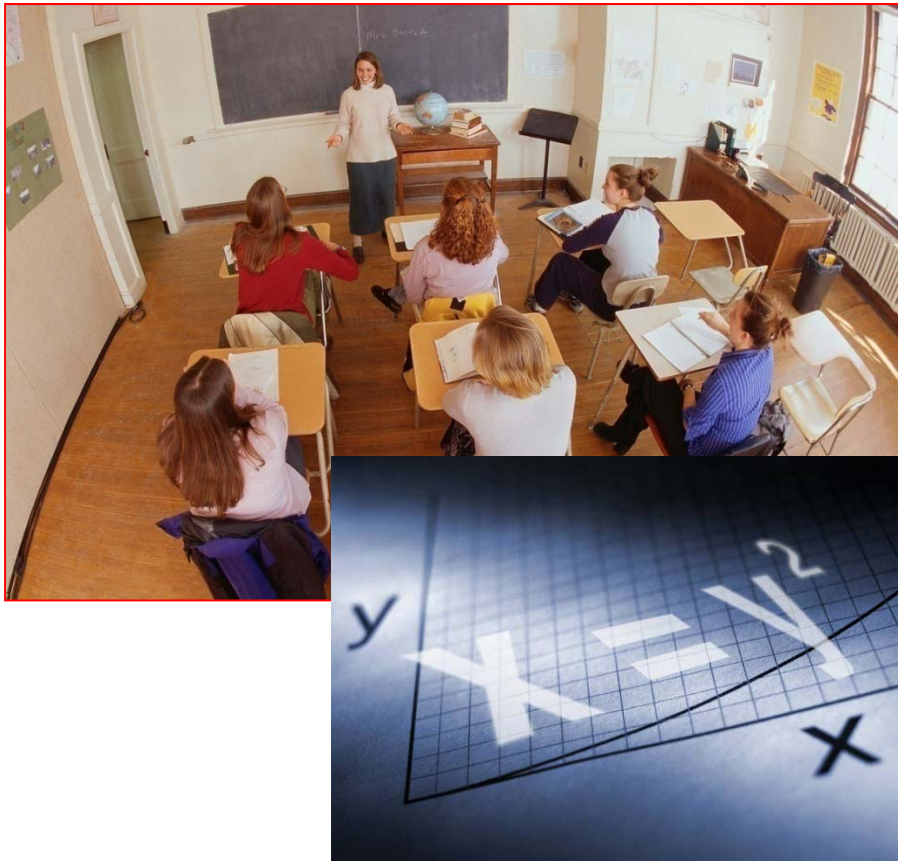
Best Practices in Secondary Math Interventions (7-12)

Jim Wright
www.interventioncentral.org



INTERVENTION CENTRAL

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RTI Toolkit: A Practical Guide for Schools

Best Practices in Secondary Math Interventions (7-12)

Jim Wright, Presenter ♦22 October 2013♦ Wisconsin Educational Resources, LLC

Contents

Workshop materials available at: http://www.interventioncentral.org/wi_ed_math_secondary

Access PPTs and other materials from this workshop at:

http://www.interventioncentral.org/wi_ed_math_secondary

Response to Intervention

Intervention Central
www.interventioncentral.org

Workshop Agenda…

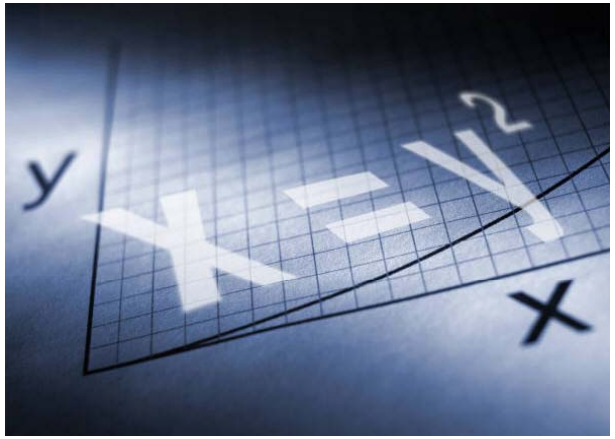
- RTI & Mathematics: Introduction
- GOAL 1: Creating a Supportive Math Instructional Environment
- GOAL 2: Obtaining or Developing Classroom Formative Math Assessments.
- GOAL 3: Developing a Math 'Intervention Menu'.
- GOAL 4: Enlisting the Student as a Motivated, Self-Managing Math Learner.
- Review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

“*In a completely rational society, the best of us would be teachers and the rest of us would have to settle for something less.*”

-Lee Iacocca

Math Instruction for Struggling Learners: A Work in Progress

Focus of Inquiry: What do we know about effective math instruction for underperforming students?



Five Strands of Mathematical Proficiency (NRC, 2002)

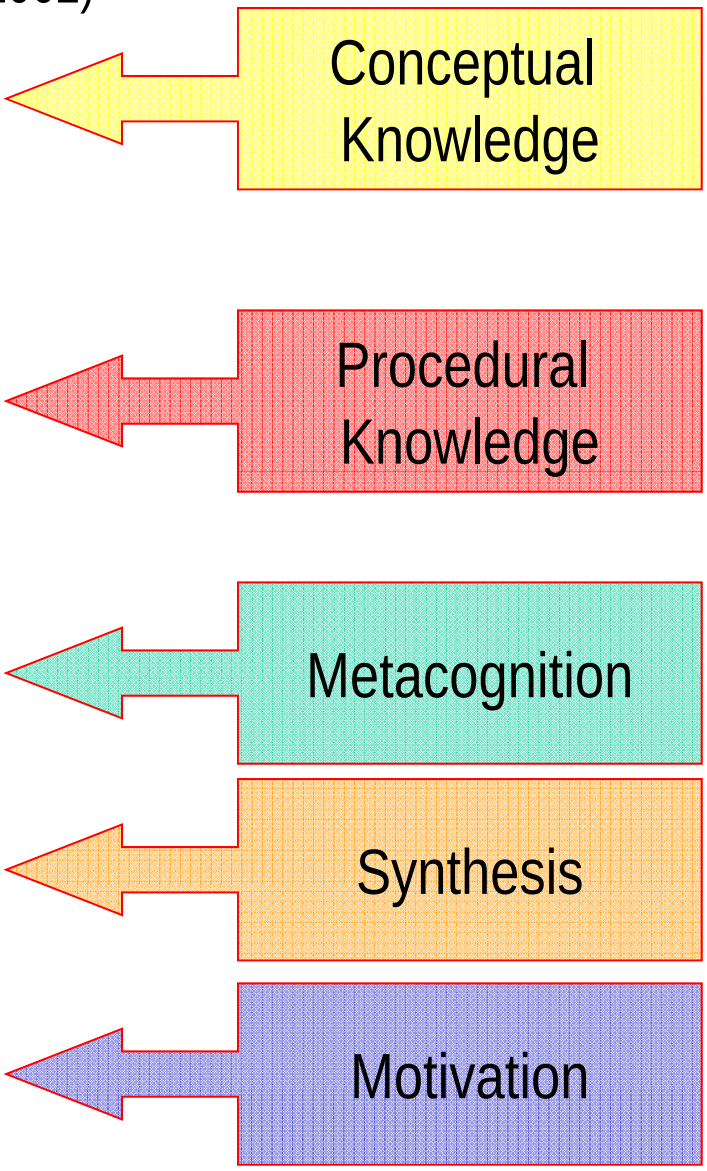
1. *Understanding: Comprehending mathematical concepts, operations, and relations--knowing what mathematical symbols, diagrams, and procedures mean.*

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 & Social Sciences & Education. Washington, DC: National Academy Press.*

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).

