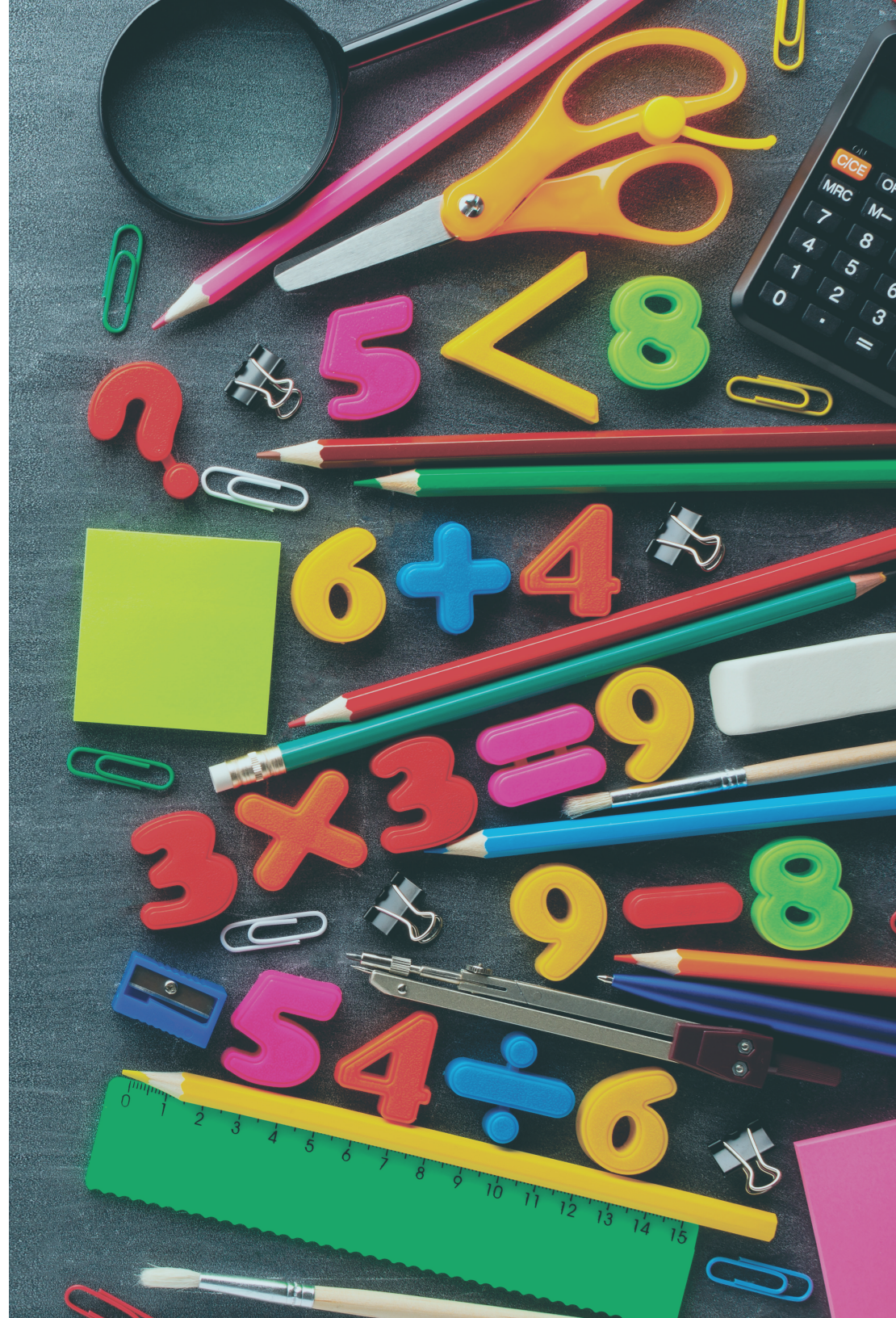


MATH Intervention BRIEFS

Effective research-based intervention protocols, aligned to the stages of learning, to accelerate students' learning. Each brief contains a title, links to research, steps for implementation, and a visualization of the intervention.



