Class-Wide Math Intervention

Addressing Skill Gaps through Daily Warm-Up Activities

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Overview

1. Why Classwide Interventions?

2. How do you Embed Classwide Interventions into the Core Instructional Routine?

3. What are Classwide Interventions?

Why Classwide Interventions?

Addressing Gaps in Student Learning

EDUCATION

Reading and math scores fell sharply during pandemic, data show

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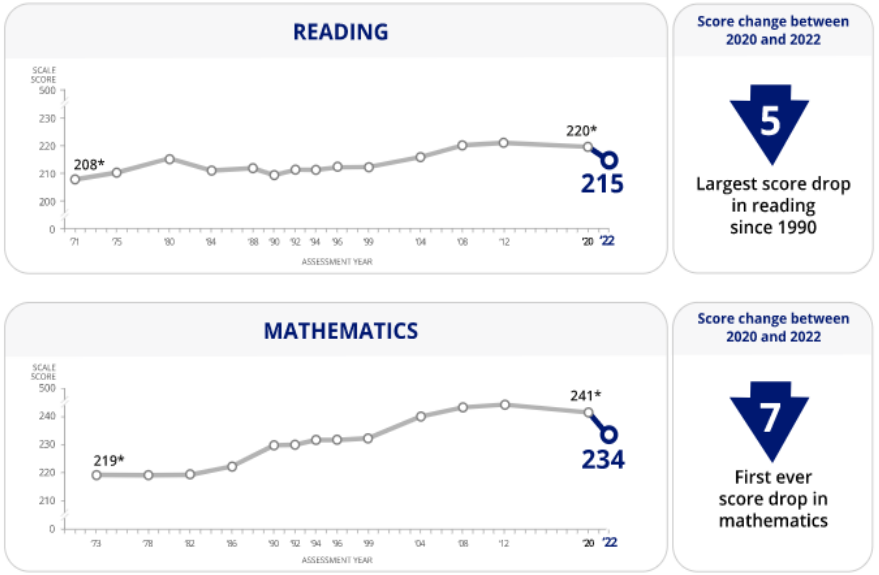
Pandemic school disruptions resulted in the largest drop in reading achievement in 30 years, according to newly released national test scores.

Matt Rourke/AP

Reading and mathematics scores decline during COVID-19 pandemic

In 2022, the National Center for Education Statistics (NCES) conducted a special administration of the NAEP long-term trend (LTT) reading and mathematics assessments for age 9 students to examine student achievement during the COVID-19 pandemic. Average scores for age 9 students in 2022 declined 5 points in reading and 7 points in mathematics compared to 2020. This is the largest average score decline in reading since 1990, and the first ever score decline in mathematics.



* Significantly different ($p < .05$) from 2022.

Impact of COVID-19 on Math 2020-2021 School Year

K-8 Students Started the Year Behind

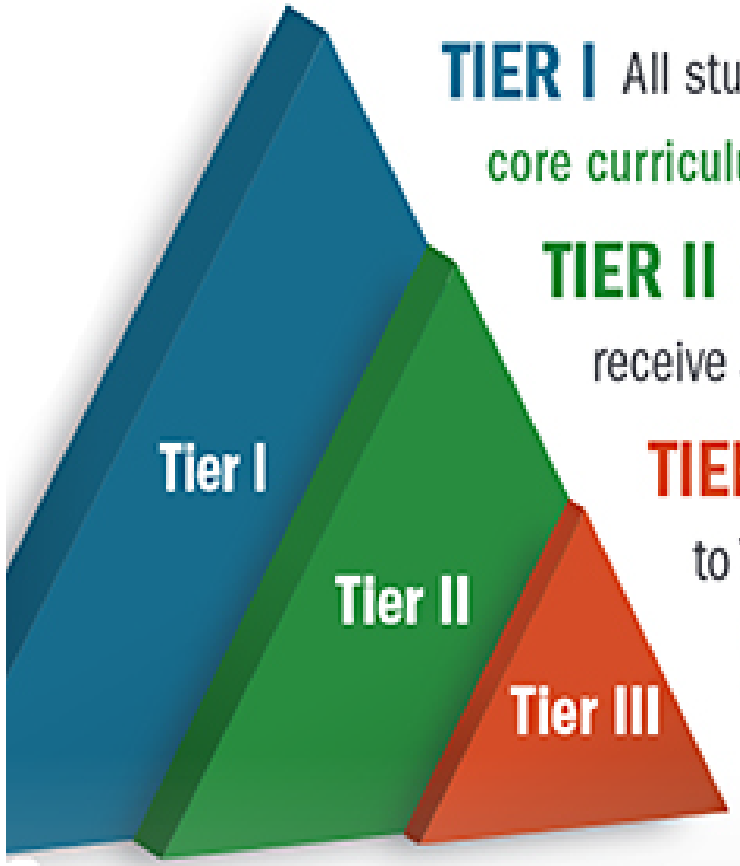
& Made Fewer Gains

Median Achievement Dropped 8-12 %ile points Compared to Spring 2019

Average Loss Over the 2020-2021 School Year was 5 Months of Learning

(Dorn et al., 2021; Lewis et al., 2021)

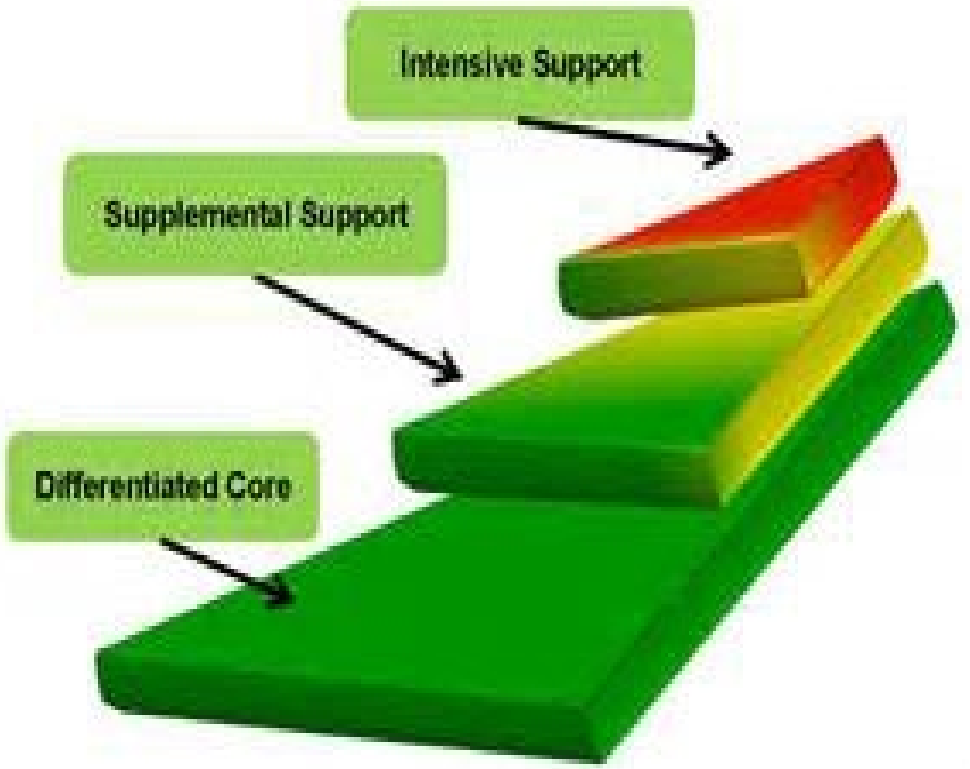
Layered MTSS Model



TIER I All students receive instruction on the core curriculum.

TIER II Students who are below grade level receive additional instruction in small groups.

TIER III Students who are unresponsive to Tiers I and II also receive individualized instruction.



Strengthening **Core** Instructional Practices…

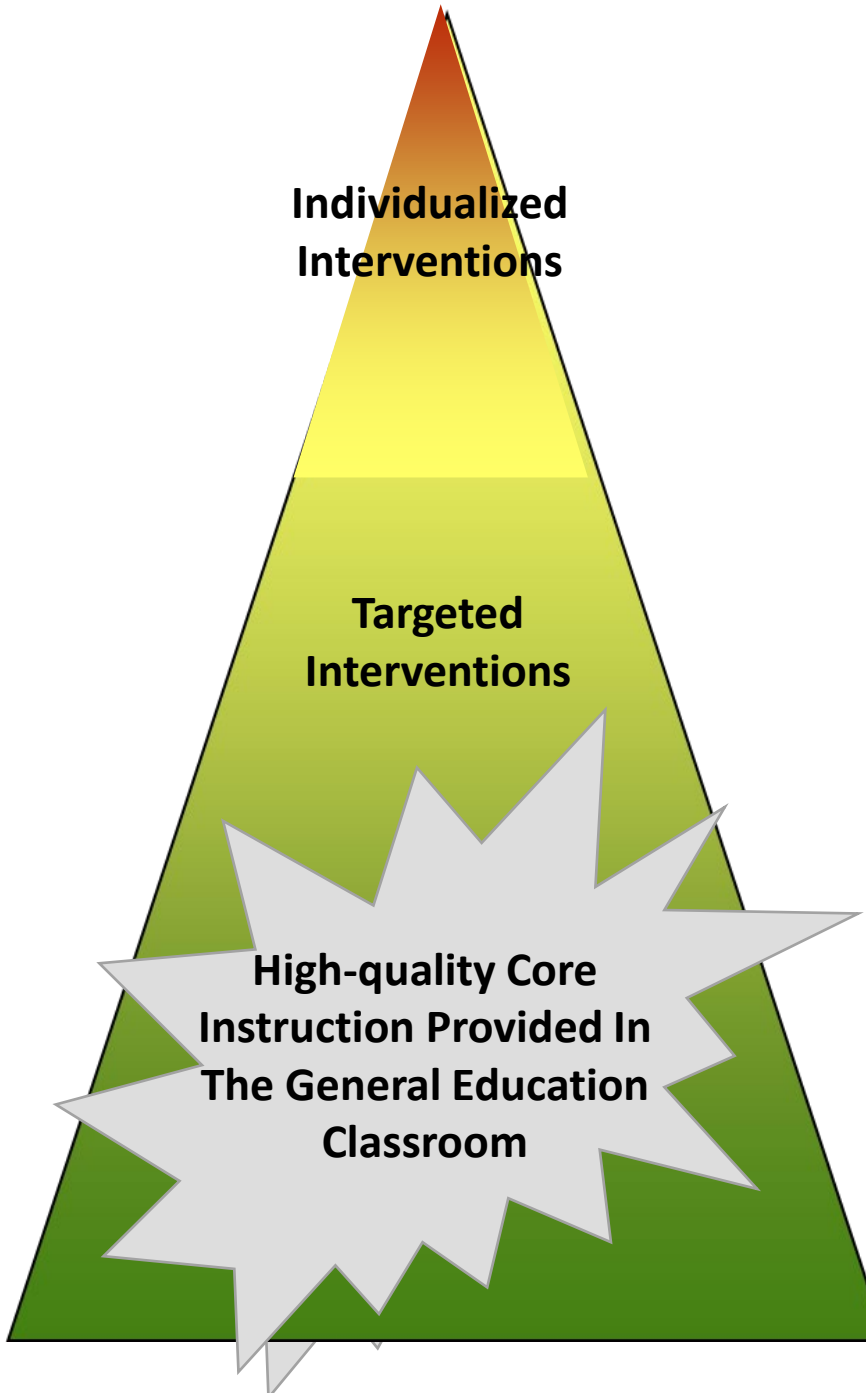
Reduces
- the number of students who will require additional supports to be successful

Frees
- resources to provide those students with or at-risk for learning disabilities the services and supports that they need

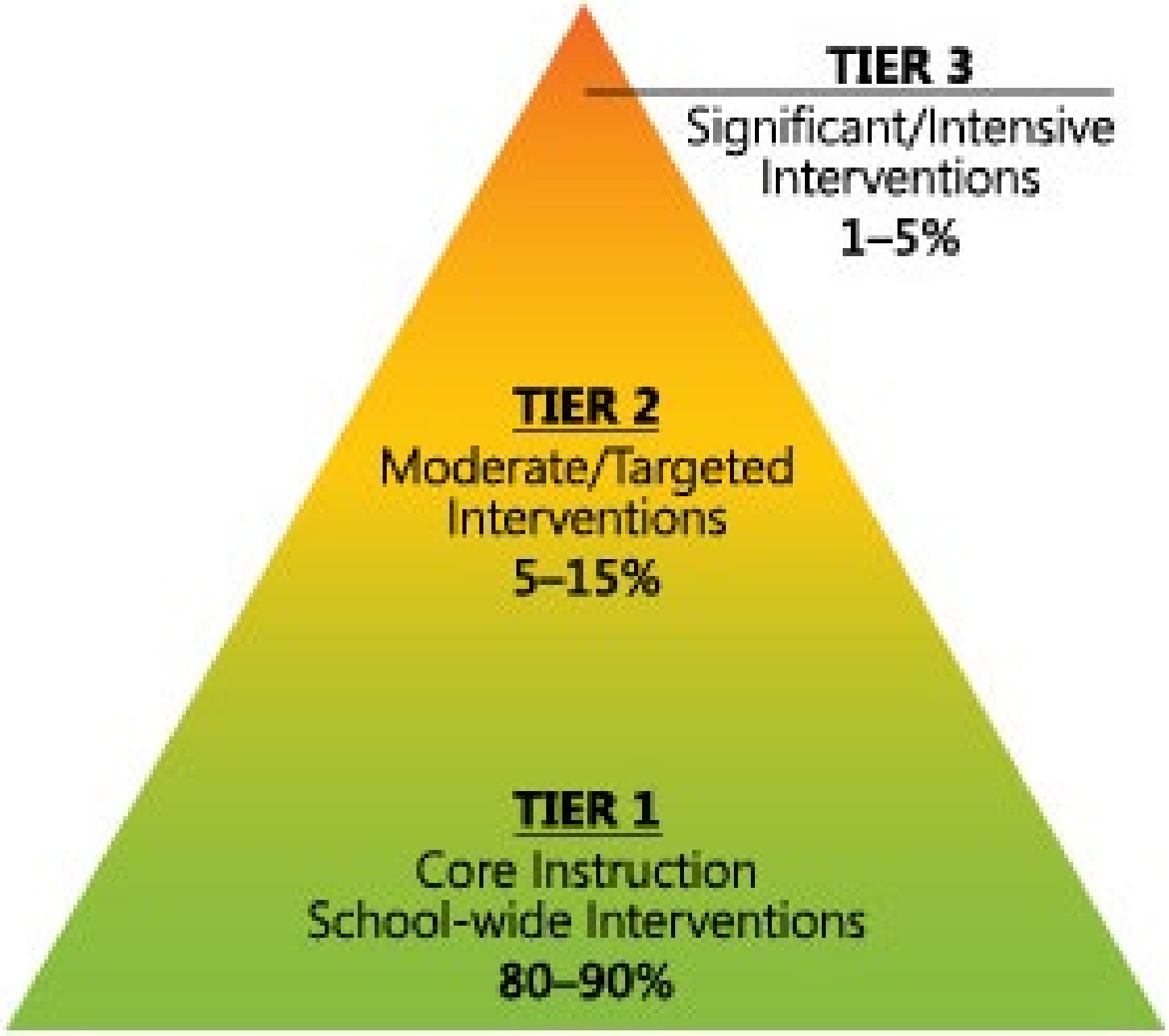
Increases
- the accuracy with which we identify students that need specialized intervention supports

Results
- in BETTER OUTCOMES for students receiving specialized intervention supports

(Barrett & VanDerHeyden, 2020; Fuchs et al., 2008; VanDerHeyden et al., 2021)



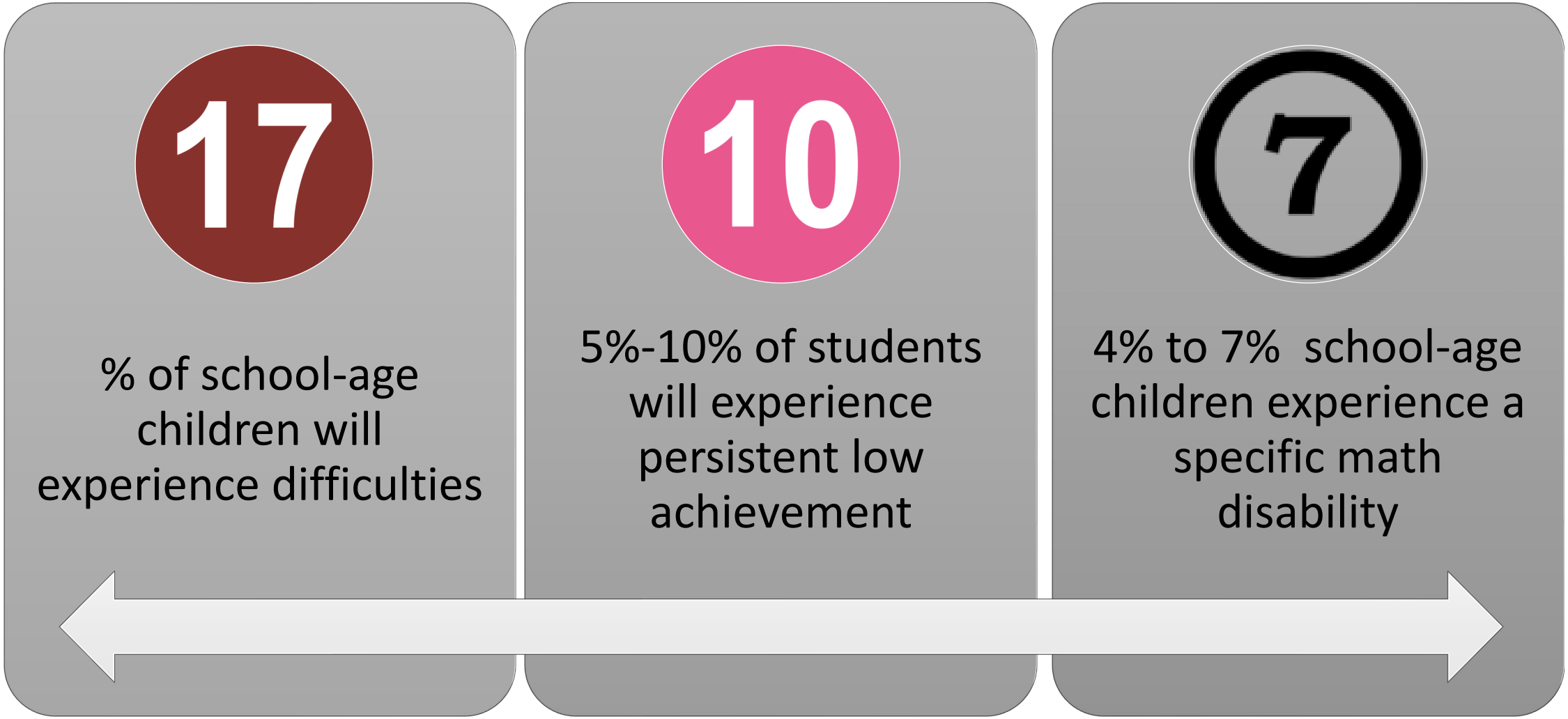
What You Hope to See with Your Screening Data



