RTI: Interventions for Elementary Students With Math Difficulties

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www.interventioncentral.org
Workshop PPTs and handout available at:

http://www.interventioncentral.org/AWSA
Response to Intervention

Keynote: RTI & Math...

1. Defining Research-Based Principles of Effective Math Instruction & Intervention
2. Sampling Effective, Research-Based Math Interventions

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Core Instruction & Tier 1 Intervention

Focus of Inquiry: What are the indicators of high-quality core instruction and classroom (Tier 1) intervention for math?
What Works Clearinghouse Practice Guide: Assisting Students Struggling with Mathematics: Response to Intervention (RtI) for Elementary and Middle Schools

http://ies.ed.gov/ncee/wwc/

This publication provides 8 recommendations for effective core instruction in mathematics for K-8.
Response to Intervention

Assisting Students Struggling with Mathematics: RtI for Elementary & Middle Schools: 8 Recommendations

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

**Recommendation 2.** Instructional materials for students receiving interventions should focus intensely on in-depth treatment of whole numbers in kindergarten through grade 5 and on rational numbers in grades 4 through 8.
Recommendation 3. Instruction during the intervention should be explicit and systematic. This includes providing models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review.

Recommendation 4. Interventions should include instruction on solving word problems that is based on common underlying structures.
• Recommendation 5. Intervention materials should include opportunities for students to work with visual representations of mathematical ideas and interventionists should be proficient in the use of visual representations of mathematical ideas.

• Recommendation 6. Interventions at all grade levels should devote about 10 minutes in each session to building fluent retrieval of basic arithmetic facts.
Recommendation 7. Monitor the progress of students receiving supplemental instruction and other students who are at risk.

Recommendation 8. Include motivational strategies in tier 2 and tier 3 interventions.
How Do We Reach Low-Performing Math Students?: Instructional Recommendations

Important elements of math instruction for low-performing students:

- “Providing teachers and students with data on student performance”
- “Using peers as tutors or instructional guides”
- “Providing clear, specific feedback to parents on their children’s mathematics success”
- “Using principles of explicit instruction in teaching math concepts and procedures.” p. 51

Three General Levels of Math Skill Development
(Kroesbergen & Van Luit, 2003)

As students move from lower to higher grades, they move through levels of acquisition of math skills, to include:

- Number sense
- Basic math operations (i.e., addition, subtraction, multiplication, division)
- Problem-solving skills: “The solution of both verbal and nonverbal problems through the application of previously acquired information” (Kroesbergen & Van Luit, 2003, p. 98)

Math Challenge: The student can not yet reliably access an internal number-line of numbers 1-10.

What Does the Research Say?...
What is ‘Number Sense’?  
(Clarke & Shinn, 2004)

“...the ability to understand the meaning of numbers and define different relationships among numbers.

Children with number sense can recognize the relative size of numbers, use referents for measuring objects and events, and think and work with numbers in a flexible manner that treats numbers as a sensible system.”  

What Are Stages of ‘Number Sense’?

(Berch, 2005, p. 336)

1. Innate Number Sense. Children appear to possess ‘hard-wired’ ability (or neurological ‘foundation structures’) in number sense. Children’s innate capabilities appear also to be to ‘represent general amounts’, not specific quantities. This innate number sense seems to be characterized by skills at estimation (‘approximate numerical judgments’) and a counting system that can be described loosely as ‘1, 2, 3, 4, … a lot’.

2. Acquired Number Sense. Young students learn through indirect and direct instruction to count specific objects beyond four and to internalize a number line as a mental representation of those precise number values.

Math Challenge: The student cannot yet reliably access an internal number-line of numbers 1-10.

Sample Strategy:
• Building Number Sense Through a Counting Board Game
Building Number Sense Through a Counting Board Game

**DESCRIPTION:** The student plays a number-based board game to build skills related to 'number sense', including number identification, counting, estimation skills, and ability to visualize and access specific number values using an internal number-line (Siegler, 2009).

