.youtube.com/channel/UCE2puwDtUSNXFONIOhmYmvA/playlists*

IDEAs that Work

**2023 OSEP LEADERSHIP AND PROJECT DIRECTORS**

# Teacher Instructional Practices (TIPs)

# Assessment of Teacher Instructional Practices



# Assessment of Teacher Instructional Practices

Importance of

Understanding of

Confidence with

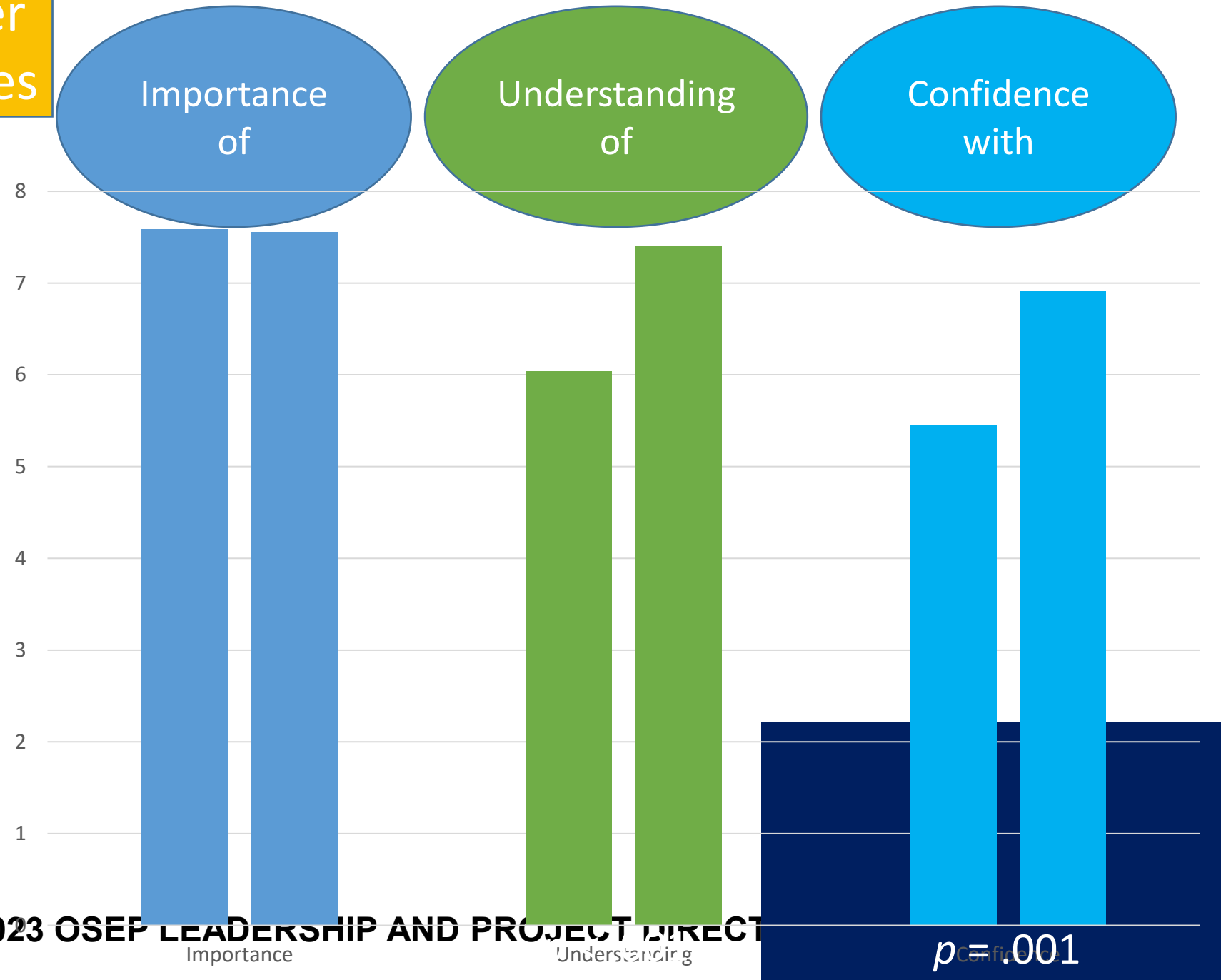
Data-Based Individualization

Instructional Practices

Assessment Practices

# Assessment of Teacher Instructional Practices

Data-Based Individualization



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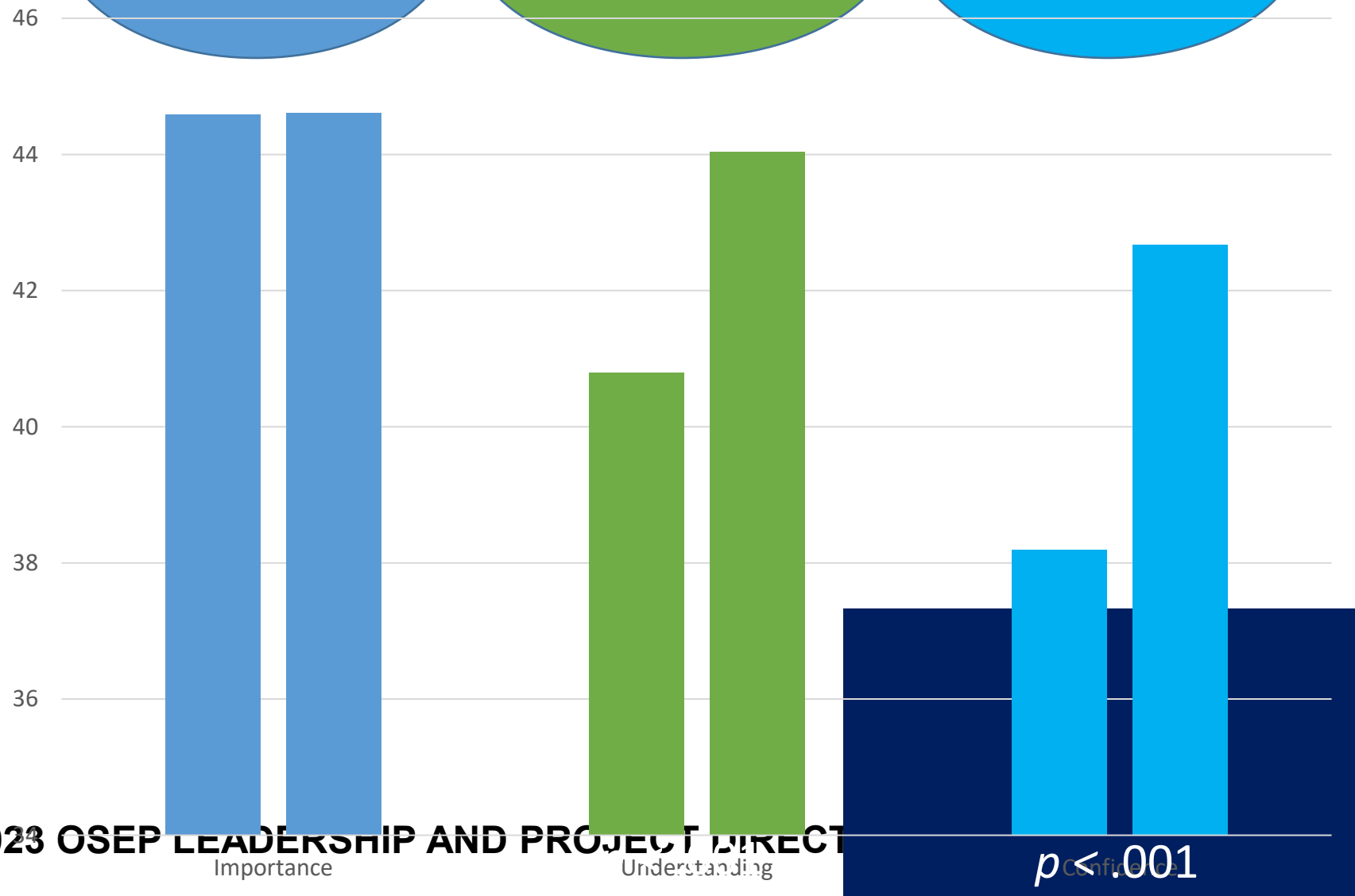


