Designing, Implementing, and Monitoring Effective Mathematics Intervention for Students At-Risk

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Mathematics Interventions
Matching intervention to function

• What are the presenting academic difficulties?
  – Use diagnostic assessment

• What evidence-based practice aligns with the profile of academic difficulties?

• How will we know if the evidence-based practice works?
  – Need to utilize Curriculum-Based Measurement (CBM) progress monitoring data
Where do students struggle in mathematics?

- **Computation**
  - Do not know basic addition, subtraction, multiplication, & division facts
  - Cannot use to solve complex problems

- **Automaticity**
  - Cannot automatically and efficiently execute arithmetic operations

- **Word Problems**
  - Difficulty solving even simple word problems
  - Special difficulties if problems contain irrelevant information
  - Do not have strategies for solving word problems

- **Motivation**
  - Low motivation
Effective teaching components

- Evidence-based teaching practices are the key to most high quality interventions
  - Objective for the lesson (concrete and measurable), including a rationale
  - Motivational activities to get students interested in and excited about the lesson
  - Modeling
  - Guided practice
  - Independent practice
  - Assessment
Activity

1  2  3  4  5  6  7  8  9

What do you think the problem might be?

How would you begin solving it?

Give it a try!
Keep all attempts and track your thinking.
Reflect

- Mathematical concepts?
- Mathematical processes?
- Behavioral or social skills?
- What would direct instruction look like after students have struggled with this problem?
Productive Struggle

“Students expend effort in order to make sense of mathematics, to figure something out that is not immediately apparent.”

Hiebert & Grouws, 2007
<table>
<thead>
<tr>
<th>Teaching Strategies</th>
<th>Student Indicators of a Productive Struggle</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Question</strong></td>
<td>Students ask questions to identify the source of their struggle, write down their ideas, clarify ideas with others, and consider alternative strategies or representations to address their struggle.</td>
</tr>
<tr>
<td>Teachers ask questions that help students focus on their thinking and identify the source of their struggle, then encourage students to build on their thinking or look at other ways to approach the problem.</td>
<td></td>
</tr>
<tr>
<td><strong>Encourage</strong></td>
<td>Students use their effort to solve problems and try to make sense of their work, not only satisfied with a correct answer or that they perceive themselves as smart or not.</td>
</tr>
<tr>
<td>Teachers encourage students to reflect on their work and support student struggle in their effort and not just in getting the correct answers.</td>
<td></td>
</tr>
<tr>
<td><strong>Give Time</strong></td>
<td>Students use their time to develop and follow through on their strategies, evaluate their progress, and understand what they can do and what still remains to be done.</td>
</tr>
<tr>
<td>Teachers give time and support for students to manage their struggles through adversity and failure by not stepping in too soon or too much, thereby taking the intellectual work away from the students.</td>
<td></td>
</tr>
<tr>
<td><strong>Acknowledge</strong></td>
<td>Students persist in their work to make sense of and to solve their problem and not give up or get discouraged easily.</td>
</tr>
<tr>
<td>Teachers acknowledge that struggle is an important part of learning and doing mathematics.</td>
<td></td>
</tr>
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The Rain Barrel Problem

Suppose we have a 48 gallon rain barrel containing 24 gallons of water and a 5 gallon water jug containing 3 gallons of water. Which container is said to be fuller? If we drain a gallon of water from each container, does this change your answer about which container is fuller? Explain.

McCabe, Warshauer, & Warshauer as cited in Warshauer, 2015
Scenario One

Sandy: I don’t know what to do.
Teacher: OK. How can we compare the amounts in the barrel to the jug?
Sandy: I’m not sure.
Teacher: Well, you have part and the whole for each, don’t you?
Sandy: Yeah.
Teacher: What kind of numbers can we make with part and a whole?
Sandy: Fractions?
Teacher: Bingo! So, what do your fractions look like?
Sandy: Um … 24/48 and 3/5 … but …
Teacher: Good. Now what do we do with fractions when they have different denominators?
Sandy: Get common denominators? Oh, OK.

Warshauer, 2015
Scenario Two

*Teacher:* OK. What do you think?

*Drew:* I put ‘no’ because it would be the same as before because you have taken a gallon from both.

*Teacher:* OK. So show me what that would look like. Show me what your gallons would look like. If you take a gallon from each, what are you looking at?