Building Number Sense Through a Counting Board Game

MATERIALS:

- **Great Number Line Race!** form
- Spinner divided into two equal regions marked "1" and "2" respectively. (NOTE: If a spinner is not available, the interventionist can purchase a small blank wooden block from a crafts store and mark three of the sides of the block with the number "1" and three sides with the number "2".)

The Great Number-Line Race!

Date: ________________ Start Time: _____: _____  End Time: _____: _____

Directions: Mark the winner for each game with an 'X' in the table below.

<table>
<thead>
<tr>
<th>Players</th>
<th>Game 1</th>
<th>Game 2</th>
<th>Game 3</th>
<th>Game 4</th>
<th>Game 5</th>
<th>Game 6</th>
<th>Game 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: _____</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: _____</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Source: www.interventioncentral.org
Response to Intervention

Building Number Sense Through a Counting Board Game

**INTERVENTION STEPS:** A counting-board game session lasts 12 to 15 minutes, with each game within the session lasting 2-4 minutes. Here are the steps:

1. **Introduce the Rules of the Game.** The student is told that he or she will attempt to beat another player (either another student or the interventionist). The student is then given a penny or other small object to serve as a game piece. The student is told that players takes turns spinning the spinner (or, alternatively, tossing the block) to learn how many spaces they can move on the Great Number Line Race! board.

   Each player then advances the game piece, moving it forward through the numbered boxes of the game-board to match the number "1" or "2" selected in the spin or block toss.

Building Number Sense Through a Counting Board Game

INTERVENTION STEPS: A counting-board game session lasts 12 to 15 minutes, with each game within the session lasting 2-4 minutes. Here are the steps:

1. **Introduce the Rules of the Game (cont.).**

When advancing the game piece, the player must call out the number of each numbered box as he or she passes over it. For example, if the player has a game piece on box 7 and spins a "2", that player advances the game piece two spaces, while calling out "8" and "9" (the names of the numbered boxes that the game piece moves across during that turn).

Building Number Sense Through a Counting Board Game

INTERVENTION STEPS: A counting-board game session lasts 12 to 15 minutes, with each game within the session lasting 2-4 minutes. Here are the steps:

2. Record Game Outcomes. At the conclusion of each game, the interventionist records the winner using the form found on the Great Number Line Race! form. The session continues with additional games being played for a total of 12-15 minutes.

3. Continue the Intervention Up to an Hour of Cumulative Play. The counting-board game continues until the student has accrued a total of at least one hour of play across multiple days. (The amount of cumulative play can be calculated by adding up the daily time spent in the game as recorded on the Great Number Line Race! form.)

The Great Number-Line Race!

Date: ________________ Start Time: _____: _____ End Time: _____: _____

Directions: Mark the winner for each game with an 'X' in the table below.

<table>
<thead>
<tr>
<th>Players</th>
<th>Game 1</th>
<th>Game 2</th>
<th>Game 3</th>
<th>Game 4</th>
<th>Game 5</th>
<th>Game 6</th>
<th>Game 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Math Challenge: The student has not yet acquired math facts.

What Does the Research Say?...
Math Skills: Importance of Fluency in Basic Math Operations

“[A key step in math education is] to learn the four basic mathematical operations (i.e., addition, subtraction, multiplication, and division). Knowledge of these operations and a capacity to perform mental arithmetic play an important role in the development of children’s later math skills. Most children with math learning difficulties are unable to master the four basic operations before leaving elementary school and, thus, need special attention to acquire the skills. A . . . category of interventions is therefore aimed at the acquisition and automatization of basic math skills.”

Math Challenge: The student has not yet acquired math facts.

Sample Strategies:

• Strategic Number Counting Instruction
• Peer Tutoring in Math Computation with Constant Time Delay
Strategic Number Counting Instruction

DESCRIPTION: The student is taught explicit number counting strategies for basic addition and subtraction. Those skills are then practiced with a tutor (adapted from Fuchs et al., 2009).

Strategic Number Counting Instruction

MATERIALS:

- Number-line
- Number combination (math fact) flash cards for basic addition and subtraction
- Strategic Number Counting Instruction Score Sheet

Strategic Number Counting Instruction

**PREPARATION:** The tutor trains the student to use these two counting strategies for addition and subtraction:

- **ADDITION:** The student is given a copy of the number-line. When presented with a two-addend addition problem, the student is taught to start with the larger of the two addends and to 'count up' by the amount of the smaller addend to arrive at the answer to the problem.