Discrete Trial Training

Acquisition

Routine

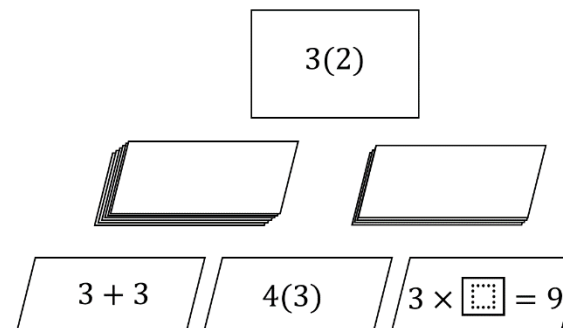
1. Develop the flashcard sets of known and unknown items.
 - a) Assess the student by showing them each of the cards one at a time.
 - b) If the student responds orally with the correct fact within 2 seconds, place the flashcard in the known item pile.
 - c) If the student gives an incorrect response, no response, or a correct response after 2 seconds, place the flashcard in the unknown item pile.
 - d) To prepare for the intervention, select a subset of unknown items to target for instruction.
2. Run the first trial. (PTDC)
 - a) Prompt – Teacher reads the problem and gives the answer.
 - b) Transfer – Student reads the problem and gives the answer.
 - c) Distract – Teacher presents between two to five known items. Student reads the problem and gives the answer.
 - d) Check – Teacher presents the unknown items, student reads the problem and gives the answer.
 - e) Run additional trials using other targeted unknown facts.
3. Error Correction
If student errors at any time, teacher prompts the students with the correct response and runs a separate trial (PTDC) for this fact.
4. Update student data.

When to Use?

Use this intervention if:

- Student knows very few items.
- Student is just beginning a concept.

Example Activity



Resources

AFIRM Discrete Trial Training Overview <https://files.eric.ed.gov/fulltext/ED595333.pdf>



Cooper, J., Heron, T., & Heward, W. (2007). *Applied Behaviour Analysis*. New Jersey: Pearson Education.

Incremental Rehearsal

Acquisition/Fluency

Routine

1. Develop the flashcard sets of known and unknown items.
 - a) Assess the student by showing them each of the cards one at a time.
 - b) If the student responds orally with the correct fact within 2 seconds, place the flashcard in the known items pile.
 - c) If the student gives an incorrect response, no response, or a correct response after 2 seconds, place the flashcard in the unknown item pile.
 - d) To prepare for the intervention, select 9 known items and 1 unknown item. The rest of the known items will not be used.
2. Run first intervention trial.
 - a) Present the unknown item. Read the problem and the answer. Student repeats the problem and the answer.
 - b) Present a known item. Student reads the problem and answer.
If student errors, teacher prompts with the correct fact and student repeats. Process is continued until student responds correctly to both the known and unknown items.
 - c) Add another known item to the card stack. Repeat the process.
 - d) Continue until you have reached 9 known items and 1 unknown item.
 - e) The unknown item is now considered a known item.
3. Run additional trial.
Begin with a new unknown item and the previous unknown item.
4. Session is ended when time runs out or student errors on unknown item three times.

Resources

Intervention Central Incremental Rehearsal Overview <https://www.interventioncentral.org/academic-interventions/math-facts/math-computation-promote-mastery-math-facts-through-incremental-re>



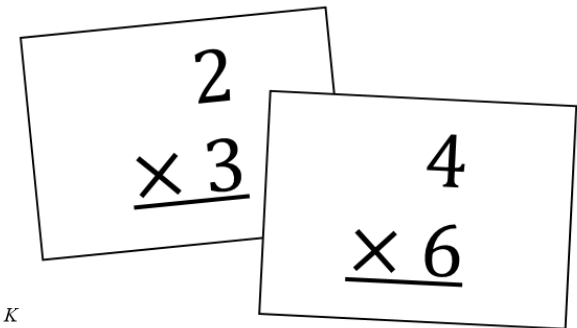
Burns, M. K. (2005). Using Incremental Rehearsal to Increase Fluency of Single-Digit Multiplication Facts with Children Identified as Learning Disabled in Mathematics Computation. *Education and Treatment of Children*, 28(3), 237-249.

When to Use?

Use this intervention if:

- Student is accurate, but slow with fact recall.
- Student knows some facts, but not all facts.

Example Activity



U
U, K
U, K, K
U, K, K, K
U, K, K, K, K
U, K, K, K, K, K
U, K, K, K, K, K, K
U, K, K, K, K, K, K, K
U, K, K, K, K, K, K, K, K

Drill Sandwich

Acquisition/Fluency

Routine

1. Develop the flashcard sets of known and unknown items.
 - a) Assess the student by showing them each of the cards one at a time.
 - b) If the student responds orally with the correct fact within 2 seconds, place the flashcard in the known items pile.
 - c) If the student gives an incorrect response, no response, or a correct response after 2 seconds place the flashcard in the unknown item pile.
2. Run first intervention trial.
 - a) To prepare for the intervention, select 7 known items and 3 unknown items. Place the unknown items in the 3rd, 6th, and 8th positions.
 - b) Present the item. Student reads the problem and the answer.
If student errors, teacher prompts with the correct fact and student repeats. Student repeats the problem and the answer.
 - c) Present the next item. If student errors, correct the error following the procedure in 2b.
 - d) After you have finished the set:
 - ⇒ Remove the unknown items, shuffle the known items.
 - ⇒ Insert 3 new unknown items in the 3rd, 6th, and 8th positions.
 - e) Run additional trial.
3. Session is ended when time runs out or five trials are run.
4. Update known and unknown items according to student errors.

