Teaching Math in Middle School

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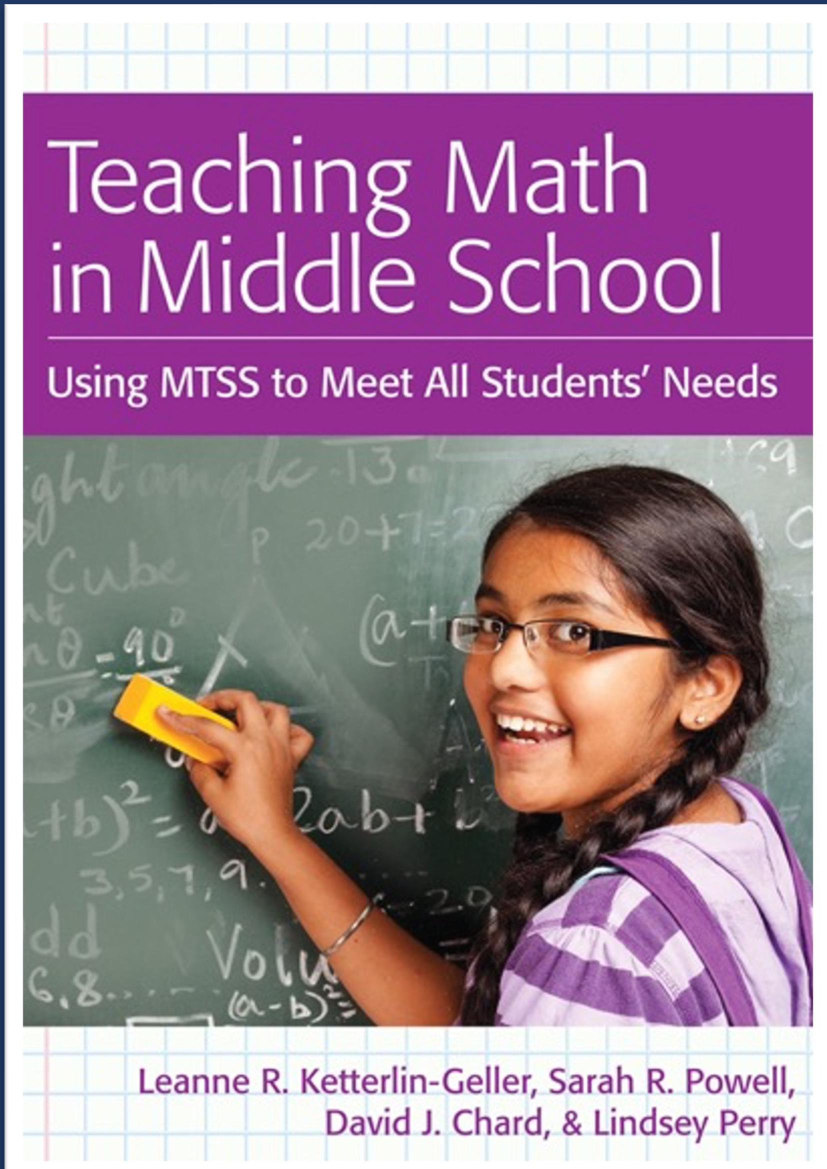
Say hello.

Tell us about yourself and the math you support.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Using MTSS to Meet All Students' Needs
Leanne R. Ketterlin-Geller, Sarah R. Powell,
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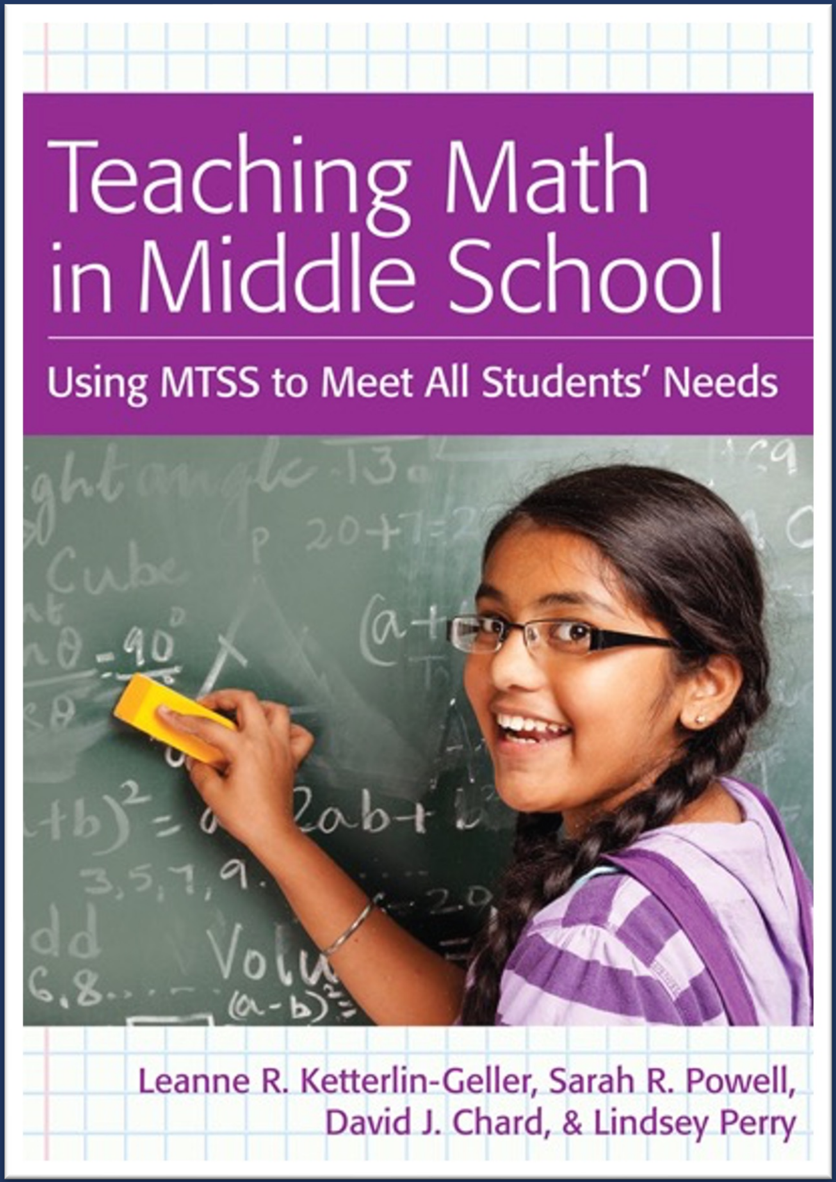
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Teaching Math in Middle School

Ketterlin-Geller, Powell, Chard, & Perry (2019)

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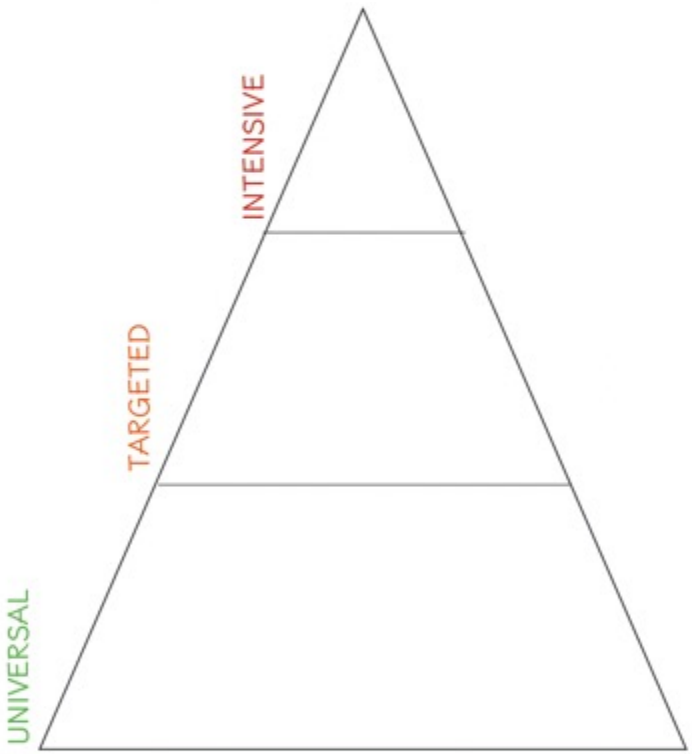
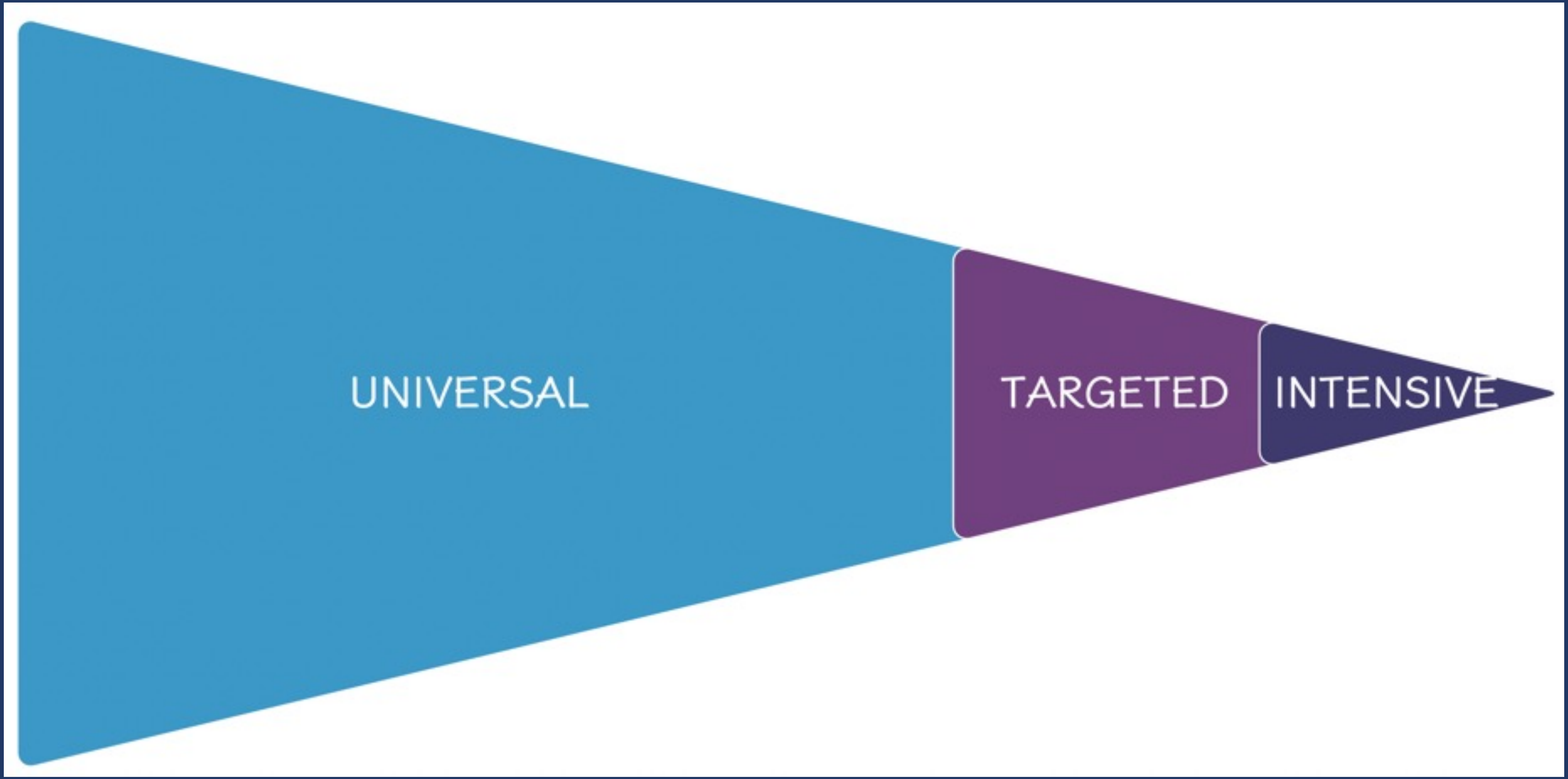
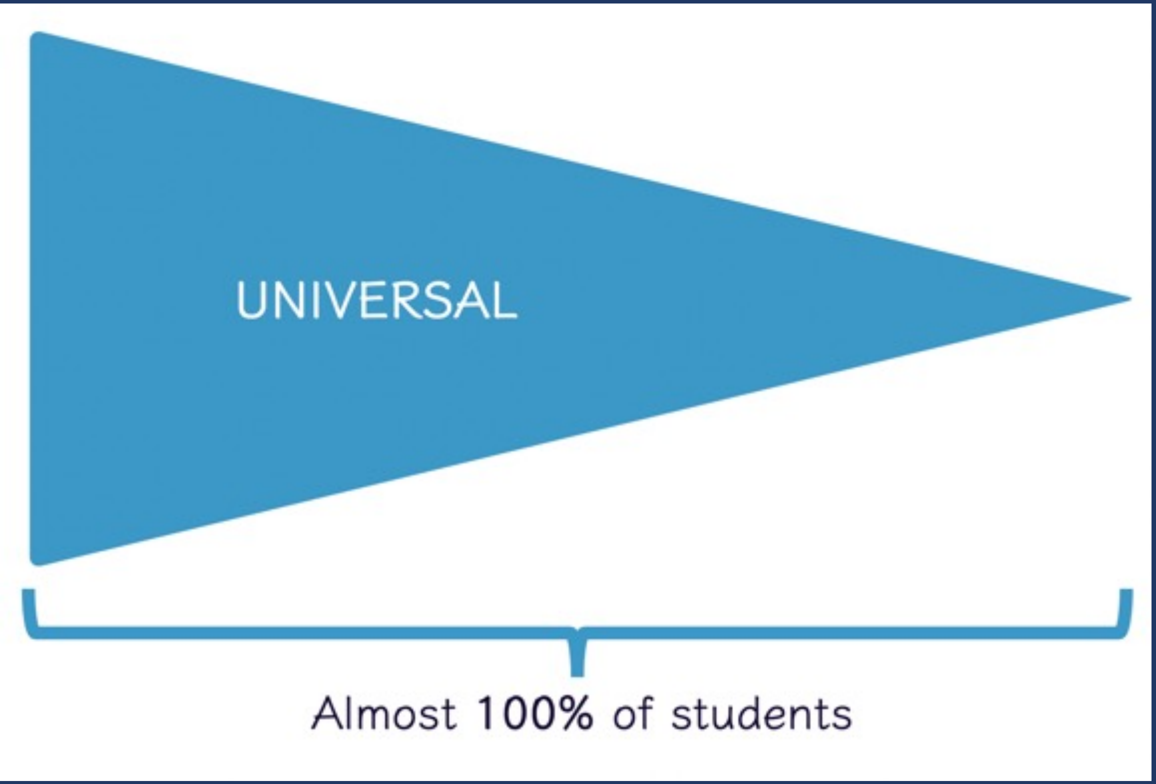


Multi-Tiered Systems of Support (MTSS)

tier.tea.texas.gov





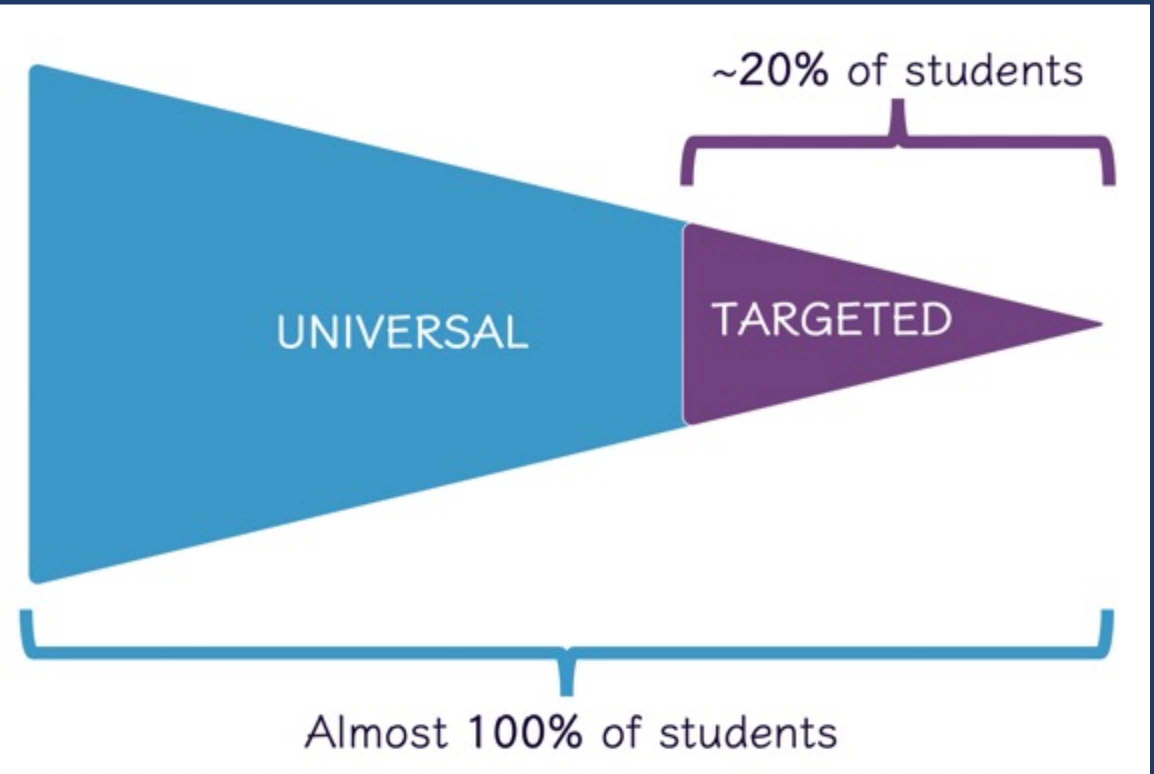
Also known as **Tier 1** or **primary prevention**

Designed for all students

Occurs in general education classroom

Almost all students participate

~80% of students need **only** universal intervention



Also known as **Tier 2** or **secondary prevention**

Designed for students experiencing difficulty in academics or behavior

Can occur inside or outside of the classroom

Provided in conjunction with universal intervention

~20% of students require targeted intervention

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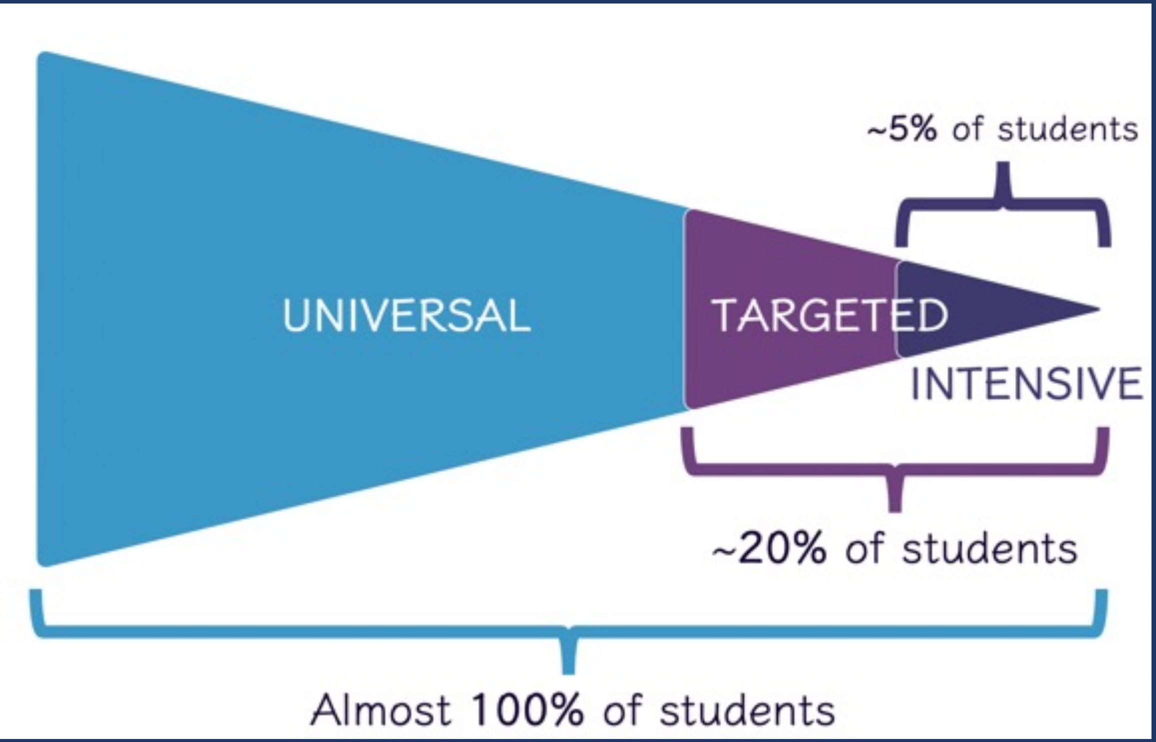
Also known as **Tier 3** or **tertiary prevention**



Designed for students who demonstrate inadequate response to universal and targeted intervention

Occurs within or outside of special education

~5% or less of students require intensive intervention

tier.tea.texas.gov

Describe the MTSS frameworks you have used or are familiar with.

What more would you like to know about MTSS in math?

Components Across Tiers

UNIVERSAL

- Universal evidence-based practices
- Screening of all students
- Progress monitoring of at-risk students
- Data-based decision making

TARGETED

- Targeted evidence-based practices
- Progress monitoring
- Data-based decision making

INTENSIVE

- Diagnostics
- Intensive evidence-based practices
- Progress monitoring
- Data-based decision making

Evidence-Based Practices

Instructional techniques supported by high-quality research demonstrating meaningful effects on student outcomes

tier.tea.texas.gov

UNIVERSAL

- Universal evidence-based practices
- Screening of all students
- Progress monitoring of at-risk students
- Data-based decision making

TARGETED

- Targeted evidence-based practices
- Progress monitoring
- Data-based decision making

INTENSIVE

- Diagnostics
- Intensive evidence-based practices
- Progress monitoring
- Data-based decision making

Progress Monitoring

Using reliable and valid assessments to determine adequacy of response to intervention

UNIVERSAL

- Universal evidence-based practices
- Screening of all students
- Progress monitoring of at-risk students
- Data-based decision making

TARGETED

- Targeted evidence-based practices
- Progress monitoring
- Data-based decision making

INTENSIVE

- Diagnostics
- Intensive evidence-based practices
- Progress monitoring
- Data-based decision making

Data-Based Decision Making

Making decisions about adequacy of student response using data from progress-monitoring measures

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UNIVERSAL

- Universal evidence-based practices
- Screening of all students
- Progress monitoring of at-risk students
- Data-based decision making

TARGETED

- Targeted evidence-based practices
- Progress monitoring
- Data-based decision making

INTENSIVE

- Diagnostics
- Intensive evidence-based practices
- Progress monitoring
- Data-based decision making

Assessments

Using reliable and valid assessments to determine which students require support and how to adapt intervention.

UNIVERSAL

- Universal evidence-based practices
- Screening of all students
- Progress monitoring of at-risk students
- Data-based decision making

TARGETED

- Targeted evidence-based practices
- Progress monitoring
- Data-based decision making

INTENSIVE

- Diagnostics
- Intensive evidence-based practices
- Progress monitoring
- Data-based decision making

At your school, which component is a strength?

Which component is an opportunity for growth?

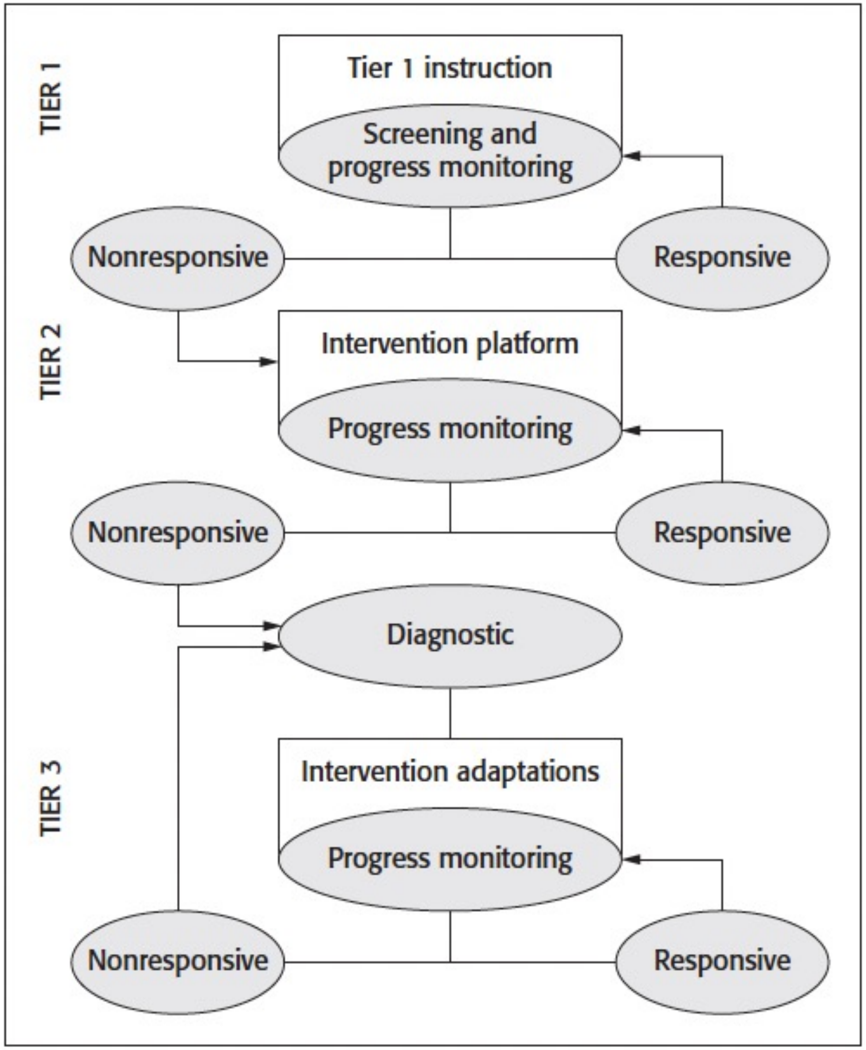
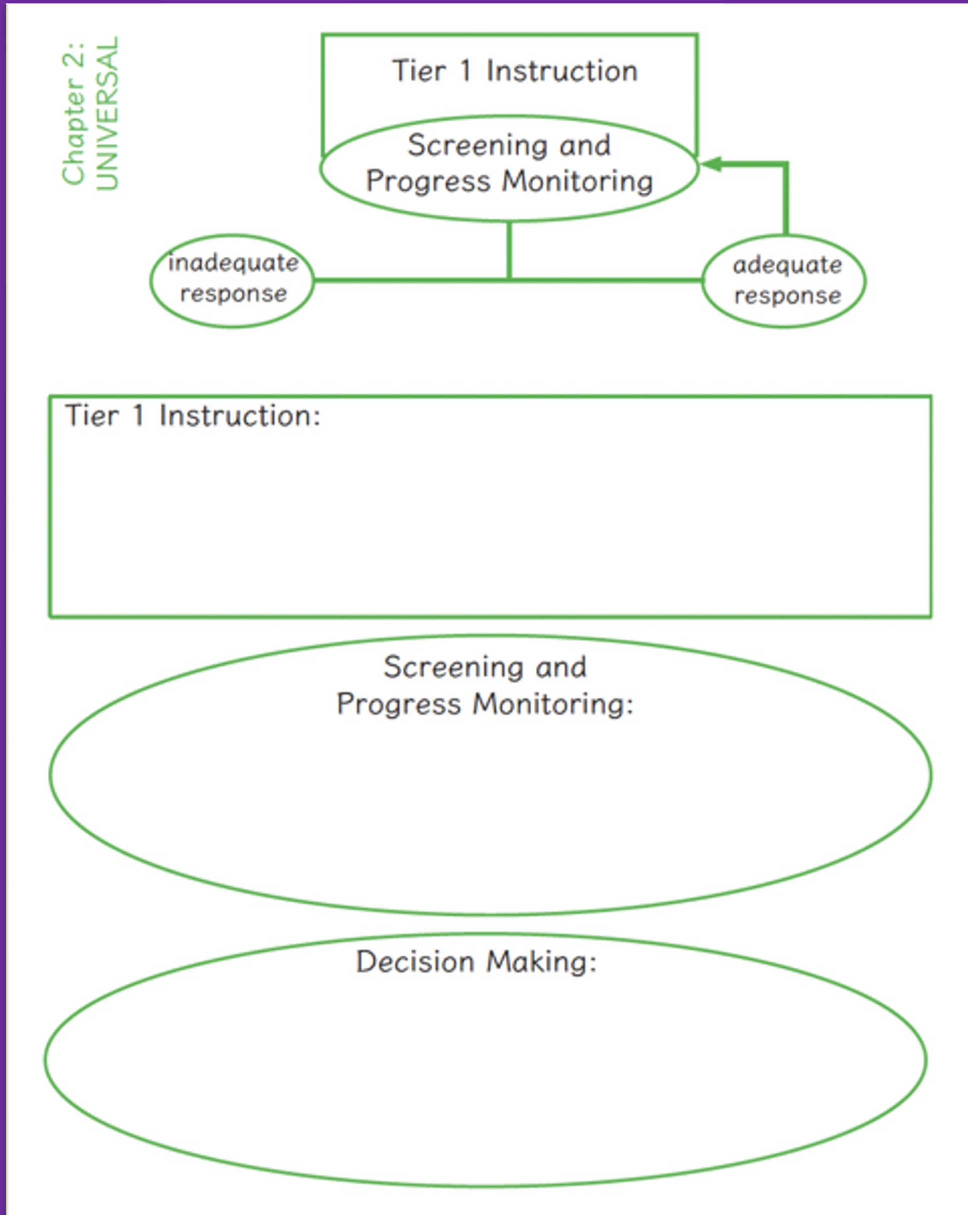
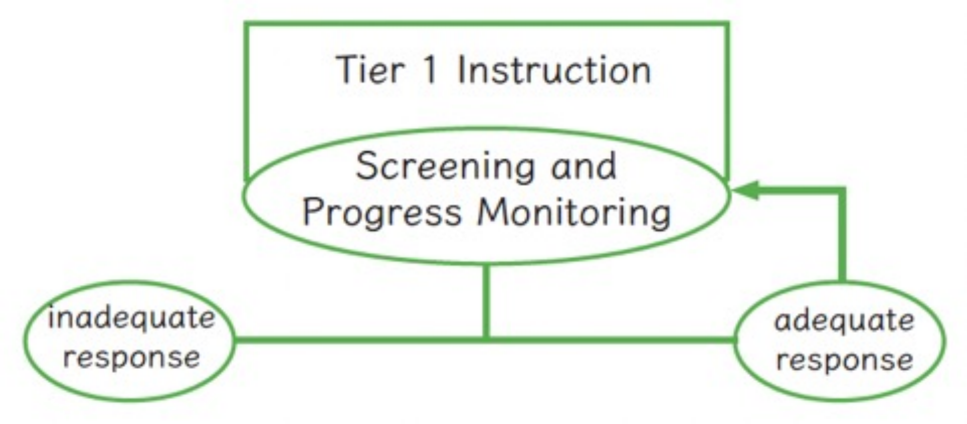


Figure 2.2. The three tiers of intervention typically included in the multi-tiered systems of support (MTSS) framework.


Chapter 2:
UNIVERSAL
Tier 1 Instruction
Screening and Progress Monitoring
inadequate response
adequate response
Tier 1 Instruction:
Screening and Progress Monitoring:
Decision Making:



- Core instruction utilizes **evidence-based practices**
- All students **screened** (universal screener)
- Students scoring below a cut-score are suspected **at risk** for math difficulties
- Suspected **at-risk students** monitored for 6 to 10 weeks during primary prevention using **progress monitoring**

evidence-based practice

A practice that has shown **consistent and positive** results

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

evidence-based practice

evidence-based intervention

evidence-based strategy

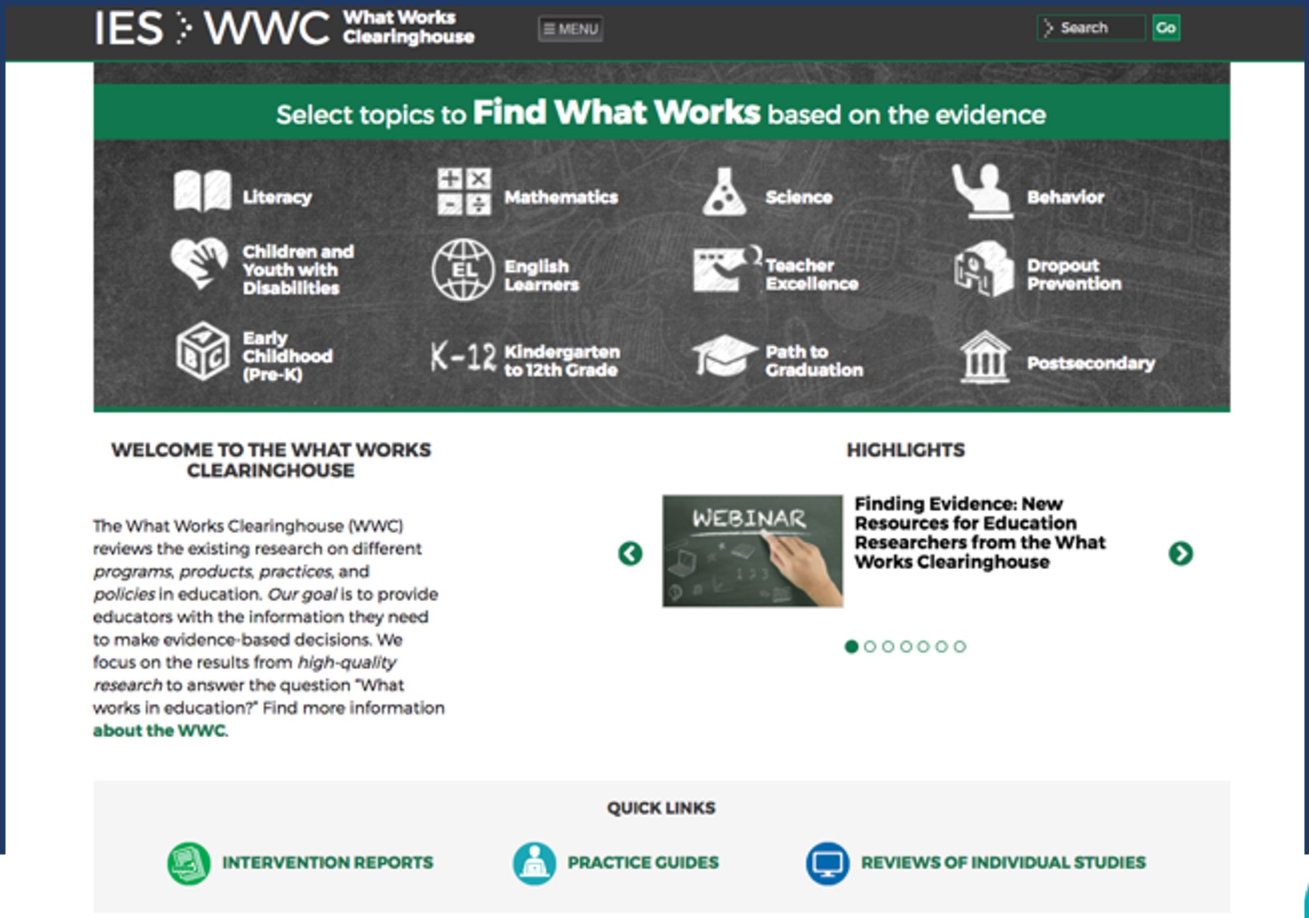
promising practice

A method or strategy that has shown a **positive** result


evidence-based practice
evidence-based intervention
evidence-based strategy
promising practice
~~no or negative evidence~~

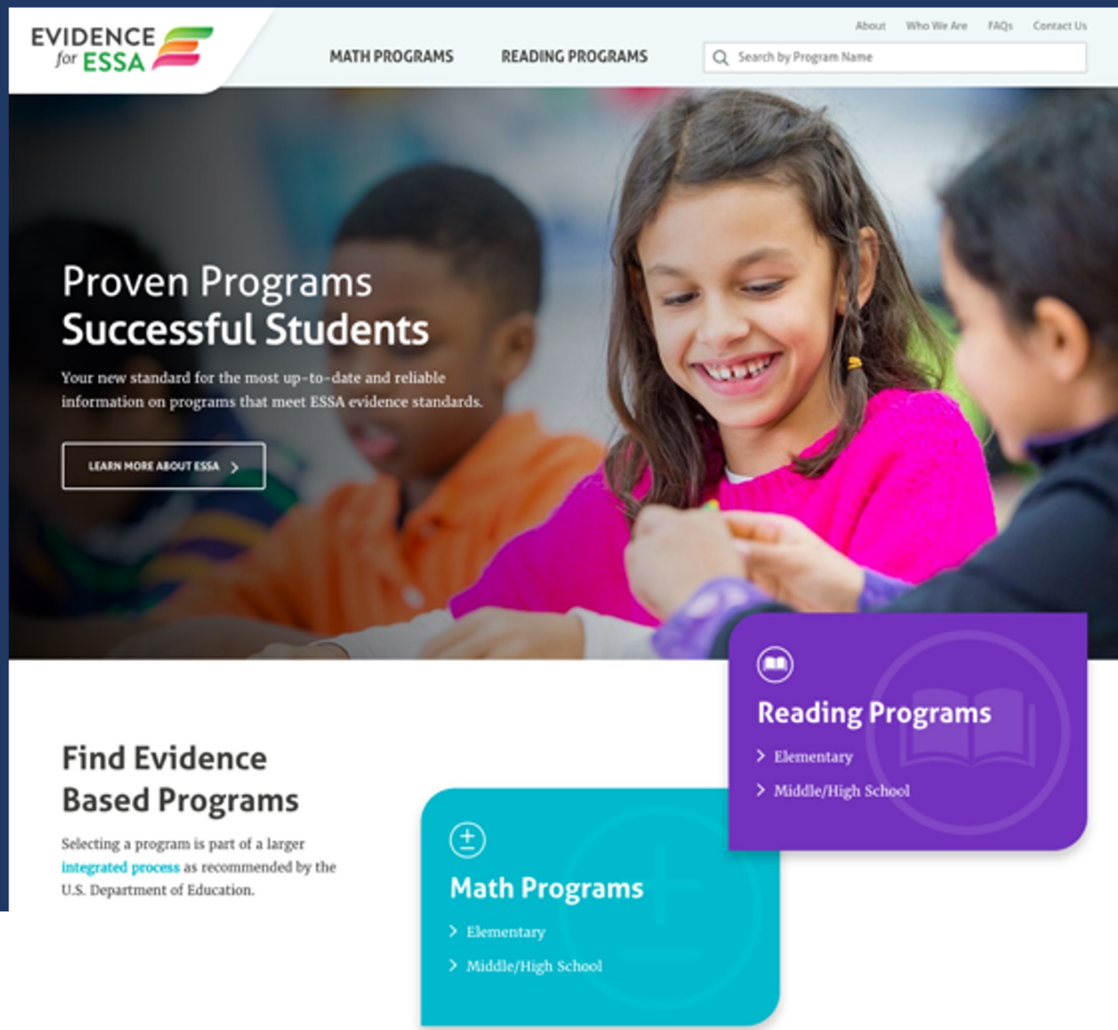
Websites

ies.ed.gov/ncee/wwc/



Websites

www.evidenceforessa.org

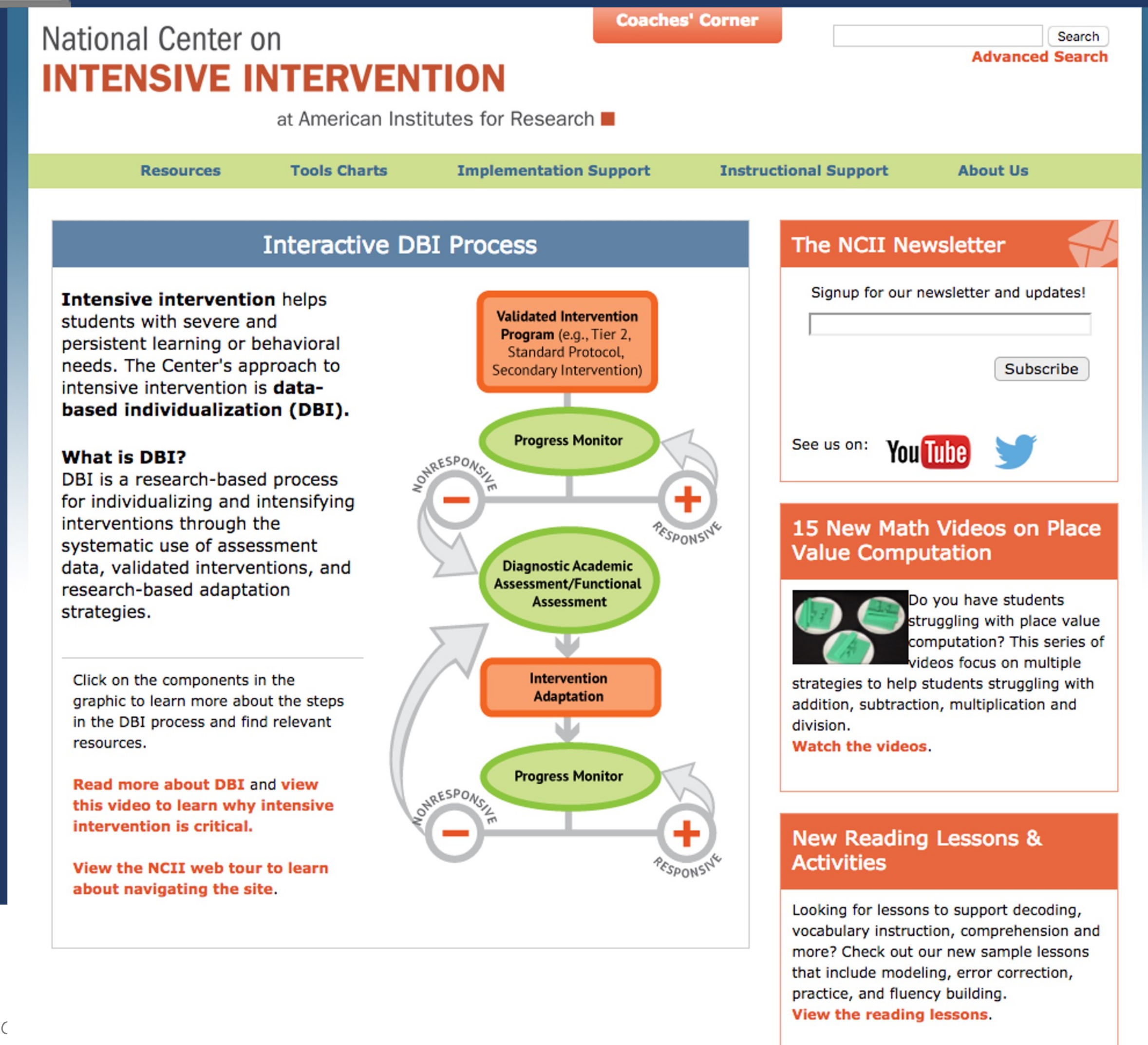


Websites

www.edreports.org

Websites

www.intensiveintervention.org



evidence-based practice

evidence-based intervention

evidence-based strategy

promising practice

Assessment data to show results

Improvement from before intervention

Improvement compared to no treatment students

Replication

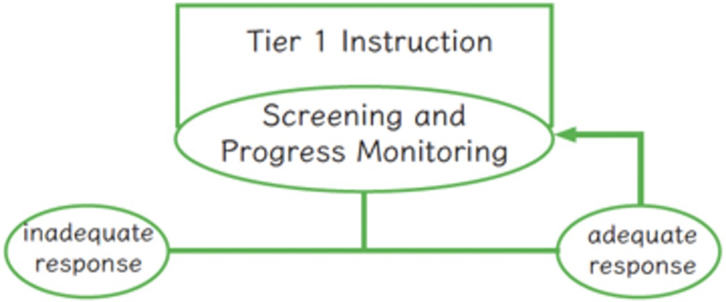
Multiple researchers

Multiple students

Multiple times

Setting and students similar to your own

Chapter 2:
UNIVERSAL



Tier 1 Instruction:

- Evidence-based practices

Screening and
Progress Monitoring:

Decision Making:

Number Identification

6	16	23	10	17
38	97	20	15	24
14	33	11	79	8
21	19	93	3	49
4	30	12	9	1
28	7	27	2	13

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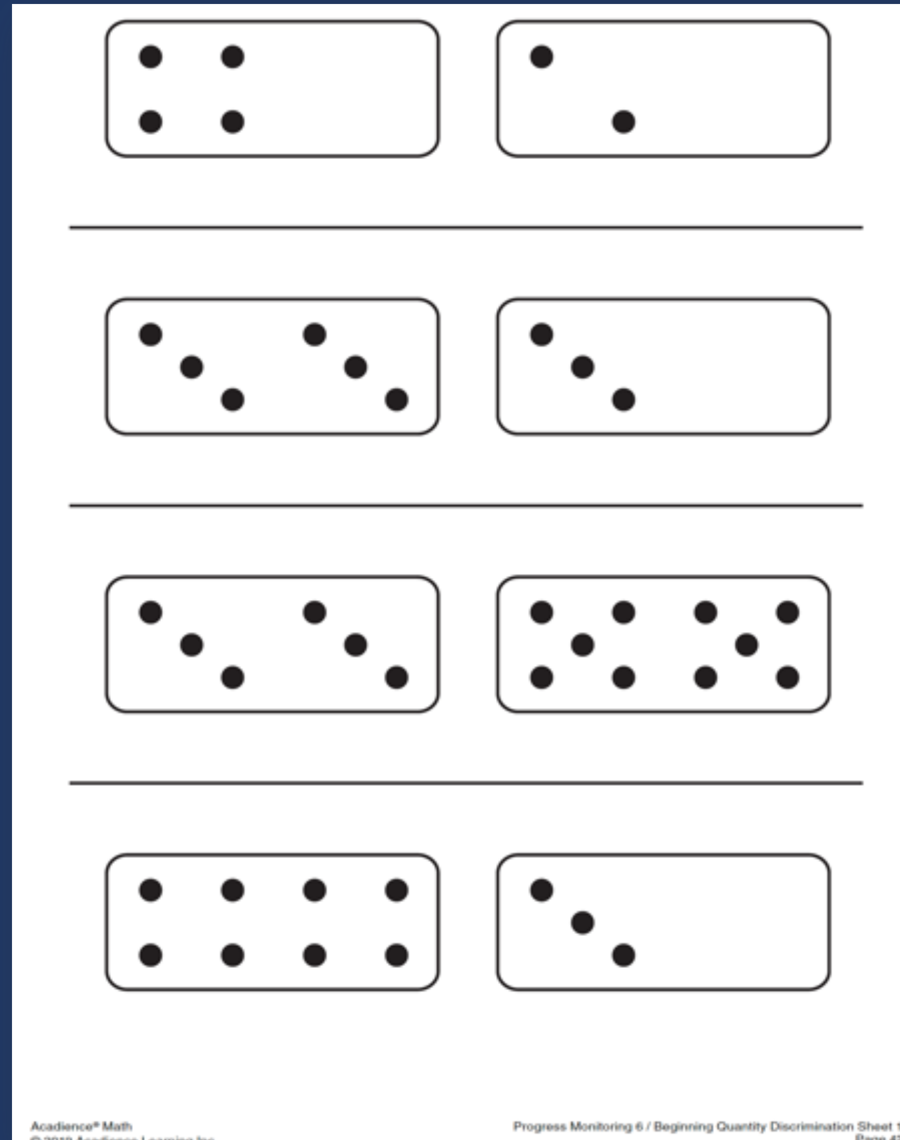
Quantity Discrimination



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Missing Number

13 __ 15 16	50 60 __ 80
40 45 __ 55	50 51 __ 53
23 __ 25 26	15 20 __ 30
27 28 __ 30	38 48 __ 68
75 __ 85 90	83 __ 85 86

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Computation

Acadience® Math / Computation Grade 4
Benchmark 1 / Form A

Total: ______

1. $527 + 320$	2. $4778 + 2242$	3. $8\frac{4}{5} - 6\frac{2}{5} =$	4. 9×8	5. $4\overline{)573}$
6. $197 - 74$	7. $\frac{5}{8} + \frac{2}{8} =$	8. $7273 - 387$	9. 19×11	10. $9\frac{7}{12} - 1\frac{4}{12} =$
11. $8\overline{)642}$	12. $7\overline{)49}$	13. 99×72	14. $\frac{1}{4} + \frac{2}{4} =$	15. 526×6
16. $8\frac{9}{10} - 1\frac{5}{10} =$	17. $\frac{1}{3} + \frac{1}{3} =$	18. $\frac{9}{12} - \frac{2}{12} =$	19. 829×7	20. $6\overline{)939}$
21. $3\overline{)397}$	22. 65×23	23. $2414 - 668$	24. $7568 + 1638$	25. 34×12

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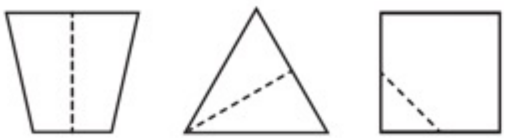
Concepts and Applications

Acadience® Math / Concepts and Applications
Grade 4 / Benchmark 1

Total: ____________

1. Is the dotted line a line of symmetry for each shape? Write "yes" or "no" in the space provided below each shape.



________ ________ ________

2. Compare the number in Box 1 with the number in Box 2. Fill in the blank with > (greater than), = (equal to), or < (less than):

Box 1	>, =, <	Box 2
835		751
333		613
131		168

3. List three numbers that are multiples of 4:

________ ________ ________

4. Jake read 17 books over the summer that were nonfiction and 43 books that were fiction. His friend Ross read 38 books total. How many more books did Jake read than Ross? ____________ books.

5. Compare the decimal in Box 1 with the decimal in Box 2. Fill in the blank with > (greater than), = (equal to), or < (less than):

Box 1	>, =, <	Box 2
0.47		0.25
0.39		0.68
0.89		0.91

6. We rented a movie that was 2 hours and 15 minutes long. How many minutes total was the movie? ____________ minutes.

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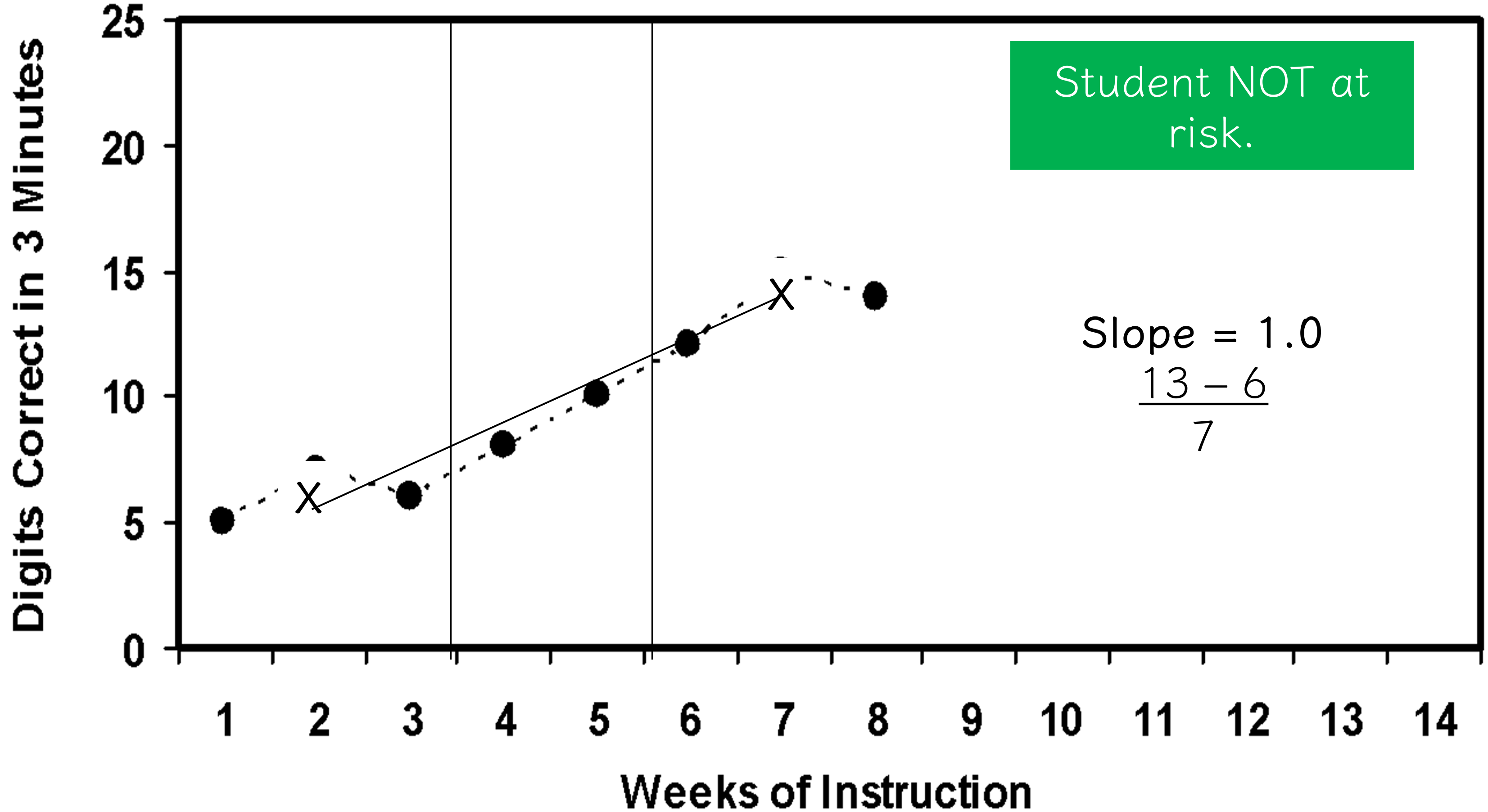
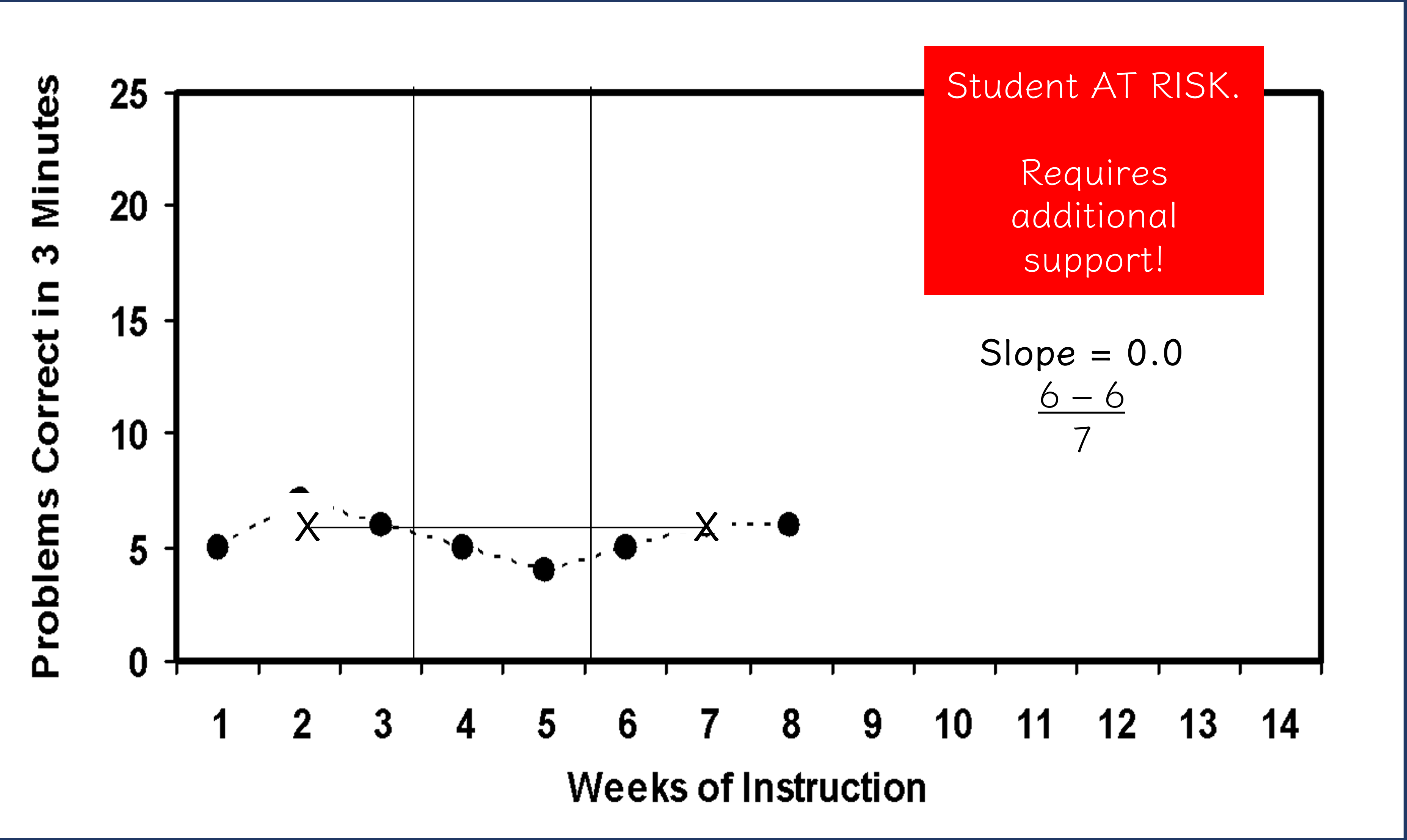
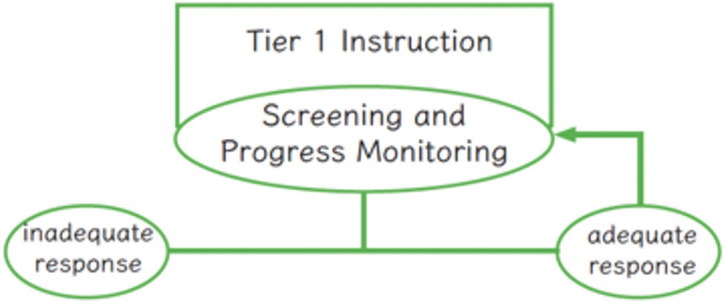

Digits Correct in 3 Minutes
25
20
15
10
5
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Weeks of Instruction
X
X
Student NOT at risk.
Slope = 1.0
13 – 6
7


Student AT RISK.
Requires additional support!
Slope = 0.0
6 – 6
7
Problems Correct in 3 Minutes
25
20
15
10
5
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14
Weeks of Instruction

Chapter 2: UNIVERSAL



Tier 1 Instruction:

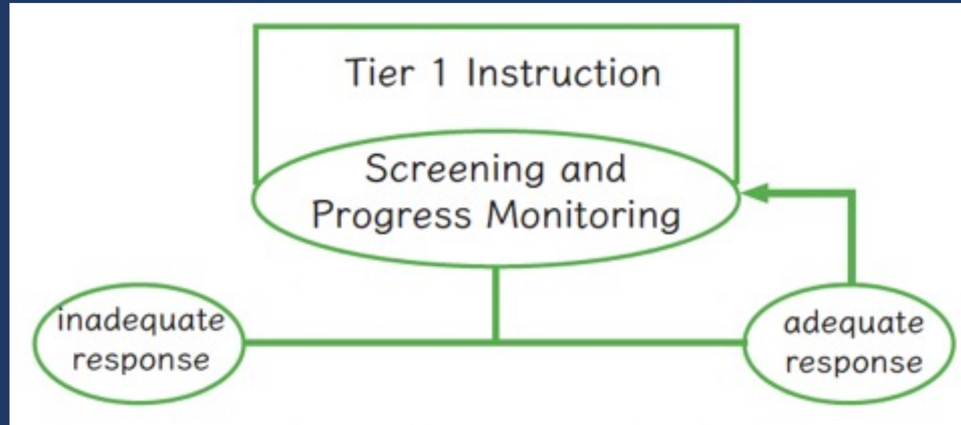
- Evidence-based practices

Screening and Progress Monitoring:

- Reliable measures with normative data
- Usually administered fall, winter, spring
- Reliable measures, administered regularly

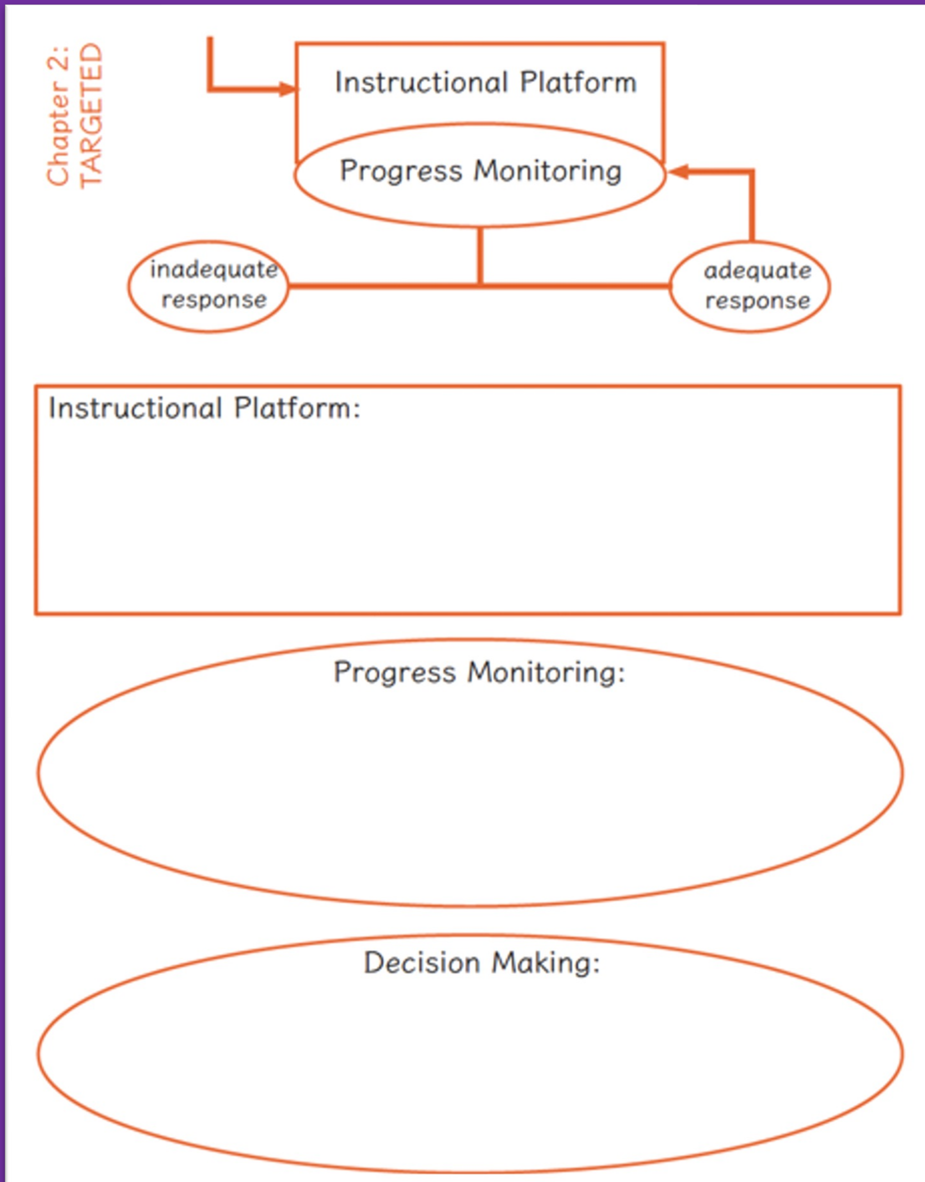
Decision Making:

- After 6-10 weeks, student risk status is **confirmed** or **disconfirmed**



Describe your school's Tier 1 strengths.