  E.g., \( 3 + 5 = \underline{___} \)

Strategic Number Counting Instruction

**PREPARATION:** The tutor trains the student to use these two counting strategies for addition and subtraction:

- **SUBTRACTION:** With access to a number-line, the student is taught to refer to the first number appearing in the subtraction problem (the minuend) as 'the number you start with' and to refer to the number appearing after the minus (subtrahend) as 'the minus number'. The student starts at the minus number on the number-line and counts up to the starting number while keeping a running tally of numbers counted up on his or her fingers. The final tally of digits separating the minus number and starting number is the answer to the subtraction problem.

  E.g., $6 - 2 = ___$

Strategic Number Counting Instruction

INTERVENTION STEPS: For each tutoring session, the tutor follows these steps:

1. Create Flashcards. The tutor creates addition and/or subtraction flashcards of problems that the student is to practice. Each flashcard displays the numerals and operation sign that make up the problem but leaves the answer blank.

Strategic Number Counting Instruction

INTERVENTION STEPS: For each tutoring session, the tutor follows these steps:

2. **Review Count-Up Strategies.** At the opening of the session, the tutor asks the student to name the two methods for answering a math fact. The correct student response is 'Know it or count up.' The tutor next has the student describe how to count up an addition problem and how to count up a subtraction problem. Then the tutor gives the student two sample addition problems and two subtraction problems and directs the student to solve each, using the appropriate count-up strategy.

Strategic Number Counting Instruction

INTERVENTION STEPS: For each tutoring session, the tutor follows these steps:

3. Complete Flashcard Warm-Up. The tutor reviews addition/subtraction flashcards with the student for three minutes. Before beginning, the tutor reminds the student that, when shown a flashcard, the student should try to 'pull the answer from your head'—but that if the student does not know the answer, he or she should use the appropriate count-up strategy. The tutor then reviews the flashcards with the student. Whenever the student makes an error, the tutor directs the student to use the correct count-up strategy to solve. NOTE: If the student cycles through all cards in the stack before the three-minute period has elapsed, the tutor shuffles the cards and begins again. At the end of the three minutes, the tutor counts up the number of cards reviewed and records the total correct responses and errors.

Strategic Number Counting Instruction

**INTERVENTION STEPS:** For each tutoring session, the tutor follows these steps:

4. *Repeat Flashcard Review.* The tutor shuffles the math-fact flashcards, encourages the student to try to beat his or her previous score, and again reviews the flashcards with the student for three minutes. As before, whenever the student makes an error, the tutor directs the student to use the appropriate count-up strategy. Also, if the student completes all cards in the stack with time remaining, the tutor shuffles the stack and continues presenting cards until the time is elapsed.

At the end of the three minutes, the tutor once again counts up the number of cards reviewed and records the total correct responses and errors.

Strategic Number Counting Instruction

INTERVENTION STEPS: For each tutoring session, the tutor follows these steps:

5. **Provide Performance Feedback.** The tutor gives the student feedback about whether (and by how much) the student’s performance on the second flashcard trial exceeded the first. The tutor also provides praise if the student beat the previous score or encouragement if the student failed to beat the previous score.

Response to Intervention

Strategic Number Counting Instruction Score Sheet

<table>
<thead>
<tr>
<th>Student: ____________________  Interventionist(s): ____________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directions: During the strategic number counting instruction intervention, use this sheet to tally student responses: Number of Flash-Cards Known From Memory; Number of Flash-Cards Answered Correctly With Count-Up Strategy (with or without assistance); Number of Flash-Cards Unknown or Answered Incorrectly (even with assistance).</td>
</tr>
</tbody>
</table>

| Date: _______  [Optional] Type Range of Addition Subtraction Math-Fact Flash-Cards Reviewed This Session: |