National Math Advisory Panel 2008: Recommendation

"To prepare students for Algebra, the curriculum must simultaneously develop conceptual understanding, computational fluency, and problem-solving skills. Debates regarding the relative importance of these aspects of mathematical knowledge are misguided. These capabilities are mutually supportive, each facilitating learning of the others. Teachers should emphasize these interrelations…"

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

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*

Students with Math Learning Disabilities: The Numbers

- It is estimated that students with “learning disabilities (LD) and deficits in mathematics competencies ” range from 5% to 7% of the school-age population. (Gersten et al., p. 1202)

Source: *Gersten, R., Chard, D. J., Jayathi, M., Baker, S. K., Morphy, P., & Flojo, J. (2009). Mathematics instruction for students with learning disabilities: A meta-analysis of instructional components. Review of Educational Research, 79, 1202-1242.*

National Assessment of Educational Progress: Mathematics: 2011 Student Sample: 26,200		
Level	Description	% / Students
Proficient	Represents "solid academic performance for each grade assessed. Students reaching this level have demonstrated competency over challenging subject matter, including subject-matter knowledge, application of such knowledge to real-world situations, and analytical skills appropriate to the subject matter."	35%
Basic	Denotes "partial mastery of prerequisite knowledge and skills that are fundamental for proficient work at each grade assessed."	38%
Below Basic	Falls below basic (as defined above)	27%

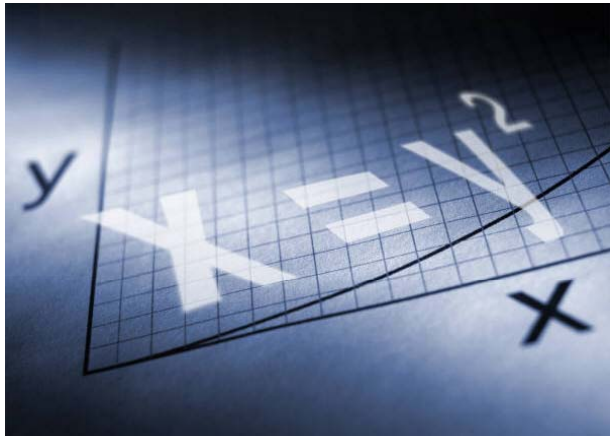
Who is At Risk for Poor Math Performance?: A Proactive Stance

"…we use the term mathematics difficulties rather than mathematics disabilities. Children who exhibit mathematics difficulties include those performing in the low average range (e.g., at or below the 35th percentile) as well as those performing well below average…Using higher percentile cutoffs increases the likelihood that young children who go on to have serious math problems will be picked up in the screening." p. 295

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.*

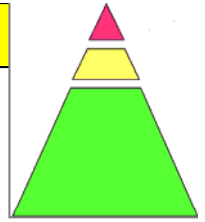
RTI, Secondary Mathematics, and Rigorous State Math Standards: A New Frontier

Focus of Inquiry: How can the 3-Tier RTI model be applied to middle and high school mathematics instruction to help struggling students to attain the math standards?



Teachers: Building an RTI Model for Math Instruction

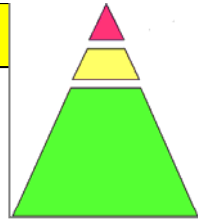
- Issue: Mathematics is arguably the **greatest challenge** for struggling students in middle and high schools. Teachers need to have **classroom** and **supplemental supports** to help students with math difficulties to attain success.



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.

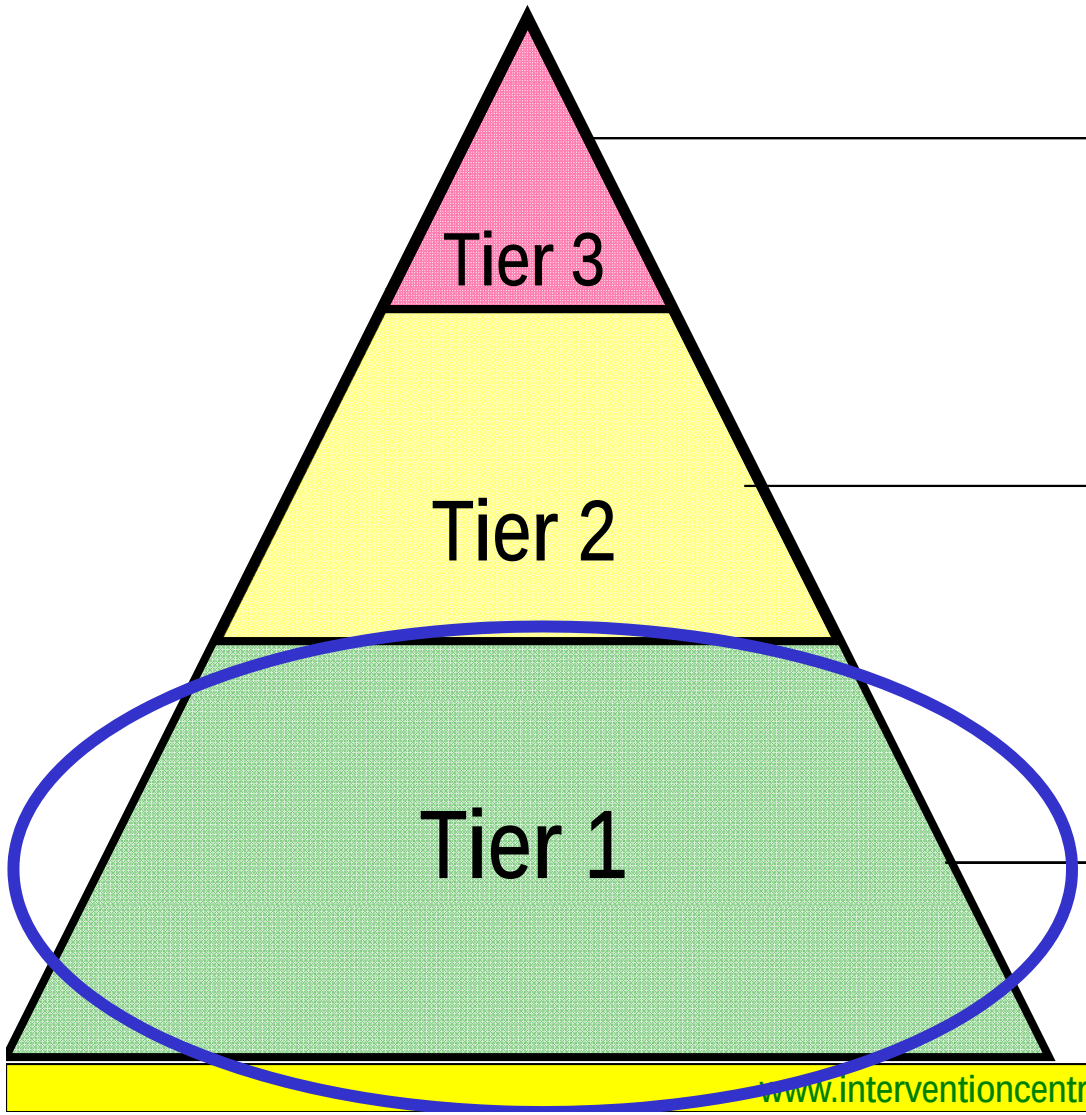


RTI: 6 Essential Elements for Mathematics (Cont.)

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.

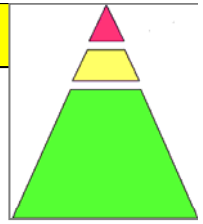
RTI 'Pyramid of Interventions'



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.

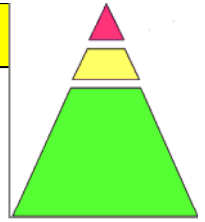


RTI Support: Tier 1 Core Instruction

- 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.