Describe your school's Tier 1 opportunities for growth.


Chapter 2:
TARGETED

Instructional Platform

Progress Monitoring

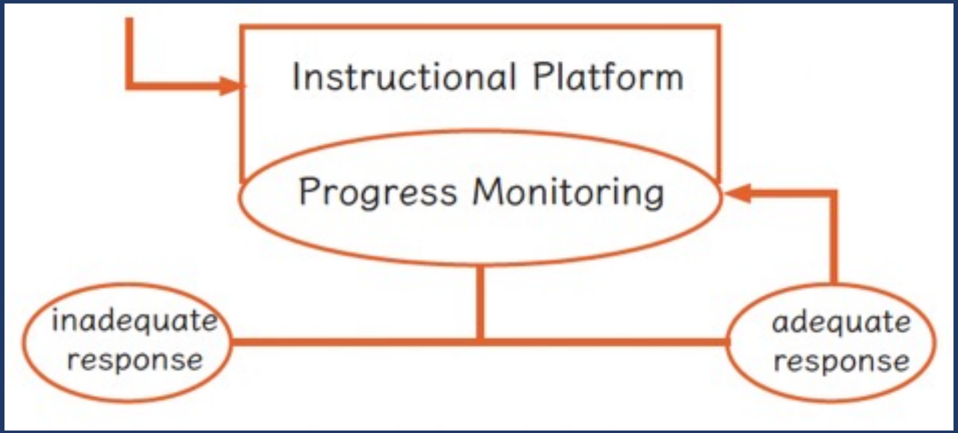
inadequate response

adequate response

Instructional Platform:

Progress Monitoring:

Decision Making:



- Students are tutored in small groups using **evidence-based practices**
- Tutoring takes place three or four times a week
- Each tutoring session lasts 30 to 60 minutes
- Tutoring lasts 10 to 20 weeks
- **Progress monitoring** continues weekly

Instructional Platform

INSTRUCTIONAL DELIVERY

- Explicit instruction
- Precise language
- Multiple representations

INSTRUCTIONAL STRATEGIES

- Fluency building
- Problem solving instruction

Explicit instruction

MODELING	PRACTICE
Step-by-step explanation	Guided practice
Planned examples	Independent practice

SUPPORTS

Ask high-level and low-level questions

Eliciting frequent responses

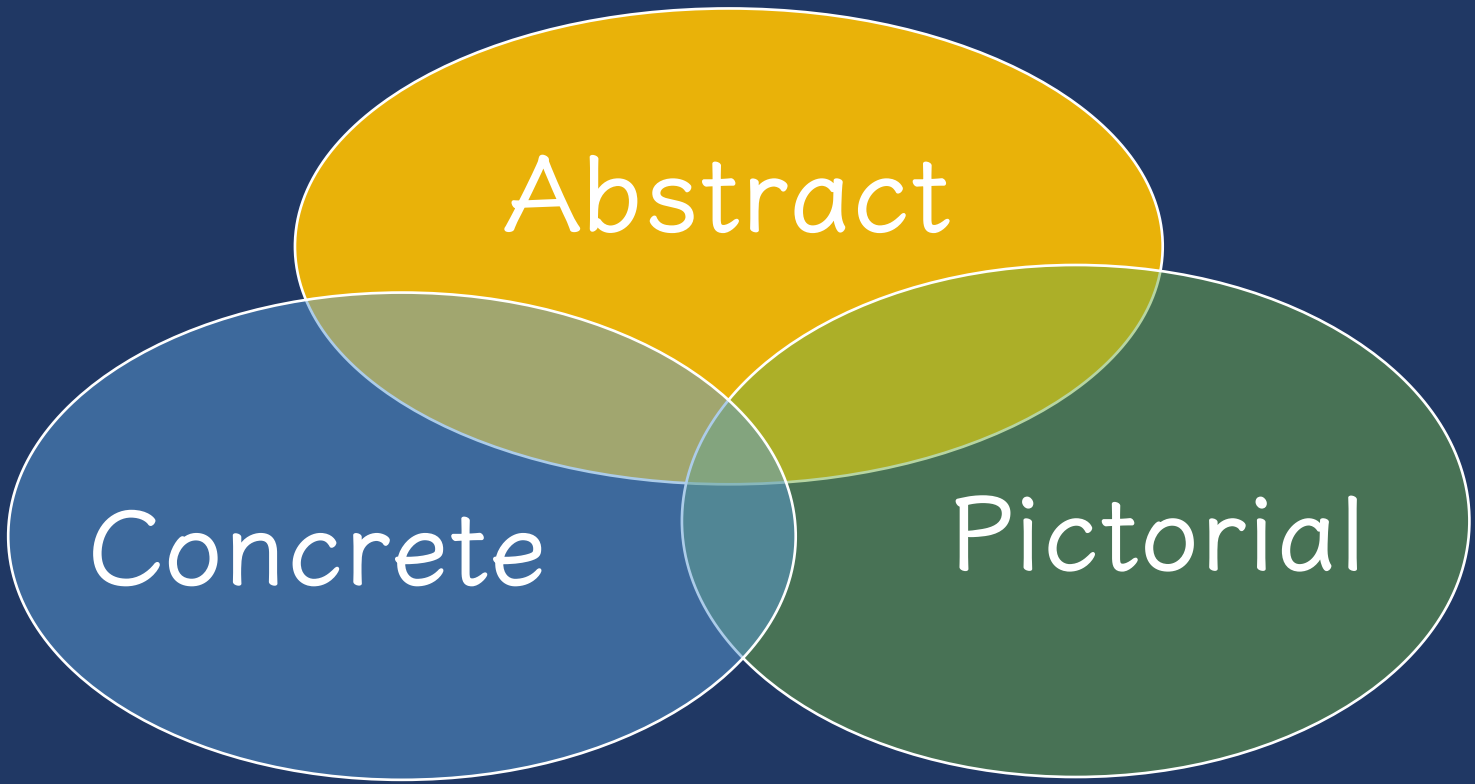
Providing affirmative and corrective feedback

Precise language

Use formal math language

Use terms precisely

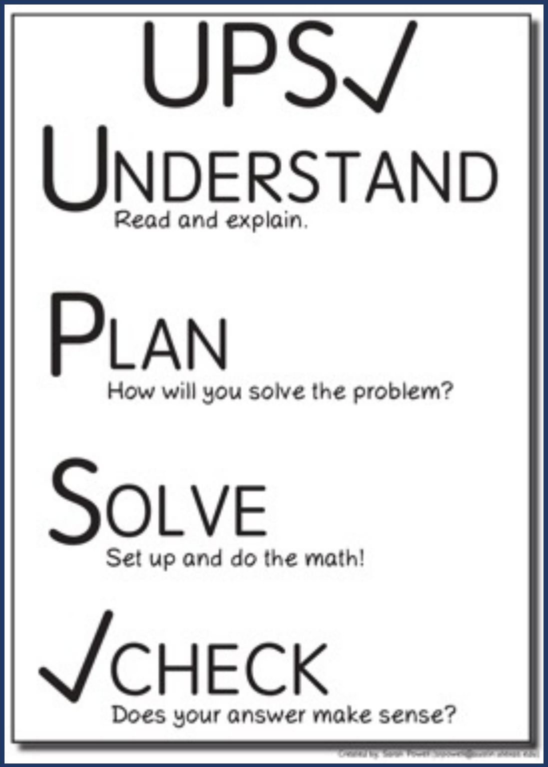
Multiple representations



Fluency building

Addition	Subtraction
Multiplication	Division

Problem solving instruction



Total

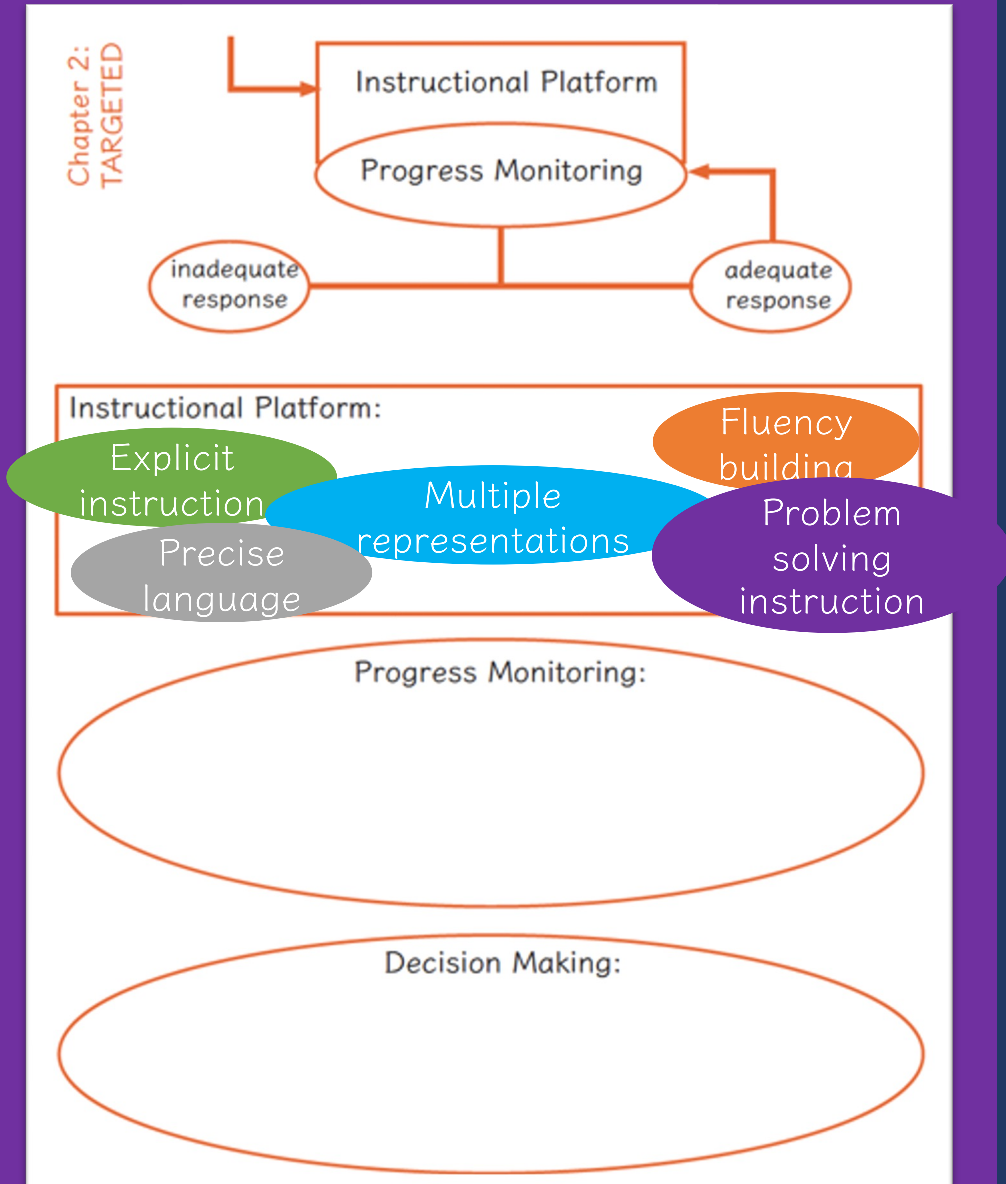
Difference

Change

Equal Groups

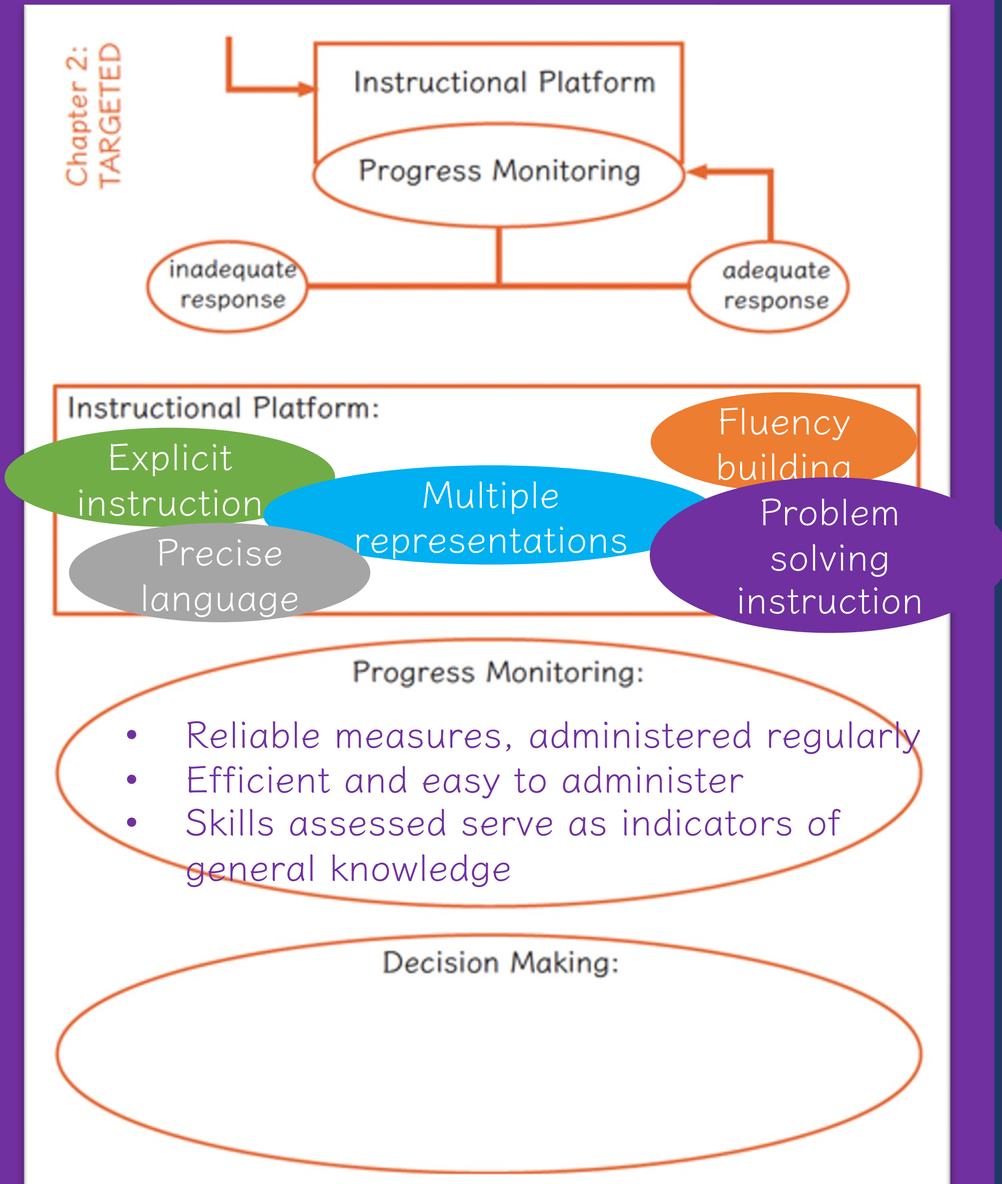
Comparison

Ratios/Proportions


Chapter 2:
TARGETED
Instructional Platform
Progress Monitoring
inadequate response
adequate response
Instructional Platform:
Explicit instruction
Multiple representations
Fluency building
Problem solving instruction
Precise language
Progress Monitoring:
Decision Making:

Progress Monitoring Considerations

- Skills to be measured—age and grade appropriate
- Cost and training requirements
- Administration and scoring time
- Data management
- Technical rigor (consider population)
  - Reliability
  - Validity
  - Evidence of being sensitive to change
  - Alternate/parallel forms


Chapter 2: TARGETED
Instructional Platform
Progress Monitoring
inadequate response
adequate response
Instructional Platform:
Explicit instruction
Multiple representations
Fluency building
Precise language
Problem solving instruction
Progress Monitoring:
• Reliable measures, administered regularly
• Efficient and easy to administer
• Skills assessed serve as indicators of general knowledge
Decision Making:

Setting Goals

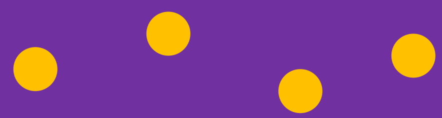
Benchmark

Slope (ROI)

Intra-
individual

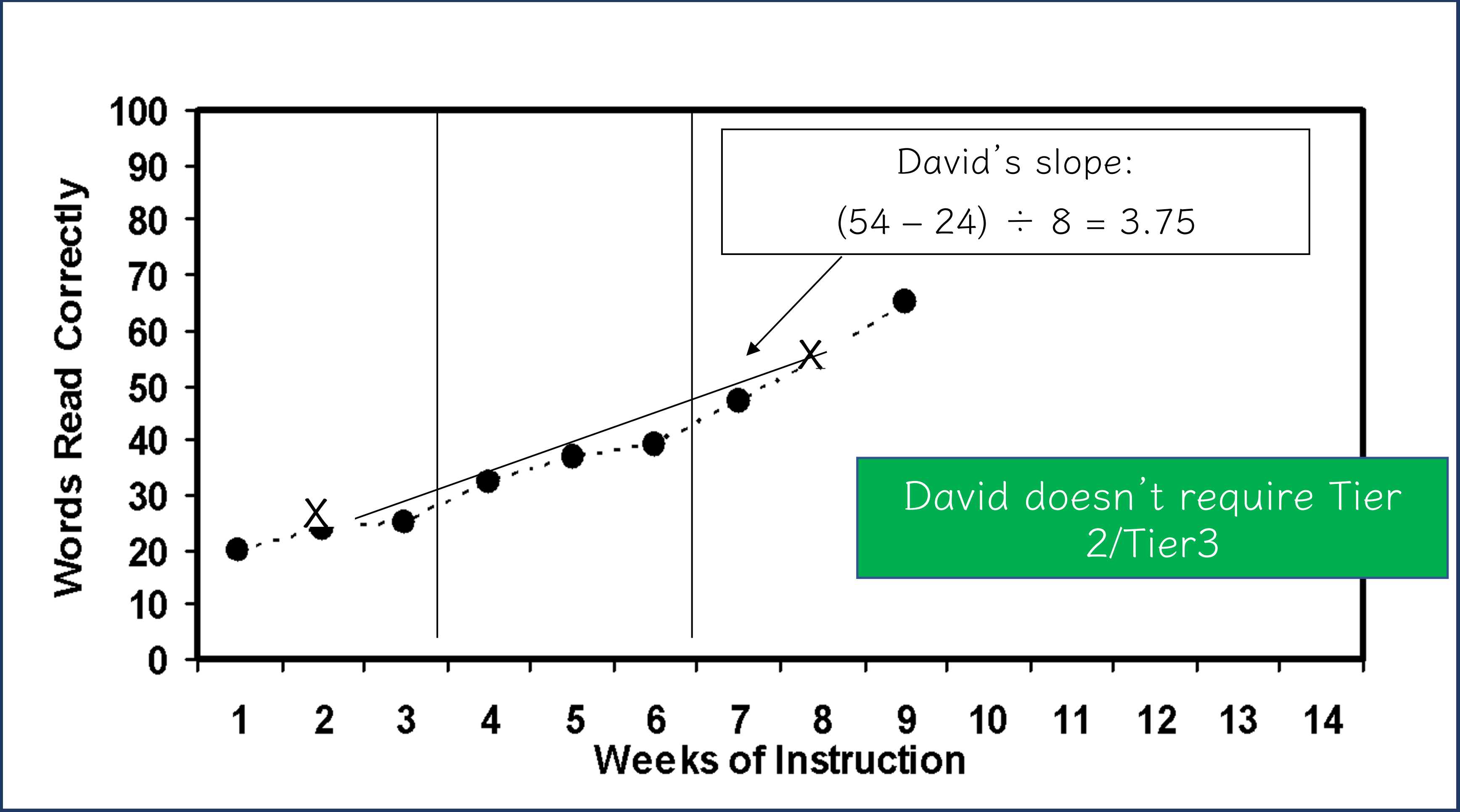
Determining Response

Four most recent, consecutive scores



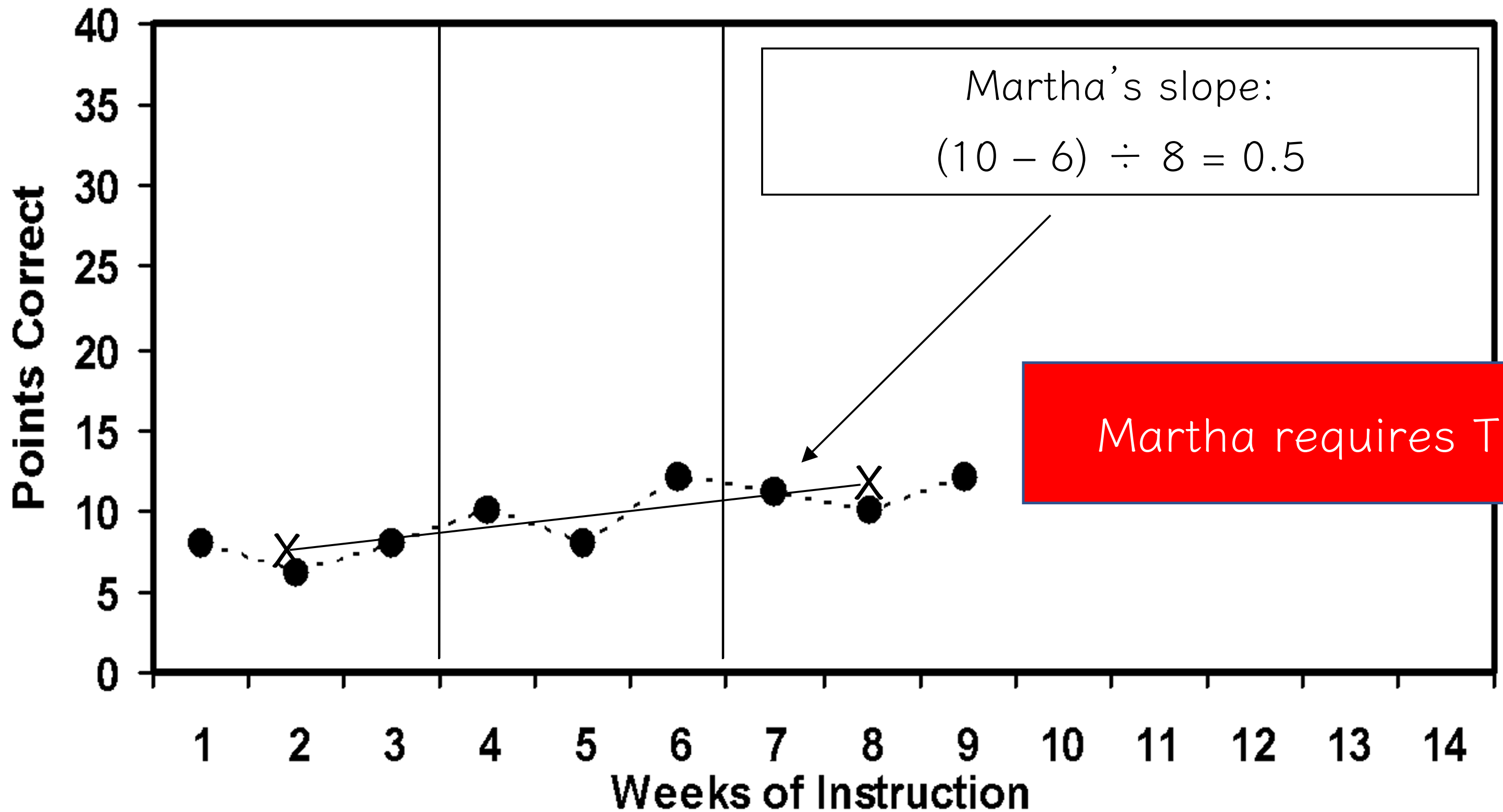
Trendline

David

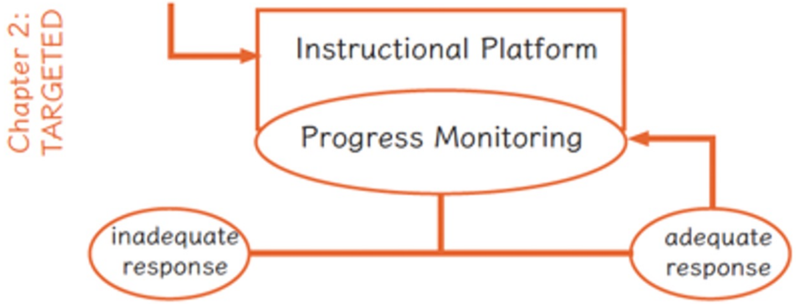


Words Read Correctly
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Weeks of Instruction
X
X
David's slope:
(54 – 24) ÷ 8 = 3.75
David doesn't require Tier 2/Tier3

Martha



Martha requires Tier 3



Instructional Platform:

Explicit instruction

Multiple representations

Fluency building

Problem solving instruction

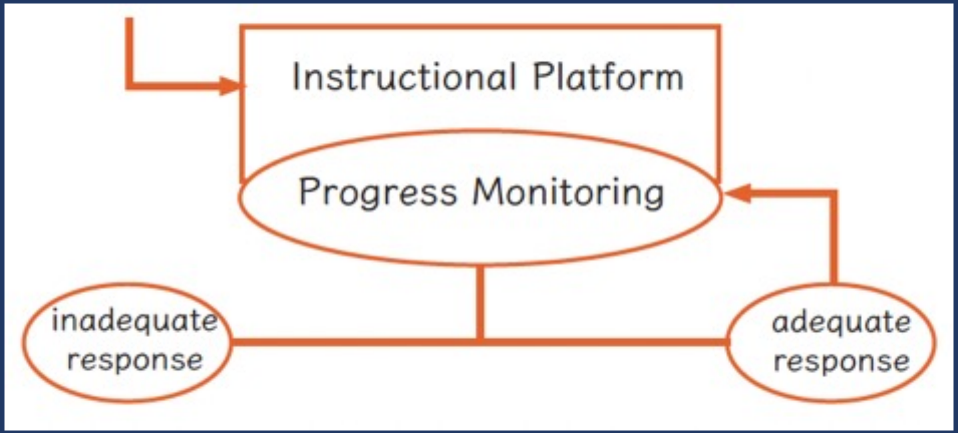
Precise language

Progress Monitoring:

- Reliable measures, administered regularly
- Efficient and easy to administer
- Skills assessed serve as indicators of general knowledge

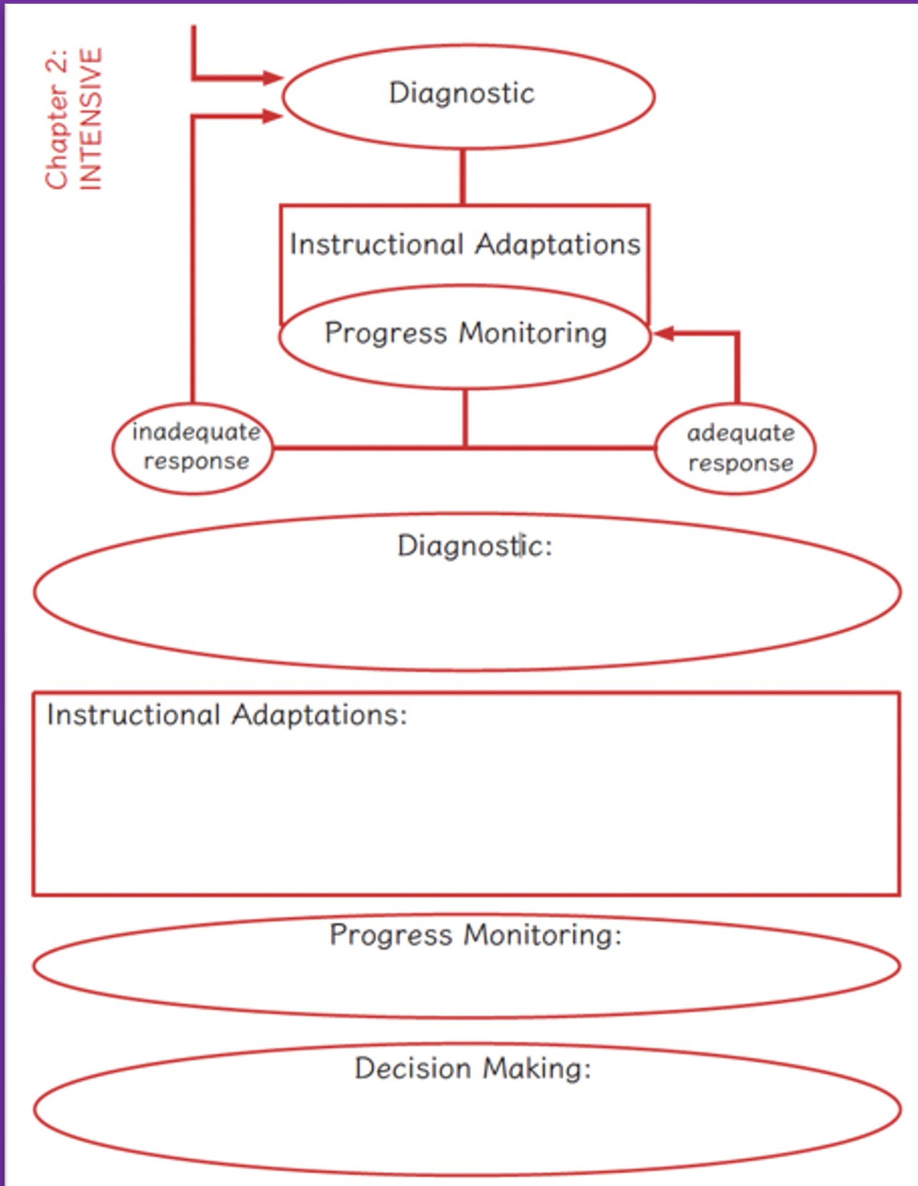
Decision Making:

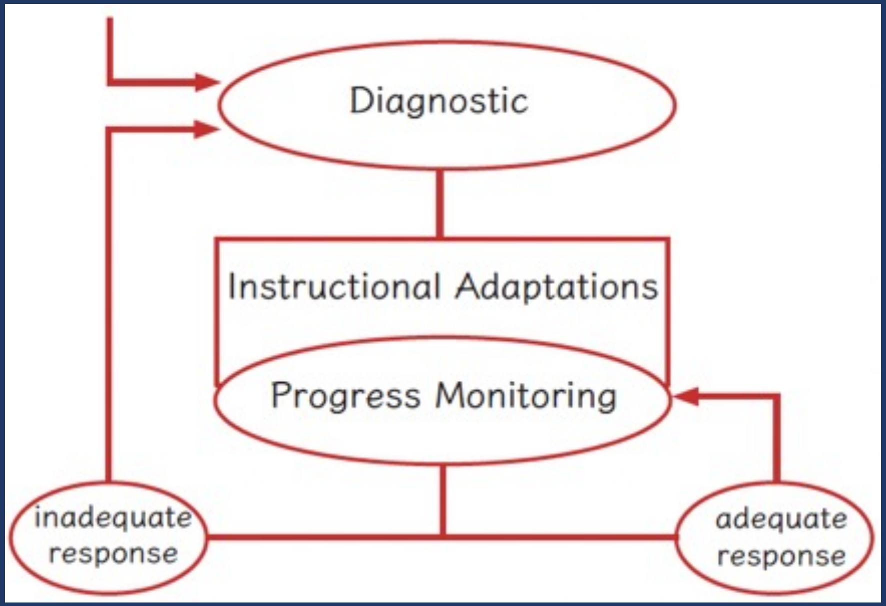
- Teachers set goals
- After 10-20, student progress is determined
  - Adaptations to instructional platform
  - Intensify support (Tier 3)



Describe your school's Tier 2 strengths.

Describe your school's Tier 2 opportunities for growth.


Chapter 2:
INTENSIVE
Diagnostic
Instructional Adaptations
Progress Monitoring
inadequate response
adequate response
Diagnostic:
Instructional Adaptations:
Progress Monitoring:
Decision Making:



- **Diagnostics** are conducted
- **Adaptations** are made to the student's intervention
- Student progress is monitored weekly
  - With *adequate* slopes or end levels, students return to Tier 1 or 2

Implement with greater fidelity

Ensure that you are implementing the intervention or strategy with fidelity

Math Fact Flash Cards

__ Tutor greets student.
__ Tutor starts timer.
__ Tutor begins flash card activity immediately.
__ Tutor reminds student of flash card procedures; answers questions if necessary.
__ Tutor sets timer for 1 minute.
__ Tutor allows student to respond to cards.
__ Tutor prompts student to Count Up if inc
__ Tutor stops presenting cards when timer
__ Tutor prompts student to count correct c
__ Tutor encourages student to "beat the sc
__ Tutor sets timer for 1 minute.
__ Tutor allows student to respond to cards
__ Tutor prompts student to Count Up if inc
__ Tutor stops presenting cards when timer
__ Tutor prompts student to count correct c
__ Tutor prompts student to graph the high
__ Tutor records flash card score in attendai
__ Tutor rewards student with gold coin.

Word Problem Warm-Up

__ Tutor presents word problem from previ
__ Tutor encourages student to talk throug
__ Tutor assists with explanation, as needec
__ Tutor rewards student with gold coin.

Tutoring Lesson

__ Tutor begins tutoring lesson immediatel
__ Tutor prompts student to describe Coun
__ Tutor quizzes student on 4 math facts, re

__ Tutor presents story problem #1.
__ Tutor allows time for student to respond
__ Tutor praises/corrects student's response
__ Tutor rewards student with gold coin.

__ Tutor presents story problem #2.
__ Tutor allows time for student to respond.
__ Tutor praises/corrects student's responses.
__ Tutor rewards student with gold coin.

__ Tutor presents story problem #3.
__ Tutor allows time for student to respond.
__ Tutor praises/corrects student's responses.
__ Tutor rewards student with gold coin.

Sorting Activity

__ Tutor begins sorting activity immediately.
__ Tutor reminds student of sorting procedures and answers questions as necessary.
__ Tutor sets timer for 2 minutes.
__ Tutor reads cards out loud for student.
__ Tutor allows student to place cards on sorting mat without interrupting.
__ Tutor prompts student to stop when timer goes off.
__ Tutor goes through correction procedure with up to 3 cards from "incorrect" pile.
__ Tutor goes through cards with student, counting the number of correct cards.
__ Tutor rewards student with gold coin.
__ Tutor records sorting cards score on Attendance Log.

Pirate Problems Daily Review

__ Tutor begins Pirate Problems Daily Review immediately.
__ Tutor reminds student of Pirate Problems procedures; answers questions as necessary.
__ Tutor sets timer for 2 minutes.
__ Tutor allows student to work independently for 2 minutes.
__ Tutor prompts student to stop when timer goes off.
__ Tutor sets timer for 2 more minutes (for word problem on back).
__ Tutor allows student to work independently for 2 more minutes.
__ Tutor prompts student to stop when timer goes off.
__ Tutor corrects the problems while student watches.
__ Tutor models Counting Up strategy for incorrectly answered items.
__ Tutor writes score on corner of sheet.
__ Tutor records Pirate Problems score in attendance log.
__ Tutor rewards student with gold coin.

__ Tutor prompts student to count coins and mark on map.
__ Tutor dismisses student to return to class.
__ Tutor stops timer.
__ Tutor records time of session in attendance log.
__ Tutor records date in attendance log.

Cover, Copy, and Compare:

1. Create a sheet for the student. This sheet should contain 10 problems and cover material the student needs to practice. All problems should be answered.
2. Ask the student to look at each problem and read it aloud.
3. Ask the student to cover the problem with an index card.
4. Ask student to copy the entire problem to the right of the covered problem.
5. Ask student to lift up index card and compare his or her copy to the original.
6. Repeat for all problems.
7. Conduct three times per week.

Implement with greater fidelity

Embed behavioral supports

May want to incorporate strategies to improve self-regulation and minimize nonproductive behavior

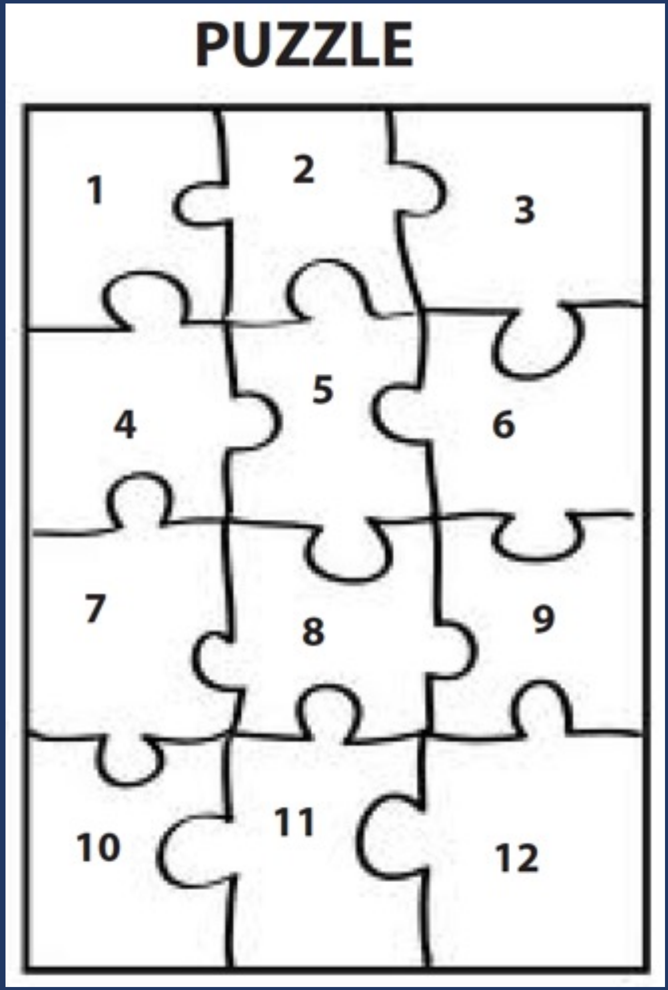
UPSCheck

Understand

Plan

Solve

Check



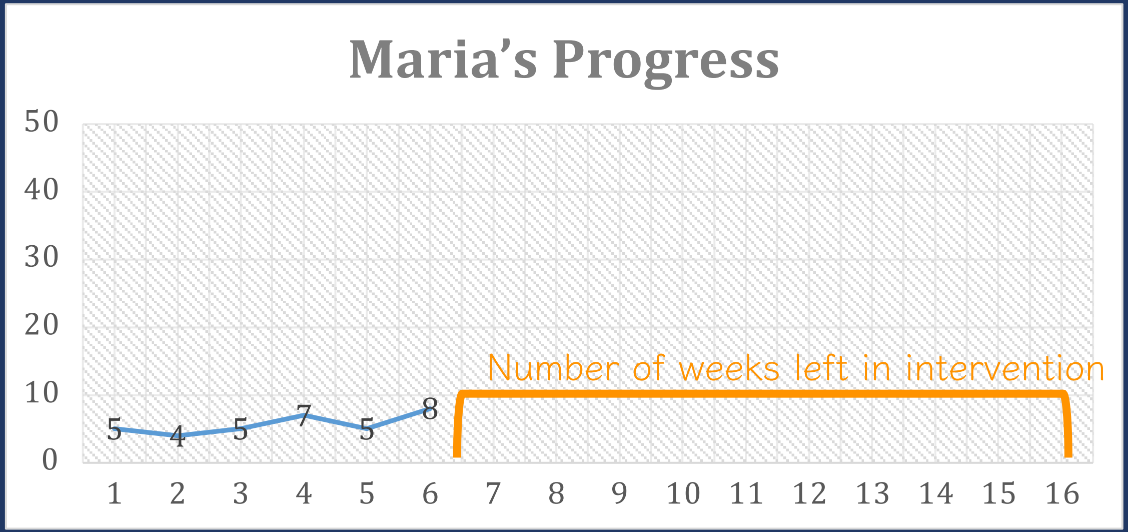
Powell, Driver, & Julian (2015)

Implement with greater fidelity

Embed behavioral supports

Increase dosage

Conduct longer sessions, more sessions per week, or more weeks within DBI



Implement with greater fidelity

Embed behavioral supports

Increase dosage

Adapt mathematics content

Implement with greater fidelity

Embed behavioral supports

Increase dosage

Adapt mathematics content

Utilize explicit instruction

Make sure you're doing it! And do it well!

MODELING	PRACTICE
Step-by-step explanation	Guided practice
Planned examples	Independent practice

SUPPORTS

Ask high-level and low-level questions

Eliciting frequent responses

Providing affirmative and corrective feedback

Implement with greater fidelity

Embed behavioral supports

Increase dosage

Adapt mathematics content

Utilize explicit instruction

Explicitly teach transfer

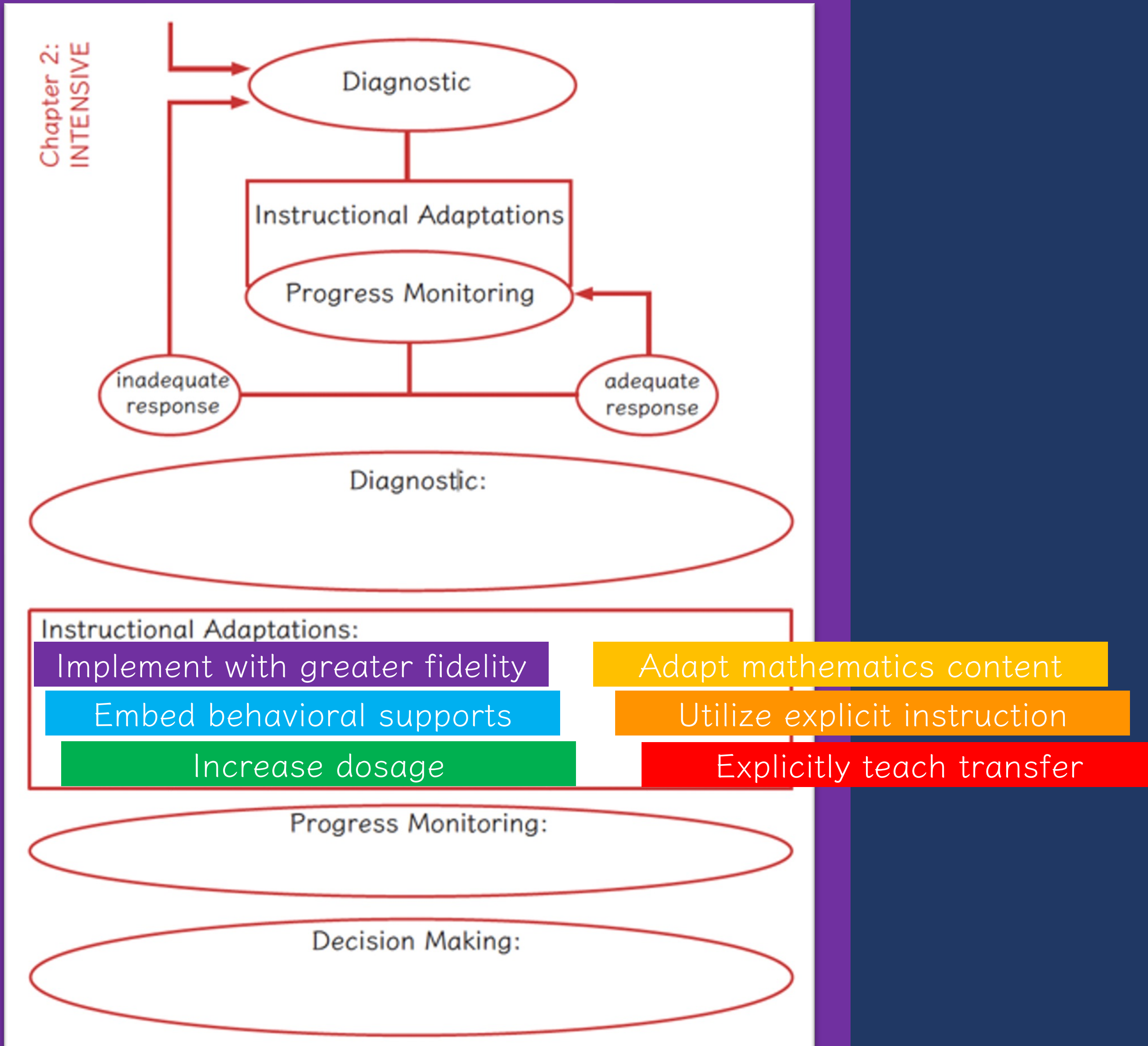
Explicitly teach how current learning relates to other learning

$$\begin{array}{r} 405 \\ +\quad 16 \\ \hline \end{array} \qquad \begin{array}{r} 4305 \\ +\quad 216 \\ \hline \end{array}$$

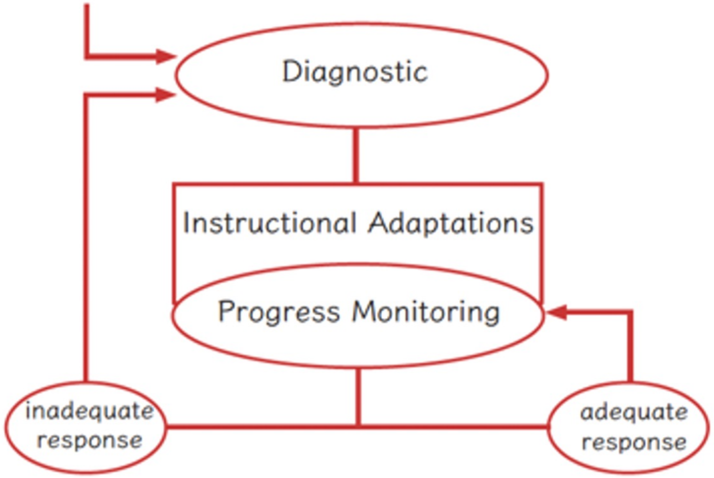
Marney baked 89 cookies and sold 40 cookies at the bake sale. How many cookies does Marney have left?

Marney had $89 and spent $40 on shoes. How many much does Marney have left?

Marney had $89 and spent $40 on shoes. How much money will Marney have after buying the shoes?


Chapter 2:
INTENSIVE
Diagnostic
Instructional Adaptations
Progress Monitoring
inadequate response
adequate response
Diagnostic:
Instructional Adaptations:
Implement with greater fidelity
Adapt mathematics content
Embed behavioral supports
Utilize explicit instruction
Increase dosage
Explicitly teach transfer
Progress Monitoring:
Decision Making:

Chapter 2: INTENSIVE



Diagnostic:

Instructional Adaptations:

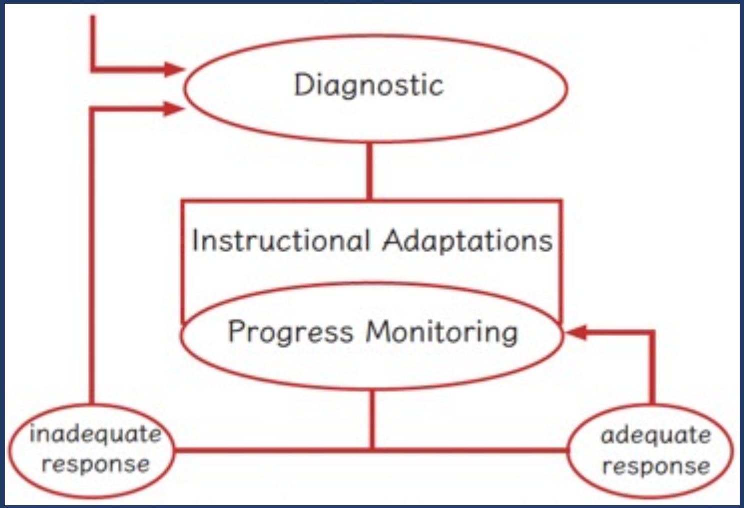
- Implement with greater fidelity
- Adapt mathematics content
- Embed behavioral supports
- Utilize explicit instruction
- Increase dosage
- Explicitly teach transfer

Progress Monitoring:

- Reliable measures, administered regularly
- Efficient and easy to administer
- Skills assessed serve as indicators of general knowledge

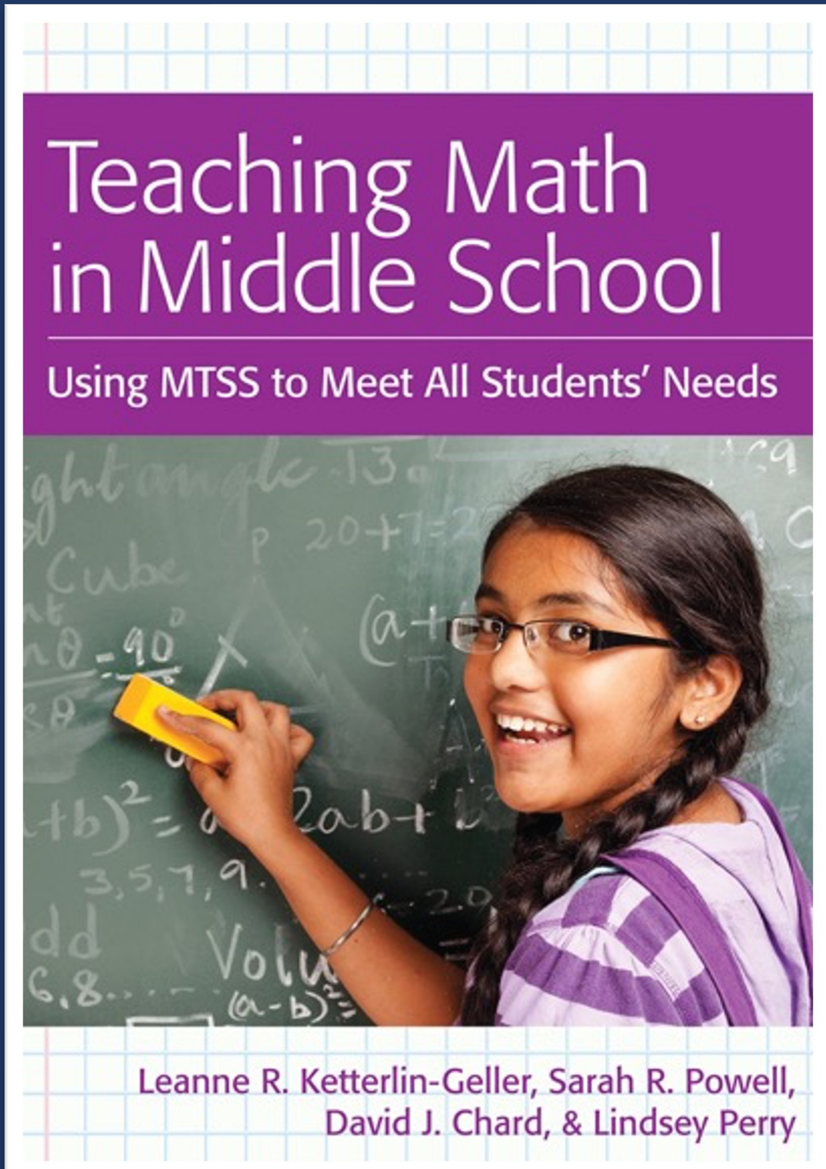
Decision Making:

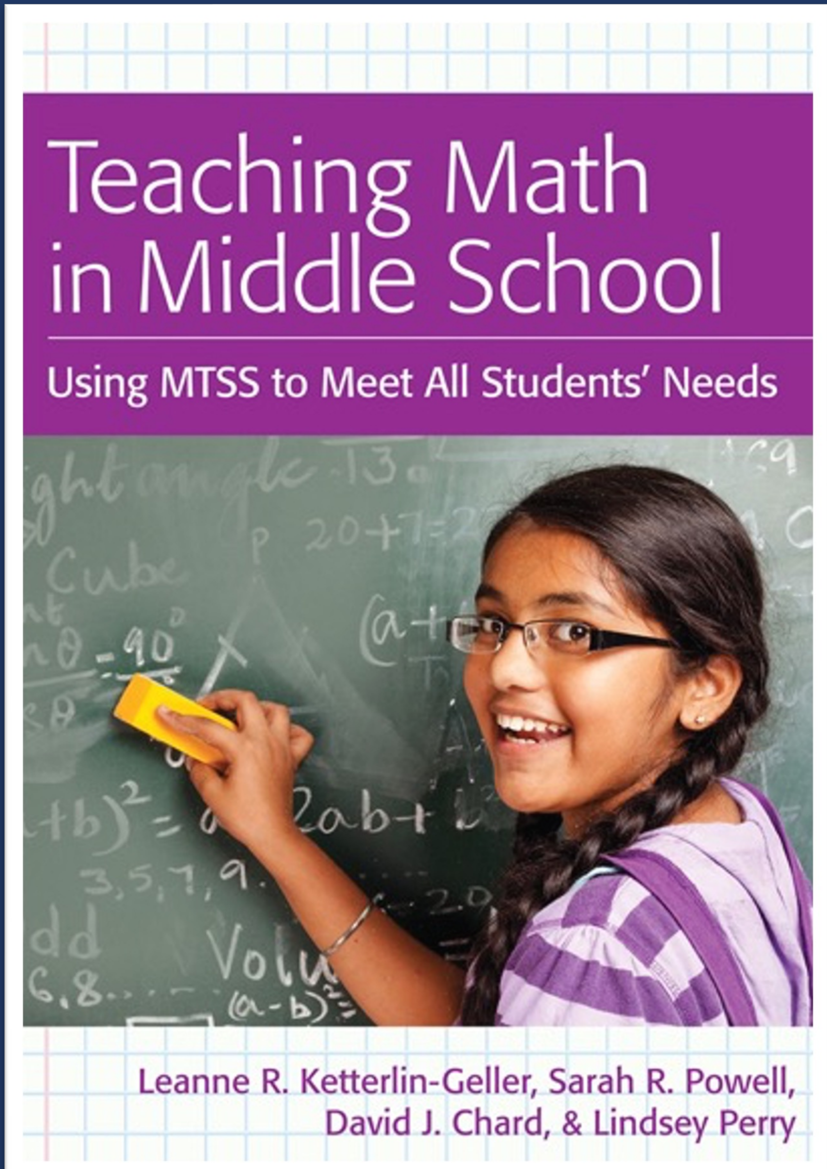
- After 10-20 weeks, student progress is determined



Describe your school's Tier 3 strengths.

