A FRAMEWORK FOR EFFECTIVELY INTEGRATING STUDENTS WITH HIGH INCIDENCE DISABILITIES INTO MATHEMATICS CCSS

MOVING FROM STANDARDS TO PRACTICE: LEADING TOMORROW'S MATHEMATICS AND SCIENCE EDUCATION IN SOUTH CAROLINA

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OVERVIEW

- The Need
- The Developing Mathematical Literacy Initiative (DML-I): A Framework for Effectively Engaging Students with HID in the CCSSM
- Potential for the DML-I and the CCSSM
- Research and Development Activities

THE NEED

MATH REALITY FOR MANY STUDENTS WITH LD

- Well below peers without disabilities
  - e.g., 40-42% at or below 20th percentile; only 11-16% at or above 61st percentile (IES, 2007)
- Historical and consistent difficulties with mathematics including algebra
  - e.g., Bryant, Bryant, & Hammill, 2000; Cawley, Parmar, Yan, & Miller, 1998; Maccini, McHaughton, & Rule, 1999; Witzel, Mercer, & Miller, 2003
- Failure to pass secondary end of course exams (Algebra 1 & Algebra 2)
  - e.g., Urquhart, 2000; Witzel, Smith, & Brownell, 2001
- Math requirements necessary at postsecondary level
  - e.g., Minskoff & Allsopp, 2003

Characteristics

- Strength
- General Learning
- Cognitive-based

Effective Teaching Practices for Characteristics

- Authentic contexts
- Strategy instruction
- Graphic organizers
- Multisensory methods
- C-R-A Instruction
- multiple opportunities
- Systematic, explicit instruction
- Scaffolding, guided practice
- Self-regulation
- Self-awareness

CCSS & Students with HID

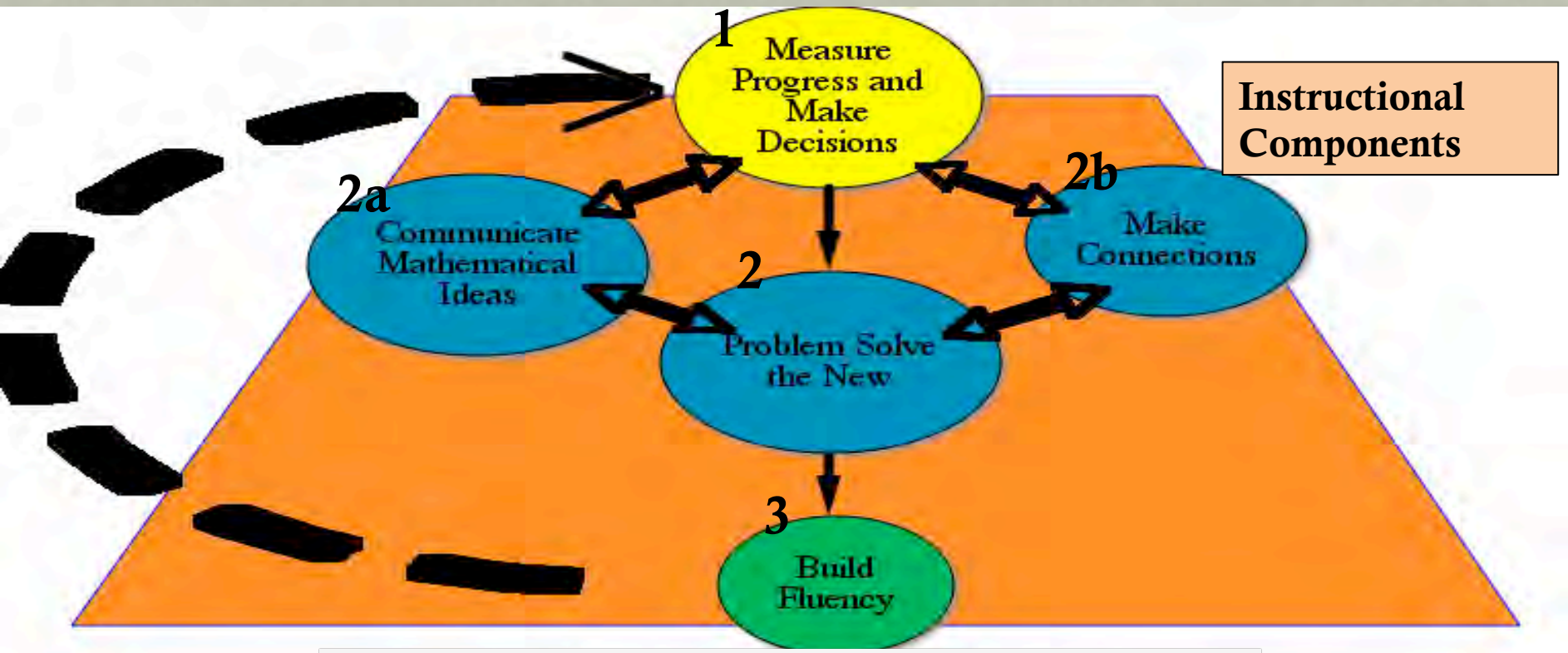
- Achieve rigorous content and skills
- Master higher-order thinking skills
- Gain knowledge and skills needed for college and work
- Learn content area literacy
- Gain depth & breadth