<table>
<thead>
<tr>
<th>Trial 1: Math Flash-Card Warm-Up: 3 Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Flash-Cards Known From Memory</td>
</tr>
<tr>
<td>-------------------------------------------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trial 2: Math Flash-Card Review: 3 Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Flash-Cards Known From Memory</td>
</tr>
</tbody>
</table>

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<tr>
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</table>

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Peer Tutoring in Math
Computation with Constant Time Delay
Peer Tutoring in Math Computation with Constant Time Delay

**DESCRIPTION:** This intervention employs students as reciprocal peer tutors to target acquisition of basic math facts (math computation) using constant time delay (Meneses & Gresham, 2009; Telecsan, Slaton, & Stevens, 1999). Each tutoring ‘session’ is brief and includes its own progress-monitoring component—making this a convenient and time-efficient math intervention for busy classrooms.
Response to Intervention

Peer Tutoring in Math Computation with Constant Time Delay

MATERIALS:

Student Packet: A work folder is created for each tutor pair. The folder contains:

- 10 math fact cards with equations written on the front and correct answer appearing on the back. NOTE: The set of cards is replenished and updated regularly as tutoring pairs master their math facts.
- Progress-monitoring form for each student.
- Pencils.

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Response to Intervention

Peer Tutoring in Math Computation with Constant Time Delay

**PREPARATION:** To prepare for the tutoring program, the teacher selects students to participate and trains them to serve as tutors.

**Select Student Participants.** Students being considered for the reciprocal peer tutor program should at minimum meet these criteria (Telecsan, Slaton, & Stevens, 1999, Menesses & Gresham, 2009):

- Is able and willing to follow directions;
- Shows generally appropriate classroom behavior;
- Can attend to a lesson or learning activity for at least 20 minutes.
Peer Tutoring in Math Computation with Constant Time Delay

Select Student Participants (Cont.). Students being considered for the reciprocal peer tutor program should at minimum meet these criteria (Telecsan, Slaton, & Stevens, 1999, Menesses & Gresham, 2009):

- Is able to name all numbers from 0 to 18 (if tutoring in addition or subtraction math facts) and name all numbers from 0 to 81 (if tutoring in multiplication or division math facts).
- Can correctly read aloud a sampling of 10 math-facts (equation plus answer) that will be used in the tutoring sessions. (NOTE: The student does not need to have memorized or otherwise mastered these math facts to participate—just be able to read them aloud from cards without errors).
- [To document a deficit in math computation] When given a two-minute math computation probe to complete independently, computes fewer than 20 correct digits (Grades 1-3) or fewer than 40 correct digits (Grades 4 and up) (Deno & Mirkin, 1977).
Peer Tutoring in Math Computation: Teacher Nomination Form

Directions: Select students in your class that you believe would benefit from participation in a peer tutoring program to boost math computation skills. Write the names of your student nominees in the space provided below. Remember, students who are considered for the peer tutoring program should—at minimum—meet these criteria:

- Show generally appropriate classroom behaviors and follow directions.
- Can pay attention to a lesson or learning activity for at least 20 minutes.
- Are able to wait appropriately to hear the correct answer from the tutor if the student does not know the answer.
- Can correctly read aloud a sampling of 10 math facts (equation plus answer) that will be used in the tutoring sessions. (NOTE: The student does not need to have memorized or otherwise mastered these math facts to participate—just be able to read them aloud from cards without errors.)

<table>
<thead>
<tr>
<th>Number</th>
<th>Student Name</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
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<tr>
<td>2.</td>
<td></td>
<td></td>
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<tr>
<td>3.</td>
<td></td>
<td></td>
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<tr>
<td>4.</td>
<td></td>
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<td>5.</td>
<td></td>
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<tr>
<td>6.</td>
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<td>7.</td>
<td></td>
<td></td>
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<tr>
<td>8.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Peer Tutoring in Math Computation with Constant Time Delay

**Tutoring Activity.** Each tutoring ‘session’ last for 3 minutes. The tutor:

– *Presents Cards.* The tutor presents each card to the tutee for 3 seconds.

– *Provides Tutor Feedback.* [When the tutee responds correctly] The tutor acknowledges the correct answer and presents the next card.

[When the tutee does not respond within 3 seconds or responds incorrectly] The tutor states the correct answer and has the tutee repeat the correct answer. The tutor then presents the next card.

