RTI: Best Practices in Secondary Math Interventions (7-12)

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www.interventioncentral.org

INTERVENTION CENTRAL

Workshop PPTs and handout available at:

http://www.interventioncentral.org/wi_ed_math

Workshop Agenda…

- RTI & Mathematics: Introduction
- GOAL 1: Creating a Supportive Math Instructional Environment
- GOAL 2: Obtaining or Developing Classroom Formative Math Assessments.
- GOAL 3: Developing a Math 'Intervention Menu'.
- GOAL 4: Enlisting the Student as a Motivated, Self-Managing Math Learner.
- Review of Free Internet Resources to Help Your School to Implement RTI for Math/Planning Activities

Planning Activity Report Out Procedures

- Review your table number.
- Before beginning your RTI planning, select 2 members of your table who will visit another table as 'ambassadors' for the report-out part of the activity.
- During the report-out, your ambassadors will visit the following tables:
  - Activity 1: Your table number +1
  - Activity 2: Your table number +2
  - Activity 3: Your table number +3
  - Activity 4: Your table number +4

National Math Advisory Panel Report: 2008

"American students have not been succeeding in the mathematical part of their education at anything like a level expected of an international leader. Particularly disturbing is the consistency of findings that American students achieve in mathematics at a mediocre level by comparison to peers worldwide. On our own "National Report Card"—the National Assessment of Educational Progress (NAEP)—... 32% of our students are at or above the "proficient" level in Grade 8, but only 23% are proficient at Grade 12.

Consistent with these findings is the vast and growing demand for remedial mathematics education among arriving students in four-year colleges and community colleges across the nation."

Source: *National Mathematics Advisory Panel. Foundations for Success: The Final Report of the National Mathematics Advisory Panel, U.S. Department of Education: Washington, DC, 2008; p. xii.*

Question: Is Algebra Essential?: PRO

"...Algebra is a demonstrable gateway to later achievement. Students need it for any form of higher mathematics later in high school; moreover, research shows that completion of Algebra II correlates significantly with success in college and earnings from employment. In fact, students who complete Algebra II are more than twice as likely to graduate from college compared to students with less mathematical preparation."

Source: *National Mathematics Advisory Panel. Foundations for Success: The Final Report of the National Mathematics Advisory Panel, U.S. Department of Education: Washington, DC, 2008; p. xiii*

Question: Is Algebra Essential?: CON

"Algebra is an onerous stumbling block for all kinds of students: disadvantaged and affluent, black and white. In New Mexico, 43 percent of white students fell below "proficient," along with 39 percent in Tennessee....

Another dropout statistic should cause equal chagrin. Of all who embark on higher education, only 58 percent end up with bachelor's degrees. The main impediment to graduation: freshman math....

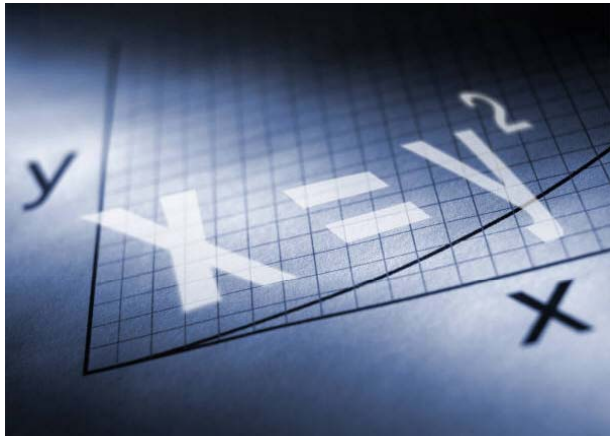
...A definitive analysis by the Georgetown Center on Education and the Workforce forecasts that in the decade ahead a mere 5 percent of entry-level workers will need to be proficient in algebra or above....

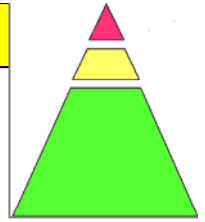
Think of math as a huge boulder we make everyone pull, without assessing what all this pain achieves. So why require it, without alternatives or exceptions? Thus far I haven't found a compelling answer."

Source: *Hacker, A. (2012, July 20). Is algebra necessary? The New York Times[Online edition]. Retrieved from http://www.nytimes.com*

RTI and Secondary Mathematics: A New Frontier

Focus of Inquiry: How can the 3-Tier RTI model be applied to middle and high school mathematics instruction?

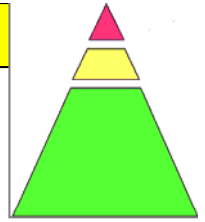




RTI: 6 Essential Elements for Mathematics

1. Educators believe that every student has the ability to learn challenging mathematics when given effective instruction and regularly monitored
2. All students are screened 3 times per year, using a math assessment battery that can identify those students who may need additional supplemental assistance to fill in skill gaps.
3. Students on math interventions have their progress monitored regularly to verify that interventions are working and to move students across Tiers as needed.

Source: Lembke, E. S., Hampton, D., & Beyers, S. J. (2012). Response to intervention in mathematics: Critical elements. Psychology in the Schools, 49(3), 257-272.



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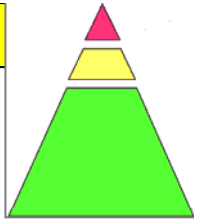
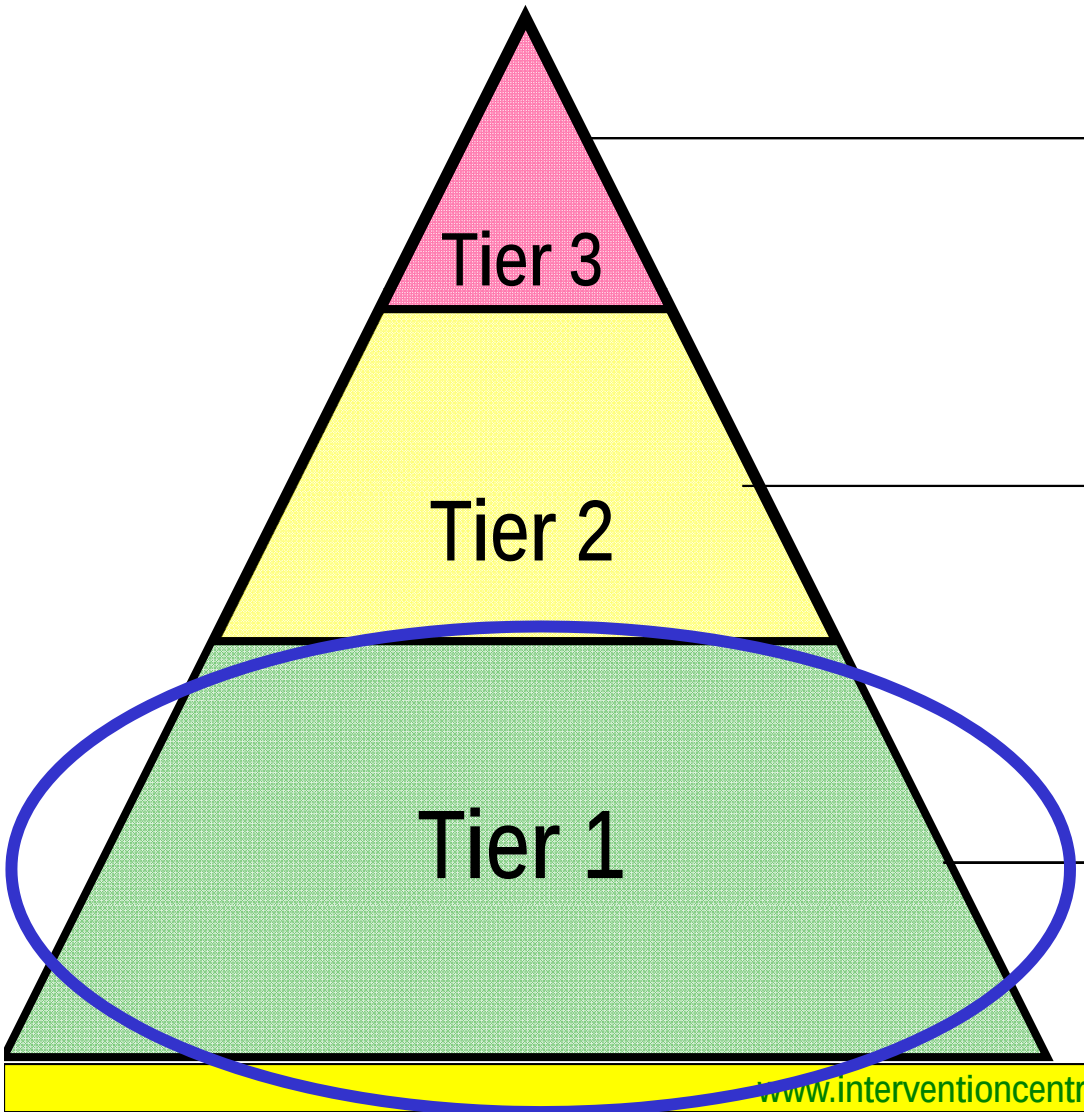


RTI: 6 Essential Elements for Mathematics (Cont.)

4. Research-based instructional practices and programs are used in core instruction and during interventions.
5. The school has a multi-Tier system set up that provides increasingly intensive math intervention support matched to student need.
6. The school regularly evaluates its Math RTI model (including measurements of intervention integrity) to verify the quality of the model.

Source: Lembke, E. S., Hampton, D., & Beyers, S. J. (2012). Response to intervention in mathematics: Critical elements. Psychology in the Schools, 49(3), 257-272.

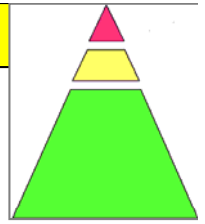
RTI 'Pyramid of Interventions'



Tier 3: Intensive interventions. Students who are 'non-responders' to Tiers 1 & 2 are referred to the RTI Team for more intensive interventions.

Tier 2 Individualized interventions. Subset of students receive interventions targeting specific needs.

Tier 1: Universal interventions. Available to all students in a classroom or school. Can consist of whole-group or individual strategies or supports.

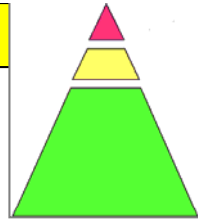


RTI Support: Tier 1 Core Instruction

- Tier 1 core instruction is considered to be 'universal' because all students receive it and benefit from it.
- Core instruction in math should have the elements of 'explicit instruction', a structured method for instructional delivery that is more likely to be effective with struggling students.
- To judge whether core instruction is adequate, RTI schools use screening instruments (e.g., math computation fluency probes, math concepts and applications measures, algebra probes) to assess classwide math performance three times yearly. If at least 80 percent of students attain or exceed the screener's performance benchmark, core instruction is considered to be adequate.

Sources: Lembke, E. S., Hampton, D., & Beyers, S. J. (2012). Response to intervention in mathematics: Critical elements. Psychology in the Schools, 49(3), 257-272.

Wright, J. (2012). RTI Success in Secondary Schools: A toolkit for middle and high schools. Port Chester, NY: National Professional Resources, Inc.



RTI Support: Tier 1 (Classroom) Intervention

Tier 1 interventions are intended for 'red flag' students who struggle in math and require additional individualized teacher support during core instruction. To successfully implement Tier 1 interventions, a middle or high school teacher will need:

- Clear criteria to identify Tier 1 intervention students (e.g., students who are failing the course on a 5-week grade report).
- Research-based strategies to address the student's academic (and perhaps motivational) deficits.
- A streamlined form to document the Tier 1 intervention plan.
- The ability to collect and interpret classroom data to judge whether the Tier 1 intervention is working.
- Guidelines for how long to implement the Tier 1 intervention before seeking additional RTI help for the student.

Sources: Wright, J. (2012). RTI Success in Secondary Schools: A toolkit for middle and high schools. Port Chester, NY: National Professional Resources, Inc.

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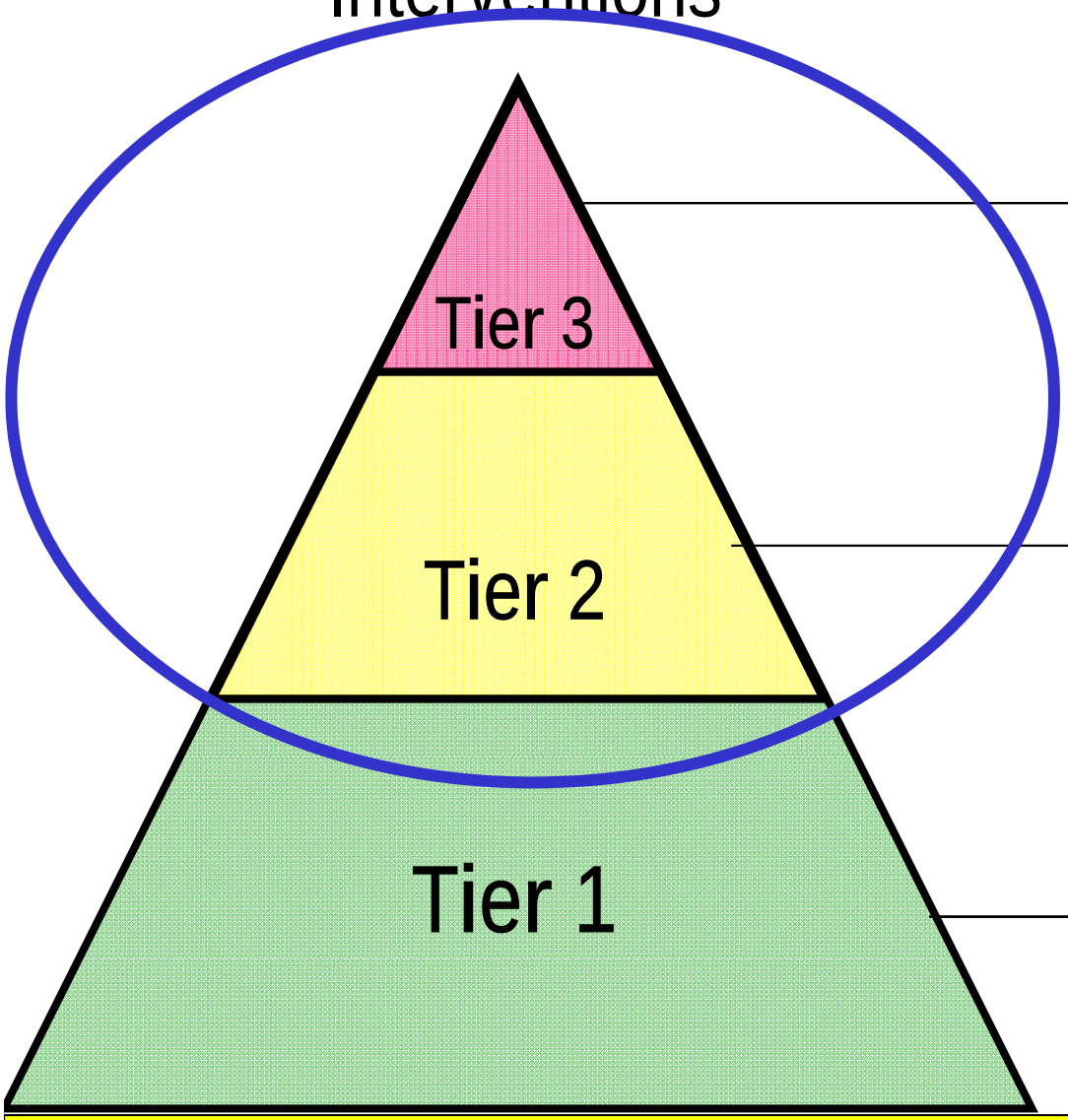

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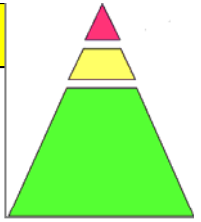
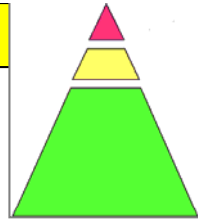


RTI Support: Tier 2/3 Supplemental Interventions

- Tier 2/3 interventions SUPPLEMENT core instruction.
- Students are identified for Tier 2/3 math services based on objective data sources such as universal screeners that allow the school to predict each student's degree of 'risk' for math failure.
- In a typical school, 10-15 % of students may require Tier 2 interventions in a given academic area.
- Interventions at Tier 2 are monitored at least twice per month. Interventions at Tier 3 are monitored weekly.
- Each Tier 2/3 intervention should last at least 6-8 instructional weeks.

Sources: Wright, J. (2012). RTI Success in Secondary Schools: A toolkit for middle and high schools. Port Chester, NY: National Professional Resources, Inc.