THE DEVELOPING MATHEMATICAL THINKING INITIATIVE (DML-I)

A Framework for Integrating Students with HID in the Mathematics CCSS

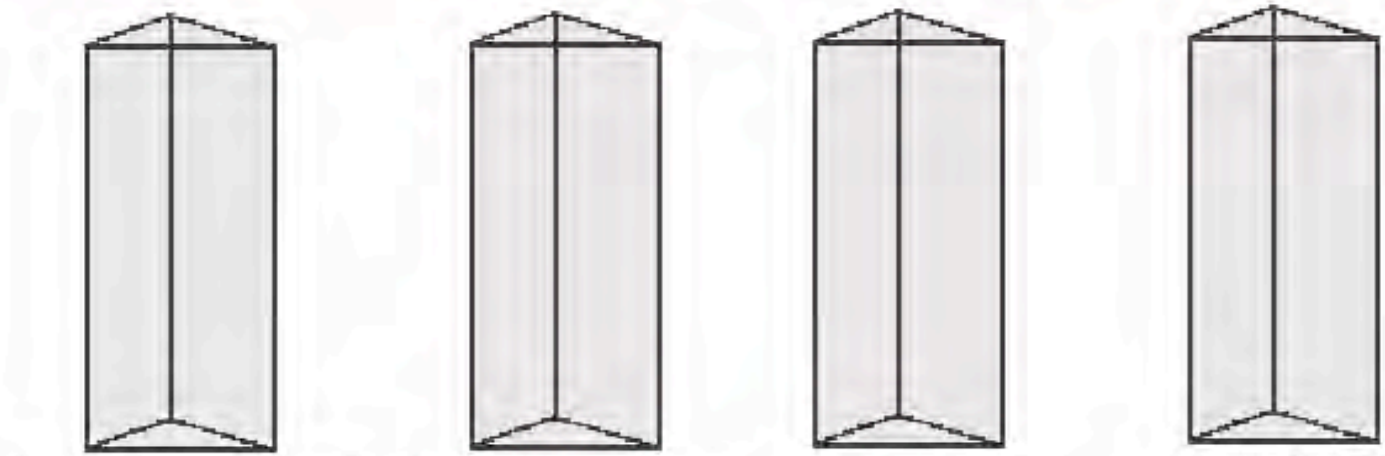
WHAT IS THE DML-I PROCESS? – QUICK OVERVIEW

- A structured but flexible instructional process that integrates research supported practices
- Initially developed for Tier 2 and Tier 3 type intervention
- Emphasis on developing mathematics *literacy*
- Number sense, Number Operations, & Algebraic Thinking concepts/skills
- 30-45 minute sessions
- Use of continuous student performance data collection to make instructional decisions