Describe your school's Tier 3 opportunities for growth.


Teaching Math in Middle School
Using MTSS to Meet All Students' Needs
Leanne R. Ketterlin-Geller, Sarah R. Powell, David J. Chard, & Lindsey Perry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Chapter 3: Differentiation, Accommodation, and Modification

Chapter 5: Evidence-Based Practices

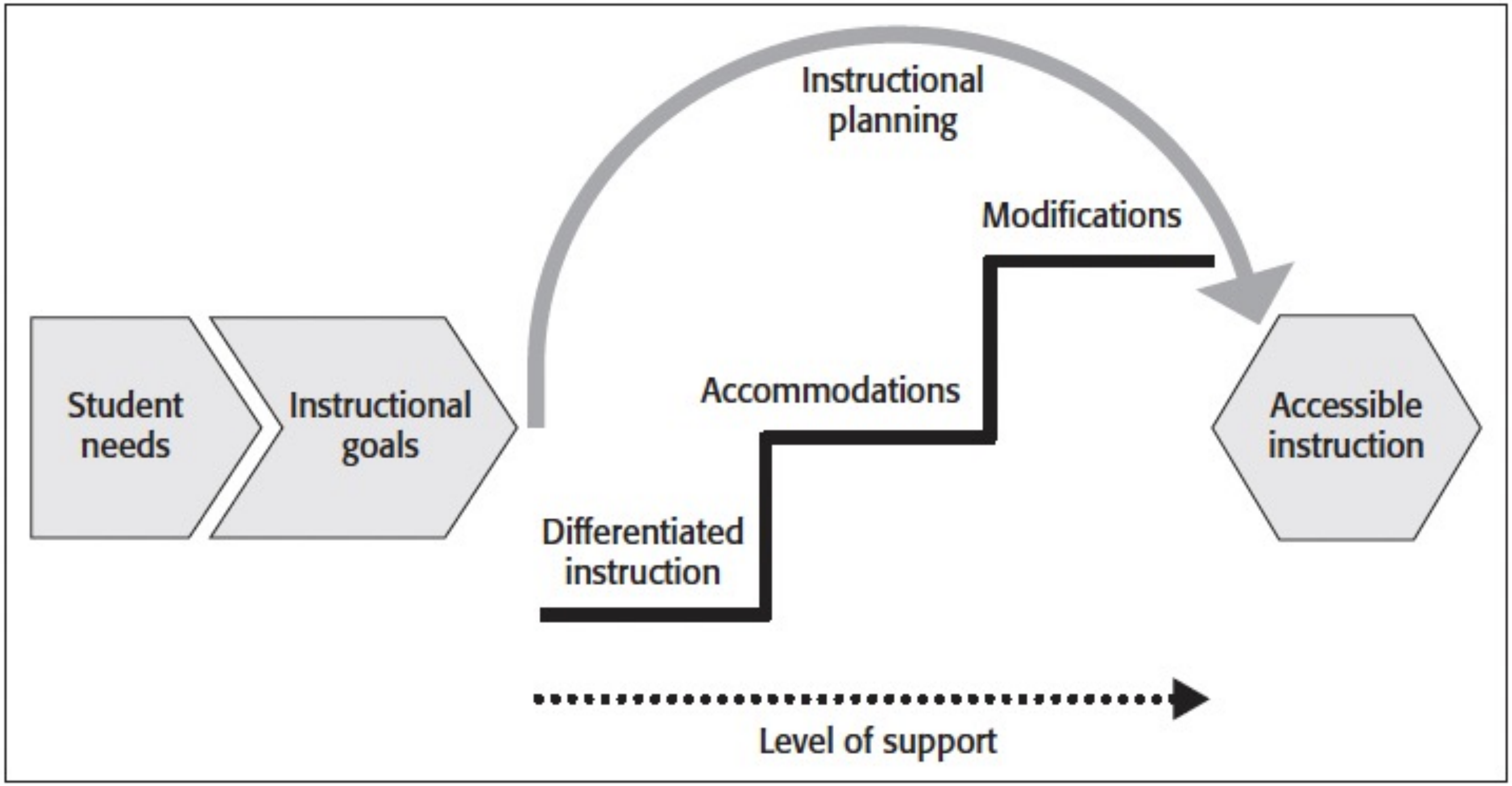


Figure 3.1. Relationship between a student's needs and the level of support required to enhance accessibility. (From Ketterlin-Geller L.R., Jamgochian E.M. [2011] Instructional Adaptations: Accommodations and Modifications That Support Accessible Instruction. In: Elliott S., Kettler R., Beddow P., Kurz A. [eds.] Handbook of Accessible Achievement Tests for All Students, 131–146. Springer, New York, NY.)

Page 38

Differentiated Instruction	Accommodations	Modifications
Intentionally changing the design and/or delivery of instruction to support students' access to learning	Changes to the presentation, setting, timing or schedule, and response mode of instruction	
Content expectations do not change	Does not change the instructional objective	Changes the instructional objective

Differentiated Instruction

Accommodations

Modifications

Changes to the presentation, setting, timing or schedule, and response mode of instruction

Table 3.3. Some examples of presentation changes

Accommodations	Modifications
• Audio- or video-record a lesson instead of taking notes • Read the directions and/or problems aloud to the student • Increase the font size (e.g., enlarge text, use a magnification device) • Increase the contrast or differentiation of information included in visual representations (e.g., use color to help students identify corresponding sides on similar figures) • Increase white space on assignments • Reduce the number of items on a page • Allow the student to use a screen reader • Provide tactile prompts such as physical guidance or raised-line paper • Allow the student to use highlighters • Provide the student with a copy of notes or class presentations before the lesson begins • Allow the student to use a dictionary that does not include mathematical terms	• Allow the student to read shorter versions of the mathematics textbook that may not contain grade-level vocabulary • Shorten story problems by reducing the number of relevant mathematical steps needed to respond • Reduce the reading expectation for word problems (e.g., removing irrelevant information) • Allow the student to use a dictionary on tests that includes mathematical terms

Differentiated Instruction

Accommodations

Modifications

Changes to the presentation, setting, timing or schedule, and response mode of instruction

Table 3.4. Some examples of setting changes

Accommodations	Modifications
• Change the location where the student is completing the assignment • Provide a separate location for the student to complete the assignment • Allow the student to use a physical device to reduce distractions (i.e., headphones or study carrel) • Allow the student to complete an assignment in a small group or in a room with fewer students • Use specialized lighting or acoustic devices	• Allow the student to work with a partner on a task that is intended to be completed alone

Differentiated Instruction

Accommodations

Modifications

Changes to the presentation, setting, timing or schedule, and response mode of instruction

Table 3.5. Some examples of timing or scheduling changes

Accommodations	Modifications
• Provide longer time for the student to complete an assignment, as needed • Allow the student to take multiple breaks while completing an assignment • Allow the student to take a test at a certain time of the day (e.g., first thing in the morning)	• Provide more time for the student to respond to an assignment or test that is intended to be timed (e.g., allow twice as much time as intended) • Extend the number of sessions a student has to complete an assignment or test that is intended to be timed (e.g., allow the student to take a test over 2 days)

Differentiated Instruction

Accommodations

Modifications

Changes to the presentation, setting, timing or schedule, and response mode of instruction

Table 3.6. Some examples of response mode changes

Accommodations	Modifications
• Allow the student to write responses to assignments instead of speaking them aloud • Allow the student to speak responses to assignments instead of writing them • Allow the student to use a communication device • Allow audio recording of teachers' presentations • Use a scribe • Use concrete objects and manipulatives • Use a graphic organizer to organize one's thoughts • Use a calculator or multiplication chart on an assignment that *does not* assess computation	• Require fewer items on an assignment or fewer assignments • Reduce the number of answer options on a multiple-choice assignment • Describe one's thinking (i.e., explanation, justification) at a reduced depth • Use a calculator or multiplication chart on an assignment that *does* assess computation • Have material scored using a different rubric or level of expectations than other students

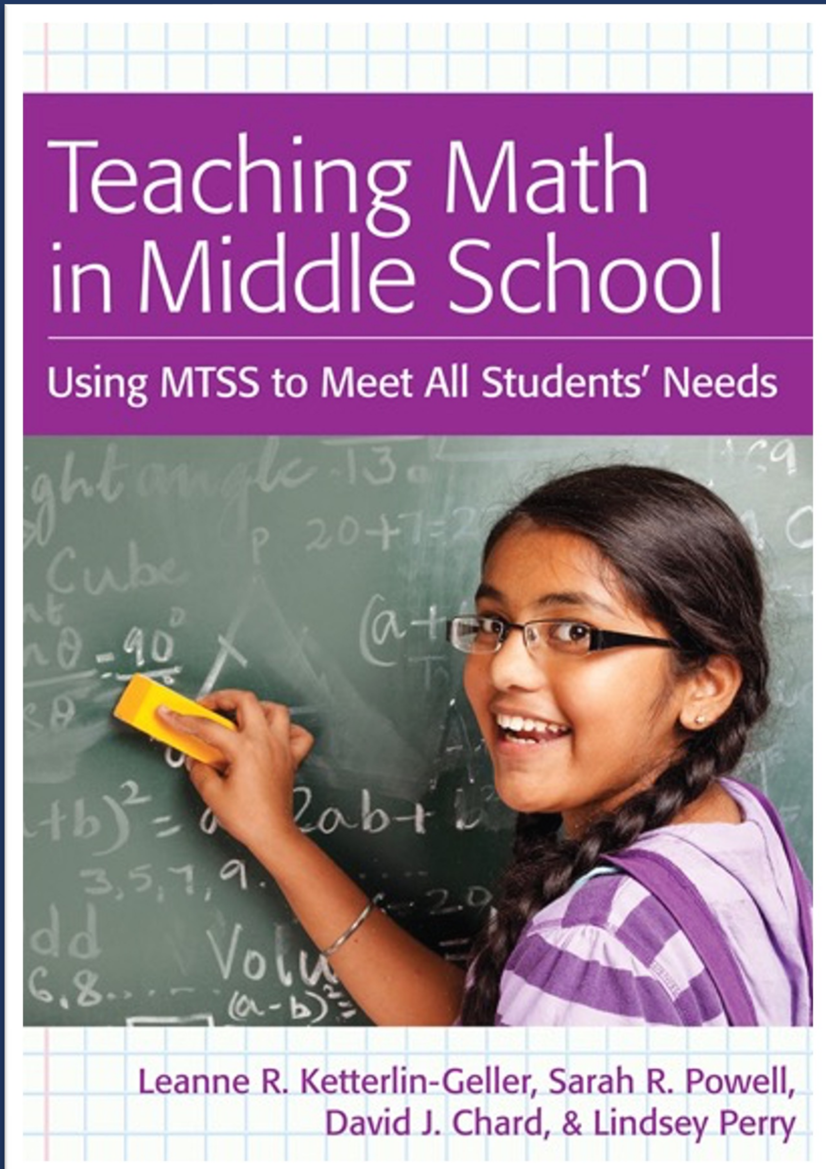
Differentiated Instruction

Accommodations

Modifications

Describe your strengths with accommodations and modifications.

Describe your opportunities for growth with accommodations and modifications.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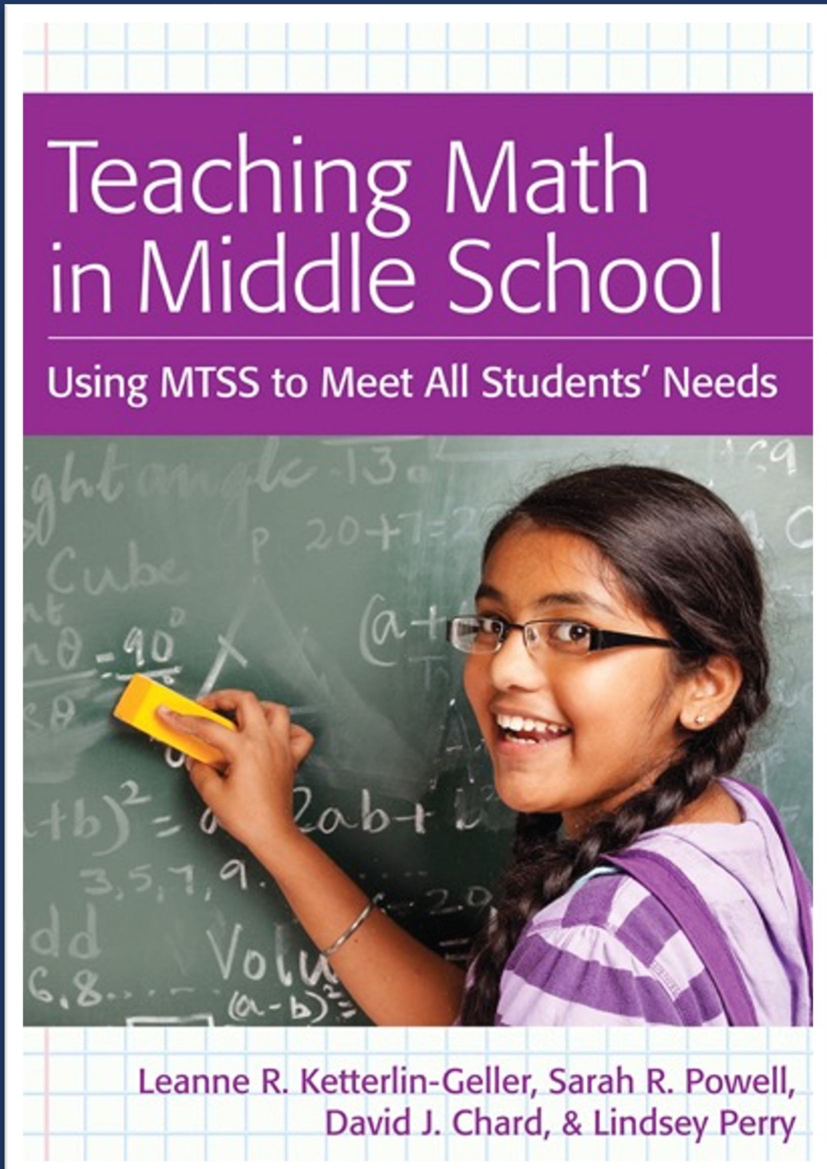
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Instructional Platform

INSTRUCTIONAL DELIVERY

Explicit instruction

Precise language

Multiple representations

INSTRUCTIONAL STRATEGIES

Fluency building

Problem solving instruction

evidence-based practice

evidence-based intervention

evidence-based strategy

promising practice

Assessment data to show results

Improvement from before intervention

Improvement compared to no treatment students

Replication

Multiple researchers

Multiple students

Multiple times

Setting and students similar to your own

How do you locate and identify *evidence-based practices?*

Which *evidence-based practices* do you plan to use?

Instructional Platform

Instructional Delivery

Instructional Strategies

Instructional Platform

INSTRUCTIONAL DELIVERY

- Explicit instruction
- Precise language
- Multiple representations

INSTRUCTIONAL STRATEGIES

- Fluency building
- Problem solving instruction

Explicit Instruction

Chapter 5: Explicit Instruction

MODELING

PRACTICE

SUPPORTS

Page 69

Instructional Platform

INSTRUCTIONAL DELIVERY

Explicit instruction

INSTRUCTIONAL STRATEGIES

MODELING	PRACTICE
Step-by-step explanation Planned examples	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

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

A teacher may do 1 modeled problem or several.

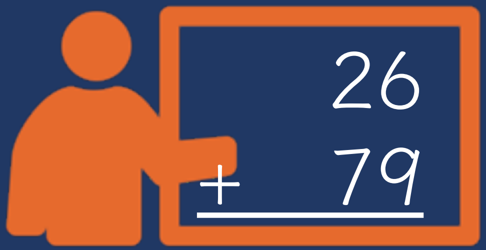
MODELING	PRACTICE
Step-by-step explanation	Guided practice
Planned examples	Independent practice

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."

$$\begin{array}{r} 26 \\ +\ 79 \\ \hline \end{array}$$

"Let's solve this problem. What's the problem?"

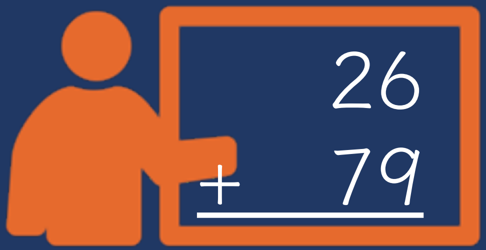
"26 plus 79."

"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?"

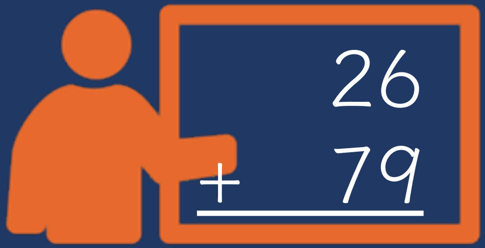
"Partial sums."

"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?"

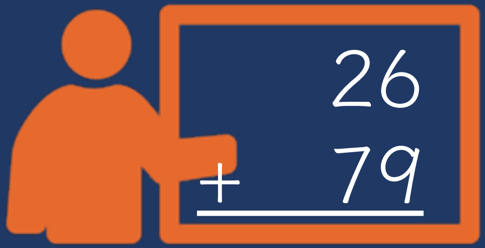
"90." 

"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?"

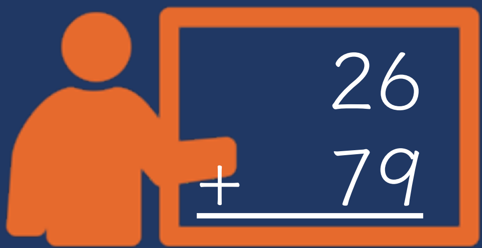
"15."

"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?"

"105."

"How did you add those numbers?"

"I added 90 plus 10 then added 5 more."

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

"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.

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

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

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

Practice continues as a dialogue between the teacher and students.

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

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

"Let's work on a problem together."

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

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 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	PRACTICE
Step-by-step explanation Planned examples	Guided practice Independent practice

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.**

MODELING	PRACTICE
Step-by-step explanation Planned examples	Guided practice Independent practice

SUPPORTS

Ask high-level and low-level questions

Eliciting frequent responses

Providing affirmative and corrective feedback

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

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 is 7 times 9?"

"63."

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

"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."

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

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

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

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

MODELING	PRACTICE
Step-by-step explanation Planned examples	Guided practice Independent practice

SUPPORTS

Ask high-level and low-level questions

Eliciting frequent responses

Providing affirmative and corrective feedback

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

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

“Nice work using your word problem attack strategy.”

MATH

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

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

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	PRACTICE
Step-by-step explanation	Guided practice
Planned examples	Independent practice

SUPPORTS

Ask high-level and low-level questions

Eliciting frequent responses

Providing affirmative and corrective feedback

What are your strengths with explicit instruction?

What are opportunities for growth with explicit instruction?

Mathematical Language

Instructional Platform

INSTRUCTIONAL DELIVERY

Explicit instruction

Precise language

INSTRUCTIONAL STRATEGIES

Chapter 5: Mathematical Language

Instead of that...	Say this...

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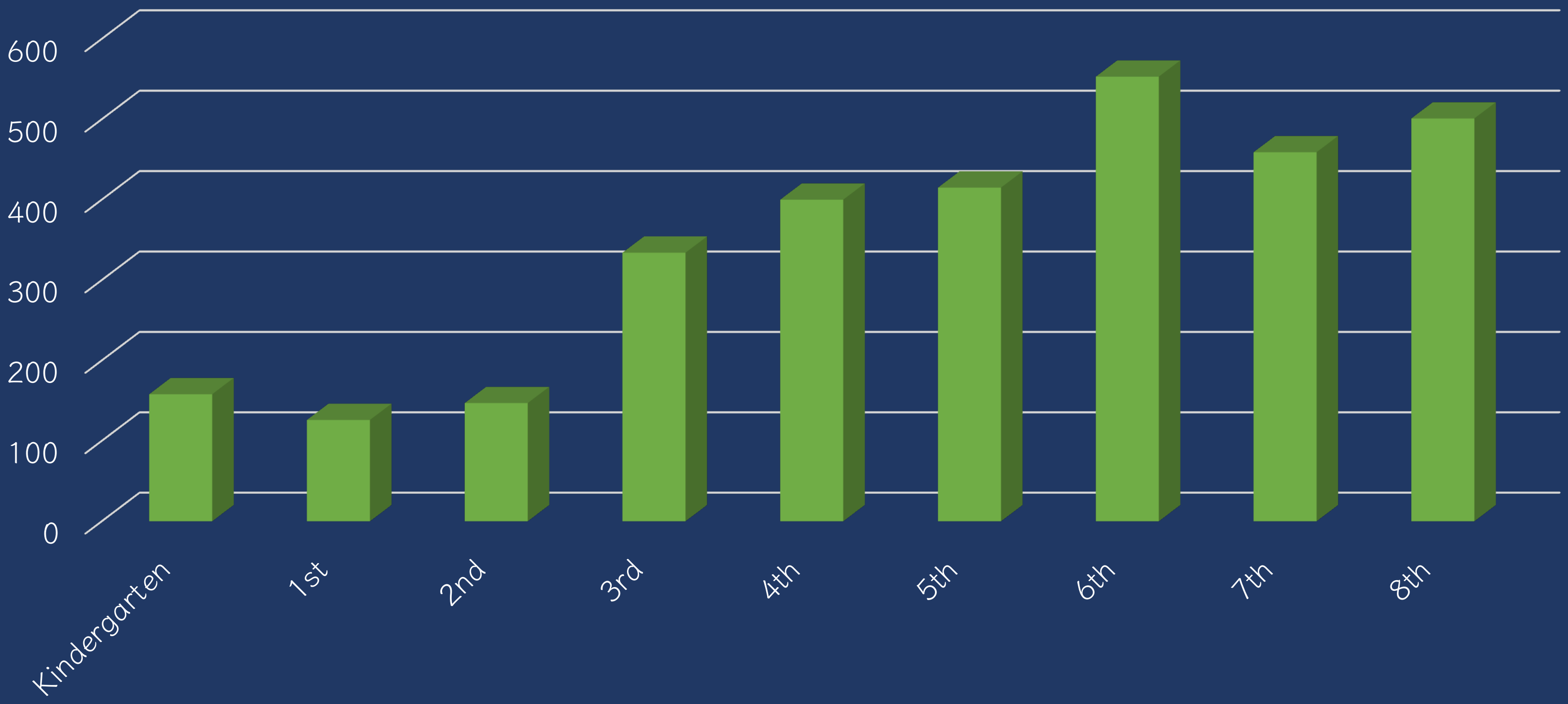
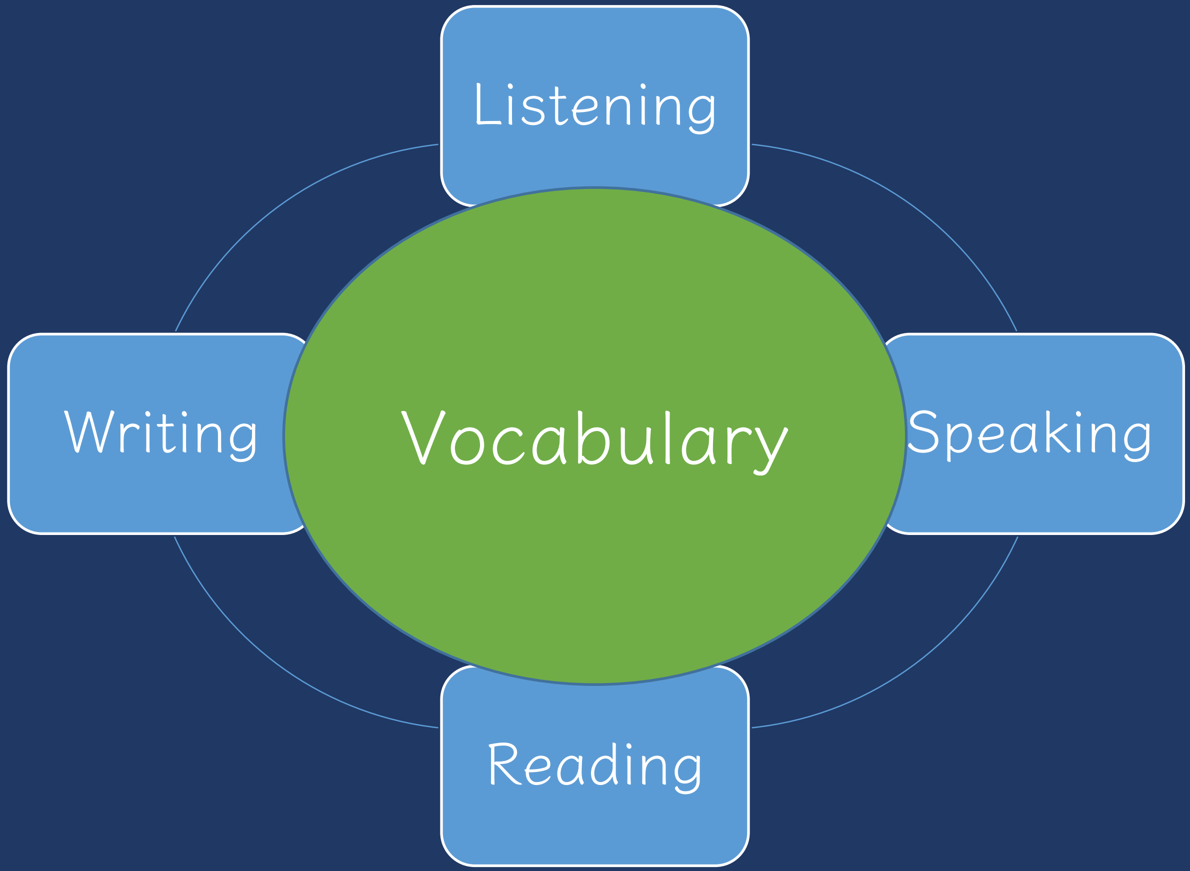


Powell, Bos, & Lin (2019)


Listening
Writing
Vocabulary
Speaking
Reading

Use formal math language

Use terms precisely

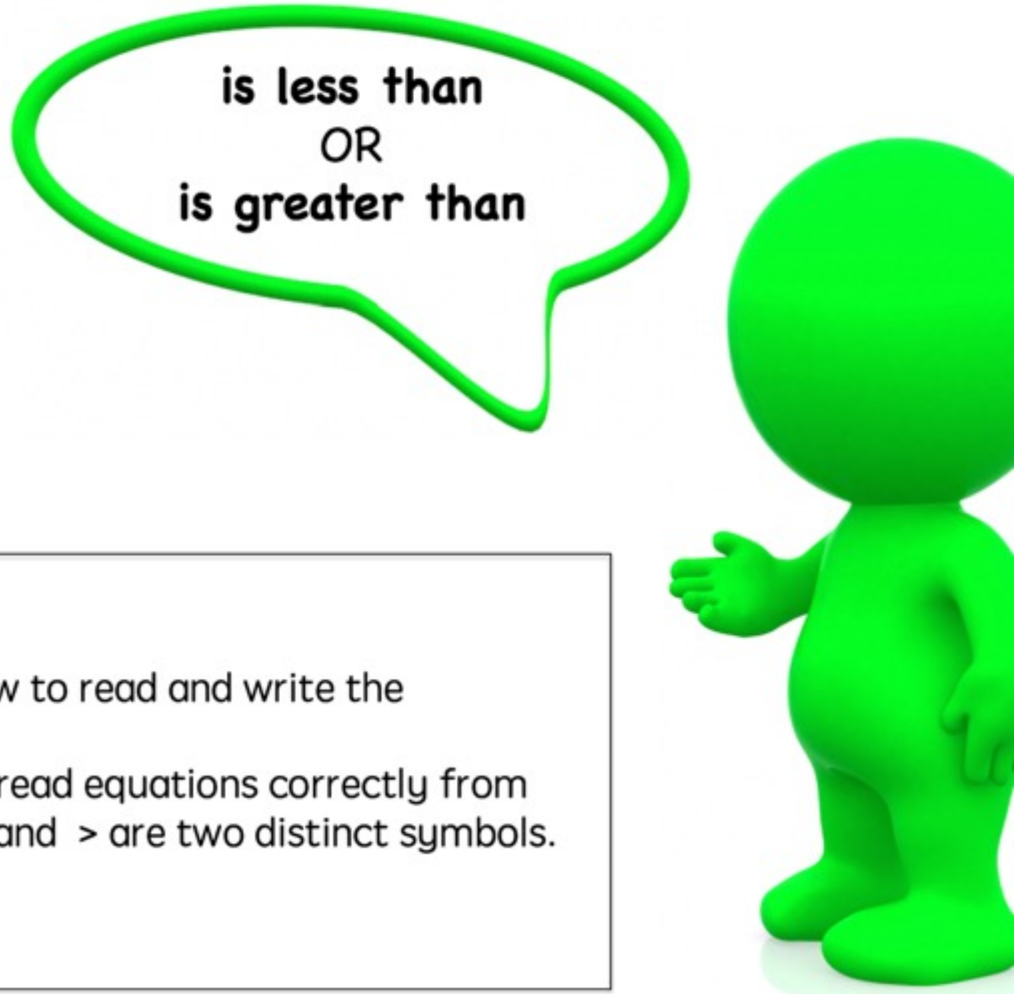
What number is in the tens place?

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

135

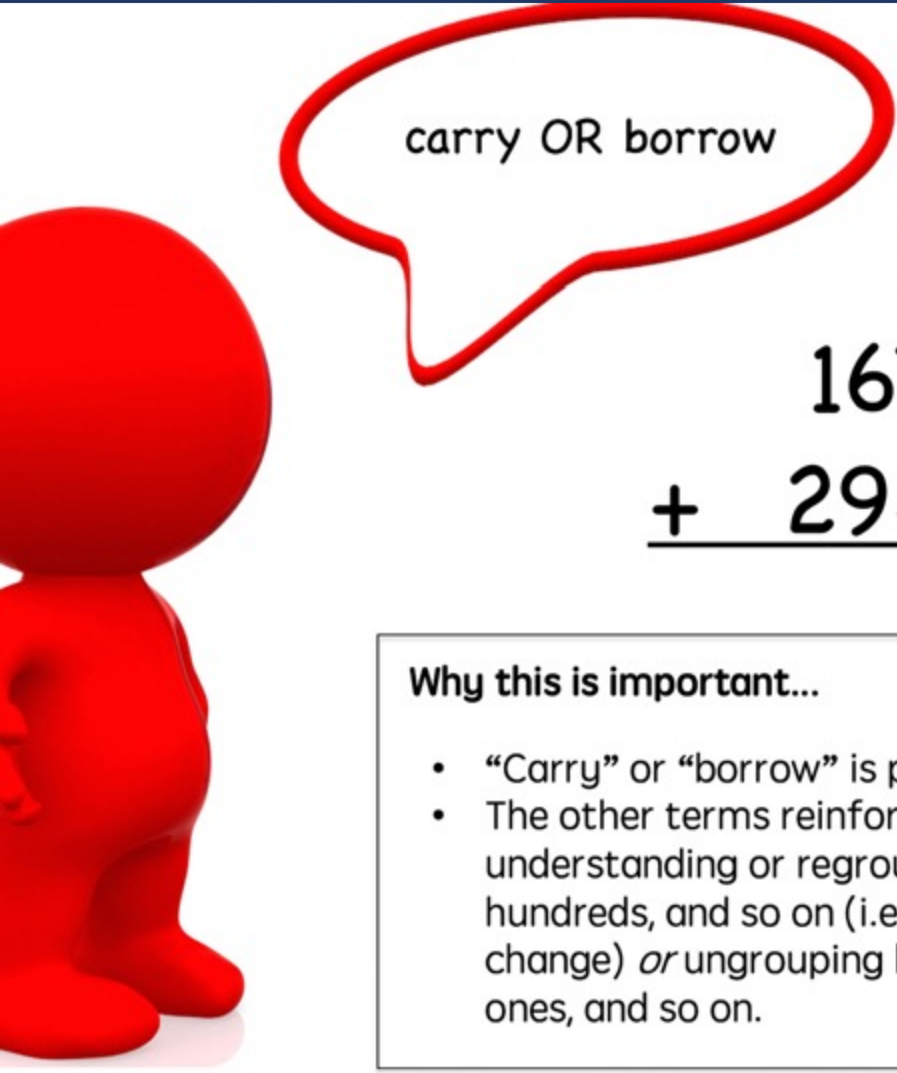
Why this is important…

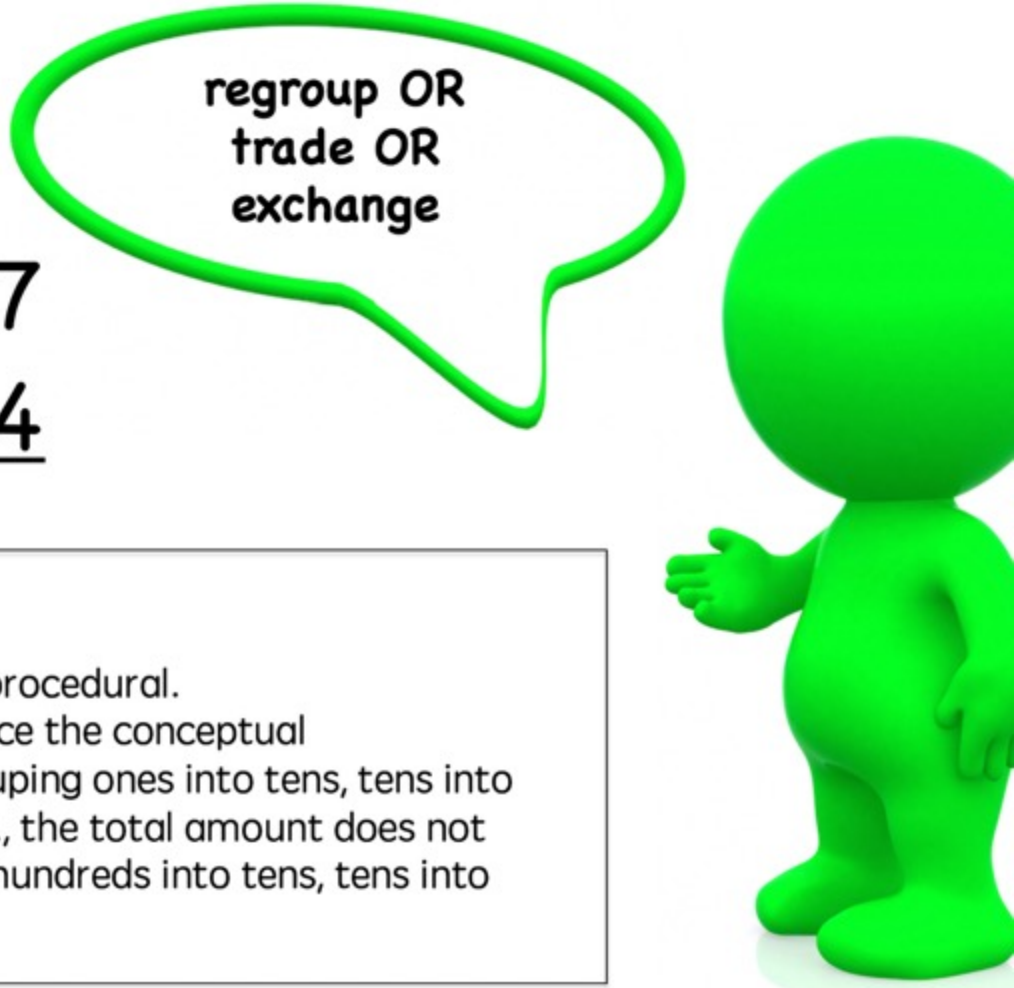
- A number refers to the entire amount.
- The 3 in the tens place value is not a number, but rather a digit in the number 135.
- Reinforces conceptual understanding of place value.
- Emphasizes that 3 is part of the number 135 with a value of 30.



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.

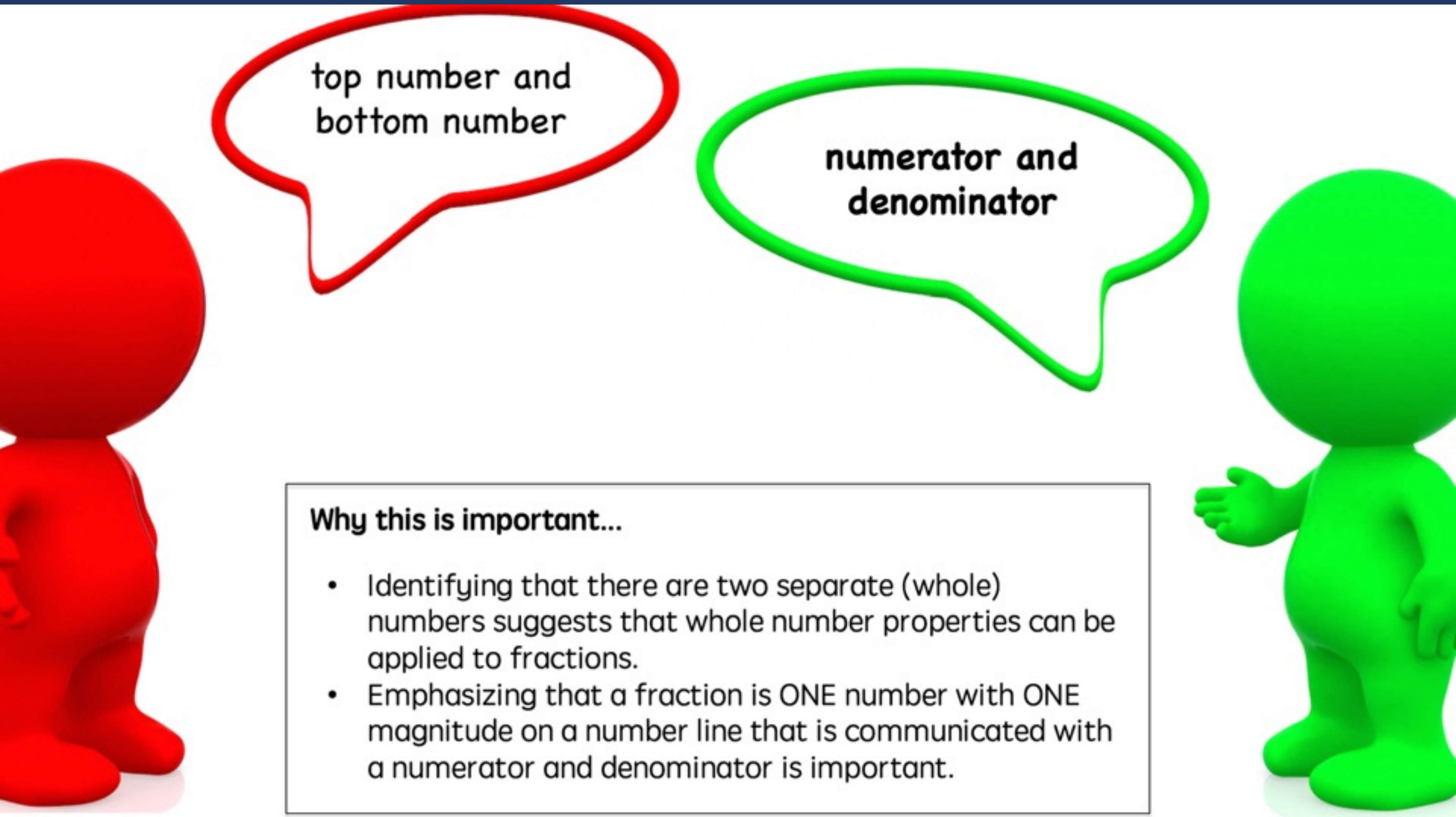




$$\begin{array}{r} 167 \\ +\quad 294 \\ \hline \end{array}$$

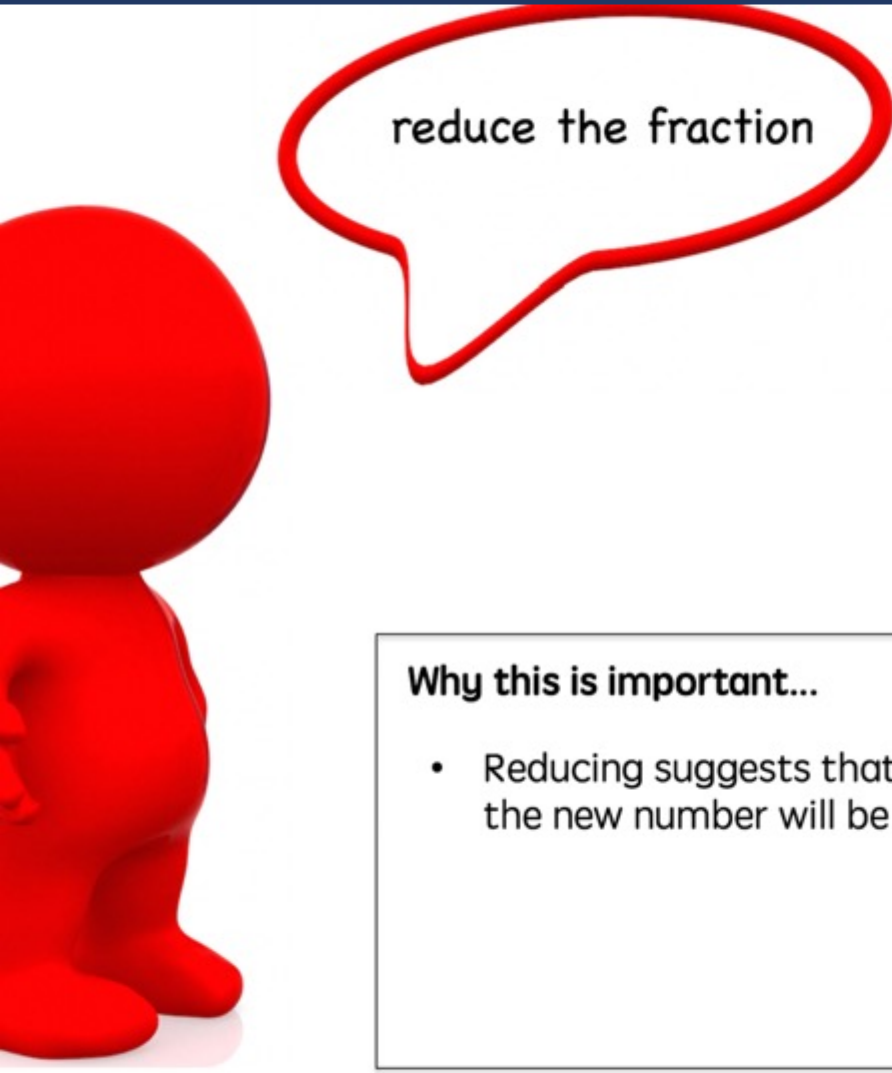
Why this is important...

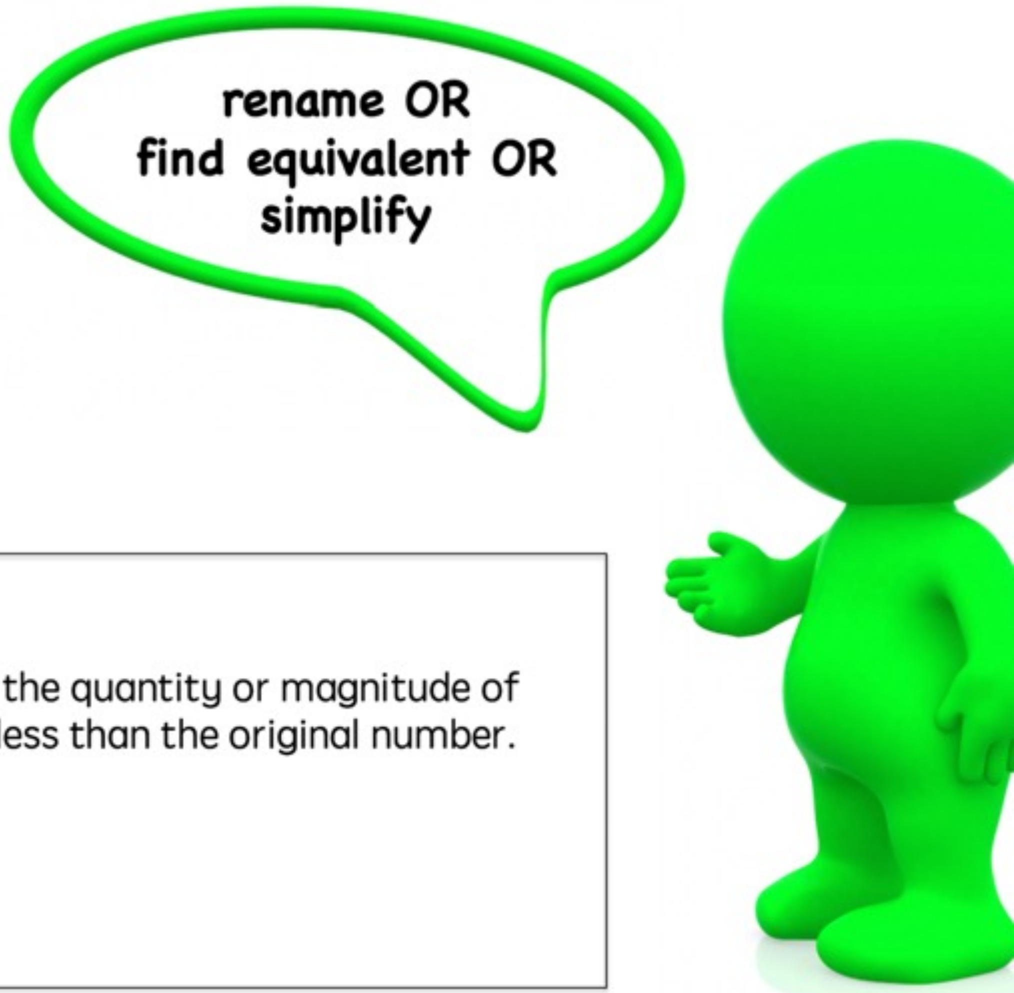
- "Carry" or "borrow" is procedural.
- The other terms reinforce the conceptual understanding or regrouping ones into tens, tens into hundreds, and so on (i.e., the total amount does not change) *or* ungrouping hundreds into tens, tens into ones, and so on.



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.





Why this is important...

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

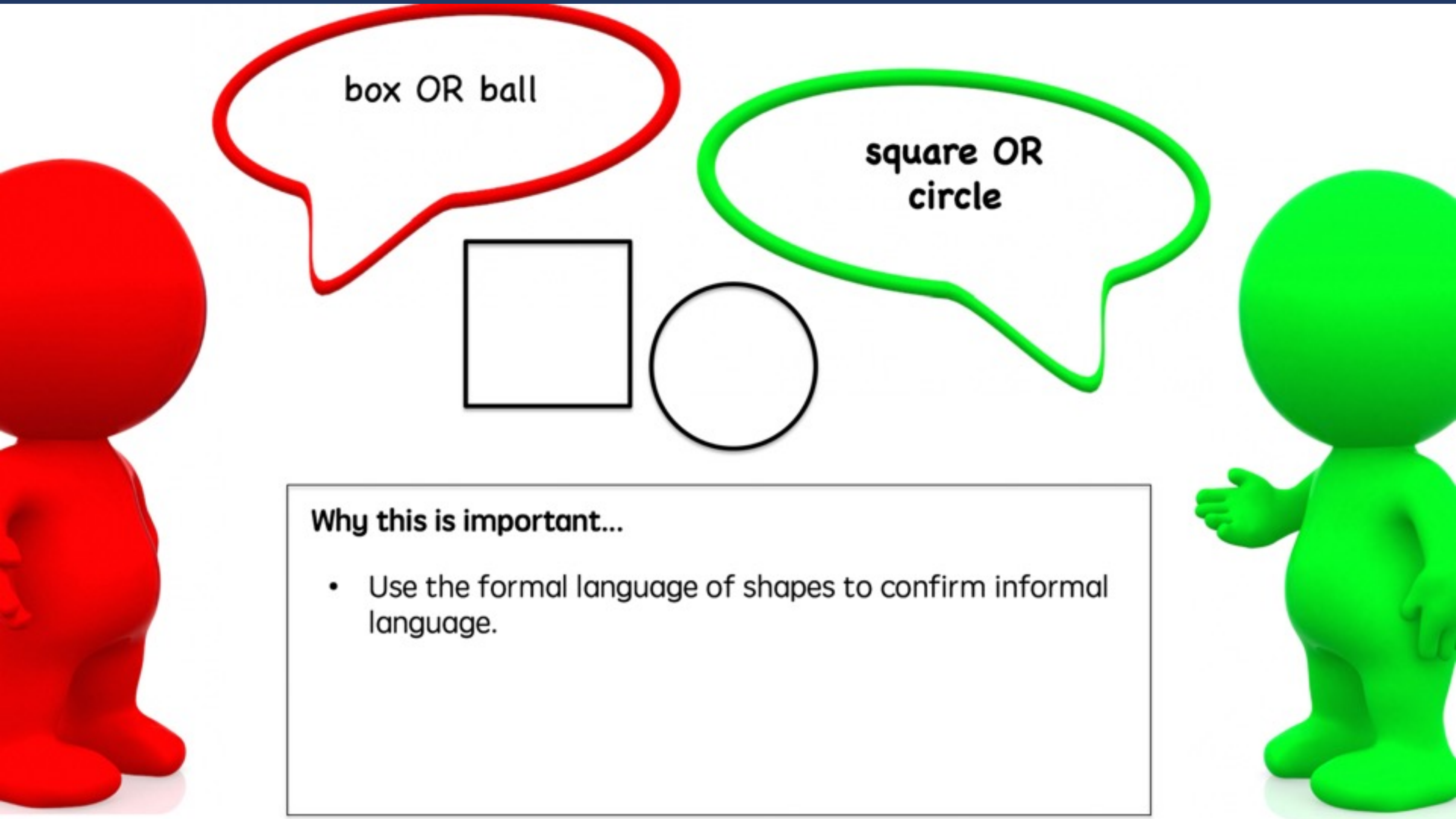
Four point seven
Four point oh seven

Four and seven tenths
Four and seven hundredths

4.7
4.07

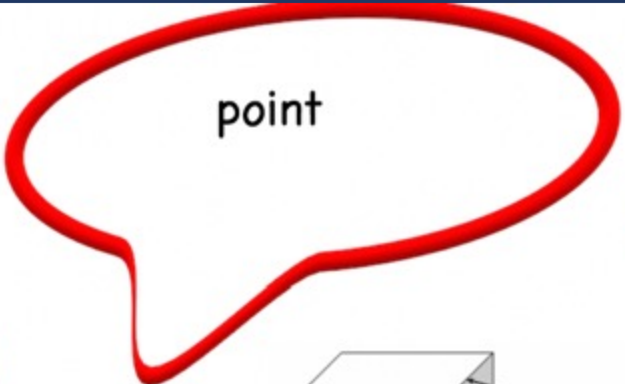
Why this is important...

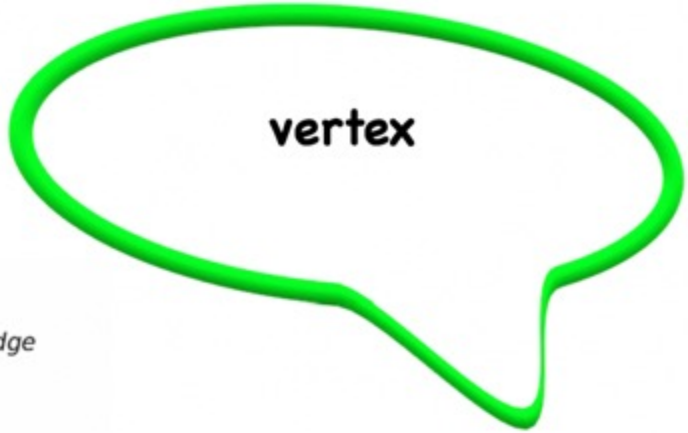
- Accurately shares the magnitude of the decimal.
- Emphasizes place value.

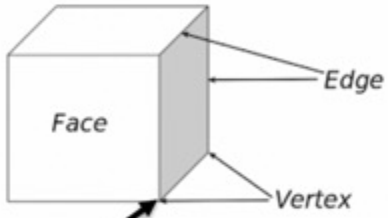


Why this is important…

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

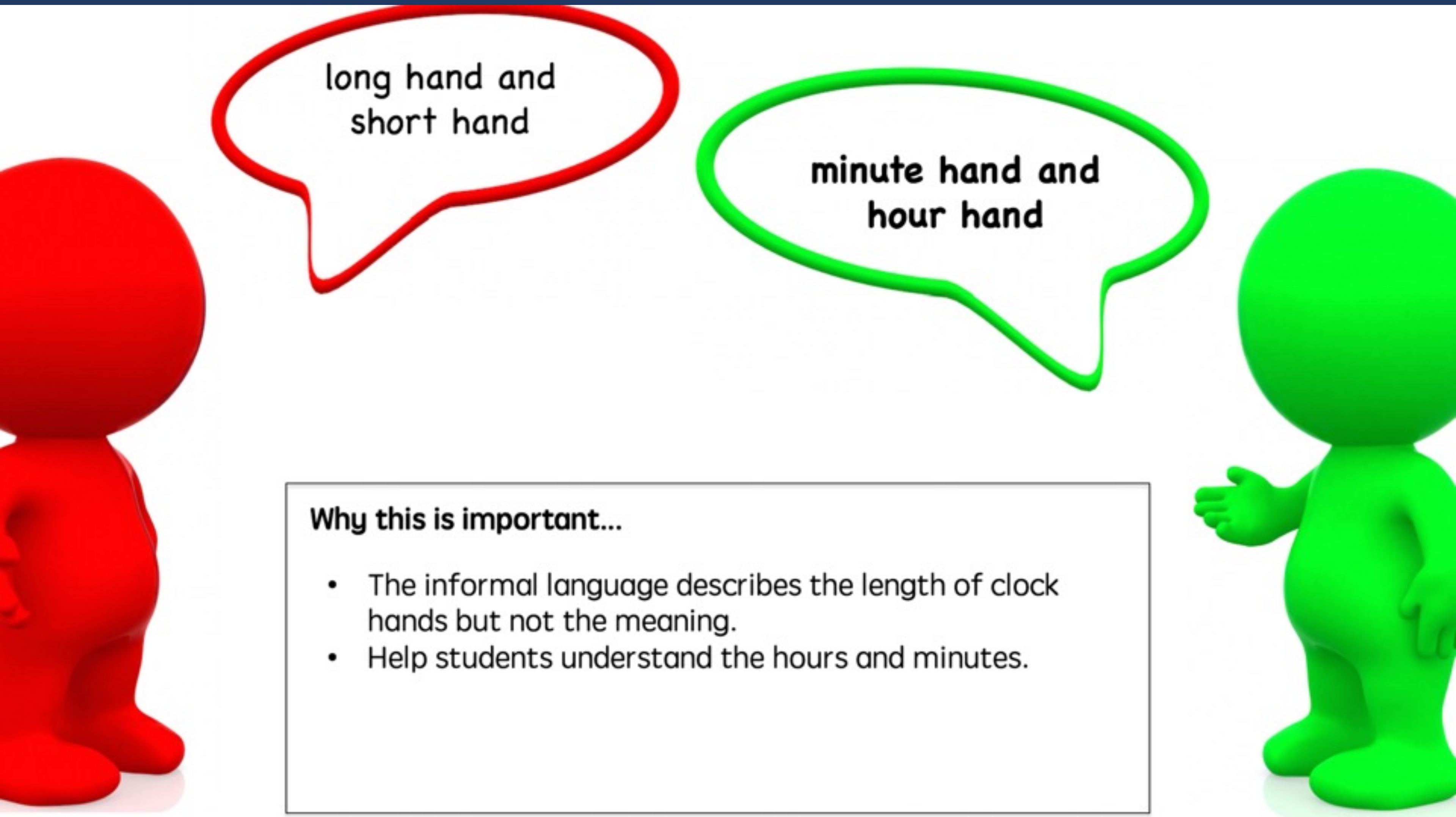






Why this is important...