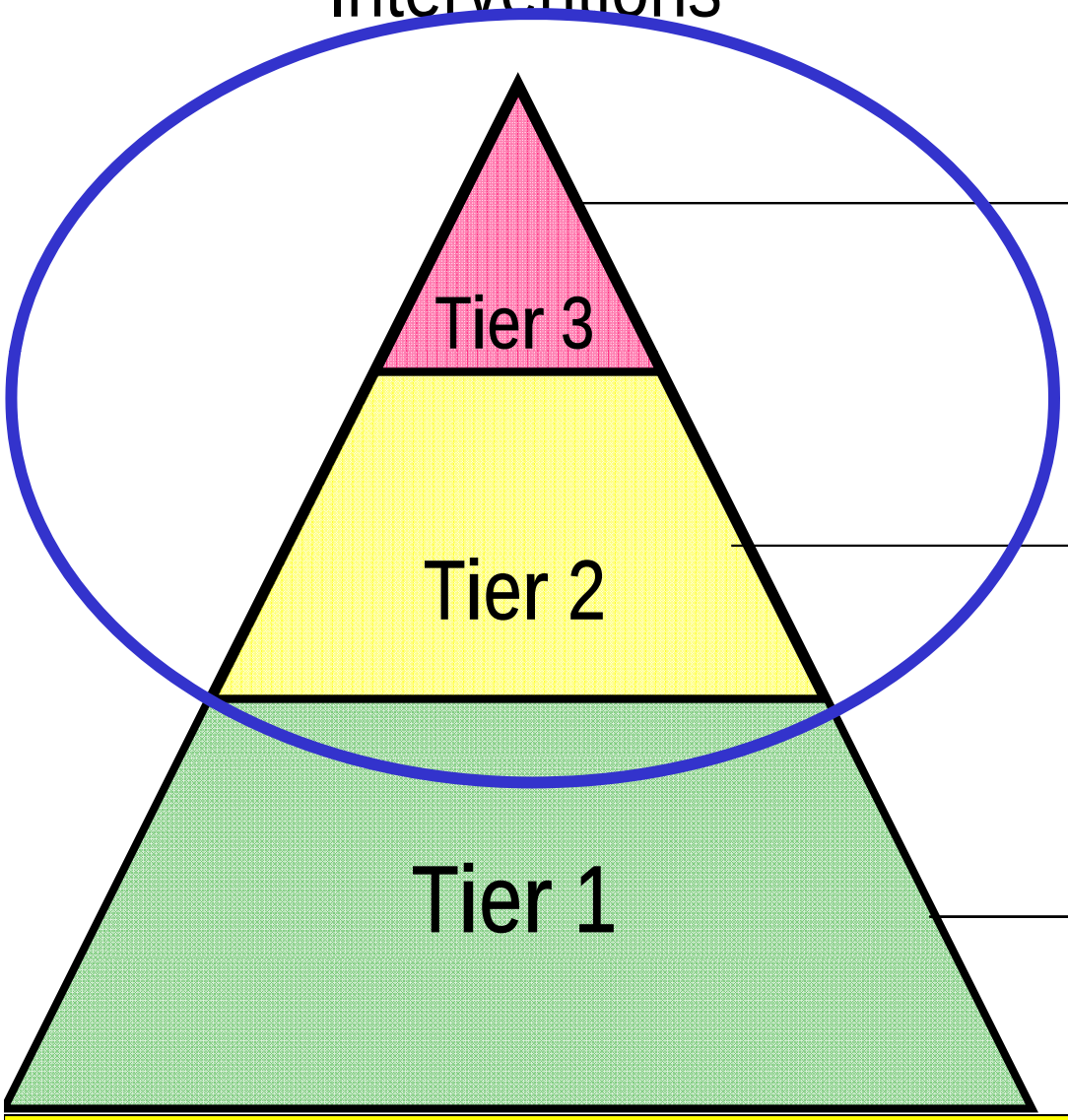
RTI Support: Tier 1 (Classroom) Intervention

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.

RTI 'Pyramid of Interventions'



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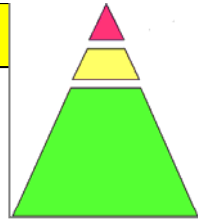
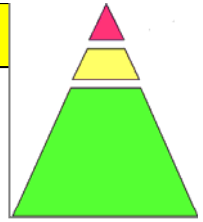


RTI Support: Tier 2/3 Supplemental Interventions

- 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 student degree of 'risk' for math failure.
- In a typical school, 10-15 % of students may require Tier 2 interventions in a given academic area, while 1-5% may need Tier 3 help.
- Interventions at Tier 2 are monitored at least twice per month. Interventions at Tier 3 are monitored weekly.
- Tier 2/3 interventions should last at least 6-8 instructional weeks.

Sources: Burns, M. K., & Gibbons, K. A. (2008). Implementing response-to-intervention in elementary and secondary schools. Routledge: New York.

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 in the Tier 2/3 intervention group have 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.

Sources: Burns, M. K., & Gibbons, K. A. (2008). Implementing response-to-intervention in elementary and secondary schools. Routledge: New York.

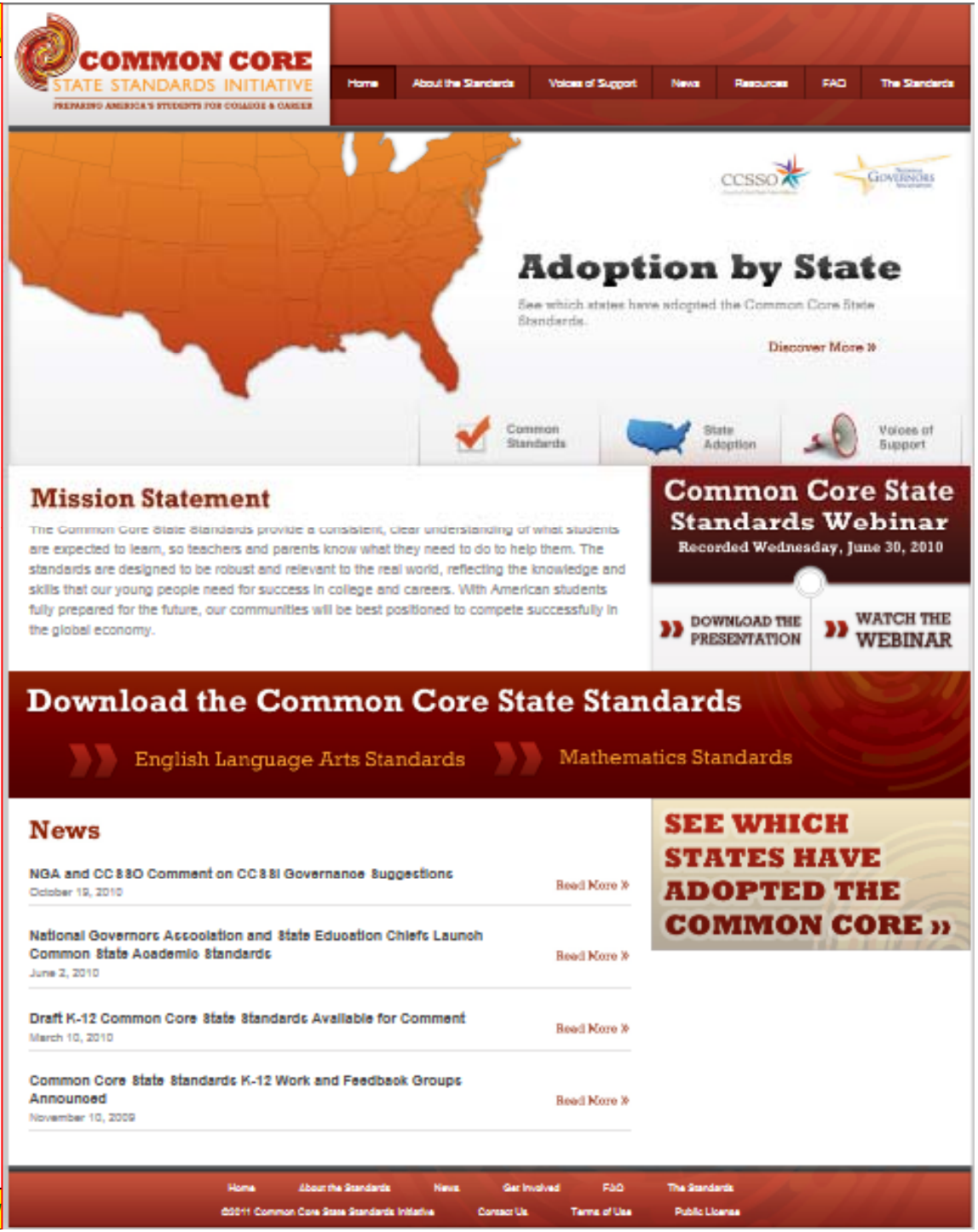
Wright, J. (2012). RTI Success in Secondary Schools: A toolkit for middle and high schools. Port Chester, NY: National Professional Resources, Inc.

Res

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.

Source: *National Governors Association Center for Best Practices and Council of Chief State School Officers. (2010). Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects.. Retrieved on September 23, 2012, from http://www.corestandards.org/; p. 6.*



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Common Core State Standards: Supporting Different Learners in ELA

"The 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. No set of grade-specific standards can fully reflect the great variety in abilities, needs, learning rates, and achievement levels of students in any given classroom."