Instructional Components

The Developing Mathematical Literacy Initiative



The Foundation

ANCHOR 1 & 2: RESEARCH SUPPORTED PRACTICES & NCTM PROCESSES

Research Supported Effective Practices & Related NCTM Processes Emphasized

- Explicit Instruction
- Meaningful Context
- C-R-A Teaching/Assessment Sequence (Representation)
- Teaching Math Strategies (Problem Solving)
- Visuals/Graphic Organizers (Representation/ Connections)
- Communicating/Verbalizing Mathematics (Communication/Rationale & Proof)
- Multiple Response Opportunities with Corrective Feedback & Positive Reinforcement
- Continuous Monitoring/Data-based Decision-making

ANCHOR #3: CONTEXT

Context

Problem solving and development of mathematics strategies are situated within narrative contexts

ANCHOR #4: DATA BASED DECISION MAKING

Pre/Post Assessment
- number sense
- number operations
- algebraic thinking

Continuous Progress Monitoring (during intervention)
- C-R-A

DATA BASED DECISION MAKING – PRE/POST ASSESSMENT

Students respond to screening instruments/probes that address important K-8 number sense, number operations, & algebraic thinking skills.

Examples: K-6 Algebraic Thinking Scope & Sequence (Allsopp, Kyger, & Lovin, 2006); The Number Knowledge Test (Okamoto & Case, 1996); ; Number Sense Brief (Jordan, Glutting, and Ramineni, 2008)

Student responses are analyzed to determine concepts/ skills needed for intervention

PRE-ASSESSMENT EXAMPLE

7. Using words, tables, graphs and rules to describe relationships	
7a. Given situations that illustrate change, the student with identify and describe the change. K-2: Qualitative change Quantitative change 3-5: Varying and constant rates	Sue planted a sunflower. Once it sprouted, she watched it grow. Look at the chart and tell me what happened using words and numbers: Two runners decided to race for 4 miles. Look at the table and describe how fast each runner ran.

Weeks in June	Inches grown each week
1	2
2	3
3	2
4	3

	Mile 1	Mile 2	Mile 3	Mile 4
Runner 1	10 minutes	10 minutes	10 minutes	10 minutes
Runner 2	8 minutes	12 minutes	12 minutes	10 minutes

DATA BASED DECISION MAKING – CONTINUOUS PROGRESS MONITORING

During Intervention Sessions

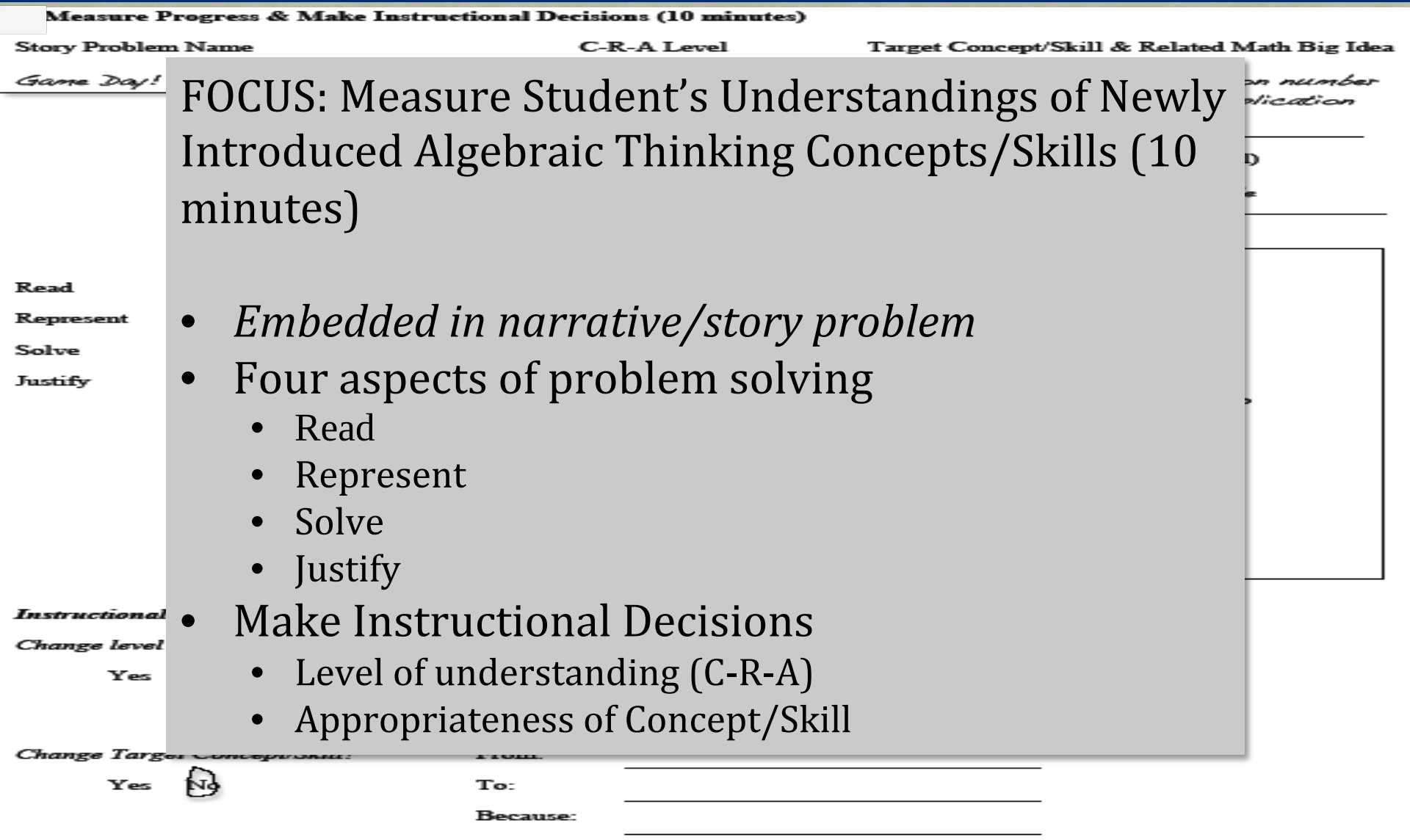
Measuring Progress Phase:

Teacher evaluates students' abilities to Read, Represent, Solve, & Justify during problem solving (i.e., word problem)

Building Fluency/Proficiency Phase:

C-R-A probe (Discrete Trial – "C" & "R;" or, Timing – "A")

INTERVENTION SESSIONS NOTES



FOCUS: Measure Student's Understandings of Newly Introduced Algebraic Thinking Concepts/Skills (10 minutes)

- *Embedded in narrative/story problem*
- Four aspects of problem solving
  - Read
  - Represent
  - Solve
  - Justify
- Make Instructional Decisions
  - Level of understanding (C-R-A)
  - Appropriateness of Concept/Skill

GAME DAY! – FOOTBALL

David's favorite team, the Gators are playing a football game this weekend and he is excited because he gets to go with his mom and dad. When they go to the games, they enjoy eating lots of good food, dancing along with the cheerleaders and doing the Gator chomp when the Gators score a touch down.


During the first quarter the Gators 7 points. In the second quarter, the Gators scored 7 points. In the third quarter, the Gators also scored 7 points. With little time remaining in the fourth quarter, the Gators scored 7 more points to win the game! When the game was over David and his parents were very happy because their team had won.

PROBLEM SOLVING PROMPTS:

1. Can you show an addition number statement that shows the points scored by the Gators in the game?
2. Can you show a multiplication number statement that shows the points scored by the Gators in the game?
3. Because the Gators scored the last touchdown in the fourth quarter to win the game, how many total points could the other time have had?
4. If the Gators had scored 14 points in the fourth quarter instead of 7 points, how could you show a number statement showing their total points using both addition and multiplication?