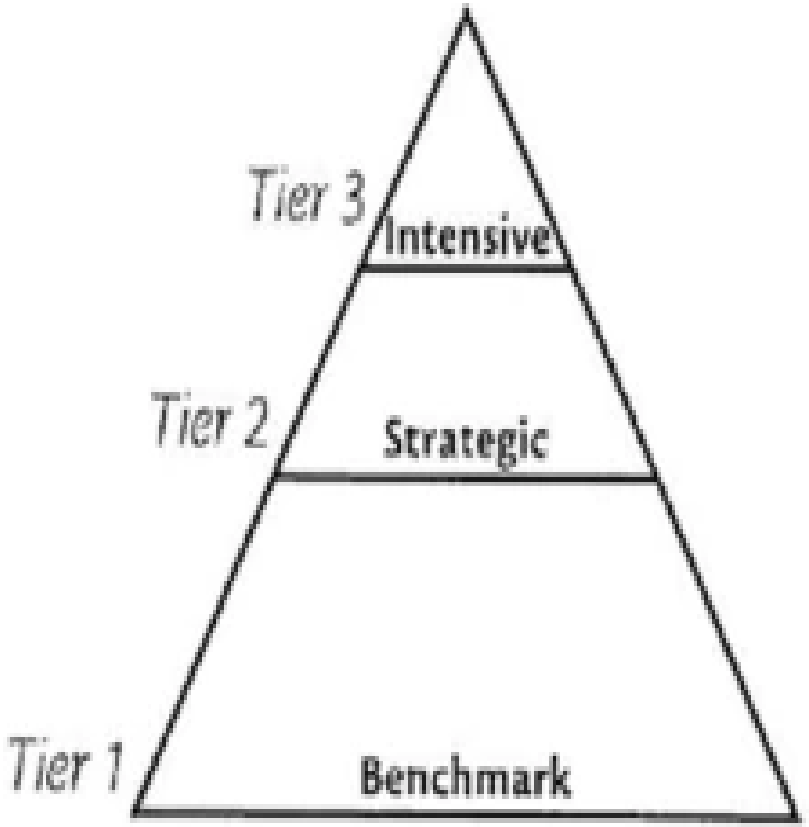
Classroom Implications

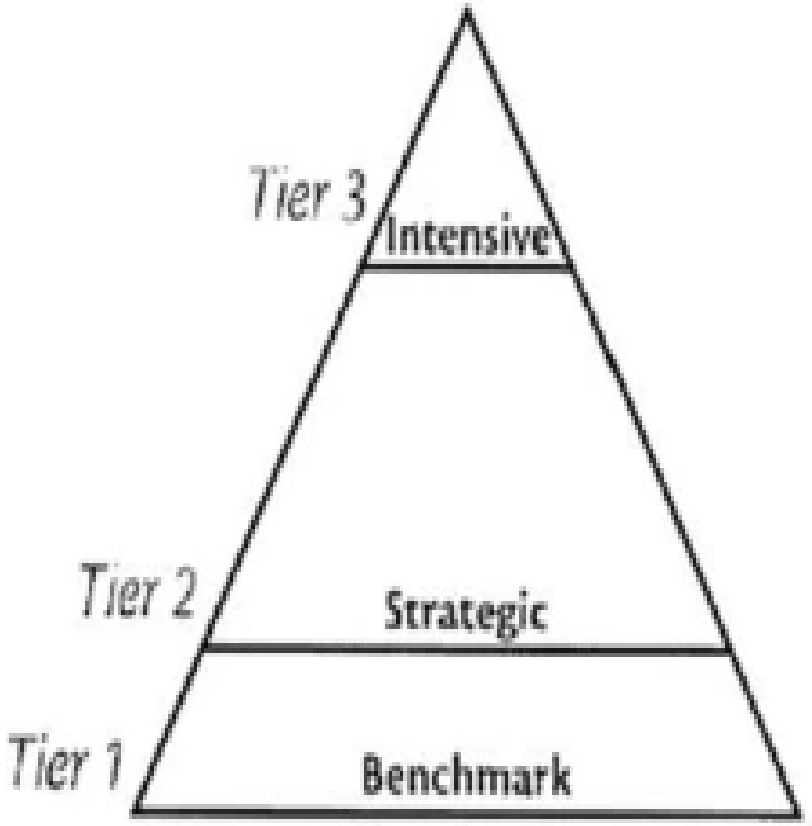
The IRIS Center. (2018). *MTSS/RTI: Mathematics.* Retrieved from https://iris.peabody.vanderbilt.edu/module/rti-math/

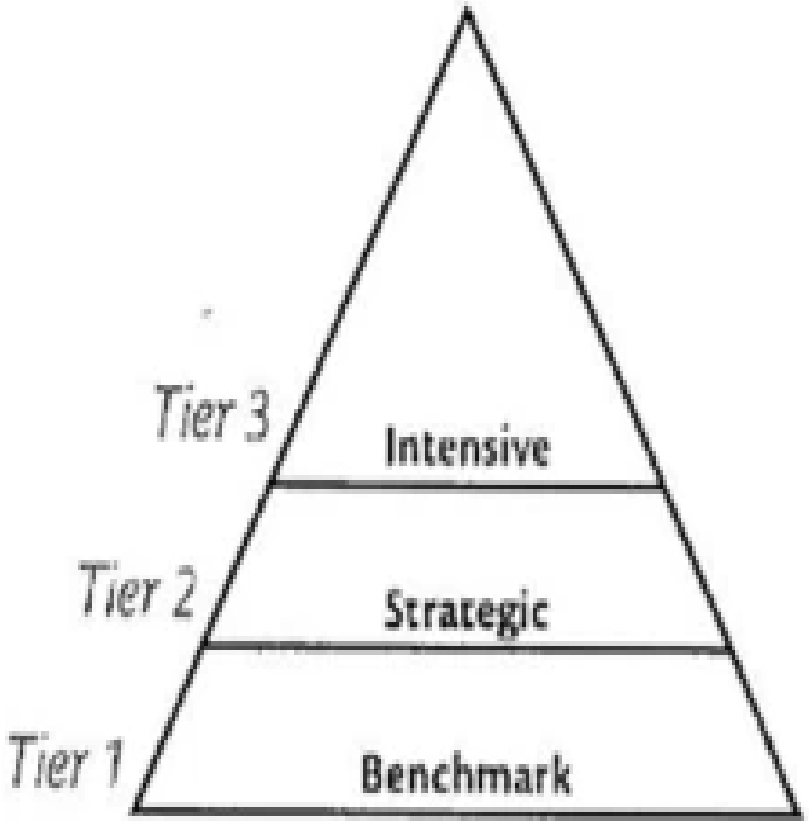
Math Learning Difficulties



(Berch & Mazzocco, 2007; Bryant et al., 2008; Fuchs, Compton et al., 2005; Fuchs, Fuchs, et al., 2008; Geary, 2004; Gersten et al., 2005; Chard, Ketterlin-Geller, & Jitendra, 2008; NCES, 2017)



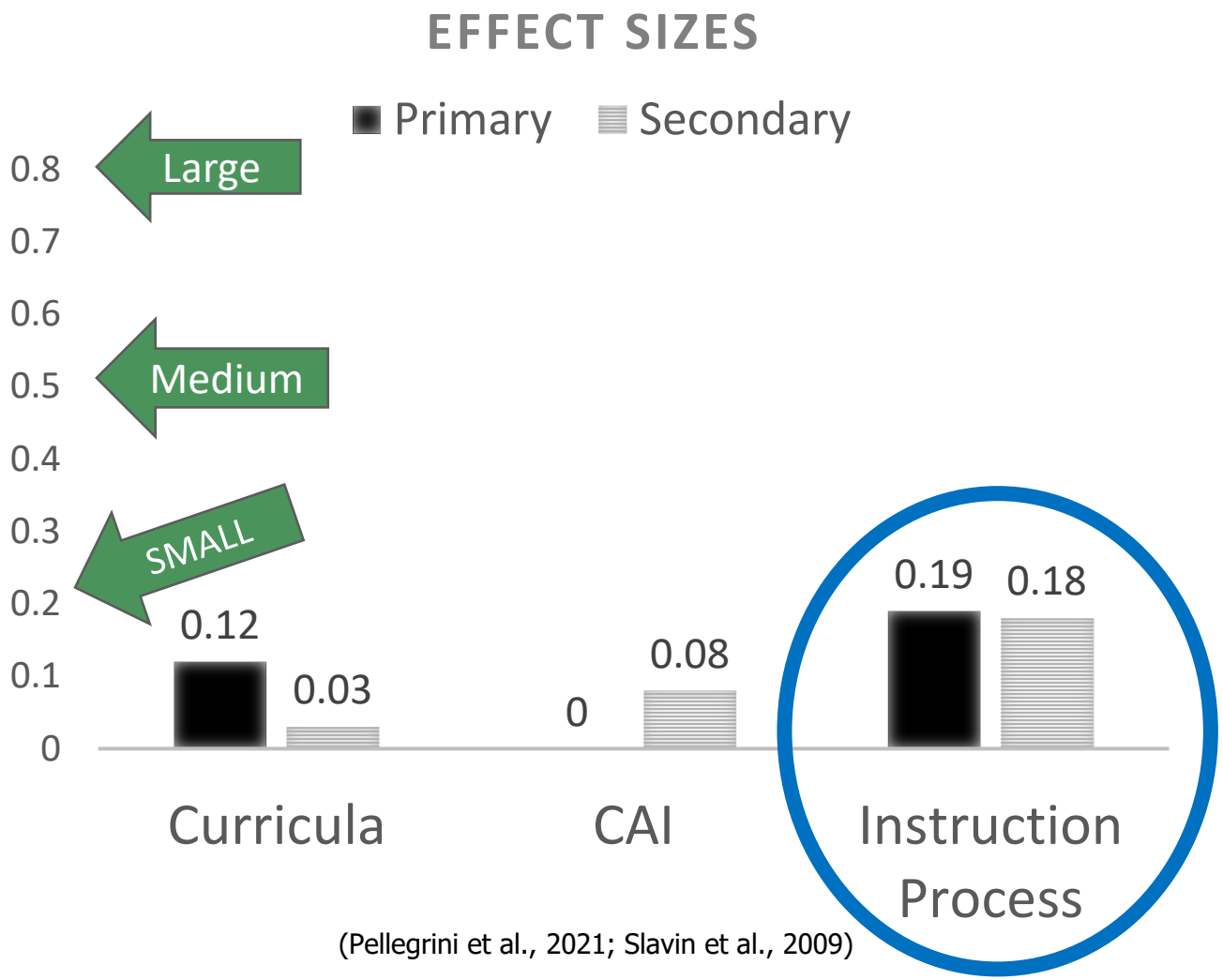




Alternative Illustrations of Your Actual Pyramid

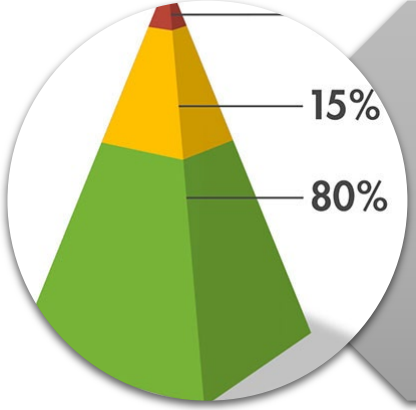
Evidence for Core Instructional Practices K-12

Best Evidence Encyclopedia	
Curricula	• Minimal effect
Digital Curricula or Computer-Assisted Supplemental Instruction (CAI)	• Negligible to Minimal effect
Instructional Process Strategies (e.g., peer mediated learning, classroom management & motivation, meta-cognitive instruction)	• Small positive effect



(Pellegrini et al., 2021; Slavin et al., 2009)

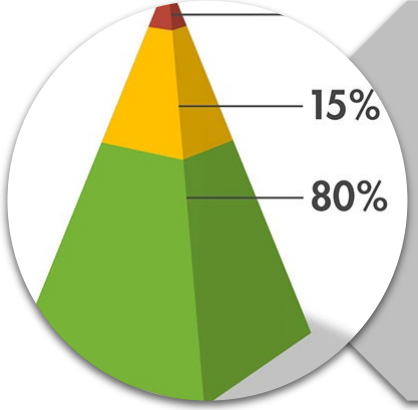
How do you Embed Classwide Interventions into the Core Instructional Routine?



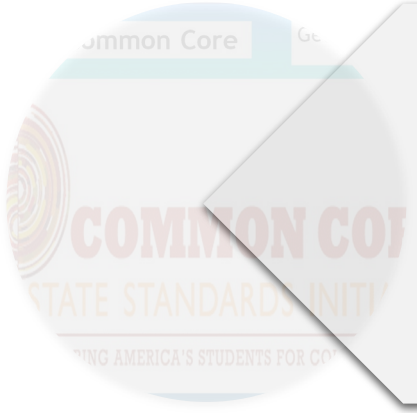
Structure & Logistics

Content

Practices



Structure & Logistics



Content

Practices

Classwide Intervention

Designate

- 15 Minutes

Determine

- Gaps By Analyzing your Data & Pre-Requisite Skills

Supplement With

- Peer-Assisted Learning
- Classroom Management & Motivation
- Meta-Cognitive (Self-Regulated) Instruction

(Codding et al., 2009; Kilpatrick et al., 2001; NMAP, 2008; Slavin & Lake, 2008; 2009)

Core Instruction with Classwide Intervention

CORE INSTRUCTION

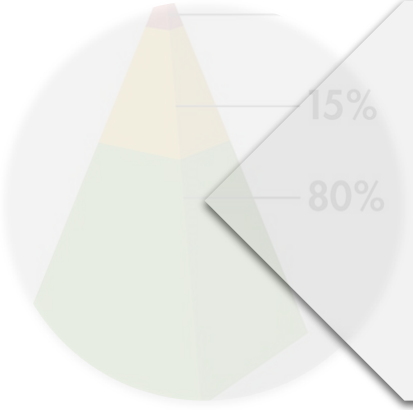
45-MINUTES

CLASSWIDE INTERVENTION

15-MINUTES

MATH BLOCK

60-MINUTES



Structure & Logistics

Content

Address Skill Gaps,
Pre-requisite Skills &
Critical Skills to Provide
Foundation For Later Success

Making the Most of Your Instructional Time

What Foundational Skills are Essential?

What Grade Level Benchmarks are Critical?

What are the Common Errors Your Class is Making?

Collaborate & Consider

What do the next grade teachers suggest students have to know upon school entry?

What aspects of the standards are ESSENTIAL for students to proceed in the curriculum?

What aspects of the standards are linked exactly to ALGEBRA?

Consider re-teaching a failed unit that is essential for further understanding of grade level concepts.

Frequently Cited Math Difficulties

Solving word problems

Multi-step procedural calculations

Mathematics language

Checking work and answers

Automatic recall of basic facts

Fractions

(Byrant et al., 2000; National Mathematics Advisory Panel, 2008)

CRITICAL FOUNDATIONS FOR

(Gersten et al., 2009; National Mathematics Advisory Panel [NMAP], 2008; USDOE, 2008)

Algebra

- Whole Number Proficiency
- Fluency with Fractions
- Key Aspects of Geometry

Key Content Areas to Target

(Gersten et al., 2009)

Kindergarten to Grade 5

- Strategic Counting
- Magnitude Comparison
- Number Composition & Decomposition
- Basic Whole Number Operations
- Place Value
- Explicit Teaching of Word Problems

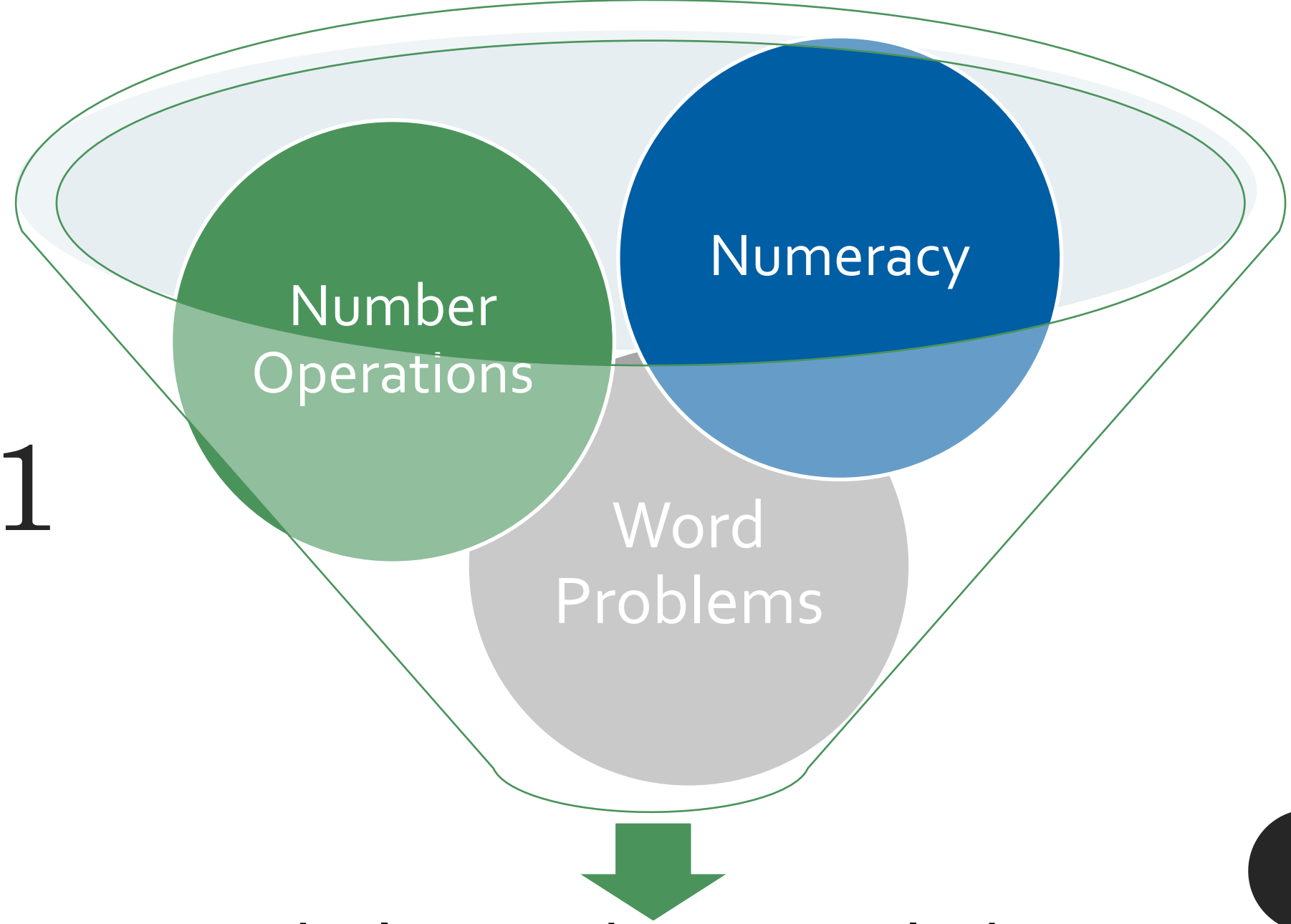
Grades 4-8

- Operations (fractions, decimals, ratios, percentages)
- Complex Operations (e.g., long division)
- Explicit Teaching of Word Problems