– *Provides Praise.* The tutor praises the tutee immediately following correct answers.

– *Shuffles Cards.* When the tutor and tutee have reviewed all of the math-fact carts, the tutor shuffles them before again presenting cards.
Peer Tutoring in Math Computation with Constant Time Delay

**Progress-Monitoring Activity.** The tutor concludes each 3-minute tutoring session by assessing the number of math facts mastered by the tutee. The tutor follows this sequence:

- *Presents Cards.* The tutor presents each card to the tutee for 3 seconds.

- *Remains Silent.* The tutor does not provide performance feedback or praise to the tutee, or otherwise talk during the assessment phase.

- *Sorts Cards.* Based on the tutee’s responses, the tutor sorts the math-fact cards into ‘correct’ and ‘incorrect’ piles.

- *Counts Cards and Records Totals.* The tutor counts the number of cards in the ‘correct’ and ‘incorrect’ piles and records the totals on the tutee’s progress-monitoring chart.
Peer Tutoring in Math Computation with Constant Time Delay

**Tutoring Integrity Checks.** As the student pairs complete the tutoring activities, the supervising adult monitors the integrity with which the intervention is carried out. At the conclusion of the tutoring session, the adult gives feedback to the student pairs, praising successful implementation and providing corrective feedback to students as needed. **NOTE:** Teachers can use the attached form *Peer Tutoring in Math Computation with Constant Time Delay: Integrity Checklist* to conduct integrity checks of the intervention and student progress-monitoring components of the math peer tutoring.
Peer Tutoring in Math Computation: Intervention Integrity Sheet: (Part 1: Tutoring Activity)

**Peer Tutoring in Math Computation with Constant Time Delay: Integrity Checklist**

**Tutoring Session: Intervention Phase**

Directions: Observe the tutor and tutee for a full intervention session. Use this checklist to record whether each of the key steps of the intervention were correctly followed.

<table>
<thead>
<tr>
<th>Correctly Carried Out?</th>
<th>Step</th>
<th>Tutor Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>_Y__N</td>
<td>1.</td>
<td>Promptly Initiates Session. At the start of the timer, the tutor immediately presents the first math-fact card.</td>
</tr>
<tr>
<td>_Y__N</td>
<td>2.</td>
<td>Presents Cards. The tutor presents each card to the tutee for 3 seconds.</td>
</tr>
<tr>
<td>_Y__N</td>
<td>3.</td>
<td>Provides Tutor Feedback. [When the tutee responds correctly] The tutor acknowledges the correct answer and presents the next card.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[When the tutee does not respond within 3 seconds or responds incorrectly] The tutor states the correct answer and has the tutee repeat the correct answer. The tutor then presents the next card.</td>
</tr>
<tr>
<td>_Y__N</td>
<td>4.</td>
<td>Provides Praise. The tutor praises the tutee immediately following correct answers.</td>
</tr>
<tr>
<td>_Y__N</td>
<td>5.</td>
<td>Shuffles Cards. When the tutor and tutee have reviewed all of the math-fact cards, the tutor shuffles them before again presenting cards.</td>
</tr>
<tr>
<td>_Y__N</td>
<td>6.</td>
<td>Continues to the Timer. The tutor continues to present math-fact cards for tutee response until the timer rings.</td>
</tr>
</tbody>
</table>
**Peer Tutoring in Math Computation: Intervention Integrity Sheet (Part 2: Progress-Monitoring)**

<table>
<thead>
<tr>
<th>Correctly Carried Out?</th>
<th>Step</th>
<th>Tutor Action</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Y</em> _N</td>
<td>1.</td>
<td>Presents Cards. The tutor presents each card to the tutee for 3 seconds.</td>
<td></td>
</tr>
<tr>
<td><em>Y</em> _N</td>
<td>2.</td>
<td>Remains Silent. The tutor does not provide performance feedback or praise to the tutee, or otherwise talk during the assessment phase.</td>
<td></td>
</tr>
<tr>
<td><em>Y</em> _N</td>
<td>3.</td>
<td>Sorts Cards. The tutor sorts cards into 'correct' and 'incorrect' piles based on the tutee's responses.</td>
<td></td>
</tr>
<tr>
<td><em>Y</em> _N</td>
<td>4.</td>
<td>Counts Cards and Records Totals. The tutor counts the number of cards in the 'correct' and 'incorrect' piles and records the totals on the tutee's progress-monitoring chart.</td>
<td></td>
</tr>
</tbody>
</table>
Response to Intervention

Peer Tutoring in Math Computation: Score Sheet
Math Challenge: The student has acquired math computation skills but is not yet fluent.