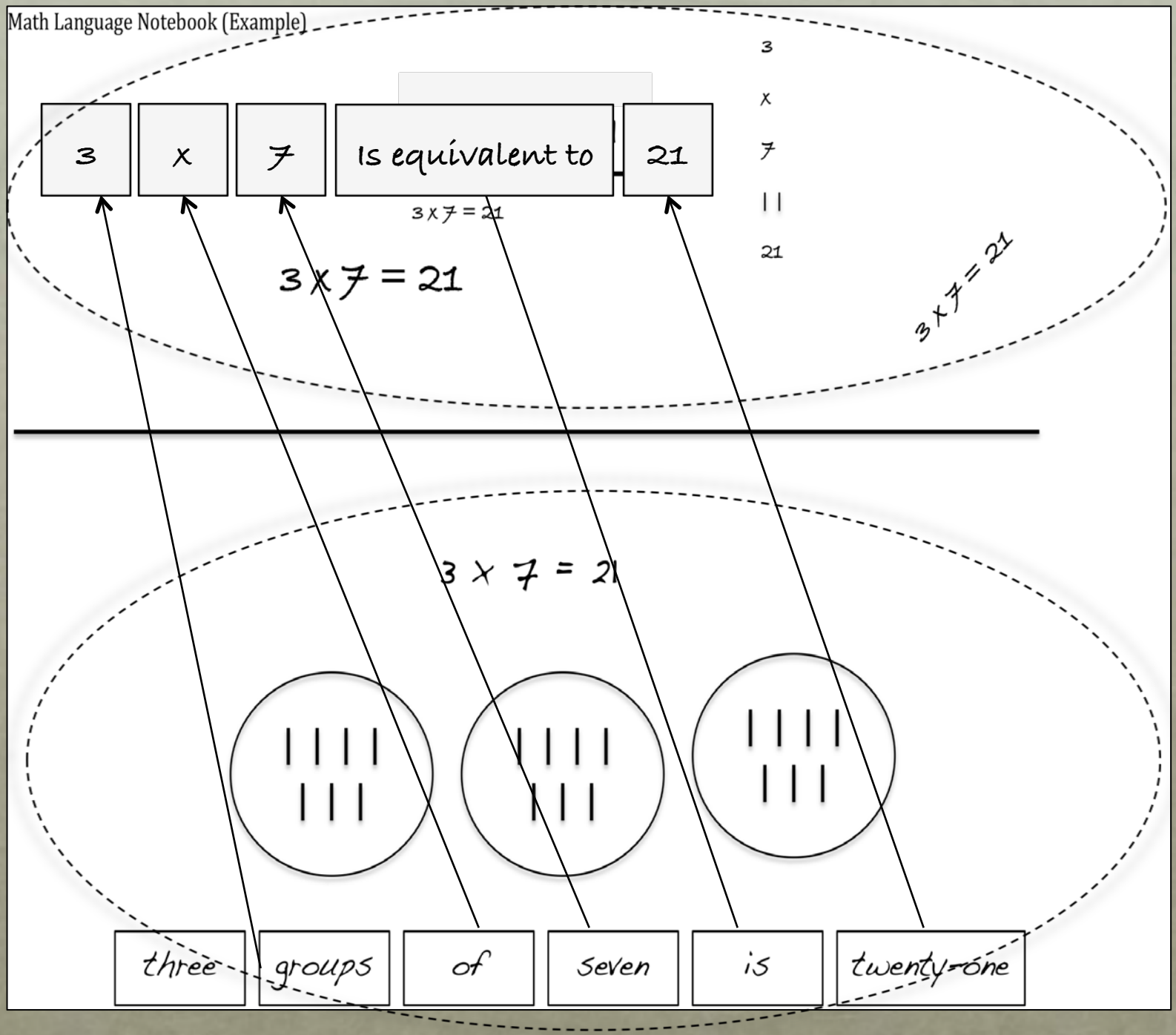
INTERVENTION SESSIONS NOTES

FOCUS: Support Students to Apply Math Strategies and Thinking to New Problems (14-20 minutes)