In Depth Knowledge of Whole Numbers

In Depth Knowledge of Rational Numbers

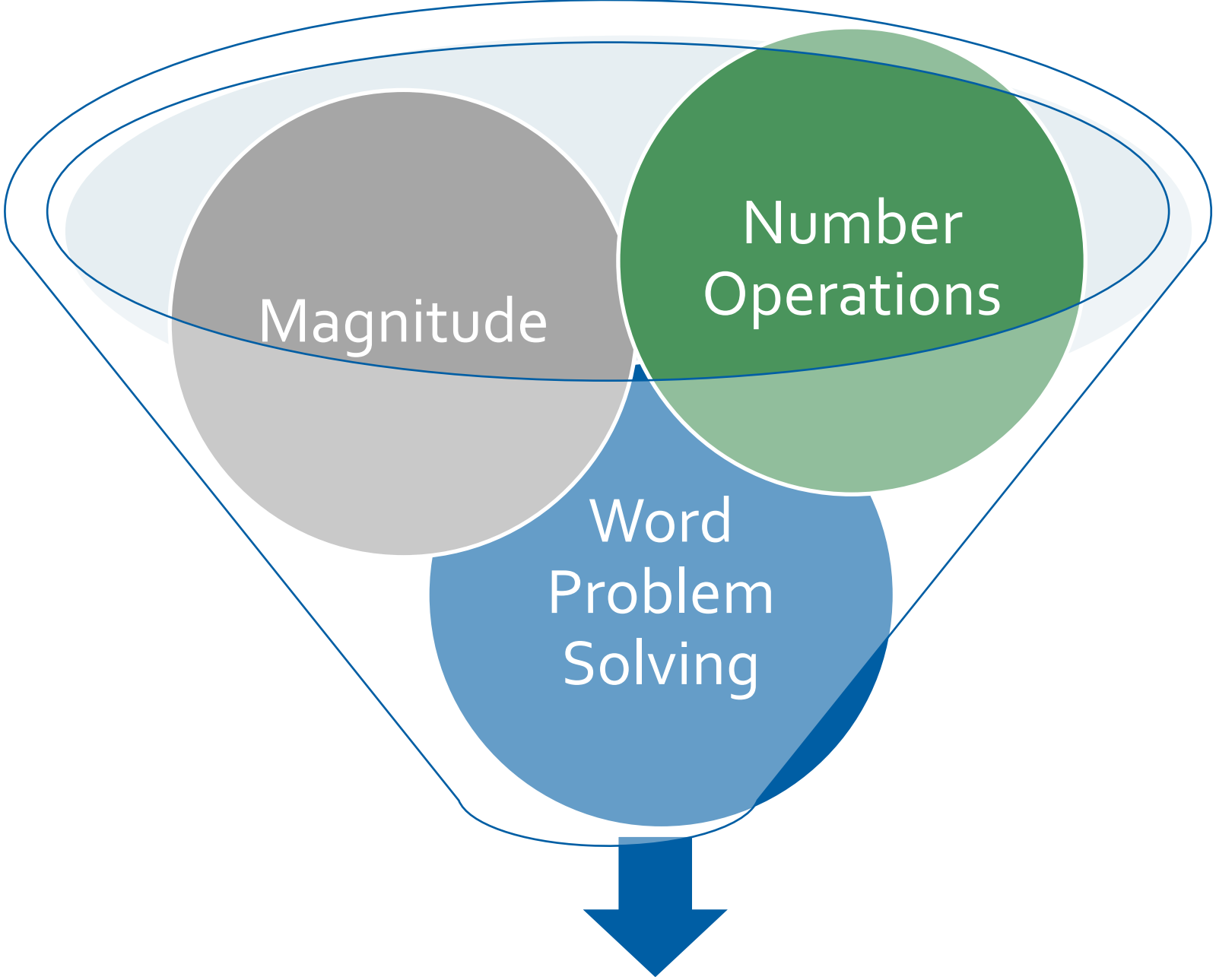
Bucket 1



Whole Number Knowledge

National Mathematics Advisory Panel (2008)

Bucket 2



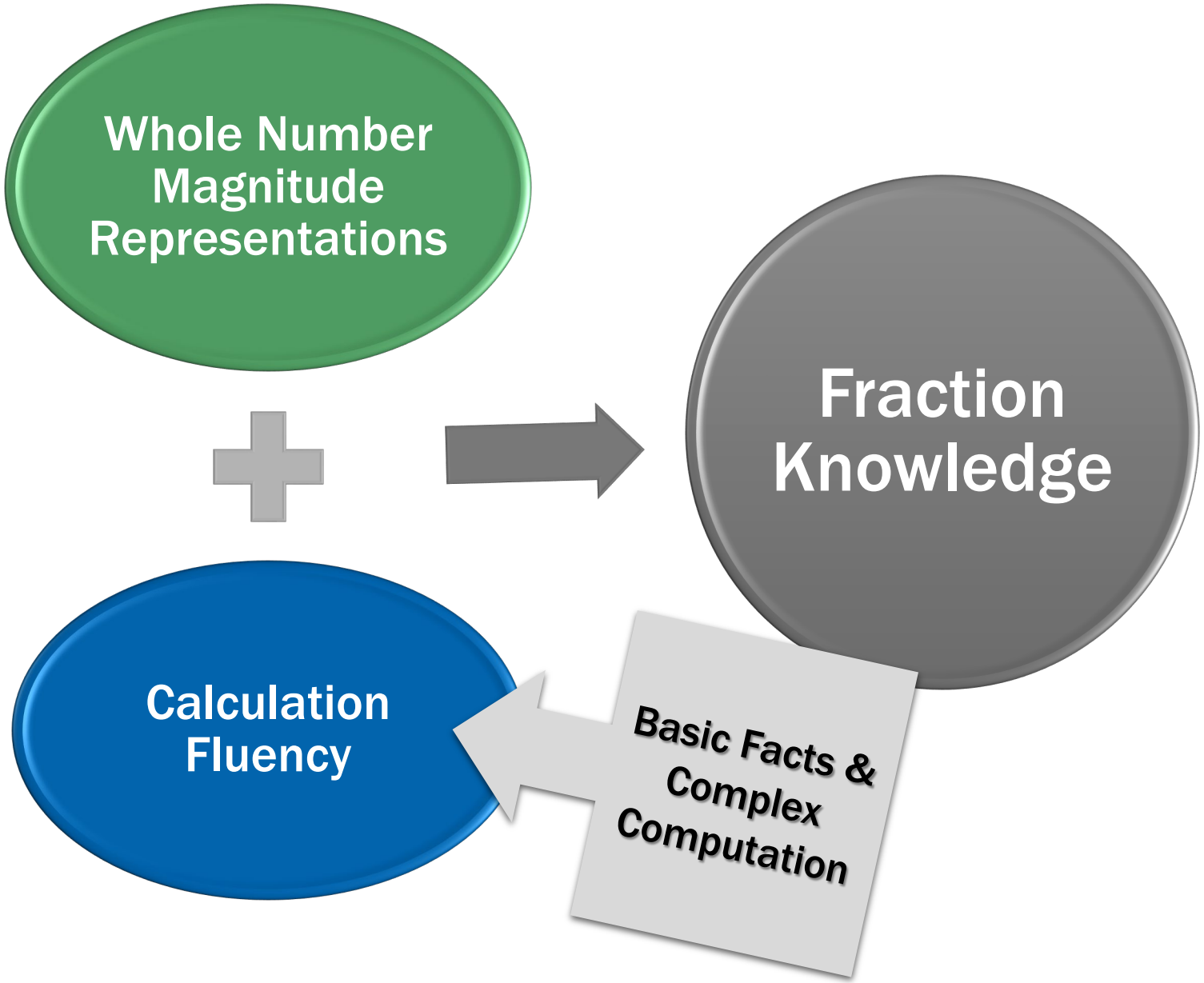
Rational Number Knowledge

RELATIONSHIP BETWEEN WHOLE & RATIONAL NUMBER KNOWLEDGE

Students with inadequate **whole number knowledge** were **MORE LIKELY** to have TROUBLE **understanding fractions** than students with adequate whole number knowledge

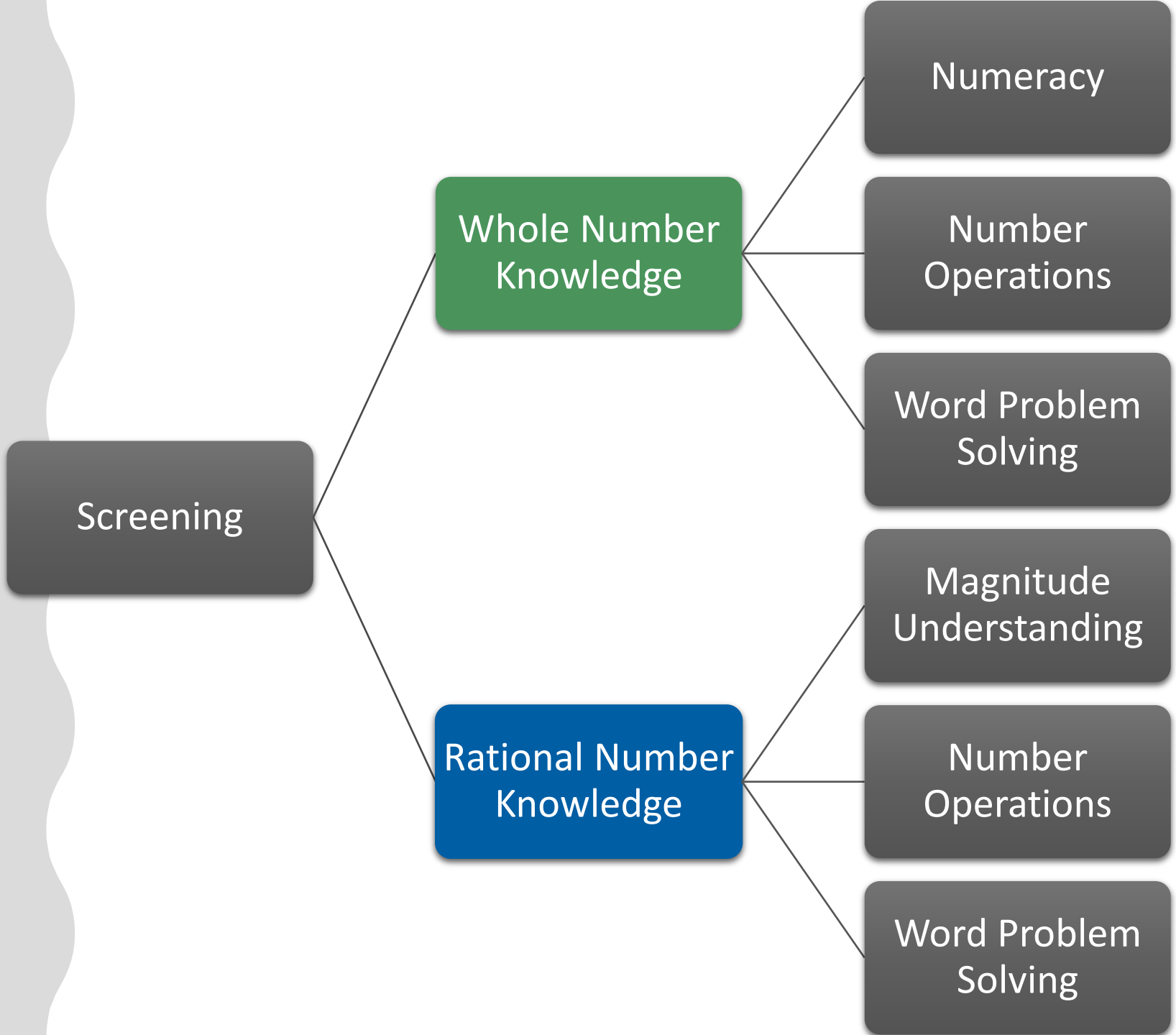
(Hansen, Jordan, & Rodrigues, 2017; Resnick et al., 2016; Numkung et al., 2018; Resnick et al 2018)

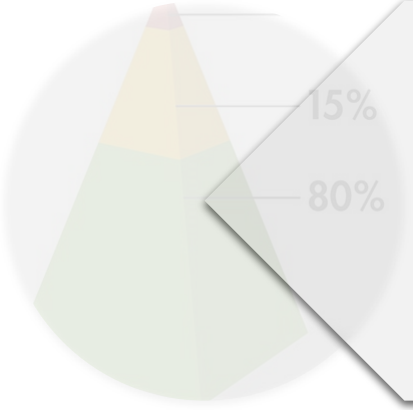
RELATIONSHIP BETWEEN WHOLE & RATIONAL # KNOWLEDGE



(Hansen, et al., 2017; Numkung et al., 2018; Resnick et al 2018; Ye et al., 2016)

Best Practices K-8: Teach Foundational Skills 1st





Structure & Logistics

Content

Practices

Goals of Classwide Interventions

01

Build fluency with core foundational skills by increasing

- # of opportunities for practice
- amount & type of feedback

02

Improve the average class performance

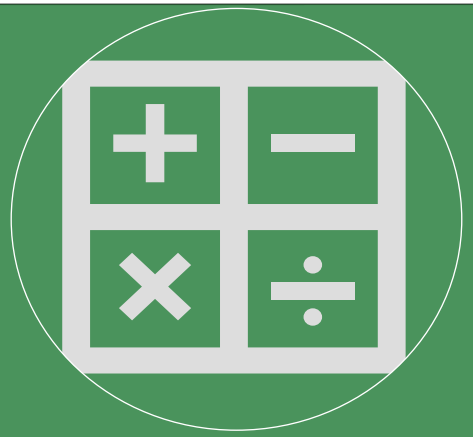
03

Improve students' beliefs & attitudes about math

04

Embed into naturally occurring classroom routines

1. Build Fluency with Math Facts & Complex Computation



390 Math Facts

109 +62 | 317 – 25

25 x 50 | 6,598/18

Determine Equivalent Fractions | Compare & Order Fractions | Estimate Sums of 2 Fractions

(Dehaene, 2011; DeSmedt et al., 2011; Gersten et al., 2009; Hasselbring et al., 1988; Jordan et al., 2009; O'Connell & SanGiovanni, 2011; Powell & Fuchs 2013; Price et al., 2013; Stickney et al., 2012)

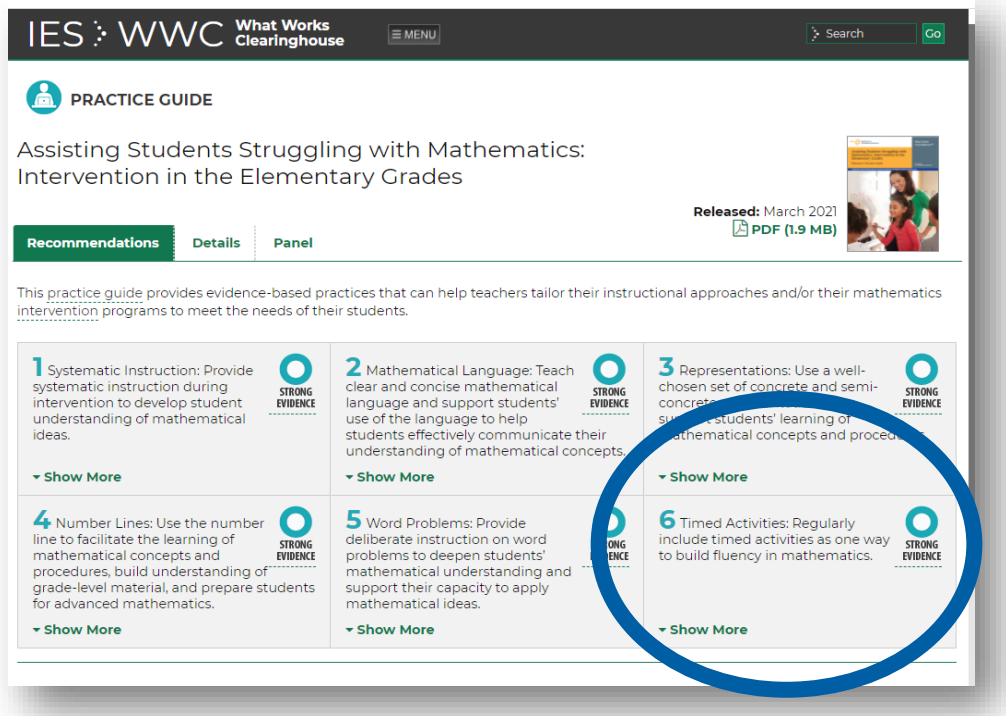
What the Science Says...Opportunities to Practice (Codding et al., 2019; Doabler et al., 2019,; Fuchs et al., 2021)

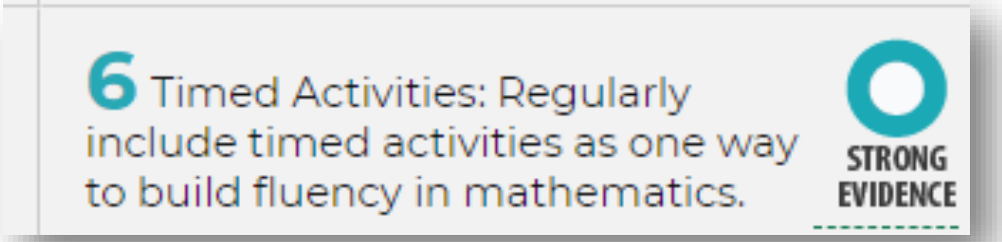
Deliberate, Productive Opportunities To Practice Are Required For All Types Of Learning (e.g., sports, music, math)

Promote Active Engagement with Math Content

Provide High Levels of Feedback & Support

Timed Practice Opportunities that Promote Efficient & Accurate Performance Improve Student Outcomes





Guided Practice

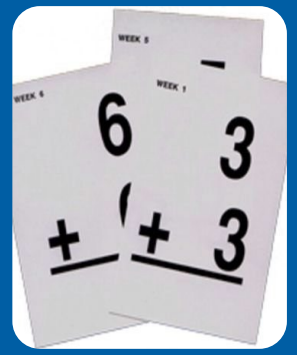
Establishing

Teacher-Led (Accuracy)

- Demonstration & Modeling
- Think Aloud While Solving
- Worked & Partially Worked Examples

Timed Practice

Retaining & Maintaining



Student-Led (Fluency)

- Flash Cards
- Worksheets
- Peer-Mediated or Team Based
- Technology

Cumulative Review

Enduring & Applying

Integrate Previously Learned Skills & Concepts (Generalization)

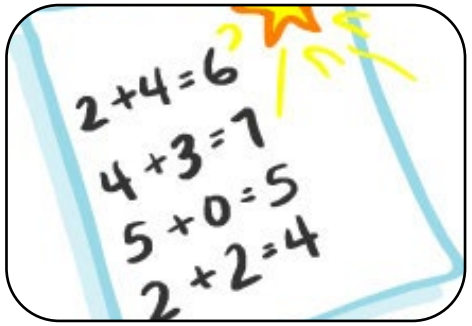
- Games
- Challenge Problems
- Interleaved Practice

3. Improve Student Beliefs & Attitudes About Math

Teamwork & Motivation

- Facilitate teamwork, mutual assistance, encouragement, and commitment to pro-social goals.
- Math achievement is improved by enhancing motivation and making students active learners.