RTI Support: Tier 2/3 Supplemental Interventions

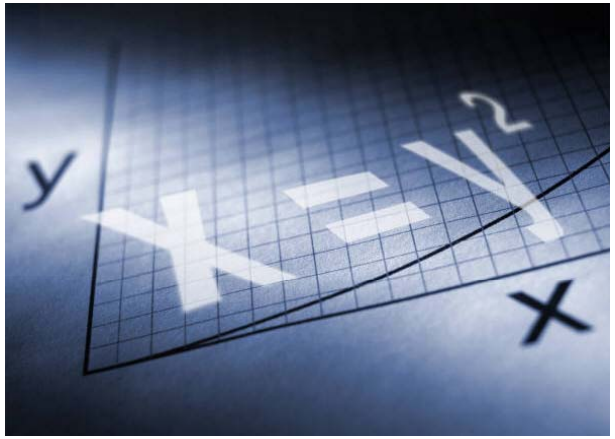
Each Tier 2/3 intervention plan shows evidence that:

- Instructional programs or practices are 'evidence-based'.
- The intervention has been selected because it logically addresses the area(s) of academic deficit for the target student.
- The student-teacher ratio in the group provides adequate student support: Tier 2 up to 7 students; Tier 3 up to 3 students. NOTE: The instructional ratio for students engaged in computer-delivered Tier 2/3 instruction is 1:1.
- Students enrolled in the Tier 2/3 intervention group have the same shared intervention need(s).
- The intervention provides contact time adequate to the student academic deficit. Tier 2 interventions occur a minimum of 3-5 times per week in sessions of 30 mins or more; Tier 3 interventions occur daily in sessions of 30 mins or more (Burns & Gibbons, 2008).

Sources: Wright, J. (2012). RTI Success in Secondary Schools: A toolkit for middle and high schools. Port Chester, NY: National Professional Resources, Inc.

Strong Core Math Instruction

Focus of Inquiry: What are the elements of strong core mathematics instruction?



An RTI Challenge: Limited Research to Support Evidence-Based Math Interventions

"… in contrast to reading, core math programs that are supported by research, or that have been constructed according to clear research-based principles, are not easy to identify. Not only have exemplary core programs not been identified, but also there are no tools available that we know of that will help schools analyze core math programs to determine their alignment with clear research-based principles." p. 459

Source: Clarke, B., Baker, S., & Chard, D. (2008). Best practices in mathematics assessment and intervention with elementary students. In A. Thomas & J. Grimes (Eds.), Best practices in school psychology V (pp. 453-463).

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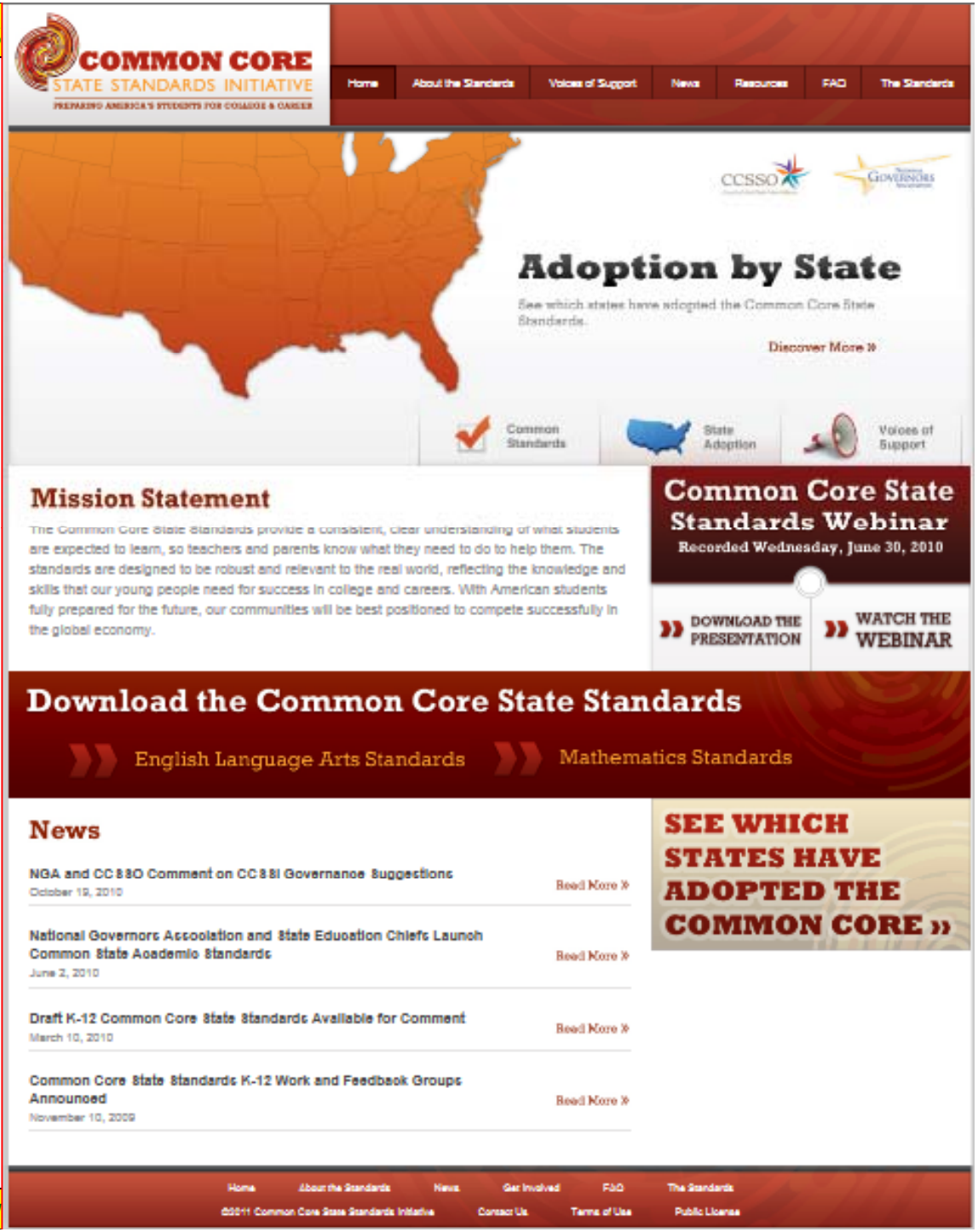
Common Core State Standards Initiative
http://www.corestandards.org/

View the set of Common Core Standards for English Language Arts (including writing) and mathematics being adopted by states across America.



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Common Core Standards, Curriculum, and Programs: How Do They Interrelate?

Common Core Standards. Provide external instructional goals that guide the development and mapping of the school's curriculum. However, the *sequence* in which the standards are taught is up to the district and school.

School Curriculum. Outlines a uniform sequence shared across instructors for attaining the Common Core Standards' instructional goals. Scope-and-sequence charts bring greater detail to the general curriculum. Curriculum mapping ensures uniformity of practice across classrooms, eliminates instructional gaps and redundancy across grade levels.

Commercial Instructional and Intervention Programs. Provide materials for teaching the curriculum. Schools often piece together materials from multiple programs to help students to master the curriculum. It should be noted that specific programs can change, while the underlying curriculum remains unchanged.

Motivation Deficit 1: *The student is unmotivated because he or she cannot do the assigned work.*

- **Profile of a Student with This Motivation Problem:**
  The student lacks essential skills required to do the task.

Handout pp.21-23

Motivation Deficit 1: Cannot Do the Work

- **Profile of a Student with This Motivation Problem (Cont.):** Areas of deficit might include:
- *Basic academic skills.* Basic skills have straightforward criteria for correct performance (e.g., the student defines vocabulary words or decodes text or computes 'math facts') and comprise the building-blocks of more complex academic tasks (Rupley, Blair, & Nichols, 2009).
- *Cognitive strategies.* Students employ specific cognitive strategies as "guiding procedures" to complete more complex academic tasks such as reading comprehension or writing (Rosenshine, 1995).
- *Academic-enabling skills.* Skills that are 'academic enablers' (DiPerna, 2006) are not tied to specific academic knowledge but rather aid student learning across a wide range of settings and tasks (e.g., organizing work materials, time management).

Motivation Deficit 1: Cannot Do the Work (Cont.)

- **What the Research Says:** When a student lacks the capability to complete an academic task because of limited or missing basic skills, cognitive strategies, or academic-enabling skills, that student is still in the acquisition stage of learning (Haring et al., 1978). That student cannot be expected to be motivated or to be successful as a learner unless he or she is first explicitly taught these weak or absent essential skills (Daly, Witt, Martens & Dool, 1997).

Motivation Deficit 1: Cannot Do the Work (Cont.)

- **How to Verify the Presence of This Motivation Problem:** The teacher collects information (e.g., through observations of the student engaging in academic tasks; interviews with the student; examination of work products, quizzes, or tests) demonstrating that the student lacks basic skills, cognitive strategies, or academic-enabling skills essential to the academic task.

Motivation Deficit 1: Cannot Do the Work (Cont.)

- **How to Fix This Motivation Problem:** Students who are not motivated because they lack essential skills need to be taught those skills.

  Direct-Instruction Format. Students learning new material, concepts, or skills benefit from a 'direct instruction' approach. (Burns, VanDerHeyden & Boice, 2008; Rosenshine, 1995; Rupley, Blair, & Nichols, 2009).

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- ❑ ensures that the lesson content is appropriately matched to students' abilities.
- ❑ opens the lesson with a brief review of concepts or material that were previously presented.
- ❑ states the goals of the current day's lesson.
- ❑ breaks new material into small, manageable increments, or steps.
- ❑ throughout the lesson, provides adequate explanations and detailed instructions for all conce and materials being taught. NOTE: Verbal explanations can include 'talk-alouds' (e.g., the teacher describes and explains each step of a cognitive strategy) and 'think-alouds' (e.g., the teacher applies a cognitive strategy to a particular problem or task and verbalizes the steps applying the strategy).
- ❑ regularly checks for student understanding by posing frequent questions and eliciting group responses.
- ❑ verifies that students are experiencing sufficient success in the lesson content to shape their learning in the desired direction and to maintain student motivation and engagement.
- ❑ provides timely and regular performance feedback and corrections throughout the lesson as needed to guide student learning.
- ❑ allows students the chance to engage in practice activities distributed throughout the lesson (e.g., through teacher demonstration; then group practice with teacher supervision and feedback; then independent, individual student practice).
- ❑ ensures that students have adequate support (e.g., clear and explicit instructions; teacher monitoring) to be successful during independent seatwork practice activities.

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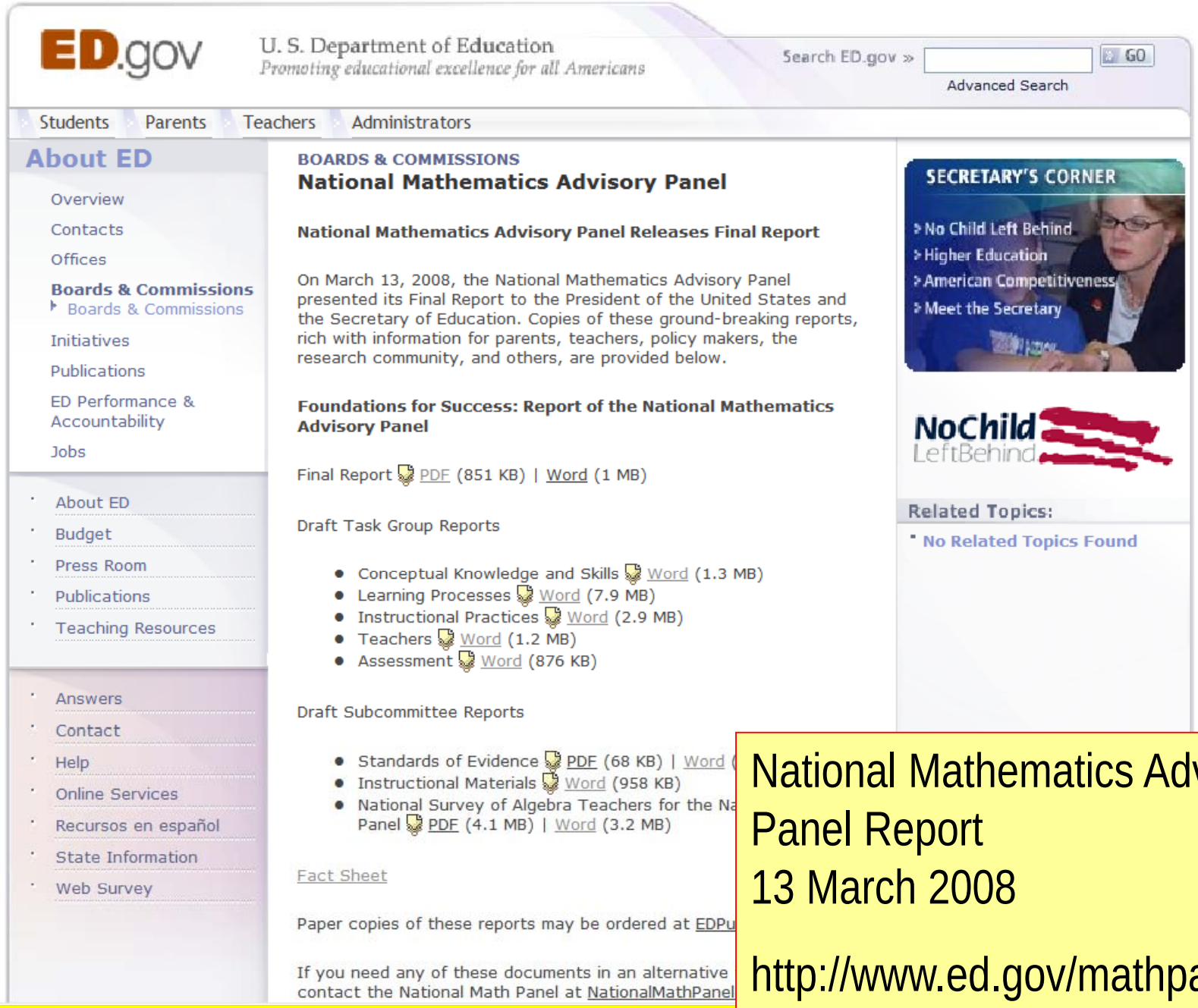
Activity: Core Instruction Fidelity Checks

- Lembke et al (2012) recommend that schools periodically use teacher self-, collegial, or administrative checks to ensure that strong explicit core instruction is occurring in mathematics classes.
- Review the Direct Instruction Format checklist that appears on page 22 of your handout.
- Discuss how your school could use this or a similar checklist to conduct occasional 'core instruction fidelity checks' to verify strong Tier 1 math instruction.

Source: Lembke, E. S., Hampton, D., & Beyers, S. J. (2012). Response to intervention in mathematics: Critical elements. Psychology in the Schools, 49(3), 257-272.



National Mathematics Advisory Panel Report
13 March 2008

http://www.ed.gov/mathpanel

2008 National Math Advisory Panel Report: Findings

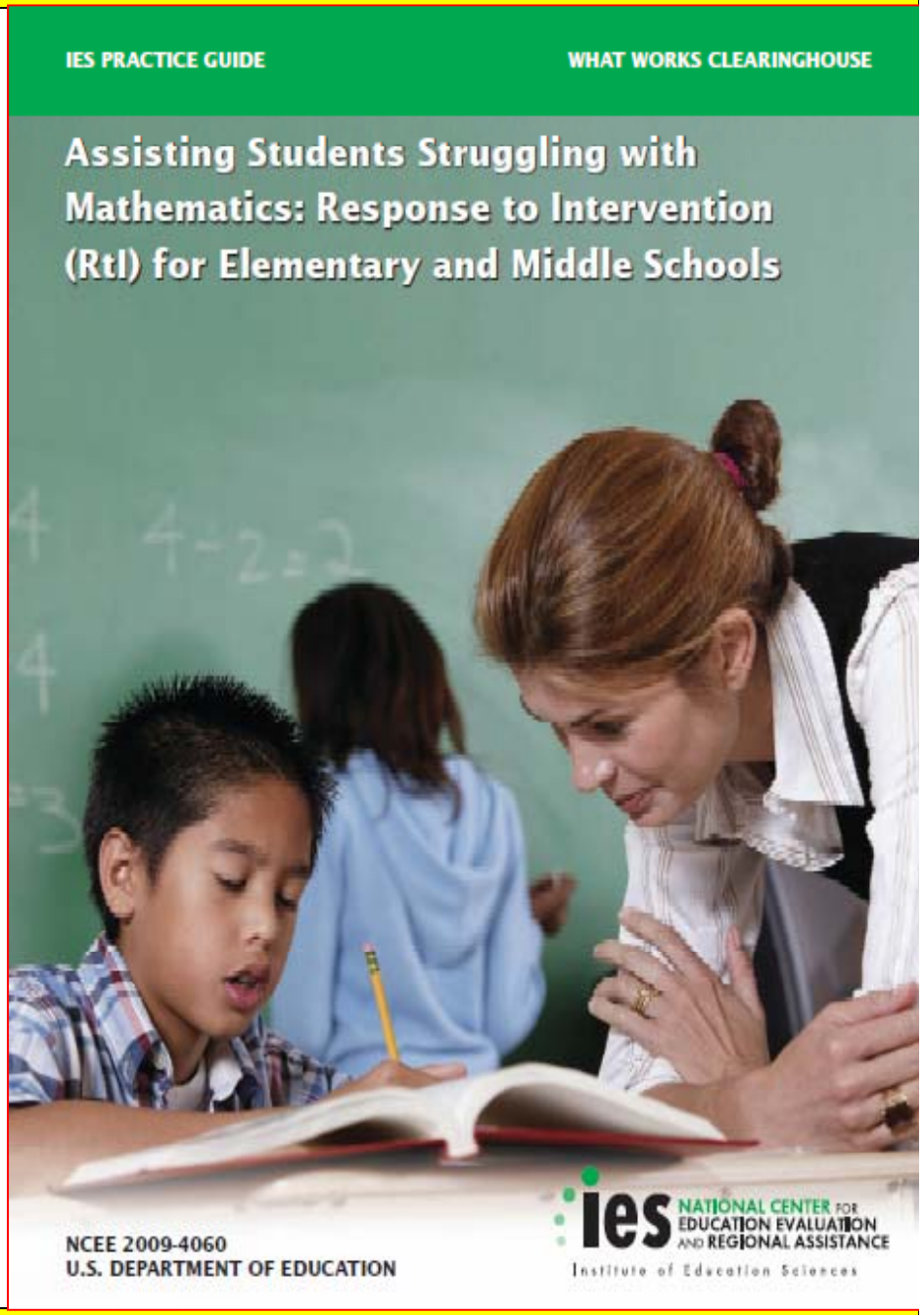
- "Teachers' regular use of formative assessments can improve student learning in mathematics."
- "Instructional practice should be informed by high-quality research, when available, and by the best professional judgment and experience of accomplished classroom teachers."
- "The belief that children of particular ages cannot learn certain content because they are "too young" or "not ready" has consistently been shown to be false."
- "Explicit instruction for students who struggle with math is effective in increasing student learning. "
- "Teachers should understand how to provide clear models for solving a problem type using an array of examples, offer opportunities for extensive practice, encourage students to "think aloud," and give specific feedback."