*Drew:* [writing on his paper]

*Teacher:* OK. So what you’re telling me [pointing to Drew’s work], you have 23 gallons out of 48 and 2 gallons out of 5, that you’re still going to have the 2 gallons out of 5 will be …

*Drew:* Lower, less full.

*Teacher:* But didn’t you tell me 3/5 was more full?

*Drew:* Wait, wait.

Warshauer, 2015
Teacher: So would it change?
Drew: Oh, OK. Yes, yes because, see …
Teacher: Because why?
Drew: They would be the same as before because you’re taking a gallon from both.
Teacher: OK, which one are you telling me is fuller?

Drew: 2/5 … but isn’t that fuller now? [Looking up at the teacher questioningly]
Teacher: Hmm, why would that one be fuller now, do you think?

Warshauer, 2015
Productive Failure

- Prepare the learner for learning
- Setup for meaningful direct instruction
Productive Failure

• “[…] engages students in solving problems requiring concepts they have yet to learn, followed by consolidation and instruction on the targeted concept.”

• Both types of learning experiences can be valuable

Kapur, 2016
Components of Productive Failure

1. Problem-solving task should be challenging and engaging, but not frustrating

2. Must allow for multiple-solutions, strategies, and representations

3. Activate students’ prior knowledge

4. Build on student-generated solutions by comparing/contrasting them with correct solution → reinforcing critical features of learning target

Kapur, 2016
How can productive failure be integrated into the evidence-based practices you’re already doing?
Effective Teaching Components: Rearranged

- Evidence-based teaching practices are the key to most high quality interventions
  - Motivational activities to get students interested in and excited about the lesson
  - Objective for the lesson (concrete and measurable), including a rationale
  - Modeling
  - Guided practice
  - Independent practice (an extension of the motivational problem)
  - Assessment
Review by Gersten, Baker, Chard (2006)—centeroninstruction.org

- Practices with moderate to large effect sizes for students at-risk or students with special needs:
  - Visual and graphic depictions
  - Systematic and explicit instruction
  - Student think-alouds
  - Structured peer-assisted learning activities
  - Formative assessment data provided to teachers and/or students
Enhancing Core Mathematics Instruction for Students At Risk for Mathematics Disabilities

- Guideline 1: prioritize instruction around critical content
- Guideline 2: pre-teach requisite skills to ensure success with new material
- Guideline 3: carefully select and sequence instructional examples
- Guideline 4: scaffold instruction to promote learner independence
- Guideline 5: model and demonstrate instructional tasks that students will learn
- Guideline 6: provide frequent and meaningful practice and review opportunities
- Guideline 7: use visual representations of math ideas
- Guideline 8: deliver timely academic feedback, both corrective and confirmatory

Doabler et al., 2012
Productive Failure + EBP

• Guideline 1: prioritize instruction around critical content

• Guideline 2: pre-teach requisite skills to ensure success with new material

• Guideline 8: deliver timely academic feedback, both corrective and confirmatory

Doabler et al., 2012
Example

- Mathematical concepts?
- Mathematical processes?
- Behavioral or social skills?
- What would direct instruction look like after students have struggled with this problem?
Example

What do these shapes have in common?

- Mathematical concepts?
- Mathematical processes?
- Behavioral or social skills?
- What would direct instruction look like after students have struggled with this problem?
Making decisions about intervention implementation

• Assessment
  – Task analysis
  – Error analysis
  – Checklists
  – Interviews
  – Can use the CBM numeracy probes diagnostically, but remember that they do not include all essential skills. They are indicators.
Interactive Data Based Intervention (DBI) Process

www.intensiveintervention.org
Example...

- Mr. Jones has just received notification that Kaden (3rd grade) will be coming to him for mathematics in his special education classroom. Mr. Jones wants to make sure he is using evidence-based practices, and prior to choosing an intervention, Mr. Jones uses a diagnostic measure like an error analysis to determine where Kaden struggles. After analyzing the results of Kaden’s responses, it appears that he struggles with accurate responding on basic facts. Mr. Jones knows he needs to build this foundational concept in order for Kaden to be able to access higher level skills. He selects an intervention like Cover, Copy, Compare, that focuses on basic fact fluency. Then Mr. Jones uses weekly CBM progress monitoring on mixed basic facts to determine if the intervention is successful in improving Kaden’s progress.
SOURCES FOR EVIDENCE-BASED PRACTICES AND ASSESSMENTS
Practice Guides
Everyday Mathematics®

Report Summary

Effectiveness
Everyday Mathematics® was found to have potentially positive effects on mathematics achievement for primary students.