When to Use?

Use this intervention if:

- Student is accurate, but slow with fact recall.
- Student knows some facts, but not a majority of facts.

Example Activity

4
+ 1

5
+ 2

K, K, U, K, K, U, K, K U, K

Resources

How to sandwich unknowns with known facts using flashcards <https://sis4teachers.org/2013/03/sandwiching-intervention/>



Routine

- Develop the Cover-Copy-Compare sheet.
 - Section a worksheet into three columns.
 - Select up to 10 facts for students to practice.
 - Write the facts as correct models on the left column. (You could use the right column if the student is left handed.)
- Student completes the sheet.
 - Study the correct fact, practice saying the fact.
 - Cover the fact (by hand or by folding the paper).
 - Copy the fact in the next column while saying the fact.
 - Uncover the original and compare.
 - ⇒ If correct, move to next problem.
 - ⇒ If incorrect, cross out the incorrect fact and go to step 2a.
 - Continue until all facts are complete.
- Update records/graphs.

If student correctly completes a facts for 3 consecutive trials:

 - Update their known facts list to include this item.
 - Update graph to monitor progress.

Variation: Instead of writing the facts, the student can practice verbal responses.

When to Use?

Use this intervention if:

- Student is struggling to acquire new math facts.
- Student is not maintaining accuracy with previously known math facts.
- Student is able to replicate the process independently.

Example Activity

How RTI Works Series © 2012 Jim Wright www.interventioncentral.org 1

Worksheet: Cover-Copy-Compare		Student:	Date:
Math Facts		Student Response	
1.	$\begin{array}{r} 8 \\ + 1 \\ \hline 9 \end{array}$		
2.	$\begin{array}{r} 9 \\ \times 8 \\ \hline 72 \end{array}$		
3.	$\begin{array}{r} 16 \\ - 8 \\ \hline 8 \end{array}$		
4.	$\begin{array}{r} 2 \\ + 6 \\ \hline 8 \end{array}$		
5.	$\begin{array}{r} 2 \\ \times 4 \\ \hline 8 \end{array}$		

Resources

How To: Master Math Facts: Cover-Copy-Compare <http://www.interventioncentral.org/academic-interventions/math-facts/how-master-math-facts-cover-copy-compare>

Cover Copy Compare Study: Coddling et al. (2007) <https://charts.intensiveintervention.org/intervention/toolSGL/5c62dbb2884584c5>

Cover-Copy-Compare Log: Mastered Items http://www.interventioncentral.org/sites/default/files/pdfs/pdfs_interventions/CCC_log_form_interactive.pdf



Detect - Practice - Repair

Fluency

Routine

1. Detect unknown items.
 - a) Give the student a structured sheet to record their answers.
 - b) *Present math fact for 3 seconds, while student writes the answer on their sheet.
 - c) Repeat for set of targeted math facts.
 - d) At the end of the assessment, display the answer key and have the student identify incorrect responses.
2. Practice
 - a) Student develops their own Detect-Practice-Repair (DPR) sheet. Use correct version of their first 5 errors.
 - b) Perform DPR procedure.
3. Repair
 - a) Teacher provides feedback.
 - b) CCC can be repeated.
 - c) Other fluency interventions can be applied for additional practice.

Variation(s): Can use a timer and flashcards or PowerPoint and 3 second transitions. Prompts could be provided verbally instead of visually.

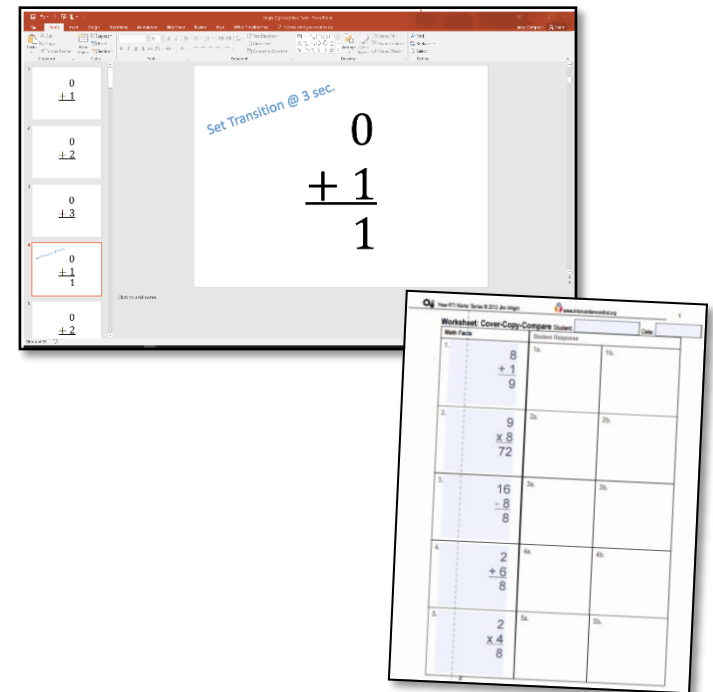
* If using PPT for facts, set the transition duration to 3 seconds.