Source: National Math Panel Fact Sheet. (March 2008). Retrieved on August 15, 2012 from http://www2.ed.gov/about/bdscomm/list/mathpanel/report/factsheet.pdf

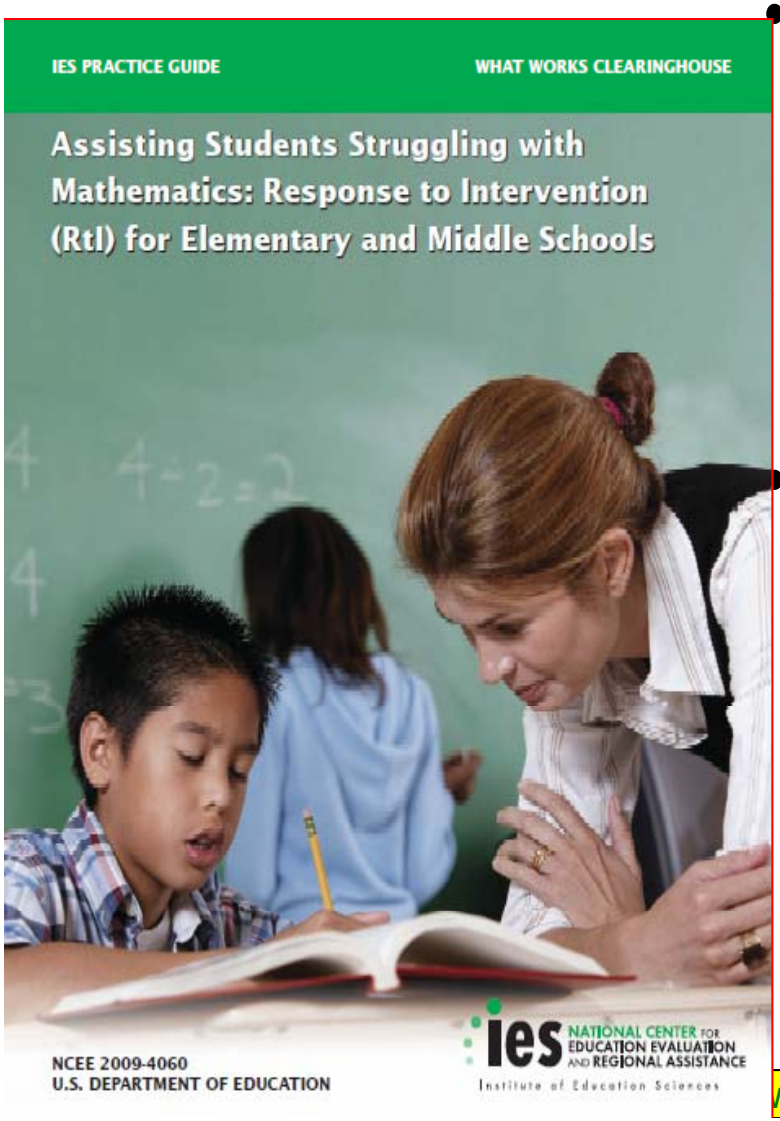
What Works Clearinghouse Practice Guide: *Assisting Students Struggling with Mathematics: Response to Intervention (RtI) for Elementary and Middle Schools*

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

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

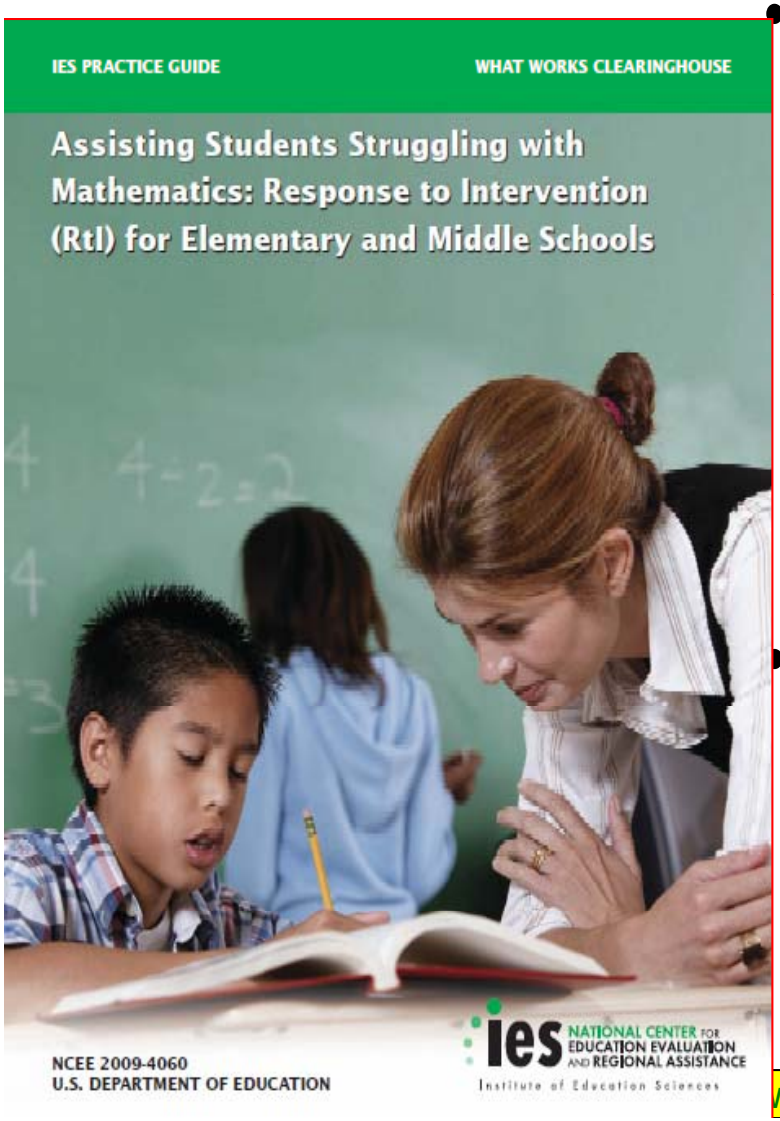


Assisting Students Struggling with Mathematics: RtI for Elementary & Middle Schools: 8 Recommendations



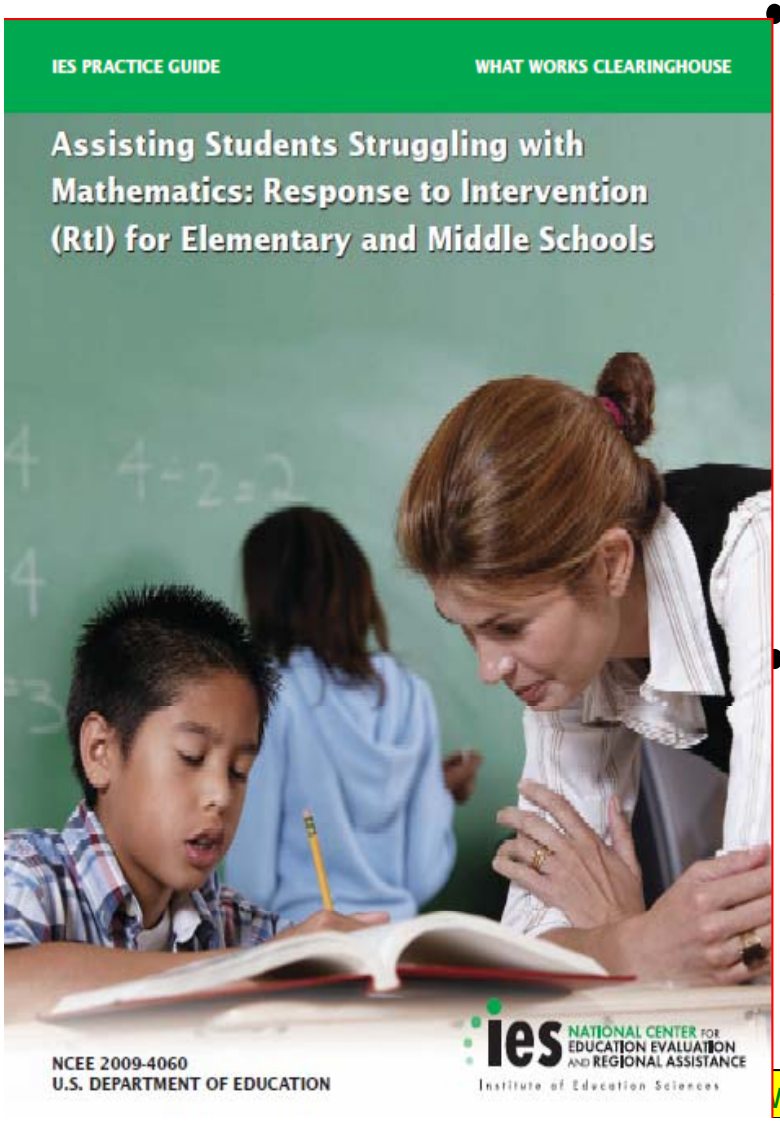
- **Recommendation 1.** Screen all students to identify those at risk for potential mathematics difficulties and provide interventions to students identified as at risk
- **Recommendation 2.** Instructional materials for students receiving interventions should focus intensely on in-depth treatment of whole numbers in kindergarten through grade 5 and on rational numbers in grades 4 through 8.

Assisting Students Struggling with Mathematics: RtI for Elementary & Middle Schools: 8 Recommendations (Cont.)



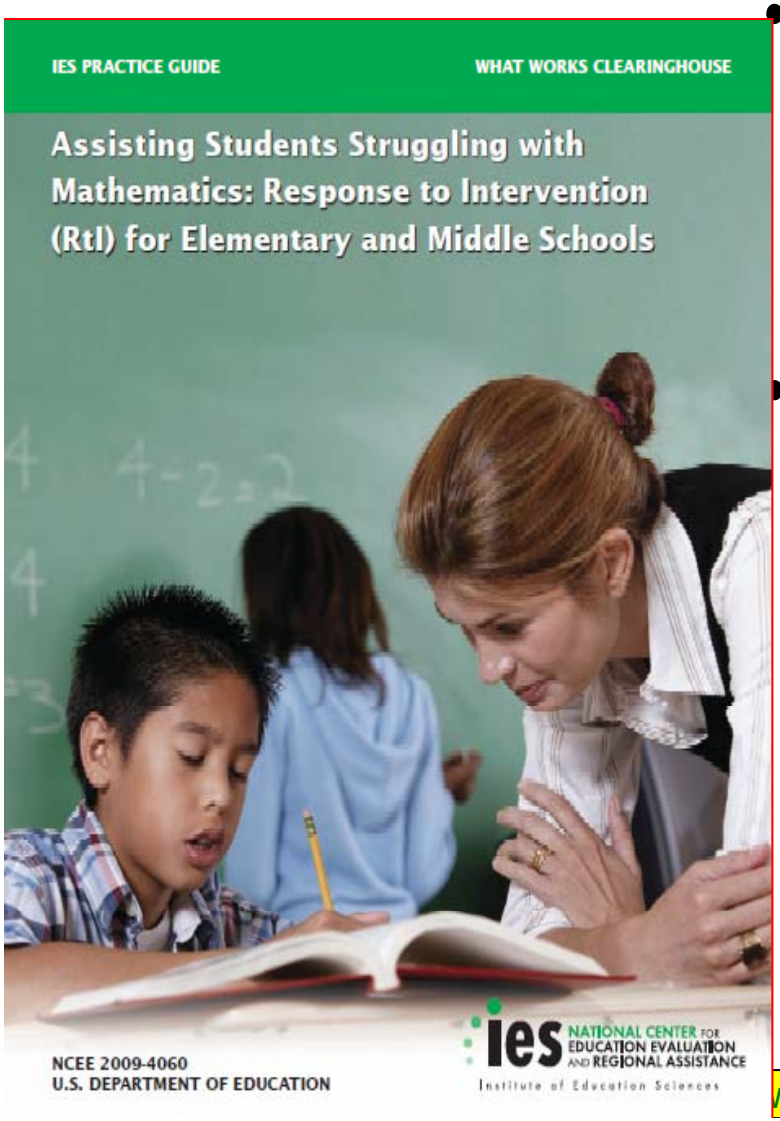
- **Recommendation 3.** Instruction during the intervention should be explicit and systematic. This includes providing models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review
- **Recommendation 4.** Interventions should include instruction on solving word problems that is based on common underlying structures.

Assisting Students Struggling with Mathematics: RtI for Elementary & Middle Schools: 8 Recommendations (Cont.)



- **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

Assisting Students Struggling with Mathematics: RtI for Elementary & Middle Schools: 8 Recommendations (Cont.)



- **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 p. 24

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 in article.

Source: Baker, S., Gersten, R., & Lee, D. (2002).A synthesis of empirical research on teaching mathematics to low-achieving students. *The Elementary School Journal, 103*(1), 51-73..

Activity: How Do We Reach Low-Performing Students? p.24

- Review the handout on p. 24 of your packet and consider each of the elements found to benefit low-performing math students.
- Select the ONE item that you feel may present the greatest challenge to fully implement. Discuss ideas for overcoming that challenge.

How Do We Reach Low-Performing Math Students?: Instructional Recommendations *Important elements of math instruction for low-performing students* (Baker, Gersten, & Lee, 2002; p. 51).'	***IDEAS FOR IMPLEMENTATION***
"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."	

Defining Our RTI Math Terms: Core Instruction, Academic Intervention, Accommodation, Modification p. 25

Core Instruction, *Interventions*, Instructional Adjustments & Modifications: Sorting Them Out

- **Core Instruction.** Those instructional strategies that are used routinely with all students in a general-education setting are considered 'core instruction'. High-quality instruction is essential and forms the foundation of RTI academic support. NOTE: While it is important to verify that good core instructional practices are in place for a struggling student, those routine practices do not 'count' as individual student interventions.

*Core Instruction, **Interventions***, Instructional Adjustments & Modifications: Sorting Them Out

- **Intervention.** An academic intervention is a strategy used to teach a new skill, build fluency in a skill, or encourage a child to apply an existing skill to new situations or settings. An intervention can be thought of as "a set of actions that, when taken, have demonstrated ability to change a fixed educational trajectory" (Methe & Riley-Tillman, 2008; p. 37).

Core Instruction, Interventions, Instructional Adjustments & Modifications: Sorting Them Out

- **Instructional Adjustment.** An instructional adjustment (accommodation) is intended to help the student to fully access and participate in the general-education curriculum without changing the instructional content and without reducing the student's rate of learning (Skinner, Pappas & Davis, 2005). An instructional adjustment is intended to remove barriers to learning while still expecting that students will master the same instructional content as their typical peers.
  - instructional adjustment example 1: Students are allowed to supplement silent reading of a novel by listening to the book on tape.
  - instructional adjustment example 2: For unmotivated students, the instructor breaks larger assignments into smaller 'chunks' and providing students with performance feedback and praise for each completed 'chunk' of assigned work (Skinner, Pappas & Davis, 2005).

> *"Teaching is giving; it isn't taking away."*
>
> *(Howell, Hosp & Kurns, 2008; p. 356).*

Source: Howell, K. W., Hosp, J. L., & Kurns, S. (2008). Best practices in curriculum-based evaluation. In A. Thomas & J. Grimes (Eds.), *Best practices in school psychology V* (pp.349-362). Bethesda, MD: National Association of School Psychologists..

Core Instruction, Interventions, Instructional Adjustments & **Modifications**: Sorting Them Out

- **Modification.** A modification changes the expectations of what a student is expected to know or do in core instruction—typically by lowering the academic standards against which the student is to be evaluated.