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



Why this is important...

- The informal language describes the length of clock hands but not the meaning.
- Help students understand the hours and minutes.

Chapter 5: Mathematical Language

Instead of that...	Say this...

Identify examples of "Instead of ____, say ____."

Use formal math language

Use terms precisely

Factor

$$1 \times 8 = 8$$

$$\underbrace{2}_{\text{factor}} \times \underbrace{4}_{\text{factor}} = 8$$

Multiple

$$8 \times 1 = 8$$

$$8 \times 2 = 16$$

multiples of 8

E

Improper fraction

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

Proportion

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

Mixed number

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

Ratio

4:3

Proper fraction

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

Unit fraction

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

D

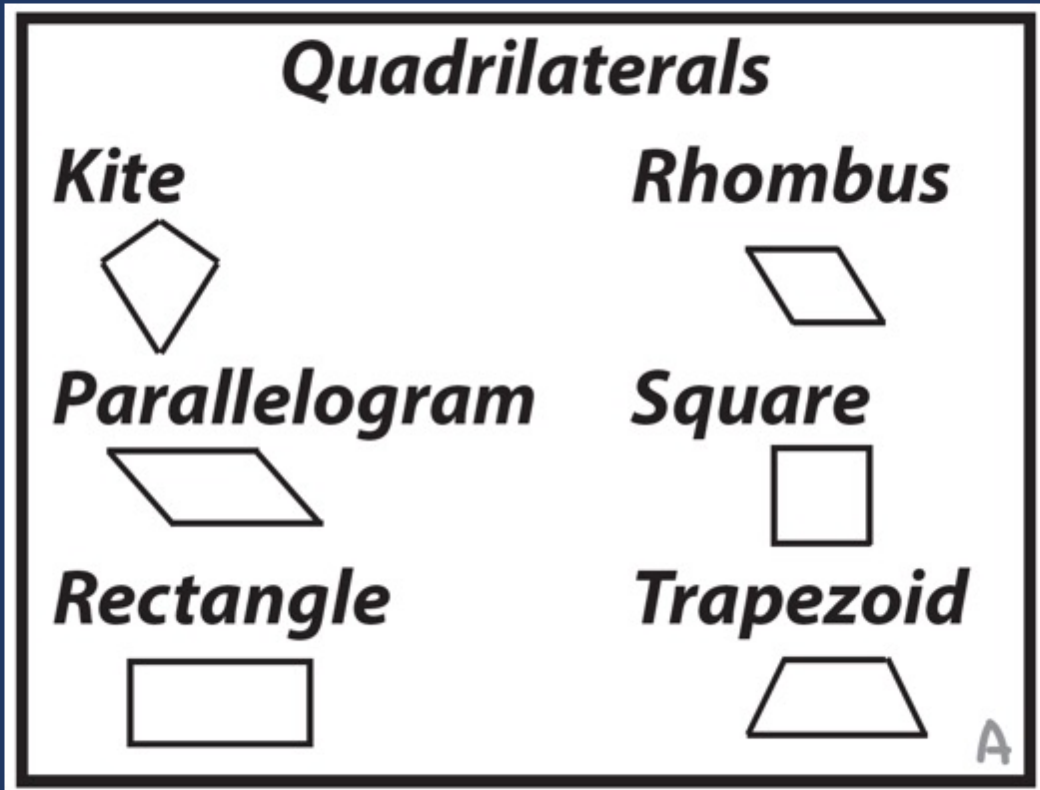
Equation	$9x - 4 = 7x$
Expression	$9x - 4$
Formula	$a^2 + b^2 = c^2$
Function	$f(x)$
Inequality	$9x - 4 > 6x$

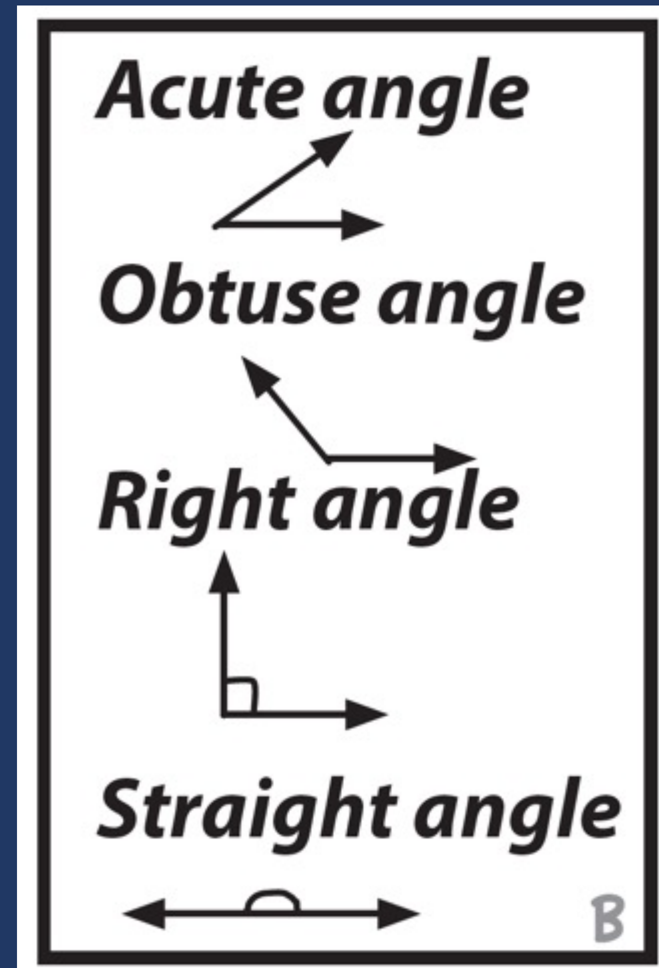
C

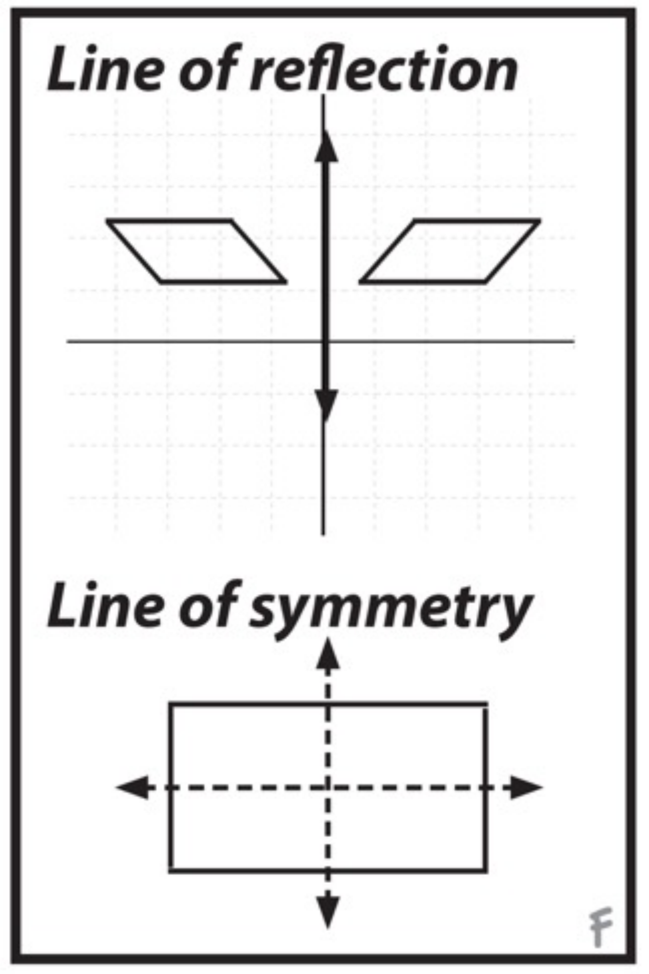
Coefficient
Constant
Term
Variable

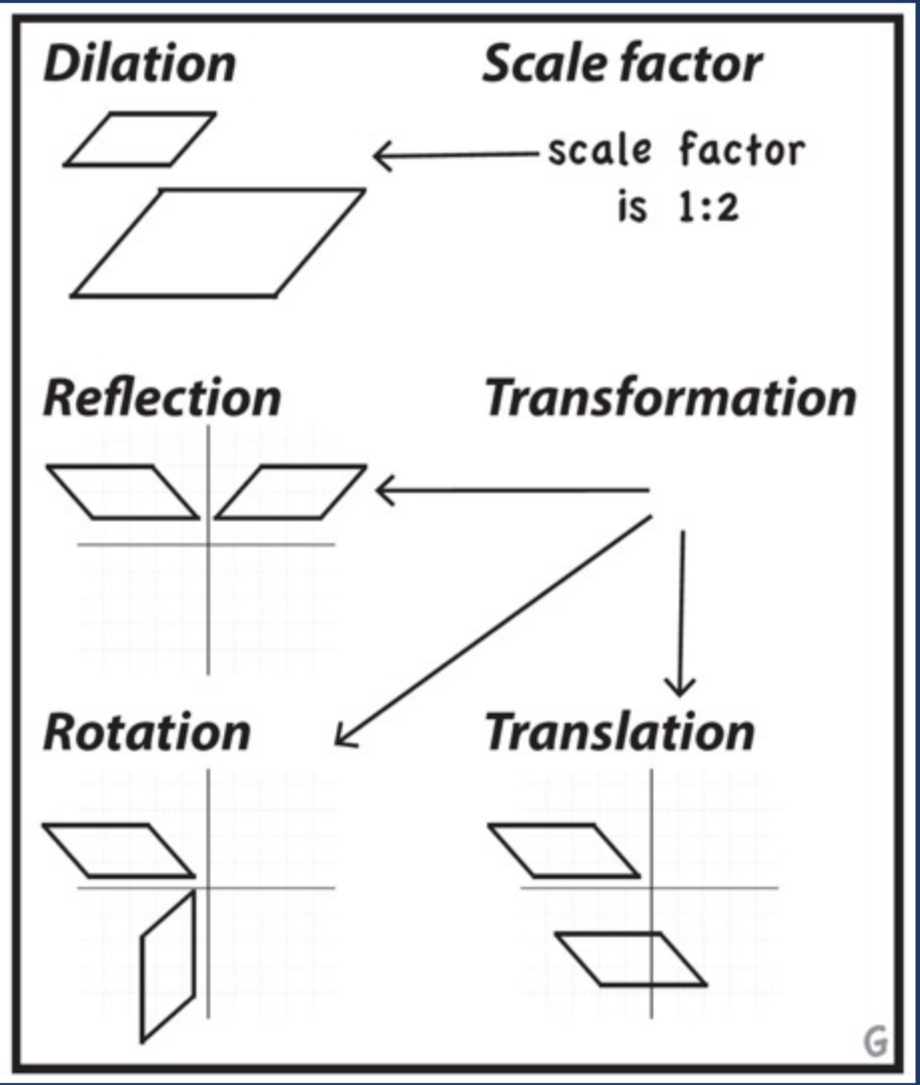
$$\overbrace{\underbrace{2}_{\text{coefficient}}\underbrace{x}_{\text{variable}}^{2}}^{\text{term}} + \overbrace{\underbrace{x}_{\text{variable}}}^{\text{term}} - \overbrace{\underbrace{3}_{\text{constant}}}^{\text{term}}$$

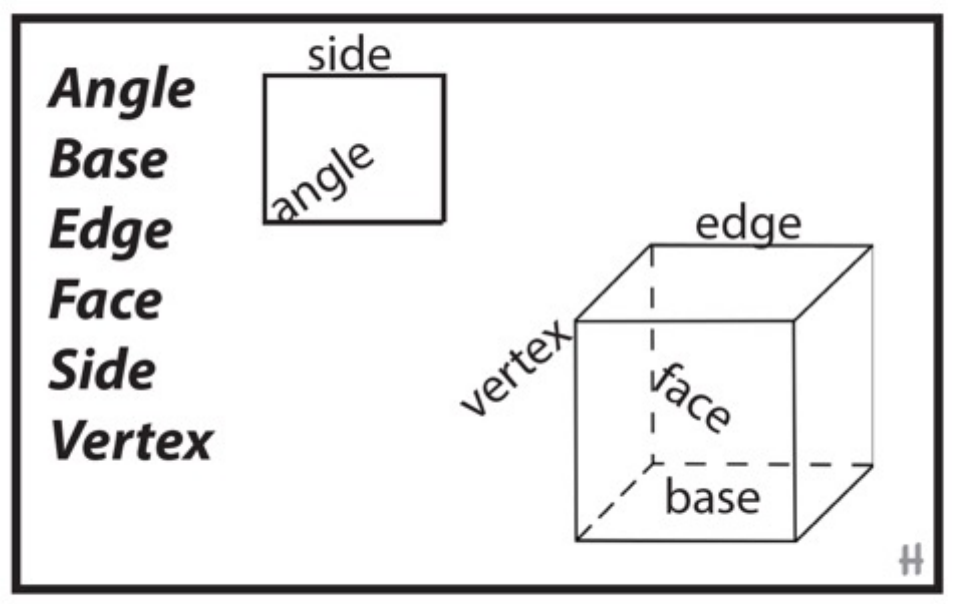
A


Quadrilaterals
Kite
Rhombus
Parallelogram
Square
Rectangle
Trapezoid
A

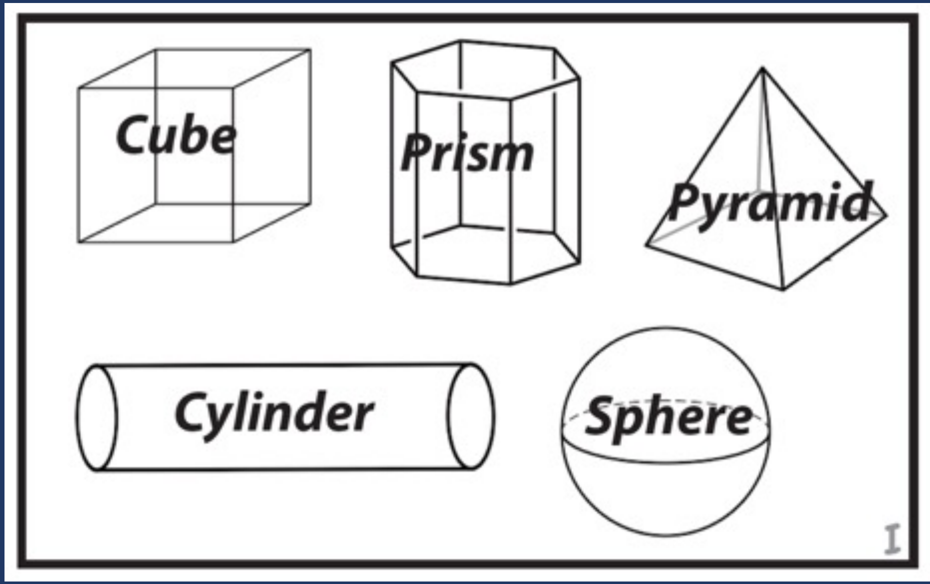

Acute angle
Obtuse angle
Right angle
Straight angle
B


Line of reflection
Line of symmetry
F


Dilation
Scale factor
scale factor
is 1:2
Reflection
Transformation
Rotation
Translation
G



Angle
Base
Edge
Face
Side
Vertex
side
angle
edge
vertex
face
base
H



Cube
Prism
Pyramid
Cylinder
Sphere
I

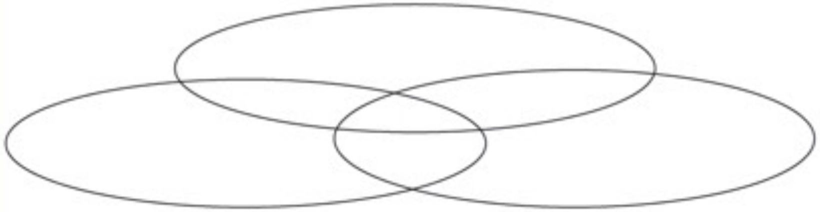
Use formal math language

Use terms precisely

What are your strategies for focusing on math language?

Multiple Representations

Chapter 5: Multiple Representations



Page 74

Instructional Platform

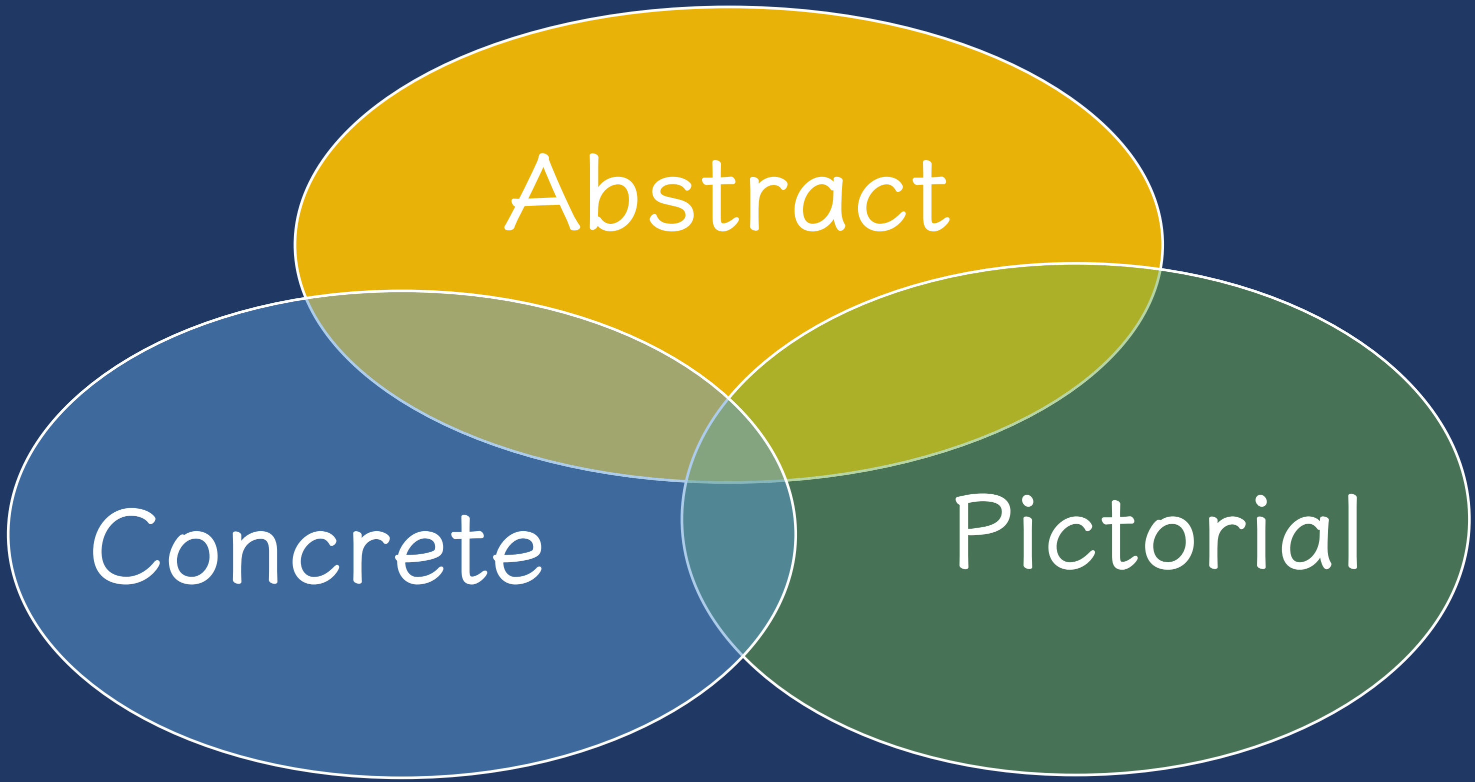
INSTRUCTIONAL DELIVERY

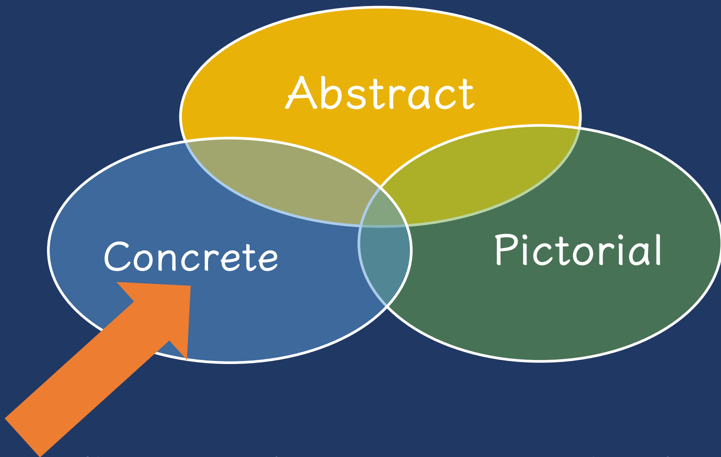
Explicit instruction

Precise language

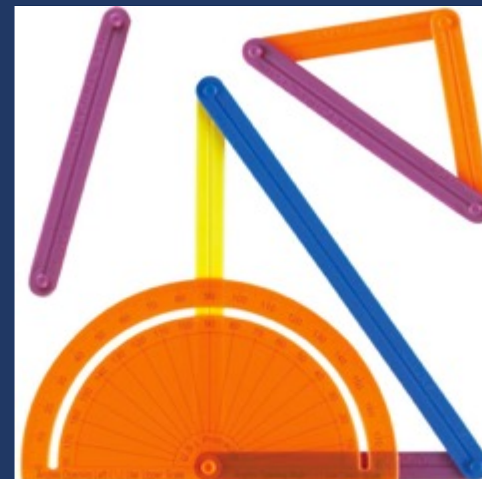
Multiple representations

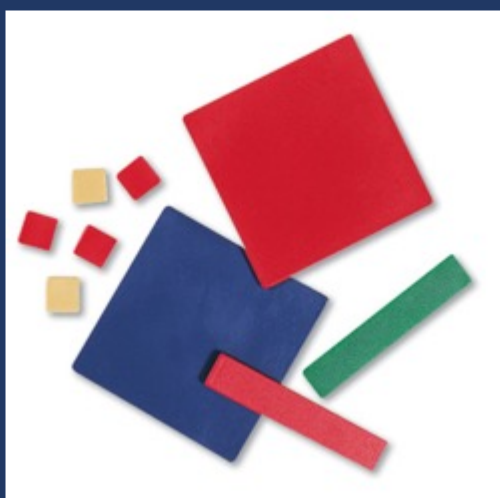
INSTRUCTIONAL STRATEGIES

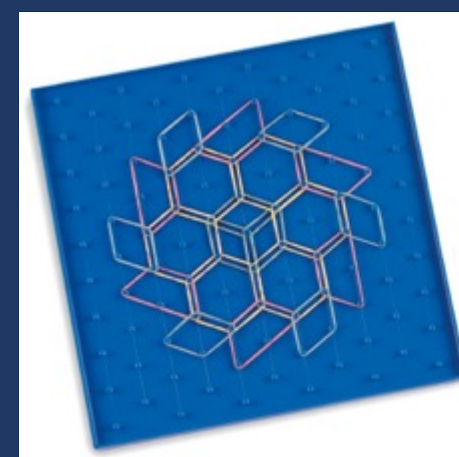

Abstract
Concrete
Pictorial

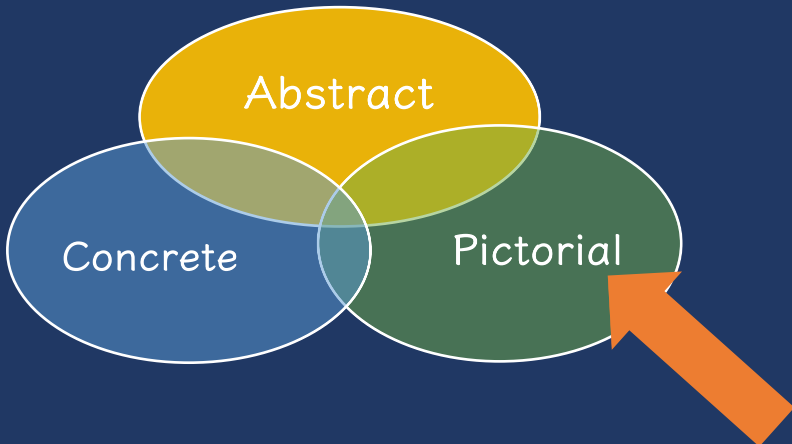


Three-dimensional objects

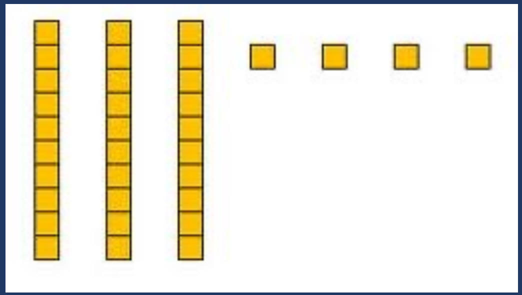


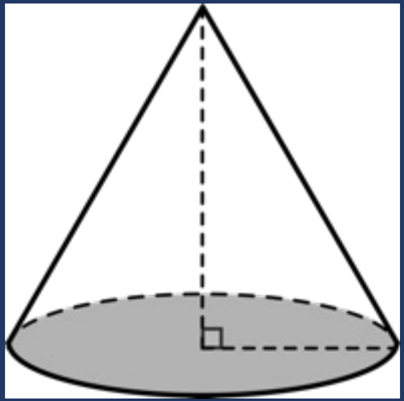


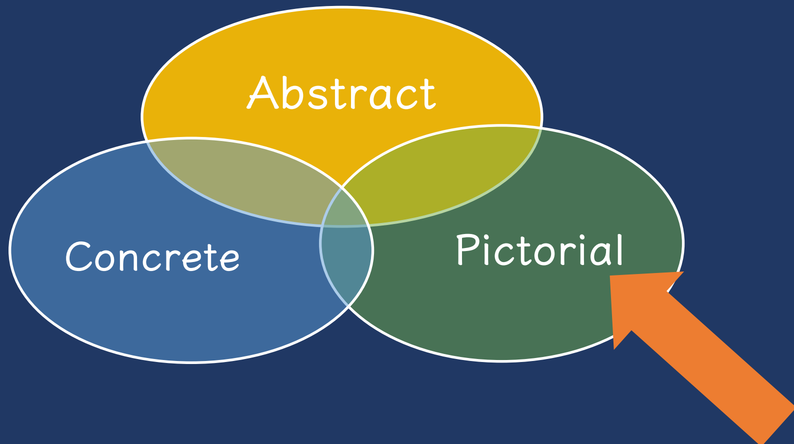




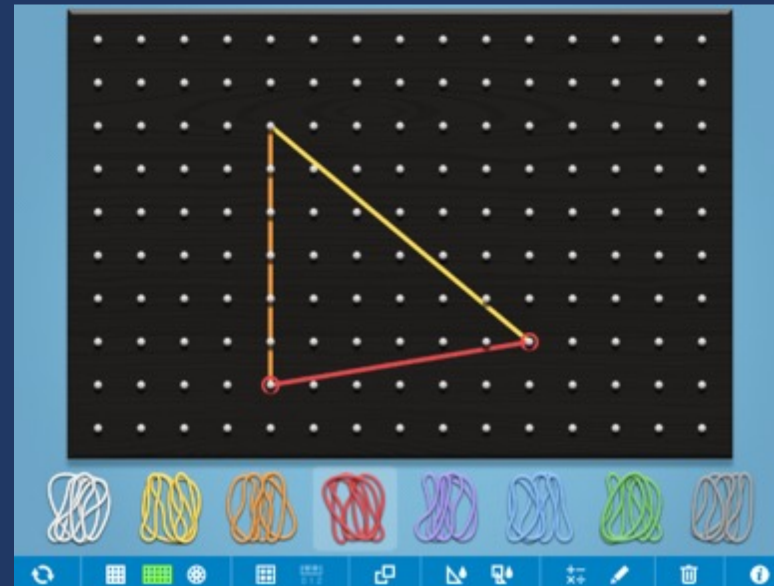
Two-dimensional images

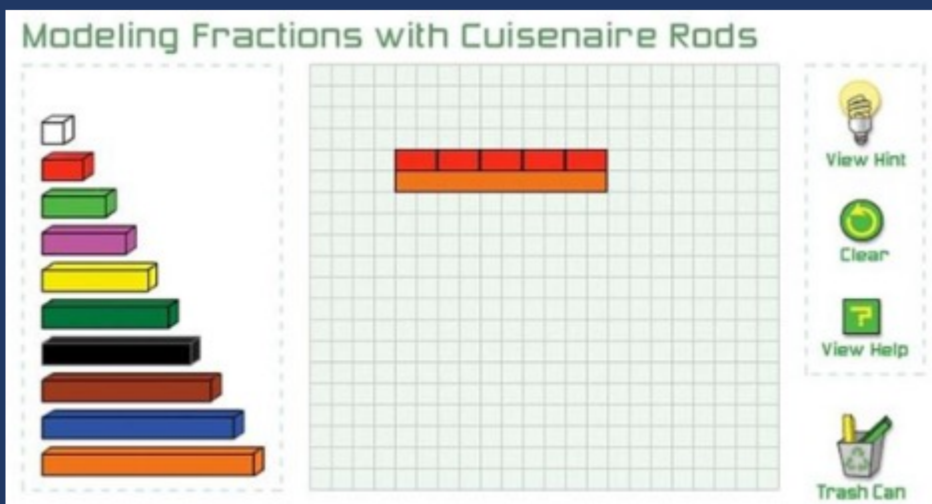


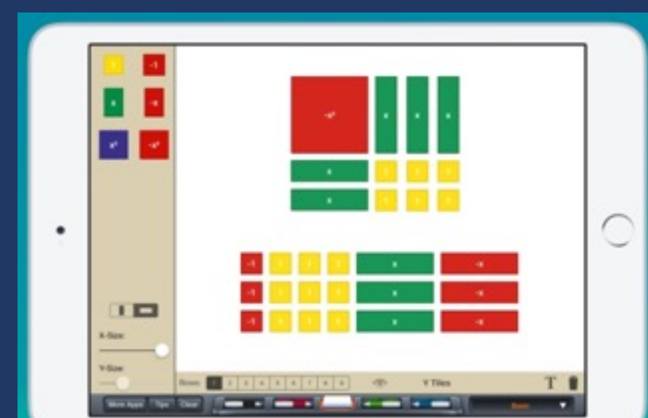


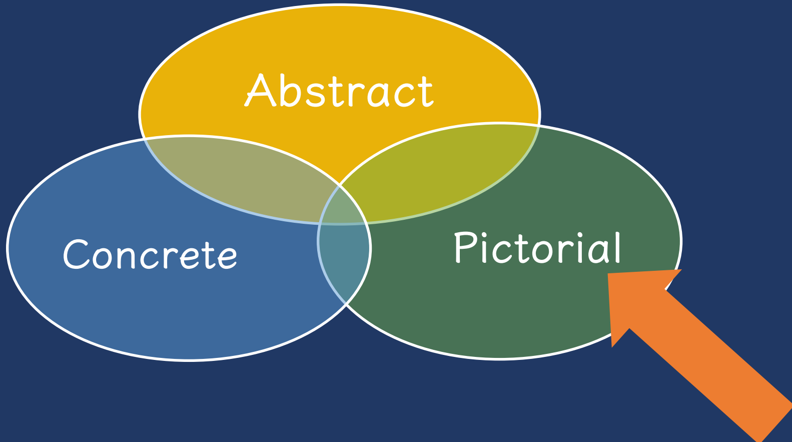


Two-dimensional images



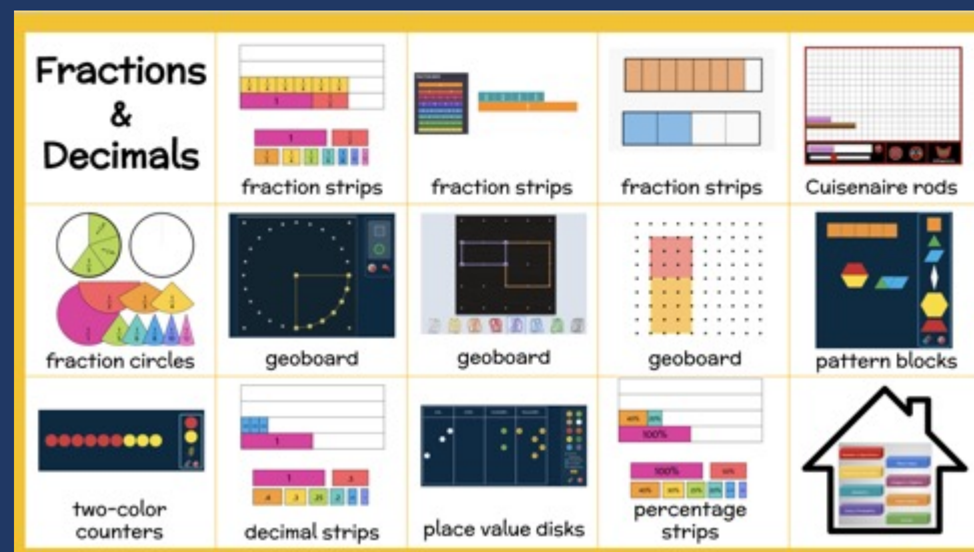


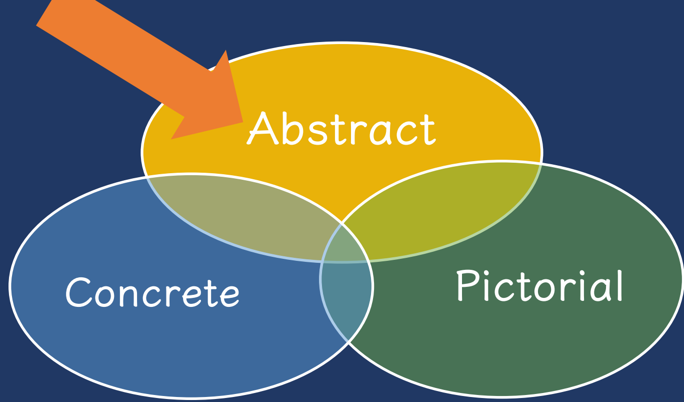




Two-dimensional images

bit.ly/srpowell





Numerals and symbols and words

$2 + 8 = 10$

$34 = 3$ tens and 4 ones

$x - 6 = 8$

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

Explore 3 virtual manipulatives.

Share with a partner.

Building Fluency

Chapter 5: Fluency

Page 78

Instructional Platform

INSTRUCTIONAL DELIVERY

Explicit instruction

Precise language

Multiple representations

INSTRUCTIONAL STRATEGIES

Fluency building

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

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

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

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

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

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

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

Addition	Subtraction
Multiplication	Division

Build fluency with integer computation

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

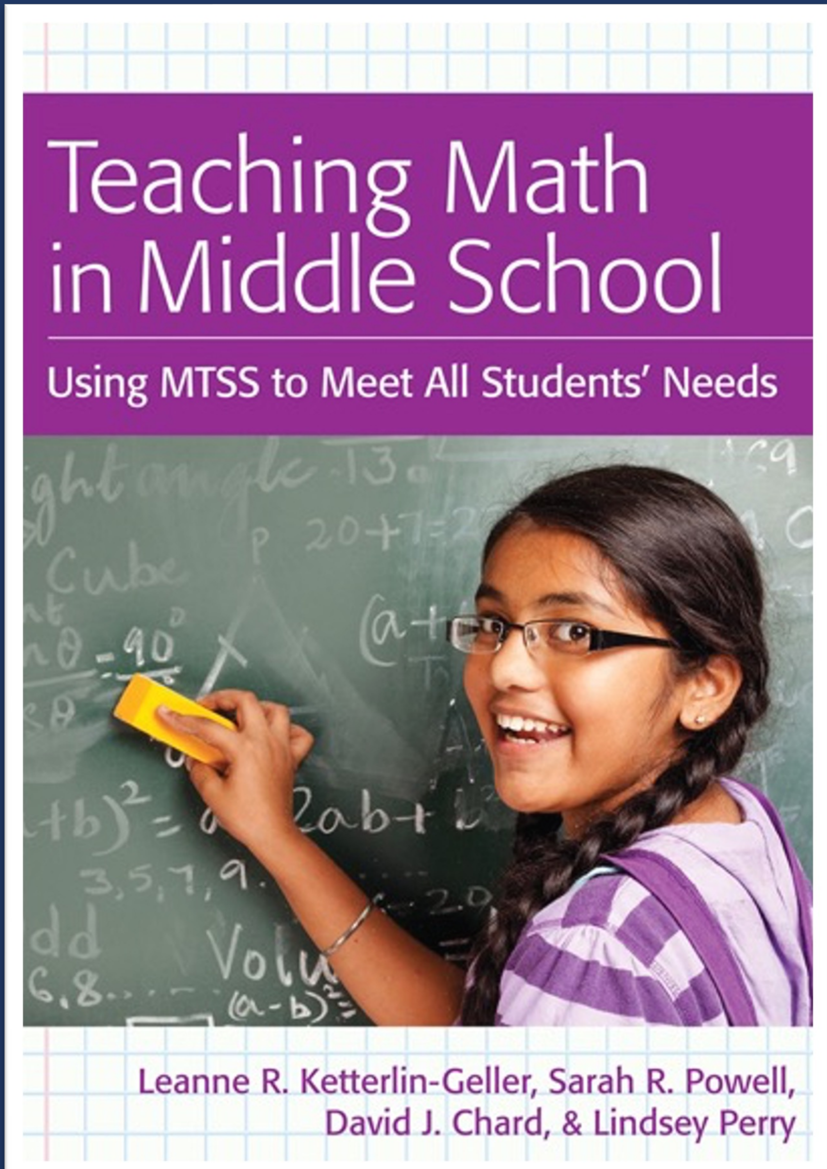
$$\begin{array}{r} 6 \\ \times \quad -12 \\ \hline \end{array}$$

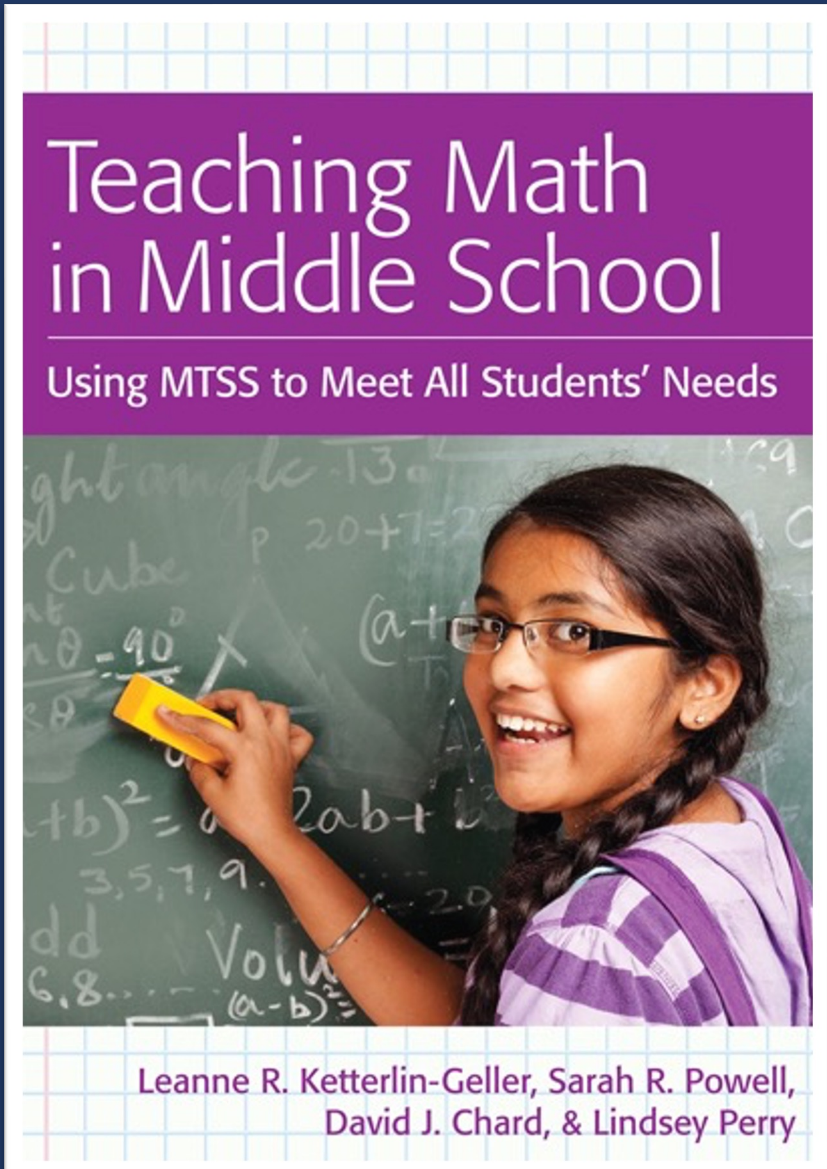
$-14 - (-7) =$

$-135 \div 2 =$

Addition	Subtraction
Multiplication	Division

Describe the fluency needs of your students.


Teaching Math in Middle School
Using MTSS to Meet All Students' Needs
Leanne R. Ketterlin-Geller, Sarah R. Powell, David J. Chard, & Lindsey Perry


Teaching Math in Middle School
Using MTSS to Meet All Students' Needs
Leanne R. Ketterlin-Geller, Sarah R. Powell,
David J. Chard, & Lindsey Perry

Word-Problem Solving

Instructional Platform

INSTRUCTIONAL DELIVERY

Explicit instruction

Precise language

Multiple representations

INSTRUCTIONAL STRATEGIES

Fluency building

Problem solving instruction

How Students Solve Word Problems

N. Donna and Natasha folded 96 paper cranes. Donna folded 25 paper cranes. How many paper cranes did Natasha fold?

N. Donna and Natasha folded 96 paper cranes. Donna folded 25 paper cranes. How many paper cranes did Natasha fold?

N. Donna and Natasha folded 96 paper cranes. Donna folded 25 paper cranes. How many paper cranes did Natasha fold?

43

N. Donna and Natasha folded 96 paper cranes. Donna folded 25 paper cranes. How many paper cranes did Natasha fold?

Donna

N. Donna and Natasha folded 96 paper cranes. Donna folded 25 paper cranes. How many paper cranes did Natasha fold?

96 peper fold

N. Donna and Natasha folded 96 paper cranes. Donna folded 25 paper cranes. How many paper cranes did Natasha fold?

95

N. Donna and Natasha folded 96 paper cranes. Donna folded 25 paper cranes. How many paper cranes did Natasha fold?

$$\begin{array}{r} {}^{1} \\ 96 \\ +\,28 \\ \hline 121 \end{array}$$

N. Donna and Natasha folded 96 paper cranes. Donna folded 25 paper cranes. How many paper cranes did Natasha fold?

$$\begin{array}{r} 1 \\ 96 \\ +25 \\ \hline 121 \end{array}$$

N. Donna and Natasha folded 96 paper cranes. Donna folded 25 paper cranes. How many paper cranes did Natasha fold?

$$\begin{array}{r} 96 \\ +\ 25 \\ \hline 121 \end{array}$$

N. Donna and Natasha folded 96 paper cranes. Donna folded 25 paper cranes. How many paper cranes did Natasha fold?

$$\begin{array}{r} 96 \\ +\ 25 \\ \hline 121 \end{array}$$

N. Donna and Natasha folded 96 paper cranes. Donna folded 25 paper cranes. How many paper cranes did Natasha fold?

$$\begin{array}{r} \overset{1}{9}6 \\ +\ 25 \\ \hline 121 \end{array}$$

N. Donna and Natasha folded 96 paper cranes. Donna folded 25 paper cranes. How many paper cranes did Natasha fold?

$$\begin{array}{r} {}^{+1} \\ 96 \\ +\ 25 \\ \hline 121 \end{array}$$

N. Donna and Natasha folded 96 paper cranes. Donna folded 25 paper cranes. How many paper cranes did Natasha fold?

$$\begin{array}{r} 1 \\ 96 \\ +\ 25 \\ \hline 121 \end{array}$$

N. Donna and Natasha folded 96 paper cranes. Donna folded 25 paper cranes. How many paper cranes did Natasha fold?

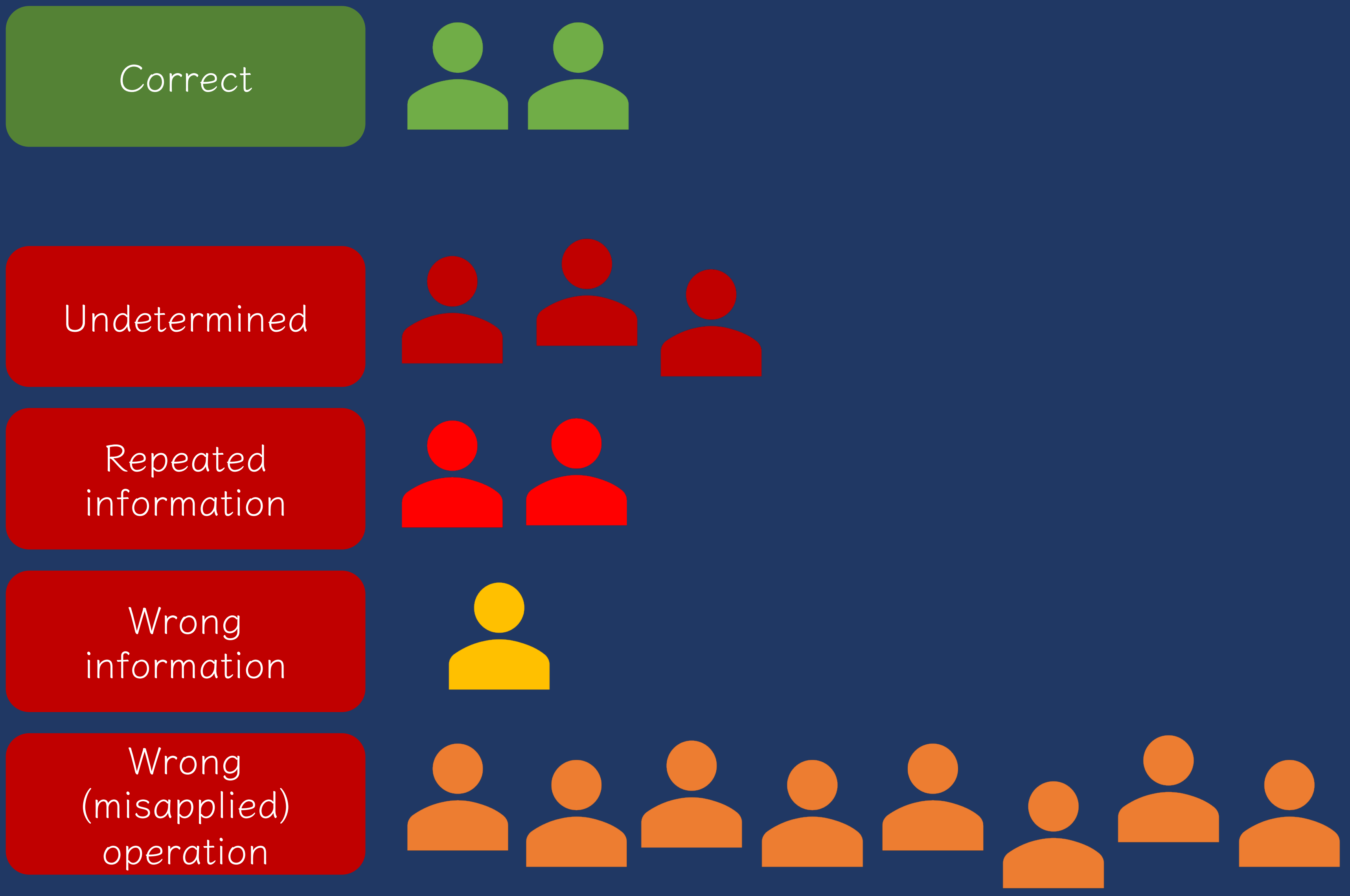
$$\begin{array}{r} {}^{1} \\ 96 \\ +\,25 \\ \hline 121 \end{array}$$

N. Donna and Natasha folded 96 paper cranes. Donna folded 25 paper cranes. How many paper cranes did Natasha fold?

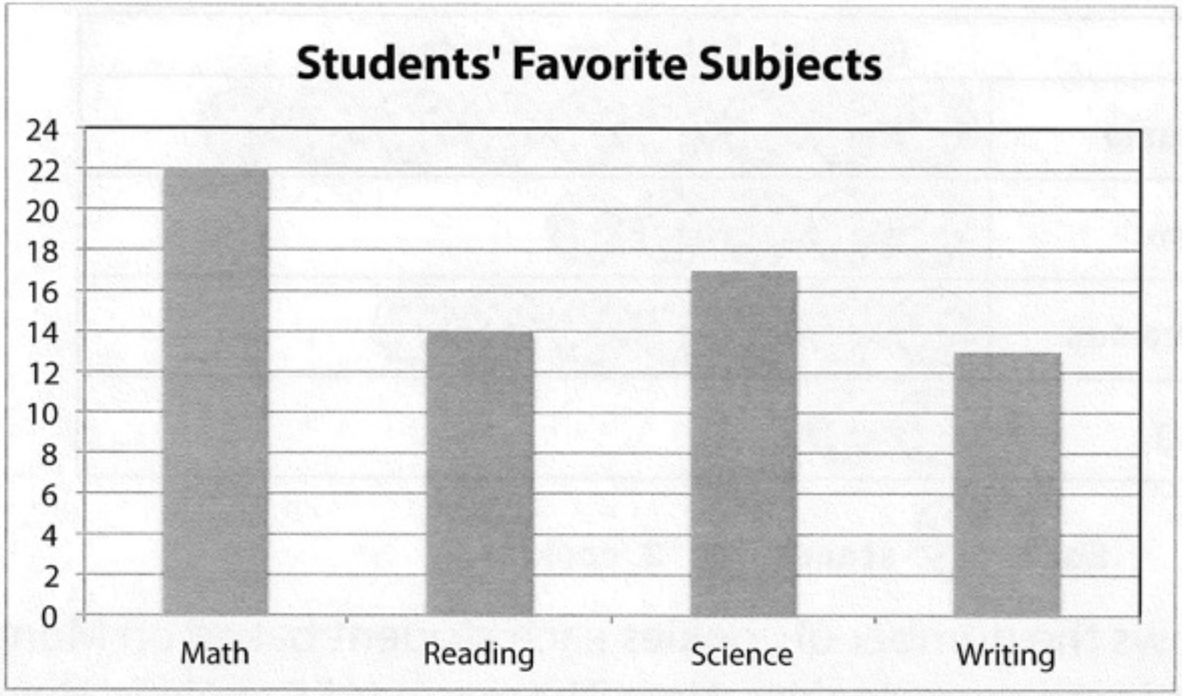
$$\begin{array}{r} 96 \\ -\ 25 \\ \hline 71 \end{array}$$

N. Donna and Natasha folded 96 paper cranes. Donna folded 25 paper cranes. How many paper cranes did Natasha fold?

$$\begin{array}{r} 96 \\ -\ 25 \\ \hline 71 \end{array}$$

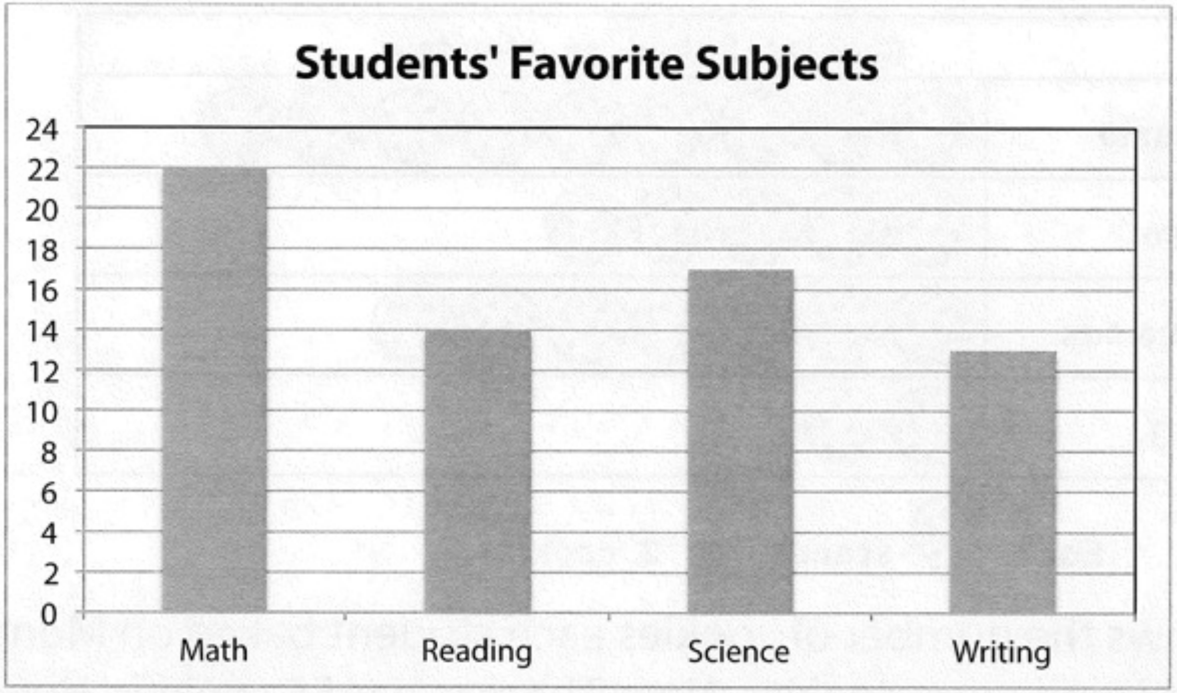

Correct
Undetermined
Repeated information
Wrong information
Wrong (misapplied) operation

J.



The graph shows the favorite subject of third-grade students. How many more students chose Math than chose Writing?

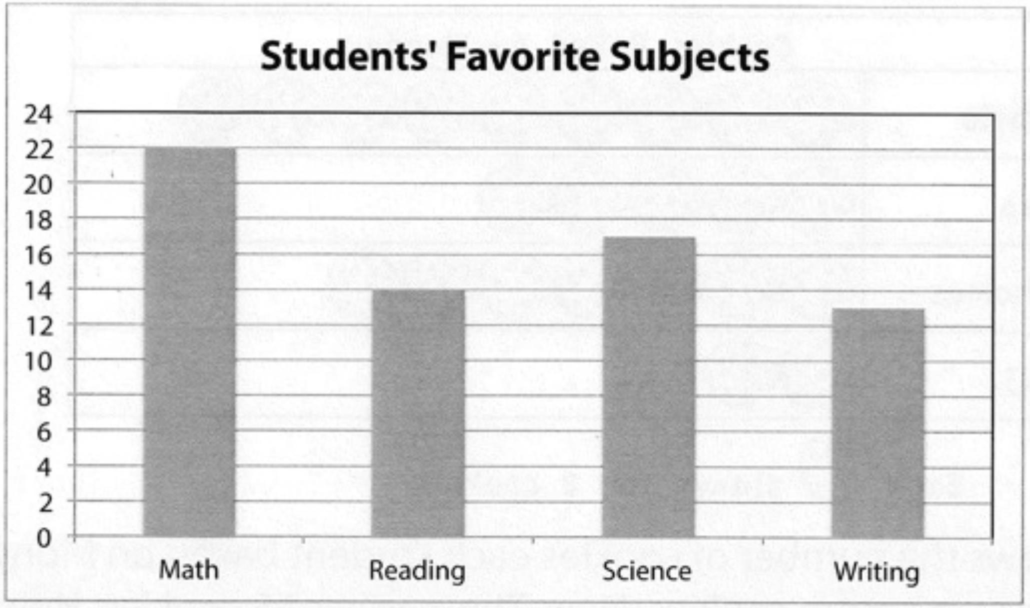
J.



The graph shows the favorite subject of third-grade students. How many more students chose Math than chose Writing?