What Does the Research Say?...
Response to Intervention

Benefits of Automaticity of ‘Arithmetic Combinations’
(Gersten, Jordan, & Flojo, 2005)

• There is a strong correlation between poor retrieval of arithmetic combinations (‘math facts’) and global math delays

• Automatic recall of arithmetic combinations frees up student ‘cognitive capacity’ to allow for understanding of higher-level problem-solving

• By internalizing numbers as mental constructs, students can manipulate those numbers in their head, allowing for the intuitive understanding of arithmetic properties, such as associative property and commutative property

Associative Property

• “within an expression containing two or more of the same associative operators in a row, the order of operations does not matter as long as the sequence of the operands is not changed”

• Example:

\[-(2+3)+5=10\]
\[-2+(3+5)=10\]

Commutative Property

• “the ability to change the order of something without changing the end result.”

• Example:
  - $2+3+5 = 10$
  - $2+5+3 = 10$

How much is $3 + 8$?: Strategies to Solve . . .

Least efficient strategy: Count out and group 3 objects; count out and group 8 objects; count all objects:

\[
\begin{array}{cccccc}
\text{3} & + & \text{8} & = & 11 \\
\end{array}
\]

More efficient strategy: Begin at the number 3 and ‘count up’ 8 more digits (often using fingers for counting): $3 + 8$

More efficient strategy: Begin at the number 8 (larger number) and ‘count up’ 3 more digits: $8 + 3$

Most efficient strategy: ‘$3 + 8$’ arithmetic combination is stored in memory and automatically retrieved: Answer $= 11$

Math Challenge: The student has acquired math computation skills but is not yet fluent.

Sample Strategy:

• Explicit Time Drills
Explicit Time Drills
Math Computational Fluency-Building Intervention

Explicit time-drills are a method to boost students’ rate of responding on math-fact worksheets.

The teacher hands out the worksheet. Students are told that they will have 3 minutes to work on problems on the sheet. The teacher starts the stop watch and tells the students to start work. At the end of the first minute in the 3-minute span, the teacher ‘calls time’, stops the stopwatch, and tells the students to underline the last number written and to put their pencils in the air. Then students are told to resume work and the teacher restarts the stopwatch. This process is repeated at the end of minutes 2 and 3. At the conclusion of the 3 minutes, the teacher collects the student worksheets.

Math Challenge: The student is often inconsistent in performance on computation or word problems—and may make a variety of hard-to-predict errors.

What Does the Research Say?...
Profile of Students With Significant Math Difficulties

**Spatial organization.** The student commits errors such as misaligning numbers in columns in a multiplication problem or confusing directionality in a subtraction problem (and subtracting the original number—minuend—from the figure to be subtracted (subtrahend)).

**Visual detail.** The student misreads a mathematical sign or leaves out a decimal or dollar sign in the answer.

**Procedural errors.** The student skips or adds a step in a computation sequence. Or the student misapplies a learned rule from one arithmetic procedure when completing another, different arithmetic procedure.

**Inability to ‘shift psychological set’**. The student does not shift from one operation type (e.g., addition) to another (e.g., multiplication) when warranted.

**Graphomotor.** The student’s poor handwriting can cause him or her to misread handwritten numbers, leading to errors in computation.

**Memory.** The student fails to remember a specific math fact needed to solve a problem. (The student may KNOW the math fact but not be able to recall it at ‘point of performance’.)

**Judgment and reasoning.** The student comes up with solutions to problems that are clearly unreasonable. However, the student is not able adequately to evaluate those responses to gauge whether they actually make sense in context.