Praise



Self-Monitoring

Self-Charting

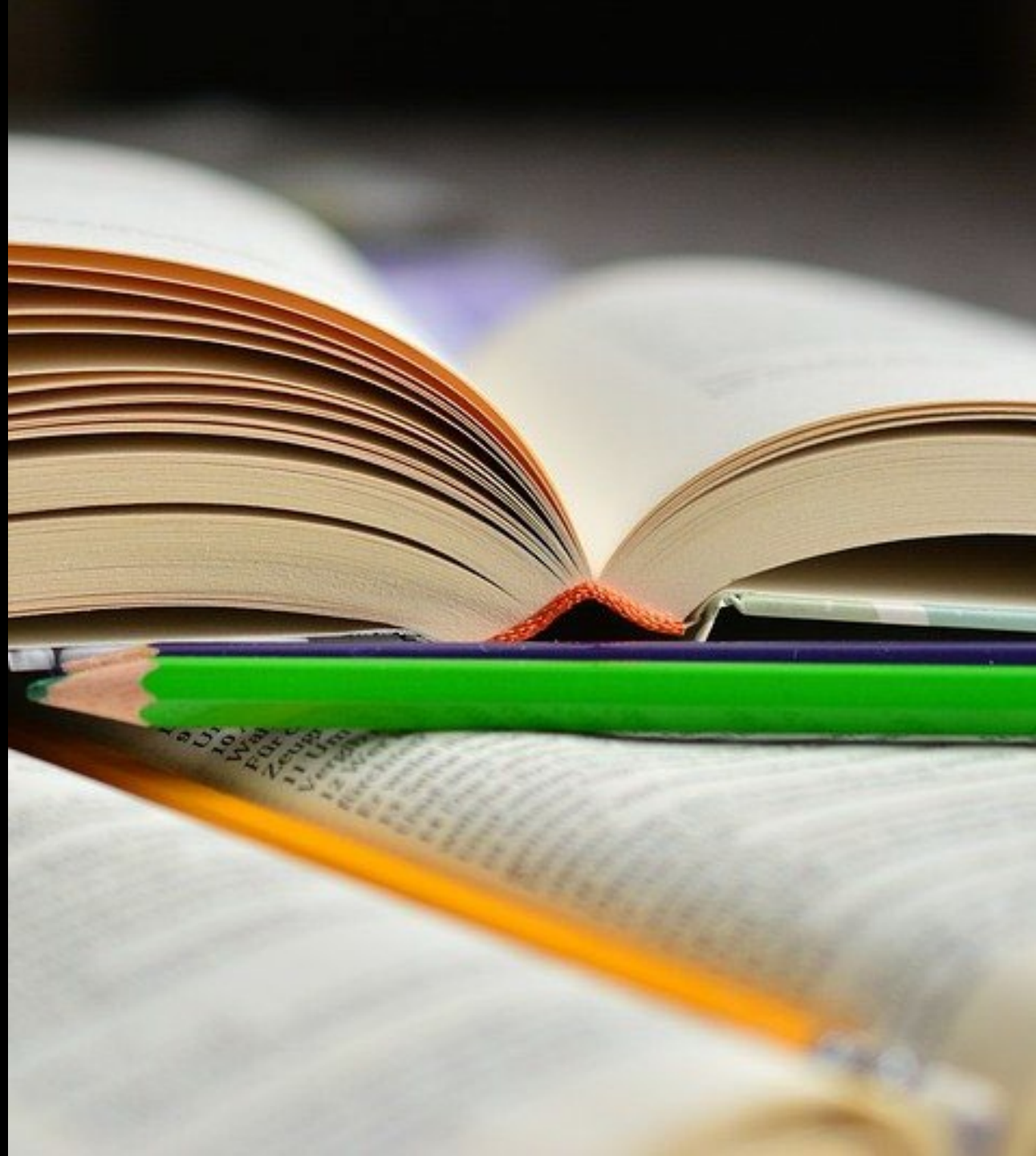
Choice

(Gersten et al., 2009; NMAP, 2008; Powell et al., 2015, 2017, Pellegrini et al, 2021)

Self-Regulation

Help students become aware of how they think when problem solving

Use of Heuristics & Mnemonics & Verbalization to teach students how to PLAN, MONITOR, & MODIFY their work



CREATING GROUP CONTINGENCIES

Define Group Rules

- Talk Only to Your Partner
- Talk Only about Math
- Be Helpful

Select Format

- Teams, Whole Group

Identify Criteria

- Points, Task Completion

Determine Rewards

- Tangibles, Edibles, Activities, Privileges/Recognition, Social
- Contingent on Group Performance

What are Classwide Interventions?

Peer Assisted Learning

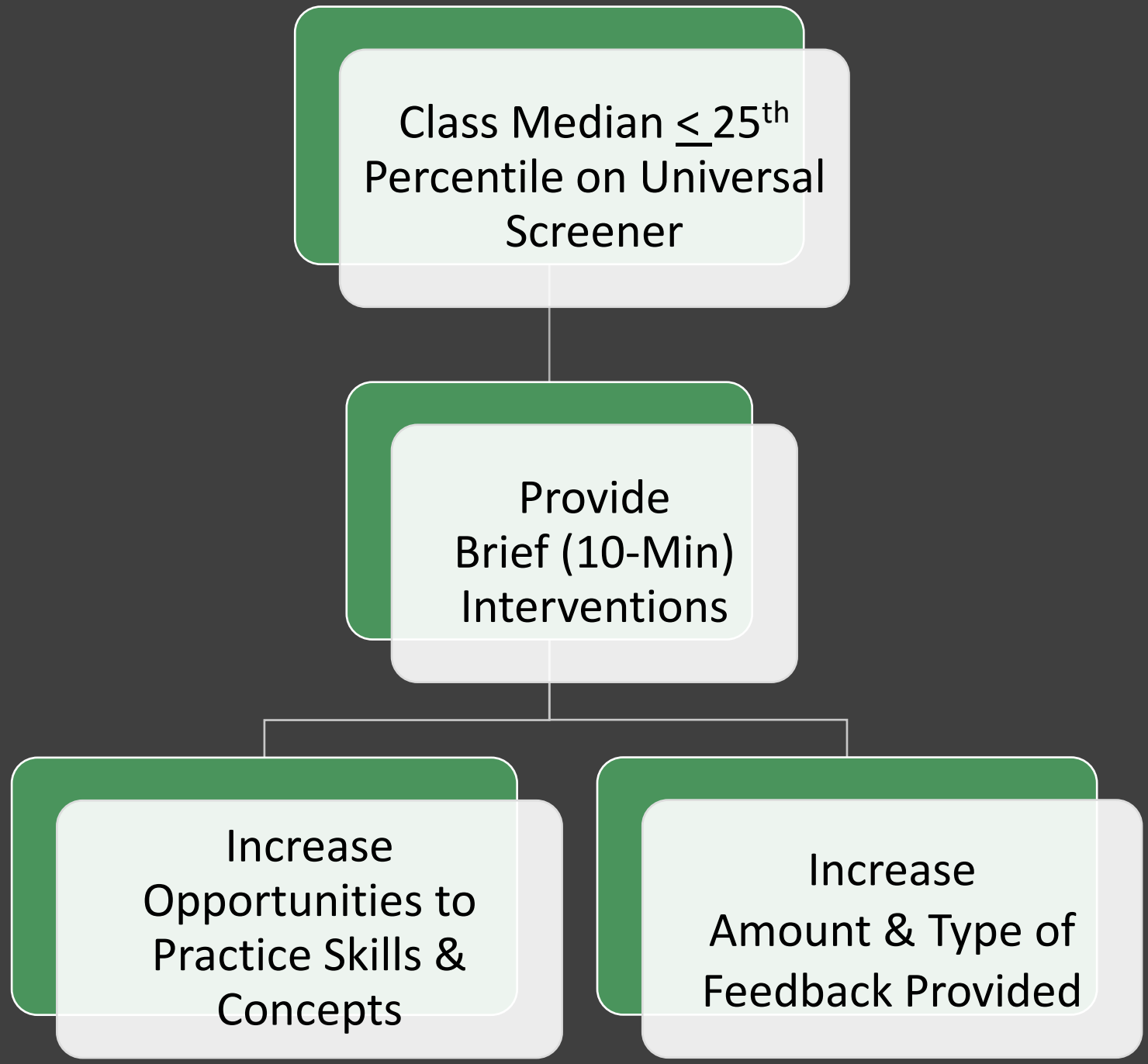
Building Computation Fluency

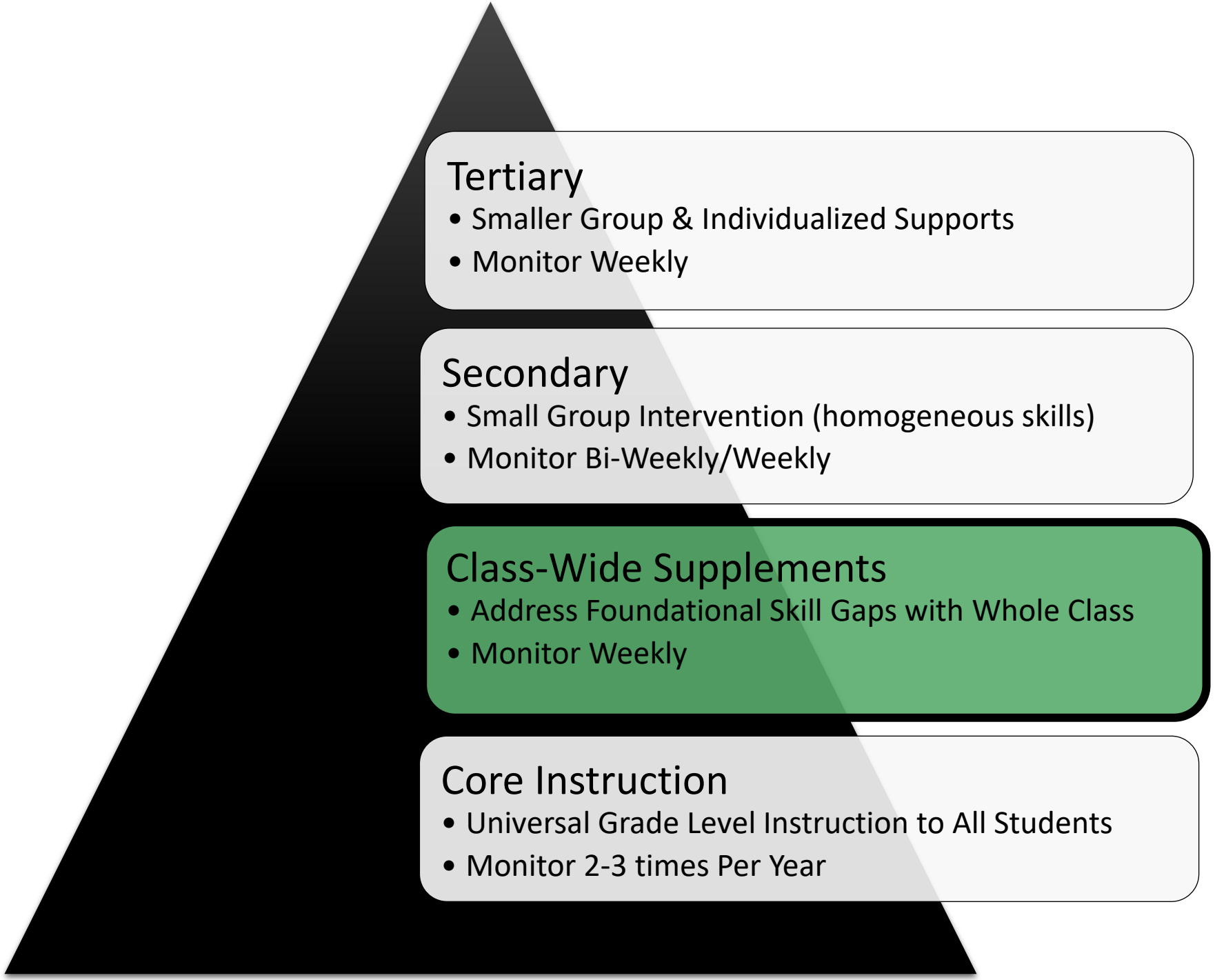
Peer Guided Pause

Response Cards

Word Problem Solving

Class-Wide Intervention Using Peer Assisted Learning




Tertiary
• Smaller Group & Individualized Supports
• Monitor Weekly
Secondary
• Small Group Intervention (homogeneous skills)
• Monitor Bi-Weekly/Weekly
Class-Wide Supplements
• Address Foundational Skill Gaps with Whole Class
• Monitor Weekly
Core Instruction
• Universal Grade Level Instruction to All Students
• Monitor 2-3 times Per Year

Benefits of Peer-Assisted Learning

Students working in **PAIRS or SMALL GROUPS** ***daily*** scored higher on the NAEP (2017) than their peers

Benefits students from low income, minoritized backgrounds in urban schools as well as English learners

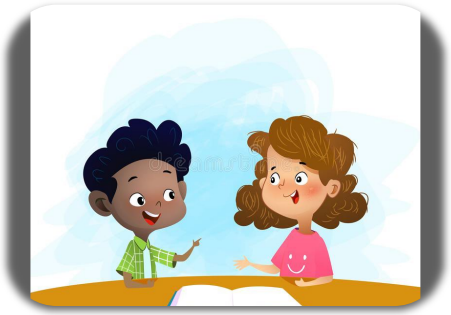
Better when students **monitor** own outcomes, **set goals**, & **evaluate** own performance

More evidence supporting benefits for whole-number concepts

(Bowman-Perrott et al., 2013; Ginsburg-Block et al., 2006; Greenwood et al. 1993; Kunsch et al., 2007; NCES, 2018; Robinson et al., 2005)

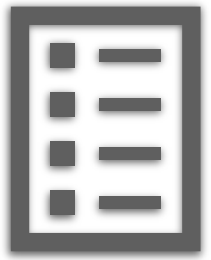
Peer-Assisted Learning Steps

1. Select Activity & Set Time (10-15 min)

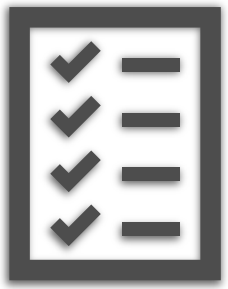


2. Pair Students

3. Provide background + review key concepts & procedures



4. Identify Rules for Working Together



5. Create Team Score Card

6. Have Pairs Select Daily or Weekly Goals

7. Assign Student to Begin as Tutor/Coach

8. Use Timer to Signal Role Switching

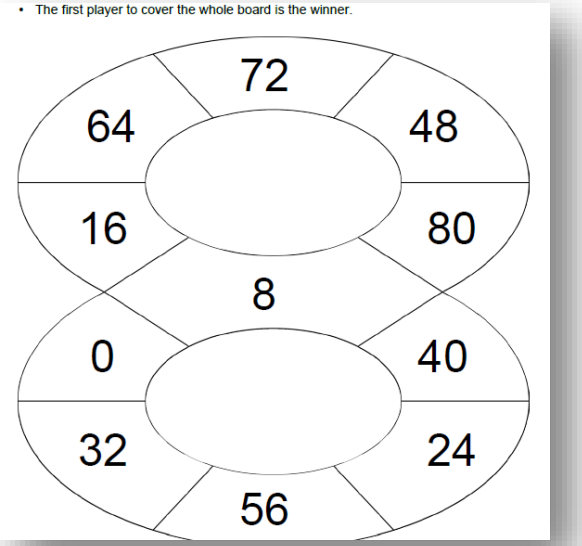
9. Wrap-Up: Evaluate Teamwork & Goals

Select Activity & Set Time (15 min)