  Examples of modifications:

  – Giving a student five math computation problems for practice instead of the 20 problems assigned to the rest of the class

  – Letting the student consult course notes during a test when peers are not permitted to do so

RTI: Are Modifications Occurring in Math Core Instruction?

In your 'elbow groups', discuss the difference between 'instructional adjustment (accommodation)' and 'modification' (p. 25).

Are there times in your classroom or school when it is difficult to avoid modifying math core instruction for a general-education student? Discuss these challenging situations.

Best Practices in Secondary Math Intervention Planning Sheet

GOAL 1: Creating a Supportive Math Instructional Environment. The math classroom that offers explicit instruction, accommodations, and strong core math instruction can reach the widest range of struggling learners.

List the 'next steps' that you plan to follow to accomplish this goal:

1. _____
2. _____
3. _____
4. _____
5. _____

Who in your school or district will you need to enlist to help you with this goal?:

1. _____
2. _____

What resources will you need beyond those supplied in this training to accomplish the goal?

1. _____
2. _____

p. 42

_____

_____

_____

Planning Activity Report Out Procedures

- Review your table number.
- Before beginning your RTI planning, select 2 members of your table who will visit another table as 'ambassadors' for the report-out part of the activity.
- During the report-out, your ambassadors will visit the following tables:
  - Activity 1: Your table number +1
  - Activity 2: Your table number +2
  - Activity 3: Your table number +3
  - Activity 4: Your table number +4

Activity: 'Next Steps' Planning Sheet

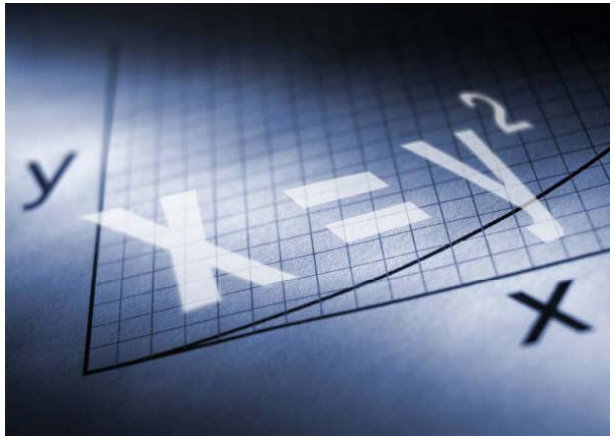
- *GOAL 1: Creating a Supportive Classroom Instructional Environment.*
- Complete the *Goal 1 Planning Sheet*-p. 42.
- When directed, you will report out on your discussion to your '+1' table.

Key Points About Creating a Supportive Classroom Instructional Environment

- Math teachers can get valuable pointers on recommended core instructional practices from the National Math Advisory Panel (2008) and the What Works Clearinghouse Practice Guide *Assisting Students Struggling with Mathematics: RtI for Elementary & Middle Schools*
- Research has revealed instructional elements that work well with low-performing math students (see handout on p 24).
- Explicit instruction is recommended in core math instruction and during student interventions to reach the widest range of students (see handout on pp. 21-23).

Measuring Student Math Skills

Focus of Inquiry: How can schools efficiently measure math skills to optimize core instruction and match struggling students to appropriate interventions?



Educational Decisions and Corresponding Types of Assessment

- SCREENING/BENCHMARKING DECISIONS: Tier 1: Brief screenings to quickly indicate whether students in the general-education population are academically proficient or at risk.
- PROGRESS-MONITORING DECISIONS: At Tiers 1, 2, and 3, ongoing 'formative' assessments to judge whether students on intervention are making adequate progress.
- INSTRUCTIONAL/DIAGNOSTIC DECISIONS: At any Tier, detailed assessment to map out specific academic deficits , discover the root cause(s) of a student's academic problem.
- OUTCOME DECISIONS: Summative assessment (e.g., state tests) to evaluate the effectiveness of a program.

Source: Hosp, M. K., Hosp, J. L., & Howell, K. W. (2007). The ABCs of CBM: A practical guide to curriculum-based measurement. New York: Guilford Press.

Methods of RTI Math Assessment

Basic Facts: Computation Fluency	The student completes a timed worksheet of basic computation math facts. This measure has been studied with grades 6 & 7.
Math Concepts & Applications: www.easycbm.com	The student completes mixed problems that sample (1)Algebra;(2) Geometry & Measurement; (3) Data Analysis, Number Operations & Algebra. Items correspond to the NCTM Math Focal Points.
AAIMS Algebra Progress-Monitoring Measures	Measures fall into these categories: (1) Algebra Basic Skills; (2) Algebra Foundations; (3) Algebra Content Analysis.
Teacher-Guided Diagnostic Math Assessment	The teacher collects data on student math performance via (1) CRA (Concrete-Representational-Abstract) Assessment; (2) Error Pattern Analysis; (3) Mathematics Interview
MAP 'Classroom Challenges' Formative Assessment Lessons	These MS and HS math lessons are designed to give teachers real-time information about student understanding and mastery of 2 kinds of lessons: Problem Solving and Concept Development
MAP Prototype Summative Assessment Tests	These ambitious tests are models for what MS and HS math assessments may look like in the era of the ambitious Common Core State Standards.

Computation Fluency: 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*

Source: *Gersten, R., Jordan, N. C., & Flojo, J. R. (2005). Early identification and interventions for students with mathematics difficulties. Journal of Learning Disabilities, 38, 293-304.*

Screening/Progress-Monitoring

Basic Facts: (Computation Fluency)

- This measure was studied with students from 6th & 7th grade.
- The student is given a timed worksheet of computation problems that is a mix of basic math facts (addition, subtraction, multiplication, division).
- While computation probes used at the elementary level are scored by **correct digit**, the scoring unit of Basic Facts is **correct responses**.

Source: *Foegen, A. (2008). Progress monitoring in middle school mathematics: Options and issues. Remedial and Special Education, 29(4), 195-207.*

Screening/Progress-Monitoring

Basic Facts: (Computation Fluency)

The Basic Facts progress-monitoring measure was found:

- To be sensitive to student growth in automatic retrieval of math facts
- To have moderately strong 'predictive validity' (that is, predicting grade-level math success).

Drawback: No 'national' norms are available. One workaround would be to norm locally (e.g., in your classroom) and provide math facts interventions to the lowest 25%.

Source: *Foegen, A. (2008). Progress monitoring in middle school mathematics: Options and issues. Remedial and Special Education, 29(4), 195-207.*

Instructional/Diagnostic Assessment

EasyCBM.com [http://www.easycbm.com]:

The student goes online to complete a mixed-skills series of 'concepts & applications' in mathematics that were developed using the Math Focal Points from the NCTM. The measures go up to grade 8

Probes are divided into 3 categories::

- Algebra Geometry & Measurement
- Data Analysis
- Number Operations & Algebra

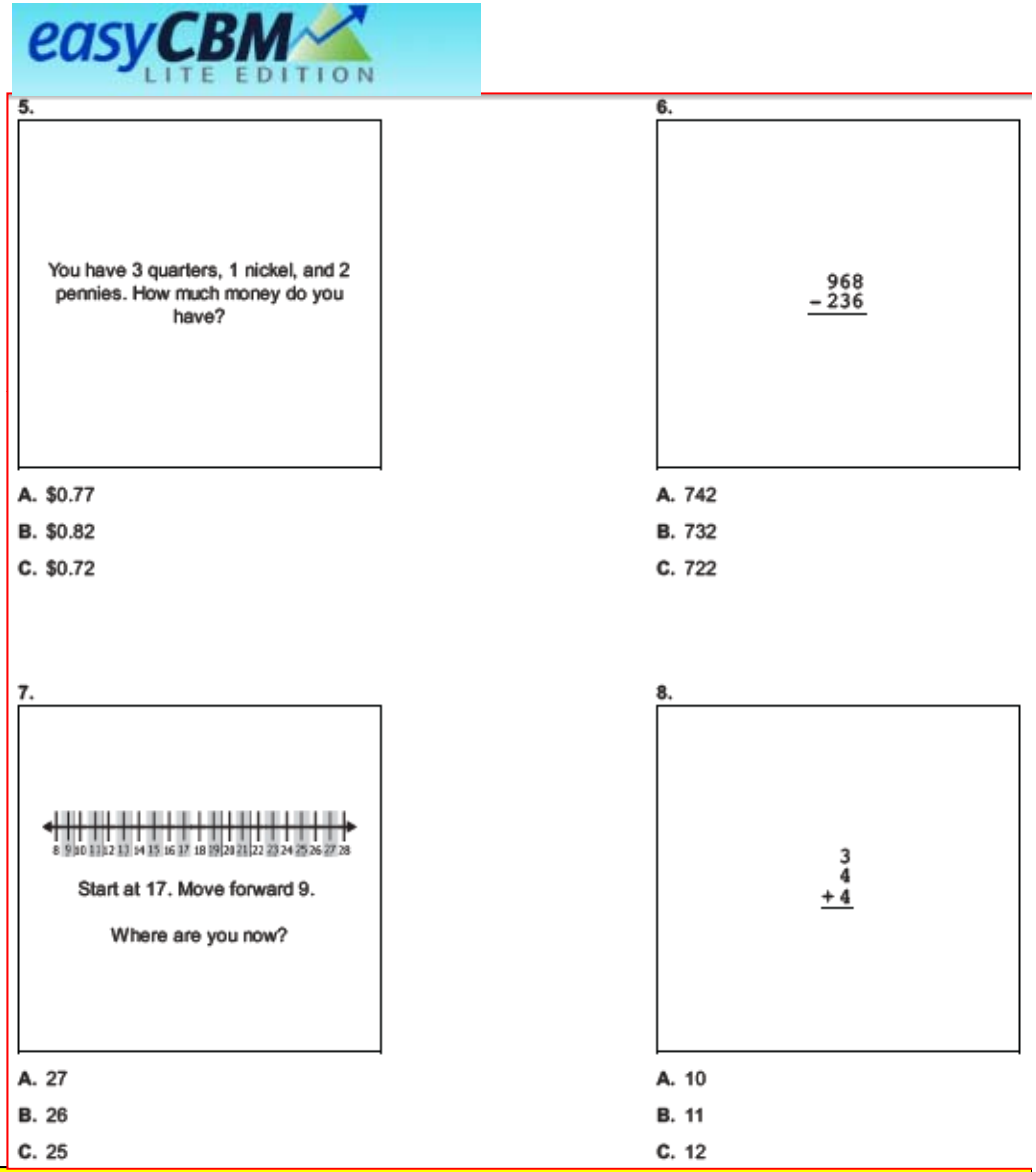
Screening/Progress-Monitoring

EasyCBM.com [http://www.easycbm.com]:

This website provides two levels of support for the Concepts & Applications measures:

• Teacher Version [free]: Any teacher can create a free account and use *easycbm* tools to monitor student progress on interventions. NOTE: There are 16 items on the C&A Teacher Version probes.

• District Version [pay]: Allows schools to screen student populations 3 times per year. NOTE: There are 45 items on the C&A District Version probes.



Using Research Math Norms to Estimate Risk: EasyCBM Example

- Low Risk: At or above the 20th percentile: *Core instruction alone is sufficient for the student.*
- Some Risk: 10th to 20th percentile: *The student will benefit from supplemental intervention in the math area(s) assessed.*
- At Risk: Below 10th percentile : *The student requires intensive intervention in the math area(s) assessed.*

Percentile	Algebra			Geometry and Measurement			Data Analysis, Number, Operations and Algebra			Math Benchmark*		
	Fall	Wint	Sprg	Fall	Wint	Sprg	Fall	Wint	Sprg	Fall	Wint	Sprg
10th	6	7	7	7	8	8	9	10	8	22	24	22
20th	7	9	8	9	9	10	11	11	11	24	27	25
50th	10	15	11	12	13	13	14	15	15	32	38	35
75th	12	16	14	14	15	15	16	16	16	39	43	41
90th	14	16	16	16	16	16	16	16	16	42	44	43

Screening/Progress-Monitoring

Algebra Assessment & Instruction: Meeting Standards

http://www.education.iastate.edu/c_i/aaims/:

The website provides brief progress-monitoring forms of algebra assessments that can be used to track the progress of an entire class at Tier 1 or specific students on Tier 2/3 algebra interventions. [This is a pay site.]

AAIMS: Algebra Measures

The AAIMS Algebra screening/progress-monitoring measures fall into 3 categories:

- **Algebra Basic Skills.** Assesses "basic algebra skill indicators.'
- **Algebra Foundations.** Measures "working with variables and expressions; manipulating expressions involving integers, exponents, and order of operations; basic graphing; solving simple equations; and solving problems involving patterns and functions." p. 242.
- **Algebra Content Analysis.** Measures that sample the content and progression of a typical algebra course, with items from the beginning, middle, and end of the course.

Source: *Foegen, A., Olson, J. R., & Impecoven-Lind, L. (2008).Developing progress monitoring measures for secondary mathematics: An illustration in algebra. Assessment for Effective Intervention, 33(4), 240-249.*

AAIMS: Algebra Measures

The researchers who created the AAIMS Algebra measures are now working on a successor project:

Professional Development: Algebra Progress-Monitoring

http://www.education.iastate.edu/c_i/pdapm/.

The goal of this ongoing project is to create online training in the use of the algebra monitoring tools and to create data tools to help teachers to analyze student data to make instructional decisions.

Clearinghouse for RTI Screening and Progress-Monitoring Tools

- The National Center on RTI (www.rti4success.org) maintains pages rating the technical adequacy of RTI screening and progress-monitoring tools.
- Schools should strongly consider selecting screening tools that have national norms or benchmarks to help them to assess the academic-risk level of their students.

Tools	Area	Reliability of the Performance Level Score	Reliability of the Slope	Validity of the Performance Level Score	Predictive Validity of the Slope of Improve-ment	Alternate Forms	Sensitive to Student Improve-ment	End-of-Year Bench-marks	Rates of Improve-ment Specified	Norms Disagg-regated for Diverse Populations	Disagg-regated Reliability and Validity Data	COMPARE / RESET
AIMSweb	Math	●	●	●	●	◐	◐	●	●	No	●	☐
AIMSweb	Oral Reading	●	●	●	●	●	◐	●	●	No	●	☐
AIMSweb	Test of Early Literacy - Letter Naming Fluency	●	●	●	●	●	◐	●	●	No	●	☐
AIMSweb	Test of Early Literacy - Letter Sound Fluency	●	●	●	●	●	◐	●	●	No	●	☐

Teacher-Guided Diagnostic Math Assessment

The math instructor can collect information on the math performance of individual students to better understand their strengths and weaknesses and to target areas requiring intervention.

Three major sources of diagnostic information include:

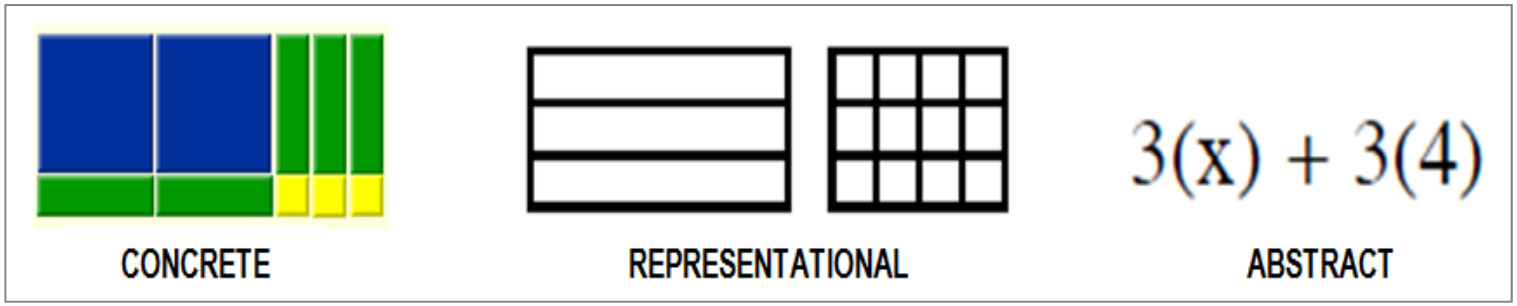
- CRA (Concrete-Representational-Abstract) Assessment
- Error Pattern Analysis
- Mathematics Interview

Sources: *Lembke, E. S., Hampton, D., & Beyers, S. J. (2012). Response to intervention in mathematics: Critical elements. Psychology in the Schools, 49(3), 257-272.*

Stewart, L. H. & Silberglit, B. (2008). Best practices in developing academic local norms. In A. Thomas & J. Grimes (Eds.), Best practices in school psychology V (pp. 225-242). Bethesda, MD: National Association of School Psychologists.

Teacher-Guided Diagnostic Math Assessment

- CRA (Concrete-Representational-Abstract) Assessment. Students fall along a continuum in mathematical reasoning. When confronted with an algebra problem, some rely on 3-dimensional ('concrete') manipulatives such as algebra tiles to solve; others are able to answer the same problem using two-dimensional ('representation') diagrams; and still others can master the problem via ('abstract') reasoning alone. The teacher can judge a student's place on the CAR continuum by giving that student various problems to solve with and without concrete and representational aids.