Source: *National Governors Association Center for Best Practices and Council of Chief State School Officers. (2010). Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects.. Retrieved on September 23, 2012, from http://www.corestandards.org/; p. 6.*

Common Core State Standards: Supporting Different Learners in ELA

"…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. 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–high school lives."

Source: *National Governors Association Center for Best Practices and Council of Chief State School Officers. (2010). Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects.. Retrieved on September 23, 2012, from http://www.corestandards.org/; p. 6.*

Response to Intervention (RTI)

Response to Intervention (RTI) is a blue-print that schools can implement to proactively identify students who struggle with academic and/or behavioral deficits and provide them with academic and behavioral intervention support. RTI divides school support resources into 3 progressively more intensive levels--or 'tiers'--of intervention. RTI first gained national recognition when written into congressional legislation, the Individuals with Disabilities Education Improvement Act (IDEIA) of 2004.

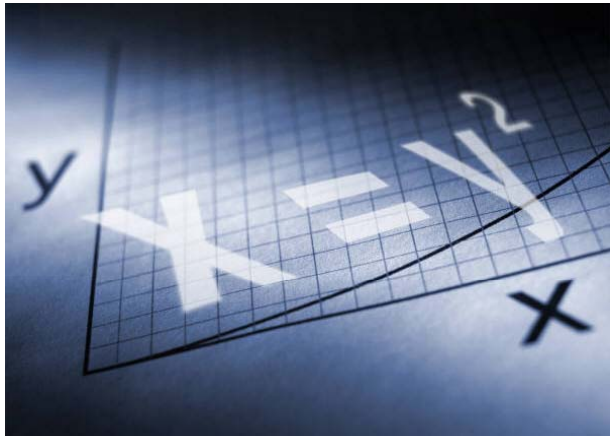
Because the focus of RTI is on the underperforming learner, schools can use this approach as the 'toolkit' for helping struggling learners to attain the ambitious standards of the Common Core.

Teachers: Building an RTI Model for Math Instruction

- Recommendation: Develop a department-wide, building or district plan for creating and implementing an RTI model to address student math difficulties.

Strong Core Math Instruction

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



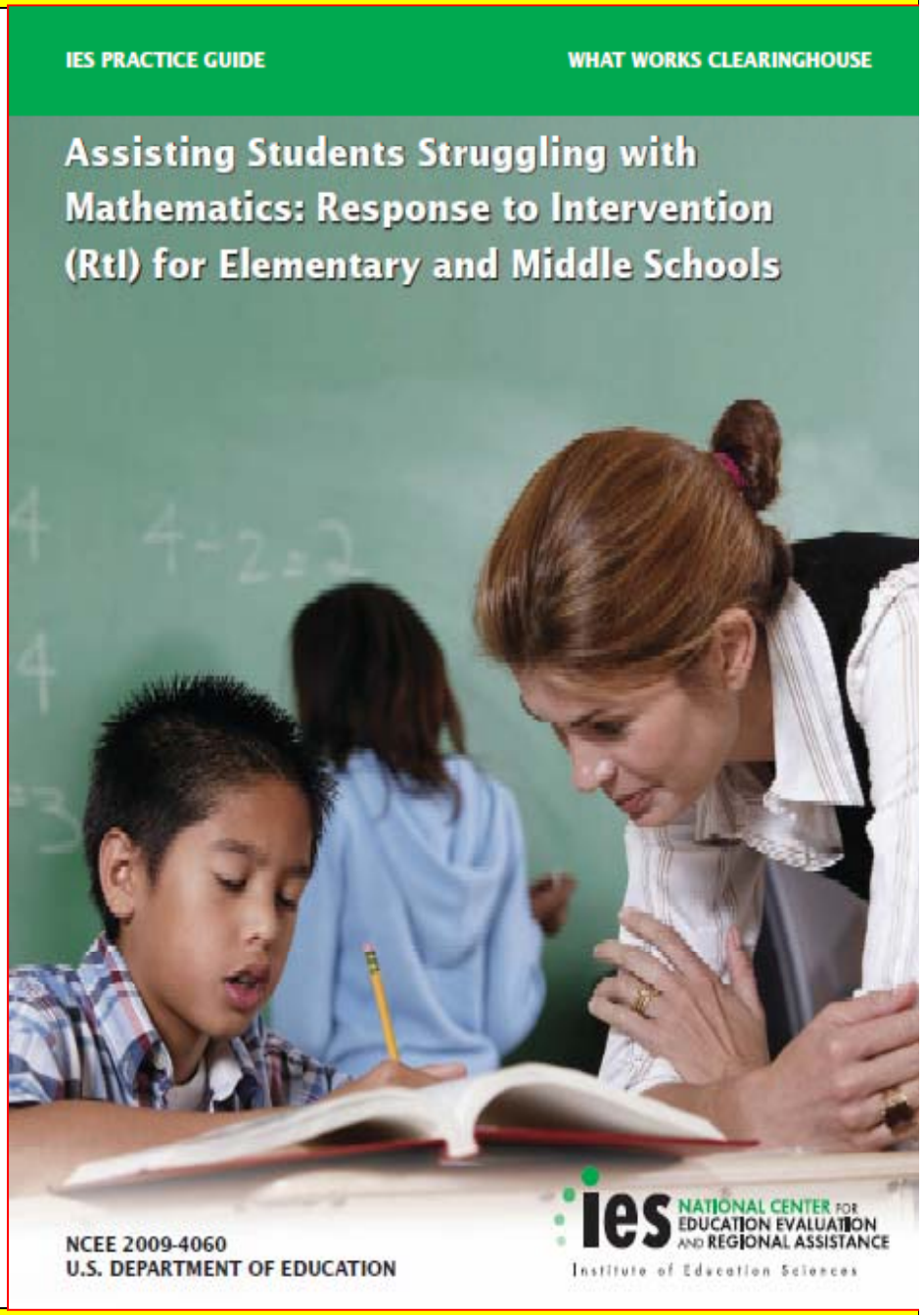
Teachers: Elements of Strong Core Math Instruction

- Issue: Research supports direct instruction as a means to effectively teach students with math difficulties in core instruction. However, many schools lack a **clear checklist** of the **instructional elements** that make up direct instruction.

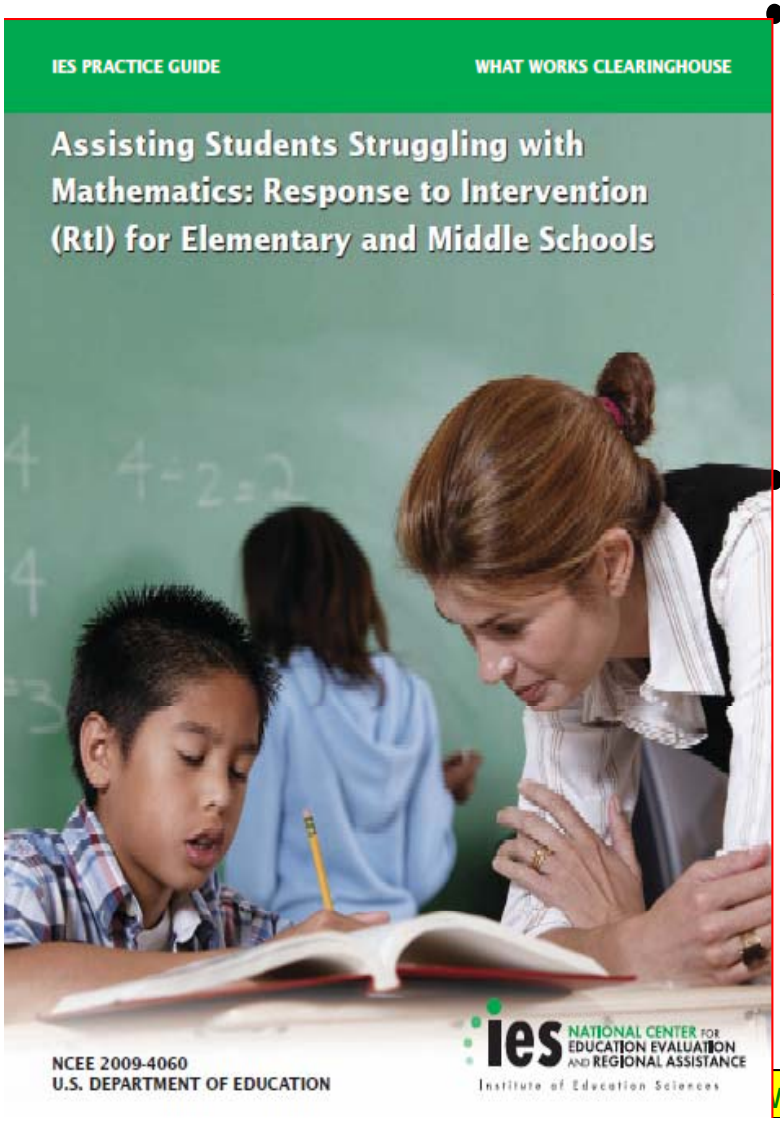
What Works Clearinghouse Practice Guide: *Assisting Students Struggling with Mathematics: Response to Intervention (RtI) for Elementary and Middle Schools*

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

This publication provides 8 recommendations for effective core instruction in mathematics for K-8. A link to this manual is on the conference web page.