When to Use?

Use this intervention if:

- Student knows some facts, but not all facts.
- Working with a group of students.
- Cover-Copy-Compare is already in use.
- Need to individualize CCC routine.

Example Activity



Resources

Axtell, Philip K., *Developing Math Automaticity Using a Classwide Fluency Building Procedure for Students with Varying Processing Speeds*. PhD diss., University of Tennessee, 2006.

Parkhurst, J., Skinner, C.H., Yaw, J., Poncy, B., Adcock, W., & Luna, E. (2010). Efficient classwide remediation: using technology to identify idiosyncratic math facts for additional automaticity drills. *International Journal of Behavioral Consultation & Therapy*, 6(2), 111-123.

Poncy, B.C., Skinner, C.H., & O'Mara, T. (2006). Detect, practice, and repair: The effects of a classwide intervention on elementary students' math fact fluency. *Journal of Evidence Based Practices for Schools*, 7, 47-68.

Taped Problems

Fluency

Routine

1. Determine the set of facts to practice based on assessment data.
 - a) Limit the number of new facts.
 - b) Include known facts for rehearsal.
2. Develop the recording.
 - a) Record the spoken problem.
 - b) Delay can be:
 - ⇒ Anywhere from 1 to 5 seconds.
 - ⇒ Shorter for errorless teaching or quick recall.
 - ⇒ Longer when the student is able to recall fact.
 - c) Record the answer.
 - d) Repeat for other problems.
 - ⇒ May prompt that next problem will occur.
 - ⇒ Limit the number of problems being practiced.
 - ⇒ Signal the end of the session.
3. Student listens to the recording.
 - a) May prompt that the next problem will occur.
 - b) Limit the number of problems being practiced.
 - c) Signal the end of the session.
4. Update data.

Variation(s): Alter time delay in recording; alter response method; allow pausing for fact rehearsal when errors occur.

Resources

Taped Problem Research Article <https://files.eric.ed.gov/fulltext/EJ959019.pdf>

Brian Poncy's M.I.N.D. <http://www.factsonfire.com>

McCallum, E., Skinner, C. H., & Hutchins, H. (2004). The Taped-Problems Intervention: Increasing Division Fact Fluency Using a Low-Tech Self-Managed Time-Delay Intervention. *Journal of Applied School Psychology*, 20(2), 129-147.



When to Use?

Use this intervention:

- With verbal stimulus.
- If student needs to self-correct.

Example Activity



Interleaved Worked Examples

Acquisition

Routine

1. Develop the worksheet.
 - a) Section the worksheet into 2 columns.
 - b) Place a set of problems that you want the student to complete in the right column.
 - c) In the left column, provide a worked example similar to the problem in the right.
 - d) There activity should be 50 percent worked examples and 50 percent problems for students to complete.
2. Student completes the sheet.
 - a) Study the completed problem, practice thinking aloud through the steps.
 - b) Complete the similar problem in the right column.
 - c) Continue until all problems are complete.
3. Provide feedback to the student, making connections to the worked examples as needed.
4. Remove scaffolds.

Variation(s): You should include writing prompts for the worked examples that focus the student's attention. You can include some problems with errors, as long as the error is identified for the student. If this is done, you should provide a writing prompt.

Resources

Organizing Instruction and Study to Improve Student Learning IES Practice Guide
<http://files.eric.ed.gov/fulltext/ED498555.pdf>

Pennsylvania Evidence Resource Center
<https://www.evidenceforpa.org/strategies/interleaved-mathematics-teaching>

Powerful Algebra 1 Teaching Strategy <https://www.serp.institute.org/algebra-by-example>



When to Use?

Use this intervention if:

- Student struggles to remember procedures.
- Student has misconceptions about procedures.
- Student struggles to accurately reproduce procedures.

Example Activity

Name: _____ Date: _____
Teacher: _____ Section: _____

AlgebraByExample
Assignment 1.1
absolute value

For each set, first examine the problem on the left and answer the question(s) about it. Then complete the similar problem on the right.

SET 1: Write the following expressions in simplest form. SHOW ALL OF YOUR WORK.
Chad simplified this expression correctly.
Here is what he wrote:

$|1-5|$
 $1-5|$
 5

Why is the negative sign not included in the answer?

Your Turn: $|1-7|$

SET 2: Write the following expressions in simplest form. SHOW ALL OF YOUR WORK.
Yiping simplified this expression correctly.
Here is what she wrote:

$|5-7|$
 $15-7|$
 $-2|$
 2

Why did Yiping subtract 7 from 5 as her first step?