Instructional Practices

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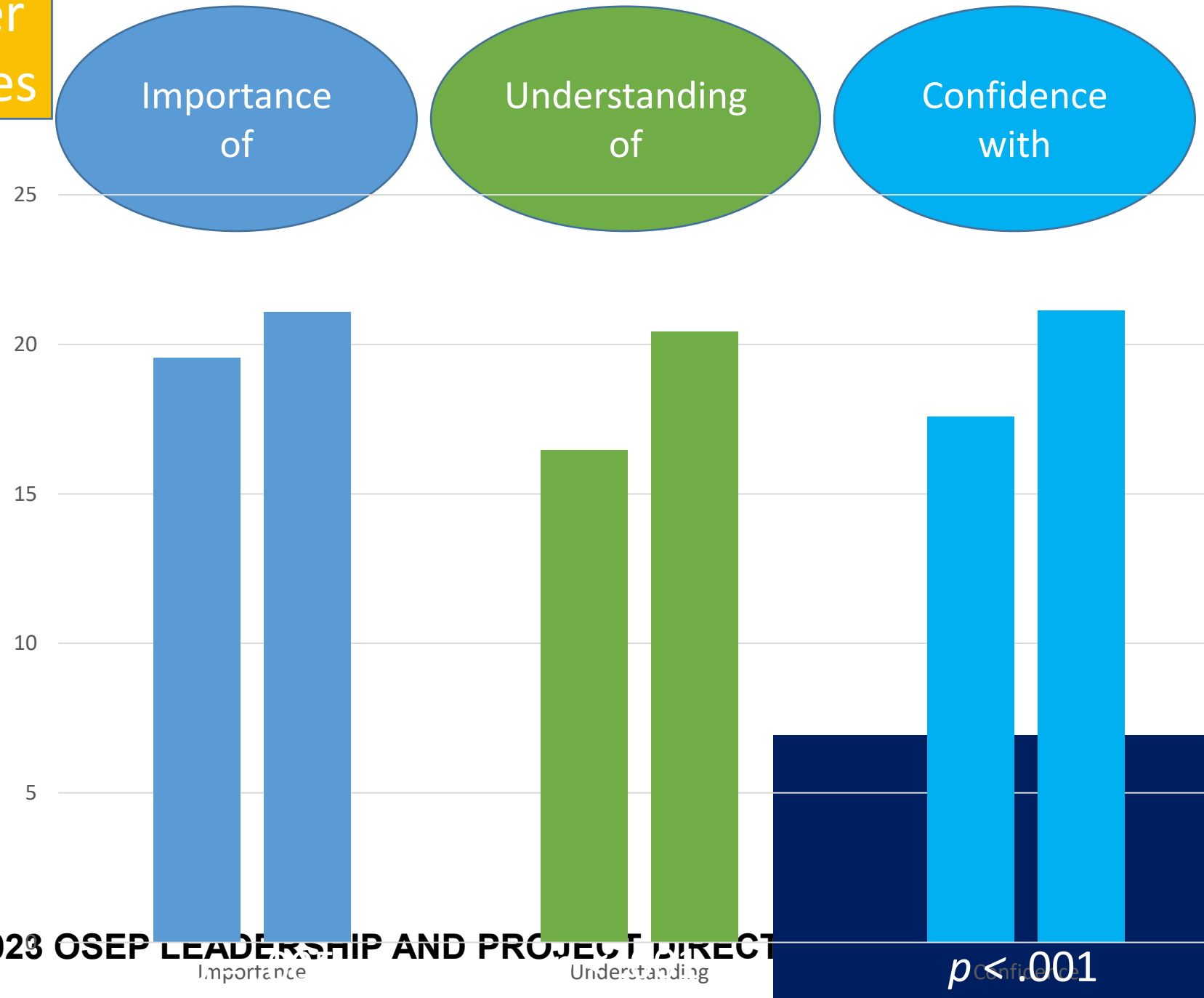


Assessment Practices

# Bringing It All Together

# Bringing It All Together

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Tiffini Pruitt-Britton
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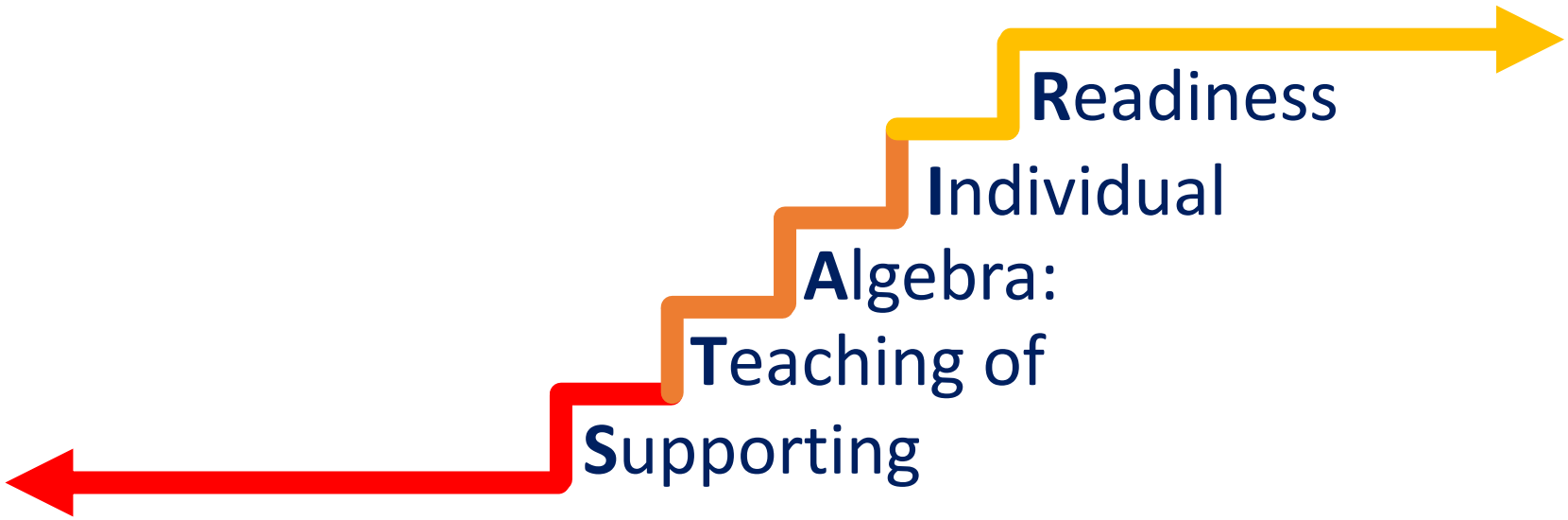
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