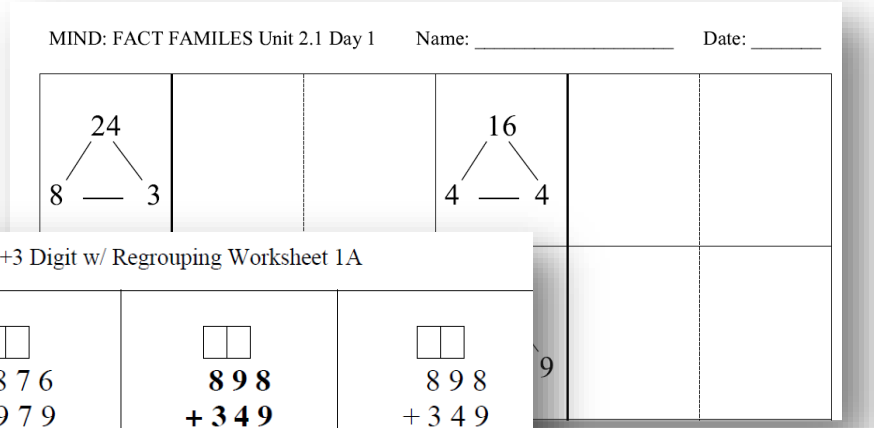
Flash Cards

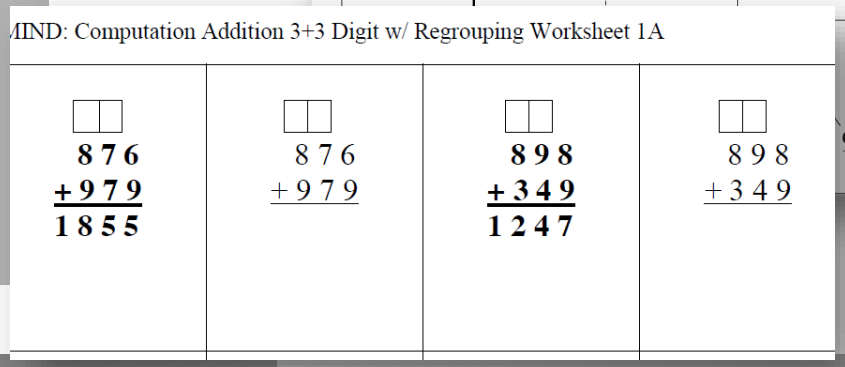
GUITAR: There are 6 strings on
the table to show how many guitars the

Number of Guitars			3		
Number of Total Strings	6	12	18	24	30

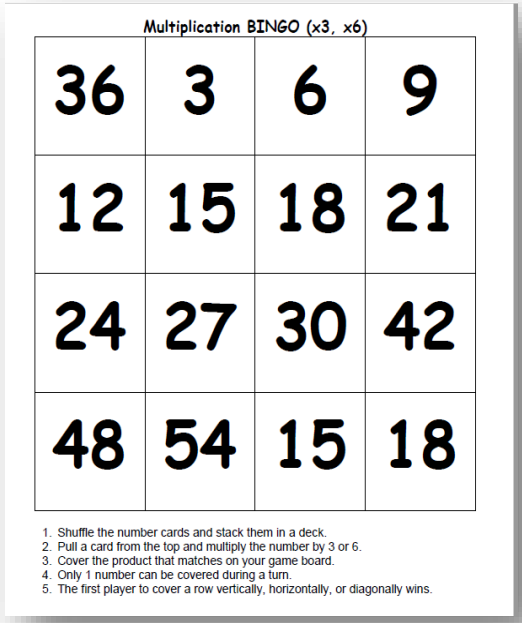


Review Activities





Worksheets



Games

Adapt Peer Mediated Activities to Work for Your Students

If close to mastery	If struggling to grasp content	If student engagement is a problem
increase salience of feedback (add goals & rewards)	scale back & work with pre-requisite skills and/or build self-monitoring checklists	add options for choice, rewards, or vary how the information is presented (worksheets, white boards, flash cards)

Adaptations to Peer Assisted Learning

Word Problem Extensions	• Each pair turns computation problems into word problems • Exchange & Solve
Self-Monitoring Checklist	• After scoring, students reflect on errors & make checklist
Play Card Games	• Deal 3 cards: 1st & 2nd card = 2-digit #; 3rd card is multiplier • Largest product = winner
Goal Setting	• Set & reflect goals, graph & score
Group Contingency	• Class competes to earn highest median score
Alternate Materials	• Worksheets-White Boards-Flash Cards-Computer
Choice	• Teacher selects 5 problems students must practice; students choose remaining 5
Intersperse	• Alternate Practice Days between Basic & Complex Operations

SELF-MONITORING CHECKLIST

- ☐  **Read**: Read the problem.
- ☐  **Ask**: What is the problem asking?
- ☐  **Draw**: Draw a picture.
- ☐  **Check**: Does my drawing match the problem?
- ☐  **Solve**: Solve it!

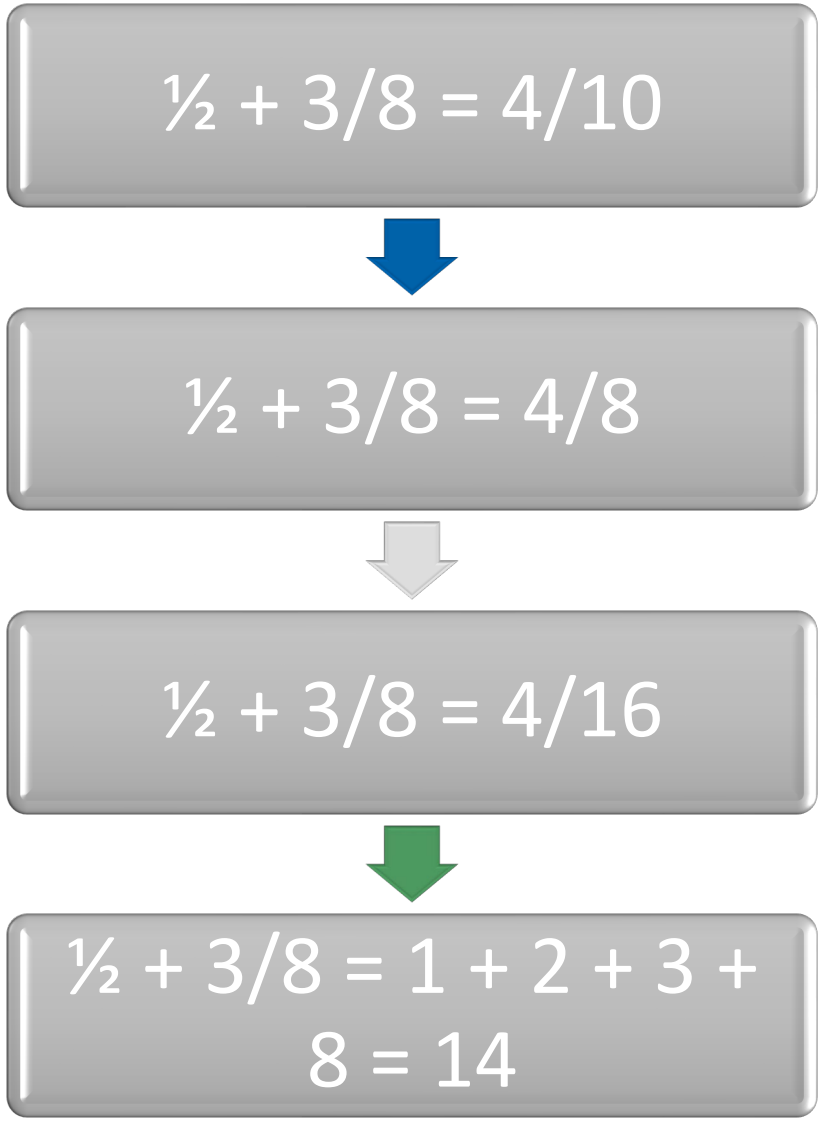
Creating A Checklist:

- Individualize
- Include Common Errors
- List Appropriate Step for Error Prevention
- Compile each ***Self-Check*** Item into a list

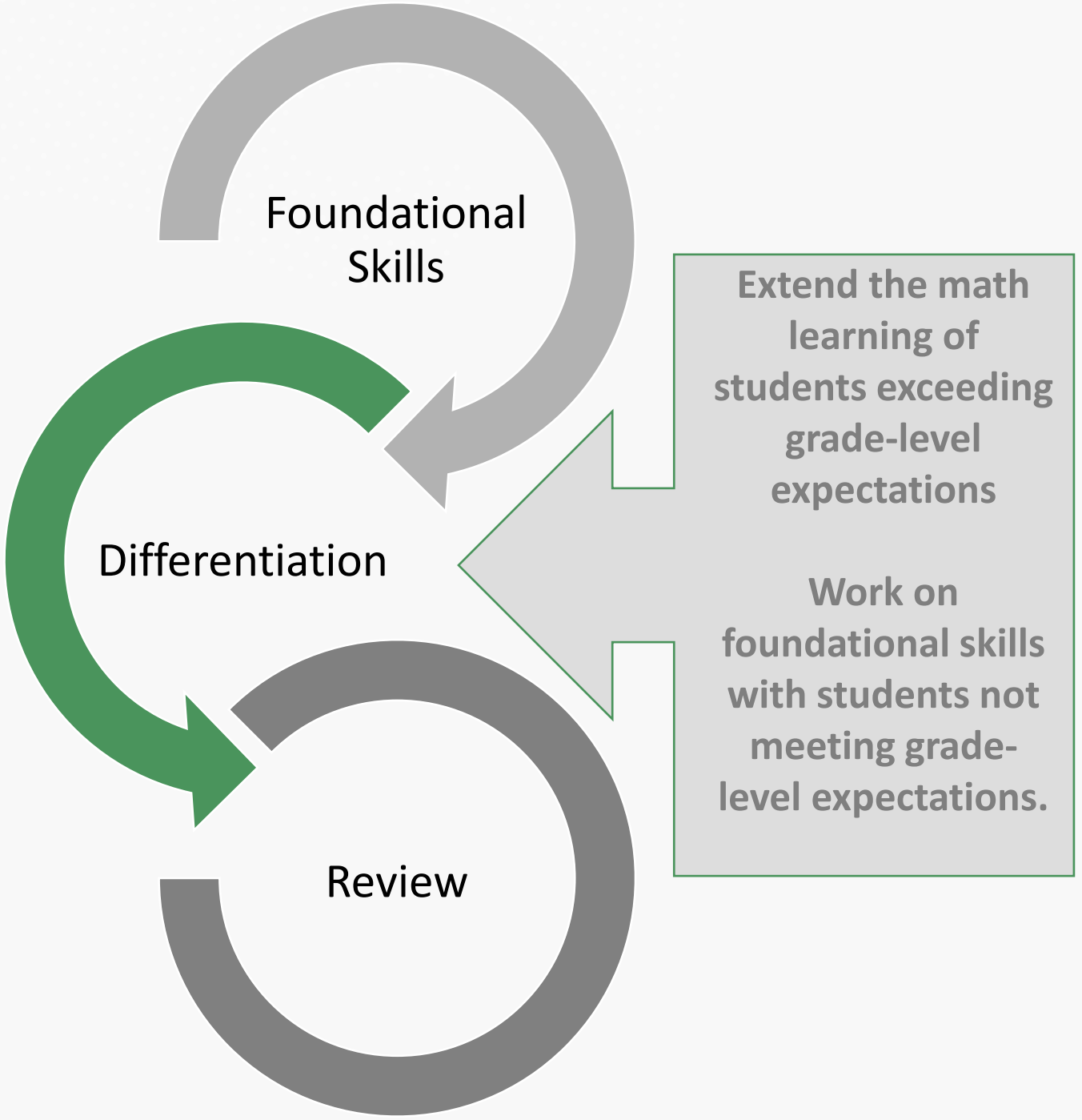
Common Errors with Fractions Operations

(Cramer & Whitney, 2010; Van de Walle, 2016)

- Combining numerators & denominators
- Selecting a denominator from the two given
- Adding across the numerator & applying different operation to denominator
- Adding together all numbers to find a sum



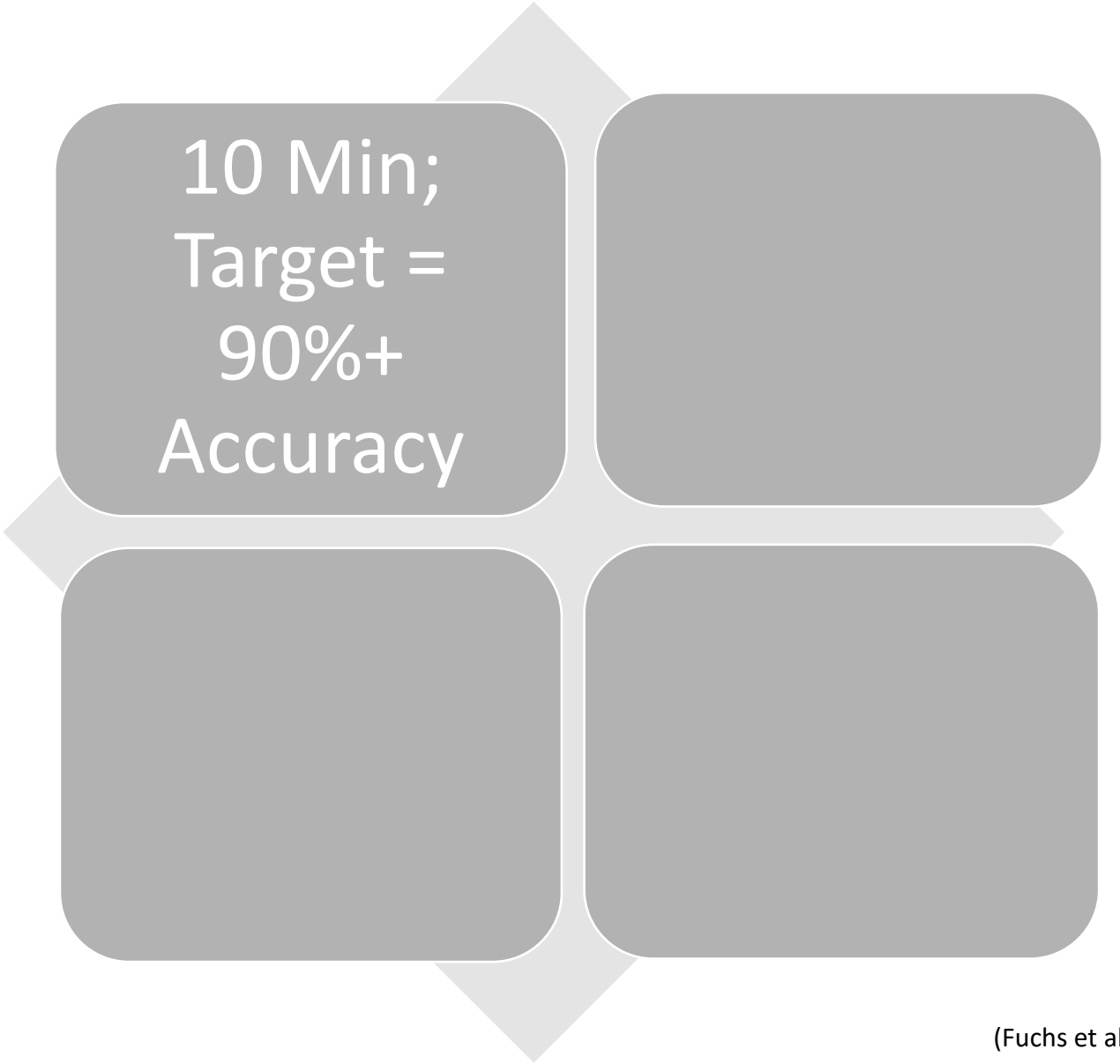
Class-Wide Intervention



Classwide Intervention Warm-Up Ideas to Enhance Foundation Skills

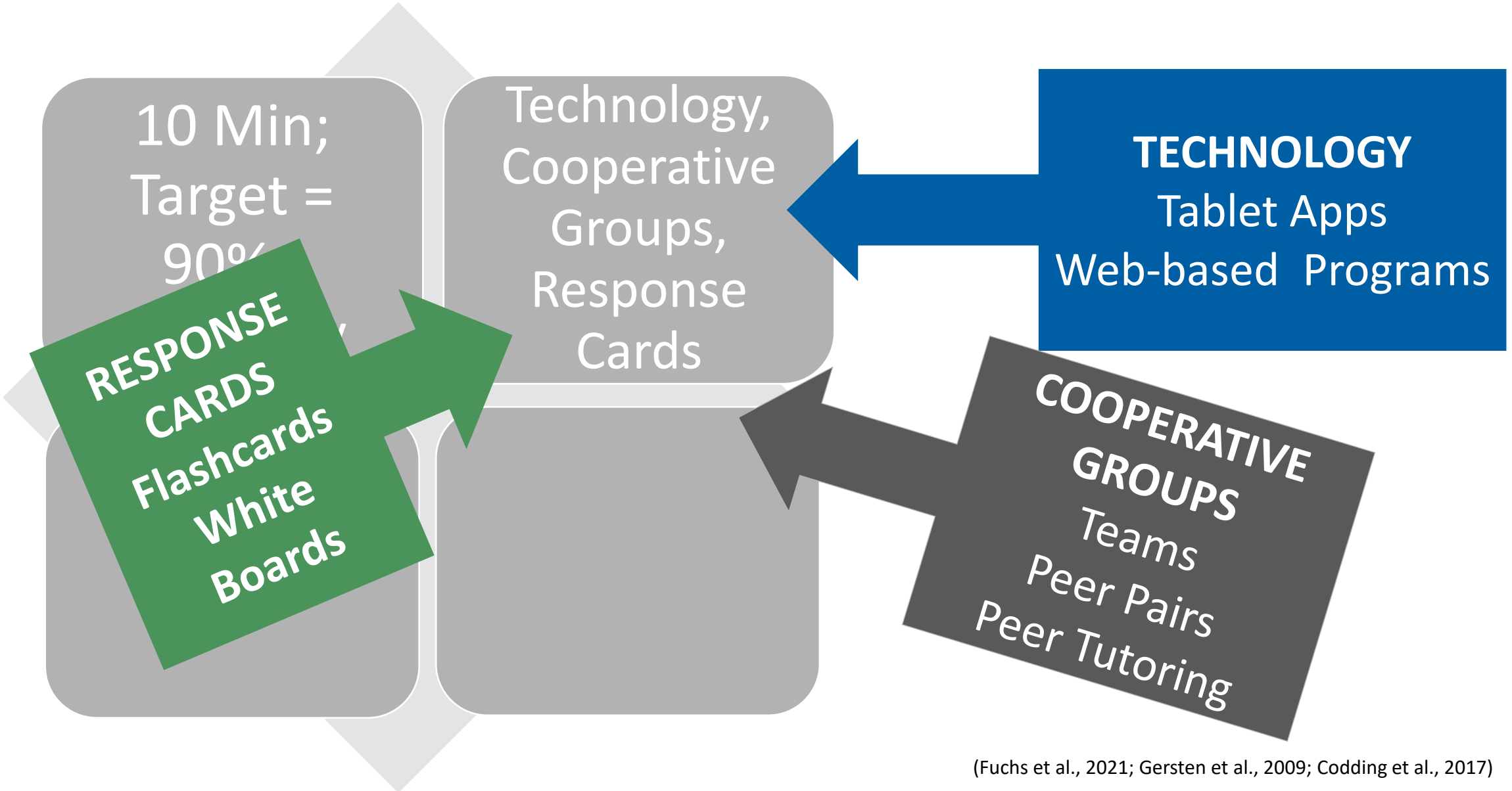
- Build Computational Fluency
- Peer Guided Pause
- Response Cards
- Pre-View Math Vocabulary