Embedded in narrative/story problem

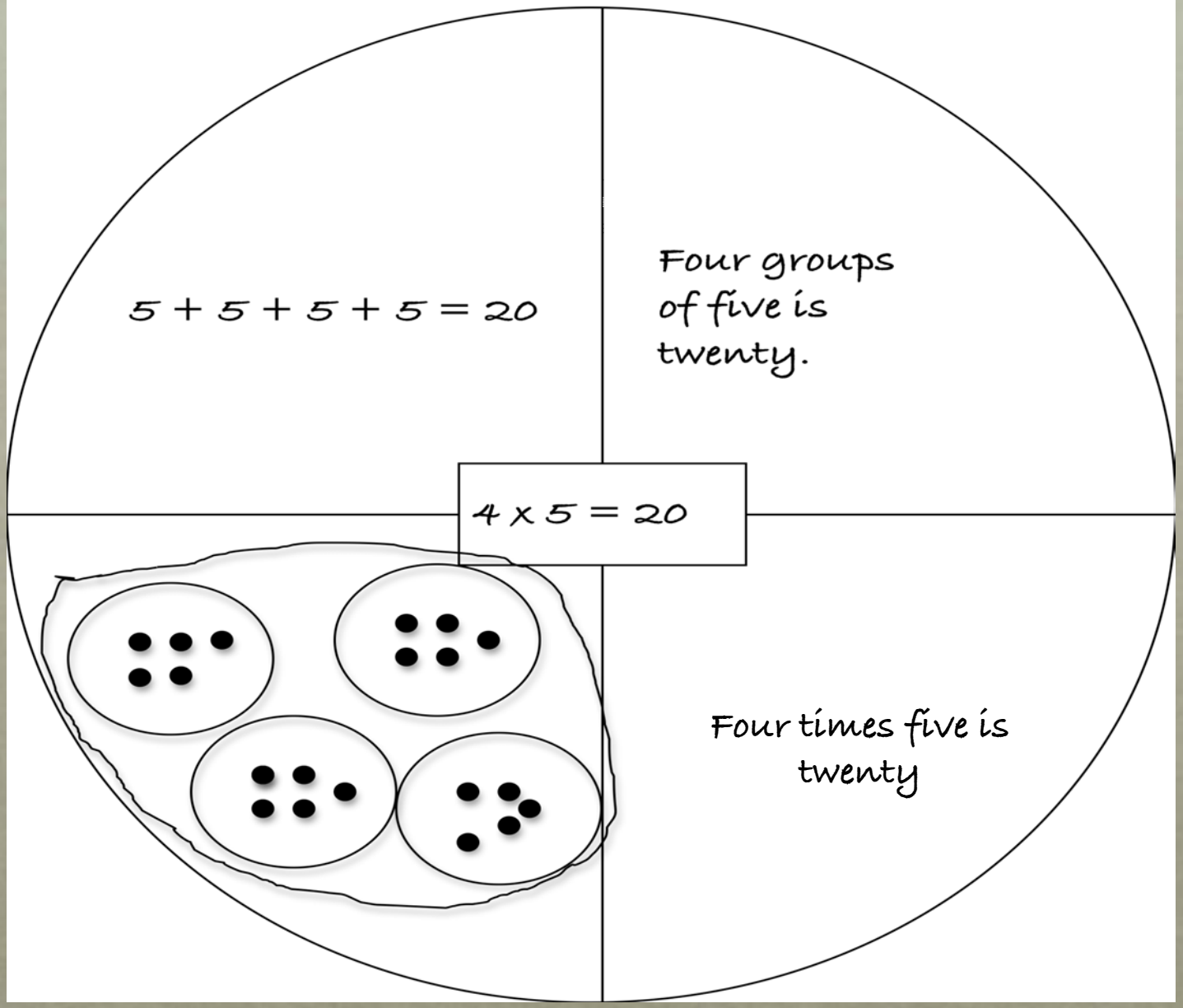
1) Set the Stage for Learning (1 minute)
   - Link
   - Identify
   - Provide Rationale
2) Problem Solve (5-9 minutes)
   - Read
   - Represent
   - Solve
   - Justify
3) Communicate Mathematical Ideas (4-5 minutes)
   - Math Language Notebook
   - Associate Language to Math Representations
4) Connect Mathematical Ideas (4-5 minutes)
   - Graphic Organizers

MAKE CONNECTIONS WORK



MAKE CONNECTIONS WORK

Describing Wheel



INTERVENTION SESSIONS NOTES

Developing Algebraic Literacy Session Notes

1. Build Proficiency (10 minutes)

***Math Literacy Practice** (5-8 minutes)*

Story Problem Name	C-R-A Level	Target Concept/Skill & Related Math Big Idea
How Many Text Messages Can You Afford?	C R (A)	Write equivalent number statements - some operation