60

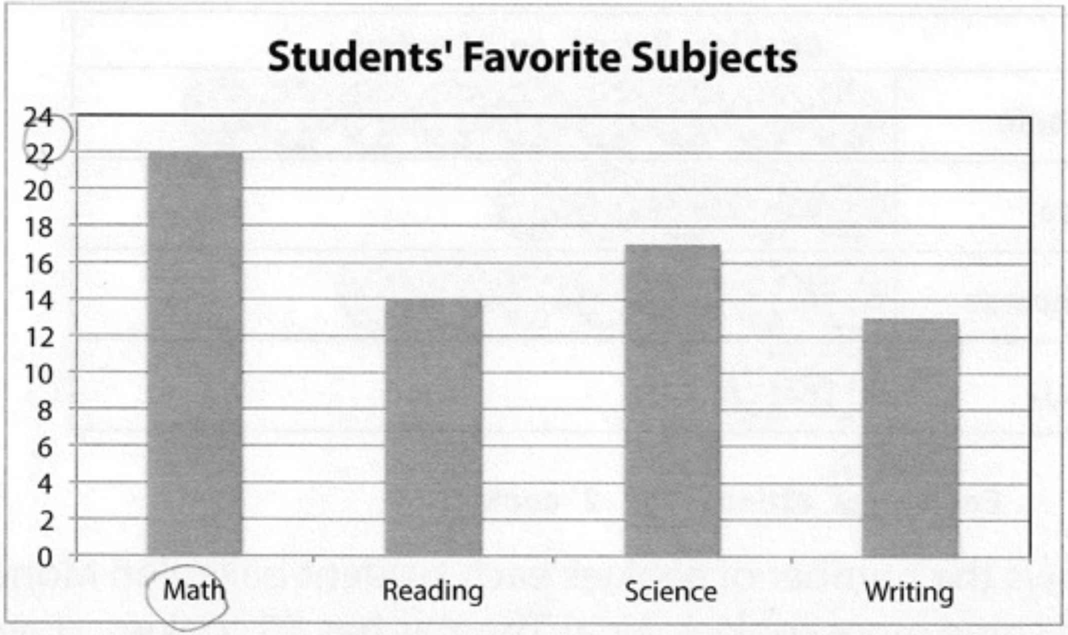
J.



The graph shows the favorite subject of third-grade students. How many more students chose Math than chose Writing?

They choose 8% more than reading

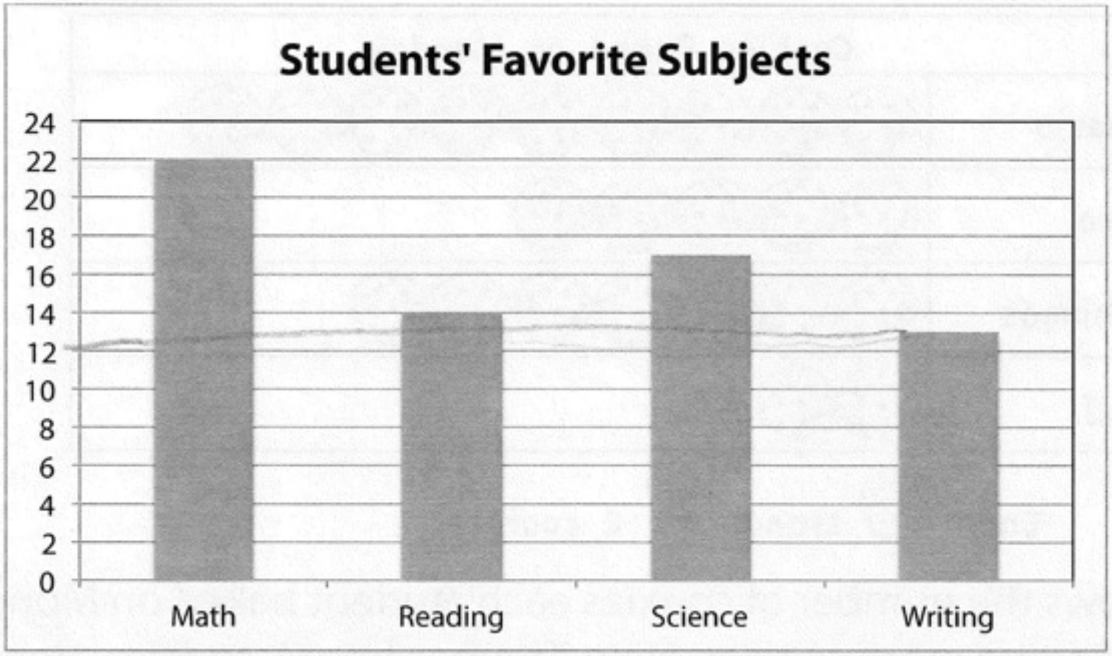
J.



The graph shows the favorite subject of third-grade students. How many more students chose Math than chose Writing?

22
Math

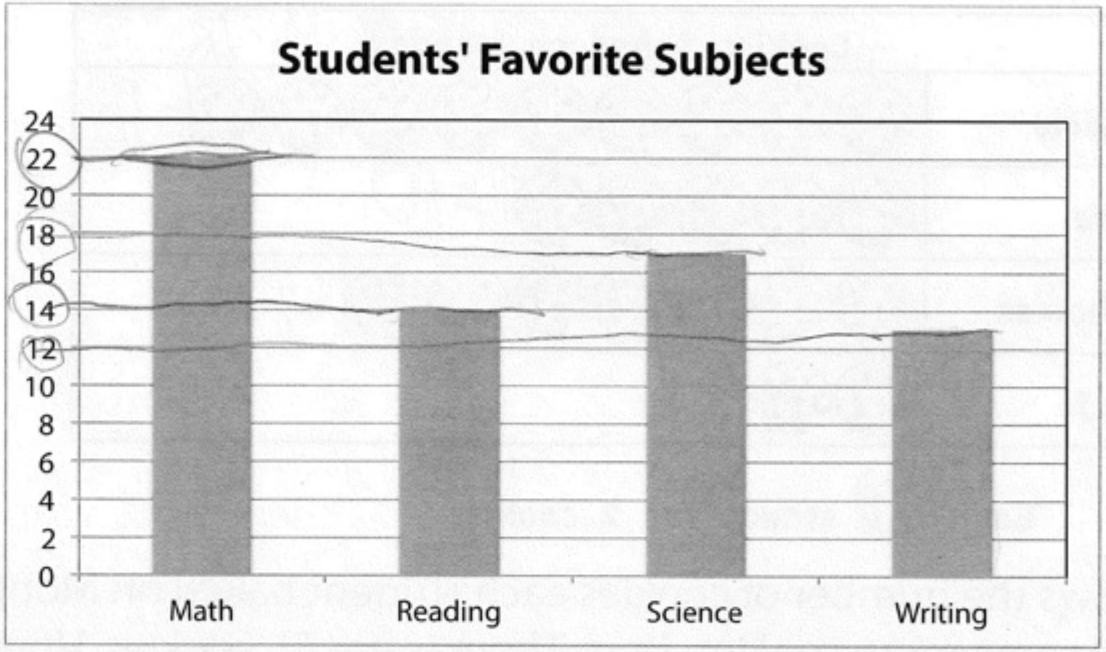
J.



The graph shows the favorite subject of third-grade students. How many more students chose Math than chose Writing?

22 math 12 writing

J.

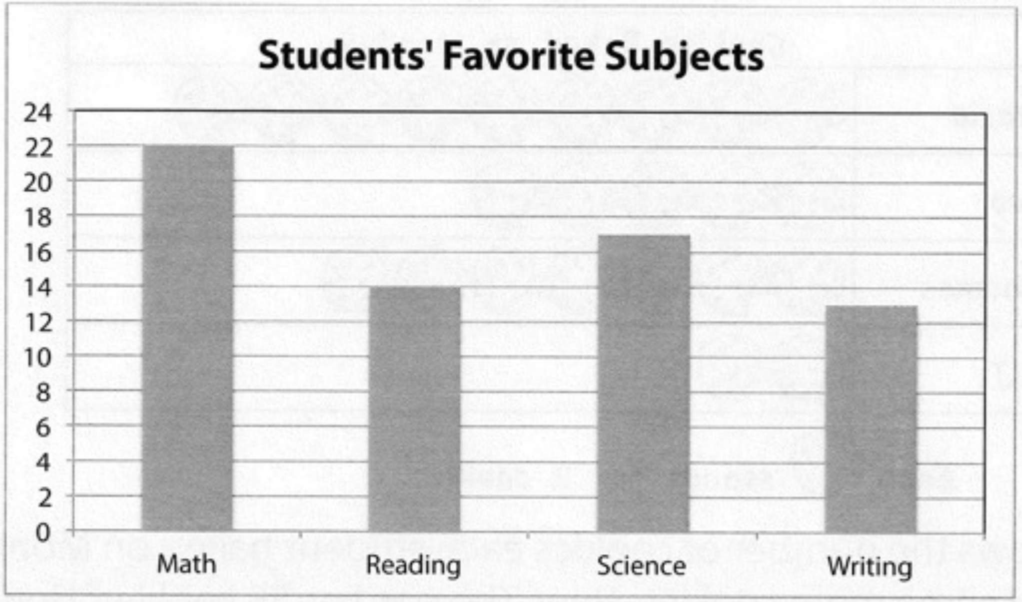


The graph shows the favorite subject of third-grade students. How many more students chose Math than chose Writing?

22 Mhatt

14 writing

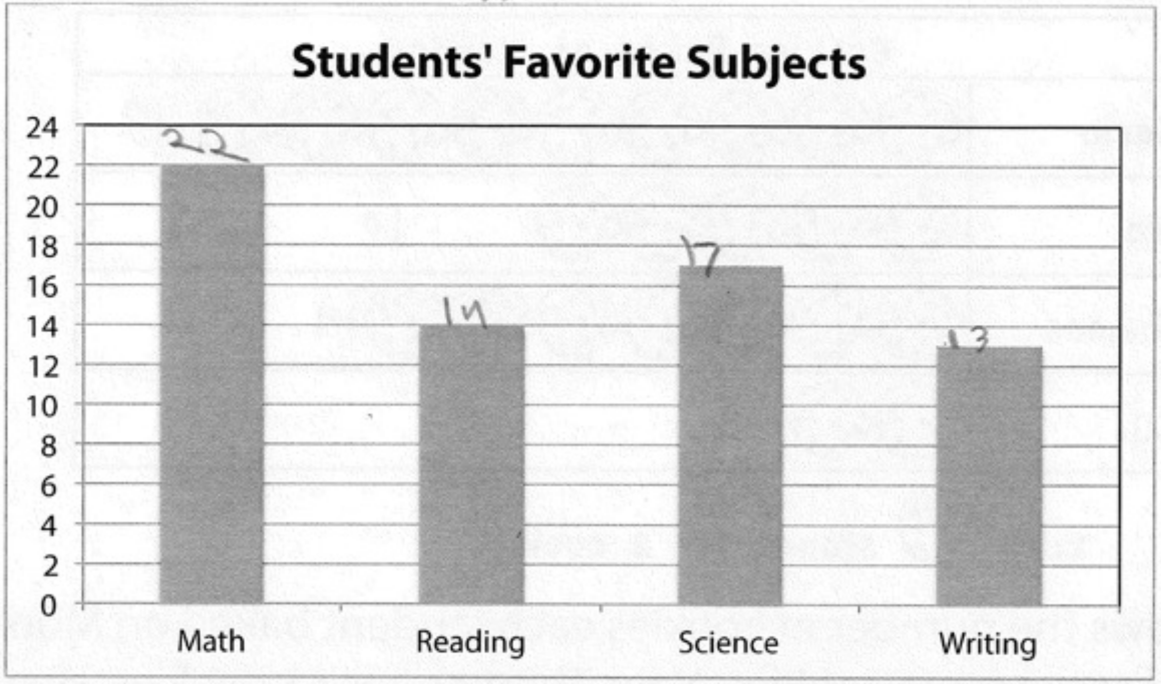
J.



The graph shows the favorite subject of third-grade students. How many more students chose Math than chose Writing?

the Students choses they Love more Math d:cas es
os fu 22 Math

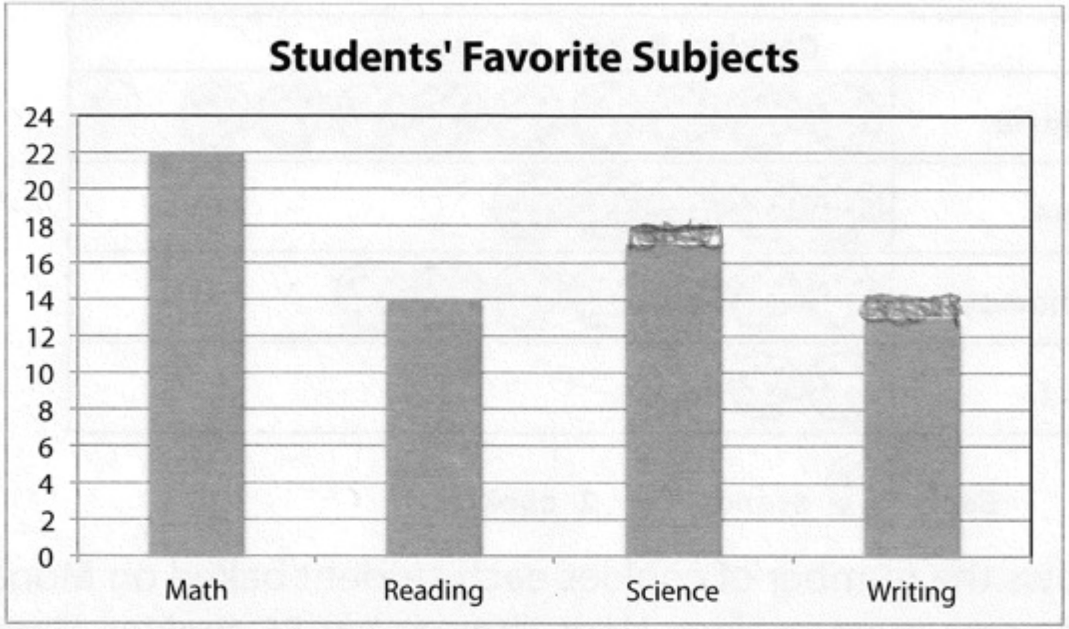
J.



The graph shows the favorite subject of third-grade students. How many more students chose Math than chose Writing?

$$\begin{array}{r} 14 \\ +13 \\ \hline 27 \end{array}$$

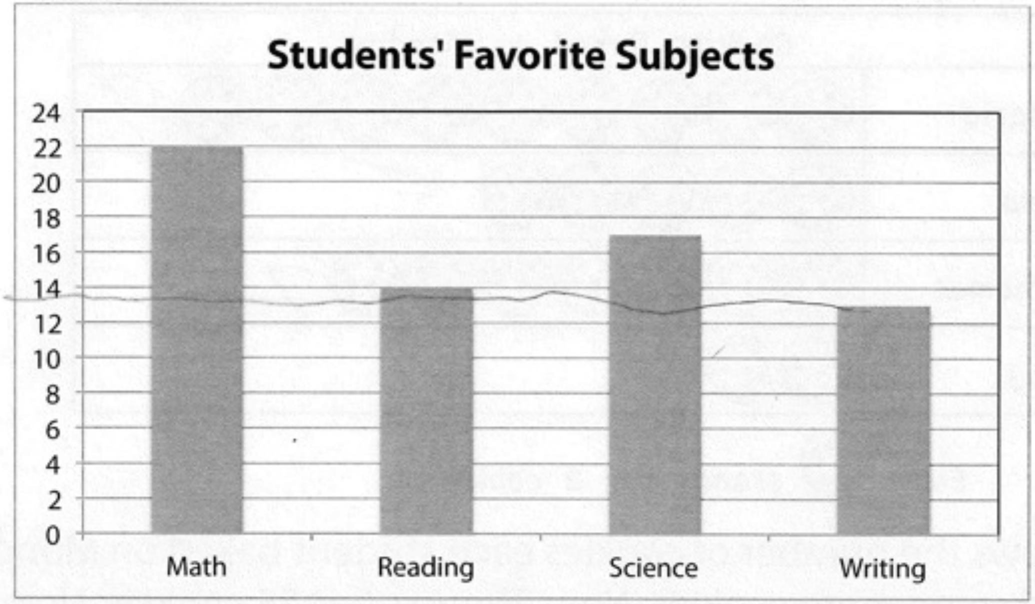
J.



The graph shows the favorite subject of third-grade students. How many more students chose Math than chose Writing?

$$\begin{array}{r} 22 \\ +\ 14 \\ \hline 36 \end{array}$$

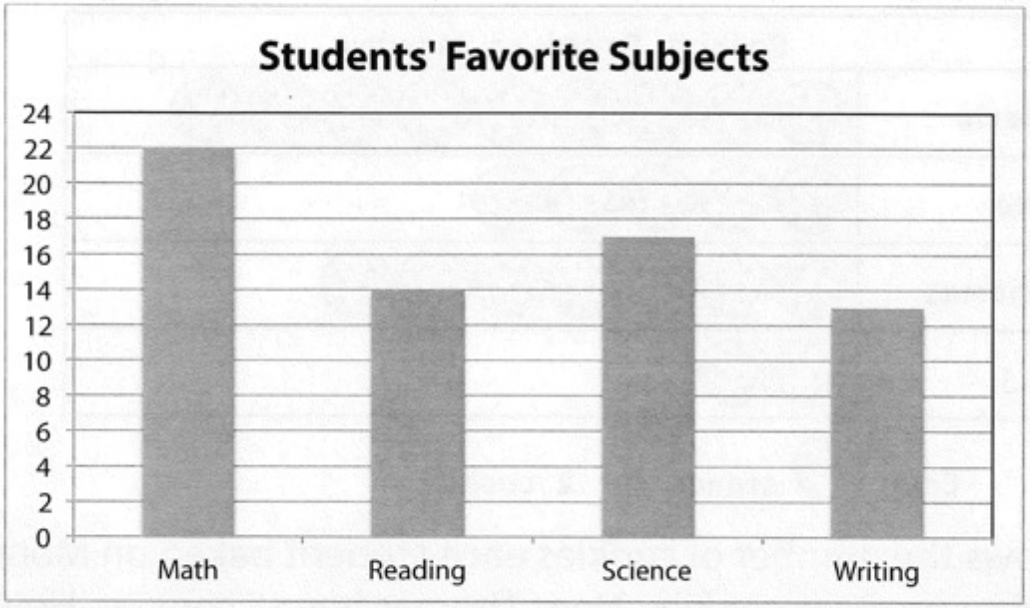
J.



The graph shows the favorite subject of third-grade students. How many more students chose Math than chose Writing?

24
+13

J.

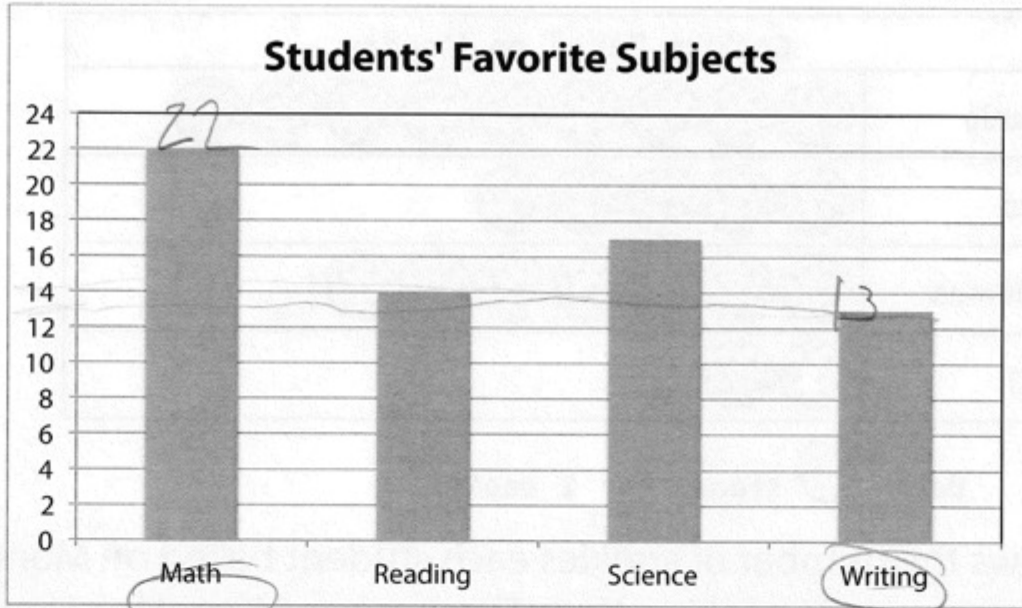


The graph shows the favorite subject of third-grade students. How many more students chose Math than chose Writing?

$$\begin{array}{r} 22 \\ +\ 12 \\ \hline 34 \end{array}$$

34

J.

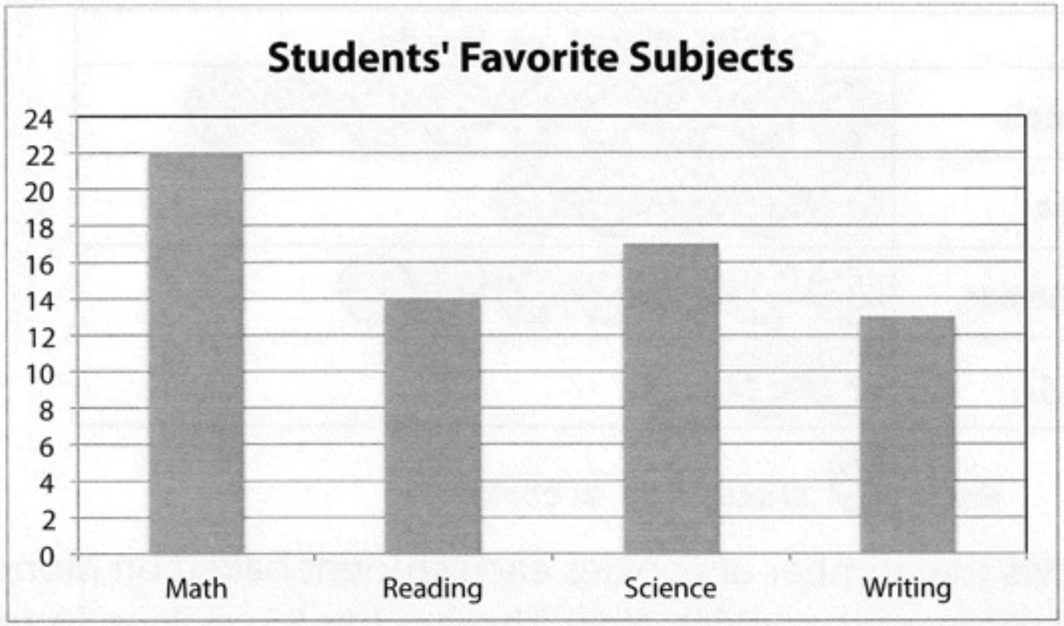


The graph shows the favorite subject of third-grade students. How many more students chose Math than chose Writing?

14

$$\begin{array}{r} 22 \\ +\ 13 \\ \hline 35 \end{array}$$

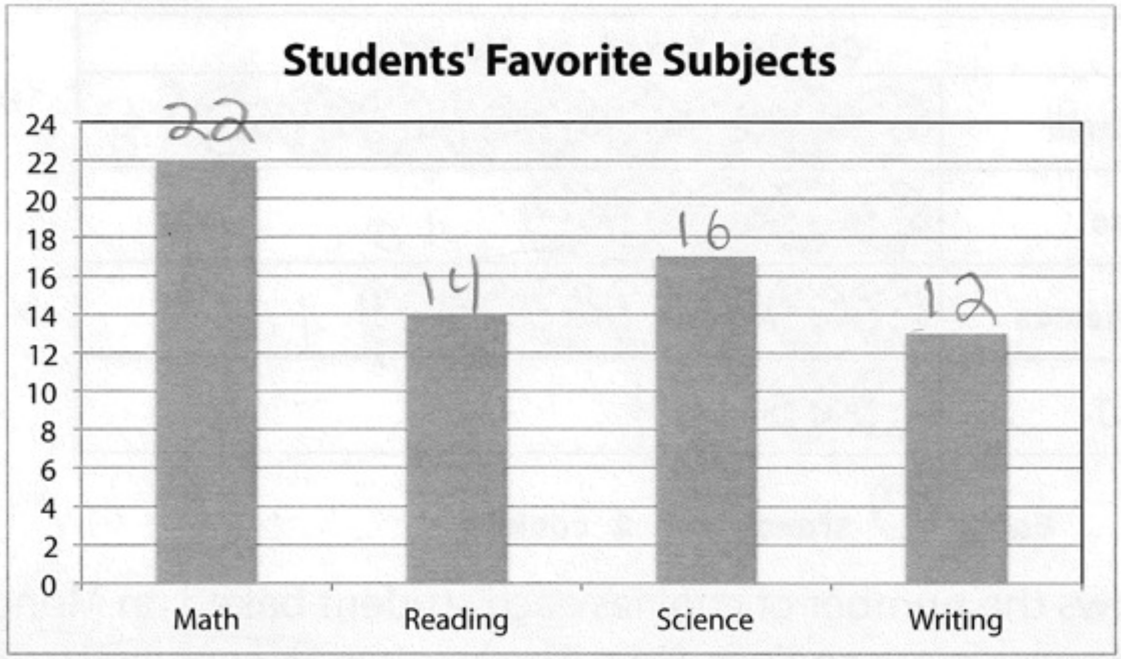
J.



The graph shows the favorite subject of third-grade students. How many more students chose Math than chose Writing?

1 ~~2~~ ~~2~~ 12
− 15
7

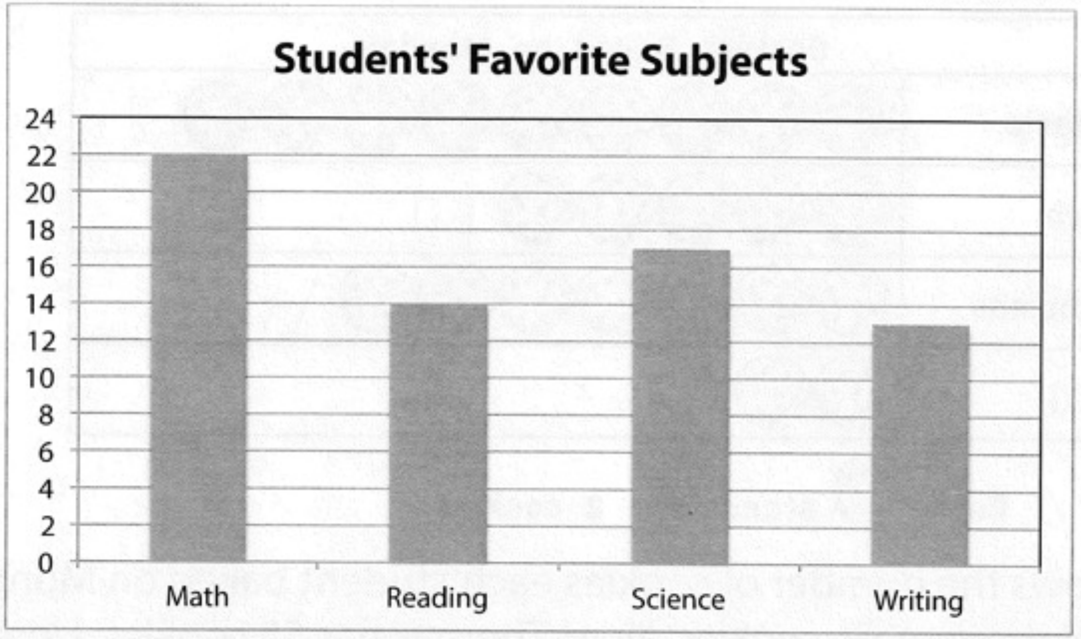
J.



The graph shows the favorite subject of third-grade students. How many more students chose Math than chose Writing?

$$\begin{array}{r} 22 \\ -\,12 \\ \hline 10 \end{array}$$

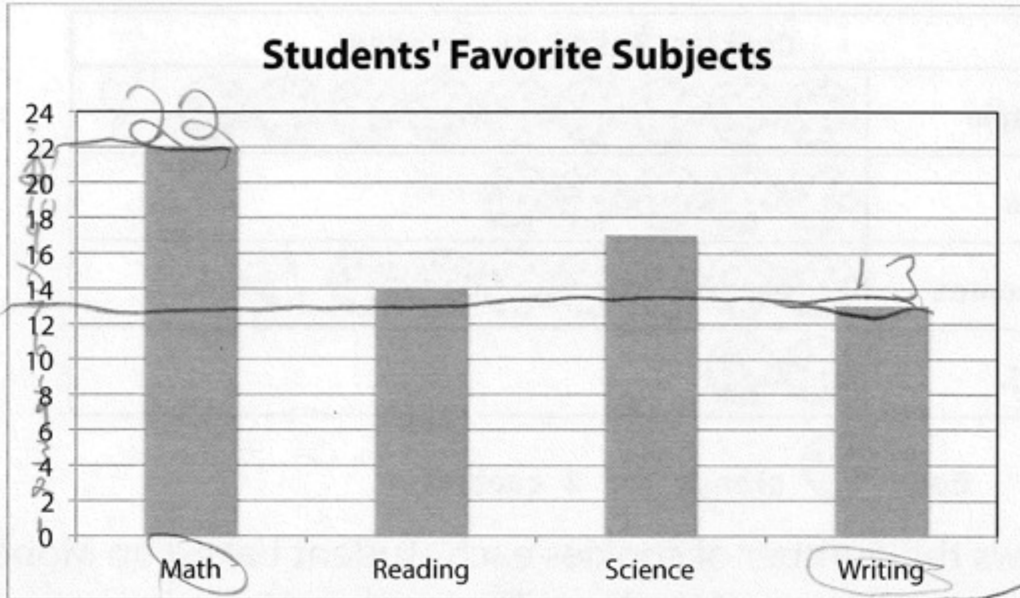
J.



The graph shows the favorite subject of third-grade students. How many more students chose Math than chose Writing?

2 12
− 14
08

J.

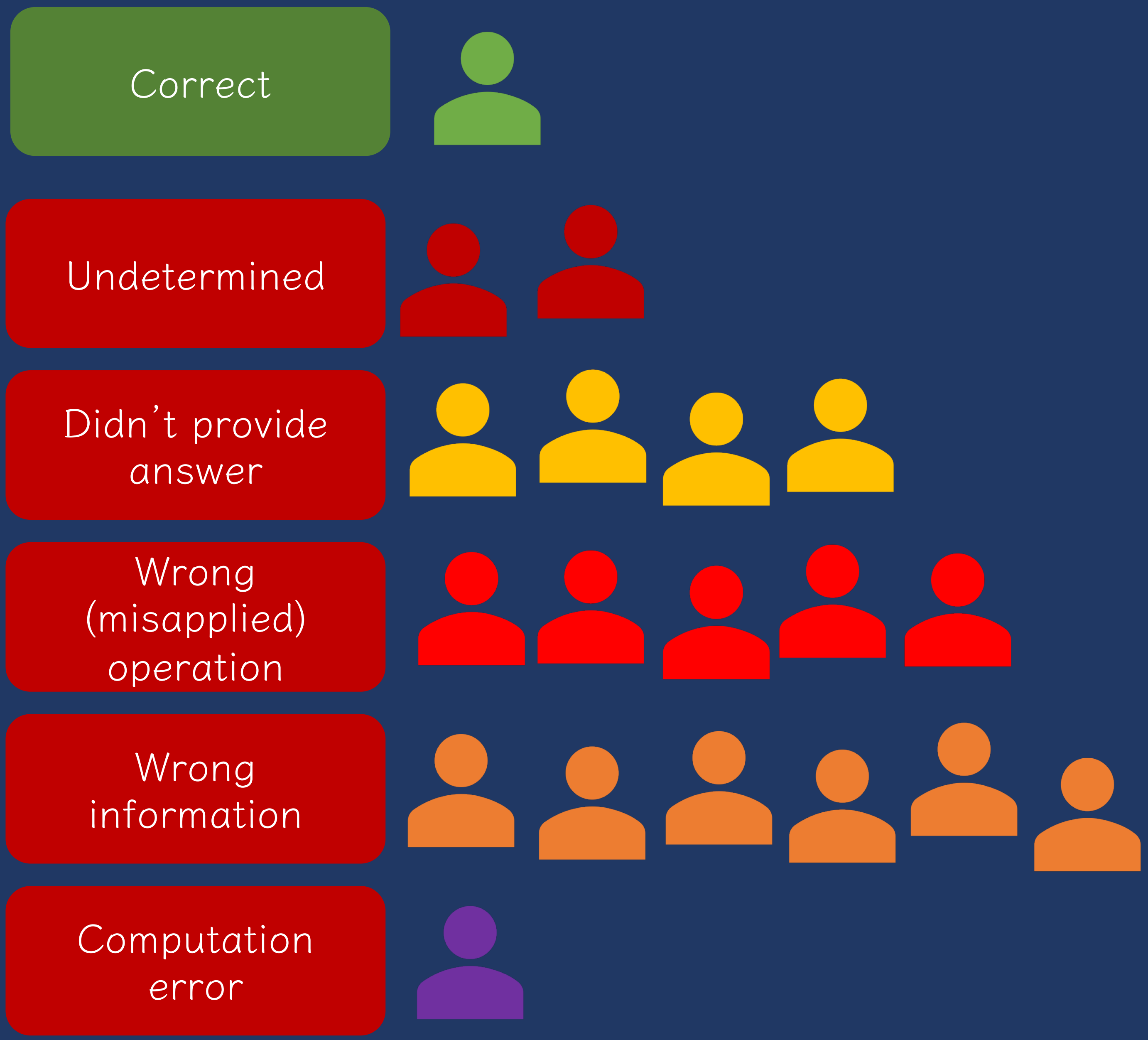


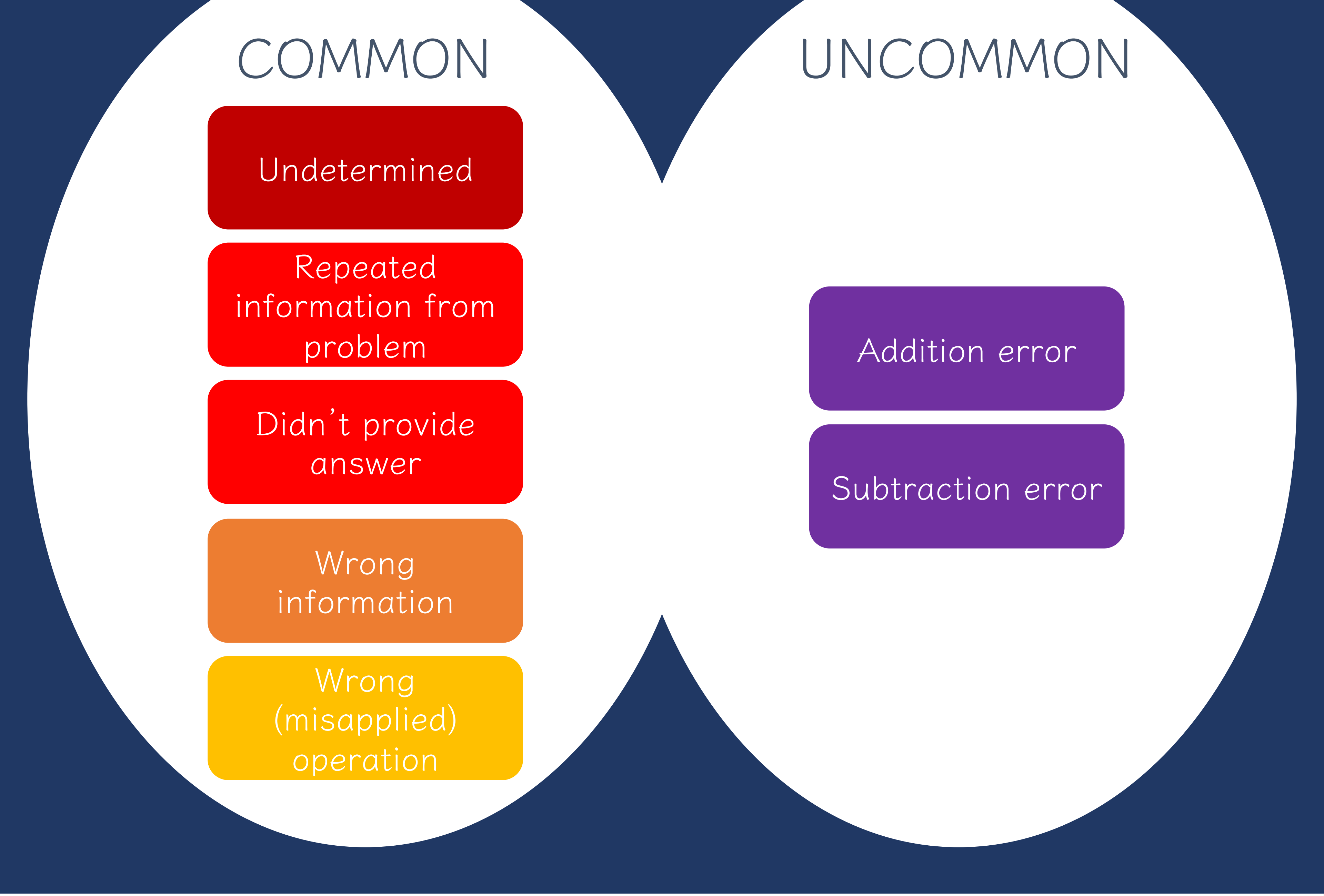
The graph shows the favorite subject of third-grade students. How many more students chose Math than chose Writing?

1 ~~22~~ 12

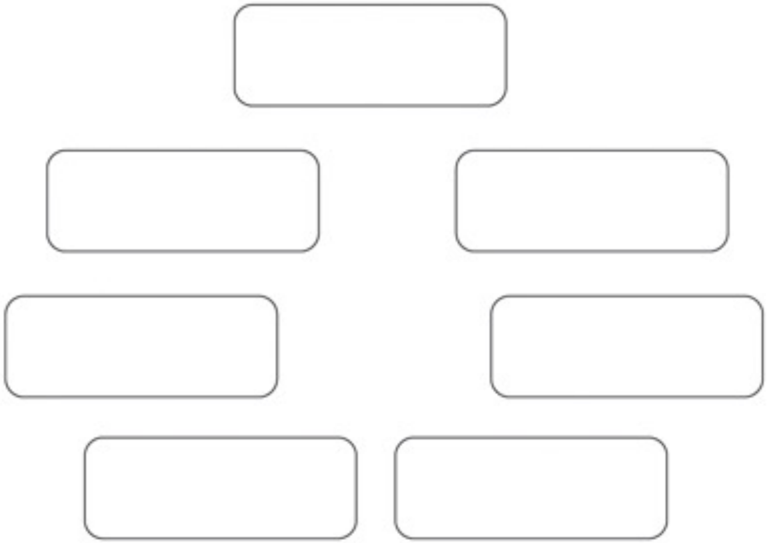
− 13

09

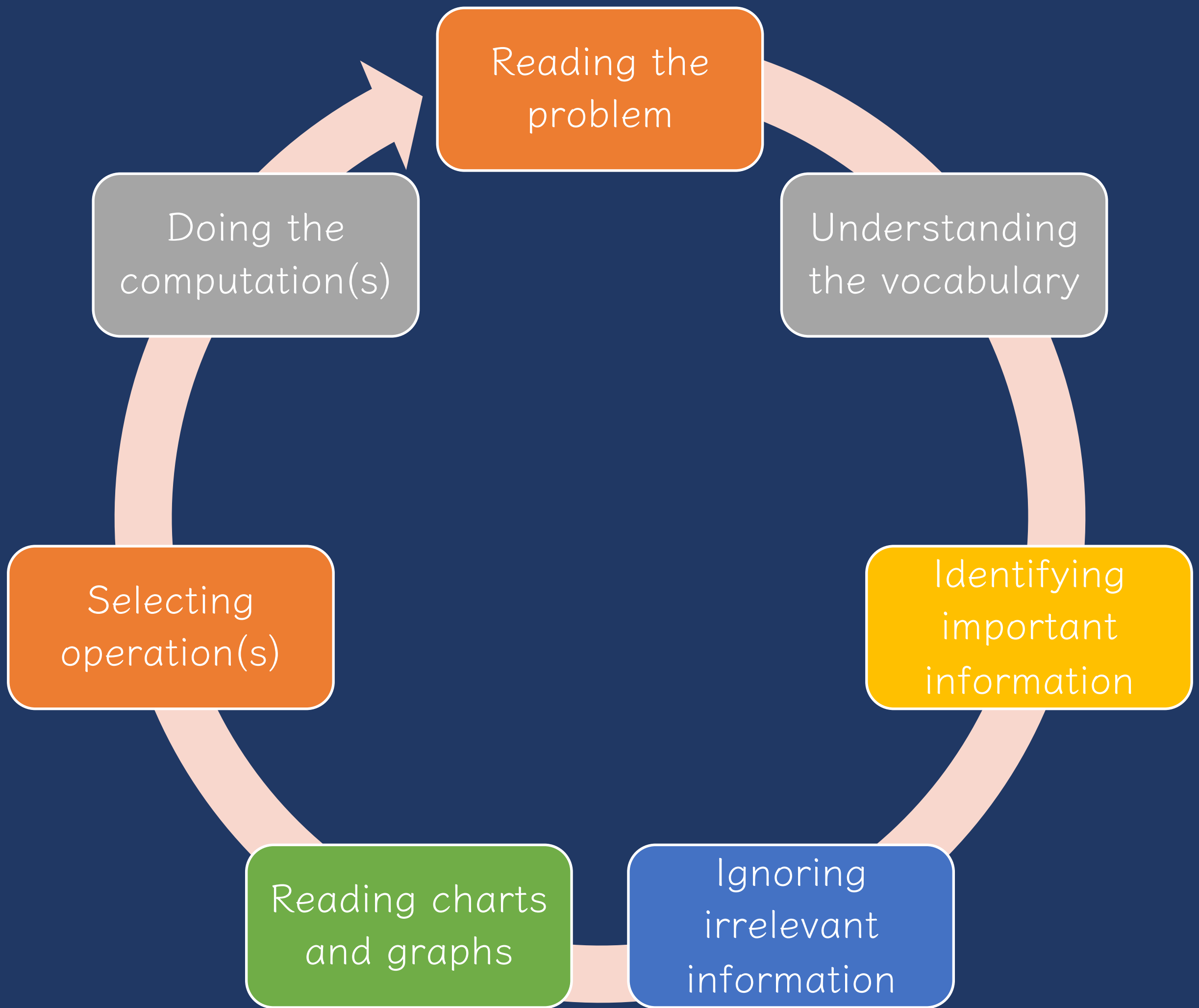

Correct
Undetermined
Didn't provide answer
Wrong (misapplied) operation
Wrong information
Computation error


COMMON
UNCOMMON
Undetermined
Repeated information from problem
Didn't provide answer
Wrong information
Wrong (misapplied) operation
Addition error
Subtraction error

Chapter 6: Word-Problem Solving



Teaching Problem Solving

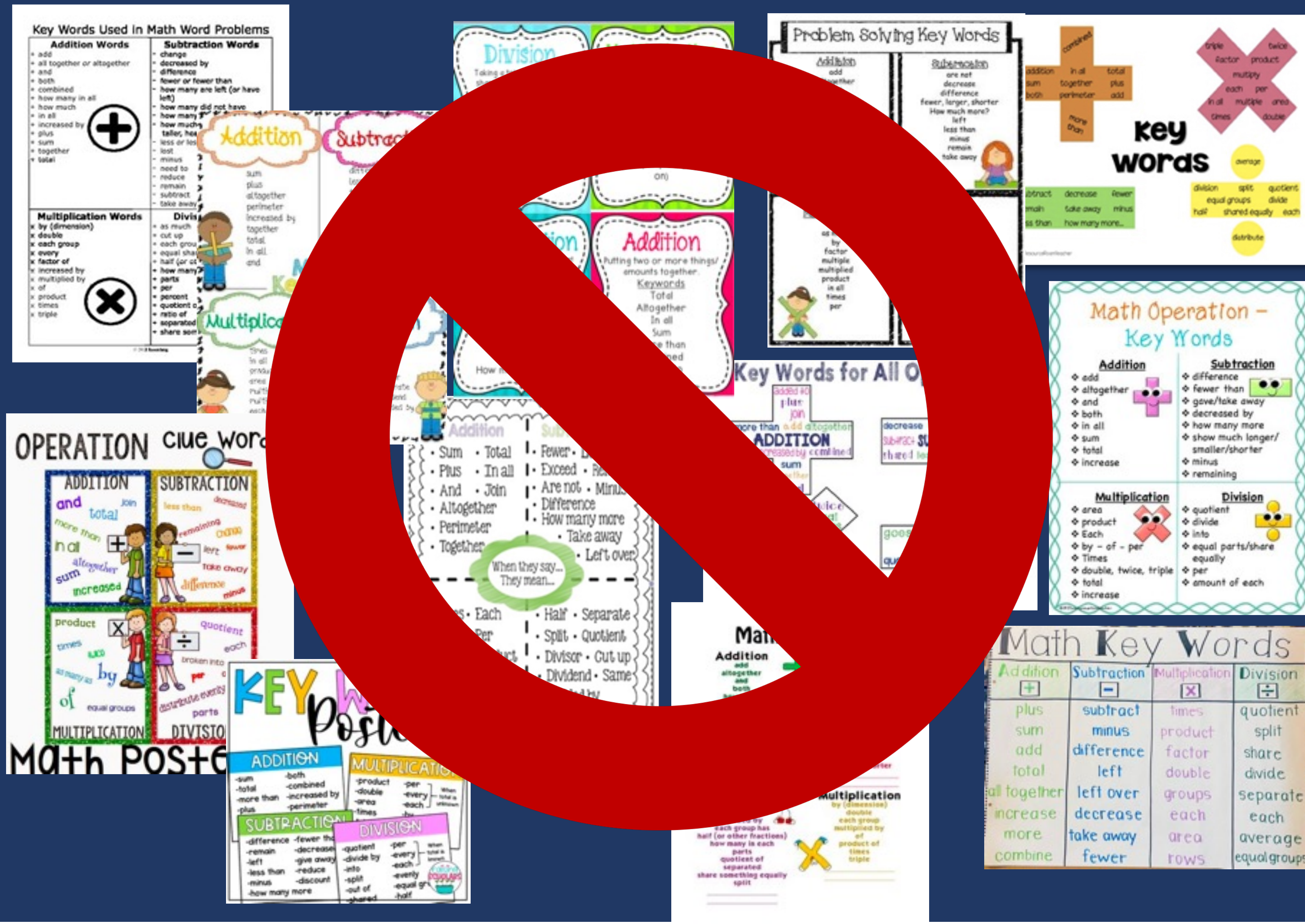

Reading the problem
Understanding the vocabulary
Identifying important information
Ignoring irrelevant information
Reading charts and graphs
Selecting operation(s)
Doing the computation(s)

Ineffective Strategies

1. Keywords tied to operations

Lincoln had 8 pencils **fewer** than Roscoe. If Roscoe had 18 pencils, how many pencils did Lincoln have?

Lincoln had 8 pencils **fewer** than Roscoe. If Lincoln had 18 pencils, how many pencils did Roscoe have?


Key Words Used in Math Word Problems
Addition Words
Subtraction Words
Multiplication Words
Problem Solving Key Words
Key words
Addition
Division
Multiplication
Math Operation – Key Words
Addition
Subtraction
Multiplication
Division
Key Words for All O
OPERATION Clue Wor
ADDITION
SUBTRACTION
MULTIPLICATION
Math Poste
When they say... They mean...
KEY W
Poste
ADDITION
MULTIPLICATION
SUBTRACTION
DIVISION
Math Key Words
Addition
Subtraction
Multiplication
Division
plus
sum
add
total
all together
increase
more
combine
subtract
minus
difference
left
left over
decrease
take away
fewer
times
product
factor
double
groups
each
area
rows
quotient
split
share
divide
separate
each
average
equal groups


m Words Poster Set
(4.1)
75%
7 Reviews
Write a Review
do you want to know about
oduct?
th 3 monthly payments of
just $4.33. No fees.
Learn more
total
join
both
increase
Addition
combined
plus
in all
add
split equally
times
product
total
by
how many more
remain
minus
decrease
Subtraction
left
less than
subtract
difference
Quantity
1
Add to Wish list

Description of Single-Step Word Problems (n = 132)

Schema	Occurrence of schema		Any keyword		Schema-specific keywords[a]		Multiple keywords[a]		Keyword(s) led to correct solution[a]	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Total	27	20.5	26	96.3	23	88.5	5	19.2	21	80.8
Difference	17	12.9	17	100.0	14	82.4	2	11.8	12	70.6
Change	11	8.3	7	63.6	5	71.4	5	71.4	2	28.6
Equal groups	29	22.0	26	89.7	22	84.6	18	69.2	8	30.8
Comparison	10	7.6	9	90.0	9	100.0	4	44.4	5	55.6
Ratios or proportions	29	22.0	23	79.3	9	39.1	9	39.1	6	26.1
Product of measures	9	6.8	9	100.0	8	88.9	1	11.1	5	55.6

[a]When a problem featured a keyword.

Description of Multi-Step Word Problems (n = 84)

Schema	Occurrence of schema[a] *n*	Occurrence of schema[a] %	Any keyword *n*	Any keyword %	Keyword(s) led to correct solution[b] *n*	Keyword(s) led to correct solution[b] %
Total	40	47.6	39	97.5	3	7.7
Difference	11	13.1	11	100.0	1	9.1
Change	21	23.8	19	95.0	1	5.3
Equal groups	49	58.3	48	98.0	1	2.1
Comparison	7	8.3	7	100.0	0	0.0
Ratios or proportions	22	25.0	16	76.2	1	6.3
Product of measures	7	8.3	7	100.0	2	28.6

[a]Sum across schemas does not equal 100 because each word problem featured more than one schema.

[b]When a problem featured a keyword.

Mr. Rivera's taxable income is $20 each hour before taxes are taken out. Mr. Rivera worked a total of 40 hours each week for 50 weeks.

What is the dollar amount, to the nearest dollar, taken out for taxes based on Mr. Rivera's taxable income?

Jessica rented 1 video game and 3 movies for a total of $11.50.

- The video game cost $4.75 to rent.
- The movies cost the same amount each to rent.

What amount, in dollars, did Jessica pay to rent each movie?

The temperature of a substance decreased by 24°C per minute for 3 minutes. What was the overall change of the temperature of the substance?

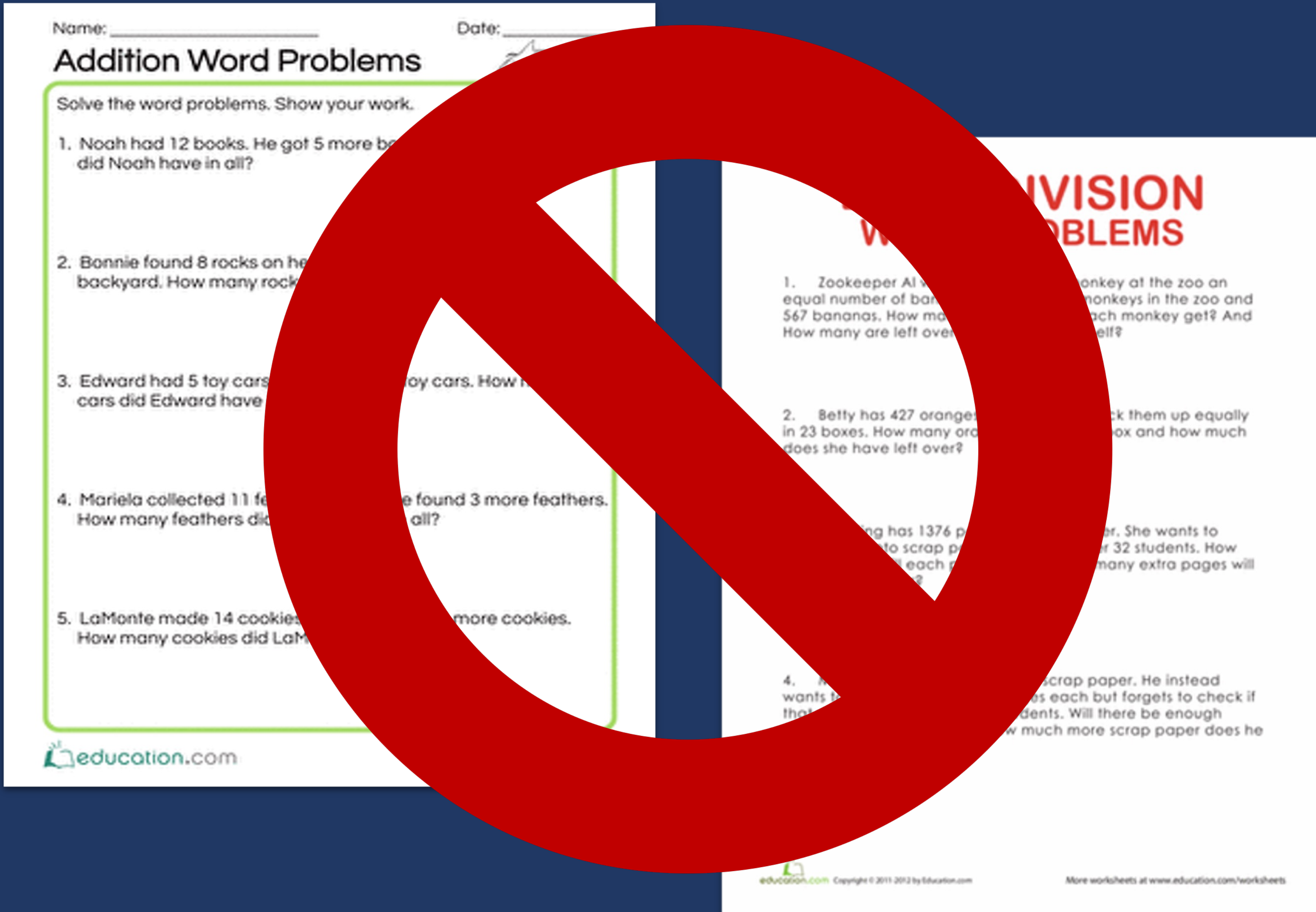
Keywords are important to identify and understand

Keywords are the mathematical vocabulary that help an students understand what the story is about and what they need to do

Talk about keywords ("What does *more than* tell you about?")

But, *do not* tie a keyword to a specific operation!

2. Presenting problems by operation


Name:
Date:
Addition Word Problems
Solve the word problems. Show your work.
education.com

Effective Strategies

Teach an attack strategy

Teach about schemas

Chapter 6: Attack Strategies

SOLVE

Study the problem.
Organize the facts.
Line up the plan.
Verify the plan with computation.
Examine the answer.

R-CUBES

Read the problem.
Circle key numbers.
Underline the question.
Box action words.
Evaluate steps.
Solve and check.

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?

Page 82

RIDE

Read the problem.

Identify the relevant information.

Determine the operation and unit for the answer.

Enter the correct numbers and calculate, then check the answer.

RIDGES

Read the problem.

I know statement.

Draw a picture.

Goal statement.

Equation development.

Solve the equation.

RICE

Read and record the problem.
Illustrate your thinking.
Compute.
Explain your thinking.

STAR

Stop and read the problem carefully.
Think about your plan and the strategy you will use.
Act. Follow your plan and solve the problem.
Review your answer.

SUPER

Slowly read the story problem twice.
Underline the question and circle the numbers you need.
Picture it. Draw the scenario to show what is happening.
Explain the problem with a number sentence.
Rewrite the answer in a sentence.

SHINES

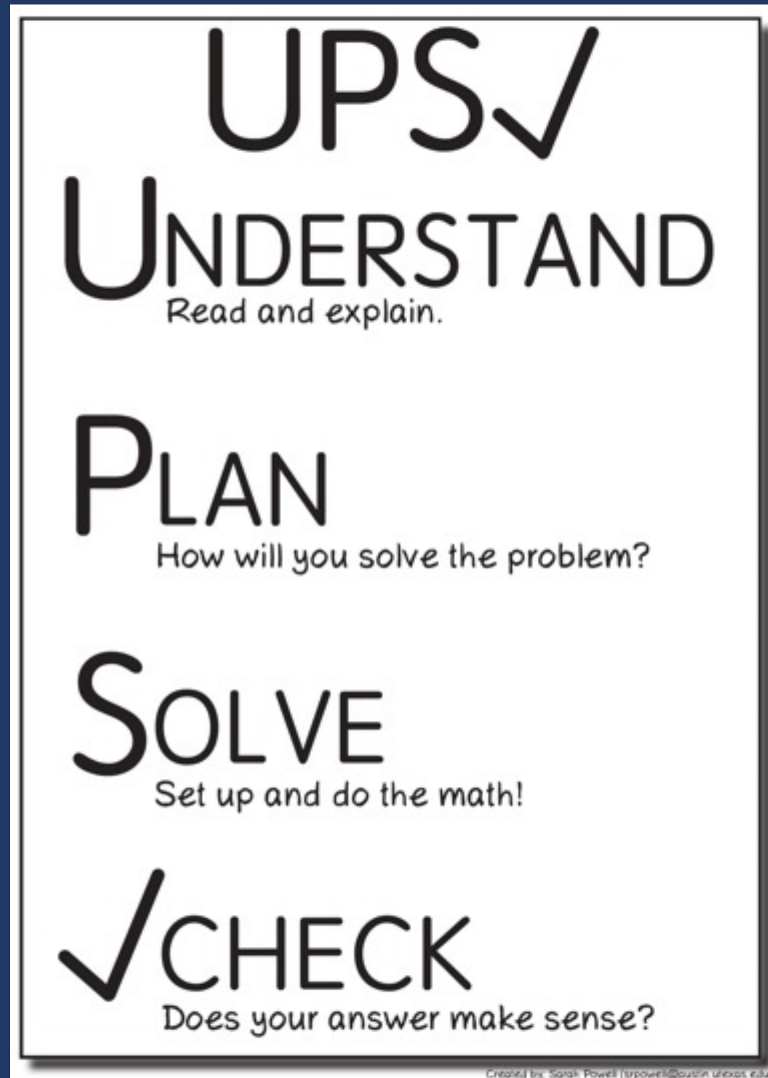
Slowly and carefully read the problem.
Highlight or underline key information.
Identify the question by drawing a circle around it.
Now solve the problem. Show your work.
Examine your work for precision, accuracy, and clarity.
Share your answer by writing a sentence.