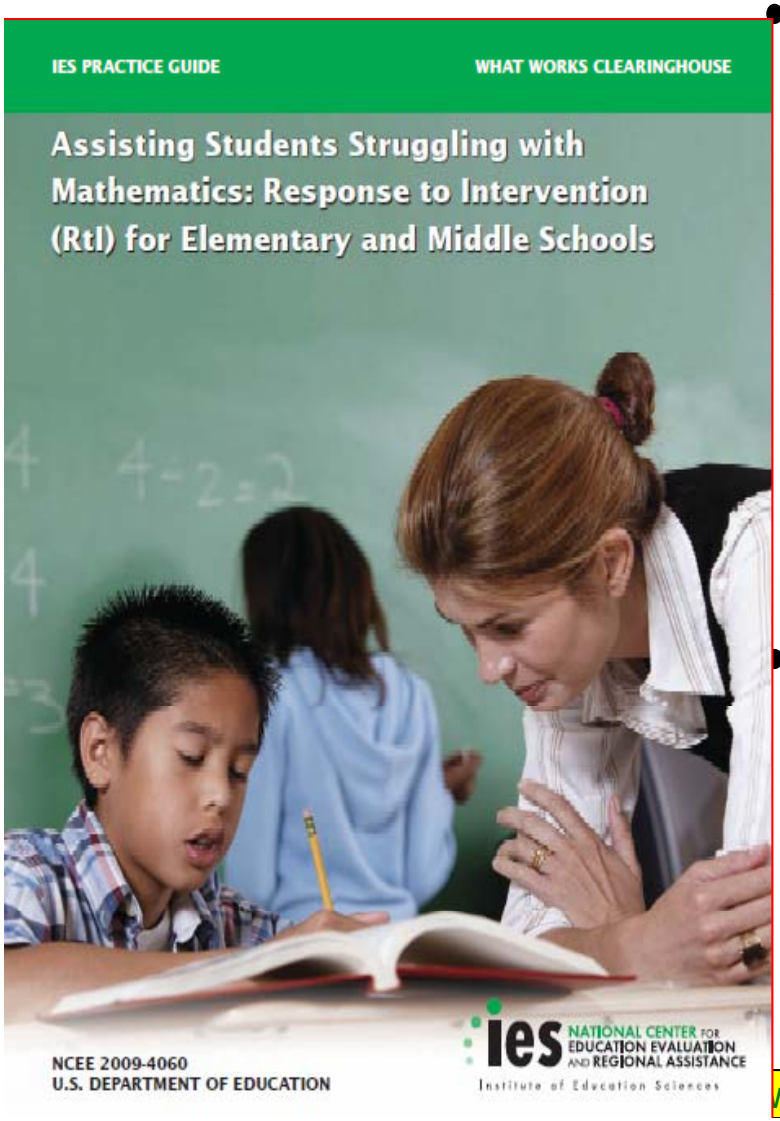


Assisting Students Struggling with Mathematics: RtI for Elementary & Middle Schools: 8 Recommendations



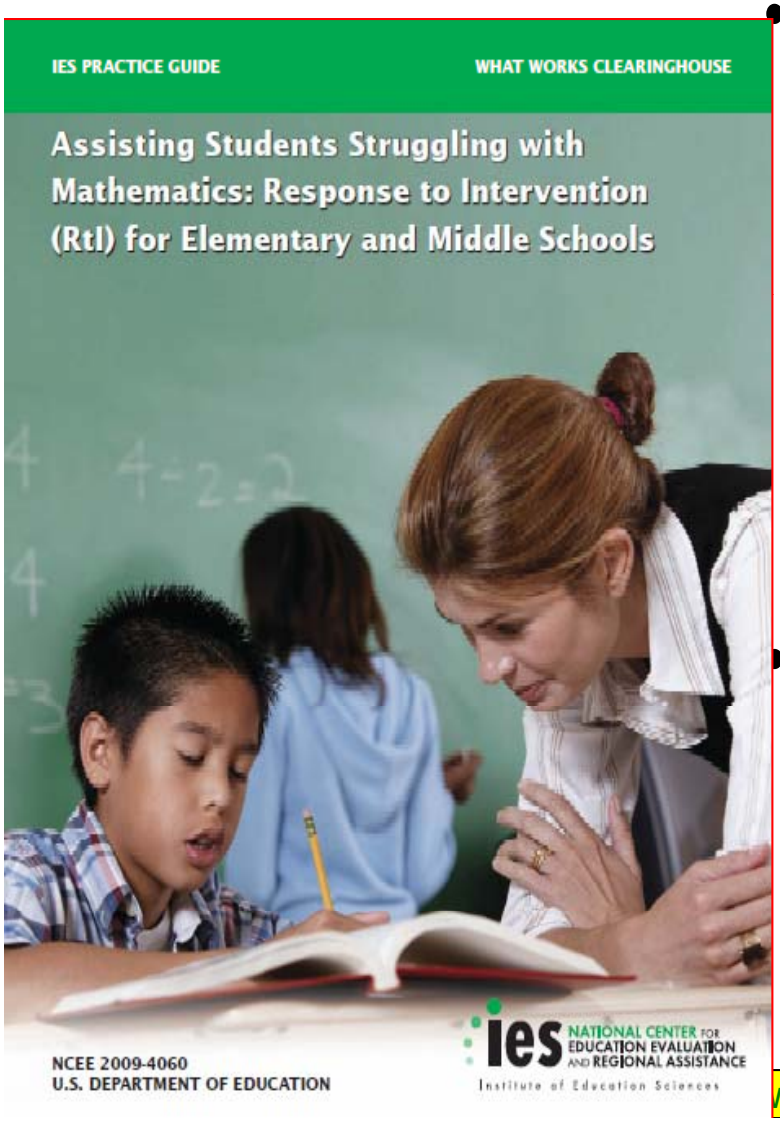
- **Recommendation 1.** Screen all students to identify those at risk for potential mathematics difficulties and provide interventions to students identified as at risk
- **Recommendation 2.** Instructional materials for students receiving interventions should focus intensely on in-depth treatment of 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.)