Program Description
Everyday Mathematics® is a core curriculum for students in grades pre-K–6. At each grade level, the curriculum provides students with multiple opportunities to reinforce concepts and practice skills. Across grade levels, concepts are reviewed and extended in varying instructional contexts. The distinguishing features of Everyday Mathematics® are its focus on real-life problem solving, student communication of mathematical thinking, and appropriate use of technology. The curriculum also emphasizes balancing different types of instruction (including collaborative learning), using various methods for skills practice, and fostering parent involvement in student learning.

Research
The What Works Clearinghouse (WWC) identified one study of Everyday Mathematics® that both falls within the scope of the Primary Mathematics topic area and meets WWC group design standards. No studies met WWC group design standards without reservations, and one study meets WWC group design standards with reservations. The study included 3,469 primary students in grades 3–5 in a large urban school district in Texas. The WWC considers the extent of evidence for Everyday Mathematics® on the achievement outcomes of primary students to be small for mathematics achievement, the only outcome domain in Primary Mathematics.

This intervention report was prepared for the WWC by Mathematica Policy Research under contract ED-IES-13-C-0010.

What is this study about?

The study authors examined the effectiveness of four fractions-related math video games in improving students’ fractions knowledge relative to four different video games that emphasized equation solving. Both sets of video games were developed by the Center for Advanced Technology in Schools (CATS), an IES-funded center focused on developing and evaluating computer games to improve students’ pre-algebra knowledge.

The study is a cluster randomized controlled trial. In total, 80 sixth-grade classrooms within 26 schools across nine school districts were originally randomly assigned to condition: 42 classrooms were assigned to the intervention group, where students played four video games that emphasized fractions knowledge, and 58 to the comparison group, where students played four video games that emphasized equation solving. From these classrooms, 1,978 students were included in the analytic sample (739 in the intervention group and 709 in the comparison group). The study examined the impact of fractions-related video games using a researcher-designed measure of fractions knowledge.

What did the study report?

The study authors reported, and the WWC confirmed, statistically significant positive effects of the CATS fractions-related math video games on fractions knowledge in sixth-grade students.

Citation


This single study review was prepared for the WWC by Mathematica Policy Research under contract ED-IES-13-C-0010.
IRIS Center

IRIS Resource Locator
- Modules, Case Studies, Activities, & more

Evidence-Based Practice Summaries
- Research annotations

Films
- Portrayals of people with disabilities

Children's Books
- Portrayals of people with disabilities

New & Coming Soon
- Latest Modules & resources

Glossary
- Disability related terms

IRIS VIDEOS
Navigating Our Website and Resources
Watch our informative videos to learn how to use the IRIS Resource Locator and how to get around a STAR Legacy Module.
### Evidence-Based Practice Summaries

These summaries of research about the effectiveness of instructional strategies and interventions contain links to research reports and include information about an intervention's level of effectiveness and the age groups for which it is designed.

<table>
<thead>
<tr>
<th>Title</th>
<th>Description</th>
<th>Evidence Base/Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accelerated Math® Elementary School Students</td>
<td>Accelerated Math is software used to customize assignments and monitor progress. It is a core or supplemental program designed to add practice components and give teachers the ability to differentiate instruction. Studies into the program's effectiveness included grades 2-5.</td>
<td>U.S. Department of Education View Research Summary</td>
</tr>
<tr>
<td>Accelerated Math® High School Students</td>
<td>Accelerated Math is software used to customize assignments and monitor student progress. It is a core or supplemental program designed to add practice components and give teachers the ability to differentiate instruction. This program has not yet been proven effective in mathematics achievement for students in high school grades 9 through 12.</td>
<td>U.S. Department of Education View Research Summary</td>
</tr>
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</table>

### IRIS Resource Locator

**Search Resources for**

- **SORT BY**
- **TOPIC**
- **RESOURCE TYPE**
- **MODULE ELEMENT**

**Topics**

- Accommodations (58)
- Assessment (includes Progress Monitoring) (75)
- Assistive Technology (41)
- Behavior and Classroom Management (81)
- Collaboration (67)
- Content Instruction (53)
- Differentiated Instruction (82)
- Disability (148)
- Diversity (73)
- Early Intervention/Early Childhood (172)
- Learning Strategies (79)
- Mathematics (46)

**Resource Types**

- Modules (7)
- Information Briefs (15)
- Interviews (1)
- Video Vignettes (15)
- Web Resource Directory (110)
New Reviews Added to the BEE!