R-CUBES

Read the problem.
Circle key numbers.
Underline the question.
Box action words.
Evaluate steps.
Solve and check.

SOLVE

Study the problem.
Organize the facts.
Line up the plan.
Verify the plan with computation.
Examine the answer.


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 (srpowell@austin.utexas.edu)

Share your favorite attack strategy.

Teach an attack strategy

Teach about schemas

Total

Difference

Change

Page 84

Page 88

Equal Groups

Comparison

Ratios/Proportions

Total

Part-part-whole
Combine

Parts put together into a total

Daniela saw 3 canoes and 8 kayaks. How many boats did Daniela see?

Daniela saw 11 boats. If 3 of the boats were canoes, how many were kayaks?

Daniela saw 11 boats. 8 of the boats were kayaks, how many were canoes?

Total

Part

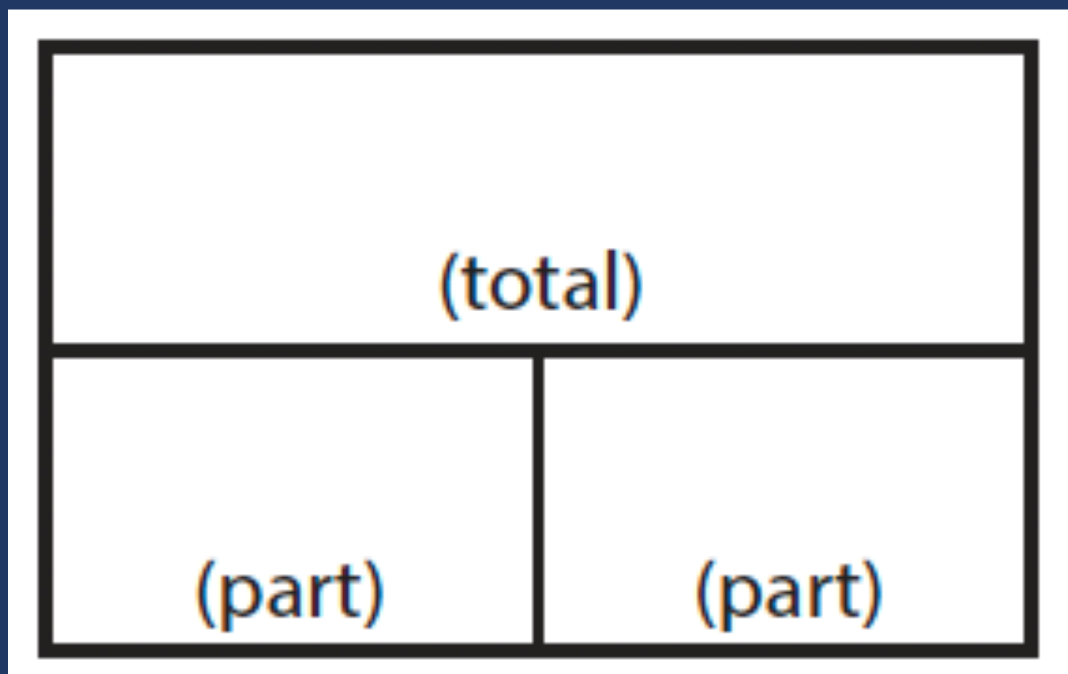
Part

Total

"Are parts put together for a total?"

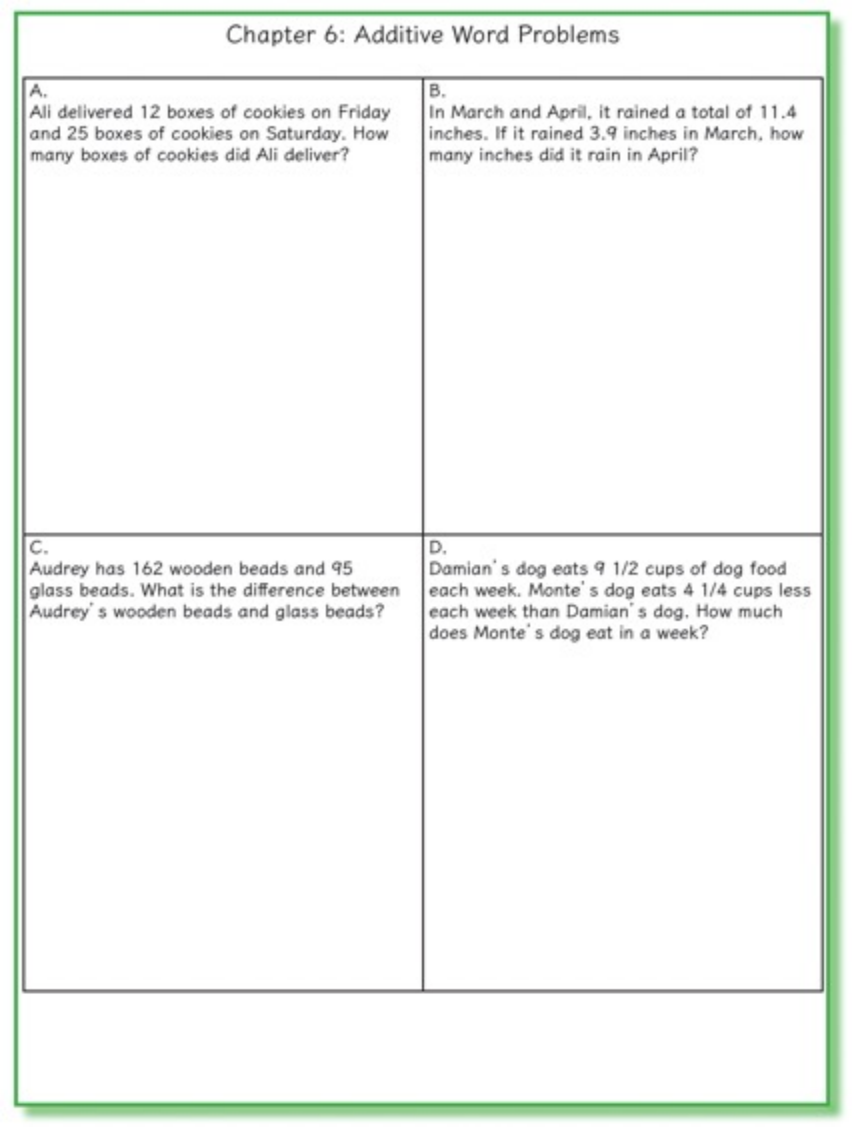
Total

$P1 \quad + \quad P2 \quad = \quad T$



Fuchs et al. (2008); Griffin & Jitendra (2009)

Total

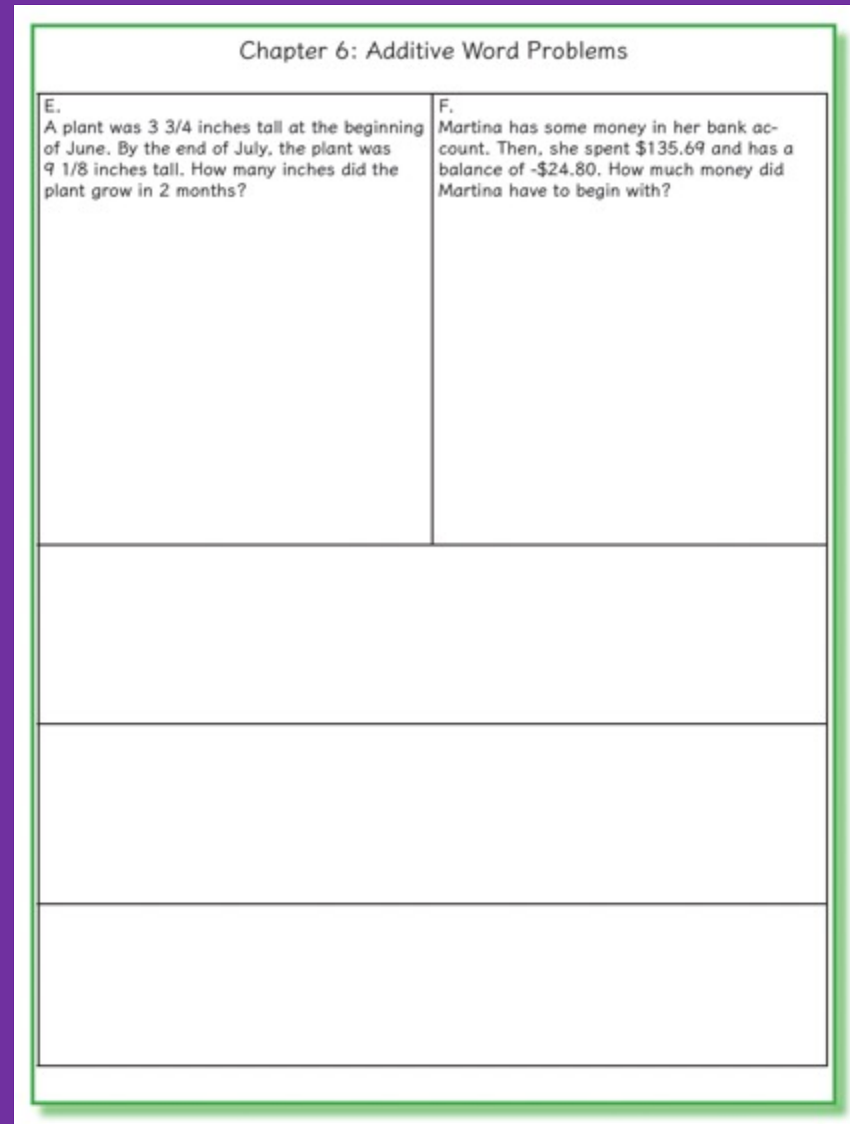


Chapter 6: Additive Word Problems

A. Ali delivered 12 boxes of cookies on Friday and 25 boxes of cookies on Saturday. How many boxes of cookies did Ali deliver?	B. In March and April, it rained a total of 11.4 inches. If it rained 3.9 inches in March, how many inches did it rain in April?
C. Audrey has 162 wooden beads and 95 glass beads. What is the difference between Audrey's wooden beads and glass beads?	D. Damian's dog eats 9 1/2 cups of dog food each week. Monte's dog eats 4 1/4 cups less each week than Damian's dog. How much does Monte's dog eat in a week?

Total

Write a Total problem.



Chapter 6: Additive Word Problems

E. A plant was 3 3/4 inches tall at the beginning of June. By the end of July, the plant was 9 1/8 inches tall. How many inches did the plant grow in 2 months?	F. Martina has some money in her bank account. Then, she spent $135.69 and has a balance of -$24.80. How much money did Martina have to begin with?

Difference

Compare

Greater and lesser amounts compared for a difference

Adrianna has 10 pencils. Tracy has 4 pencils. How many more pencils does Adrianna have?

Adrianna has 6 more pencils than Tracy. If Tracy has 4 pencils, how many does Adrianna have?

Tracy has 6 fewer pencils than Adrianna. Adrianna has 10 pencils. How many pencils does Tracy have?

Difference

Greater amount

Lesser amount

Total

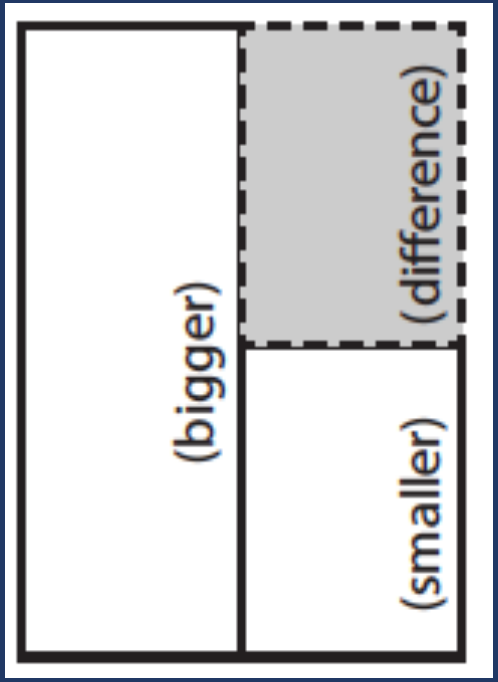
"Are parts put together for a total?"

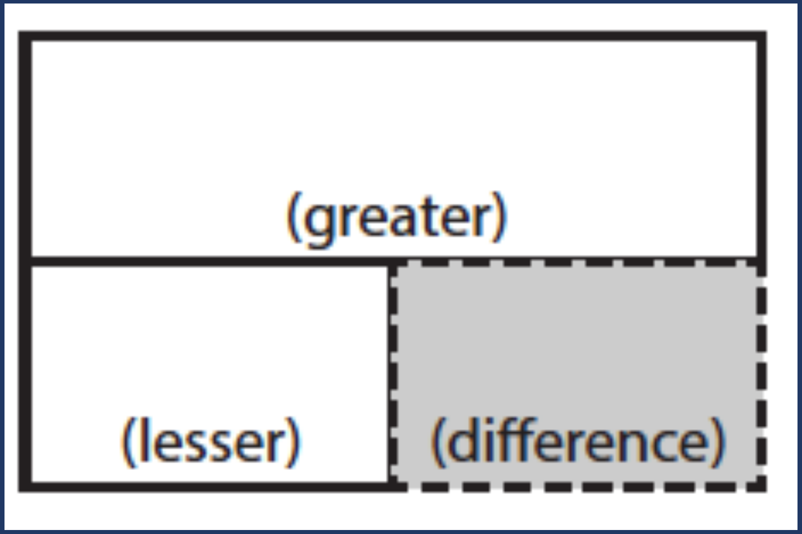
Difference

"Are amounts compared for a difference?"

Difference

G − L = D





Fuchs et al. (2008); Griffin & Jitendra (2009)

Difference

Chapter 6: Additive Word Problems

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Difference

Write a Difference problem.

Chapter 6: Additive Word Problems

E. A plant was 3 3/4 inches tall at the beginning of June. By the end of July, the plant was 9 1/8 inches tall. How many inches did the plant grow in 2 months?	F. Martina has some money in her bank account. Then, she spent $135.69 and has a balance of -$24.80. How much money did Martina have to begin with?

Change

Join

An amount that **increases** or decreases

Nickole had 6 notebooks. Then, she bought 3 notebooks. How many notebooks does Nickole have now?

End amount

Nickole had 6 notebooks. Then, she bought a few more notebooks. Now, Nickole has 9 notebooks. How many notebooks did she buy?

Change amount

Nickole had some notebooks. Then, she bought 3 notebooks. Now, Nickole has 9 notebooks. How many notebooks did she have to start with?

Start amount

Change

Separate

An amount that increases or **decreases**

Samantha baked 20 cookies. Then, she ate 3 of the cookies. How many cookies does Samantha have now?

End amount

Samantha baked 20 cookies. Then, she ate some of the cookies. Now, she has 17 cookies. How many cookies did Samantha eat?

Change amount

Samantha baked some cookies. She ate 3 of the cookies and has 17 cookies left. How many cookies did Samantha bake?

Start amount

Total

"Are parts put together for a total?"

Difference

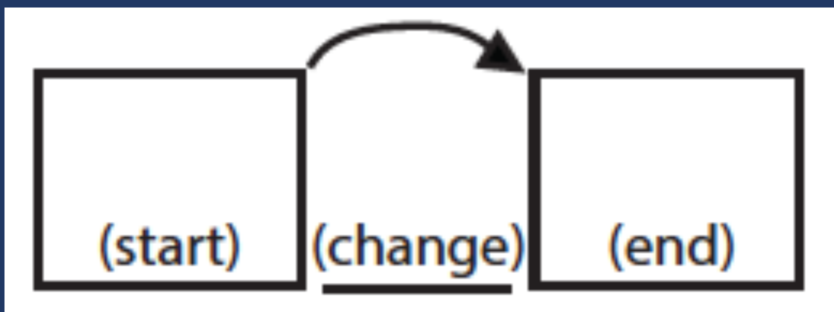
"Are amounts compared for a difference?"

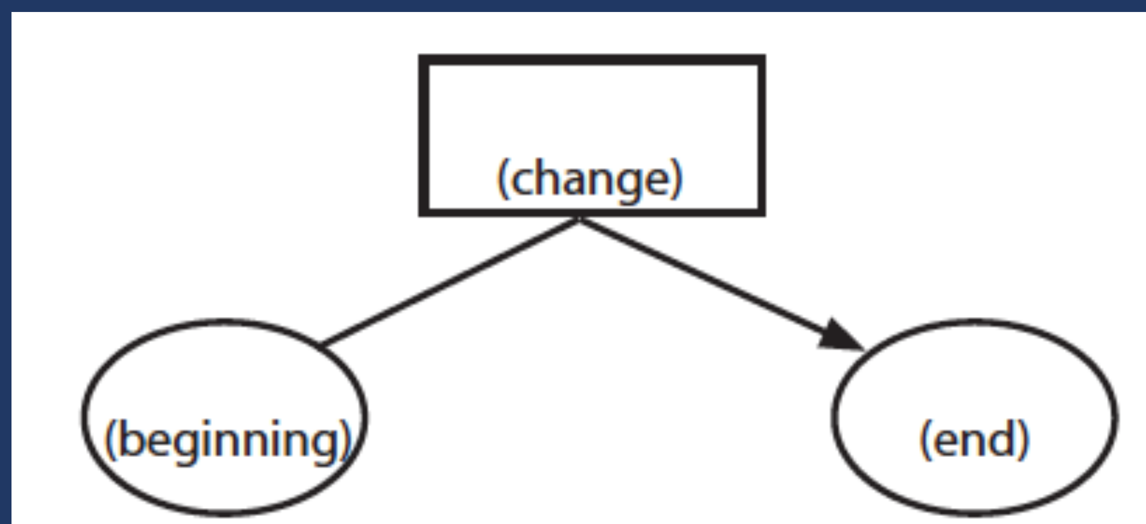
Change

"Does an amount increase or decrease?"

Change

ST +/– C = E





Fuchs et al. (2008); Griffin & Jitendra (2009)

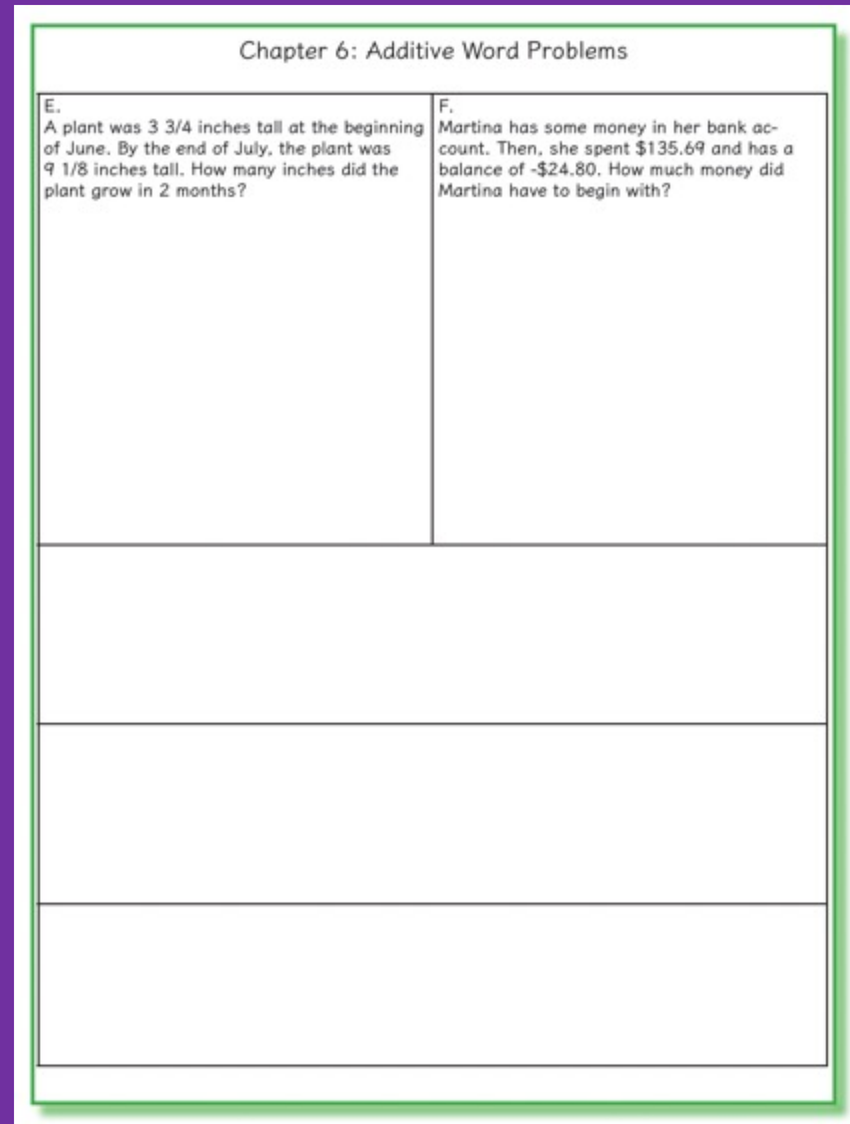
Change

Chapter 6: Additive Word Problems

E. A plant was 3 3/4 inches tall at the beginning of June. By the end of July, the plant was 9 1/8 inches tall. How many inches did the plant grow in 2 months?	F. Martina has some money in her bank account. Then, she spent $135.69 and has a balance of -$24.80. How much money did Martina have to begin with?

Change

Write a Change problem.



Chapter 6: Additive Word Problems

E. A plant was 3 3/4 inches tall at the beginning of June. By the end of July, the plant was 9 1/8 inches tall. How many inches did the plant grow in 2 months?	F. Martina has some money in her bank account. Then, she spent $135.69 and has a balance of -$24.80. How much money did Martina have to begin with?

Schema Check!

Change

Pablo goes to a stamp show where he can share, buy, and sell stamps.

26. Part A

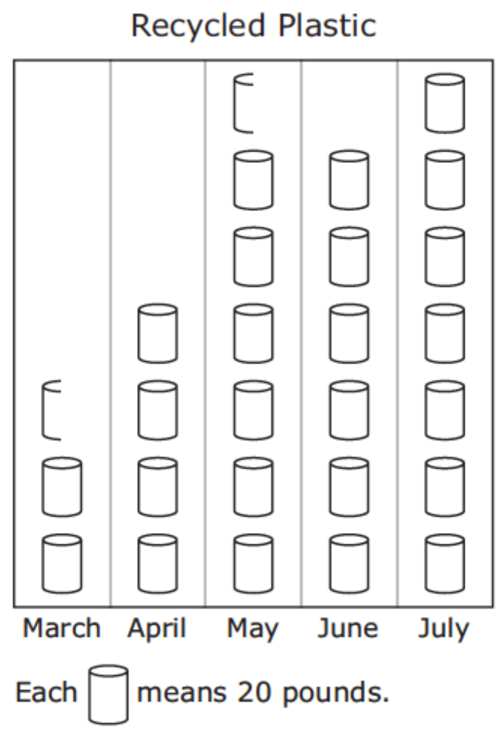
The first day, Pablo starts with 744 stamps. He buys 27 stamps from his friend. He then sells 139 stamps.

What is the total number of stamps that Pablo has after the first day of the stamp show?

Grade 3 PARCC

Difference

The graph below shows the number of pounds of plastic the Keller family recycled for five months.



Based on the graph, how many more pounds of plastic did the family recycle in July than in April?

Grade 3 STAAR

Total

Mr. Conley delivers packages. The bar graph shows the total number of packages he delivered on five days last week.

10. Part A

What is the total number of packages Mr. Conley delivered on Monday and Tuesday?

Ⓐ 300

Ⓑ 340

Ⓒ 350

Ⓓ 360

Grade 3 PARCC

Total

Difference

Change

Equal Groups

Comparison

Ratios/Proportions

Equal Groups

Array
Vary

Groups multiplied by number in each group for a product

Toni has 2 boxes of crayons. There are 12 crayons in each box. How many crayons does Toni have altogether?

Toni has 24 crayons. They want to place them equally into 2 boxes. How many crayons will Toni place in each box?

Toni has 24 crayons. They put them into boxes with 12 crayons each. How many boxes did Toni use?

Product

Number in each group

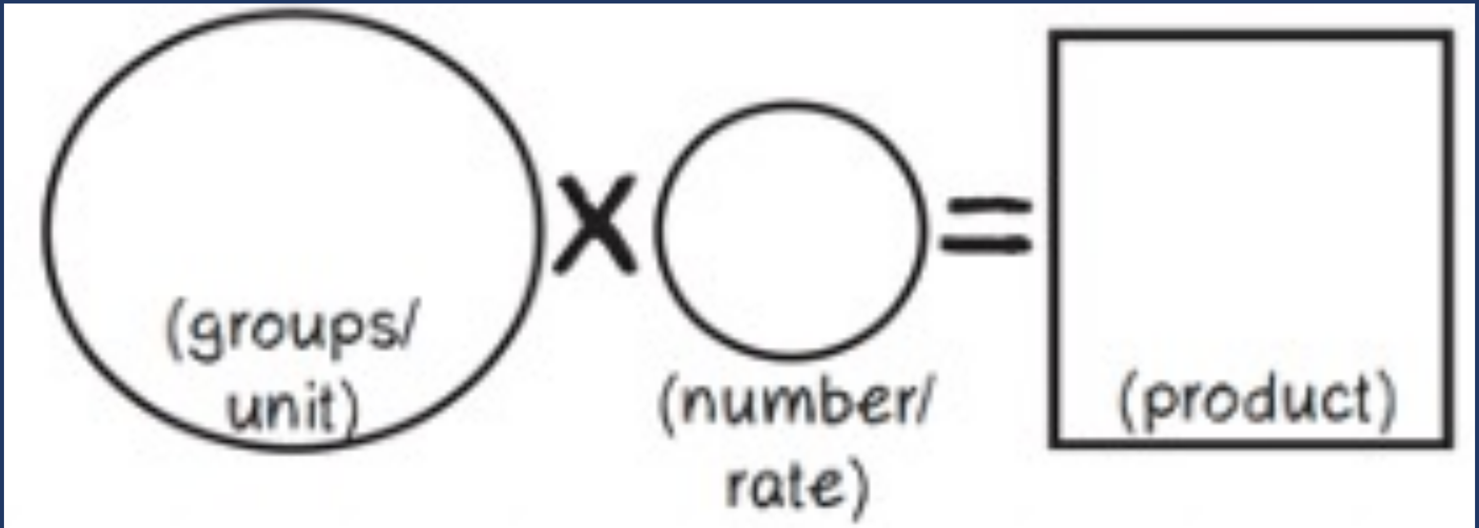
Groups

Equal Groups

"Are there groups with an equal number in each group?"

Equal Groups

$$GR \times N(E) = P$$



Equal Groups

Chapter 6: Multiplicative Word Problems

A.
Lola baked 6 pies. For each pie, Lola used 5 apples. How many apples did Lola use?

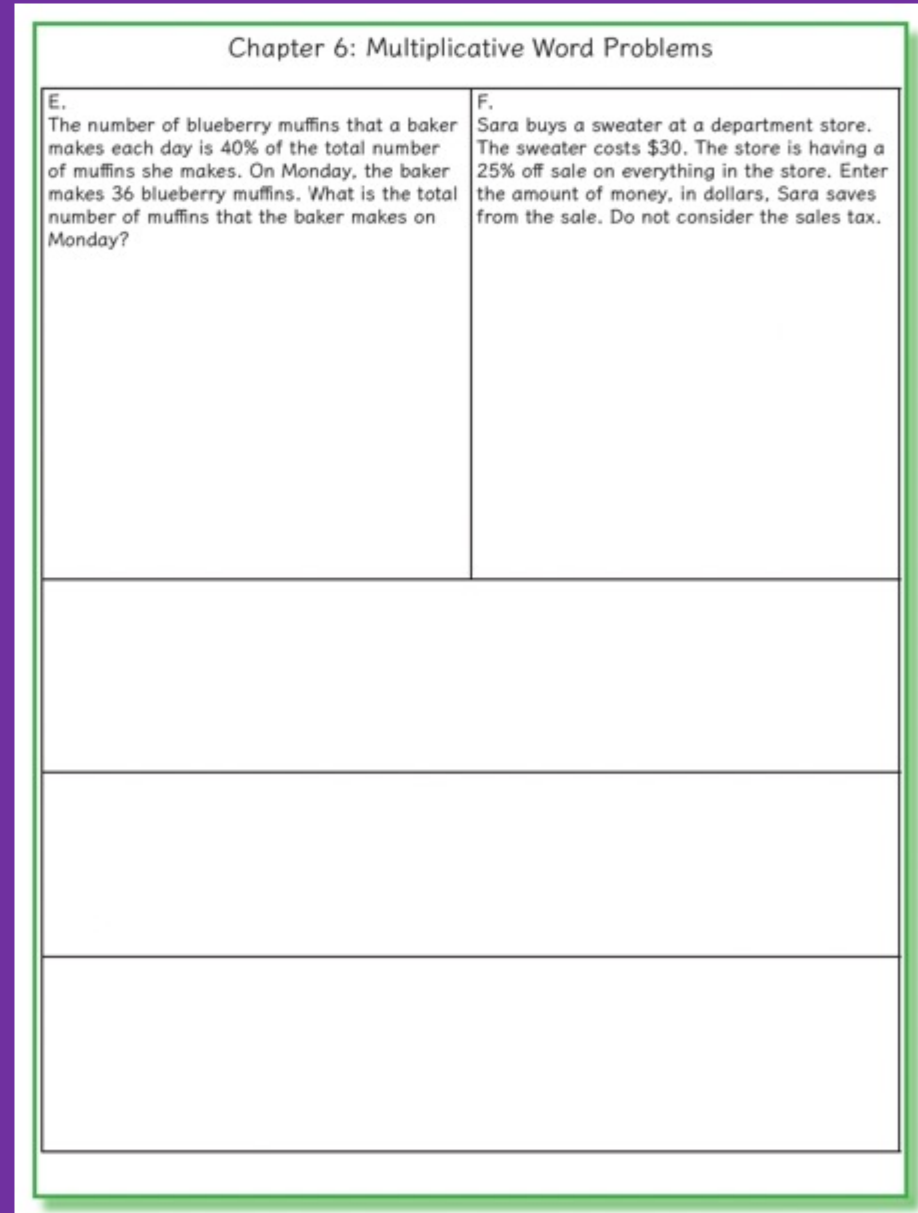
B.
Jane bought 112 light bulbs. The light bulbs come in packs of 4. How many packs of light bulbs did Jane buy?

C.
Enrique has 2 times as many pencils as Ava. Ava has 6 pencils. How many pencils does Enrique have?

D.
Susan has 7 times as many books as Mo. Mo has 18 books. How many books Susan has?

Equal Groups

Write an Equal Groups problem.



Chapter 6: Multiplicative Word Problems

E.	F.
The number of blueberry muffins that a baker makes each day is 40% of the total number of muffins she makes. On Monday, the baker makes 36 blueberry muffins. What is the total number of muffins that the baker makes on Monday?	Sara buys a sweater at a department store. The sweater costs $30. The store is having a 25% off sale on everything in the store. Enter the amount of money, in dollars, Sara saves from the sale. Do not consider the sales tax.

Comparison

Set multiplied by a number of times for a product

Brooke ran 6 minutes. Shaleeni ran 4 times longer than Brooke. How many minutes did Shaleeni run?

Set

Number of times

Product

Equal Groups

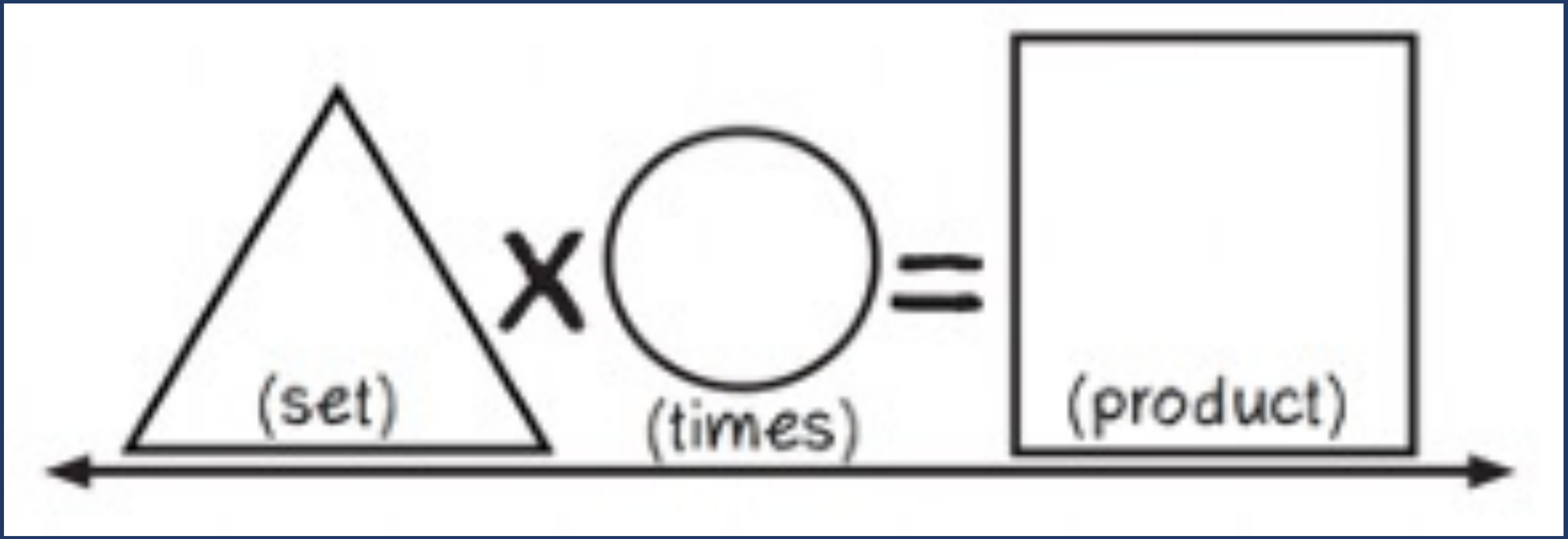
"Are there groups with an equal number in each group?"

Comparison

"Is a set compared a number of times?"

Comparison

S × T = P



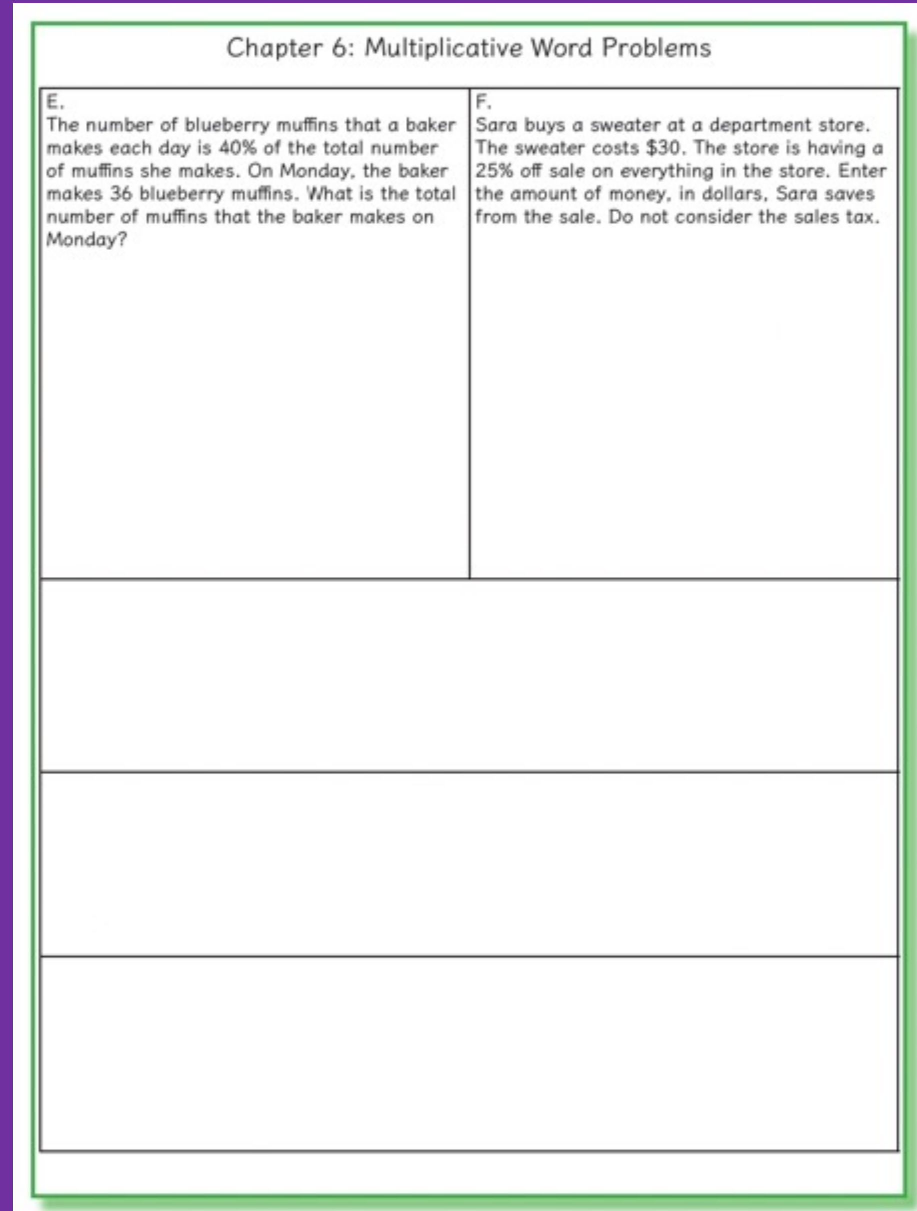
Comparison

Chapter 6: Multiplicative Word Problems

A. Lola baked 6 pies. For each pie, Lola used 5 apples. How many apples did Lola use?	B. Jane bought 112 light bulbs. The light bulbs come in packs of 4. How many packs of light bulbs did Jane buy?
C. Enrique has 2 times as many pencils as Ava. Ava has 6 pencils. How many pencils does Enrique have?	D. Susan has 7 times as many books as Mo. Mo has 18 books. How many books Susan has?

Comparison

Write a Comparison problem.



Chapter 6: Multiplicative Word Problems

E. The number of blueberry muffins that a baker makes each day is 40% of the total number of muffins she makes. On Monday, the baker makes 36 blueberry muffins. What is the total number of muffins that the baker makes on Monday?	F. Sara buys a sweater at a department store. The sweater costs $30. The store is having a 25% off sale on everything in the store. Enter the amount of money, in dollars, Sara saves from the sale. Do not consider the sales tax.

Ratios/Proportions

Description of relationships among quantities

Melissa baked cookies and brownies. The ratio of cookies to brownies was 3:5. If she baked 25 brownies, how many cookies did she bake?

Emma typed 56 words in 2 minutes. At this rate, how many words could Emma type in 7 minutes?

Xin et al. (2005)

Equal Groups

"Are there groups with an equal number in each group?"

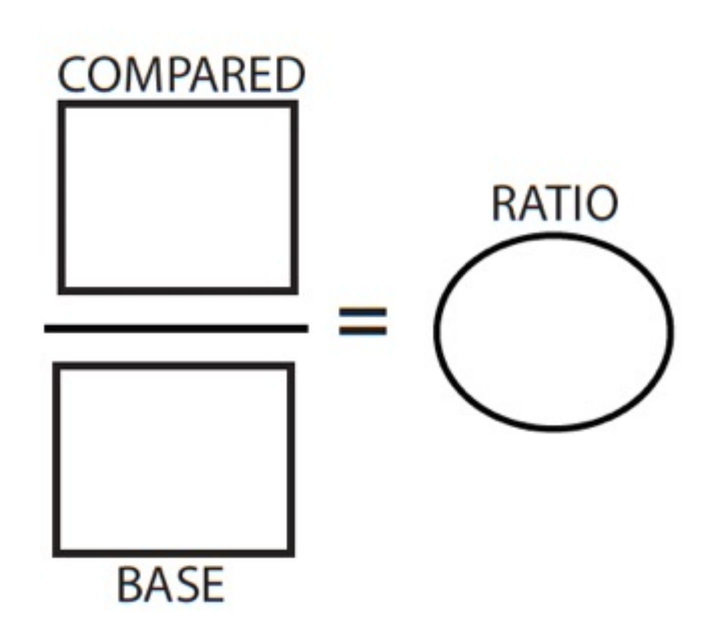
Comparison

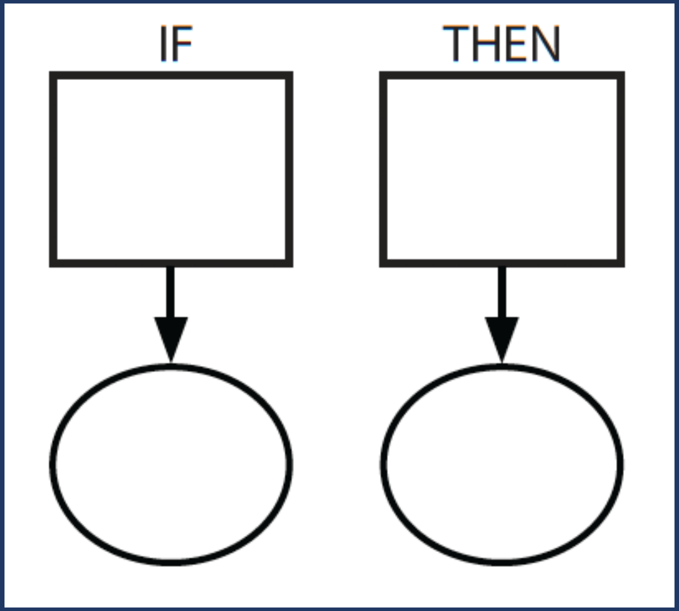
"Is a set compared a number of times?"

Ratios/Proportions

"Are there relationships among quantities - if this, then this?"

Ratios/Proportions





Xin et al. (2005)

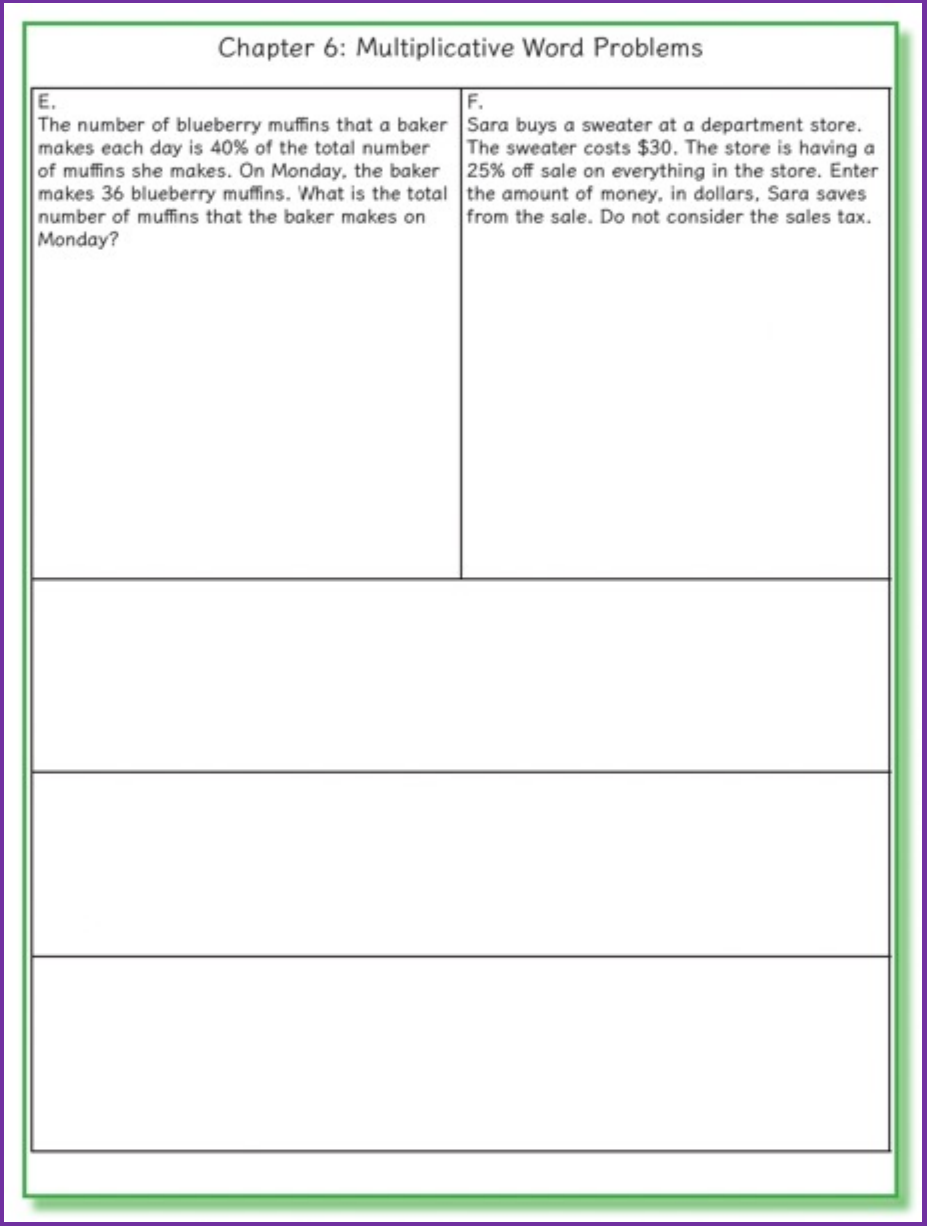
Ratios/Proportions

Multiplicative Word Problems

H. The number of blueberry muffins that a baker makes each day is 40% of the total number of muffins she makes. On Monday, the baker makes 36 blueberry muffins. What is the total number of muffins that the baker makes on Monday?	I. Sara buys a sweater at a department store. The sweater costs $30. The store is having a 25% off sale on everything in the store. Enter the amount of money, in dollars, Sara saves from the sale. Do not consider the sales tax.
J. Margarita baked cookies and brownies. The ratio of cookies to brownies was 3:5. If she baked 25 brownies, how many cookies did she bake?	NOTES:

Ratios/Proportions

Write a Proportions problem.



Chapter 6: Multiplicative Word Problems

E. The number of blueberry muffins that a baker makes each day is 40% of the total number of muffins she makes. On Monday, the baker makes 36 blueberry muffins. What is the total number of muffins that the baker makes on Monday?	F. Sara buys a sweater at a department store. The sweater costs $30. The store is having a 25% off sale on everything in the store. Enter the amount of money, in dollars, Sara saves from the sale. Do not consider the sales tax.

Schema Check!

Equal Groups

Mr. Kowolski ordered 35 boxes of granola bars. Each box contained 24 granola bars.

What is the total number of granola bars Mr. Kowolski ordered?

Grade 4 PARCC

Ratios/Proportions

A company makes 625 cell phone cases each day. How many cell phone cases does the company make in 31 days?

Comparison

Danielle's full-grown dog weighs 10 times as much as her puppy. The puppy weighs 9 pounds.

Enter the number of pounds the full-grown dog weighs.

Grade 4 Smarter Balanced

Total

Difference

Change

Equal Groups

Comparison

Ratios/Proportions

Total

Difference

Change

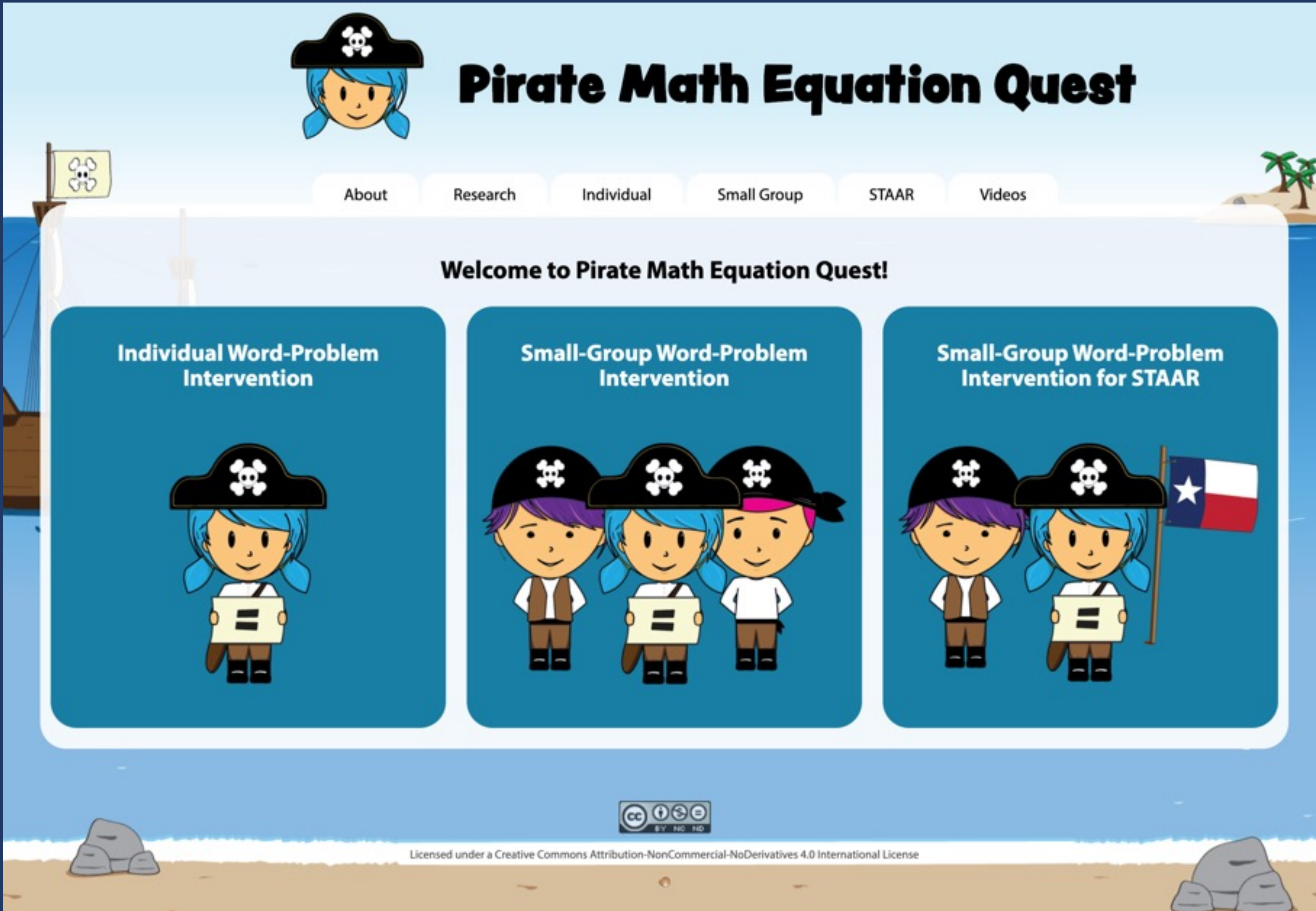
Equal Groups

Comparison

Ratio/ Proportion

Teach an attack strategy

Teach about schemas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https://intensiveintervention.org/intensive-intervention-math-course

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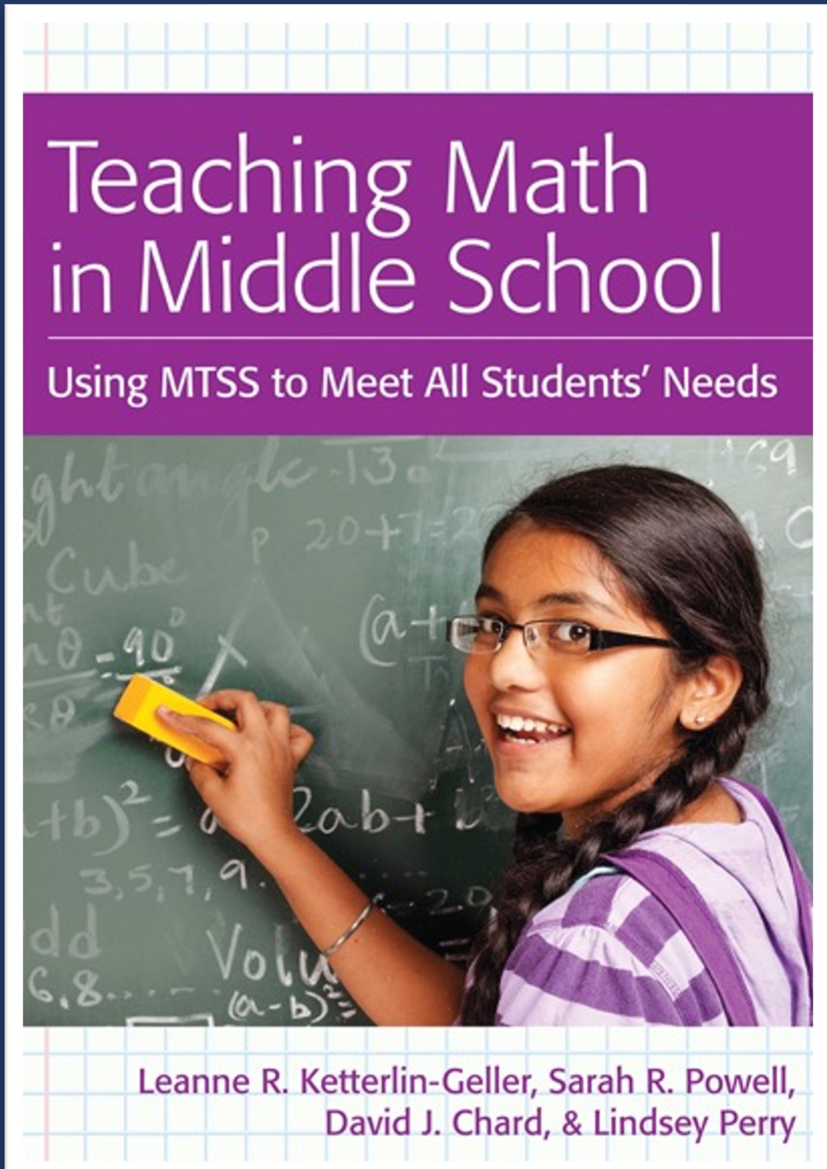
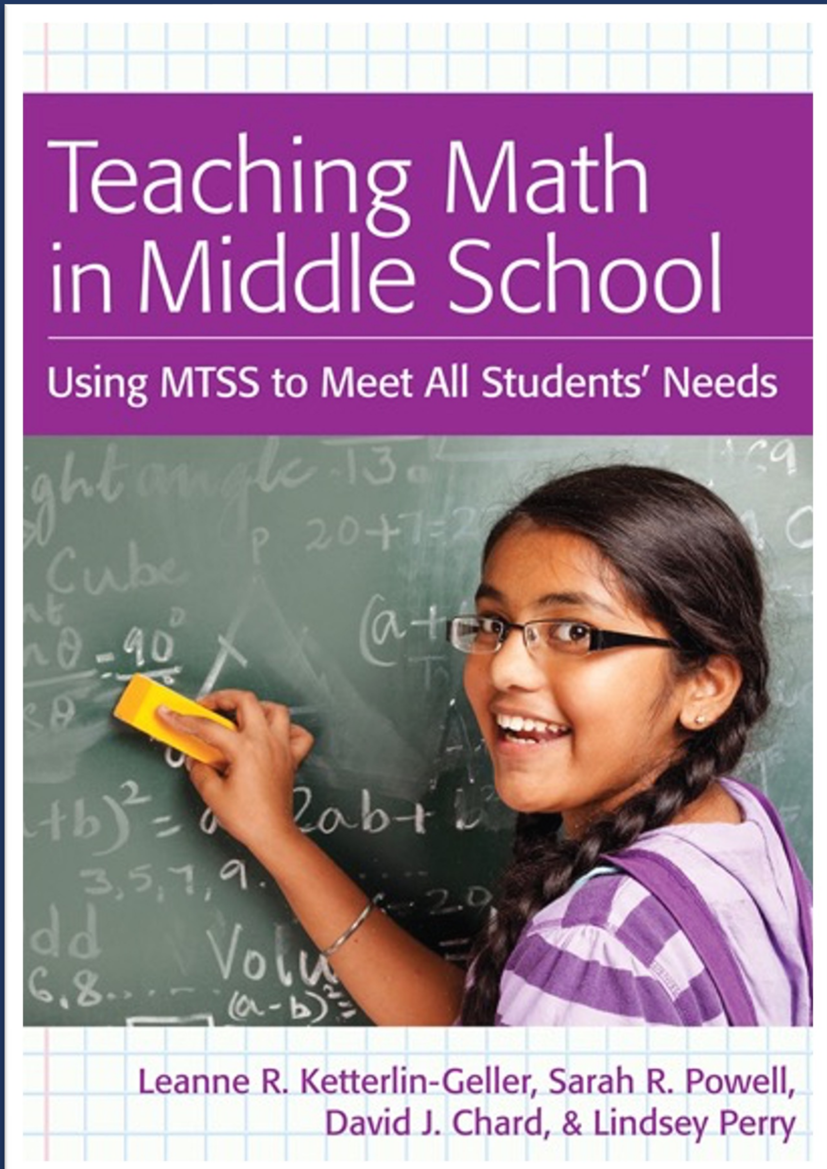
Intensive Intervention in Mathematics Course Content

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.