FOCUS: Familiar Mathematics Concepts/Skills (12-15 minutes)

- Math Literacy Practice (10 minutes)
- Measure Level of Proficiency (2-5 minutes)

Strategie

DOT-T
Point
Operati
Total
Think
Other
Compu

Some difficulty with confusing + and x signs.
Most errors occur with division (treats like communicative property)

***Measuring Level of Proficiency** (2-5 minutes)*

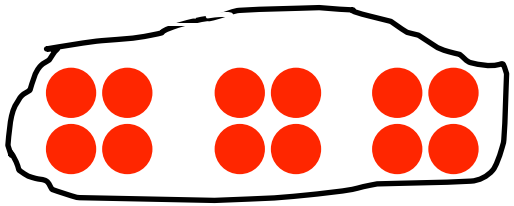
Response Task	C-R-A Level	Discrete Trial OR Timing (circle)	Goal for Next Time
Write Equivalent Expressions/Number Statements	C R (A)	Result: 12/5 two minutes	Reduce Errors/Division

CRA Level of Understanding	Method	Criterion
Abstract	1-5 minute timings (depends on nature of target concept)	Fluency (Rate & Accuracy)
Drawing	8-10 tasks	Accuracy 90-100% 3 times
Concrete	3 tasks	Accuracy 100% 3 times

Examples of Concrete and Representational/Drawing Probe Tasks

Concrete

Use circle pieces and string to solve the following equations.

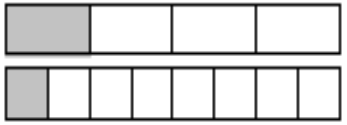


Representational/ Drawing

1. Below each item, draw a fraction that shows the first fraction and then draw a fraction that makes each statement true. You can use any of the fractional parts listed in the parentheses for each item.

   1a. (Use halves, thirds, sixths, eighths, tenths, or twelfths)