Your Turn: $|2-7|$

page 3
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Concrete - Representational - Abstract

Acquisition

Routine

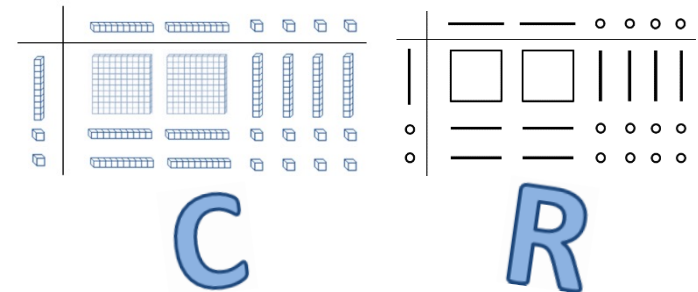
- Develop the CRA progression.
 - Outline the thought/language requirements of the abstract problem.
 - Select/develop modeling structure that can be used with objects and easily drawn.
 - Determine the manipulative(s) to be used.
 - Establish connections between the three models.
- Teach Concrete Model
 - Teach the manipulative.
 - Ensure correct language/thought process.
 - The student practices solving problems using the concrete model until accurate with model and language.
- Teach Representational Model
 - Build efficiency with modeling and language.
 - Increase complexity of problems.
 - The student practices solving problems using the representational model until accurate and efficient with model and language.
- Teach Abstract Model
 - Build understanding from concrete and representational models.
 - Utilize language to think aloud.
 - The student practices solving problems abstractly with support until independent. Then shift to fluency routines.
- Ongoing Progress Monitoring
 - Develop a task analysis in line with the math concept/procedure.
 - Assess the student on the process and provide corrective feedback.
 - Transition through CRA progression as students demonstrate understanding.

When to Use?

Use this intervention if:

- Student struggles with underlying concepts.
- Student struggles with math language.
- Student struggles with math facts.
- Student needs support with procedural skills.

Example Activity



C

R

	20	4	
10	200	40	240
2	40	8	+ 48
			288

A

$$\begin{array}{r}
 24 \\
 \times 12 \\
 \hline
 48 \\
 +240 \\
 \hline
 288
 \end{array}$$

Resources

Flores, M.M., Hinton, V. and Strozier, S.D. (2014), Teaching Subtraction and Multiplication with Regrouping Using the Concrete-Representational-Abstract Sequence and Strategic Instruction Model. *Learning Disabilities Research & Practice*, 29: 75-88. <https://doi.org/10.1111/ldrp.12032>

University of South Florida CRA Guides and Examples. <https://fcit.usf.edu/mathvids/strategies/cra.html>

Concrete-Representational-Abstract: Instructional Sequence for Mathematics <https://www.pattan.net/Publications/Concrete-Representational-Abstract-CRA-Instructional-Sequence-for-Mathematics>



Classwide Fluency Building

Fluency

Routine

1. Develop a logical hierarchy of math skills, to assess backward to find the earliest prerequisite skill the majority of the class has not yet mastered.
2. Create worksheets with the problem type identified for classwide intervention. Ensure practice worksheets have more problems than needed for 6 minutes of work.
3. Put students in partner groups, (e.g., rank order students by performance on skill: in a class of 24, student 1 is with student 12, student 2 with student 13).
4. Guided peer practice: One peer is worker, the other is helper. Worker solves problems and talks through how to solve them. The helper watches and provides corrective feedback. Higher performing student is worker first. Teacher tells students to begin and times for 3 minutes. After 3 minutes, teacher tells students to switch roles, and new worker starts after last completed problem. After 3 minutes, the teacher tells students to stop.
5. Timed independent practice: Each student gets their own paper. Teacher times students for 2 minutes. Students then trade papers for scoring with their partner. Error correction: Teacher provides correct answers and students give corrected papers back to owners. Owners also write correct answer under problem where they had an error. They explain how they fixed their mistakes.
6. Students chart their progress.
7. Teacher randomly selects paper from stack. If score is above criterion, the whole class earn incentive. Teacher keeps record of classwide scores.

Variation(s): Guided practice could be lead by teacher. Detect-Practice-Repair routine could be used to customize Cover-Copy-Compare for the whole class. The routine illustrates one way to run classwide intervention, but other intervention can be leveraged based on students' needs.

Resources

Burns, M.K., Riley-Tillman, T.C., & VanDerHeyden, A.M. (2012). *RTI applications: Academic and behavioral interventions*, New York: Guilford Press.

When to Use?

Use this intervention if:

- Classwide data reflect the median student's score in the class is below the success criterion for a skill.
- Use daily for approximately 10 to 15 minutes as a supplement to core instruction.