Math Challenge: The student is often inconsistent in performance on computation or word problems—and may make a variety of hard-to-predict errors.

Sample Strategy:

• Increase Student Math Success with Customized Math Self-Correction Checklists
Increase Student Math Success with Customized Math Self-Correction Checklists

**DESCRIPTION:** The teacher analyzes a particular student's pattern of errors commonly made when solving a math algorithm (on either computation or word problems) and develops a brief error self-correction checklist unique to that student. The student then uses this checklist to self-monitor—and when necessary correct—his or her performance on math worksheets before turning them in.

Sources:
Increase Student Math Success with Customized Math Self-Correction Checklists

MATERIALS:

- Customized student math error self-correction checklist
- Worksheets or assignments containing math problems matched to the error self-correction checklist

Sources:


www.interventioncentral.org
**Math Self-Correction Checklist**

<table>
<thead>
<tr>
<th>I underlined all numbers at the top of the subtraction problem that were smaller than their matching numbers at the bottom of the problem.</th>
<th>Problem#1</th>
<th>Problem#2</th>
<th>Problem#3</th>
<th>Problem#4</th>
<th>Problem#5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did the student succeed in this behavior goal?</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>YES</td>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I wrote all numbers carefully so that I could read them easily and not mistake them for other numbers.</td>
<td>Problem#1</td>
<td>Problem#2</td>
<td>Problem#3</td>
<td>Problem#4</td>
<td>Problem#5</td>
</tr>
<tr>
<td>Did the student succeed in this behavior goal?</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>YES</td>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I lined up all numbers in the right place-value columns.</td>
<td>Problem#1</td>
<td>Problem#2</td>
<td>Problem#3</td>
<td>Problem#4</td>
<td>Problem#5</td>
</tr>
<tr>
<td>Did the student succeed in this behavior goal?</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>YES</td>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I rechecked all of my answers.</td>
<td>Problem#1</td>
<td>Problem#2</td>
<td>Problem#3</td>
<td>Problem#4</td>
<td>Problem#5</td>
</tr>
<tr>
<td>Did the student succeed in this behavior goal?</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>YES</td>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Response to Intervention

Increase Student Math Success with Customized Math Self-Correction Checklists

INTERVENTION STEPS: The intervention includes these steps (adapted from Dunlap & Dunlap, 1989; Uberti et al., 2004):

1. Develop the Checklist. The teacher draws on multiple sources of data available in the classroom to create a list of errors that the student commonly makes on a specific type of math computation or word problem. Good sources of information for analyzing a student's unique pattern of math-related errors include review of completed worksheets and other work products, interviewing the student, asking the student to solve a math problem using a 'think aloud' approach to walk through the steps of an algorithm, and observing the student completing math problems in a cooperative learning activity with other children.


Increase Student Math Success with Customized Math Self-Correction Checklists

INTERVENTION STEPS: The intervention includes these steps (adapted from Dunlap & Dunlap, 1989; Uberti et al., 2004):

1. Develop the Checklist (cont.). Based on this error analysis, the teacher creates a short (4-to-5 item) student self-correction checklist that includes the most common errors made by that student. Items on the checklist are written in the first person and when possible are stated as 'replacement' or goal behaviors.

NOTE: To reduce copying costs, the teacher can laminate the self-correction checklist and provide the student with an erasable marker to allow for multiple re-use of the form.


Response to Intervention

Increase Student Math Success with Customized Math Self-Correction Checklists

**INTERVENTION STEPS:** The intervention includes these steps (adapted from Dunlap & Dunlap, 1989; Uberti et al., 2004):

2. *Introduce the Checklist.* The teacher shows the student the self-correction checklist customized for that student. The teacher states that the student is to use the checklist to check his or her work before turning it in so that the student can identify and correct the most common errors.