The BEE has recently added two major new reviews:

Secondary Science. A comprehensive review of research on science programs for grades 6-12.

Early Childhood Education. A comprehensive review focusing on studies comparing programs for four-year-olds using either "balanced" approaches, which include phonemic awareness and early phonics along with traditional preschool activities, to "developmental" approaches, which include little focus on pre-reading skills.

Other reviews being substantially updated and revised include:

- Elementary math
- Secondary reading
- Methodology effects in systematic reviews

Watch this space!
Best Evidence Encyclopedia

Mathematics / Elementary

Top-Rated Programs

Key Findings
Limited Evidence Programs
Review Summary
Other Programs
Review Methods

Mathematics Curricula (MC), such as Everyday Mathematics, Saxon Math, and other standard and alternative textbooks.

Computer-Assisted Instruction (CAI), such as Jostens/Compass Learning and SuccessMaker.

Instructional Process Programs (IP), such as cooperative learning, classroom management programs, and other approaches primarily intended to change teachers' instructional strategies rather than curriculum or textbooks.

Full Report


Additional source:


Links

Sign Up for News
Click Here to sign up for our Best Evidence in Brief e-newsletter

Limited Evidence Programs

Full Report (PDF, 1MB)
Educator’s Summary (PDF, 283k)
Educator’s Guide (PDF, 322k)

Program Ratings

Rating
Program
Type
Description
Contact / Website

Accelerated Mathematics
CAI
Supplementary program that prints out assignments for students based on their level of performance.
Website: www.relearn.com/am/

Dynamic Pedagogy
IP
Program that provides teachers with workshops in math strategies.
Contact Eleanor Armour-Thomas at armourthomas@yahoo.com

Every Day Counts
IP
An interactive K-6 bulletin-board program designed to supplement ordinary math instruction with discussions about math concepts built around the calendar and other
Website: www.greatsource.com
Best Evidence Encyclopedia

Review Summary
This article reviews research on the achievement outcomes of three types of approaches to improving elementary mathematics: Mathematics curricula, computer-assisted instruction (CAI), and instructional process programs. Study inclusion requirements included use of a randomized or matched control group, a study duration of 12 weeks, and achievement measures not inherent to the experimental treatment. Eighty-seven studies met these criteria, of which 36 used random assignment to treatments. There was limited evidence supporting differential effects of various mathematics textbooks. Effects of CAI were moderate. The strongest positive effects were found for instructional process approaches such as those involving cooperative learning, classroom management and motivation programs, and supplemental tutoring programs. The review concludes that programs designed to change daily teaching practices appear to have more promise than those that deal primarily with curriculum or technology alone.

Key Findings
Overall, 87 studies met the inclusion criterion, of which 36 used random assignment to treatments. These included 13 studies of mathematics curricula (2 randomized), 38 studies of CAI (15 randomized), and 36 studies of instructional process programs (20 randomized).

- **Mathematics Curricula (MC).** The review found limited evidence that it matters which textbook is used, at least for student outcomes on standardized tests. Studies of curricula supported by the National Science Foundation, such as Everyday Mathematics and Math Trails, found small differences in math achievement in comparison to control groups. Similarly, Saxon Math and traditional math texts had little evidence of effectiveness. Median effect size across 13 studies: +0.10.

- **Computer-Assisted Instruction (CAI).** Most studies of CAI find positive achievement outcomes. However, the outcomes are very mixed, and the highest-quality studies find few positive effects. Also, most qualifying studies evaluated programs that are no longer available; there are few studies of current versions of CAI. Median effect size across 38 studies: +0.19.

- **Instructional Process Strategies (IP).** The highest-quality studies and strongest positive effects were found for instructional process programs such as cooperative learning, classroom management and motivation programs, and small-group tutoring programs. Median effect size across 36 studies: +0.33.