Teacher-Guided Diagnostic Math Assessment

- **Error Pattern Analysis.** The teacher reviews completed student math problems from homework, in-class work, or tests, looking for patterns in the errors that the student commonly makes.

  This analysis might reveal that the student selects the wrong operation, uses an incorrect algorithm, or commits other types of errors. Error pattern analysis can be helpful not only in drawing the student's attention to common mistakes but in alerting the teacher to student misunderstandings of math concepts.

Teacher-Guided Diagnostic Math Assessment

- **Student Math Interview.** The teacher conducts a structured math interview with the student to observe his or her math reasoning skills and content knowledge--and possibly to uncover student errors or misunderstandings.

  The teacher can choose to run the interview as a 'think aloud' in which the student is given a problem to solve and directed to verbalize the steps needed to reach the solution.

  Alternatively the teacher may structure the interview to include specific questions about the definition of selected math terms or concepts. The student may also be encouraged to draw a problem before solving it or may be given manipulatives and/or diagrams to use in its solution.

MAP: 'Classroom Challenges' Formative Assessment Lessons

The Mathematics Assessment Project (MAP) is a collaboration between the University of Nottingham (UK) and the University of California at Berkeley. MAP receives funding from the Bill and Melinda Gates Foundation.

One of the free resources being developed by MAP is a series of 'Classroom Challenges' formative assessment lessons for middle and high school.

The 'Classroom Challenges' Lessons are divided into two types: *Problem Solving* and *Concept Development*.

MAP: 'Classroom Challenges' Formative Assessment Lessons (Cont.)

The 'Classroom Challenges' Lessons have the following elements:

- math problems to be solved
- examples of previously collected student work to be analyzed by students as part of the lesson
- discussion questions
- teacher guidance on how to solve the math problems, interpret student responses, and intervene with students who may need extra assistance.

Instructional/Diagnostic Assessment

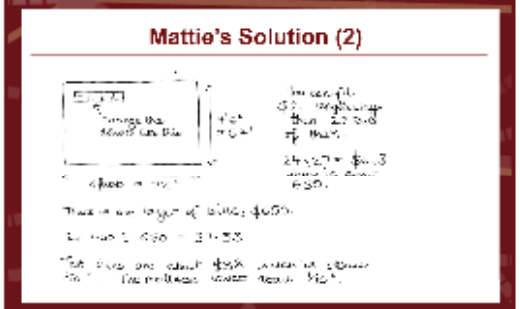
MAP: 'Classroom Challenges' Formative Assessment Lessons

Mathematics Assessment Project
CLASSROOM CHALLENGES
Formative Assessment Lessons (beta) for Middle School

MARS Mathematics Assessment Resource Service

Home | MAP Overview | Lessons | Tasks | Tests | Professional Development | Standards | Instructions | Log In

Formative Assessment Lessons (beta) | Middle School | Find: | Go



- High School
- **Middle School**

Problem Solving

- Using Dimensions: Designing a Sports Bag
- Developing a Sense of Scale
- Estimations and Approximations: The Money Munchers
- Estimating: Counting Trees

▸ Read more about the purpose of the MAP *Classroom Challenges…*

Estimations and Approximations: The Money Munchers

Mathematical goals

This lesson unit is intended to help you assess how well students are able to:

- Model a situation.
- Make sensible, realistic assumptions and estimates.
- Use assumptions and estimates to create a chain of reasoning, in order to solve a practical problem.

Introduction

In this unit, students choose and use mathematics to model a problem situation.

- Before the lesson, students attempt the task *The Money Munchers* individually. You then review their work and create questions for them to answer in order to improve their solutions.
- At the start of the lesson, students again work individually on *The Money Munchers* task, answering your questions.

Summative (Outcome) Measures

Mathematics Assessment Project: Prototype Summative Assessment Tests

The Mathematics Assessment Project (MAP) has created prototypes of ambitious tests to test student mastery of the Common Core State Standards. These materials are free.

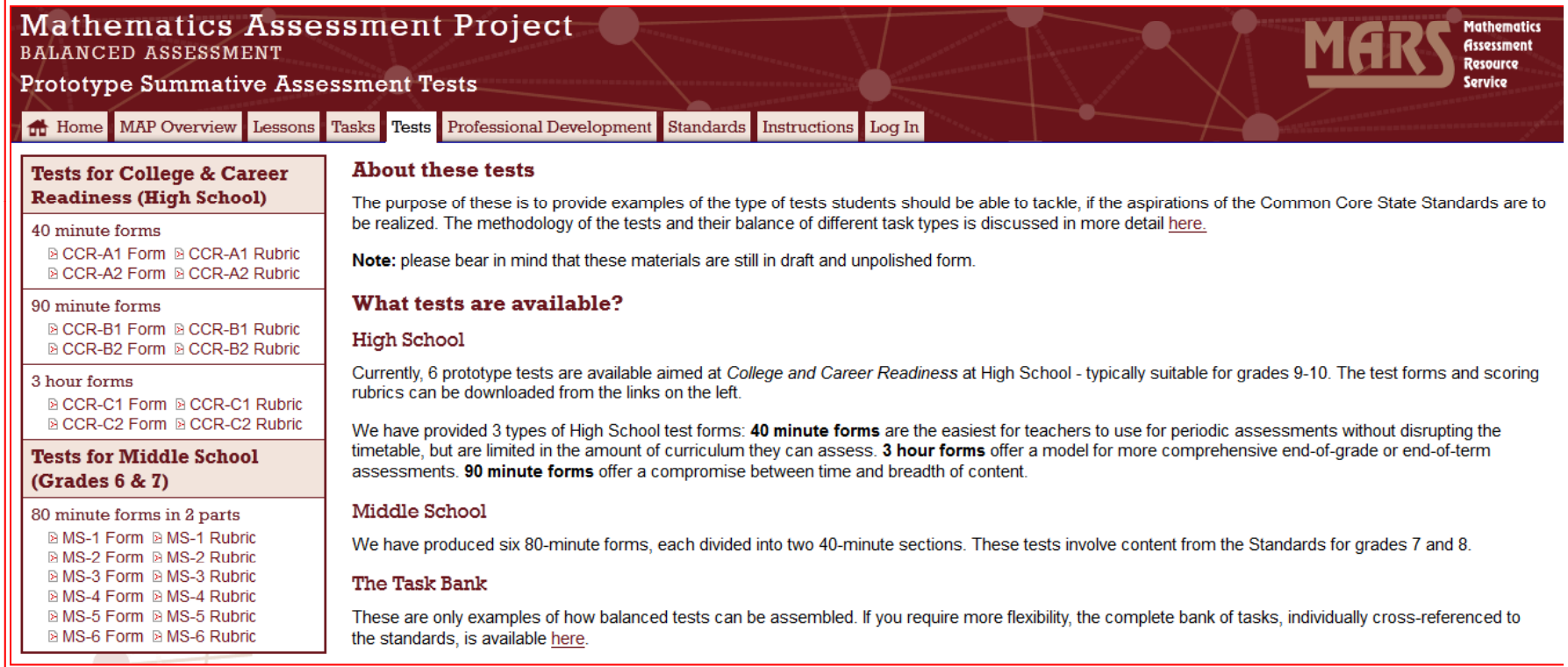
Tests for middle school are 80-minute exams, divided into 2 parts.

The Tests for College & Career Readiness (high school) come in three versions: (1) 40 minutes; (2) 90 minutes; (3) 180 minutes

Schools are explicitly cautioned **not** to incorporate these prototype materials into high-stakes tests. However, schools may wish to review the test bank to obtain ideas for constructing test items and to get a sense of what kinds of test questions are needed to measure attainment of Common Core State Standards.

Summative (Outcome) Measures

Mathematics Assessment Project: Prototype Summative Assessment Tests



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MAP Prototype Summative Assessment Tests	These ambitious tests are models for what MS and HS math assessments may look like in the era of the ambitious Common Core State Standards.

Best Practices in Secondary Math Intervention Planning Sheet

GOAL 2: Obtaining or Developing Classroom Formative Math Assessments. Teachers who can measure student math skills formatively can efficiently adjust instruction to meet the needs of a wider range of math learners.

List the 'next steps' that you plan to follow to accomplish this goal:

1. _____
2. _____
3. _____
4. _____
5. _____

Who in your school or district will you need to enlist to help you with this goal?:

1. _____
2. _____

What resources will you need beyond those supplied in this training to accomplish the goal?

1. _____
2. _____

p. 42

_____

_____

_____

Planning Activity Report Out Procedures

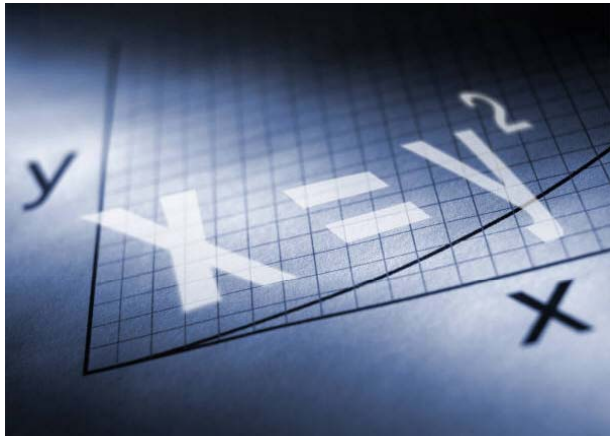
- Review your table number.
- Before beginning your RTI planning, select 2 members of your table who will visit another table as 'ambassadors' for the report-out part of the activity.
- During the report-out, your ambassadors will visit the following tables:
  - Activity 1: Your table number +1
  - Activity 2: Your table number +2
  - Activity 3: Your table number +3
  - Activity 4: Your table number +4

Activity: 'Next Steps' Planning Sheet

- *GOAL 2: Obtaining or Developing Classroom Formative Math Assessments.*
- Complete the *Goal 2 Planning Sheet*-p. 42.
- When directed, you will report out on your discussion to your '+2' table.

Secondary Mathematics & Interventions

Focus of Inquiry: What intervention support should be offered to students who struggle with middle-school or high-school mathematics?



Common Core State Standards: Supporting Different Learners in Mathematics Instruction

"The [Common Core State] Standards set grade-specific standards but do not define the intervention methods or materials necessary to support students who are well below or well above grade-level expectations.

It is also beyond the scope of the Standards to define the full range of supports appropriate for English language learners and for students with special needs."

Source: *National Governors Association Center for Best Practices and Council of Chief State School Officers. (2010). Common core state standards for mathematics. Retrieved on September 23, 2012, from http://www.corestandards.org/; p. 4.*

Common Core State Standards: Supporting Different Learners in Mathematics Instruction (Cont.)

"At the same time, all students must have the opportunity to learn and meet the same high standards if they are to access the knowledge and skills necessary in their post-school lives.

The Standards should be read as allowing for the widest possible range of students to participate fully from the outset, along with appropriate accommodations to ensure maximum participation of students with special education needs."

Source: *National Governors Association Center for Best Practices and Council of Chief State School Officers. (2010). Common core state standards for mathematics. Retrieved on September 23, 2012, from http://www.corestandards.org/; p. 4.*

Interventions: Potential 'Fatal Flaws'

Any intervention must include 4 essential elements. The absence of any one of the elements would be considered a 'fatal flaw' (Witt, VanDerHeyden & Gilbertson, 2004):

1. *Clearly defined problem.* The student's target concern is stated in specific, observable, measureable terms. This 'problem identification statement' is the most important step of the problem-solving model (Bergan, 1995), as a clearly defined problem allows the teacher or RTI Team to select a well-matched intervention to address it.
2. *Baseline data*. The teacher or RTI Team measures the student's academic skills in the target concern (e.g., reading fluency, math computation) prior to beginning the intervention. Baseline data becomes the point of comparison throughout the intervention to help the school to determine whether the intervention is effective.

Source: Witt, J. C., VanDerHeyden, A. M., & Gilbertson, D. (2004). Troubleshooting behavioral interventions. A systematic process for finding and eliminating problems. *School Psychology Review, 33*, 363-383.

Interventions: Potential 'Fatal Flaws' (Cont.)

3. *Performance goal*. The teacher or RTI Team sets a specific, data-based goal for student improvement during the intervention and a checkpoint date by which the goal should be attained.
4. *Progress-monitoring plan*. The teacher or RTI Team collects student data regularly to determine whether the student is on-track to reach the performance goal.

Source: Witt, J. C., VanDerHeyden, A. M., & Gilbertson, D. (2004). Troubleshooting behavioral interventions. A systematic process for finding and eliminating problems. *School Psychology Review, 33*, 363-383.

The Key Role of Classroom Teachers as 'Interventionists' in RTI: 6 Steps

1. The teacher defines the student academic or behavioral problem clearly.
2. The teacher decides on the best explanation for why the problem is occurring.
3. The teacher selects 'research-based' interventions.
4. The teacher documents the student's Tier 1 intervention plan.
5. The teacher monitors the student's response (progress) to the intervention plan.
6. The teacher knows what the next steps are when a student fails to make adequate progress with Tier 1 interventions alone.

Classroom Intervention Planning Sheet

Teacher/Team: _____ Date: _____ Student: _____

Student Problem Definition #1: _____

Student Problem Definition #2: _____

[Optional] Person(s) assisting with intervention planning process: _____

Interventions: Essential Elements (Witt et al., 2004)

- Clear problem-definition(s)
- Baseline data
- Goal for improvement
- Progress-monitoring plan

Intervention Description	Intervention Delivery	Check-Up Date	Assessment Data
Describe each intervention that you plan to use to address the student's concern(s).	List key details about delivery of the intervention, such as:; (1) where & when the intervention will be used; (2) the adult-to-student ratio; (3) how frequently the intervention will take place; (4) the length of time each session of the intervention will last;.	Select a date when the data will be reviewed to evaluate the intervention.	Note what classroom data will be used to establish baseline , set a goal for improvement, and track the student's progress during this intervention.
			Type(s) of Data to Be Used:
			Baseline / Goal by Check-Up
			Type(s) of Data to Be Used:
			Baseline / Goal by Check-Up
			Type(s) of Data to Be Used:
			Baseline / Goal by Check-Up

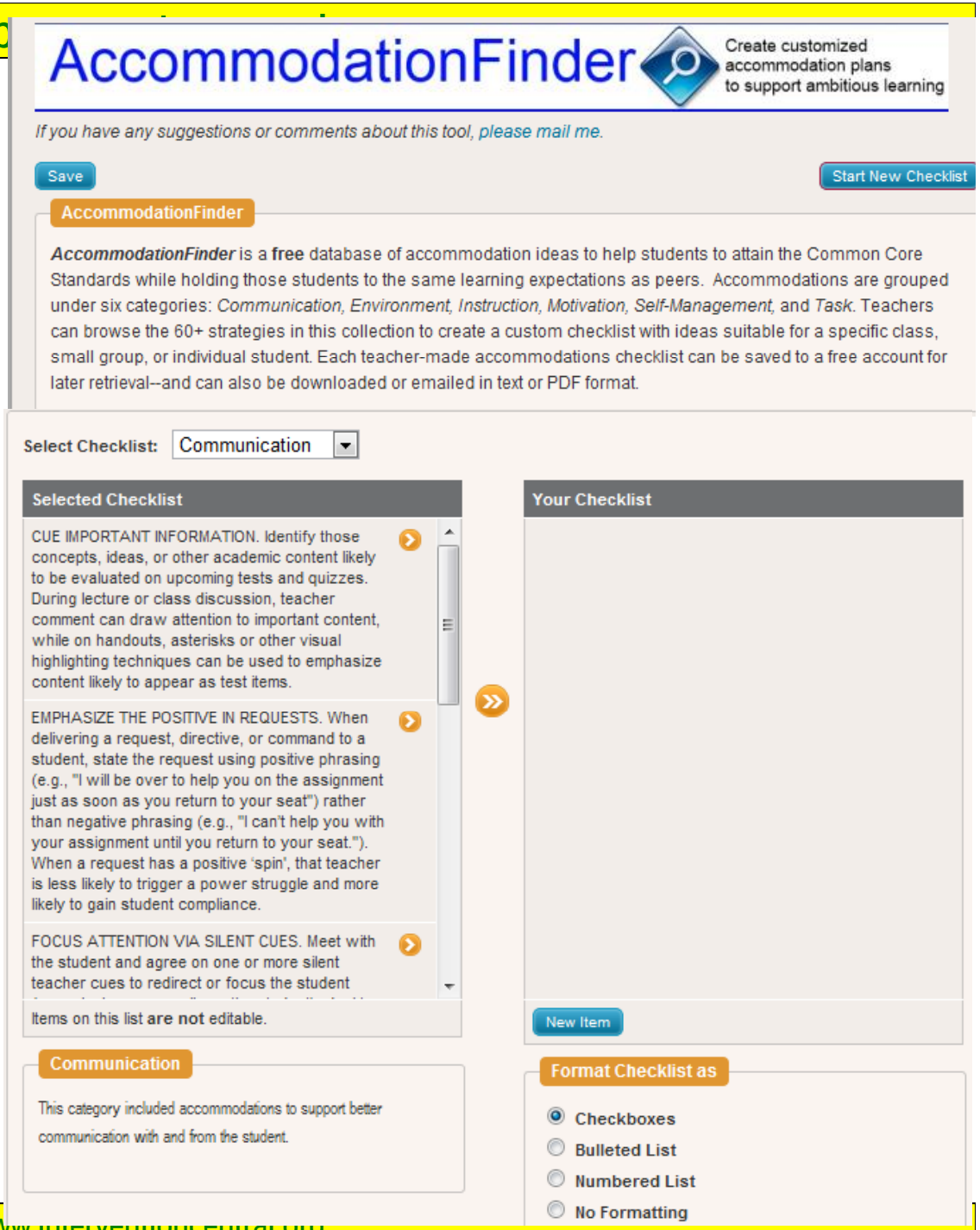
Form Available on Conference Web Page

AccommodationFinder

http://www.interventioncentral.org/tools/accommodationfinder

This application allows the user to browse a set of 60+ classroom accommodations to put together a unique plan for a struggling learner.