Teaching Math in Middle School
Using MTSS to Meet All Students' Needs
Leanne R. Ketterlin-Geller, Sarah R. Powell, David J. Chard, & Lindsey Perry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Chapter 7: Designing Interventions

Chapter 8: Implementing Interventions

Page 95

Page 107

continuum of mathematics learning

Fluently add and subtract multi-digit whole numbers using the standard algorithm.

Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division…

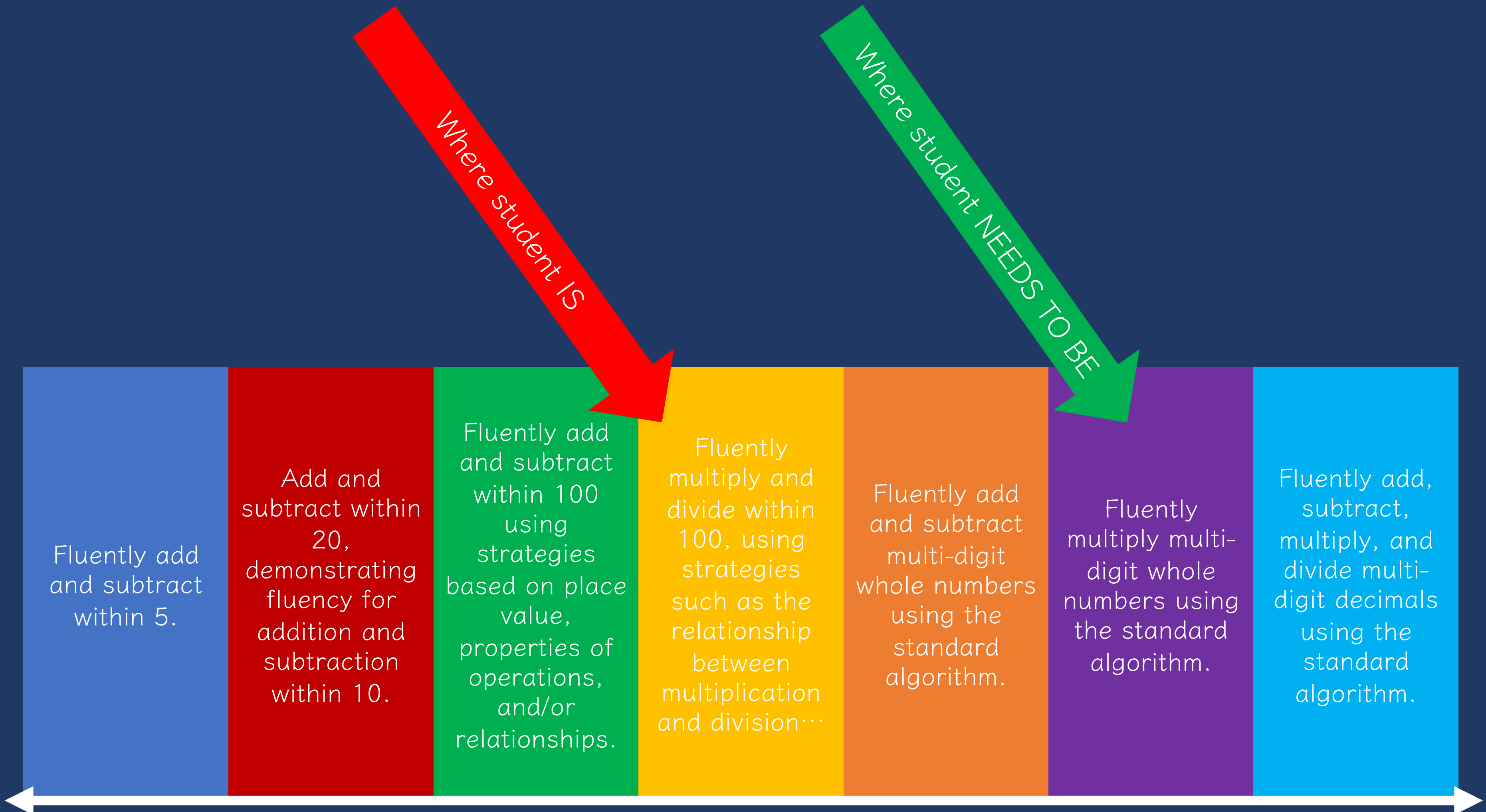
Fluently multiply multi-digit whole numbers using the standard algorithm.

Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or relationships.

Fluently add and subtract within 5.

Add and subtract within 20, demonstrating fluency for addition and subtraction within 10.

Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm.


Where student IS
Where student NEEDS TO BE
Fluently add and subtract within 5.
Add and subtract within 20, demonstrating fluency for addition and subtraction within 10.
Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or relationships.
Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division…
Fluently add and subtract multi-digit whole numbers using the standard algorithm.
Fluently multiply multi-digit whole numbers using the standard algorithm.
Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm.

Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.

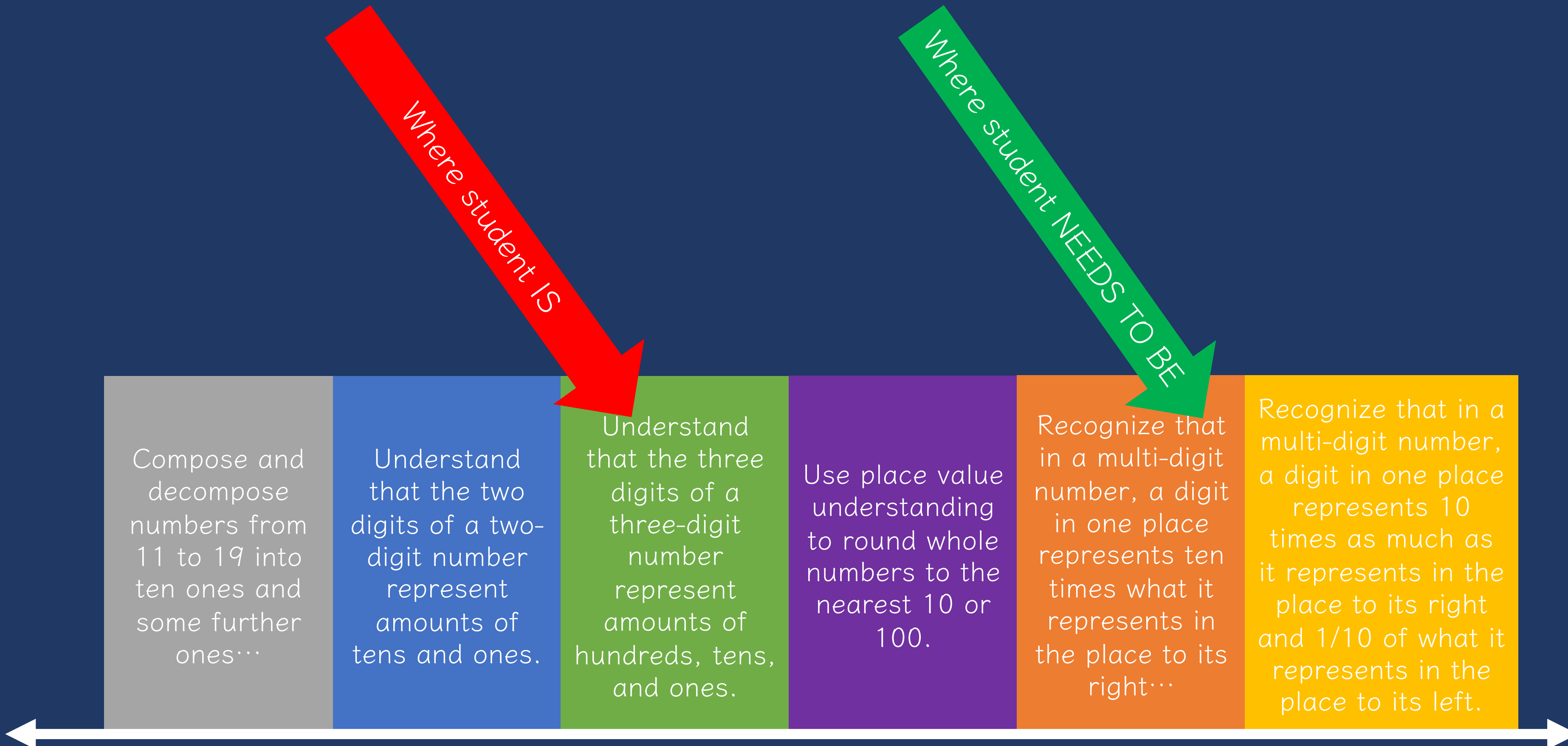
Understand that the two digits of a two-digit number represent amounts of tens and ones.

Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones.

Recognize that in a multi-digit number, a digit in one place represents ten times what it represents in the place to its right…

Compose and decompose numbers from 11 to 19 into ten ones and some further ones…

Use place value understanding to round whole numbers to the nearest 10 or 100.


Where student IS
Where student NEEDS TO BE
Compose and decompose numbers from 11 to 19 into ten ones and some further ones…
Understand that the two digits of a two-digit number represent amounts of tens and ones.
Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones.
Use place value understanding to round whole numbers to the nearest 10 or 100.
Recognize that in a multi-digit number, a digit in one place represents ten times what it represents in the place to its right…
Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.

Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions…

Solve real-world and mathematical problems leading to two linear equations in two variables.

Solve multi-step word problems posed with whole numbers and having whole-number answers using the four operations…

Use multiplication and division within 100 to solve word problems…

Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20…

Solve addition and subtraction word problems, and add and subtract within 10…

Use addition and subtraction within 100 to solve one- and two-step word problems…

Solve real-world and mathematical problems involving the four operations with rational numbers.

Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators…

Solve addition and subtraction word problems, and add and subtract within 10…

Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20…

Use addition and subtraction within 100 to solve one- and two-step word problems…

Use multiplication and division within 100 to solve word problems…

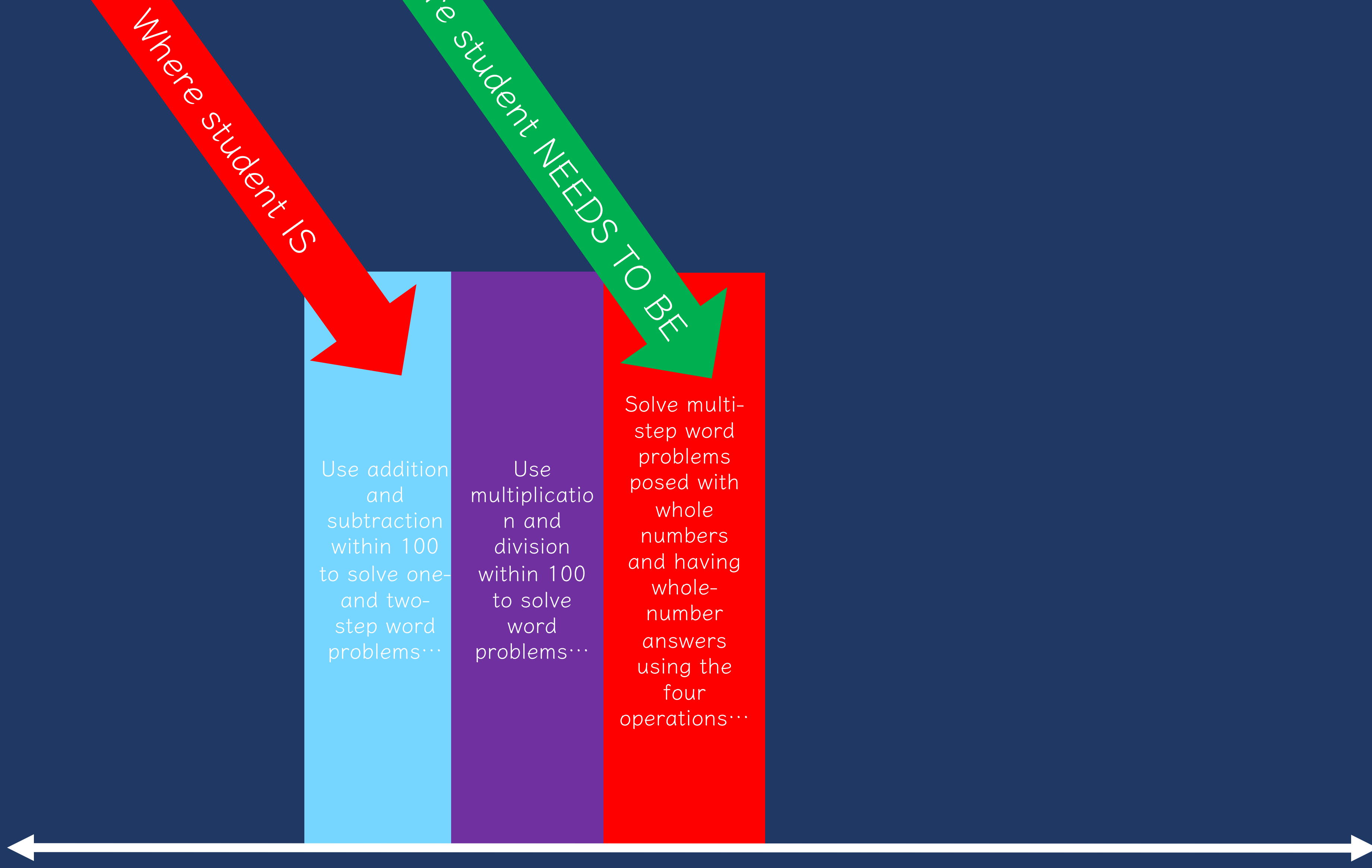
Solve multi-step word problems posed with whole numbers and having whole-number answers using the four operations…

Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators…

Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions…

Solve real-world and mathematical problems involving the four operations with rational numbers.

Solve real-world and mathematical problems leading to two linear equations in two variables.


Where student IS
e student NEEDS TO BE
Use addition and subtraction within 100 to solve one- and two-step word problems…
Use multiplication and division within 100 to solve word problems…
Solve multi-step word problems posed with whole numbers and having whole-number answers using the four operations…


Where student IS
Where student NEEDS TO BE
Understand that the two digits of a two-digit number represent amounts of tens and ones.
Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or relationships.
Apply properties of operations as strategies to multiply and divide….
Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division…
Fluently add and subtract multi-digit whole numbers using the standard algorithm.
Fluently multiply multi-digit whole numbers using the standard algorithm.

Kindergarten	Grade 1	Grade 2	Grade 3
Comparing and Ordering Numbers			
(2) Number and operations. The student applies mathematical process standards to understand how to represent and compare whole numbers, the relative position and magnitude of whole numbers, and relationships within the numeration system. The student is expected to:	(2) Number and operations. The student applies mathematical process standards to represent and compare whole numbers, the relative position and magnitude of whole numbers, and relationships within the numeration system related to place value. The student is expected to:	(2) Number and operations. The student applies mathematical process standards to understand how to represent and compare whole numbers, the relative position and magnitude of whole numbers, and relationships within the numeration system related to place value. The student is expected to:	(2) Number and operations. The student applies mathematical process standards to represent and compare whole numbers and understand relationships related to place value. The student is expected to:
(G) compare sets of objects up to at least 20 in each set using comparative language.	(E) use place value to compare whole numbers up to 120 using comparative language.	(D) use place value to compare and order whole numbers up to 1,200 using comparative language, numbers, and symbols (>, <, or =).	(D) compare and order whole numbers up to 100,000 and represent comparisons using the symbols >, <, or =.
(H) use comparative language to describe two numbers up to 20 presented as written numerals.			
	(F) order whole numbers up to 120 using place value and open number lines.		
	(G) represent the comparison of two numbers to 100 using the symbols >, <, or =.		

https://www.texasgateway.org/resource/vertical-alignment-charts-revised-mathematics-teks

An important subset of the major work in grades K–8 is the progression that leads toward middle school algebra.

K	1	2	3	4	5	6	7	8
Know number names and the count sequence Count to tell the number of objects Compare numbers Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from Work with numbers 11-19 to gain foundations for place value	Represent and solve problems involving addition and subtraction Understand and apply properties of operations and the relationship between addition and subtraction Add and subtract within 20 Work with addition and subtraction equations Extend the counting sequence Understand place value Use place value understanding and properties of operations to add and subtract Measure lengths indirectly and by iterating length units	Represent and solve problems involving addition and subtraction Add and subtract within 20 Understand place value Use place value understanding and properties of operations to add and subtract Measure and estimate lengths in standard units Relate addition and subtraction to length	Represent & solve problems involving multiplication and division Understand properties of multiplication and the relationship between multiplication and division Multiply & divide within 100 Solve problems involving the four operations, and identify & explain patterns in arithmetic Develop understanding of fractions as numbers Solve problems involving measurement and estimation of intervals of time, liquid volumes, & masses of objects Geometric measurement: understand concepts of area and relate area to multiplication and to addition	Use the four operations with whole numbers to solve problems Generalize place value understanding for multi-digit whole numbers Use place value understanding and properties of operations to perform multidigit arithmetic Extend understanding of fraction equivalence and ordering Build fractions from unit fractions by applying and extending previous understandings of operations Understand decimal notation for fractions, and compare decimal fractions	Understand the place value system Perform operations with multi-digit whole numbers and decimals to hundredths Use equivalent fractions as a strategy to add and subtract fractions Apply and extend previous understandings of multiplication and division to multiply and divide fractions Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition Graph points in the coordinate plane to solve real-world and mathematical problems*	Apply and extend previous understandings of multiplication and division to divide fractions by fractions Apply and extend previous understandings of numbers to the system of rational numbers Understand ratio concepts and use ratio reasoning to solve problems Apply and extend previous understandings of arithmetic to algebraic expressions Reason about and solve one-variable equations and inequalities Represent and analyze quantitative relationships between dependent and independent variables	Apply and extend previous understanding of operations with fractions to add, subtract, multiply, and divide rational numbers Analyze proportional relationships and use them to solve real-world and mathematical problems Use properties of operations to generate equivalent expressions Solve real-life and mathematical problems using numerical and algebraic expressions and equations	Work with radical and integer exponents Understand the connections between proportional relationships, lines, and linear equations** Analyze and solve linear equations and pairs of simultaneous linear equations Define, evaluate, and compare functions Use functions to model relationships between quantities

* Indicates a cluster that is well thought of as a part of a student's progress to algebra, but that is currently not designated as major by the assessment consortia in their draft materials. Apart from the one asterisked exception, the clusters listed here are a subset of those designated as major in the assessment consortia's draft documents.
** Depends on similarity ideas from geometry to show that slope can be defined and then used to show that a linear equation has a graph which is a straight line and conversely.

https://achievethecore.org/category/774/mathematics-focus-by-grade-level

Table A.3. Grades 6–8 Curriculum Focal Points and Connections Compared with the Expectations of the Content Standards in *Principles and Standards for School Mathematics*

Grade 6 · Grade 7 · Grade 8 · Outside grades 6–8 · Not identified at any level, pre-K–8

Curriculum Focal Points and Connections

Grade 6 Curriculum Focal Points

***Number and Operations:* Developing an understanding of and fluency with multiplication and division of fractions and decimals**

Students use the meanings of fractions, multiplication and division, and the inverse relationship between multiplication and division to make sense of procedures for multiplying and dividing fractions and explain why they work. They use the relationship between decimals and fractions, as well as the relationship between finite decimals and whole numbers (i.e., a finite decimal multiplied by an appropriate power of 10 is a whole number), to understand and explain the procedures for multiplying and dividing decimals. Students use common procedures to multiply and divide fractions and decimals efficiently and accurately. They multiply and divide fractions and decimals to solve problems, including multistep problems and problems involving measurement.

***Number and Operations:* Connecting ratio and rate to multiplication and division**

Students use simple reasoning about multiplication and division to solve ratio and rate problems (e.g., "If 5 items cost $3.75 and all items are the same price, then I can find the cost of 12 items by first dividing $3.75 by 5 to find out how much one item costs and then multiplying the cost of a single item by 12"). By viewing equivalent ratios and rates as deriving from, and extending, pairs of rows (or columns) in the multiplication table, and by analyzing simple drawings that indicate the relative sizes of quantities, students extend whole number multiplication and division to ratios and rates. Thus, they expand the repertoire of problems that they can solve by using multiplication and division, and they build on their understanding of fractions to understand ratios. Students solve a wide variety of problems involving ratios and rates.

***Algebra:* Writing, interpreting, and using mathematical expressions and equations**

Students write mathematical expressions and equations that correspond to given situations, they evaluate expressions, and they use expressions and formulas to solve problems. They understand that variables represent numbers whose exact values are not yet specified, and they use variables appropriately. Students understand that expressions in different forms can be equivalent, and they can rewrite an expression to represent a quantity in a different way (e.g., to make it more compact or to feature different information). Students know that the solutions of an equation are the values of the variables that

Expectations of the Content Standards

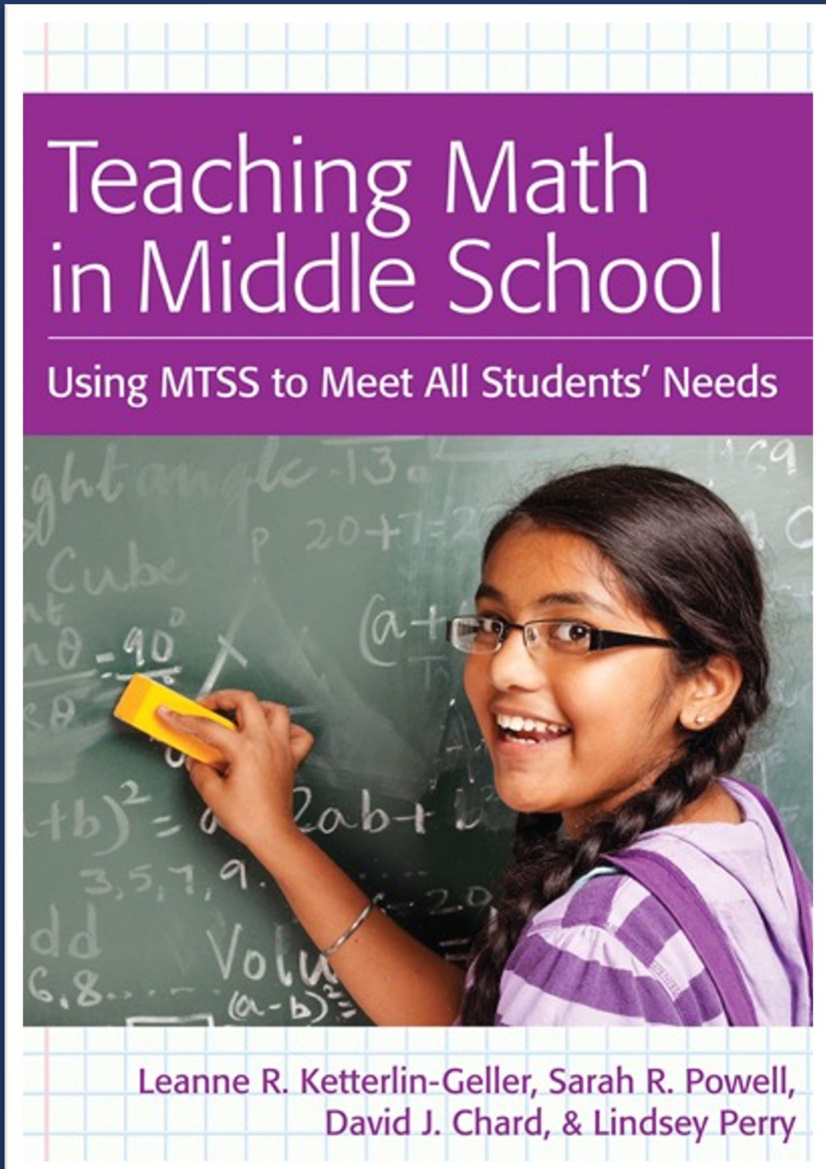
Number and Operations, Grades 6–8

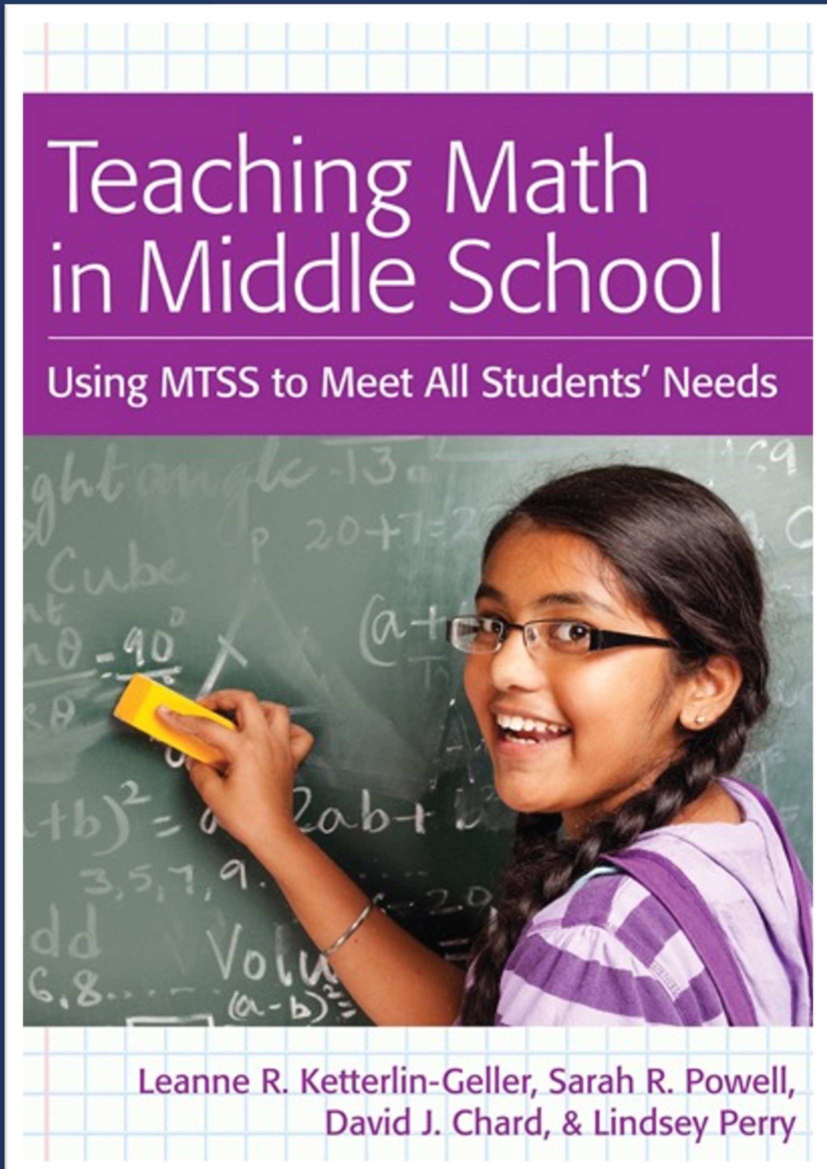
- Work flexibly with fractions, decimals, and percents to solve problems
- Compare and order fractions, decimals, and percents efficiently and find their approximate locations on a number line
- Develop meaning for percents greater than 100 and less than 1
- Understand and use ratios and proportions to represent quantitative relationships
- Develop an understanding of large numbers [identified in Grades 4 and 5 Curriculum Focal Points] and recognize and appropriately use exponential, scientific, and calculator notation
- Use factors, multiples, prime factorization, and relatively prime numbers to solve problems
- Develop meaning for integers and represent and compare quantities with them
- Understand the meaning and effects of arithmetic operations with fractions, decimals, and integers
- Use the associative and commutative properties of addition and multiplication and the distributive property of multiplication over addition to simplify computations with integers, fractions, and decimals
- Understand and use the inverse relationships of addition and subtraction, multiplication and division, and squaring and finding square roots to simplify computations and solve problems
- Select appropriate methods and tools for computing with fractions and decimals from among mental computation, estimation, calculators or computers, and paper and pencil, depending on the situation, and apply the selected methods

https://www.nctm.org/curriculumfocalpoints/

What are your resources for planning around a continuum of math?

How can your district or school engage in vertical planning?


Teaching Math in Middle School
Using MTSS to Meet All Students' Needs
Leanne R. Ketterlin-Geller, Sarah R. Powell,
David J. Chard, & Lindsey Perry


Teaching Math
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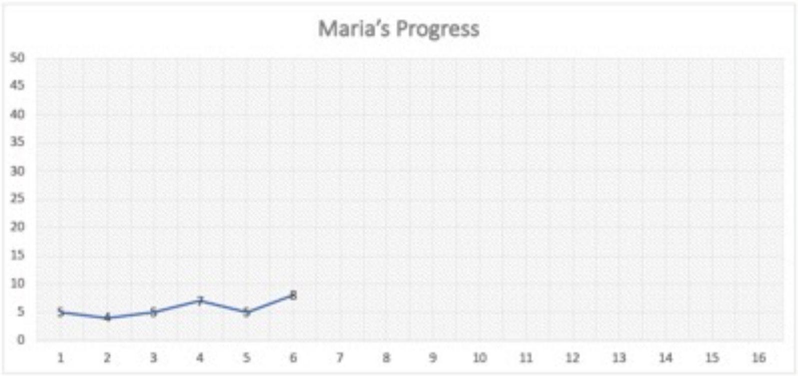
Chapter 12: Progress Monitoring

Goal Setting: Benchmark

1. Identify appropriate grade-level benchmark
2. Mark benchmark on student graph with an X
3. Draw goal-line from baseline progress monitoring scores to X



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What is Progress Monitoring?

Tests/measures/probes administered **frequently**

Compare scores to understand **mathematics growth**

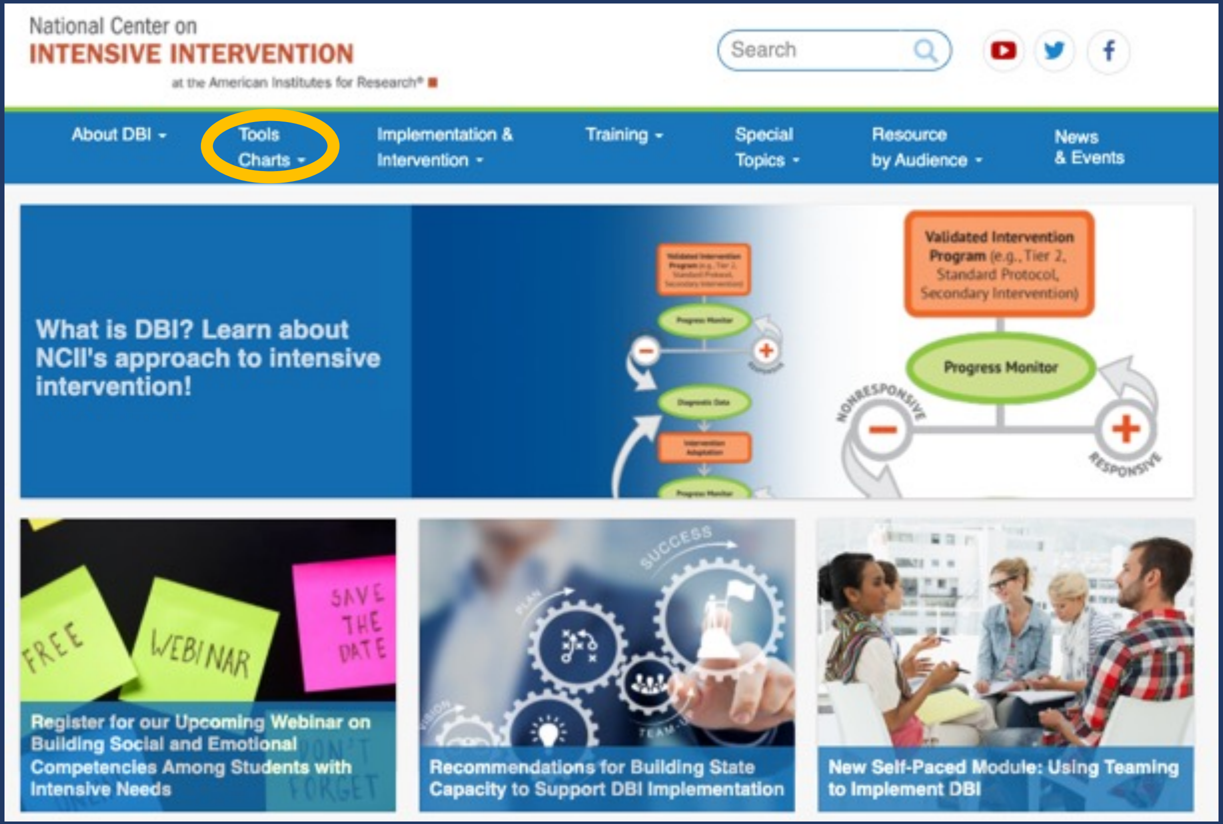
Must be **reliable** and **valid**

Must have **alternate forms**

Where to Find Progress Monitoring Measures?

National Center on Intensive Intervention

www.intensiveintervention.org



Progress Monitoring Considerations

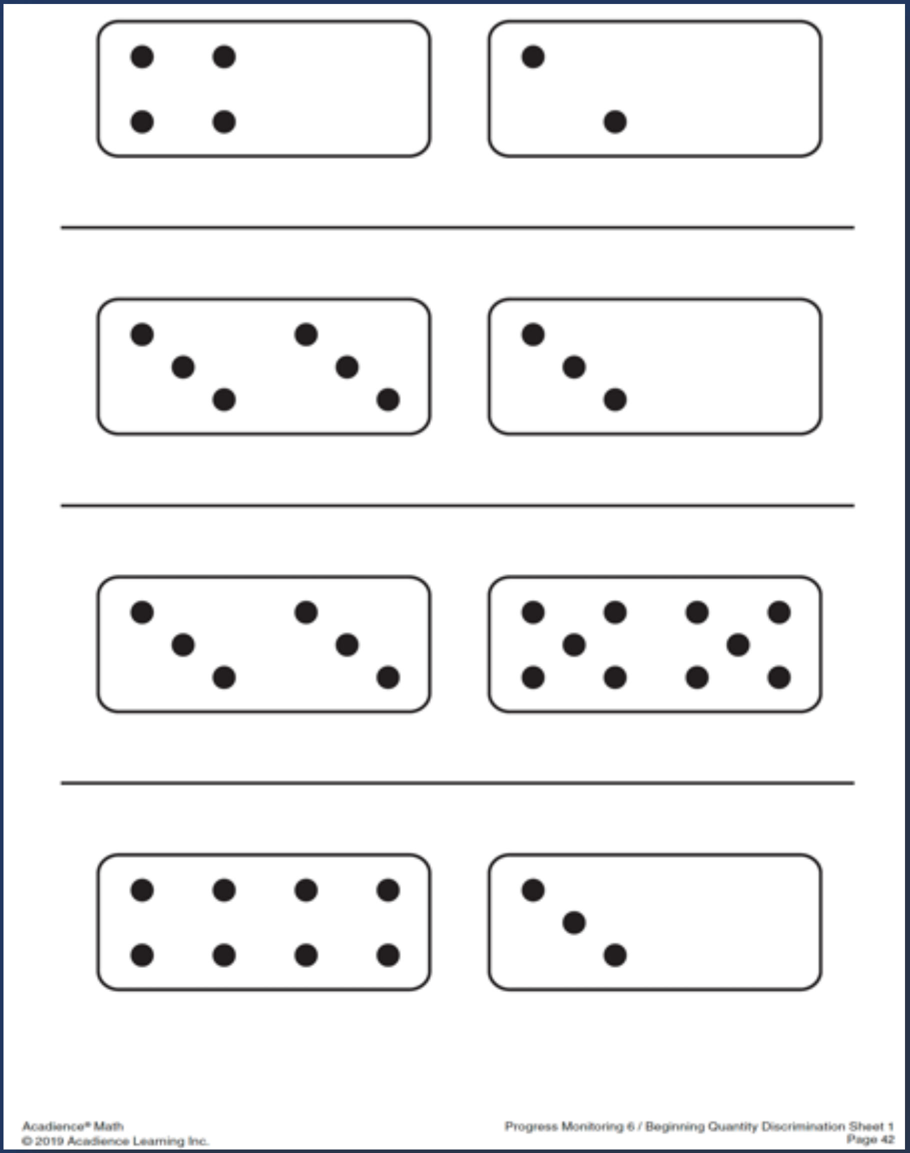
- Skills to be measured—age and grade appropriate
- Cost and training requirements
- Administration and scoring time
- Data management
- Technical rigor (consider population)
  - Reliability
  - Validity
  - Evidence of being sensitive to change
  - Alternate/parallel forms

Number Identification

6	16	23	10	17
38	97	20	15	24
14	33	11	79	8
21	19	93	3	49
4	30	12	9	1
28	7	27	2	13

https://www.acadiencelearning.org

Quantity Discrimination



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Missing Number

13 ___ 15 16	50 60 ___ 80
40 45 ___ 55	50 51 ___ 53
23 ___ 25 26	15 20 ___ 30
27 28 ___ 30	38 48 ___ 68
75 ___ 85 90	83 ___ 85 86

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Computation

Acadience® Math / Computation Grade 4
Benchmark 1 / Form A

Total: ______

1. $\begin{array}{r}527\\ \underline{+320}\end{array}$	2. $\begin{array}{r}4778\\ \underline{+2242}\end{array}$	3. $8\frac{4}{5} - 6\frac{2}{5} =$	4. $\begin{array}{r}9\\ \underline{x8}\end{array}$	5. $4\overline{)573}$
6. $\begin{array}{r}197\\ \underline{-\ \ 74}\end{array}$	7. $\frac{5}{8} + \frac{2}{8} =$	8. $\begin{array}{r}7273\\ \underline{-\ \ 387}\end{array}$	9. $\begin{array}{r}19\\ \underline{x11}\end{array}$	10. $9\frac{7}{12} - 1\frac{4}{12} =$
11. $8\overline{)642}$	12. $7\overline{)49}$	13. $\begin{array}{r}99\\ \underline{x72}\end{array}$	14. $\frac{1}{4} + \frac{2}{4} =$	15. $\begin{array}{r}526\\ \underline{x\ \ \ 6}\end{array}$
16. $8\frac{9}{10} - 1\frac{5}{10} =$	17. $\frac{1}{3} + \frac{1}{3} =$	18. $\frac{9}{12} - \frac{2}{12} =$	19. $\begin{array}{r}829\\ \underline{x\ \ \ 7}\end{array}$	20. $6\overline{)939}$
21. $3\overline{)397}$	22. $\begin{array}{r}65\\ \underline{x23}\end{array}$	23. $\begin{array}{r}2414\\ \underline{-\ \ 668}\end{array}$	24. $\begin{array}{r}7568\\ \underline{+1638}\end{array}$	25. $\begin{array}{r}34\\ \underline{x12}\end{array}$

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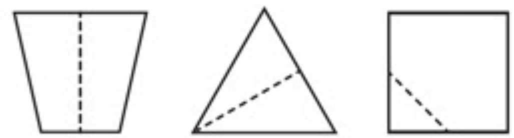
Concepts and Applications

Acadience® Math / Concepts and Applications
Grade 4 / Benchmark 1

Total: ________

1. Is the dotted line a line of symmetry for each shape? Write "yes" or "no" in the space provided below each shape.



_______ _______ _______

2. Compare the number in Box 1 with the number in Box 2. Fill in the blank with > (greater than), = (equal to), or < (less than):

Box 1	>, =, <	Box 2
835		751
333		613
131		168

3. List three numbers that are multiples of 4:

_______ _______ _______

4. Jake read 17 books over the summer that were nonfiction and 43 books that were fiction. His friend Ross read 38 books total. How many more books did Jake read than Ross? __________ books.

5. Compare the decimal in Box 1 with the decimal in Box 2. Fill in the blank with > (greater than), = (equal to), or < (less than):

Box 1	>, =, <	Box 2
0.47		0.25
0.39		0.68
0.89		0.91

6. We rented a movie that was 2 hours and 15 minutes long. How many minutes total was the movie? __________ minutes.

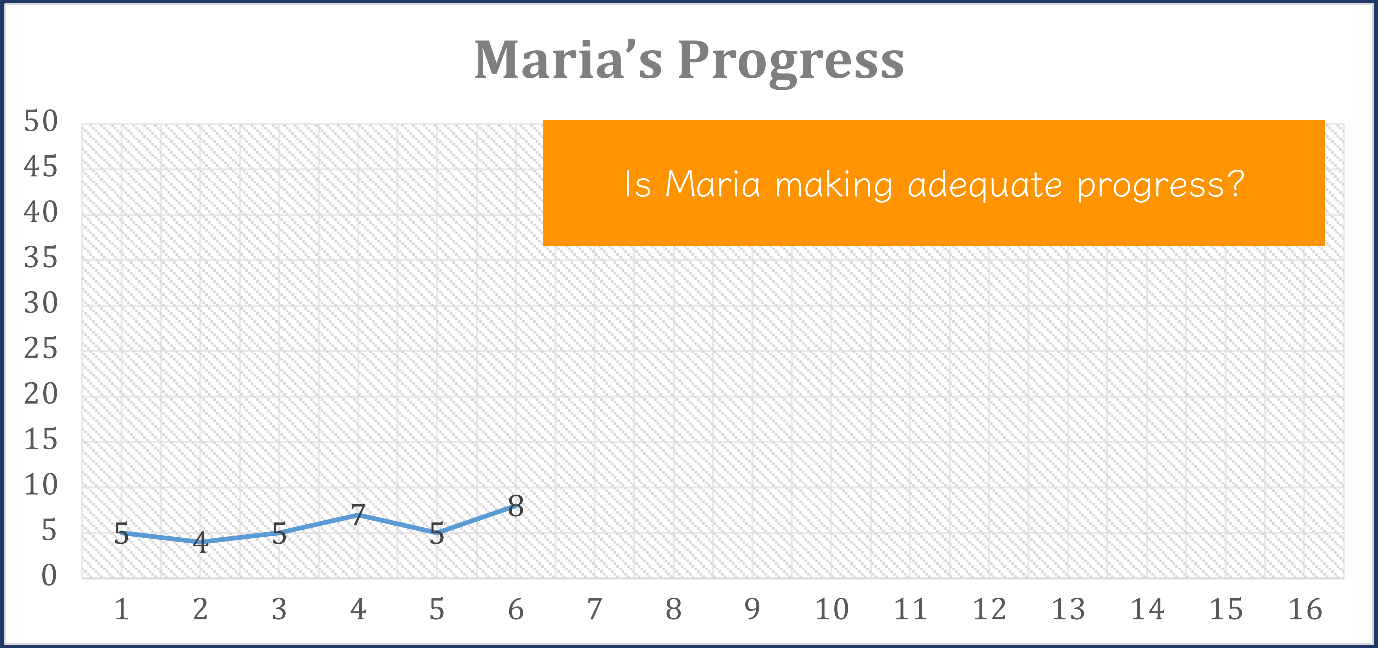
https://www.acadiencelearning.org

Beyond these measures…

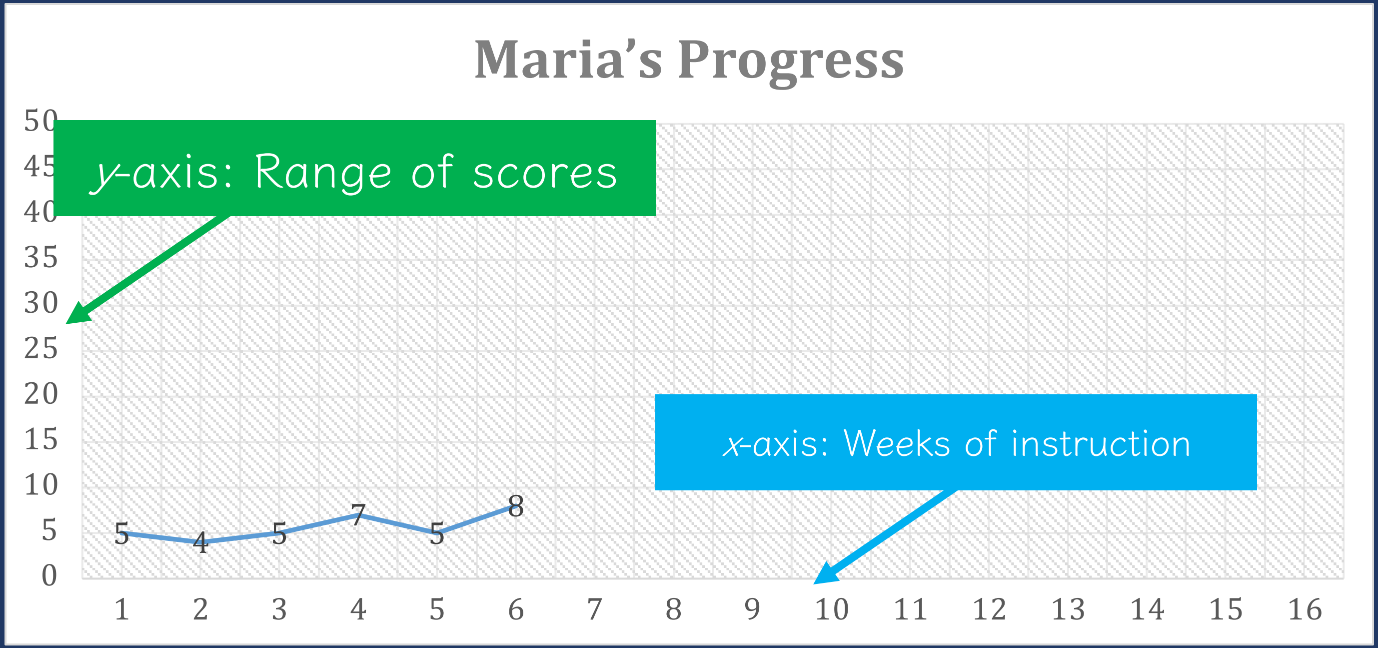
Next Number / Counting	Grades K-1
Geometry / Measurement	Grades 1-6
Proportional Reasoning / Quantity Discrimination / Number Properties	Middle School
Algebra	High School

Which progress monitoring measures do you use (or plan to use) at middle school?

Goal Setting and Decision Making



Graphing


Maria's Progress
y-axis: Range of scores
x-axis: Weeks of instruction
50
45
40
35
30
25
20
15
10
5
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
5 4 5 7 5 8

Setting Goals

Benchmark

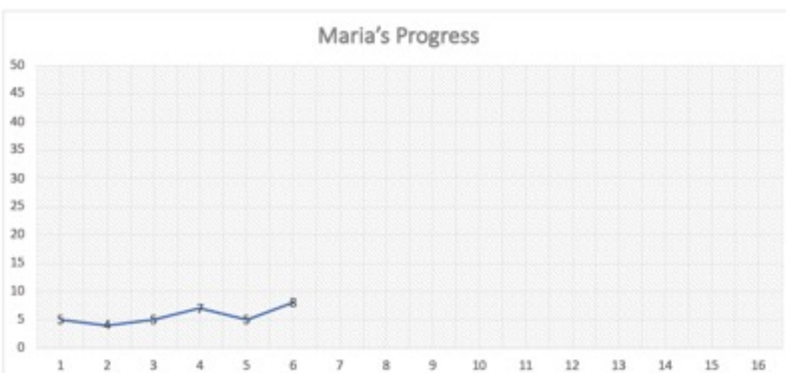
Slope (ROI)

Intra-individual

Chapter 12: Progress Monitoring

Goal Setting: Benchmark

1. Identify appropriate grade-level benchmark
2. Mark benchmark on student graph with an X
3. Draw goal-line from baseline progress monitoring scores to X



Benchmark

1. Identify appropriate grade-level benchmark
2. Mark benchmark on student graph with an X
3. Draw goal-line from baseline progress monitoring scores to X

Benchmark

1. Identify appropriate grade-level benchmark

Grade	Computation	Concepts and Applications
1	20 digits	20 points
2	20 digits	20 points
3	30 digits	30 points
4	40 digits	30 points
5	30 digits	15 points
6	35 digits	15 points

http://www.rti4success.org/resource/rti-implementer-series-module-2-progress-monitoring

Benchmark

1. Identify appropriate grade-level benchmark

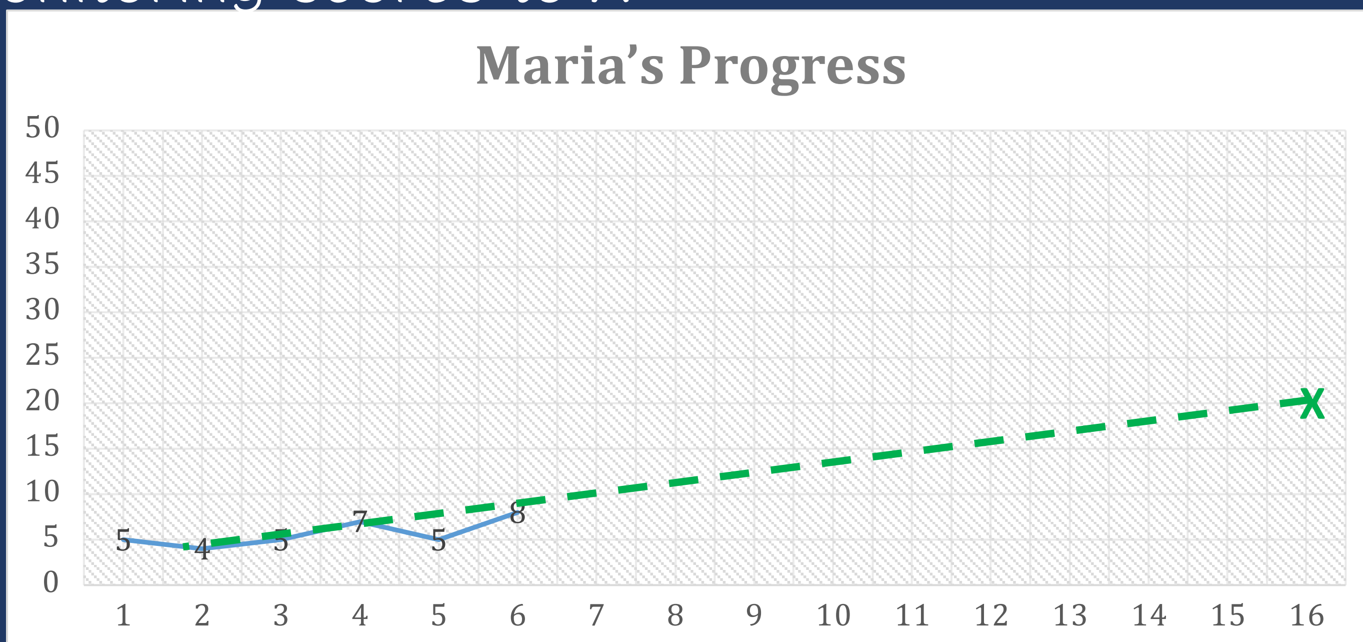
Grade	Computation	Concepts and Applications
1	20 digits	20 points
2	20 digits	20 points
3	30 digits	30 points
4	40 digits	30 points
5	30 digits	15 points
6	35 digits	15 points

Maria: 2nd-grade student using Computation

http://www.rti4success.org/resource/rti-implementer-series-module-2-progress-monitoring

Benchmark

1. Identify appropriate grade-level benchmark
2. Mark benchmark on student graph with an X
3. Draw goal-line from baseline progress monitoring scores to X



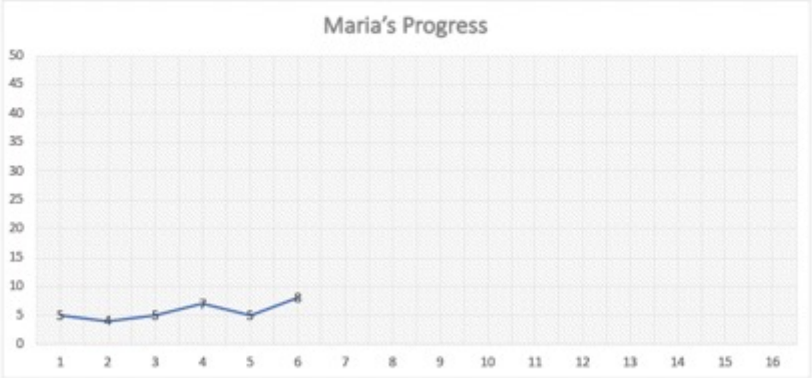
Setting Goals

Benchmark

Slope (ROI)

Goal Setting: Slope (Rate of Improvement)

1. Locate slope (i.e., rate of improvement – ROI)
2. Multiply ROI by number of weeks left in intervention
3. Add to baseline of progress monitoring scores
4. Mark goal on student graph with an X
5. Draw goal-line from baseline progress monitoring scores to X



Slope (ROI)

1. Locate slope (i.e., rate of improvement – ROI)
2. Multiply ROI by number of weeks left in intervention
3. Add to baseline of progress monitoring scores
4. Mark goal on student graph with an X
5. Draw goal-line from baseline progress monitoring scores to X

Slope (ROI)

1. Locate slope (i.e., rate of improvement – ROI)

Grade	Computation—Slope for Digits Correct	Concepts and Applications — Slope for Points
1	0.35	No data available
2	0.30	0.40
3	0.30	0.60
4	0.70	0.70
5	0.70	0.70
6	0.40	0.70

http://www.rti4success.org/resource/rti-implementer-series-module-2-progress-monitoring

Slope (ROI)

1. Locate slope (i.e., rate of improvement – ROI)

Grade	Computation—Slope for Digits Correct	Concepts and Applications — Slope for Points
1	0.35	No data available
2	0.30	0.40
3	0.30	0.60
4	0.70	0.70
5	0.70	0.70
6	0.40	0.70

Maria: 2nd-grade student using Computation

http://www.rti4success.org/resource/rti-implementer-series-module-2-progress-monitoring

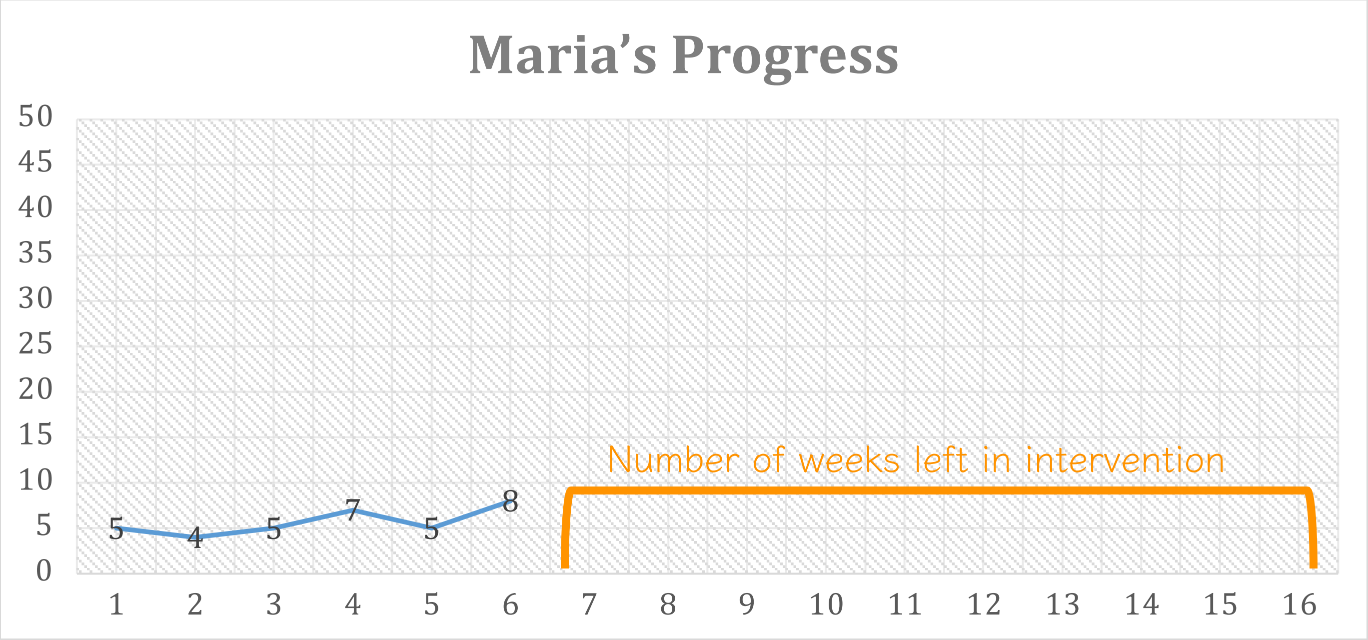
Slope (ROI)

1. Locate slope (i.e., rate of improvement – ROI) 0.30

Slope (ROI)

1. Locate slope (i.e., rate of improvement – ROI) 0.30
2. Multiply ROI by number of weeks left in intervention 0.30 ×

Slope (ROI)



Maria's Progress
50
45
40
35
30
25
20
15
10
5
0
5
4
5
7
5
8
Number of weeks left in intervention
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