Review Methods
An exhaustive search considered hundreds of published and unpublished articles. It included those that met the following criteria:

- Schools or classrooms using each program had to be compared to randomly assigned or well-matched control groups
- Study duration had to be at least 12 weeks
- Outcome measures had to be assessments of the mathematics being taught in all classes. Almost all are standardized tests or state assessments.
- The review placed particular emphasis on studies in which schools, teachers, or students were assigned at random to experimental or control groups.

Program Ratings Basis
Programs were rated according to the overall strength of the evidence supporting their effects on math achievement. "Effect size" (ES) is the proportion of a standard deviation by which a treatment group exceeds a control group. Large studies are those involving a total of at least 10 classes or 250 students. The categories are as follows:

- **Strong Evidence of Effectiveness:** At least one large or two small randomized studies with median ES= +0.20 or more.

- **Moderate Evidence of Effectiveness:** At least two large or four small studies (randomized and matched) with median ES= +0.20 or more.

- **Limited Evidence of Effectiveness:** At least one qualifying study with a significant positive effect and/or median ES=+0.10 or more.

- **Insufficient Evidence:** Studies show no significant differences

- **No Qualifying Studies:** No studies met inclusion standards
# National Center on Intensive Intervention

<table>
<thead>
<tr>
<th>Title</th>
<th>Study Type</th>
<th>Mean ES</th>
<th>Visual Analytics</th>
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<th>Visual Analytics</th>
<th>Intensity</th>
<th>Additional Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academy of MATH</td>
<td>Group Design</td>
<td>0.58</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Cressy &amp; Ed BK</td>
<td>Group Design</td>
<td>0.39</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Becker, McLaughlin, Weber, &amp; Gower (2009)</td>
<td>Single-Subject Design</td>
<td>0.48</td>
<td>N/A</td>
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# Study: Becker, McLaughlin, Weber, & Gower (2009)


**Cover Copy Compare**

Cover Copy Compare is a general strategy for building fluency with math facts or other math skills (e.g., numerical identification). When applying this strategy to math, a student (or teacher) at a correct-or-wrong problem. (If the student is correct, the student is now ready to move on to the next problem. If the student is incorrect, the correct answer is provided and the student is now ready to move on to the next problem.)

<table>
<thead>
<tr>
<th>Description</th>
<th>Usage</th>
<th>Acquisition and Cost</th>
<th>Progress Specifications and Assessments</th>
<th>Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover Copy Compare is a non-commercial intervention and, therefore, does not have a formal pricing structure.</td>
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<td></td>
<td></td>
<td>A school staff person at each school can provide instructions on Cover Copy Compare. For implementation, instructors must be familiar with the Cover Copy Compare procedure and teach the procedure to students. The program does not assume that this instruction has been given in a group.</td>
</tr>
</tbody>
</table>
Evidence-Based Intervention (EBI) Network

Math Interventions

The EBI Network math team (Dr. Erica Lehmke at the University of Missouri, Dr. Sarah Powell at the University of Texas, Dr. Pamela Seelhauer at Vanderbilt University, and Elizabeth Hughes at Duquesne University) has developed a framework to present math interventions that incorporate both a focus on content area (e.g. Counting & Cardinality or Operations & Algebraic Thinking) and the type of problem the child is having (acquisition, proficiency or generalization). As with other interventions on the site each intervention will have a brief for field use. For more information about our plans, see our current guiding document.

- Mathematics EBI Network Guiding Document

To select the appropriate intervention consider what you think the most likely reason is for the student’s mathematics difficulty. This question will help with the selection of a class of academic intervention (acquisition, proficiency, generalization of motivation). Once selected click on the hypothesized reason for a list of EBI that were developed for that situation.

- Acquisition Interventions – The task is too hard for the student
- Proficiency Interventions – They need to become more fluent with the math skill
- Generalization Interventions – The student has not done the academic task that way before
- Motivation Interventions – The student does not want to do the academic task

Please click here for a current full list of math interventions post on the EBI Network

Math Interventions - Acquisition Interventions: The task is too hard for the student

Roots
2014-11-24 12:59:44  Acquisition Interventions: The task is too hard for the student, Generalization Interventions: The student has not done the academic task that way before, Math Interventions, Proficiency Interventions - They need to become more fluent with the math skill

ROOTS is a small-group tutoring program for kindergarten students experiencing mathematics difficulty. With ROOTS, students participate in 50 lessons focused on developing number sense to help improve understanding of kindergarten mathematics numbers and vocabulary. ROOTS is designed as a supplement to core instruction.