How to Build Computational Fluency



(Fuchs et al., 2021; Gersten et al., 2009; Codding et al., 2017)

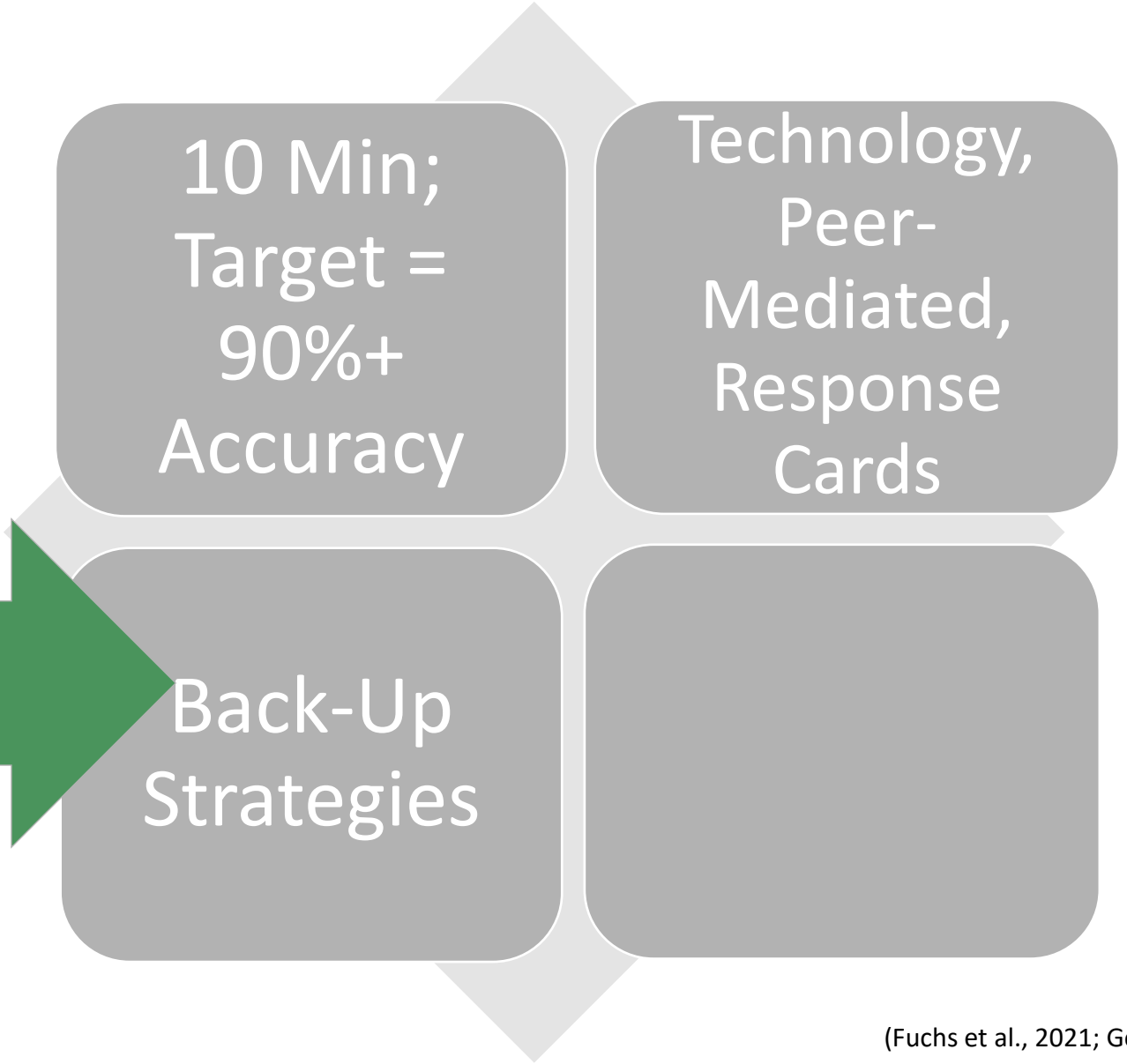
How to Build Computational Fluency



(Fuchs et al., 2021; Gersten et al., 2009; Codding et al., 2017)

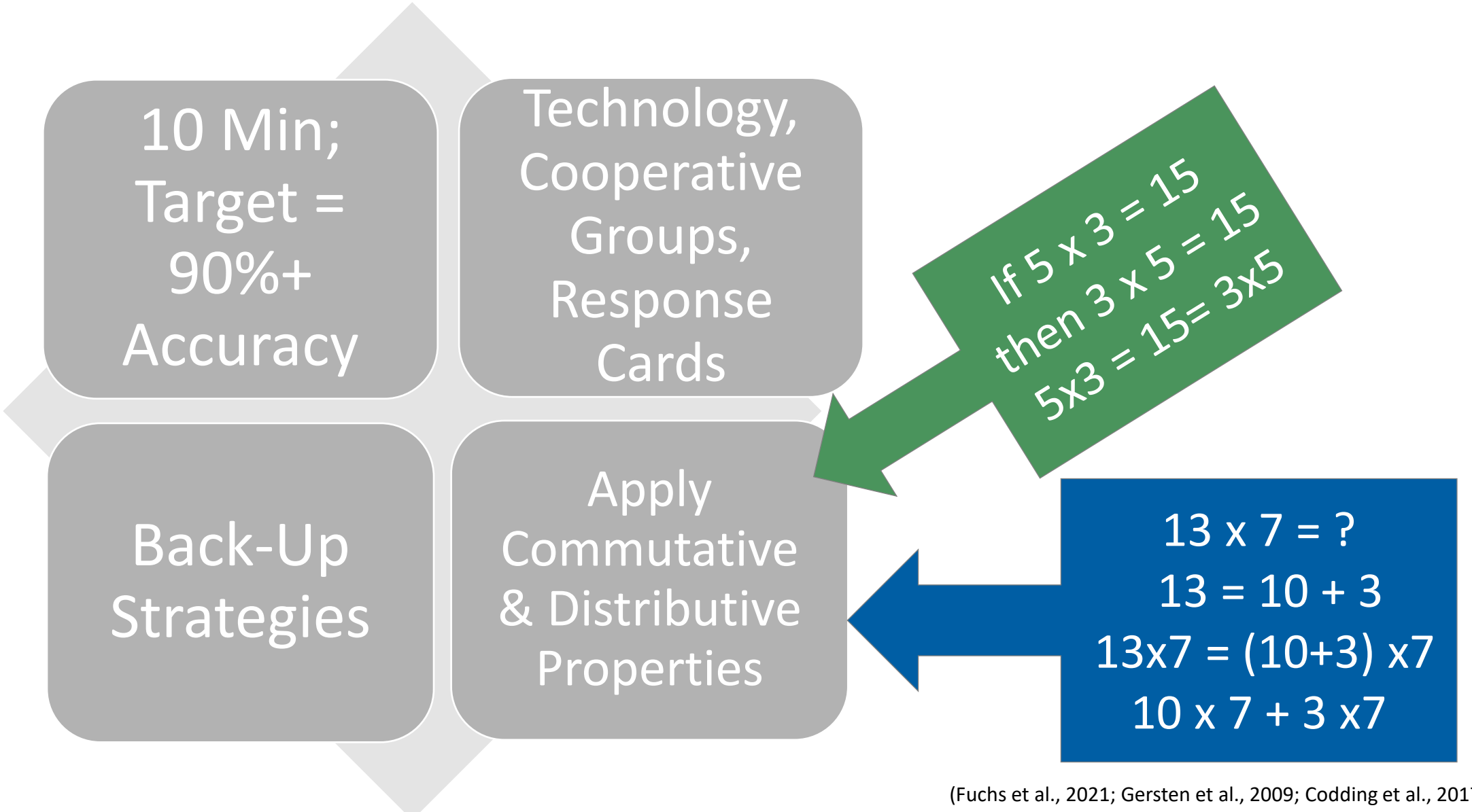
How to Build Computational Fluency

1. Skip Counting
2. Repeated Addition
3. Doubles
4. Build an Array
5. Use Known Facts First (3x7; 6 x7→ 6 is twice 3)



(Fuchs et al., 2021; Gersten et al., 2009; Codding et al., 2017)

How to Build Computational Fluency



(Fuchs et al., 2021; Gersten et al., 2009; Codding et al., 2017)

Identify A Skill Sequence

Math Two-a-day Skill Scope and Sequence by Grade

Grade	1st	2nd	3rd	4th	5th
Skill	Number writing	Sums to 9	Sums to 18	2x2 Sums	2x2 Sums *rgrp
	Missing Number	Sub from 10	Sub from 20	2x2 Sums *rgrp	2x2 Sub *rgrp
	Sums to 6	Sums to 18	2x2 Sums	2x2 Sub	Mult to 81
	Sums to 9	Sub from 20	2x2 Sums *rgrp	2x2 Sub *rgrp	Div from 81
	Sub from 6	2x2 Sums	2x2 Sub	Mult to 81	Mult 2x1
	Sub from 9	2x2 Sums *rgrp	2x2 Sub *rgrp	Div from 81	Mult 2x2
		2x2 Sub	Mult to 81	Mult 2x1	Mixed method
		2x2 Sub *rgrp	Div from 81	Mult 2x2	

* rgrp = regrouping

Microsoft Word - Math2aDayManual-Draft4(b) (filesusr.com)

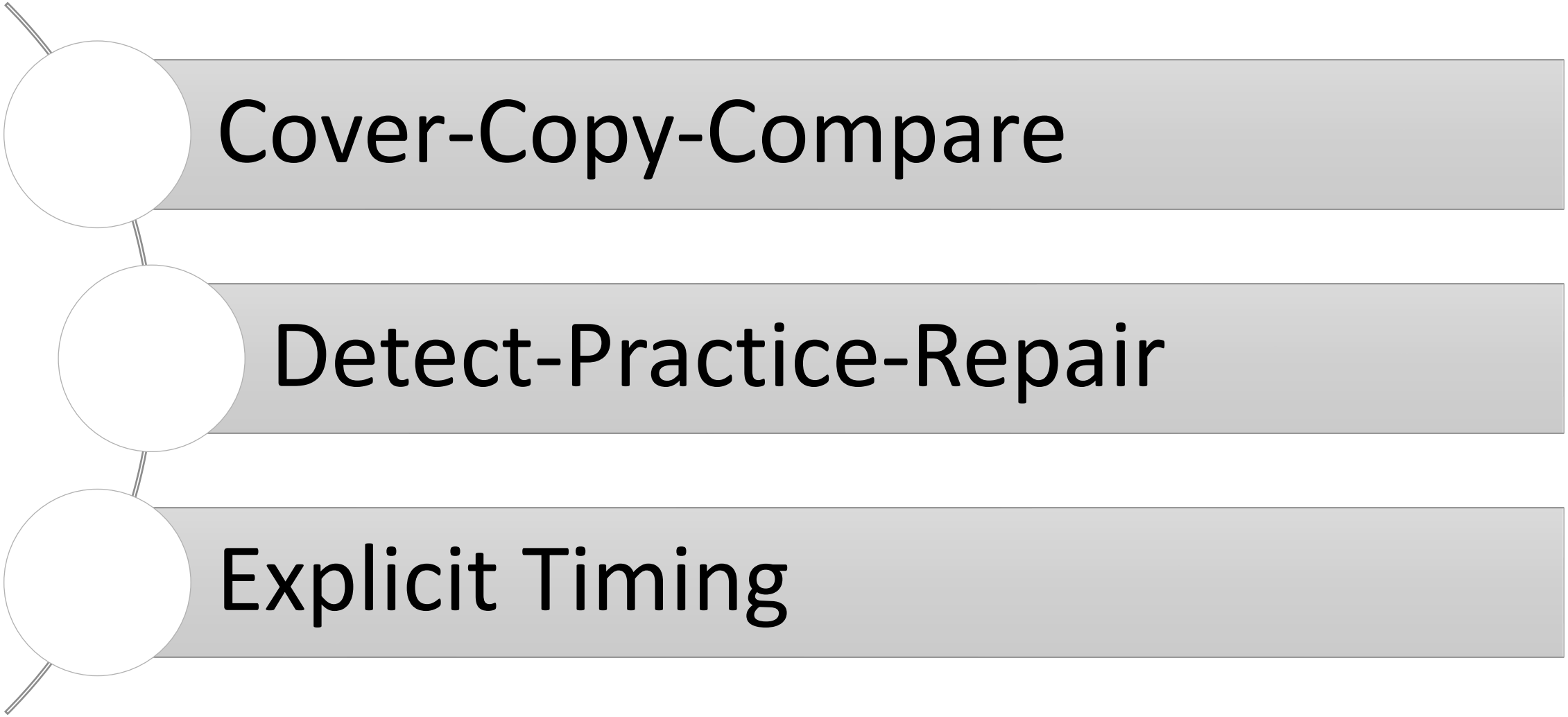
VanDerHeyden et al. (2021)

Table 1. Grade 6 Class-Wide Intervention Skill Sequence

- 2-Digit Subtraction With & Without Regrouping
- Multi-Digit Multiplication With & Without Regrouping
- Multi-Digit Division With & Without Remainders
- Order of Operations
- Find Least Common Denominator
- Simplify Fractions (A)
- Simplify Fractions (B)
- Simplify Fractions (C)
- Add & Subtract Fractions With Unlike Denominators
- Add & Subtract Mixed Numbers With Like Denominators and Regrouping
- Convert Improper Fractions to Mixed Numbers
- Multiply & Divide Proper and Improper Fractions
- Convert Mixed Numbers to Improper Fractions
- Multiply & Divide Mixed Numbers
- Mixed Fraction Operations
- Distributive Property of Expression
- Collect Like Terms
- Substitute Whole Number to Solve Equations
- Find Percent of a Whole Number
- Add & Subtract Decimals to the Hundredths
- Multiply & Divide Decimals
- Multiply 2-Digit by 2-Digit With Decimals
- Quantity Comparison With Integers
- Graph in a Coordinate Plane Skill

Sequence used in SpringMath (www.springmath.com). Reprinted by permission of author.

Interventions to Facilitate Computational Fluency



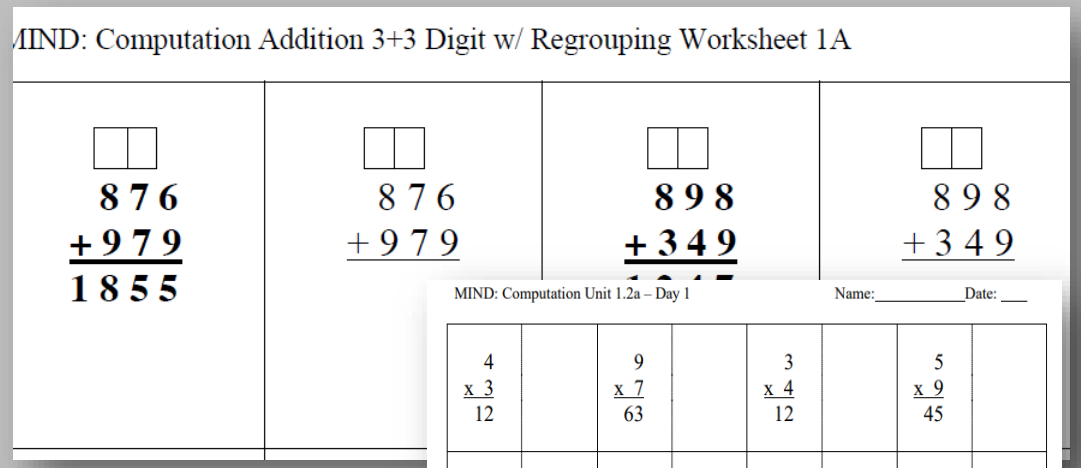
Cover-Copy-Compare

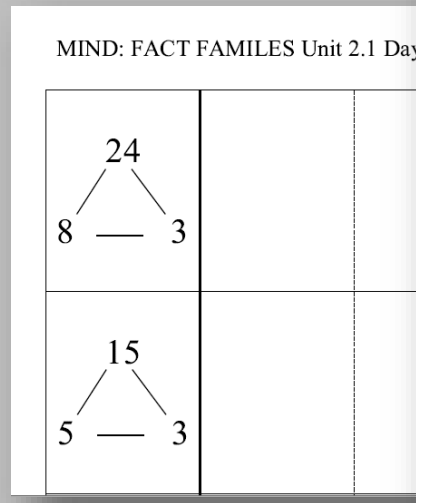
Pros

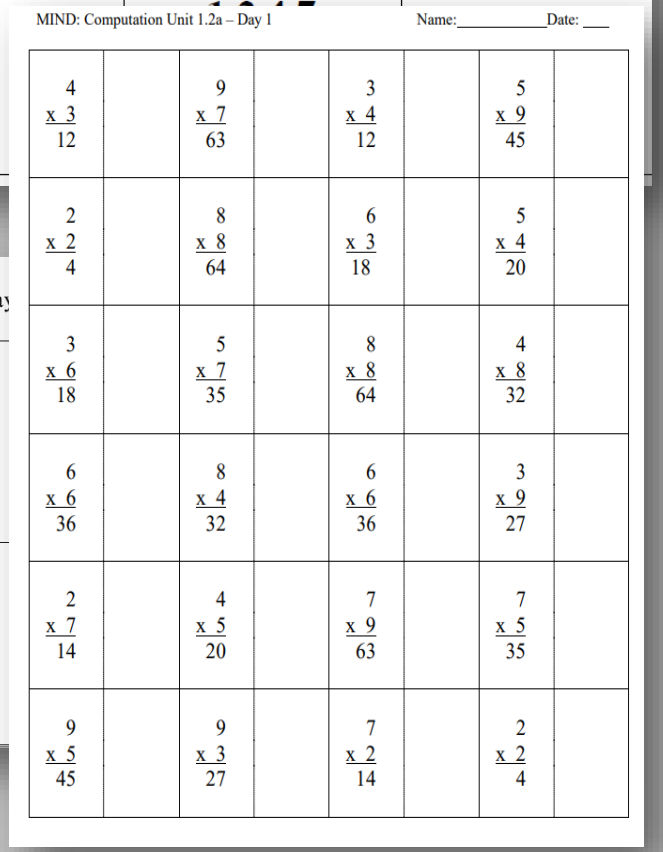
- Model to ensure accurate responding
- Easy to use when differentiating skills or different set sizes among students