NOTE: These ideas are featured in your workshop handout: pp. 26-41



Sample Math Interventions for Secondary Classrooms

Peer Tutoring in Math Computation with Constant Time Delay (Available on Conference Web Page)

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 (Menesses & 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.

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.

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

Reciprocal Peer Tutoring in Math Computation: Teacher Nomination Form

Teacher: _____ Classroom: _____ Date: _____

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.
- 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).
- Can 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).

Number	Student Name	NOTES
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		

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.			
Correctly Carried Out?	Step	Tutor Action	NOTES
__Y__N	1.	**Promptly Initiates Session.** At the start of the timer, the tutor immediately presents the first math-fact card.	
__Y__N	2.	**Presents Cards.** The tutor presents each card to the tutee for 3 seconds.	
__Y__N	3.	**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.	
__Y__N	4.	**Provides Praise.** The tutor praises the tutee immediately following correct answers.	
__Y__N	5.	**Shuffles Cards.** When the tutor and tutee have reviewed all of the math-fact cards, the tutor shuffles them before again presenting cards.	
__Y__N	6.	**Continues to the Timer.** The tutor continues to presents math-fact cards for tutee response until the timer rings.	

Peer Tutoring in Math Computation: Intervention Integrity Sheet (Part 2: Progress-Monitoring)

Tutoring Session: Assessment Phase			
Directions: Observe the tutor and tutee during the progress-monitoring phase of the session. Use this checklist to record whether each of the key steps of the assessment were correctly followed.			
Correctly Carried Out?	Step	Tutor Action	NOTES
__Y__N	1.	**Presents Cards.** The tutor presents each card to the tutee for 3 seconds.	
__Y__N	2.	**Remains Silent.** The tutor does not provide performance feedback or praise to the tutee, or otherwise talk during the assessment phase.	
__Y__N	3.	**Sorts Cards.** The tutor sorts cards into 'correct' and 'incorrect' piles based on the tutee's responses.	
__Y__N	4.	**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: Score Sheet

Math Tutoring: Score Sheet

Tutor 'Coach': _____ Tutee 'Player': _____

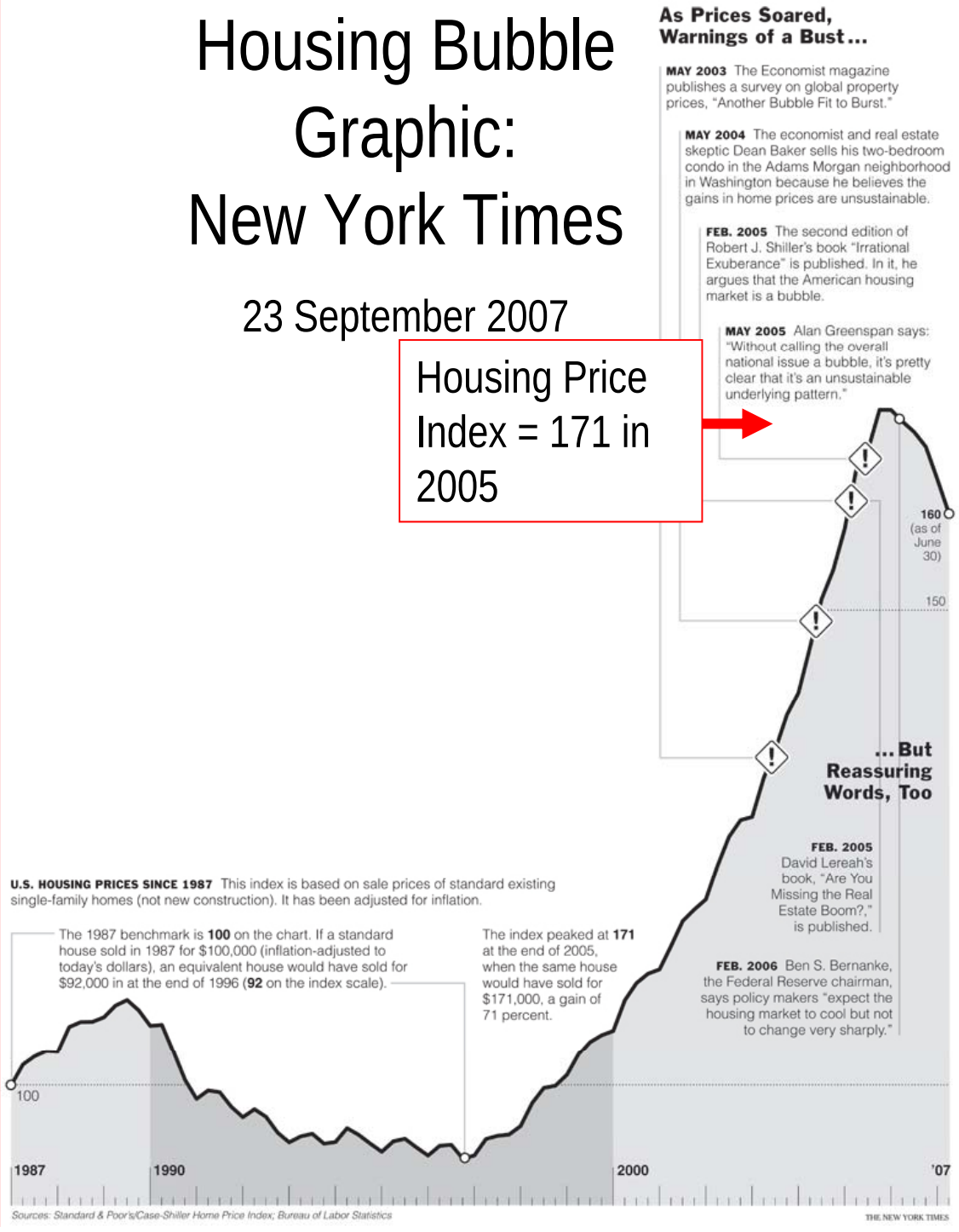
Directions to the Tutor: Write down the number of math-fact cards that your partner answered *correctly* and the number answered *incorrectly*.		
Date:	Cards Correct:	Cards Incorrect:
Date:	Cards Correct:	Cards Incorrect:
Date:	Cards Correct:	Cards Incorrect:
Date:	Cards Correct:	Cards Incorrect:
Date:	Cards Correct:	Cards Incorrect:
Date:	Cards Correct:	Cards Incorrect:
Date:	Cards Correct:	Cards Incorrect:
Date:	Cards Correct:	Cards Incorrect:

Interpreting Math Graphics: A Reading Comprehension Intervention p. 11

Housing Bubble Graphic: New York Times

23 September 2007

Housing Price Index = 171 in 2005



Housing Price Index = 100 in 1987

Classroom Challenges in Interpreting Math Graphics

When encountering math graphics, students may :

- expect the answer to be easily accessible when in fact the graphic may expect the reader to interpret and draw conclusions
- be inattentive to details of the graphic
- treat irrelevant data as 'relevant'
- not pay close attention to questions before turning to graphics to find the answer
- fail to use their prior knowledge both to extend the information on the graphic and to act as a possible 'check' on the information that it presents.

Source: *Mesmer, H.A.E., & Hutchins, E.J. (2002). Using QARs with charts and graphs. The Reading Teacher, 56, 21–27.*

Using Question-Answer Relationships (QARs) to Interpret Information from Math Graphics

Students can be more savvy interpreters of graphics in applied math problems by applying the Question-Answer Relationship (QAR) strategy. Four Kinds of QAR Questions:

- RIGHT THERE questions are fact-based and can be found in a single sentence, often accompanied by 'clue' words that also appear in the question.
- THINK AND SEARCH questions can be answered by information in the text but require the scanning of text and making connections between different pieces of factual information.
- AUTHOR AND YOU questions require that students take information or opinions that appear in the text and combine them with the reader's own experiences or opinions to formulate an answer.
- ON MY OWN questions are based on the students' own experiences and do not require knowledge of the text to answer.

Source: *Mesmer, H.A.E., & Hutchins, E.J. (2002). Using QARs with charts and graphs. The Reading Teacher, 56, 21–27.*

Using Question-Answer Relationships (QARs) to Interpret Information from Math Graphics: 4-Step Teaching Sequence

1. DISTINGUISHING DIFFERENT KINDS OF GRAPHICS. Students are taught to differentiate between common types of graphics: e.g., table (grid with information contained in cells), chart (boxes with possible connecting lines or arrows), picture (figure with labels), line graph, bar graph.

   Students note significant differences between the various graphics, while the teacher records those observations on a wall chart. Next students are given examples of graphics and asked to identify which general kind of graphic each is.

   Finally, students are assigned to go on a 'graphics hunt', locating graphics in magazines and newspapers, labeling them, and bringing to class to review.

Source: *Mesmer, H.A.E., & Hutchins, E.J. (2002). Using QARs with charts and graphs. The Reading Teacher, 56, 21–27.*

Using Question-Answer Relationships (QARs) to Interpret Information from Math Graphics: 4-Step Teaching Sequence

2. INTERPRETING INFORMATION IN GRAPHICS. Students are paired off, with stronger students matched with less strong ones. The teacher spends at least one session presenting students with examples from each of the graphics categories.

   The presentation sequence is ordered so that students begin with examples of the most concrete graphics and move toward the more abstract: Pictures > tables > bar graphs > charts > line graphs.

   At each session, student pairs examine graphics and discuss questions such as: “What information does this graphic present? What are strengths of this graphic for presenting data? What are possible weaknesses?”

Source: *Mesmer, H.A.E., & Hutchins, E.J. (2002). Using QARs with charts and graphs. The Reading Teacher, 56, 21–27.*

Using Question-Answer Relationships (QARs) to Interpret Information from Math Graphics: 4-Step Teaching Sequence

3. LINKING THE USE OF QARS TO GRAPHICS. Students are given a series of data questions and correct answers, with each question accompanied by a graphic that contains information needed to formulate the answer.

   Students are also each given index cards with titles and descriptions of each of the 4 QAR questions: RIGHT THERE, THINK AND SEARCH, AUTHOR AND YOU, ON MY OWN.

   Working in small groups and then individually, students read the questions, study the matching graphics, and 'verify' the answers as correct. They then identify the type question being asked using their QAR index cards.

Source: *Mesmer, H.A.E., & Hutchins, E.J. (2002). Using QARs with charts and graphs. The Reading Teacher, 56, 21–27.*

Using Question-Answer Relationships (QARs) to Interpret Information from Math Graphics: 4-Step Teaching Sequence

4. USING QARS WITH GRAPHICS INDEPENDENTLY. When students are ready to use the QAR strategy independently to read graphics, they are given a laminated card as a reference with 6 steps to follow:

   A. Read the question,

   B. Review the graphic,

   C. Reread the question,

   D. Choose a QAR,

   E. Answer the question, and

   F. Locate the answer derived from the graphic in the answer choices offered.

   Students are strongly encouraged NOT to read the answer choices offered until they have first derived their own answer, so that those choices don't short-circuit their inquiry.

Source: *Mesmer, H.A.E., & Hutchins, E.J. (2002). Using QARs with charts and graphs. The Reading Teacher, 56, 21–27.*

Developing Student Metacognitive Abilities p. 14

Importance of Metacognitive Strategy Use…

"Metacognitive processes focus on self-awareness of cognitive knowledge that is presumed to be necessary for effective problem solving, and they direct and regulate cognitive processes and strategies during problem solving…That is, successful problem solvers, consciously or unconsciously (depending on task demands), use self-instruction, self-questioning, and self-monitoring to gain access to strategic knowledge, guide execution of strategies, and regulate use of strategies and problem-solving performance." p. 231

Source: *Montague, M. (1992). The effects of cognitive and metacognitive strategy instruction on the mathematical problem solving of middle school students with learning disabilities.* Journal of Learning Disabilities, 25*, 230-248.*

Elements of Metacognitive Processes

"**Self-instruction** helps students to identify and direct the problem-solving strategies prior to execution. **Self-questioning** promotes internal dialogue for systematically analyzing problem information and regulating execution of cognitive strategies. **Self-monitoring** promotes appropriate use of specific strategies and encourages students to monitor general performance. [Emphasis added]." p. 231

Source: *Montague, M. (1992). The effects of cognitive and metacognitive strategy instruction on the mathematical problem solving of middle school students with learning disabilities.* Journal of Learning Disabilities, 25, *230-248.*

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').

Combined Cognitive & Metacognitive Elements of Strategy

Table 1: 'Say-Ask-Check' Metacognitive Prompts Tied to a Word-Problem Cognitive Strategy (Montague, 1992)		
Cognitive Strategy Step	Metacognitive 'Say-Ask-Check' Prompt Targets	Sample Metacognitive 'Say-Ask-Check' Prompts
1. **Read the problem.**	**'Say' (Self-Instruction) Target:** *The student reads and studies the problem carefully before proceeding.* ***'Ask' (Self-Question) Target:*** *Does the student fully understand the problem?* ***'Check' (Self-Monitor) Target:*** *Proceed only if the problem is understood.*	**Say:** "I will read the problem. I will reread the problem if I don't understand it." **Ask:** "Now that I have read the problem, do I fully understand it?" **Check:** "I understand the problem and will move forward."

Combined Cognitive & Metacognitive Elements of Strategy

Table 1: 'Say-Ask-Check' Metacognitive Prompts Tied to a Word-Problem Cognitive Strategy (Montague, 1992)		
Cognitive Strategy Step	Metacognitive 'Say-Ask-Check' Prompt Targets	Sample Metacognitive 'Say-Ask-Check' Prompts
2. **Paraphrase the problem.**	**'Say' (Self-Instruction) Target:** *The student restates the problem in order to demonstrate understanding.* ***'Ask' (Self-Question) Target:*** *Is the student able to paraphrase the problem?* ***'Check' (Self-Monitor) Target:*** *Ensure that any highlighted key words are relevant to the question.*	**Say:** "I will highlight key words and phrases that relate to the problem question." "I will restate the problem in my own words." **Ask:** "Did I highlight the most important words or phrases in the problem?" **Check:** "I found the key words or phrases that will help to solve the problem."

Combined Cognitive & Metacognitive Elements of Strategy

Table 1: 'Say-Ask-Check' Metacognitive Prompts Tied to a Word-Problem Cognitive Strategy (Montague, 1992)		
Cognitive Strategy Step	Metacognitive 'Say-Ask-Check' Prompt Targets	Sample Metacognitive 'Say-Ask-Check' Prompts
3. **'Draw' the problem.**	**'Say' (Self-Instruction) Target:** *The student creates a drawing of the problem to consolidate understanding.* ***'Ask' (Self-Question) Target:*** *Is there a match between the drawing and the problem?* ***'Check' (Self-Monitor) Target:*** *The drawing includes in visual form the key elements of the math problem.*	**Say:** "I will draw a diagram of the problem." **Ask:** "Does my drawing represent the problem?" **Check:** "The drawing contains the essential parts of the problem."

Combined Cognitive & Metacognitive Elements of Strategy

Table 1: 'Say-Ask-Check' Metacognitive Prompts Tied to a Word-Problem Cognitive Strategy (Montague, 1992)		
Cognitive Strategy Step	Metacognitive 'Say-Ask-Check' Prompt Targets	Sample Metacognitive 'Say-Ask-Check' Prompts
4. **Create a plan to solve the problem.**	**'Say' (Self-Instruction) Target:** *The student generates a plan to solve the problem.* ***'Ask' (Self-Question) Target:*** *What plan will help the student to solve this problem?* ***'Check' (Self-Monitor) Target:*** *The plan is appropriate to solve the problem.*	**Say:** "I will make a plan to solve the problem." **Ask:** "What is the first step of this plan? What is the next step of the plan?" **Check:** "My plan has the right steps to solve the problem."

Combined Cognitive & Metacognitive Elements of Strategy

Table 1: 'Say-Ask-Check' Metacognitive Prompts Tied to a Word-Problem Cognitive Strategy (Montague, 1992)		
Cognitive Strategy Step	Metacognitive 'Say-Ask-Check' Prompt Targets	Sample Metacognitive 'Say-Ask-Check' Prompts
5. **Predict/ estimate the Answer.**	**'Say' (Self-Instruction) Target:** *The student uses estimation or other strategies to predict or estimate the answer.* ***'Ask' (Self-Question) Target:*** *What estimating technique will the student use to predict the answer?* ***'Check' (Self-Monitor) Target:*** *The predicted/estimated answer used all of the essential problem information.*	**Say:** "I will estimate what the answer will be." **Ask:** "What numbers in the problem should be used in my estimation?" **Check:** "I did not skip any important information in my estimation."