Sources:


www.interventioncentral.org
Increase Student Math Success with Customized Math Self-Correction Checklists

INTERVENTION STEPS: The intervention includes these steps (adapted from Dunlap & Dunlap, 1989; Uberti et al., 2004):

3. *Prompt the Student to Use the Checklist to Evaluate Each Problem.* The student is directed to briefly review all items on the checklist before starting any worksheet or assignment containing the math problems that it targets. The student uses the checklist after every problem to check the work—marking each checklist item with a plus sign ('+') if correctly followed or a minus sign ('-') if not correctly followed. If any checklist item receives a minus rating, the student leaves the original solution to the problem untouched, solves the problem again, and again uses the checklist to check the work.

Sources:

Increase Student Math Success with Customized Math Self-Correction Checklists

**INTERVENTION STEPS:** The intervention includes these steps (adapted from Dunlap & Dunlap, 1989; Uberti et al., 2004):

4. *Provide Performance Feedback, Praise, and Encouragement.* Soon after the student submits any math worksheets associated with the intervention, the teacher should provide him or her with timely feedback about errors, praise for correct responses, and encouragement to continue to apply best effort.

**Sources:**

Increase Student Math Success with Customized Math Self-Correction Checklists

**INTERVENTION STEPS:** The intervention includes these steps (adapted from Dunlap & Dunlap, 1989; Uberti et al., 2004):

5. **[OPTIONAL] Provide Reinforcement for Checklist Use.** If the student appears to need additional incentives to increase motivation for the intervention, the teacher can assign the student points for intervention compliance: (1) the student earns one point on any assignment for each correct answer, and (2) the student earns an additional point for each problem on which the student committed none of the errors listed on the self-correction checklist. The student is allowed to collect points and to redeem them for privileges or other rewards in a manner to be determined by the teacher.

Sources:
Increase Student Math Success with Customized Math Self-Correction Checklists

**INTERVENTION STEPS:** The intervention includes these steps (adapted from Dunlap & Dunlap, 1989; Uberti et al., 2004):

6. *Fade the Intervention.* The error self-correction checklist can be discontinued when the student is found reliably to perform on the targeted math skill(s) at a level that the teacher defines as successful (e.g., 90 percent success or greater).


Math Challenge: The student fails to use a structured approach to solving word problems.

Sample Strategy:

• Cognitive/Meta-Cognitive Strategy to Attack Word Problems
Combining Cognitive & Metacognitive Strategies to Assist Students With Mathematical Problem Solving

Solving an advanced math problem independently requires the coordination of a number of complex skills. The following strategies combine both cognitive and metacognitive elements (Montague, 1992; Montague & Dietz, 2009). First, the student is taught a 7-step process for attacking a math word problem (cognitive strategy). Second, the instructor trains the student to use a three-part self-coaching routine for each of the seven problem-solving steps (metacognitive strategy).
Cognitive Portion of Combined Problem Solving Approach

In the cognitive part of this multi-strategy intervention, the student learns an explicit series of steps to analyze and solve a math problem. Those steps include:

1. **Reading the problem.** The student reads the problem carefully, noting and attempting to clear up any areas of uncertainly or confusion (e.g., unknown vocabulary terms).

2. **Paraphrasing the problem.** The student restates the problem in his or her own words.

3. **‘Drawing’ the problem.** The student creates a drawing of the problem, creating a visual representation of the word problem.

4. **Creating a plan to solve the problem.** The student decides on the best way to solve the problem and develops a plan to do so.

5. **Predicting/Estimating the answer.** The student estimates or predicts what the answer to the problem will be. The student may compute a quick approximation of the answer, using rounding or other shortcuts.

6. **Computing the answer.** The student follows the plan developed earlier to compute the answer to the problem.

7. **Checking the answer.** The student methodically checks the calculations for each step of the problem. The student also compares the actual answer to the estimated answer calculated in a previous step to ensure that there is general agreement between the two values.
Metacognitive Portion of Combined Problem Solving Approach

The metacognitive component of the intervention is a three-part routine that follows a sequence of ‘Say’, ‘Ask’, ‘Check’. For each of the 7 problem-solving steps reviewed above:

- The student first self-instructs by stating, or ‘saying’, the purpose of the step (‘Say’).
- The student next self-questions by ‘asking’ what he or she intends to do to complete the step (‘Ask’).
- The student concludes the step by self-monitoring, or ‘checking’, the successful completion of the step (‘Check’).