Common Core Standards: Multiple
Setting: Small Group
Focus Area: Acquisition, Fluency, Generalization

Full Brief Link
Comments (0)

Early Learning in Mathematics (ELM)
2014-04-09 10:27:16  Acquisition Interventions: The task is too hard for the student, Generalization Interventions: The student has not done the academic task that way before, Math Interventions,
• Mathematics EBI Network Guiding Document

Current Intervention Briefs

• Interleaved Solutions and Problem Solving
  ○ Common Core Standards: Varied
  ○ Setting: Whole Class, Small Group, Individual
  ○ Focus Area: Acquisition, Fluency and Generalization
  ○ Overview: The purpose of interleaving worked problems and problems to solve is to provide scaffolding through models or examples for students as they proceed through a set of math problems
  ○ Full Brief Link

• Keyword Mnemonics
  ○ Common Core Standards: Varied
  ○ Setting: Whole Class, Small Group, Individual
  ○ Focus Area: Acquisition, Fluency and Generalization
  ○ Overview: Mnemonics are strategies and techniques that aid in memory. A mnemonic keyword connects a new vocabulary word to students' prior knowledge by using a visual depicting the definition to the new vocabulary word. New vocabulary terms are introduced through a similar sounding word (keyword). This keyword is illustrated in such a way that the keyword interacts with critical attributes of the definition of the new word. Lastly, a sentence is created to connect the keyword to the new definition.
  ○ Full Brief Link

• Math Wise
**Intervention Name:** Schema-Based Instruction / Schema-Broadening Instruction (SBI)

**Additive Schemas (addition and subtraction)**

**Diagram:**
- Two objects being added or subtracted.
- An equation representing the operation.
- A word problem requiring the use of additive schemas.

**Example Problem:**
A group of 3 children is playing at the park. If 2 more children join them, how many children are there now?

**Solutions:**
- Addition: 3 + 2 = 5
- Subtraction: 5 - 2 = 3

**Additional Example:**
A classroom has 15 students. If 10 more students join the class, how many students are there now?

**Find the problem type:**
- Addition

**Solve the problem:**
- 15 + 10 = 25

**Additive Compositional Model:**
- Student: How many blocks do you have?
- Teacher: I have 3 blocks.
- Student: And you give me 2 more, how many do you have left?

**References:**

**Note:**
- SBI is an acronym for Schema-Based Instruction.
- Additional strategies and resources can be found in the intervention manual by the authors.

**Keywords:**
- Additive schemas
- Problem solving
- SBI
- Instructional strategies
Where do students struggle in mathematics?

• Computation
  – Do not know basic addition, subtraction, multiplication, & division facts
  – Cannot use to solve complex problems

• Automaticity
  – Cannot automatically and efficiently execute arithmetic operations

• Word Problems
  – Difficulty solving even simple word problems
  – Special difficulties if problems contain irrelevant information
  – Do not have strategies for solving word problems

• Motivation
  – Low motivation
Making decisions about intervention implementation

• Assessment
  – Task analysis
  – Error analysis
  – Checklists
  – Interviews
  – Can use the CBM numeracy probes diagnostically, but remember that they do not include all essential skills. They are indicators.
Error Analysis

• Discovering patterns of errors by analyzing student’s work samples
• Goal is identification of error patterns
  – Work sample is scored
  – All errors are noted
  – An attempt is made to sort the errors into meaningful categories
    • Random responding
    • Basic fact error
    • Wrong operation
    • Defective algorithm
    • Place value problems
Assessment & Error Analysis

- Construct probes with representative problem types
- Have student complete probe and either
  - Talk while doing problems
  - Tell you after each problem how he or she solved the problems

Sample problems:

1. Added all numbers together (defective algorithms, no regard for place value)
2. Student does not regroup (carry)
3. Student adds numbers from left to right (and carries to column on right)
Wrap up, questions, evaluation
Conclusion, questions

• How will you determine what interventions to implement?
• How can you use parts of what we’ve discussed today? Or all of what we’ve discussed today?
• Further questions?