Example Activity

The example activity materials include:

- Workers Role Card:** Features a brain icon and the text "We use our brains to think." Below it is a mouth icon with the text "We use our mouths to explain." At the bottom is a hand icon with the text "We use our hands to write."
- Helpers Role Card:** Features an ear icon with the text "We use our ears to listen." Below it is an eye icon with the text "We use our eyes to watch." At the bottom is a mouth icon with the text "We use our mouths to help."
- Classwide Progress Chart:** A grid with "Students" on the vertical axis (0-40) and "Instructional Days" on the horizontal axis. A line graph plots "Behavioral to Measure" over time.
- Math Worksheet:** Two pages of math problems, including addition and subtraction exercises.
- Illustrations:** A pencil and a stopwatch.

Math to Mastery

Acquisition/Fluency

Routine

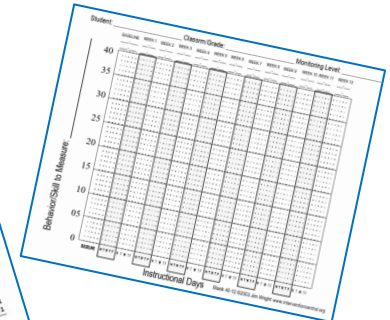
1. Determine the skill(s) used for the intervention according to Curriculum Based Assessment (CBA) or computer adapted assessments.
The earliest unmastered prerequisite skills in the sequence for the math operation should be targeted first.
2. Demonstrate how to complete each math problem on a worksheet while the student follows along on his/her copy.
3. Student practices the problems on the worksheet in one-minute trials until mastery criterion (e.g., 32 DCPM) is attained or ten one-minute trials are completed.
4. Follow along while student is working, marking errors and giving immediate corrective feedback.
5. After each one-minute trial, compute the digits correct and errors; provide specific praise for effort and performance.
6. Student charts their own performance at the end of each one-minute trial.
7. At the end of each session (or at least once weekly), student is administered a brief assessment (e.g., CBA), which is completed individually and scored to monitor progress on the target skill.
8. Once every other week (or monthly), a multiple skill Curriculum Based Measure (CBM) probe is administered to progress monitor for generalization.

When to Use?

Use this intervention if the student is having difficulty with computation skills:

- Addition
- Subtraction
- Multiplication
- Division

Example Activity



Resources

NY-RTI Math to Mastery Guide <https://nysrti.org/intervention-tools/math-tools/tool:math-to-mastery/>



Doggett, R.A., Henington, C., & Johnson-Gros, K.N. (2006). *Math to Mastery: A direct instruction remedial math intervention designed to increase student fluency with basic math facts*. Unpublished manuscript, Mississippi State University.

Explicit Timing

Fluency

Routine

1. Select skill on which student will practice.
 - a) Develop appropriate skill sequence.
 - b) Access appropriate practice worksheets.
 - c) Assess and identify the starting skill.
2. Document date, start time, and end time.
3. Pass out worksheets or Explicit Timing folder.
4. If doing self-graphing, read the following, "Class, please open your folder and locate your graph and score from yesterday's practice. Mark your score on your graph and see whether you beat your previous score (pause). Now take out today's math worksheet."
5. Read directions, "Today we are going to complete math worksheets using explicit timing. With explicit timing, I am going to give you x minutes to complete as many problems as you can. Your first goal is to complete each problem correctly and to not skip around. In addition, push yourself to work as quickly as possible. Ready, begin."
6. Start stopwatch and stop students after x minutes have elapsed.
7. Score probes to inform decision making.
 - a) Move back a skill (student is inaccurate, score is below half of the mastery criteria).
 - b) Continue with current skill (student is accurate but not fluent, score is above half of the mastery criteria, but criteria is not yet met).
 - c) Move to next skill (student has eclipsed mastery criteria).

Resources

Science of Math Explicit Timing Explanation <https://www.thescienceofmath.com/what-is-explicit-instruction>

Brian Poncy's M.I.N.D. ET Protocol Resources <https://brianponcywixsite.com/mind/explicit-timing>

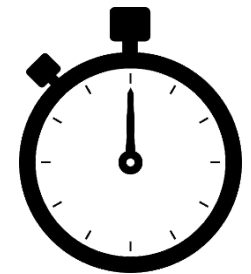
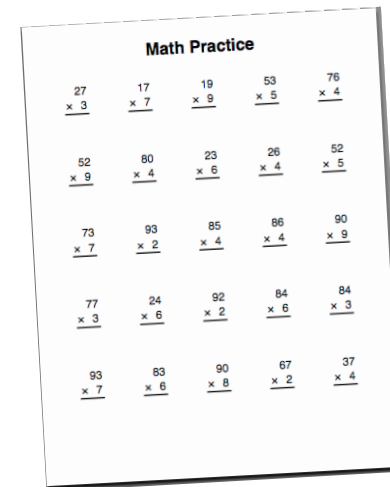
Codding, R.S., Volpe, R.J., Poncy, B.C., (2017). *Effective math interventions: a guide to improving whole-number knowledge*. New York : The Guilford Press.