Cons

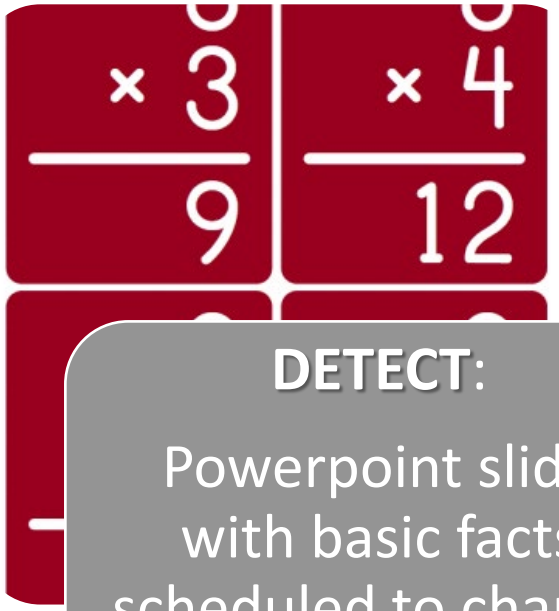
- Number of opportunities to respond are slowed by the study-cover-copy-compare process





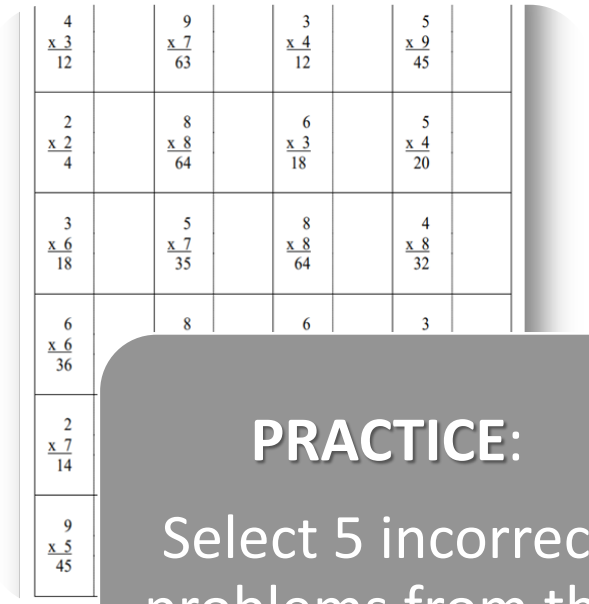


Detect-Practice-Repair



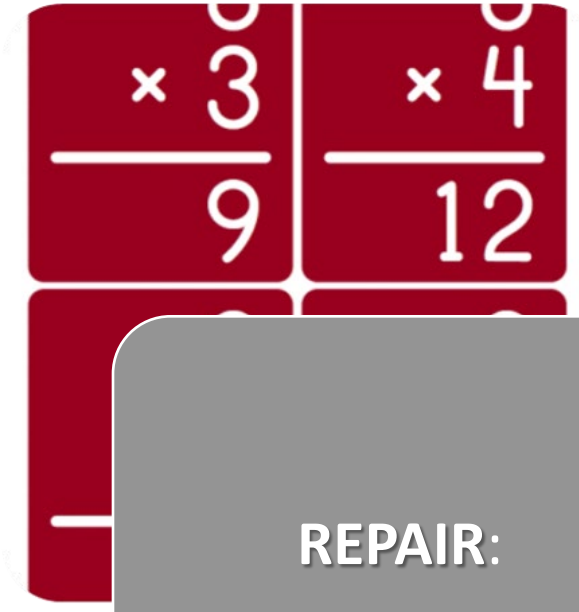
DETECT:

Powerpoint slide with basic facts scheduled to change every 3 seconds (1-min). Students have worksheet to write answers & later score.



PRACTICE:

Select 5 incorrect problems from the detect phase & build own Cover-Copy-Compare worksheet



REPAIR:

Redo Detect Phase with second worksheet

(e.g., Poncy et al. 2010)

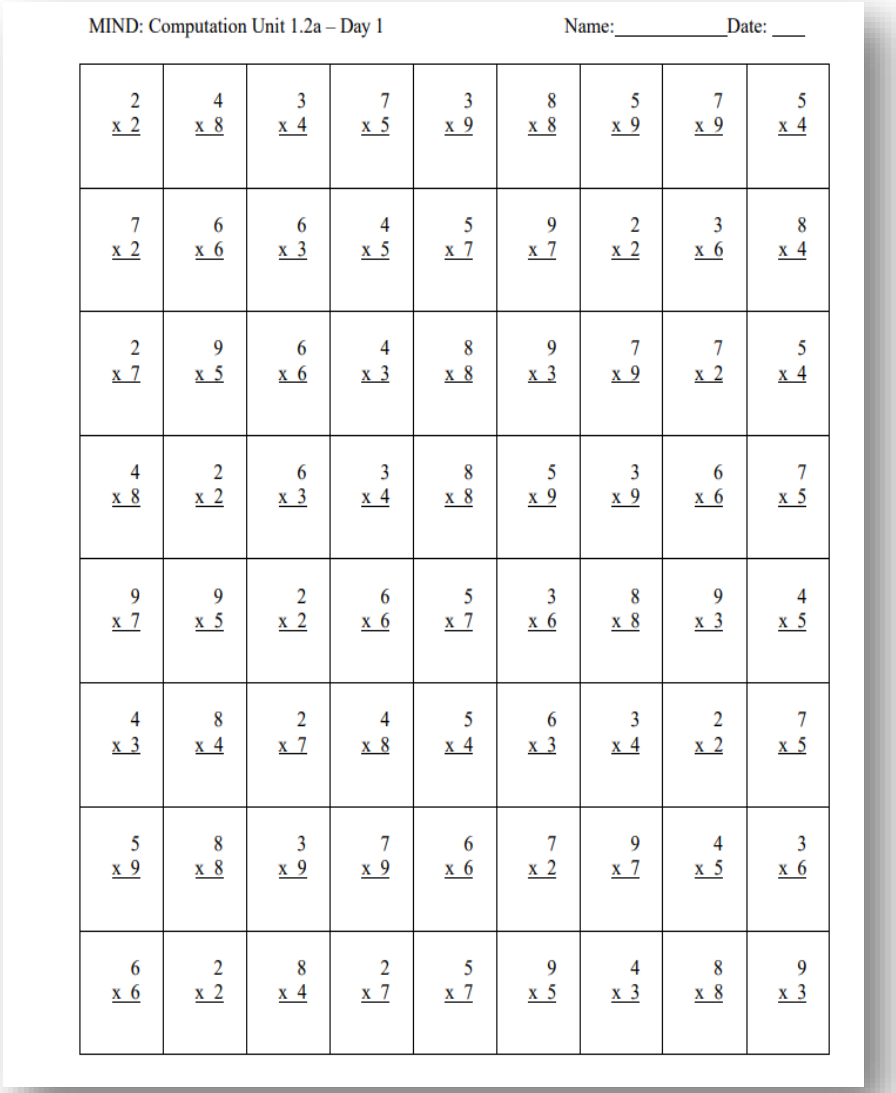
Explicit Timing

Timed Practice Activity

- Students need to accurately & independently complete the activity
- Teacher provides finite time for task (1-min, 2-min, 4-min)
- Student either works problems for the time

Pros and Cons

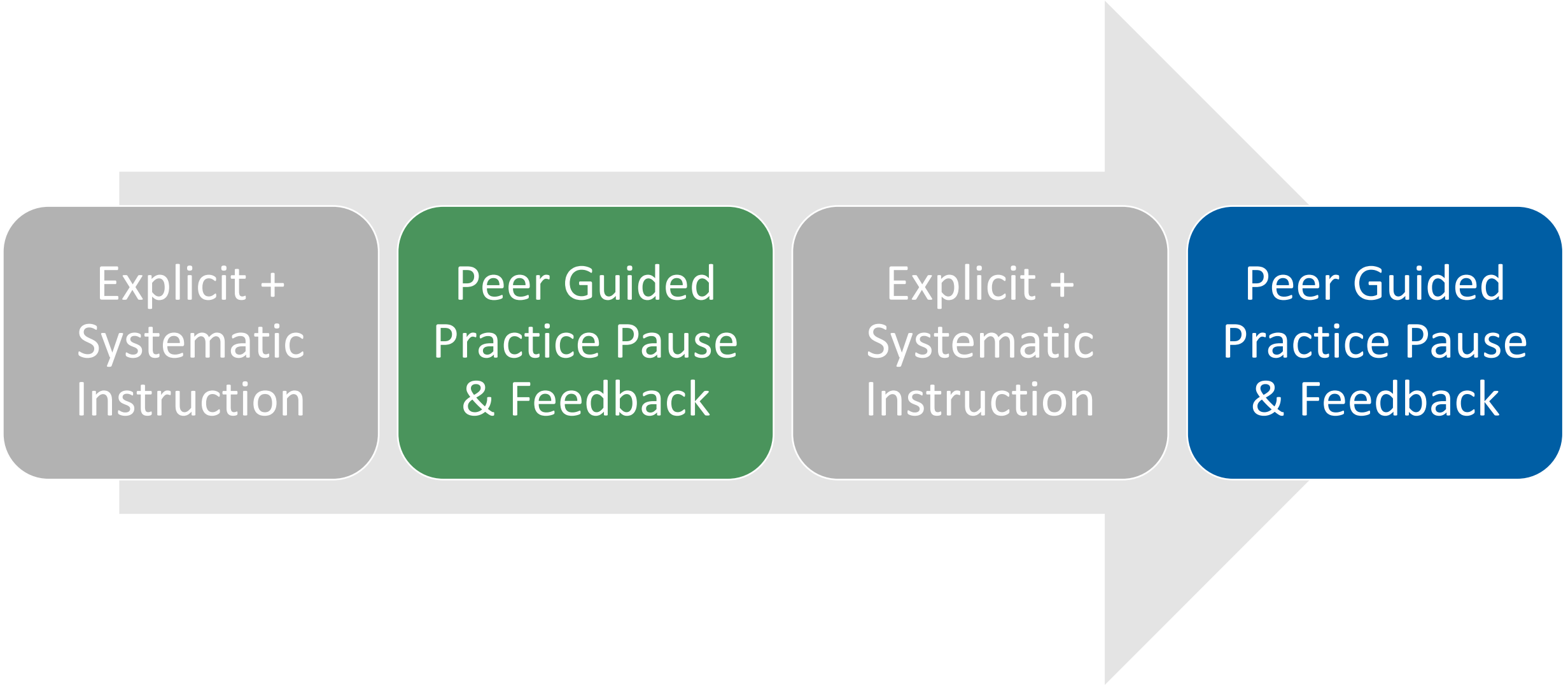
- PROS: Easy to incorporate in classroom routines, low cost, efficient & effective
- CONS: Need to match the student to the appropriate skill & know when to move to a new skill



MIND: Computation Unit 1.2a – Day 1 Name:_____Date: ___

2 x 2	4 x 8	3 x 4	7 x 5	3 x 9	8 x 8	5 x 9	7 x 9	5 x 4
7 x 2	6 x 6	6 x 3	4 x 5	5 x 7	9 x 7	2 x 2	3 x 6	8 x 4
2 x 7	9 x 5	6 x 6	4 x 3	8 x 8	9 x 3	7 x 9	7 x 2	5 x 4
4 x 8	2 x 2	6 x 3	3 x 4	8 x 8	5 x 9	3 x 9	6 x 6	7 x 5
9 x 7	9 x 5	2 x 2	6 x 6	5 x 7	3 x 6	8 x 8	9 x 3	4 x 5
4 x 3	8 x 4	2 x 7	4 x 8	5 x 4	6 x 3	3 x 4	2 x 2	7 x 5
5 x 9	8 x 8	3 x 9	7 x 9	6 x 6	7 x 2	9 x 7	4 x 5	3 x 6
6 x 6	2 x 2	8 x 4	2 x 7	5 x 7	9 x 5	4 x 3	8 x 8	9 x 3

Embedding Peer Guided Practice Pauses Into Core Instruction



Peer Guided Pause: How it Works

When

- During Review Times in Group Lecture

What

- Students Directed to Work in Pairs for 4-5 Minutes

Materials

- Worksheet with:
  1. One Completed Problem Illustrating the Concept
  2. One-Two New Problems

Procedures

1. Pairs Review the Completed Problem Aloud
2. Work Cooperatively on New Problems
3. Check Work

Interleaving Worked Examples

Which approach: Asking for solutions to all 8 problems OR interleaving 4 worked examples with 4 problems, will lead to better learning?

Solve for x:
12 + 2x = 15

Solve for x: 12 + 2x = 15

Study each step in this solution, so you can better solve the next problem on your own:

2x = 15-12

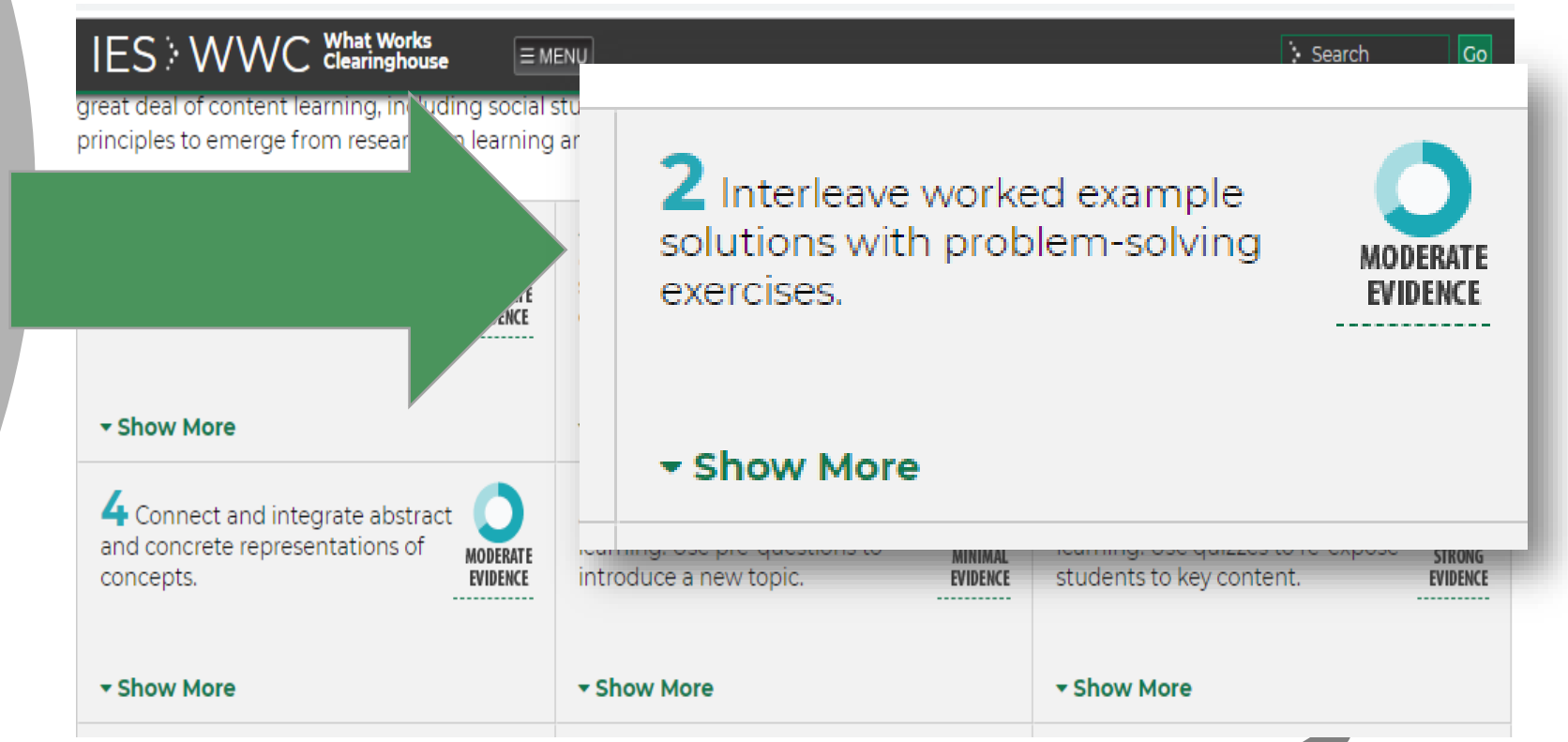
2x = 3

x = 3/2

x = 1.5

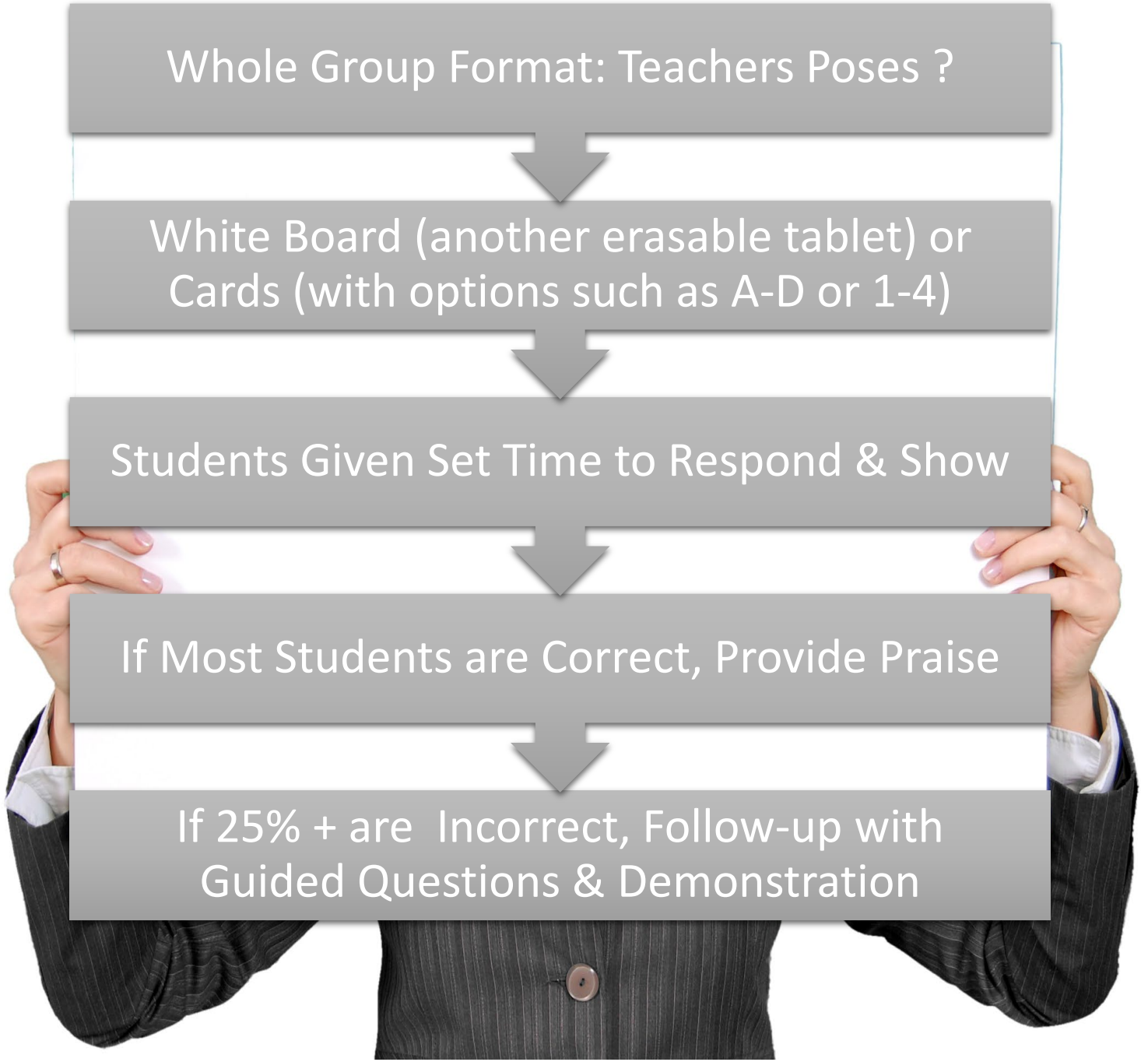
Interleaved Worked Examples

Research has shown that students typically learn more deeply and more easily from when ***examples are interleaved between problems***.