Combined Cognitive & Metacognitive Elements of Strategy

Table 1: 'Say-Ask-Check' Metacognitive Prompts Tied to a Word-Problem Cognitive Strategy (Montague, 1992)		
Cognitive Strategy Step	Metacognitive 'Say-Ask-Check' Prompt Targets	Sample Metacognitive 'Say-Ask-Check' Prompts
6. **Compute the answer.**	**'Say' (Self-Instruction) Target:** *The student follows the plan to compute the solution to the problem.* ***'Ask' (Self-Question) Target:*** *Does the answer agree with the estimate?* ***'Check' (Self-Monitor) Target:*** *The steps in the plan were followed and the operations completed in the correct order.*	**Say:** "I will compute the answer to the problem." **Ask:** "Does my answer sound right?" "Is my answer close to my estimate?" **Check:** "I carried out all of the operations in the correct order to solve this problem."

Combined Cognitive & Metacognitive Elements of Strategy

Table 1: 'Say-Ask-Check' Metacognitive Prompts Tied to a Word-Problem Cognitive Strategy (Montague, 1992)		
Cognitive Strategy Step	Metacognitive 'Say-Ask-Check' Prompt Targets	Sample Metacognitive 'Say-Ask-Check' Prompts
7. **Check the answer.**	**'Say' (Self-Instruction) Target:** *The student reviews the computation steps to verify the answer.* ***'Ask' (Self-Question) Target:*** *Did the student check all the steps in solving the problem and are all computations correct?* ***'Check' (Self-Monitor) Target:*** *The problem solution appears to have been done correctly.*	**Say:** "I will check the steps of my answer." **Ask:** "Did I go through each step in my answer and check my work?" **Check:** ""

Student Self-Monitoring: Customized Math Self-Correction Checklists p. 7

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: *Dunlap, L. K., & Dunlap, G. (1989). A self-monitoring package for teaching subtraction with regrouping to students with learning disabilities. Journal of Applied Behavior Analysis, 229, 309-314.*

Uberti, H. Z., Mastropieri, M. A., & Scruggs, T. E. (2004). Check it off: Individualizing a math algorithm for students with disabilities via self-monitoring checklists. Intervention in School and Clinic, 39(5), 269-275.

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: *Dunlap, L. K., & Dunlap, G. (1989). A self-monitoring package for teaching subtraction with regrouping to students with learning disabilities. Journal of Applied Behavior Analysis, 229, 309-314.*

Uberti, H. Z., Mastropieri, M. A., & Scruggs, T. E. (2004). Check it off: Individualizing a math algorithm for students with disabilities via self-monitoring checklists. Intervention in School and Clinic, 39(5), 269-275.

Sample Self-Correction Checklist

Math Self-Correction Checklist

Student Name: _____ Date: _____

Rater: Student Classroom: _____

Directions: To the Student: BEFORE YOU START: Look at each of these goals for careful math work before beginning your assignment. AFTER EACH PROBLEM: Stop and rate YES or NO whether you performed each goal correctly.

	Problem#1	Problem#2	Problem#3	Problem#4	Problem#5
I underlined all numbers at the top of the subtraction problem that were smaller than their matching numbers at the bottom of the problem. Did the student succeed in this behavior goal? ❑ YES ❑ NO	__Y __N	__Y __N	__Y __N	__Y __N	__Y __N
I wrote all numbers carefully so that I could read them easily and not mistake them for other numbers. Did the student succeed in this behavior goal? ❑ YES ❑ NO	__Y __N	__Y __N	__Y __N	__Y __N	__Y __N
I lined up all numbers in the right place-value columns. Did the student succeed in this behavior goal? ❑ YES ❑ NO	__Y __N	__Y __N	__Y __N	__Y __N	__Y __N
I rechecked all of my answers. Did the student succeed in this behavior goal? ❑ YES ❑ NO	__Y __N	__Y __N	__Y __N	__Y __N	__Y __N

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.

Sources: *Dunlap, L. K., & Dunlap, G. (1989). A self-monitoring package for teaching subtraction with regrouping to students with learning disabilities. Journal of Applied Behavior Analysis, 229, 309-314.*

Uberti, H. Z., Mastropieri, M. A., & Scruggs, T. E. (2004). Check it off: Individualizing a math algorithm for students with disabilities via self-monitoring checklists. Intervention in School and Clinic, 39(5), 269-275.

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.

Sources: *Dunlap, L. K., & Dunlap, G. (1989). A self-monitoring package for teaching subtraction with regrouping to students with learning disabilities. Journal of Applied Behavior Analysis, 229, 309-314.*

Uberti, H. Z., Mastropieri, M. A., & Scruggs, T. E. (2004). Check it off: Individualizing a math algorithm for students with disabilities via self-monitoring checklists. Intervention in School and Clinic, 39(5), 269-275.

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: *Dunlap, L. K., & Dunlap, G. (1989). A self-monitoring package for teaching subtraction with regrouping to students with learning disabilities. Journal of Applied Behavior Analysis, 229, 309-314.*

Uberti, H. Z., Mastropieri, M. A., & Scruggs, T. E. (2004). Check it off: Individualizing a math algorithm for students with disabilities via self-monitoring checklists. Intervention in School and Clinic, 39(5), 269-275.

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: *Dunlap, L. K., & Dunlap, G. (1989). A self-monitoring package for teaching subtraction with regrouping to students with learning disabilities. Journal of Applied Behavior Analysis, 229, 309-314.*

Uberti, H. Z., Mastropieri, M. A., & Scruggs, T. E. (2004). Check it off: Individualizing a math algorithm for students with disabilities via self-monitoring checklists. Intervention in School and Clinic, 39(5), 269-275.

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: *Dunlap, L. K., & Dunlap, G. (1989). A self-monitoring package for teaching subtraction with regrouping to students with learning disabilities. Journal of Applied Behavior Analysis, 229, 309-314.*

Uberti, H. Z., Mastropieri, M. A., & Scruggs, T. E. (2004). Check it off: Individualizing a math algorithm for students with disabilities via self-monitoring checklists. Intervention in School and Clinic, 39(5), 269-275.

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: *Dunlap, L. K., & Dunlap, G. (1989). A self-monitoring package for teaching subtraction with regrouping to students with learning disabilities. Journal of Applied Behavior Analysis, 229, 309-314.*

Uberti, H. Z., Mastropieri, M. A., & Scruggs, T. E. (2004). Check it off: Individualizing a math algorithm for students with disabilities via self-monitoring checklists. Intervention in School and Clinic, 39(5), 269-275.

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).

Sources: *Dunlap, L. K., & Dunlap, G. (1989). A self-monitoring package for teaching subtraction with regrouping to students with learning disabilities. Journal of Applied Behavior Analysis, 229, 309-314.*

Uberti, H. Z., Mastropieri, M. A., & Scruggs, T. E. (2004). Check it off: Individualizing a math algorithm for students with disabilities via self-monitoring checklists. Intervention in School and Clinic, 39(5), 269-275.

Math Self-Correction Checklists: Create a Classwide Example

- In your handout, review the section *Student Math Competencies: Sampling of Essential Skills* (pp. 2-6).

- Select up to FIVE (5) items that you feel are primary sources of student error in your math classes.

- Consider how you might take your selected items and turn them into a math self-correction checklist to use with your entire class.

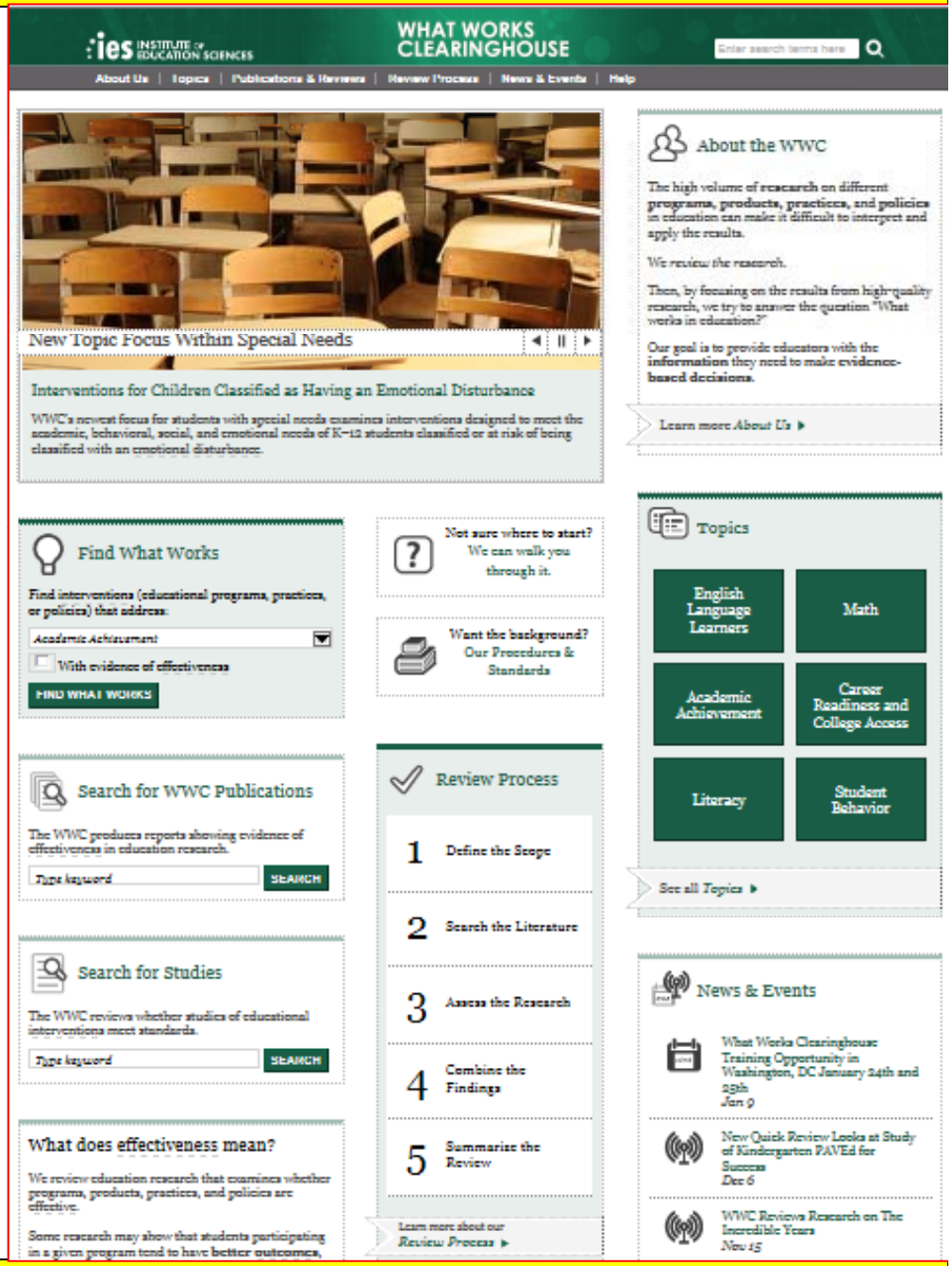
Where to Find High-Quality Tier 2/3 Math Intervention Programs

What Works Clearinghouse

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

This website reviews core instruction and intervention programs in mathematics, as well as other academic areas.

The site reviews existing studies and draws conclusions about whether specific intervention programs show evidence of effectiveness.



Best Evidence Encyclopedia
http://www.bestevidence.org/

This site provides reviews of evidence-based math and reading programs.

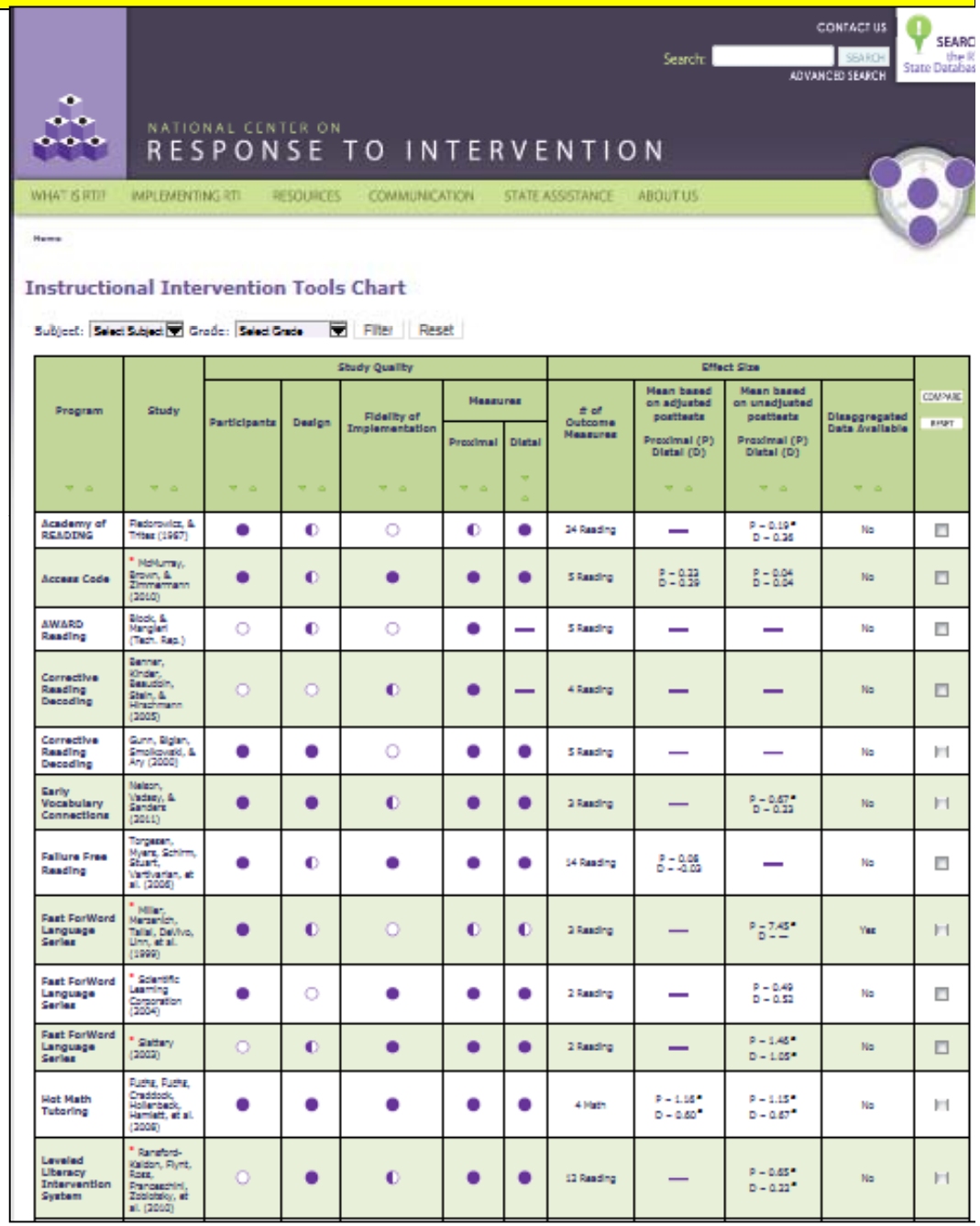
The website is sponsored by the Johns Hopkins University School of Education's Center for Data-Driven Reform in Education (CDDRE) .

Response to Intervention

National Center on RTI Instructional Intervention Tools Chart
http://www.rti4success.org/instructionTools

Sponsored by the National Center on RTI, this page provides ratings to intervention programs in math, reading, and writing.

Users can sort their search by subject and grade level.