When to Use?

Use this intervention if the student needs to increase response rates for a specific problem type.

Example Activity



The Great Race

Fluency

Routine

1. Construct a gameboard of 10 horizontally arranged squares of equal size, with numbers 1 to 10 listed left to right. Ensure "start" is by 1 and "end" is by 10.
2. Create a game spinner by dividing a circle in two halves. One half labeled "1" and the other half labeled "2."
3. Find items for game pieces representing different colors/shapes (e.g., buttons, beads).
4. Students and teacher each select their game pieces.
5. Tell students that they will each take turns spinning the spinner. Whomever reaches the end first wins.
6. Tell the students when it is their turn that they should move their game piece the number of spaces indicated on the spinner (either 1 or 2 spaces).
7. Ask the students to say the number they spun AND to say the numbers on the spaces through which they moved.
For example, if the student was on the numeral 5 and spun 2, the student should say, "I am on number 5 and spun a 2, so I will move two spaces." The student should say, "six, seven" as the game piece is moved.
8. If the student names the numeral incorrectly, provide the student with the correct number and have the student repeat the name(s) while moving the token.

Resources

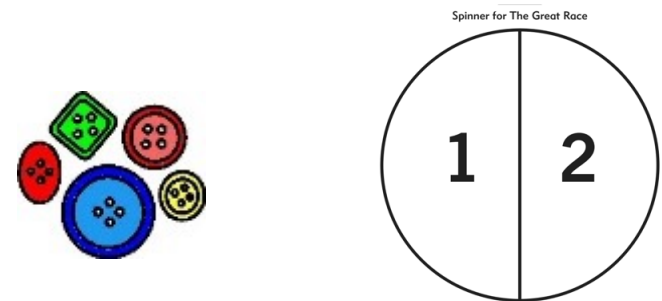
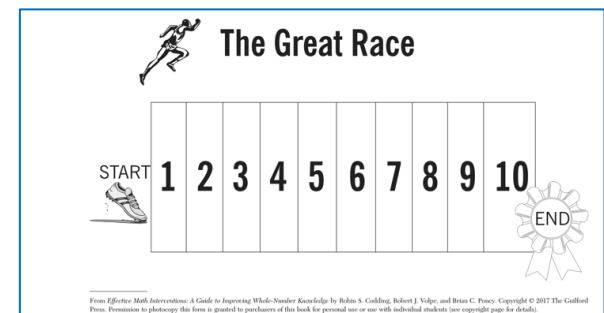
Ramani, G.B., & Siegler, R.S. (2008). Promoting broad and stable improvements in low-income children's numerical knowledge through playing board games. *Child Development, 79*, 375-394.

Ramani, G.B., Hitti, A., & Siegler, R.S. (2012). Taking it to the classroom: Number board games as a small group learning activity. *Journal of Educational Psychology, 104*, 661-672.

When to Use?

Use this intervention if the student needs practice with counting and cardinality.

Example Activity



Routine

1. Construct a gameboard of 10x10 matrix of squares of equal size, with numbers 1 to 100 arranged from the bottom left (1) to the top right (100). Place the word "start" with the numeral "0" beside it at the beginning, and place a star or the word "end" by the numeral 100. Background of board gradually darkens as numerals increase, providing a cue for number magnitude.
2. Create a game spinner by dividing a circle into 5 equal sections labeled 1 to 5.
3. Find items for game pieces representing different colors/shapes (e.g., buttons, beads).
4. Students and teacher each select their game piece.
5. Tell students that the purpose of the game is to learn about the numbers 0 to 100. Explain that you will each take turns spinning the spinner. Whomever reaches the end first wins.
6. Tell the students when it is their turn that they should move their game piece the number of spaces indicated on the spinner (either 1 or 2 spaces).
7. Ask the students to say the number they spun AND to say the numbers on the spaces through which they moved.
For example, if the student was on the numeral 5 and spun 2, the student should say, "I am on number 5 and spun a 2, so I will move two spaces." The student should say, "six, seven" as the game piece is moved.
8. If the student names the numeral incorrectly, provide the student with the correct number and have the student repeat the name(s) while moving the token.

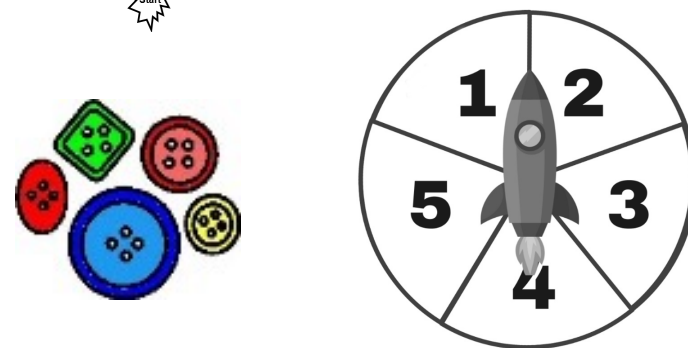
When to Use?