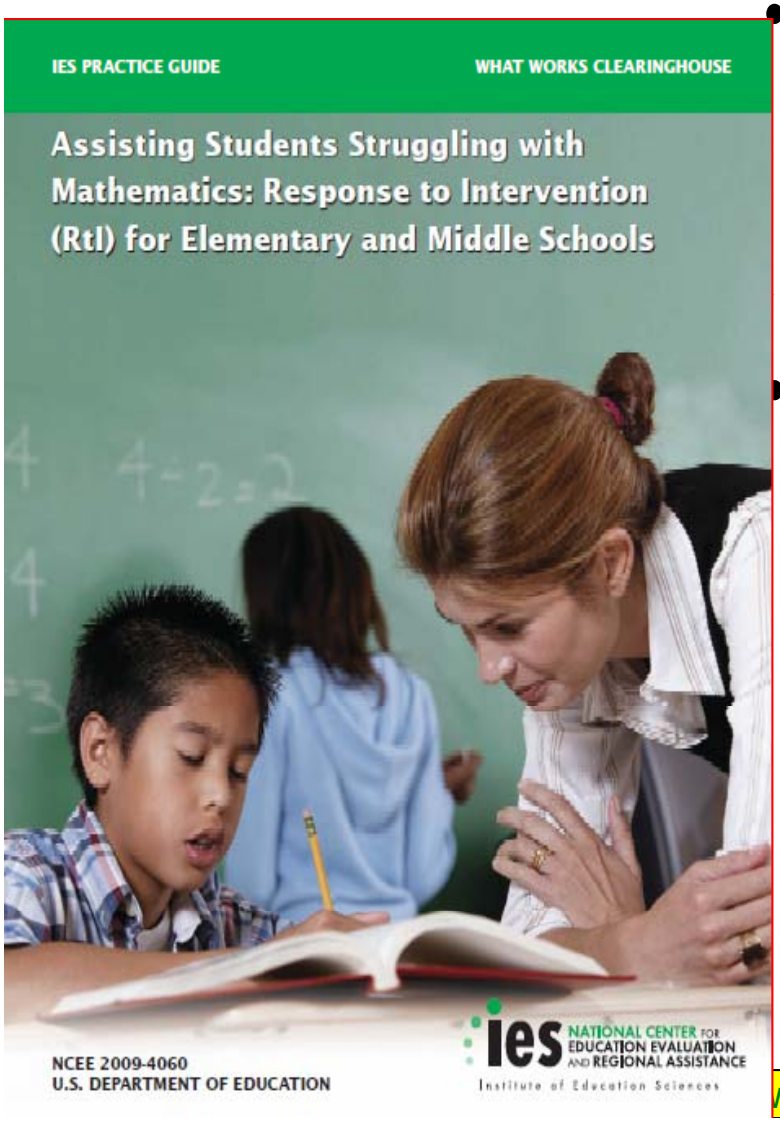
- **Recommendation 3.** Instruction during the intervention should be explicit and systematic. This includes providing models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review
- **Recommendation 4.** Interventions should 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.** Progress should be monitored for students receiving supplemental instruction/intervention and other students who are at risk.
- **Recommendation 8.** Tier 2/3 math interventions should include motivational strategies to energize and engage reluctant learners.

How Do We Reach Low-Performing Math Students?: Instructional Recommendations p. 5

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..

Peer-Guided Pause p. 33

- Students are trained to work in pairs.
- At one or more appropriate review points in a lecture, the instructor directs students to pair up to work together for 4-8 minutes.
- During each Peer Guided Pause, students are given a worksheet that contains one or more correctly completed word or number problems illustrating the math concept(s) covered in the lecture. The sheet also contains several additional, similar problems that pairs of students work cooperatively to complete, along with an answer key.
- Student pairs are reminded to (a) monitor their understanding of the lesson concepts; (b) review the correctly math model problem; (c) work cooperatively on the additional problems, and (d) check their answers. The teacher can direct student pairs to write their names on the practice sheets and collect them to monitor student understanding.

Source: *Hawkins, J., & Brady, M. P. (1994). The effects of independent and peer guided practice during instructional pauses on the academic performance of students with mild handicaps. Education & Treatment of Children, 17 (1), 1-28.*

How To: Implement Strong Core Instruction (Handout: pp. 2-4)

How To: Implement Strong Core Instruction

When teachers must present challenging academic material to struggling learners, they can make that material more accessible and promote faster learning by building assistance directly into instruction. Researchers use several terms to refer to this increased level of student instructional support: explicit instruction, direct instruction, supported instruction (Rosenshine, 2008).

The checklist below summarizes the essential elements of a supported-instruction approach. When preparing lesson plans, instructors can use this resource as a 'pre-flight' checklist to make sure that their lessons reach the widest range of diverse learners.

1. Increase Access to Instruction

Instructional Element	Notes
☐ **Instructional Match.** Lesson content is appropriately matched to students' abilities (Burns, VanDerHeyden, & Boice, 2008).	
☐ **Content Review at Lesson Start.** The lesson opens with a brief review of concepts or material that have previously been presented. (Burns, VanDerHeyden, & Boice, 2008, Rosenshine, 2008).	
☐ **Preview of Lesson Goal(s).** At the start of instruction, the goals of the current day's lesson are shared (Rosenshine, 2008).	
☐ **Chunking of New Material.** The teacher breaks new material into small, manageable increments, 'chunks', or steps (Rosenshine, 2008).	

2. Provided 'Scaffolding' Support

Instructional Element	Notes
☐ **Detailed Explanations & Instructions.** throughout the lesson, the teacher provides adequate explanations and detailed instructions for all concepts and materials being taught (Burns, VanDerHeyden, & Boice, 2008).	
☐ **Think-Alouds/Talk-Alouds.** When presenting cognitive strategies that cannot be observed directly, the teacher describes those strategies for students. Verbal explanations 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 in applying the strategy) (Burns, VanDerHeyden, & Boice, 2008, Rosenshine, 2008).	
☐ **Work Models.** The teacher makes exemplars of academic work (e.g., essays, completed math word problems) available to students for use as models (Rosenshine, 2008).	
☐ **Active Engagement.** The teacher ensures that the lesson engages the student in 'active accurate responding' (Skinner, Pappas & Davis, 2005) often enough to capture student attention and to optimize learning.	
☐ **Collaborative Assignments.** Students have frequent opportunities to work collaboratively--in pairs or groups. (Baker, Gersten, & Lee, 2002; Gettinger & Seibert, 2002).	
☐ **Checks for Understanding.** The instructor regularly checks for student understanding by posing frequent questions to the group (Rosenshine, 2008).	

How To Implement Strong Core Instruction

Increase Access to Instruction

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How To Implement Strong Core Instruction

Increase Access to Instruction

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How To Implement Strong Core Instruction

Provide 'Scaffolding' Support

1. **Detailed Explanations & Instructions**. Throughout the lesson, the teacher provides adequate explanations and detailed instructions for all concepts and materials being taught (Burns, VanDerHeyden, & Boice, 2008).
2. **Talk-Alouds/Think-Alouds.** Verbal explanations are given to explain cognitive strategies: '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 in applying the strategy) (Burns, VanDerHeyden, & Boice, 2008, Rosenshine, 2008).

How To Implement Strong Core Instruction

Provide 'Scaffolding' Support

3. **Work Models.** The teacher makes exemplars of academic work (e.g., essays, completed math word problems) available to students for use as models (Rosenshine, 2008).
4. **Active Engagement.** The teacher ensures that the lesson engages the student in 'active accurate responding' (Skinner, Pappas & Davis, 2005) often enough to capture student attention and to optimize learning.

How To Implement Strong Core Instruction

Provide 'Scaffolding' Support

5. **Collaborative Assignments.** Students have frequent opportunities to work collaboratively--in pairs or groups. (Baker, Gersten, & Lee, 2002; Gettinger & Seibert, 2002).
6. **Checks for Understanding.** The instructor regularly checks for student understanding by posing frequent questions to the group (Rosenshine, 2008).

How To Implement Strong Core Instruction

Provide 'Scaffolding' Support

7. **Group Responding.** The teacher ensures full class participation and boosts levels of student attention by having all students respond in various ways (e.g., choral responding, response cards, white boards) to instructor questions (Rosenshine, 2008).
8. **High Rate of Student Success**. The teacher verifies that students are experiencing at least 80% success in the lesson content to shape their learning in the desired direction and to maintain student motivation and engagement (Gettinger & Seibert, 2002).

How To Implement Strong Core Instruction

Provide 'Scaffolding' Support

9. **Brisk Rate of Instruction**. The lesson moves at a brisk rate--sufficient to hold student attention (Carnine,1976; Gettinger & Seibert, 2002).
10. **Fix-Up Strategies.** Students are taught fix-up strategies (Rosenshine, 2008) for use during independent work (e.g., for defining unknown words in reading assignments, for solving challenging math word problems).

How To Implement Strong Core Instruction

Give Timely Performance Feedback

1. **Regular Feedback.** The teacher provides timely and regular performance feedback and corrections throughout the lesson as needed to guide student learning (Burns, VanDerHeyden, & Boice).
2. **Step-by-Step Checklists.** For multi-step cognitive strategies, the teacher creates checklists for students to use to self-monitor performance (Rosenshine, 2008).