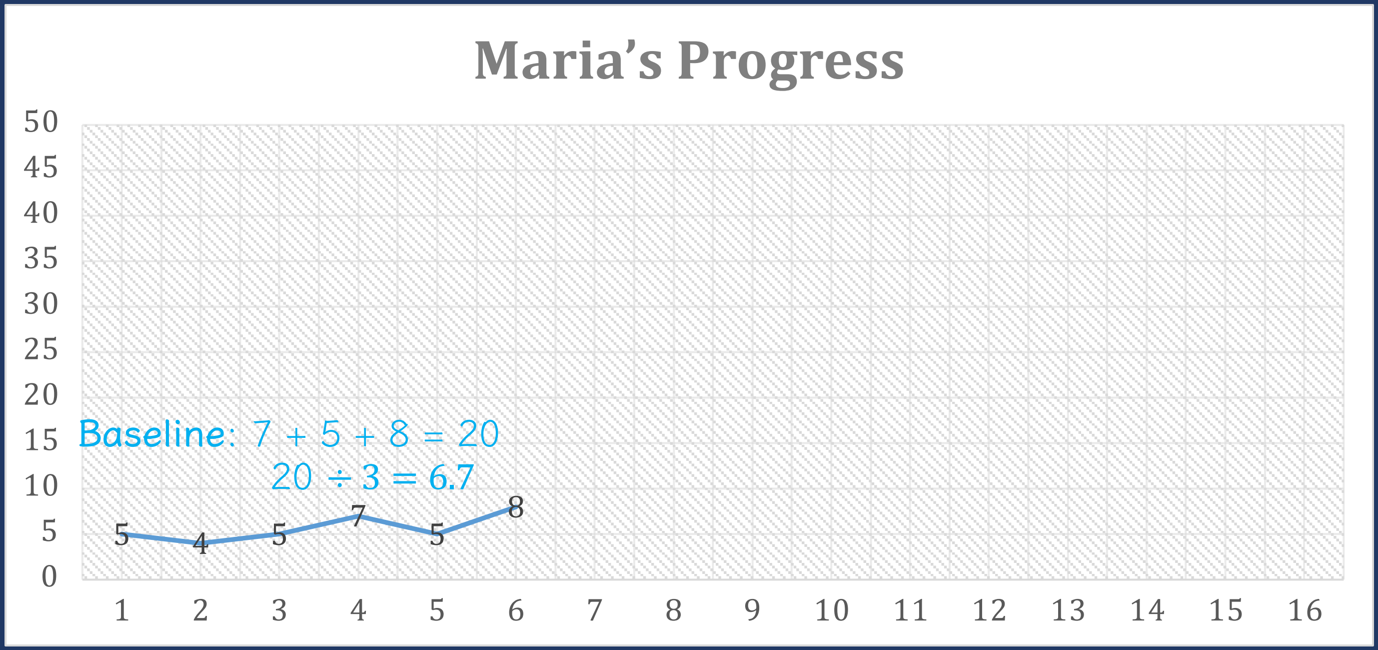
Slope (ROI)

1. Locate slope (i.e., rate of improvement – ROI) 0.30
2. Multiply ROI by number of weeks left in intervention $0.30 \times 10 = 3$

Slope (ROI)

1. Locate slope (i.e., rate of improvement – ROI) 0.30
2. Multiply ROI by number of weeks left in intervention $0.30 \times 10 = 3$
3. Add to baseline of progress monitoring scores $3 +$

Slope (ROI)



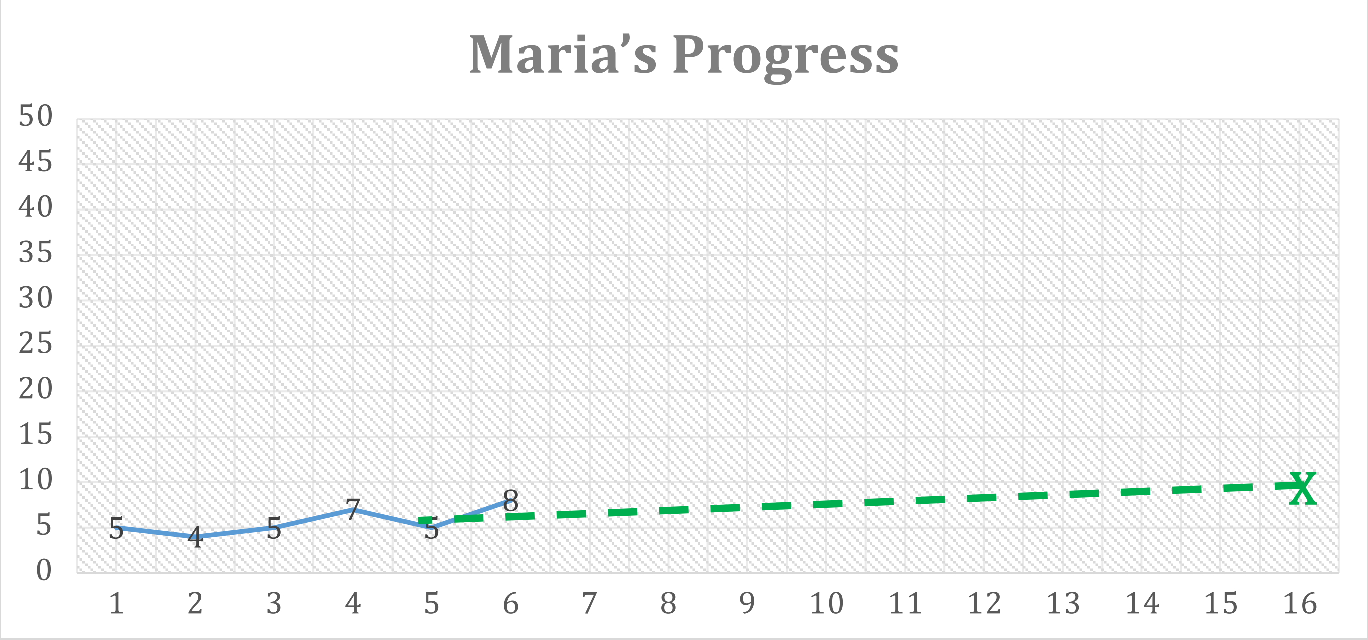
Maria's Progress
50
45
40
35
30
25
20
15
10
5
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
5 4 5 7 5 8
Baseline: 7 + 5 + 8 = 20
20 ÷ 3 = 6.7

Slope (ROI)

1. Locate slope (i.e., rate of improvement – ROI) — 0.30
2. Multiply ROI by number of weeks left in intervention — $0.30 \times 10 = 3$
3. Add to baseline of progress monitoring scores — $3 + 6.7 = 9.7$

Slope (ROI)

1. Locate slope (i.e., rate of improvement – ROI) 0.30
2. Multiply ROI by number of weeks left in intervention $0.30 \times 10 = 3$
3. Add to baseline of progress monitoring scores $3 + 6.7 = 9.7$
4. Mark goal on student graph with an X
5. Draw goal-line from baseline progress monitoring scores to X



Setting Goals

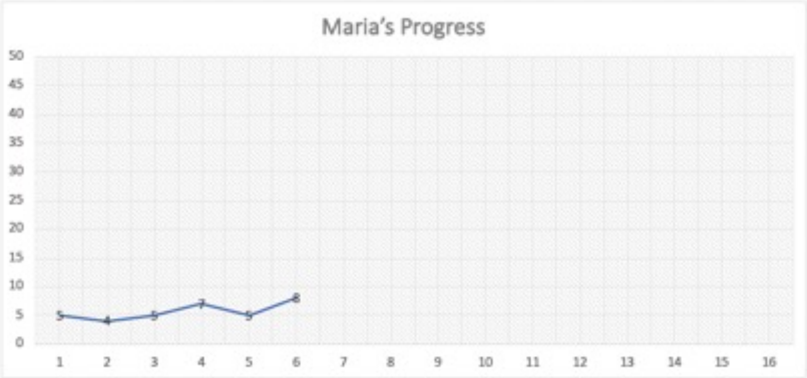
Benchmark

Slope (ROI)

Intra-
individual

Goal Setting: Intra-Individual Framework

1. Identify student's slope
2. Multiply slope by 1.5
3. Multiply by number of weeks until end of intervention
4. Add to student's baseline score
5. Mark goal on student graph with an X
6. Draw goal-line from baseline progress monitoring scores to X



Intra-individual

1. Identify student's slope
2. Multiply slope by 1.5
3. Multiply by number of weeks until end of intervention
4. Add to student's baseline score
5. Mark goal on student graph with an X
6. Draw goal-line from baseline progress monitoring scores to X

Intra-individual

1. Identify student's slope

SLOPE CALCULATION:

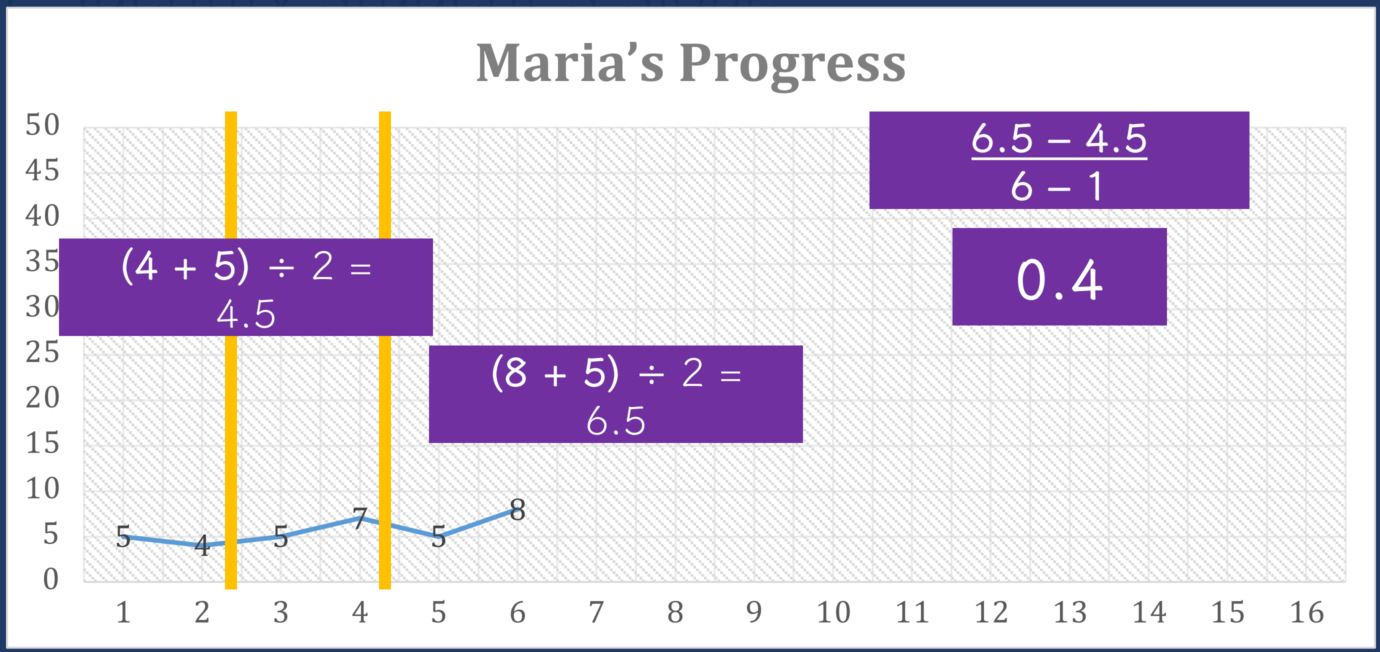
$$\frac{\text{3rd median} - \text{1st median}}{\text{\#data points} - 1}$$

Intra-individual

SLOPE CALCULATION:

$$\frac{3^{rd}\text{ median} - 1^{st}\text{ median}}{\#\text{data points} - 1}$$

1. Identify student's slope



Intra-individual

1. Identify student's slope

0.4

Intra-individual

1. Identify student's slope
2. Multiply slope by 1.5

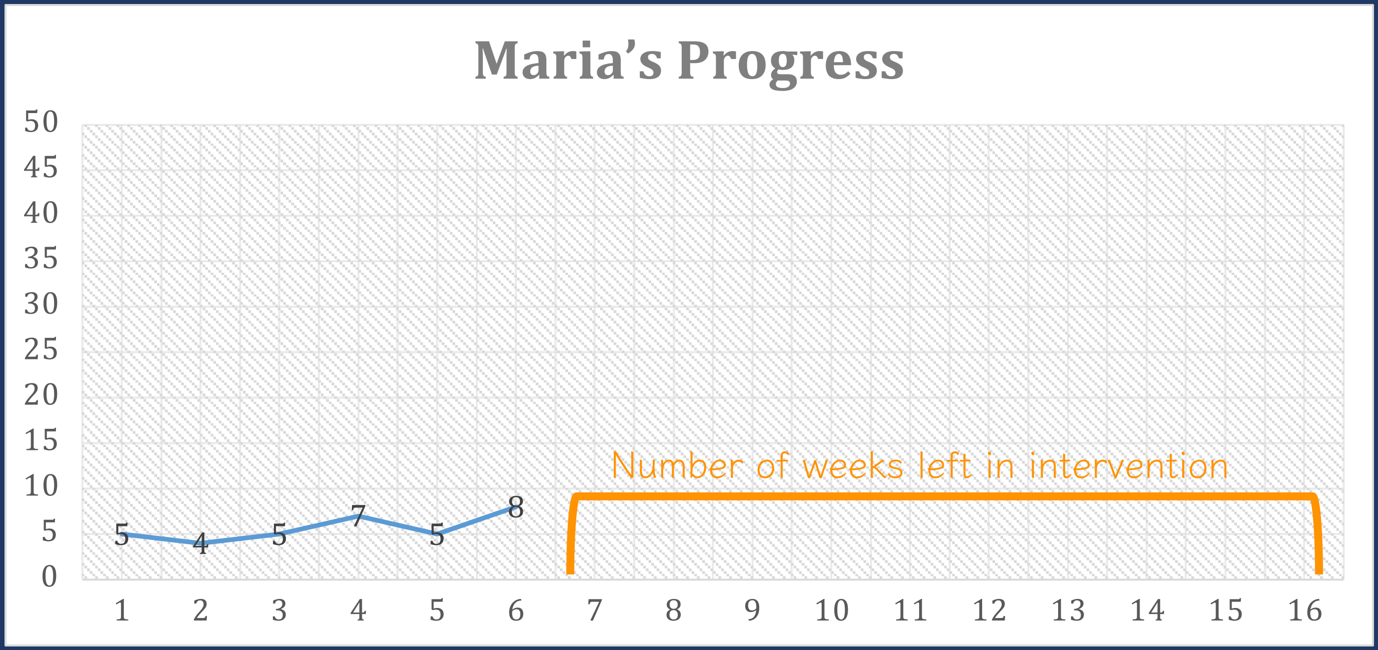
0.4

$0.4 \times 1.5 = 0.6$

Intra-individual

1. Identify student's slope — 0.4
2. Multiply slope by 1.5 — $0.4 \times 1.5 = 0.6$
3. Multiply by number of weeks until end of intervention — $0.6 \times$

Intra-individual



Intra-individual

1. Identify student's slope
2. Multiply slope by 1.5
3. Multiply by number of weeks until end of intervention

0.4

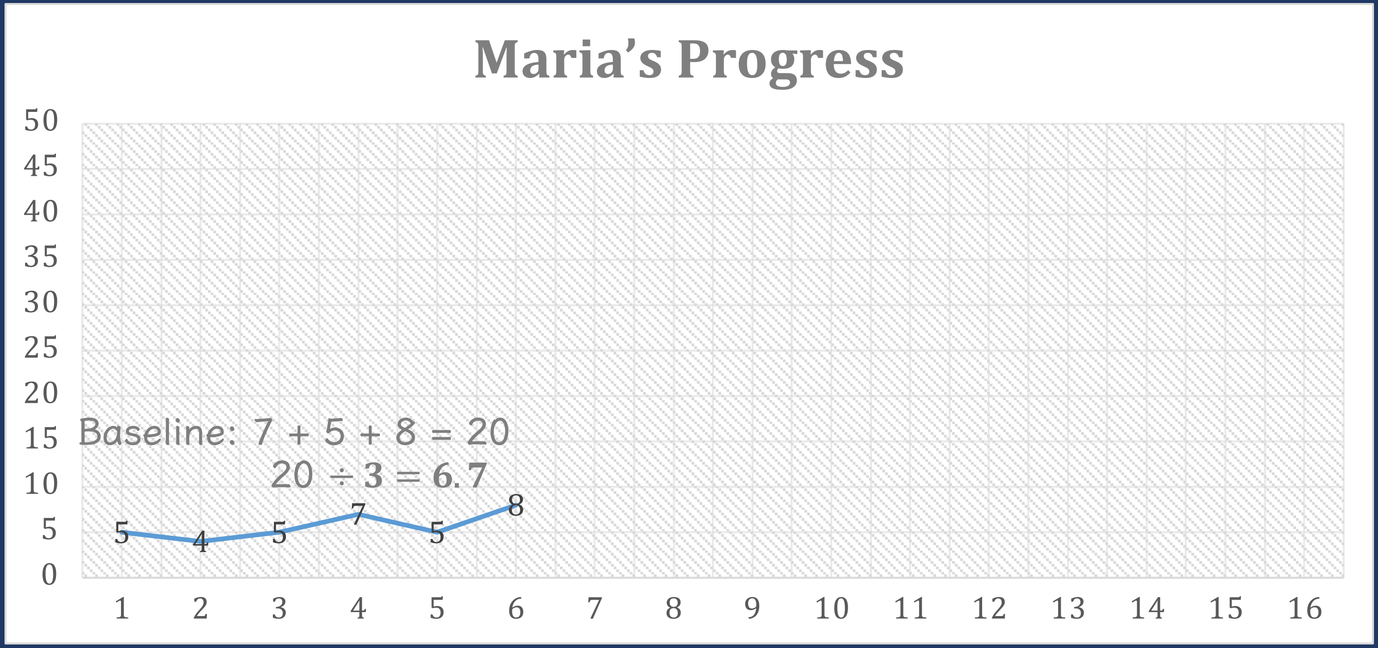
$0.4 \times 1.5 = 0.6$

$0.6 \times 10 = 6$

Intra-
individual

1. Identify student's slope — 0.4
2. Multiply slope by 1.5 — $0.4 \times 1.5 = 0.6$
3. Multiply by number of weeks until end of intervention — $0.6 \times 10 = 6$
4. Add to student's baseline score — 6

Intra-
individual

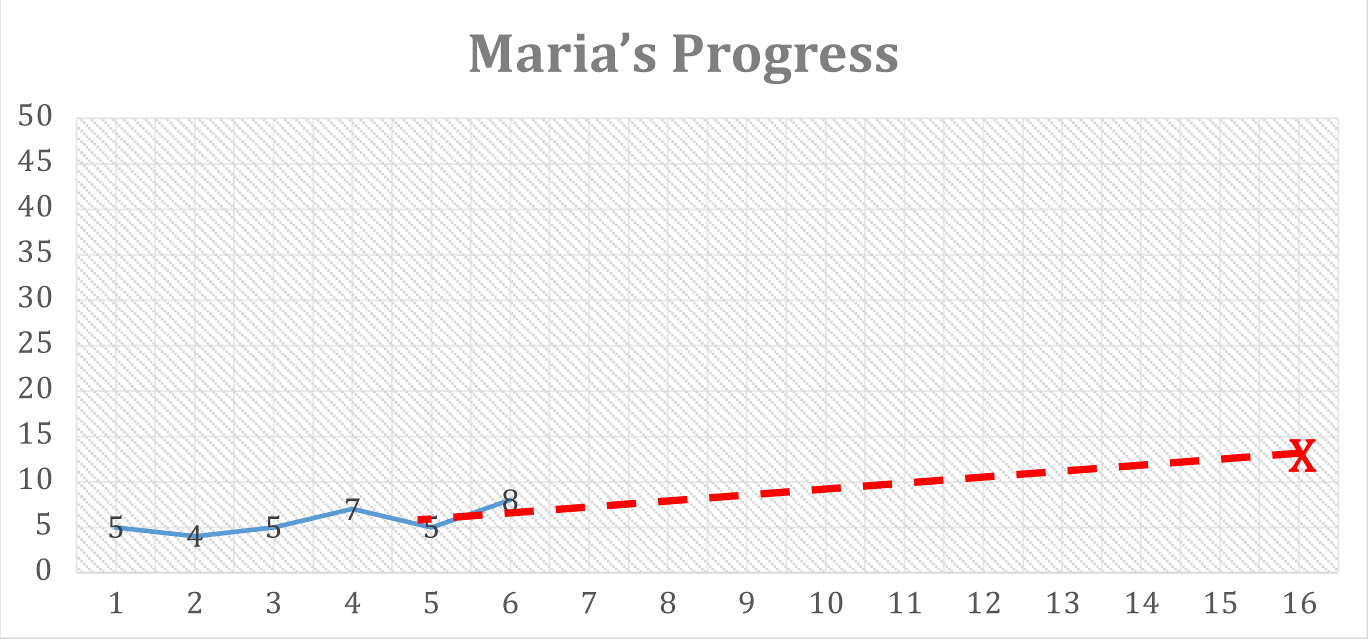


Intra-individual

1. Identify student's slope — 0.4
2. Multiply slope by 1.5 — $0.4 \times 1.5 = 0.6$
3. Multiply by number of weeks until end of intervention — $0.6 \times 10 = 6$
4. Add to student's baseline score — $6 + 6.7 = 12.7$

Intra-individual

1. Identify student's slope — 0.4
2. Multiply slope by 1.5 — $0.4 \times 1.5 = 0.6$
3. Multiply by number of weeks until end of intervention — $0.6 \times 10 = 6$
4. Add to student's baseline score — $6 + 6.7 = 12.7$
5. Mark goal on student graph with an X
6. Draw goal-line from baseline progress monitoring scores to X



To Review

Benchmark

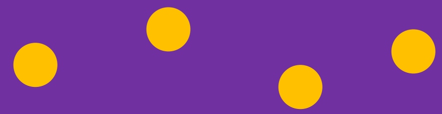
Slope (ROI)

Intra-individual

Which goal setting method(s) might you use?

Determining Response

Four most recent, consecutive scores



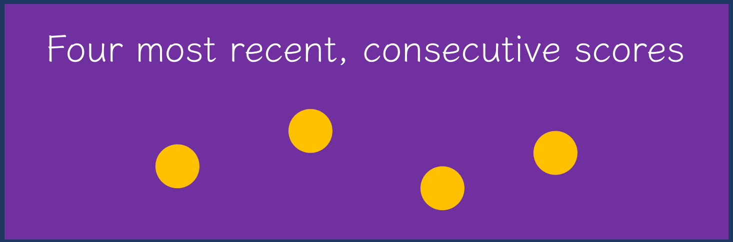
Trendline

Determining Response

Four most recent, consecutive scores

Trendline

Determining Response

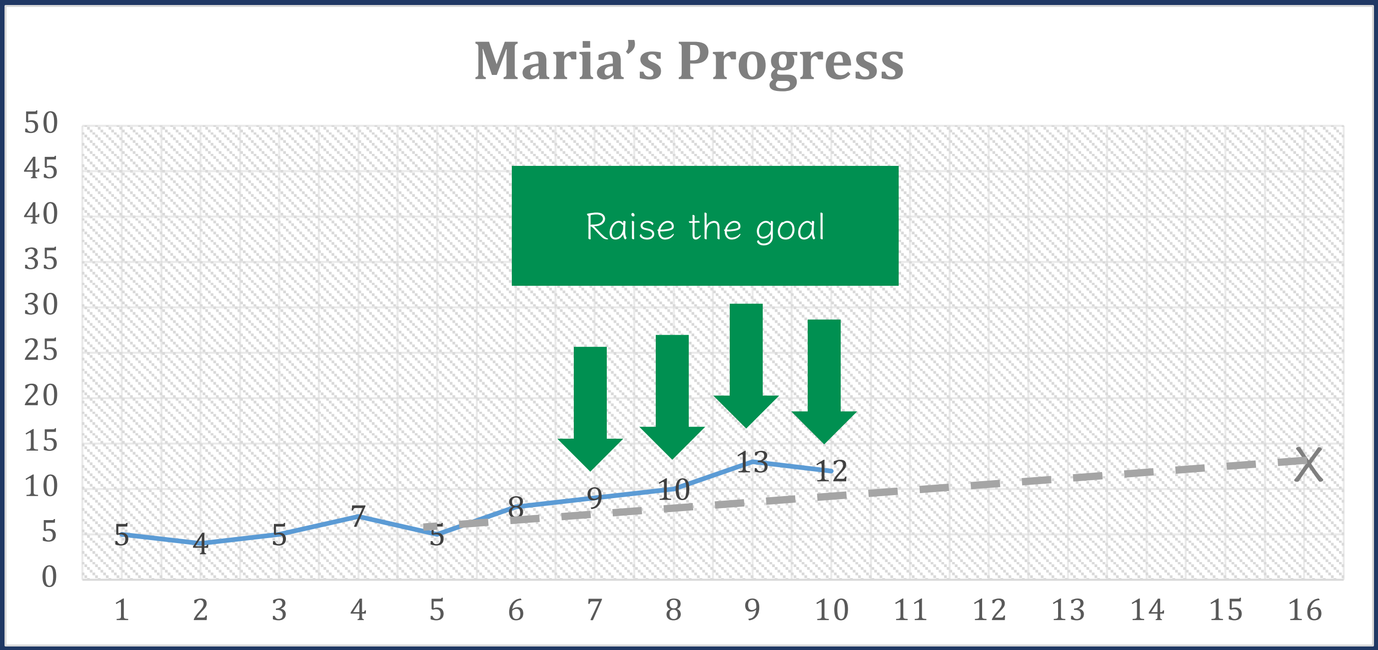


If at least 6 weeks of instruction have occurred:

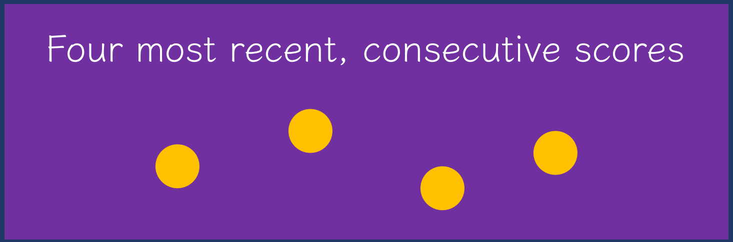
- If all four most recent scores fall above the goal-line, increase the goal.

Determining Response

Four most recent, consecutive scores



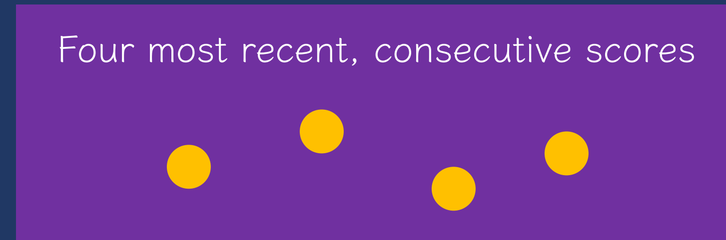
Determining Response

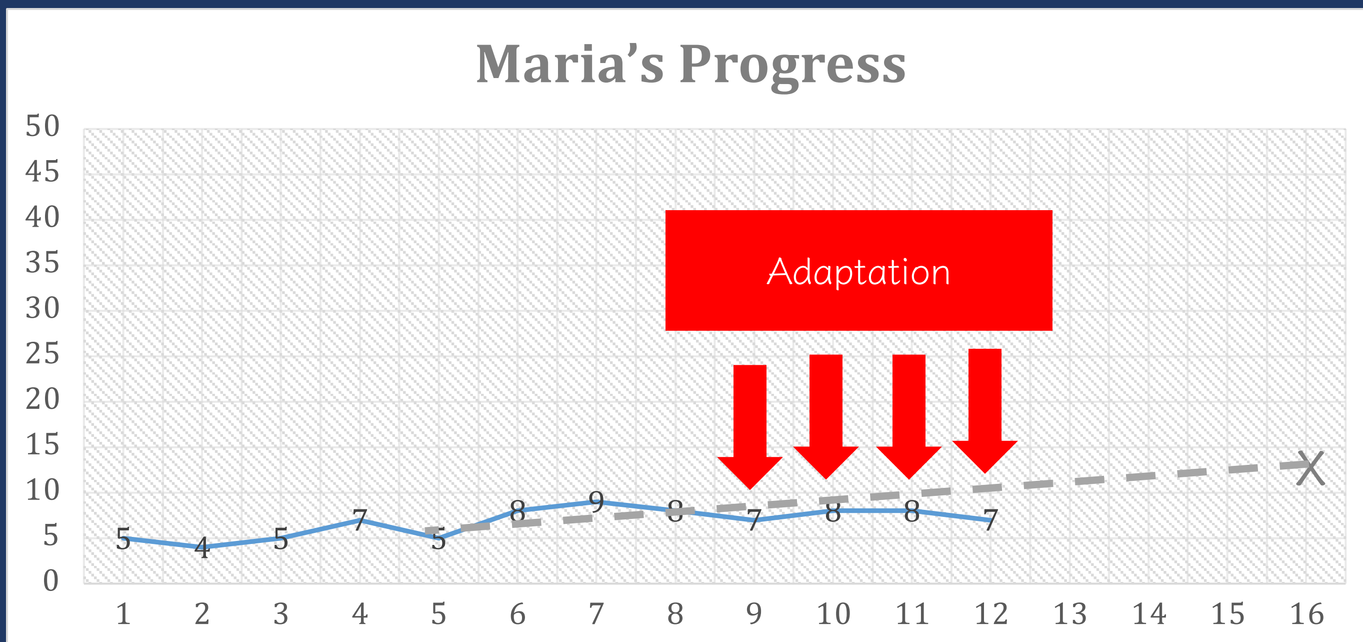


If at least 6 weeks of instruction have occurred:

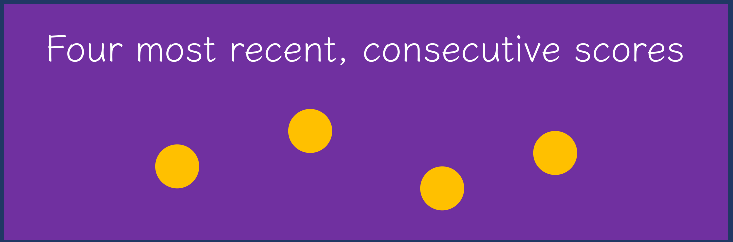
- If all four most recent scores fall above the goal-line, increase the goal.
- If all four most recent scores fall below the goal-line, adapt the intervention.

Determining Response





Determining Response

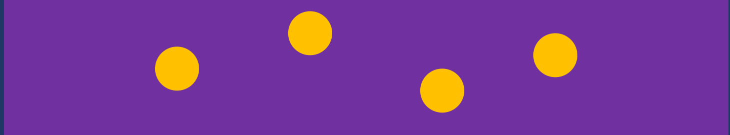


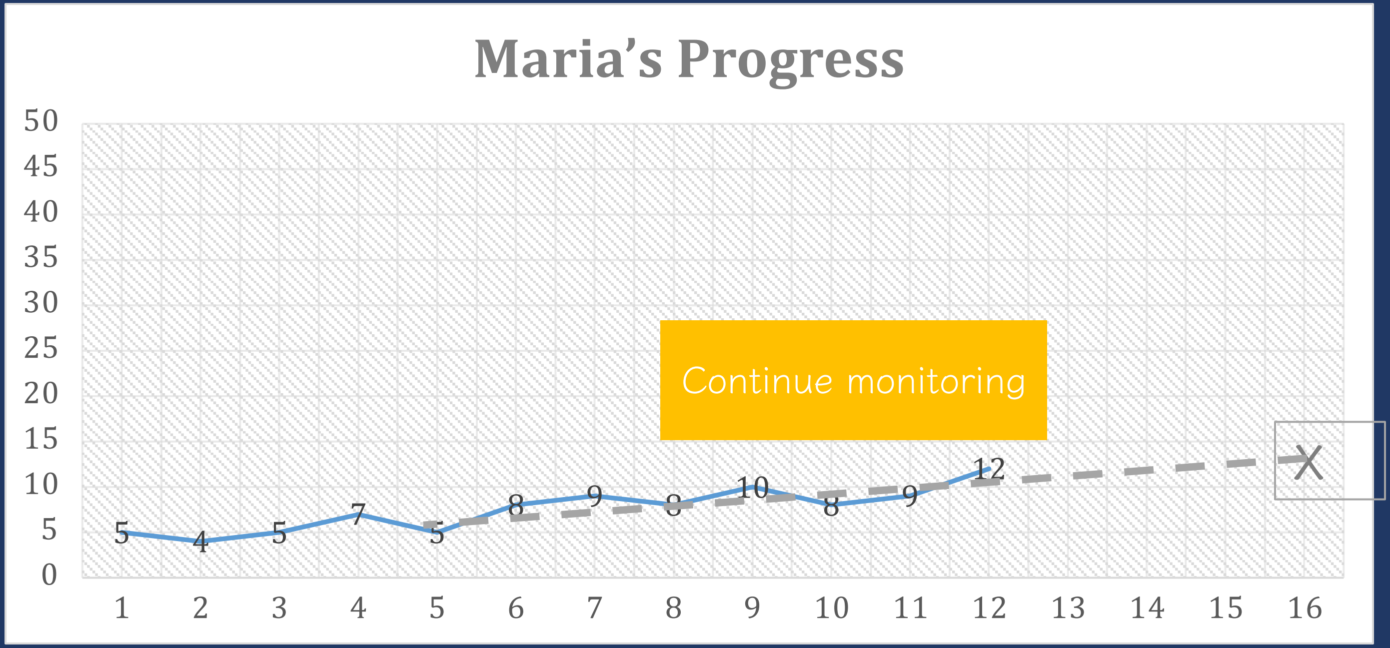
If at least 6 weeks of instruction have occurred:

- If all four most recent scores fall above the goal-line, increase the goal.
- If all four most recent scores fall below the goal-line, adapt the intervention.
- If the four most recent scores fall both above and below the goal-line, continue monitoring data.

Determining Response

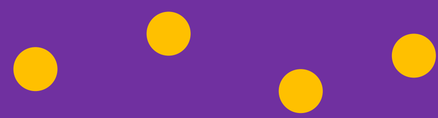
Four most recent, consecutive scores





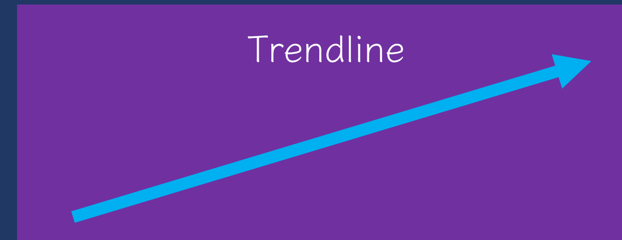
Determining Response

Four most recent, consecutive scores



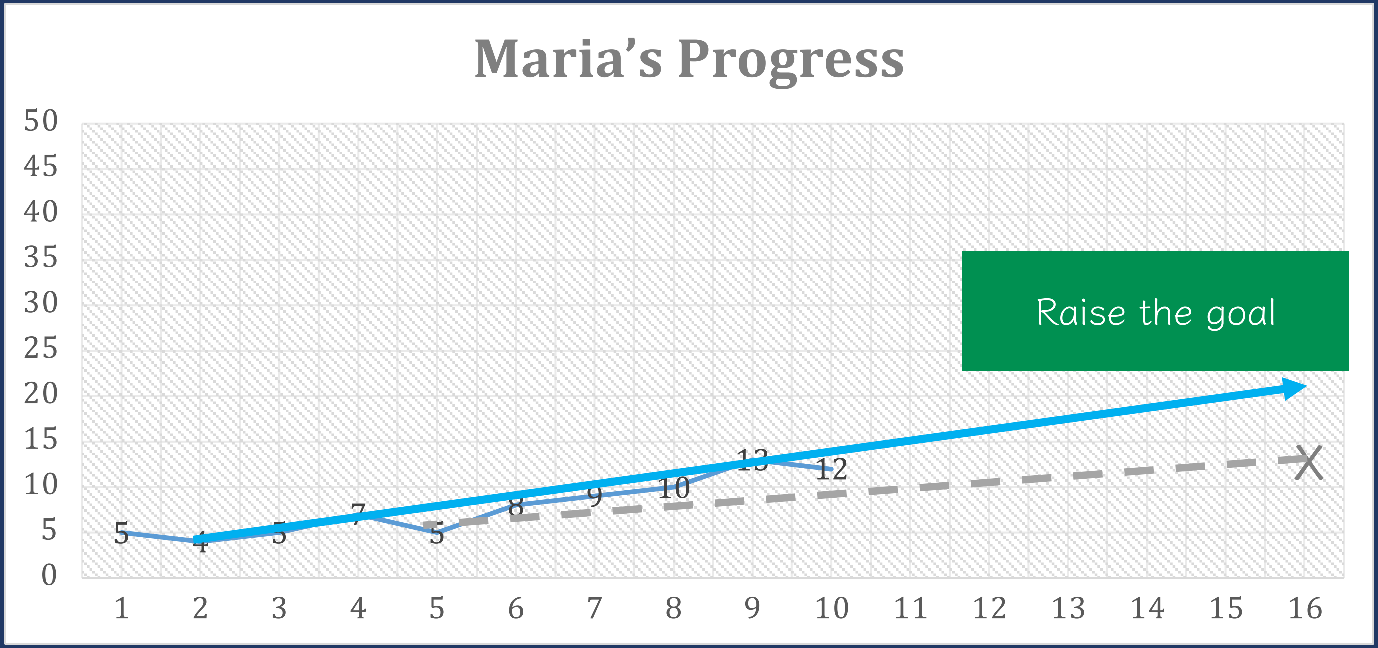
Trendline

Determining Response



- If the trend-line is steeper than the goal line, then increase the goal.

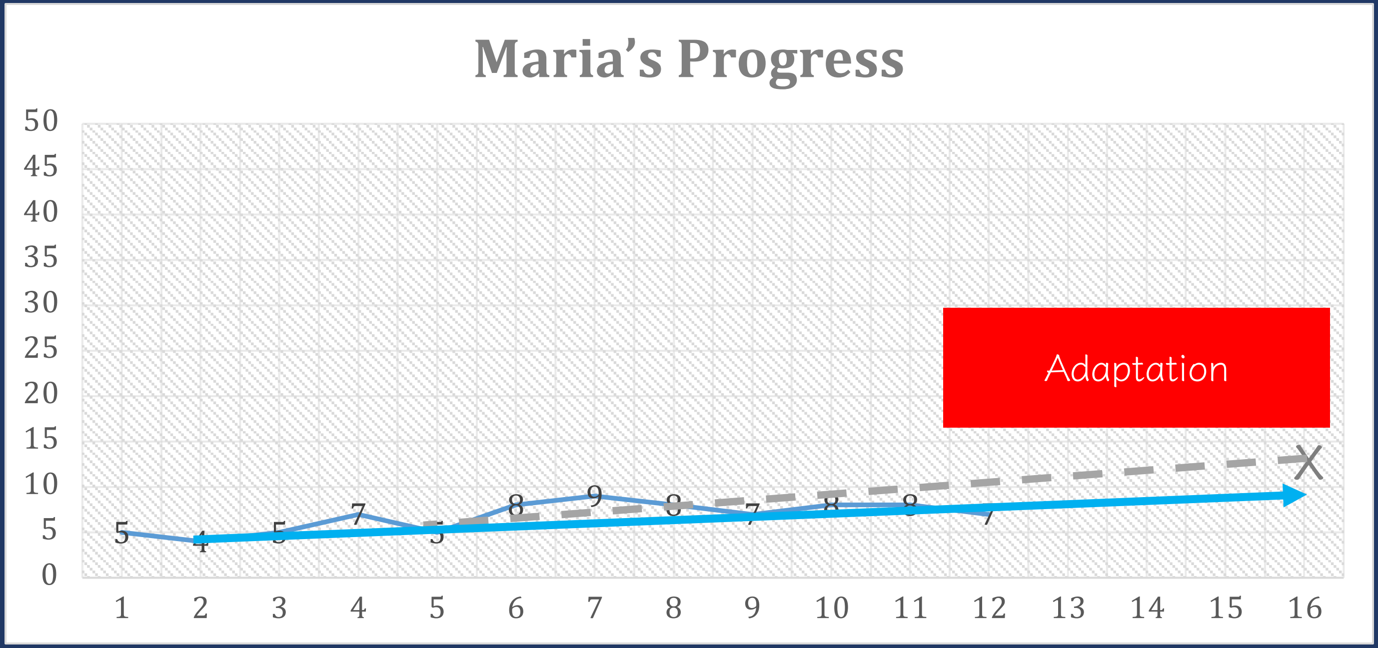
Determining Response



Determining Response

- If the trend-line is steeper than the goal line, then *increase* the goal.
- If the trend-line is flatter than the goal line, then *adapt* the intervention.

Determining Response

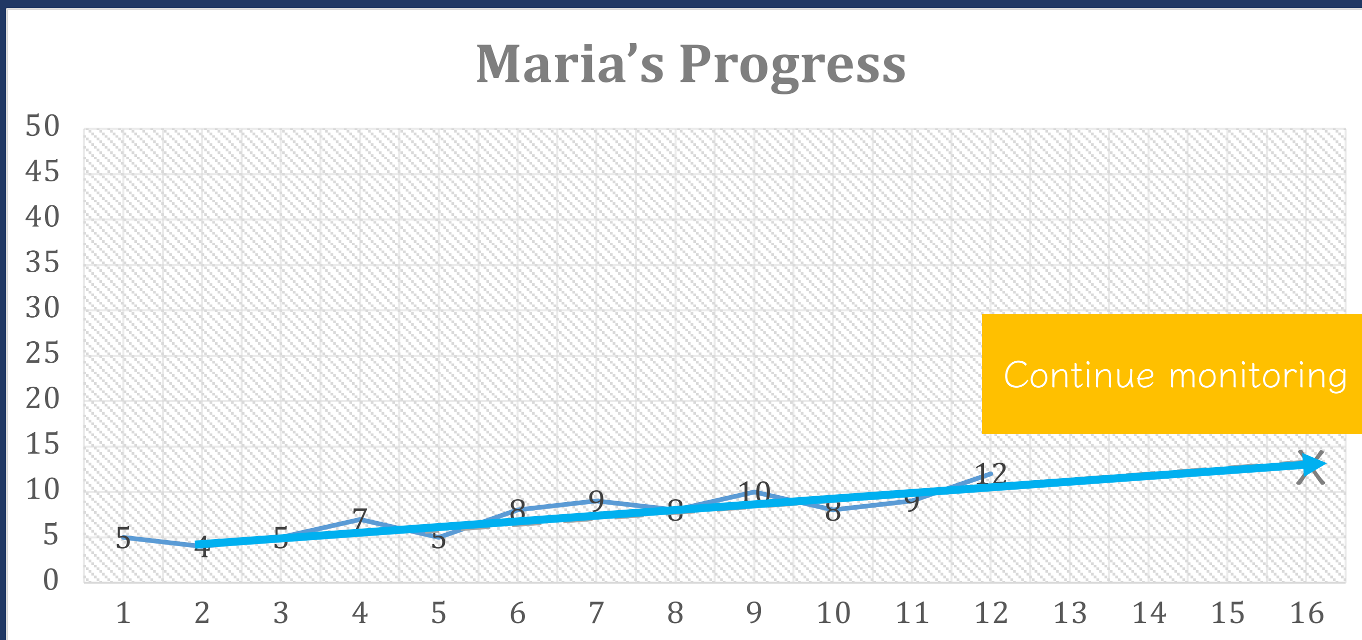


Determining Response

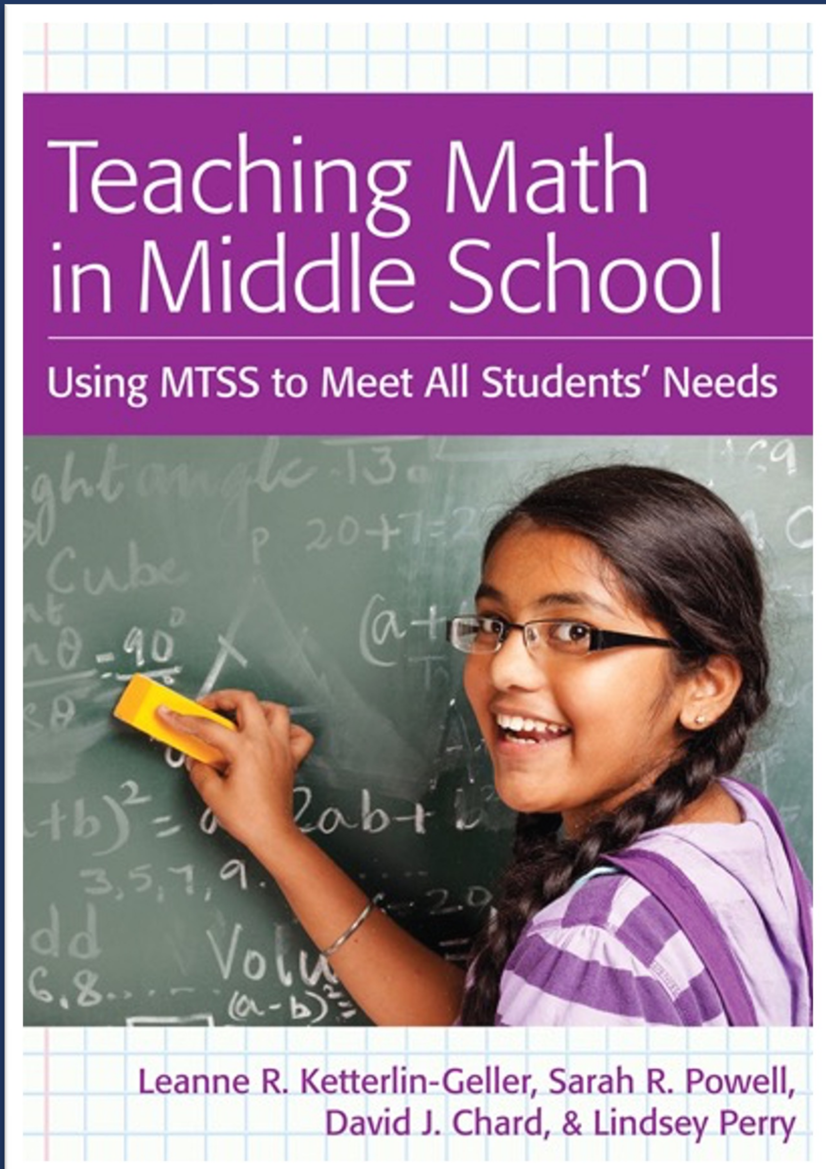
- If the trend-line is steeper than the goal line, then increase the goal.
- If the trend-line is flatter than the goal line, then adapt the intervention.
- If the trend-line and goal-line are fairly equal, continue monitoring progress.

Determining Response

Trendline



Which decision making method(s) might you use?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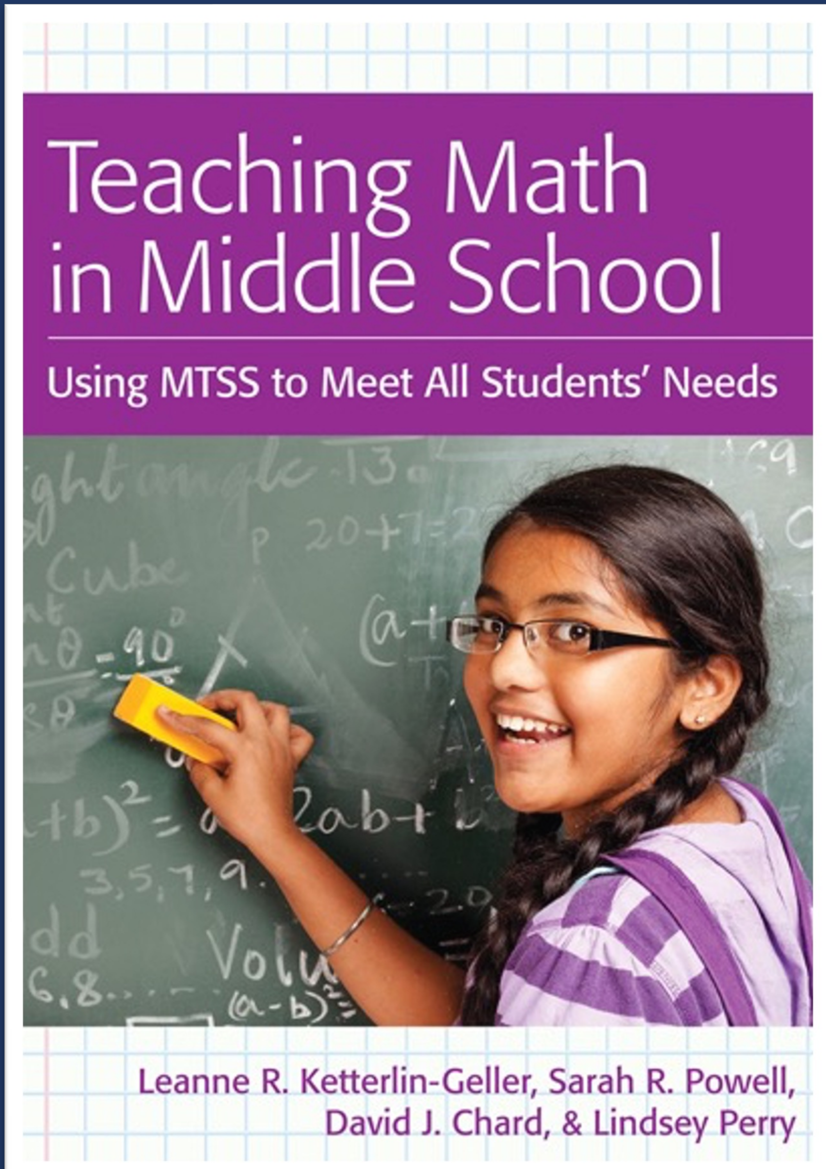
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Chapter 15: Readiness Checklist - Campus Administration

	Is this practice, action, or belief already established?	If yes, what is working well? What changes could be made to improve this practice, action, or belief?	If no, what are the current conditions that exist? What is needed to change this practice, action, or belief?
There is campus-level support at the highest levels, including agreement to adopt an MTSS model and allocate required resources.			
There is an understanding of and commitment to a long-term change process (3 or more years).			
There is long-term commitment of resources for administering assessments and implementing tiered instructional support.			
The district leadership team has a basic level of knowledge of the research related to RtI and the desire to learn more.			
There is expertise at the district- and campus-level with respect to research-based practices for academic success and positive behavioral outcomes.			

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Chapter 15: Readiness Checklist - MTSS Team

	Is this practice, action, or belief already established?	If yes, what is working well? What changes could be made to improve this practice, action, or belief?	If no, what are the current conditions that exist? What is needed to change this practice, action, or belief?
There is campus-wide commitment to distributed leadership.			
Key stakeholders* are willing to work together.			
There is a content specialist who is communicative and considered a leader on campus.			
There is a data specialist who is communicative and considered a leader on campus.			
There is someone who could serve as the MTSS coordinator who is communicative and considered a leader on campus.			
There is a common planning time for educators to make instructional plans and review assessment data.			

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Chapter 15: Readiness Checklist - Assessment

	Is this practice, action, or belief already established?	If yes, what is working well? What changes could be made to improve this practice, action, or belief?	If no, what are the current conditions that exist? What is needed to change this practice, action, or belief?
We administer a universal screener in mathematics to all students.			
We administer diagnostic assessments to students who are struggling document their strengths and areas of improvement.			
We monitor progress of students who are struggling or at-risk for mathematics difficulties.			
We have structured conversations around assessment results to inform instructional decisions.			
We provide ongoing professional learning and growth opportunities for interpreting assessment results to guide instructional decisions.			
We have a data management system in place.			

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Chapter 15: Readiness Checklist - Instruction

	Is this practice, action, or belief already established?	If yes, what is working well? What changes could be made to improve this practice, action, or belief?	If no, what are the current conditions that exist? What is needed to change this practice, action, or belief?
We use a research-validated Tier 1 instructional program in mathematics.			
We use (or are able to acquire) research-based supplemental intervention materials for Tier 2 support.			
We use (or are able to acquire) research-based supplemental intervention materials for Tier 3 support.			
We have highly trained educators to provide Tier 1 instruction with fidelity.			
We have highly trained educators to provide Tier 2 instruction with fidelity.			
We have highly trained educators to provide Tier 3 instruction with fidelity.			
We have systems in place to evaluate the fidelity of implementation of instruction in Tiers 1-3.			
We provide ongoing professional learning and growth opportunities for implementing evidence-based instructional practices.			
We provide ongoing professional learning and growth opportunities that focus on deepening teachers' content knowledge in mathematics.			

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Chapter 15: Readiness Checklist - Professional Learning

	Is this practice, action, or belief already established?	If yes, what is working well? What changes could be made to improve this practice, action, or belief?	If no, what are the current conditions that exist? What is needed to change this practice, action, or belief?
Professional learning and growth opportunities exist for all staff and across all roles within the school community.			
Professional learning and growth opportunities include ongoing support such as coaching, peer feedback, or professional learning communities.			
Professional learning and growth opportunities are aligned with the goals of MTSS.			
All stakeholders believe in the value of professional learning and growth.			
Opportunities to learn about MTSS exist for parents and other stakeholders within the school community.			
Professional learning and growth opportunities address relevant aspects of implementing MTSS.			
Professional learning and growth opportunities focus on improving learning by supporting the needs of all students.			

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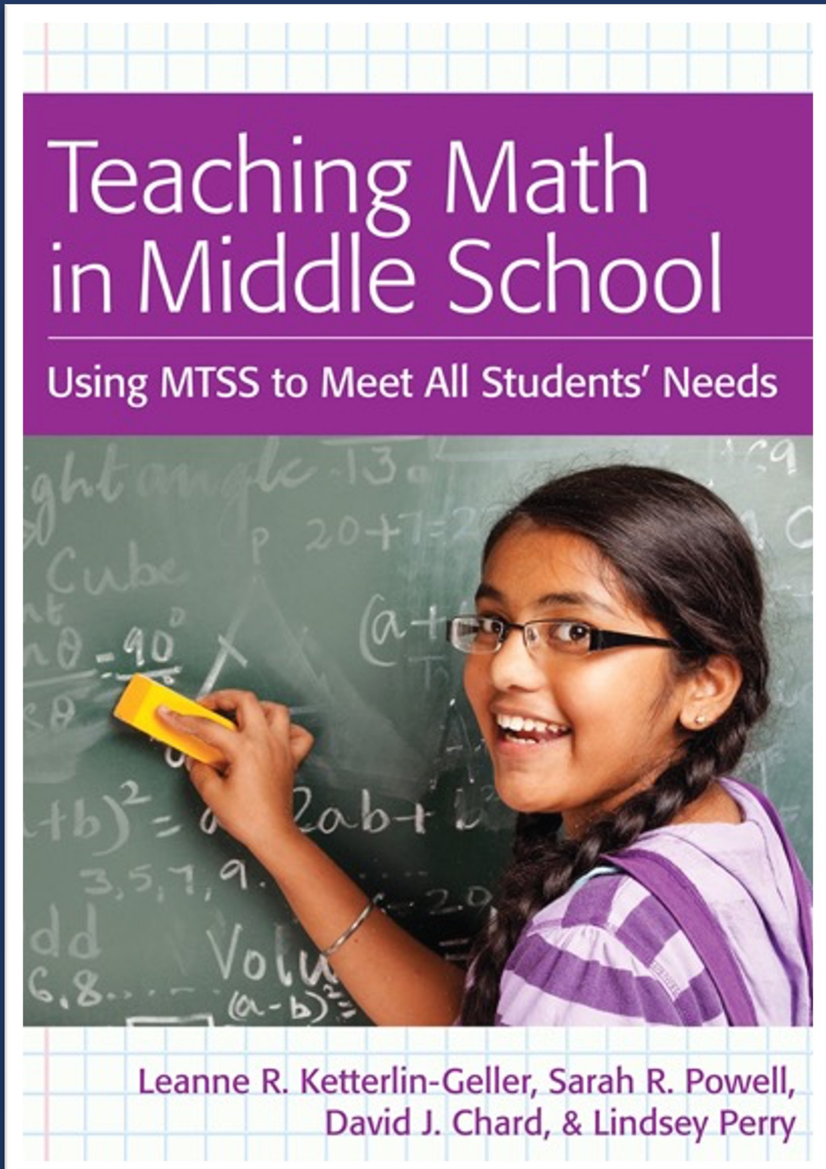
MTSS: The First Four Years

	YEAR 1	YEAR 2	YEAR 3	YEAR 4
MTSS SET UP				
MTSS team	Select members for MTSS team; Determine personnel for delivery for Tier 1	Determine personnel for delivery of Tier 2	Determine personnel for delivery of Tier 3	
MTSS plan	Determine MTSS plan for middle school	Implement plan at Tier 1	Continue implementation of Tier 1; Implement plan at Tier 2	Continue implementation of Tiers 1 and 2; Implement plan at Tier 3
Scheduling	Determine whether time is devoted to math instruction at Tier 1	Schedule Tier 2 intervention time within school day	Schedule Tier 3 intervention time within school day	
Training	Train all staff on MTSS structure with a focus on Tier 1	Train all staff on MTSS structure at Tier 2	Train all staff on MTSS structure at Tier 3	
TIER 1				
Math screener	Choose screener	Implement screener		
Tier 1 math instruction	Review current evidence-based practices	Implement Tier 1 evidence-based practices with fidelity		
Math progress monitoring	Choose progress monitoring measure	Implement progress monitoring with "at-risk" students		
Decision making at Tier 1	Determine decision making process	Implement decision making at Tier 1		
TIER 2				
Tier 2 math instruction		Review and select evidence-based Tier 2 interventions	Implement Tier 2 interventions with fidelity	
Math progress monitoring		Determine whether additional progress monitoring measures are necessary for Tier 2	Implement progress monitoring with Tier 2 students	
Decision making at Tier 2		Determine decision making process	Implement decision making at Tier 2	
TIER 3				
Diagnostic assessments		Select appropriate math diagnostics	Pilot diagnostic assessments with select Tier 2 students	Implement diagnostic assessments with Tier 3 students
Tier 3 math instruction			Review and select evidence-based Tier 3 interventions	Implement Tier 3 interventions with fidelity; Make adaptations based on diagnostic data
Math progress monitoring				Implement progress monitoring with Tier 3 students
Decision making at Tier 3				Implement decision making at Tier 3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