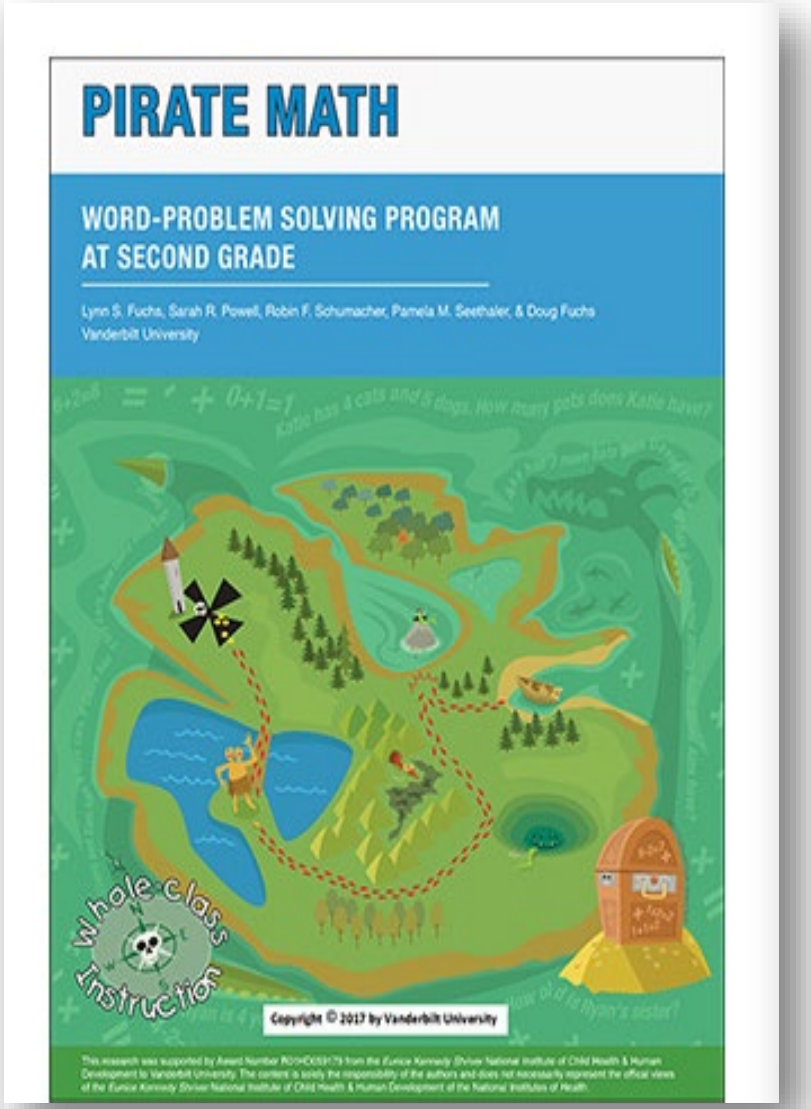


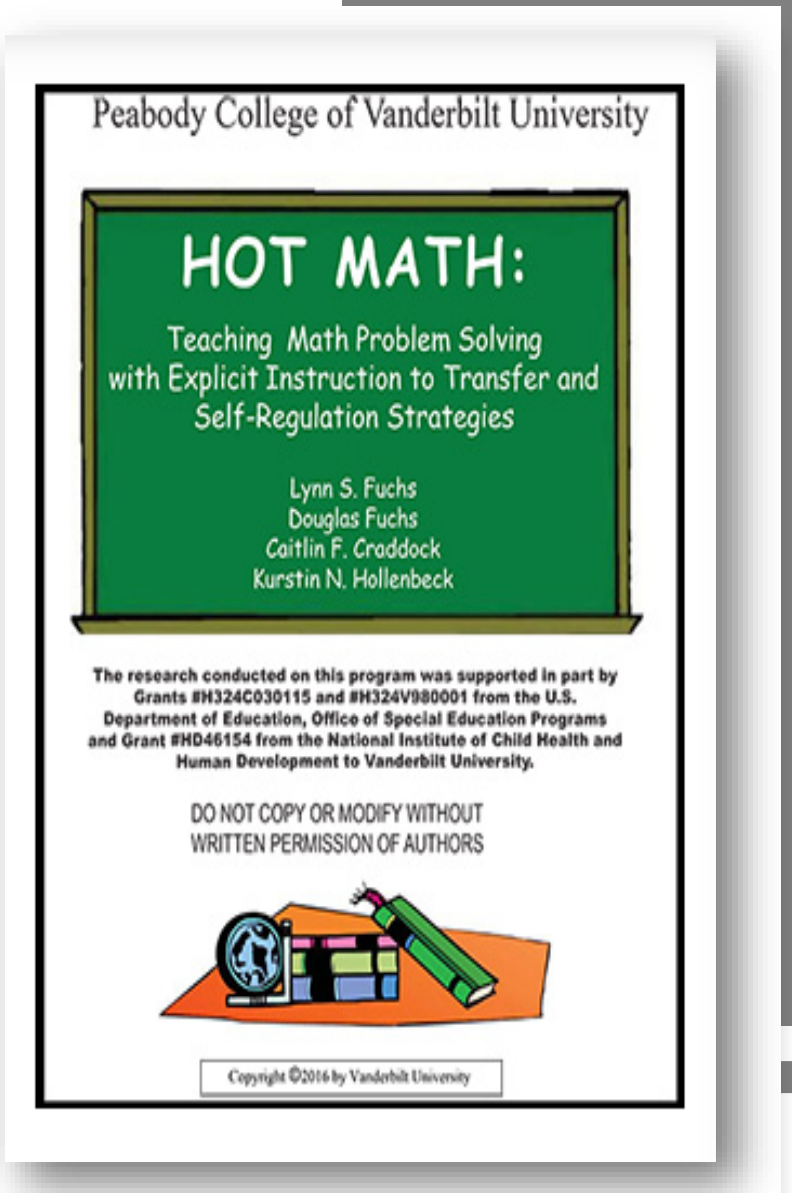
Response Cards

Best Used with Review Concepts



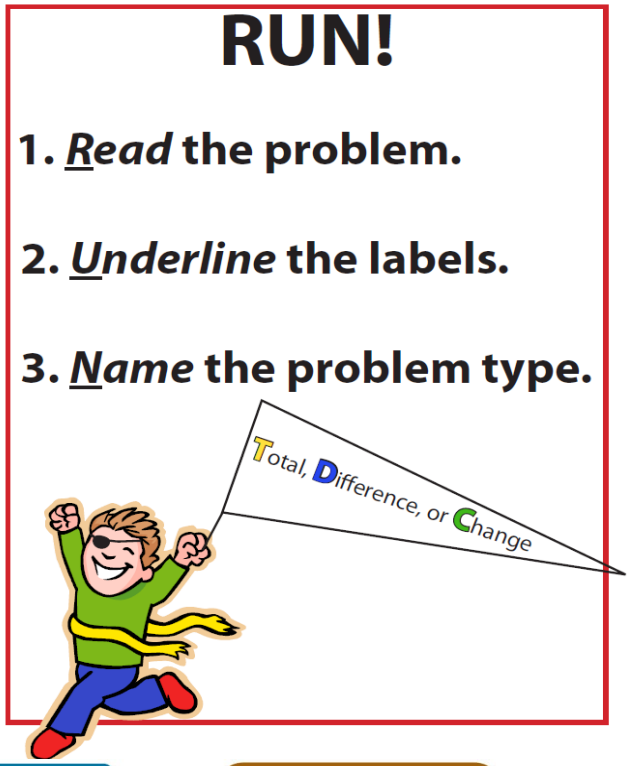
Promoting Word Problem Solving

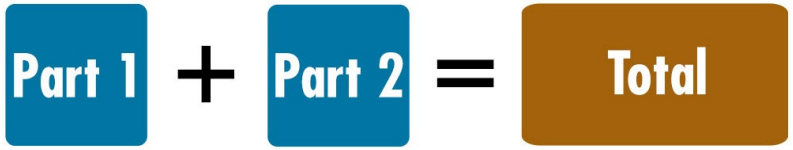




Common Features of Classwide WPS Intervention

- Organize problems on structural features (e.g., additive → total, difference, change) using diagrams
- Use explicit modeling of problem-solving steps
- Teach attack strategies

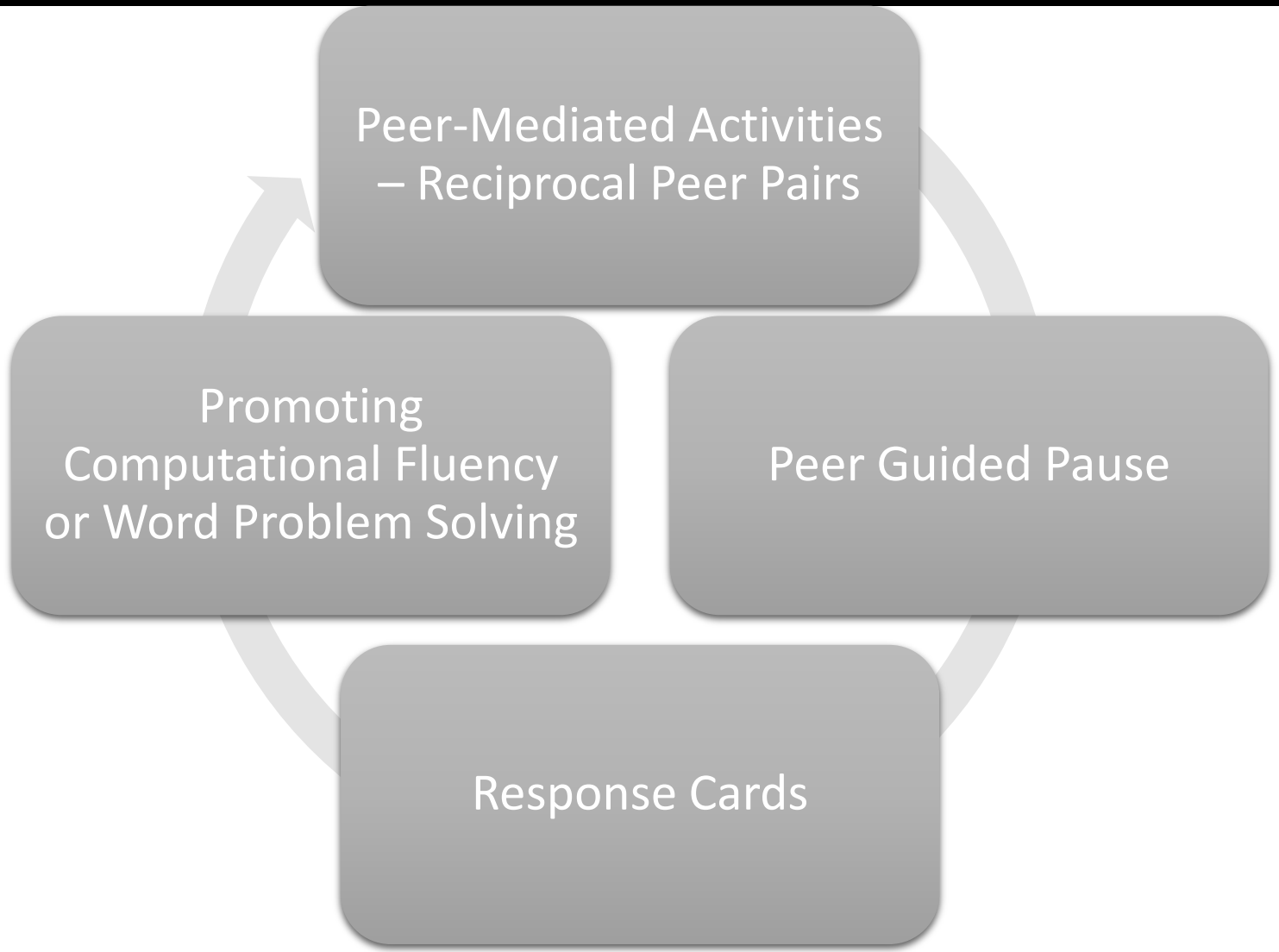




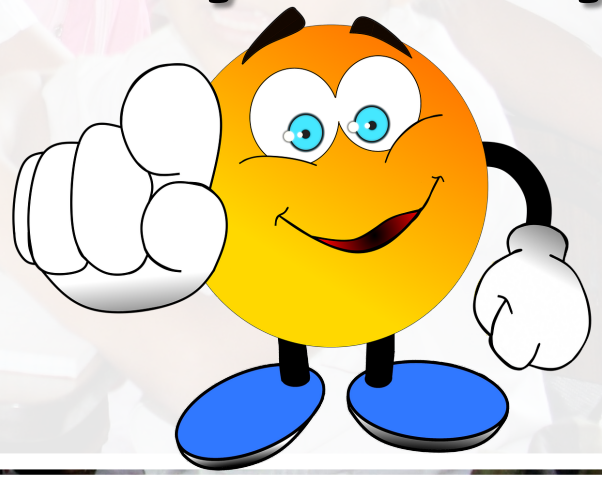
Summary

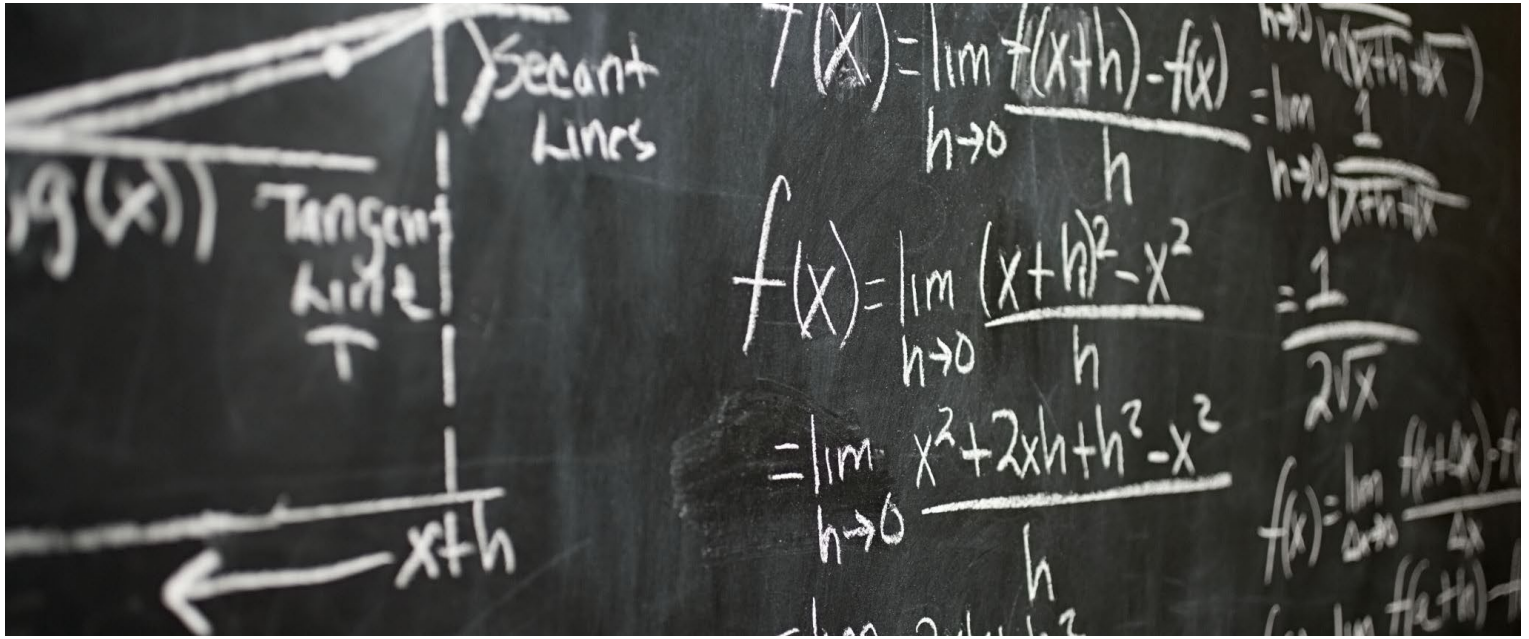
Goals

- Improve Median Class Performance on Foundational Skills
- Increase Opportunities to Practice
- Increase the Amount & Type of Feedback
- Build Fluency & Generalization



What Classwide Intervention Approach will you Try?





Class-Wide Math Intervention

Addressing Skill Gaps through Daily Warm-Up Activities

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