How To Implement Strong Core Instruction

Provide Opportunities for Review & Practice

1. **Spacing of Practice Throughout Lesson.** The lesson includes practice activities spaced throughout the lesson. (e.g., through teacher demonstration; then group practice with teacher supervision and feedback; then independent, individual student practice) (Burns, VanDerHeyden, & Boice).

How To Implement Strong Core Instruction

Provide Opportunities for Review & Practice

2. **Guided Practice.** When teaching challenging material, the teacher provides immediate corrective feedback to each student response. When the instructor anticipates the possibility of an incorrect response, that teacher forestalls student error through use of cues, prompts, or hints. The teacher also tracks student responding and ensures sufficient success during supervised lessons before having students practice the new skills or knowledge independently (Burns, VanDerHeyden, & Boice, 2008).

How To Implement Strong Core Instruction

Provide Opportunities for Review & Practice

3. **Support for Independent Practice.** The teacher ensures that students have adequate support (e.g., clear and explicit instructions; teacher monitoring) to be successful during independent seatwork practice activities (Rosenshine, 2008).
4. **Distributed Practice.** The teacher reviews previously taught content one or more times over a period of several weeks or months (Pashler et al., 2007; Rosenshine & Stevens, 1995).

Teachers: Elements of Strong Core Math Instruction

- Recommendation 1: Use an ‘elements of strong core instruction’ checklist like the one shared today in your school as a shared definition of direct instruction.
- Recommendation 2: Whenever planning lessons for struggling students, have a direct-instruction checklist on hand as a reference to be able to single out and address important instructional elements.

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 classes.
- Discuss how – as a consultant – you can promote the use of a 'core instruction' checklist like the one just reviewed to ensure strong Tier 1 (core) instruction across all classrooms in your school(s).

How To: Implement Strong Core Instruction

When teachers must present challenging academic material to struggling learners, they can make that material more accessible and promote faster learning by building assistance directly into instruction. Researchers use several terms to refer to this increased level of student instructional support: explicit instruction, direct instruction, supported instruction (Rosenshine, 2008).

The checklist below summarizes the essential elements of a supported-instruction approach. When preparing lesson plans, instructors can use this resource as a 'pre-flight' checklist to make sure that their lessons reach the widest range of diverse learners.

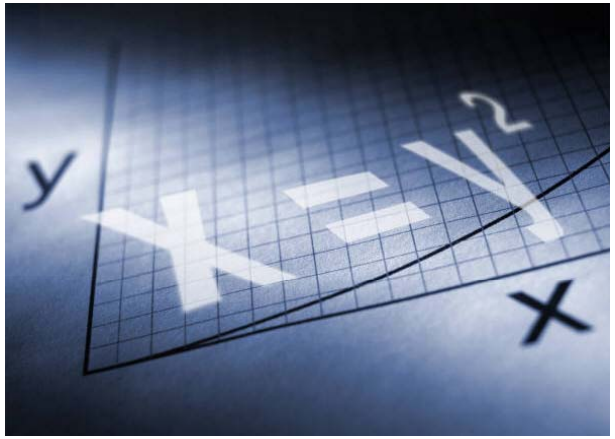
1. Increase Access to Instruction	
Instructional Element	Notes
☐ **Instructional Match.** Lesson content is appropriately matched to students' abilities (Burns, VanDerHeyden, & Boice, 2008).	
☐ **Content Review at Lesson Start.** The lesson opens with a brief review of concepts or material that have previously been presented. (Burns, VanDerHeyden, & Boice, 2008, Rosenshine, 2008).	
☐ **Preview of Lesson Goal(s).** At the start of instruction, the goals of the current day's lesson are shared (Rosenshine, 2008).	
☐ **Chunking of New Material.** The teacher breaks new material into small, manageable increments, 'chunks', or steps (Rosenshine, 2008).	

2. Provided 'Scaffolding' Support	
Instructional Element	Notes
☐ **Detailed Explanations & Instructions.** throughout the lesson, the teacher provides adequate explanations and detailed instructions for all concepts and materials being taught (Burns, VanDerHeyden, & Boice, 2008).	
☐ **Think-Alouds/Talk-Alouds.** When presenting cognitive strategies that cannot be observed directly, the teacher describes those strategies for students. Verbal explanations 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 in applying the strategy) (Burns, VanDerHeyden, & Boice, 2008, Rosenshine, 2008).	
☐ **Work Models.** The teacher makes exemplars of academic work (e.g., essays, completed math word problems) available to students for use as models (Rosenshine, 2008).	
☐ **Active Engagement.** The teacher ensures that the lesson engages the student in 'active accurate responding' (Skinner, Pappas & Davis, 2005) often enough to capture student attention and to optimize learning.	
☐ **Collaborative Assignments.** Students have frequent opportunities to work collaboratively--in pairs or groups. (Baker, Gersten, & Lee, 2002; Gettinger & Seibert, 2002).	
☐ **Checks for Understanding.** The instructor regularly checks for student understanding by posing frequent questions to the group (Rosenshine, 2008).	

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.

Math Interventions: 7 Big Ideas

Focus of Inquiry: What are the quality indicators of a classroom math intervention?



Academic Interventions: 7 'Big Ideas'

- *Academic problems should be clearly defined.* Before a teacher can select interventions to address a student academic problem, the instructor must be able to describe in clear and specific terms just what the student problem is. In fact, the most important step in the entire process of developing an intervention is to be able to describe correctly and specifically the problem that must be fixed (Bergan, 1995).

1

Academic Interventions: 7 'Big Ideas'

- *Academic problems should be linked to their probable cause.* Once an academic problem has been defined, the teacher will want to develop a hypothesis ('educated guess') about what issue is causing that problem.

  For example, a student may do poorly on a reading comprehension task because she lacks the necessary comprehension skills, is accurate but not yet fluent in those skills, had once learned those skills but failed to retain them, can perform the skills but has limited endurance, or possesses the skills but does not recognize situations when she should use them (Martens & Witt, 2004).

2

Academic Interventions: 7 'Big Ideas'

- *Intervention strategies should be research-based*. When possible, the teacher should include in an intervention plan only those ideas supported by research. At present, there is no consensus on how to define 'research-based' interventions (Odom et al., 2005). However, a sensible rule of thumb to follow is that an intervention idea should be shown as effective in at least one study published in a reputable peer-reviewed research journal before it is used in school intervention plans.

3

Academic Interventions: 7 ‘Big Ideas’

- *Intervention plans should help students to access instruction--but not 'dumb down' instruction*. When putting together classroom intervention plans, instructors can choose from among a wide array of strategies to help the student to achieve academic success. But teachers should take care not cross the line and modify core instruction for struggling general-education students; that is, they should not hold underperforming students to a lesser academic standard than their classmates (Tindal & Fuchs, 1999).

4

Academic Interventions: 7 'Big Ideas'

- *Interventions should be documented in writing*. When a teacher commits to develop an academic intervention to support a student, that instructor should always create a written plan to document the intervention prior to implementing it (Burns & Gibbons, 2008).

  Writing out intervention plans help teachers to carry them out more consistently and be able to produce the plans when needed as proof that they are providing at-risk students with ongoing assistance.

5

Academic Interventions: 7 'Big Ideas'

- *Interventions should be carried out with integrity.* The teacher should monitor the integrity of any classroom intervention closely, ensuring that the actual intervention conforms as closely as possible to the guidelines contained in the written intervention plan (Gansle & Noell, 2007) and taking steps when needed to bring the intervention back into alignment with good practices.

6

Academic Interventions: 7 'Big Ideas'

- *Goal-setting and progress-monitoring should be a part of all academic interventions*. At their core, academic interventions are intended to improve student performance (Duhon, Mesmer, Atkins, Greguson, & Olinger, 2009). But teachers cannot know with certainty whether a student is actually benefiting from an intervention unless they set specific outcome goals up front and then collect data periodically throughout the intervention to verify that these goals are met (Wright 2007).

7

How To: Create a Written Record of Classroom Interventions pp. 10-12

Classroom Intervention Planning Sheet: Math Computation Example

This worksheet is designed to help teachers to quickly create classroom plans for academic and behavioral interventions. (For a tutorial on how to fill out this sheet, review the accompanying directions.)

Case Information

What to Write: Record the important case information, including student, person delivering the intervention, date of plan, start and end dates for the intervention plan, and the total number of instructional weeks that the intervention will run.

