ADDRESSING NUMERACY WITH THE STRUGGLING LEARNER K-2

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BASED ON RESEARCH: THE INSTITUTE OF EDUCATIONAL RESEARCH

Assisting Students Struggling with Mathematics: Response to Intervention (RtI) for Elementary and Middle Schools (IES Website)

RECOMMENDATIONS

1. Screen all students to identify those at risk for potential mathematics difficulties and provide interventions to students identified as at risk.
INSTRUCTIONAL MATERIALS

2. Instructional materials should focus intensely on in-depth treatment of whole numbers K-5 and rational numbers in grades 4-8.

MAJOR CLUSTERS

Teach less, learn more.
- Singapore/Hong Kong Motto

PRIORITIZES THE MAJOR CLUSTERS

<table>
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<tr>
<th>Grade</th>
<th>Focus Areas in Support of Rich Instruction and Expectations of Fluency and Conceptual Understanding</th>
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<tr>
<td>K-2</td>
<td>Addition and subtraction-counting concepts, skills, place value and problem solving</td>
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<tr>
<td>3-5</td>
<td>Multiplication and division of whole numbers and fractions – concepts, skills, and problem solving</td>
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Major Clusters – areas of intense focus, where students need fluent understanding and application of the core concepts (approximately 70%)
NUMERACY
• Subitizing regular and irregular dot patterns
  – Perceptual and Conceptual
• Counting and Cardinality
• Identifying Numbers
• Counting forward and backward
• What comes before/After
• Developing addition and subtraction strategies developmentally
• Working towards fluency – composing and decomposing numbers

INSTRUCTION
3. Instruction should be explicit and systematic; providing models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review.

WHAT IS EXPLICIT INSTRUCTION?
The National Mathematics Advisory Panel defines explicit instruction as follows (2008, p. 23):
• “Teachers provide clear models for solving a problem type using an array of examples.”
• “Students provide clear models for solving a problem type using an array of examples.”
• “Students receive extensive practice in use of newly learned strategies and skills.”
• “Students are provided with opportunities to think aloud (i.e., talk through the decisions they make and the steps they take).”
• “Students are provided with extensive feedback.”
4. Interventions should include instruction on solving word problems that is based on common underlying structures.

Neesha has 15 crayons. She gave 9 to Marta. How many crayons does Neesha have left?
Neesha has 15 crayons. She gave 9 to Marta. How many crayons does Neesha have left?

15 – 9 =

Neesha gave 6 crayons to Marta. Neesha now has 9 crayons left. How many crayons did Neesha have to begin with?

Neesha gave 6 crayons to Marta. Neesha now has 9 crayons left. How many crayons did Neesha have to begin with?  

6 + 9 =
WORD PROBLEM TYPES

• Review the types of problems primary students are required to solve (handout)
  – Change problems (add to/take from)
  – Group problems (put together/take apart)
  – Compare problems

• Consider what is unknown in the context of the problem.

CHANGE PROBLEMS

2. The farmer bought 9 pigs at the market. As she was putting the pigs in the pen, 4 got away. How many pigs were left?

Take From: Result Unknown
9 - 4 = _____
WHAT KIND OF PROBLEM?

4 Emma had 8 toy horses. She got some more toy horses for her birthday. Now she has 20 toy horses. How many toy horses did Emma get for her birthday?

Equation: \( x + 8 = 20 \)

Add to: Change Unknown
\( 8 + \_\_\_ = 12 \)

WHAT KIND OF PROBLEM?

6 Jeff has 13 balloons. Rose has 7 balloons. How many more balloons does Rose have than Jeff?

Equation: \( 13 - 7 = \_\_\_ \) OR \( \_\_\_ + 7 = 13 \)

GRAPHIC ORGANIZERS
DAY 1.0  OF  WORKSHOP  MATERIALS  

**COMPARE PROBLEM**

Mrs. Douglas made 17 treat bags and Mrs. Johnson made 10 treat bags for the party. How many more treat bags did Mrs. Douglas make than Ms. Johnson?

![Diagram for compare problem]

Larger Amount: ___
Smaller Amount: ___
Difference: ___
Equation: ___ – ___ = ___

**COMPARE PROBLEM**

Mrs. Douglas made 17 treat bags and Ms. Johnson made 10 treat bags for the party. How many more treat bags did Mrs. Douglas make than Ms. Johnson?

![Diagram for compare problem]

Larger Amount: 17
Smaller Amount: 10
Difference: ___
Equation: 17 – 10 = ___ or 10 + ___ = ___

**VISUAL REPRESENTATIONS**

5. Materials should include visual representation of mathematical ideas and interventionists should be proficient in the use of these materials.
SEEING AS UNDERSTANDING: THE IMPORTANCE OF VISUAL MATHEMATICS FOR OUR BRAIN AND LEARNING – JO BOALER

- When students learn mathematics through visual approaches, mathematics changes for them, and they are given access to deep and new understanding.
- When we work on mathematics...brain activity is distributed between many different networks which include two visual pathways.
- The brain uses representations of fingers, well beyond the time and age that people use their fingers to count.
- “If students are not learning about numbers through thinking about their fingers, numbers “will never have a normal representation in their brain.” (Butterworth 1999)

MODELS FOR THINKING

- Finger Patterns
- Five-Frame Display Card
- Finger Pattern Display Card
- Five-Frames
- Flashing
- Number Rack
- Bundles & Sticks
- Unifix Cubes
- Hundreds Grid
Computational Fluency

6. Devote 10 minutes each session to build fluency with basic arithmetic facts. Promote extensive practice with strategy retrieval.

Computational Fluency

Efficiency
Efficiency implies that the student does not get bogged down in many steps or lose track of the logic in the strategy. An efficient strategy is one that the student can carry out easily, keeping track of sub-problems and making use of intermediate results to solve the problem.

Accuracy
Accuracy depends on several aspects of the problem-solving process, among them, careful recording, the knowledge of basic number combinations and other important number relationships, and concern for double-checking results.

Flexibility
Flexibility requires the knowledge of more than one approach to solving a particular kind of problem. Students need to be flexible and choose an appropriate strategy for solving the problem at hand. They can use one method to solve a problem and another method to double-check the results.
**FLUENCY STRATEGIES**

- Counting on, doubles, make ten, ten and some more
- Subtraction as comparisons or difference, inverse operations, and missing addends
- Jumping & splitting on the empty number line
- Modeling and notating student thinking

**PROGRESS MONITORING**

7. Monitor student progress at least once a month, using grade appropriate outcome measures.

**MOTIVATIONAL STRATEGIES**

8. Include motivational strategies in interventions that promote a growth mind-set.
HOW DO STUDENTS FEEL ABOUT MATH?

Thank you for joining me today!