Use this intervention if the student needs practice with counting and cardinality.

Example Activity

RACE TO SPACE

91	92	93	94	95	96	97	98	99	100
81	82	83	84	85	86	87	88	89	90
71	72	73	74	75	76	77	78	79	80
61	62	63	64	65	66	67	68	69	70
51	52	53	54	55	56	57	58	59	60
41	42	43	44	45	46	47	48	49	50
31	32	33	34	35	36	37	38	39	40
21	22	23	24	25	26	27	28	29	30
11	12	13	14	15	16	17	18	19	20
1	2	3	4	5	6	7	8	9	10



Resources

Ramani, G.B., & Siegler, R.S. (2008). Promoting broad and stable improvements in low-income children's numerical knowledge through playing board games. *Child Development*, 79, 375-394.

Ramani, G.B., Hitti, A., & Siegler, R.S. (2012). Taking it to the classroom: Number board games as a small group learning activity. *Journal of Educational Psychology*, 104, 661-672.

High-Preference/Interspersed Problems

Fluency/Generalization

Routine

1. Determine the skill that will be used for the intervention.
2. Create worksheets that include the target skill and intersperse a one-digit x one-digit (basic fact) in the same area of operation (+ - x ÷) as the target skill.
3. Simple single-digit problems should be interspersed into target skill worksheets every other problem (one easy problem, one target problem).
4. Distribute worksheets to students and set a timer for 10 minutes. When 10 minutes have been completed, tell students to stop working.
5. Collect and score the worksheets, or provide an answer key and have students score their own worksheet, or have them exchange papers and score their peer's worksheet.
6. At the end of each session (at least once weekly), all students are administered a brief assessment, which is scored to monitor progress, on the target skill.
7. Once every other week or monthly, a multiple-skill curriculum-based measurement probe is administered to progress monitor for generalization.

When to Use?

Use this intervention if:

- Students are building fluency and generalization with complex computation.
- Students' motivation or persistence on practice activities are contributing to lack of automaticity with number combinations.

Example Activity

$$\begin{array}{r} 22 \\ + 36 \\ \hline \end{array} \quad \begin{array}{r} 7 \\ + 7 \\ \hline \end{array} \quad \begin{array}{r} 41 \\ + 19 \\ \hline \end{array} \quad \begin{array}{r} 8 \\ + 2 \\ \hline \end{array}$$

Resources

Effective Math Interventions: A Guide to Improving Whole Number Knowledge, Coddling, et al. 2017.

Additional Resources

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Codding, R. S., Eckert, T. L., Fanning, E., Shiyko, M., & Solomon, E. (2007). Comparing Mathematics Interventions: The Effects of Cover-Copy-Compare Alone and Combined with Performance Feedback on Digits Correct and Incorrect. *Journal of Behavioral Education*, 16(2), 125-141. <http://www.jstor.org/stable/41824398>



Codding, R. S., Chan-Iannetta, L., Palmer, M., & Lukito, G. (2009). Examining a classwide application of cover-copy-compare with and without goal setting to enhance mathematics fluency. *School Psychology Quarterly*, 24(3), 173-185. <https://doi.org/10.1037/a0017192>



Grafman, J.M. and Cates, G.L. (2010). The differential effects of two self-managed math instruction procedures: Cover, Copy, and Compare versus Copy, Cover, and Compare. *Psychol. Schs.*, 47: 153-165. <https://doi.org/10.1002/pits.20459>



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Booth, J. L., Oyer, M. H., Paré-Blagoev, E. J., Elliot, A. J., Barbieri, C., Augustine, A., & Koedinger, K. R. (2015). Learning Algebra by Example in Real-World Classrooms. *Journal of Research on Educational Effectiveness*, 8(4), 530-551. <https://doi.org/10.1080/19345747.2015.1055636>



Organizing Instruction and Study to Improve Student Learning: IES Practice Guide (pg. 9). <http://files.eric.ed.gov/fulltext/ED498555.pdf>



Pennsylvania Evidence Resource Center, *Interleaved Mathematics Teaching* <https://www.evidenceforpa.org/strategies/interleaved-mathematics-teaching>



AlgebraByExample resources, <https://www.serp.institute.org/algebra-by-example>



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Pennsylvania Evidence Resource Center: C-R-A Strategy Page <https://www.evidenceforpa.org/strategies/concrete-representational-abstract>



Commonwealth of Pennsylvania

Josh Shapiro, Governor