   1/4 is greater than 1/8

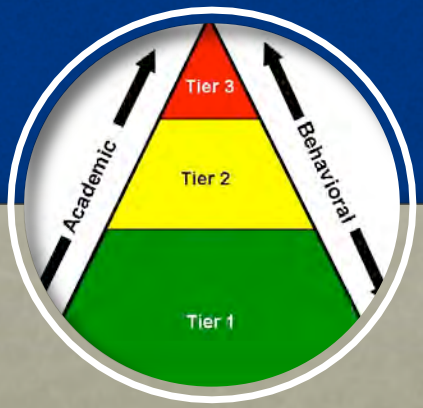


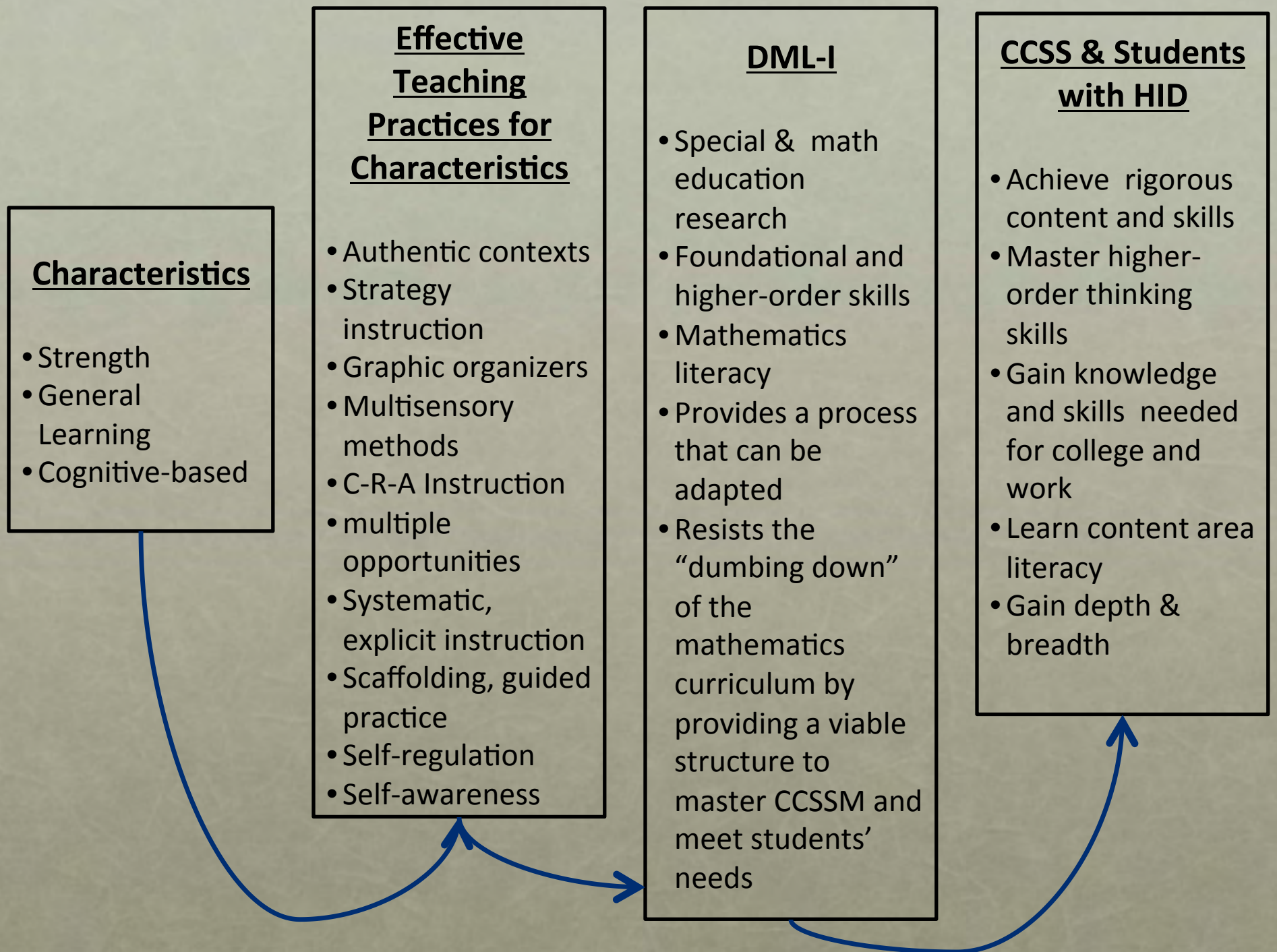
Example of Timing Probe

Algebraic Thinking Domain: The Notion of Variables (and Equality)
Objective: Write number sentences to represent equivalent mathematical relationships
Level of Understanding: Abstract
Response Task: Read number sentence/Write a different number sentence that is equivalent

			Cumulative Count
5 + 4 = _____	6 x 2 = _____	6 – 1 = _____	3
4 x 3 = _____	7 + 4 = _____	4 ÷ 2 = _____	6
4 -3 = _____	5 x 2 = _____	6 – 3 = _____	9
4 x 5 = _____	0 + 0 = _____	1 x 9 = _____	12
7 – 7 = _____	2 – 1 = _____	3 x 3 = _____	15
9 ÷ 3 = _____	5 + 0 = _____	3 x 4 = _____	18
10 – 6 = _____	6 x 2 = _____	8 + 8 = _____	21
2 – 0 = _____	0 + 4 = _____	5 x 0 = _____	24
3 + 7 = _____	8 x 3 = _____	15 ÷ 3 = _____	27
12 ÷ 12 = _____	13 + 2 = _____	6 x 6 = _____	30

POTENTIAL FOR THE CCSS

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• Authentic contexts
• Strategy instruction
• Graphic organizers
• Multisensory methods
• C-R-A Instruction
• multiple opportunities
• Systematic, explicit instruction
• Scaffolding, guided practice
• Self-regulation
• Self-awareness
DML-I
• Special & math education research
• Foundational and higher-order skills
• Mathematics literacy
• Provides a process that can be adapted
• Resists the "dumbing down" of the mathematics curriculum by providing a viable structure to master CCSSM and meet students' needs
CCSS & Students with HID
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• Master higher-order thinking skills
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• Learn content area literacy
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OBSERVATIONS & QUESTIONS