Program	Study	Study Quality: Participants	Study Quality: Design	Study Quality: Fidelity of Implementation	Study Quality: Measures: Proximal	Study Quality: Measures: Distal	Effect Size: # of Outcome Measures	Effect Size: Mean based on adjusted posttests: Proximal (P) Distal (D)	Effect Size: Mean based on unadjusted posttests: Proximal (P) Distal (D)	Disaggregated Data Available	COMPARE REPORT
Academy of READING	Radorovics, & Trites (1987)	●	◐	○	◐	●	24 Reading	—	P – 0.19* D – 0.36	No	☐
Access Code	* McMurray, Brown, & Zimmermann (2010)	●	◐	●	●	●	5 Reading	P – 0.33 D – 0.39	P – 0.04 D – 0.04	No	☐
AWARD Reading	Block, & Mangieri (Tech. Rep.)	○	◐	○	●	—	5 Reading	—	—	No	☐
Corrective Reading Decoding	Benner, Kinder, Beaudoin, Stein, & Hirschmann (2005)	○	○	◐	●	—	4 Reading	—	—	No	☐
Corrective Reading Decoding	Gunn, Biglan, Smolkowski, & Ary (2000)	●	●	○	●	●	5 Reading	—	—	No	☐
Early Vocabulary Connections	Nelson, Vadasy, & Sanders (2011)	●	●	◐	●	●	3 Reading	—	P – 0.67* D – 0.33	No	☐
Failure Free Reading	Torgesen, Myers, Schirm, Stuart, Vartivarian, et al. (2006)	●	◐	●	●	●	14 Reading	P – 0.06 D – -0.03	—	No	☐
Fast ForWord Language Series	* Miller, Merzenich, Tallal, DeVivo, Linn, et al. (1999)	●	◐	○	◐	◐	3 Reading	—	P – 7.45* D – —	Yes	☐
Fast ForWord Language Series	* Scientific Learning Corporation (2004)	●	○	●	●	●	2 Reading	—	P – 0.49 D – 0.52	No	☐
Fast ForWord Language Series	* Slattery (2003)	○	◐	●	●	●	2 Reading	—	P – 1.46* D – 1.06*	No	☐
Hot Math Tutoring	Fuchs, Fuchs, Craddock, Hollenbeck, Hamlett, et al. (2008)	●	●	●	●	●	4 Math	P – 1.16* D – 0.60*	P – 1.15* D – 0.67*	No	☐
Leveled Literacy Intervention System	* Ransford-Kaldon, Flynt, Ross, Franceschini, Zoblotsky, et al. (2010)	○	●	◐	●	●	12 Reading	—	P – 0.65* D – 0.33*	No	☐

Doing What Works
http://dww.ed.gov/

This website is sponsored by the U.S. Department of Education and offers specific guidelines for how to teach effectively across disciplines.

The site has a section devoted to math and science, including pragmatic recommendations for putting into classroom practice the specific recommendations of the National Math Advisory Panel Report of 2008.

Planning Activity Report Out Procedures

- Review your table number.
- Before beginning your RTI planning, select 2 members of your table who will visit another table as 'ambassadors' for the report-out part of the activity.
- During the report-out, your ambassadors will visit the following tables:
  - Activity 1: Your table number +1
  - Activity 2: Your table number +2
  - Activity 3: Your table number +3
  - Activity 4: Your table number +4

Activity: 'Next Steps' Planning Sheet

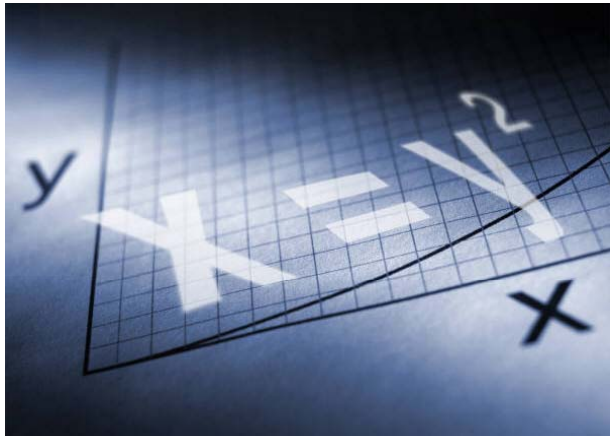
- *GOAL 3: Developing a Math 'Intervention Menu'.*
- Complete the *Goal 3 Planning Sheet*- p. 43.
- When directed, you will report out on your discussion to your '+3' table.

Key Points About Math Interventions:

- The math teacher has a clearly defined role (6 steps) as intervention 'first responder'.
- A math RTI plan can include strategies for core instruction, academic intervention, and/or instructional adjustment (accommodation)—but will typically NOT include modifications.
- Sample secondary-level math interventions include Reciprocal Peer Tutoring, QARs with math graphics, a 7-step cognitive/ metacognitive strategy for word problems, and math self-correction checklists.
- A listing of web sites with high-quality math intervention programs for Tier 2/3.
- To help with intervention targets, you can consult the list of Student Math Competencies-p.2

Student Involvement

Focus of Inquiry: When considering math interventions, what strategies can promote student motivation and responsibility?



Five Strands of Mathematical Proficiency (NRC, 2002)

1. *Understanding: Comprehending mathematical concepts, operations, and relations--knowing what mathematical symbols, diagrams, and procedures mean.*

2. *Computing: Carrying out mathematical procedures, such as adding, subtracting, multiplying, and dividing numbers flexibly, accurately, efficiently, and appropriately.*

3. *Applying: Being able to formulate problems mathematically and to devise strategies for solving them using concepts and procedures appropriately.*

4. *Reasoning: Using logic to explain and justify a solution to a problem or to extend from something known to something less known.*

5. *Engaging: Seeing mathematics as sensible, useful, and doable—if you work at it—and being willing to do the work.*

Source: *National Research Council. (2002). Helping children learn mathematics. Mathematics Learning Study Committee, J. Kilpatrick & J. Swafford, Editors, Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press.*

Unmotivated Students: What Works

Motivation can be thought of as having two dimensions:

1. the student's expectation of success on the task 10

   Multiplied by X

2. the value that the student places on achieving success on that learning task 10

   100

The relationship between the two factors is *multiplicative*. If EITHER of these factors (the student's expectation of success on the task OR the student's valuing of that success) is zero, then the 'motivation' product will also be zero.

Source: Sprick, R. S., Borgmeier, C., & Nolet, V. (2002). Prevention and management of behavior problems in secondary schools. In M. A. Shinn, H. M. Walker & G. Stoner (Eds.), *Interventions for academic and behavior problems II: Preventive and remedial approaches* (pp.373-401). Bethesda, MD: National Association of School Psychologists.

Cognitive Bias: Impact on Student Motivation

Availability heuristic. When assessing the probability of a possible outcome (e.g., of winning the lottery), people are influenced by how *easily* they can imagine that outcome (Tversky & Kahneman, 1974; p. 1127.)

Source:Tversky, A. & Kahneman, D. (1974) Judgment under uncertainty: Heuristics and biases.. Science, 185, 1124-1131.

AVAILABILITY: 'BIASES OFIMAGINABILITY'. The degree of motivation that a student brings to math work can be influenced by the ease with which that student is able to imagine positive or negative outcomes.

Source: Tversky, A. & Kahneman, D. (1974) Judgment under uncertainty: Heuristics and biases.. Science, 185, 1124-1131.

EXAMPLE--AVAILABILITY: 'BIASES OFIMAGINABILITY'. A student lacks motivation to put her full effort into a math assignment because

- she can vividly imagine failing the assignment (based on past experience) but
- cannot easily picture succeeding on the assignment (because she has few if any prior examples of success to call to mind).

In this case, the ‘bias of imaginability’ is tilted toward the negative and saps student motivation.

Motivating the Unmotivated Math Student: Strategies

The unmotivated student can often benefit from:

- Explicit instruction (because it helps the student to grasp challenging math content).
- Regular feedback about math performance, including completion of course requirements (grades, missing work) and mastery of Common Core State Standards.
- Training in 'academic survival skills' to foster student responsibility and independence.

Preventing Students from Falling Behind Through Proactive Teacher Communication

(Available on Conference Web Page)

What is the Advantage of 'Proactive Teacher Communication'?

Struggling students benefit greatly when the teacher provides a clear explanation of course requirements, and offers regularly updated information about upcoming assignments, missing work, and students' current standing in the course. When the teacher makes a proactive effort to keep students fully and continually informed about course expectations and their own performance, the instructor substantially reduces the likelihood that students will fall behind in their work and be at risk for underperformance or failure in the course.

The Elements of 'Proactive Teacher Communication'

1. *Prepare a Course Syllabus.* At the start of the semester, the teacher hands out a syllabus listing all major course assignments, their descriptions, and due dates, as well as dates of quizzes and tests. This syllabus provides the student with a comprehensive map of all of the work to be done in the course for the semester. It also gives a clear explanation of the grading system, including the relative weight toward the final grade of tests, quizzes, homework, classwork, and student participation. Additionally, the syllabus spells out any penalties for submission of late work.

The Elements of 'Proactive Teacher Communication'

2. *Hand Out Weekly Work Agenda.* On Mondays, the teacher gives students a work agenda for the week. The agenda lists any in-class and homework assignments for that week, their descriptions (if necessary), and due dates. [Optional but recommended] The agenda may also include milestone tasks from larger, multi-week projects (e.g., reminding students in a November agenda that they should have their 6 required source documents for a term paper selected by Friday of the current week).

The Elements of 'Proactive Teacher Communication'

3. *Schedule Weekly Student Conferences.* The teacher holds brief meetings with individual students to review their performance in the course to date, note any missing work and get the student to commit to a plan to submit that work, and checks in with the student about upcoming assignments, quizzes, and tests to ensure that the student continues to stay on top of course requirements. NOTE: If time constraints prevent the teacher from being able to conference with the entire class each week, the instructor may instead meet with at-risk students weekly and meet less frequently (e.g., every other week or monthly) with the remainder of the class.

Academic Survival Skills Checklists: A Tool to Help Students to Manage Their Own Learning

Students who would achieve success on the ambitious Common Core State Standards must first cultivate a set of general 'academic survival skills' that they can apply to any coursework (DiPerna, 2006).

Examples of academic survival skills include the ability to study effectively, be organized, and manage time well.

When academic survival skills are described in global terms, though, it can be difficult to define them. For example, two teachers may have different understandings about what the term 'study skills' means.

Source: DiPerna, J. C. (2006). Academic enablers and student achievement: Implications for assessment and intervention services in the schools. Psychology in the Schools, 43, 7-17.

Academic Survival Skills Checklists: A Tool to Help Students to Manage Their Own Learning (Cont.)

A solution is to complete a 'task analysis' of a given global academic-survival skill, dividing that larger skill into a checklist of component sub-skills (Kazdin, 1989).

With a checklist that breaks a global academic survival skill into components, a teacher can judge whether a student possesses the essential building-block strategies that make up a larger global 'survival skills' term. Teachers have access to good sources of information to verify what academic survival skills a student possesses, including direct observation; interviews (of the student, past teacher, or parent); and student work products.

Source:Kazdin, A. E. (1989). Behavior modification in applied settings (4th ed.). Pacific Gove, CA: Brooks/Cole.

Academic Survival Skills Checklist: Study Skills Example

STUDY SKILLS CHECKLIST
1. MAINTAIN A STUDY SCHEDULE. Maintain a regular (e.g., daily) study schedule with sufficient time set aside to review course content and information.
2. AVOID DISTRACTERS. When studying, avoid distracters (e.g., cell phone, television, Internet) that can erode study time and divert attention.
3. CREATE AN ORGANIZED STUDY SPACE. Prepare the study environment by organizing a space and setting out all necessary work materials before beginning study.

Source: Academic Survival Skills Checklist Maker. (2012). Retrieved from http://www.interventioncentral.org/tools/academic-survival-skills-checklist-maker

Academic Survival Skills Checklist: Study Skills Example

STUDY SKILLS CHECKLIST
4. SET STUDY GOALS. Prior to a study session, define one or more specific study goals to accomplish (e.g., to review information for an upcoming quiz; to locate key information to include in an essay).
5. MAKE A STUDY AGENDA. If studying multiple subjects in one session, create a study agenda for that session with a listing of the key information to be reviewed for each subject and the time allocated for that review.
6. DO THE TOUGH STUDY WORK FIRST. Tackle the most difficult or challenging study objectives first during study sessions, when energy levels and ability to concentrate are at their peak.

Source: Academic Survival Skills Checklist Maker. (2012). Retrieved from http://www.interventioncentral.org/tools/academic-survival-skills-checklist-maker

Academic Survival Skills Checklist: Study Skills Example

STUDY SKILLS CHECKLIST
7. VARY ACTIVITIES. Mix up study activities during a study session (e.g., alternating between reading and writing) to maintain engagement and interest.
8. CHUNK A LARGE STUDY TASK INTO SMALLER UNITS. If studying a large amount of material in a single session, 'chunk' the material into smaller units and take short breaks between each unit to maintain focus.
9. TEACH CHALLENGING CONTENT. When studying complex or challenging material, assume the role of instructor and attempt to explain or describe the material to a real or imagined listener. Teaching study material is an efficient way to verify understanding.

Source: Academic Survival Skills Checklist Maker. (2012). Retrieved from http://www.interventioncentral.org/tools/academic-survival-skills-checklist-maker

Academic Survival Skills Checklist: Study Skills Example

STUDY SKILLS CHECKLIST
10. HIGHLIGHT QUESTIONS. When reviewing notes or completing course readings, use highlighters, margin notes, sticky notes, or other notation methods to flag questions, unknown vocabulary terms, or areas of confusion for later review with teacher or tutor.
11. SEEK HELP WHEN NEEED. Approach the teacher or tutor for help as needed to answer questions or clear up areas of confusion identified during study sessions.

Source: Academic Survival Skills Checklist Maker. (2012). Retrieved from http://www.interventioncentral.org/tools/academic-survival-skills-checklist-maker

Academic Survival Skills Checklist: Study Skills Example

STUDY SKILLS CHECKLIST

12. AVOID CRAM SESSIONS. Stay away from all-night cram sessions before major tests. Cram sessions are ineffective because they are inefficient and often leave students exhausted and unable to perform their best on exams. Instead, distribute study and test-review time across multiple days and consider allocating an upward limit of about 1 hour per study session to maintain focus and energy.

Source: Academic Survival Skills Checklist Maker. (2012). Retrieved from http://www.interventioncentral.org/tools/academic-survival-skills-checklist-maker

Academic Survival Skills Checklists: 5 Uses

Consistent expectations among teachers. Teachers at a grade level, on an instructional team, or within an instructional department can work together to develop checklists for essential global academic-survival skills. As teachers collaborate to create these checklists, they reach agreement on the essential skills that students need for academic success and can then consistently promote those skills across their classrooms.

1

Academic Survival Skills Checklists: 5 Uses

Proactive student skills training. One excellent use of these checklists is as a classwide student training tool. At the start of the school year, teachers can create checklists for those academic survival skills in which students are weak (e.g., study skills, time management) and use them as tools to train students in specific strategies to remediate these deficiencies. Several instructors working with the same group of students can even pool their efforts so that each teacher might be required to teach a checklist in only a single survival-skill area.

2

Academic Survival Skills Checklists: 5 Uses

Student skills self-check. Teachers can use academic survival-skills checklists to promote student responsibility. Students are provided with master copies of checklists and encouraged to develop their own customized checklists by selecting and editing those strategies likely to work best for them. Instructors can then hold students accountable to consult and use these individualized checklists to expand their repertoire of strategies for managing their own learning.

3

Academic Survival Skills Checklists: 5 Uses

Monitoring progress of academic survival-skills interventions. Often, intervention plans developed for middle and high school students include strategies to address academic survival-skill targets such as homework completion or organization. Checklists are a good way for teachers to measure the student's baseline use of academic survival skills in a targeted area prior to the start of the intervention. Checklists can also be used to calculate a student outcome goal that will signify a successful intervention and to measure (e.g., weekly) the student's progress in using an expanded range of academic survival-skills during the intervention period.

4

Academic Survival Skills Checklists: 5 Uses

Parent conferences. When teachers meet with parents to discuss student academic concerns, academic survival-skills checklists can serve as a vehicle to define expected student competencies and also to decide what specific school and home supports will most benefit the student. In addition, parents often appreciate receiving copies of these checklists to review with their child at home.

5

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Academic Survival Skills Checklist Maker

http://www.interventioncentral.org/tools/academic-survival-skills-checklist-maker

The Academic Survival Skills Checklist Maker provides a starter set of strategies to address:

- homework
- note-taking
- organization
- study skills
- time management.

Teachers can use the application to create and print customized checklists and can also save their checklists online.

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Best Practices in Secondary Math Intervention Planning Sheet

GOAL 4: Enlisting the Student as a Motivated, Self-Managing Learner. The teacher who can motivate a struggling student to take increased responsibility for his or her own math learning has a greater likelihood of success.

List the 'next steps' that you plan to follow to accomplish this goal:

1. _____
2. _____
3. _____
4. _____

Who in your school or district will you need to enlist to help you with this goal?:

1. _____
2. _____

What resources will you need beyond those supplied in this training to accomplish the goal?

1. _____
2. _____

p. 43

Additional Notes: _____

_____

_____

Planning Activity Report Out Procedures

- Review your table number.
- Before beginning your RTI planning, select 2 members of your table who will visit another table as 'ambassadors' for the report-out part of the activity.
- During the report-out, your ambassadors will visit the following tables:
  - Activity 1: Your table number +1
  - Activity 2: Your table number +2
  - Activity 3: Your table number +3
  - Activity 4: Your table number +4

Activity: 'Next Steps' Planning Sheet

- *GOAL 4: Enlisting the Student as a Motivated, Self-Managing Learner.*
- Complete the *Goal 4 Planning Sheet*-p. 43.
- When directed, you will report out on your discussion to your '+4' table.

Key Points About Motivating Students to Be Engaged, Self-Managing Learners:

- Student motivation is a combination of (1) *expectation* for success and (2) the *value* placed on success.
- Students may lack motivation because of previous lack of success ('bias of imaginability').
- Teachers can provide proactive course feedback to students via (1) a course syllabus, (2) weekly assignment agendas, and (3) brief weekly student conferences.
- Academic Survival Skills Checklists can help students to develop self-management skills in organization, time management, and other areas.