Student:	*John Samuelson-Gr 4*	Interventionist(s):	*Mrs. Kennedy, classroom teacher*	Date Intervention Plan Was Written:	*10 October 2012*
Date Intervention is to Start:	*M 8 Oct 2012*	Date Intervention is to End:	*F 16 Nov 2012*	Total Number of Intervention Weeks:	*6 weeks*
Description of the Student Problem:	*Slow math computation speed (computes multiplication facts at 12 correct digits in 2 minutes, when typical gr 4 peers compute at least 24 correct digits).*				

Intervention

What to Write: Write a brief description of the intervention(s) to be used with this student. TIP: If you have a script for this intervention, you can just write its name here and attach the script to this sheet.

Math Computation Time Drill (Rhymer et al., 2002)
Explicit time-drills are a method to boost students' rate of responding on arithmetic-fact worksheets: (1) The teacher hands out the worksheet. Students are instructed that they will have 3 minutes to work on problems on the sheet. (2) The teacher starts the stop watch and tells the students to start work. (3) At the end of the first minute in the 3-minute span, the teacher calls 'time', stops the stopwatch, and tells the students to underline the last number written and to put their pencils in the air. Then students are told to resume work and the teacher restarts the stopwatch. (4) This process is repeated at the end of minutes 2 and 3. (5) At the conclusion of the 3 minutes, the teacher collects the student worksheets.

Materials

What to Write: Jot down materials (e.g., flashcards) or resources (e.g., Internet-connected computer) needed to carry out this intervention.

Use math worksheet generator on www.interventioncentral.org to create all time-drill and assessment materials.

Training

What to Write: Note what training–if any–is needed to prepare adult(s) and/or the student to carry out the intervention.

Meet with the student at least once before the intervention to familiarize with the time-drill technique and timed math computation assessments.

Progress-Monitoring

What to Write: Select a method to monitor student progress on this intervention. For the method selected, record what type of data is to be used, enter student baseline (starting-point) information, calculate an intervention outcome goal, and note how frequently you plan to monitor the intervention. Tip: Several ideas for classroom data collection appear on the right side of this table.

Type of Data Used to Monitor: *Curriculum-based measurement: math computation assessments: 2 minute single-skill probes*

Baseline	Outcome Goal
12 correct digits per 2 minute probe	*24 correct digits per 2 minute probe*

How often will data be collected? (e.g., daily, every other day, weekly): *WEEKLY*

Ideas for Intervention Progress-Monitoring

- Existing data: grades, homework logs, etc.
- Cumulative mastery log
- Rubric
- Curriculum-based measurement
- Behavior report card
- Behavior checklist

Creating a Written Record of Classroom Interventions: Form

- *Case information*. The opening section of the form includes general information about the case, including:
  - Target student
  - Teacher/interventionist
  - Date of the intervention plan
  - Start and end dates for the intervention
  - Description of the student problem to be addressed

Case Information

What to Write: Record the important case information, including student, person delivering the intervention, date of plan, start and end dates for the intervention plan, and the total number of instructional weeks that the intervention will run.

Student:	*John Samuelson-Gr 4*	Interventionist(s):	*Mrs. Kennedy, classroom teacher*	Date Intervention Plan Was Written:	*10 October 2012*
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Creating a Written Record of Classroom Interventions: Form

- *Intervention.* The teacher describes the evidence-based intervention(s) that will be used to address the identified student concern(s). As a shortcut, the instructor can simply write the intervention name in this section and attach a more detailed intervention script/description to the intervention plan.

Intervention
What to Write: Write a brief description of the intervention(s) to be used with this student. TIP: If you have a script for this intervention, you can just write its name here and attach the script to this sheet.
Math Computation Time Drill.(Rhymer et al., 2002)-See attached description

Creating a Written Record of Classroom Interventions: Form

- *Materials.* The teacher lists any materials (e.g., flashcards, wordlists, worksheets) or other resources (e.g., Internet-connected computer) necessary for the intervention.

Materials
What to Write: Jot down materials (e.g., flashcards) or resources (e.g., Internet-connected computer) needed to carry out this intervention.
Use math worksheet generator on www.interventioncentral.org to create all time-drill and assessment materials.

Creating a Written Record of Classroom Interventions: Form

- *Training.* If adults and/or the target student require any training prior to the intervention, the teacher records those training needs in this section of the form.

Training
What to Write: Note what training–if any--is needed to prepare adult(s) and/or the student to carry out the intervention.
Meet with the student at least once before the intervention to familiarize with the time-drill technique and timed math computation assessments.

Creating a Written Record of Classroom Interventions: Form

- *Progress-Monitoring.* The teacher selects a method to monitor student progress during the intervention, to include:
  - what type of data is to be used
  - student baseline (starting-point) information
  - an intervention outcome goal
  - the frequency that data will be collected.

Progress-Monitoring

What to Write: Select a method to monitor student progress on this intervention. For the method selected, record what type of data is to be used, enter student baseline (starting-point) information, calculate an intervention outcome goal, and note how frequently you plan to monitor the intervention. Tip: Several ideas for classroom data collection appear on the right side of this table.

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Ideas for Intervention Progress-Monitoring

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Resp

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Ideas for Intervention Progress-Monitoring

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- Behavior report card
- Behavior checklist

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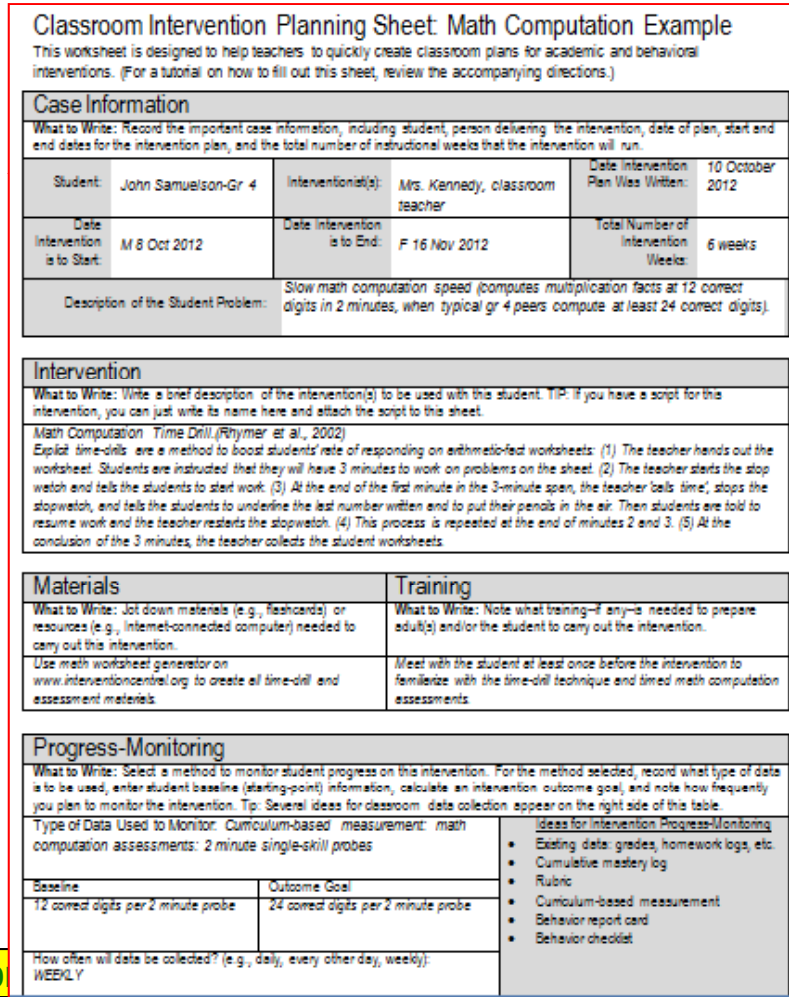
Activity: Documenting Classroom Interventions

- Review the *Classroom Intervention Planning Sheet* in your packet (pp. 10-12).
- Discuss how you currently document your classroom intervention efforts.
- Would a form like this be useful?
- Be prepared to report out!



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Progress-Monitoring

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How often will data be collected? (e.g., daily, every other day, weekly): *WEEKLY*

Ideas for Intervention Progress-Monitoring
- Existing data: grades, homework logs, etc.
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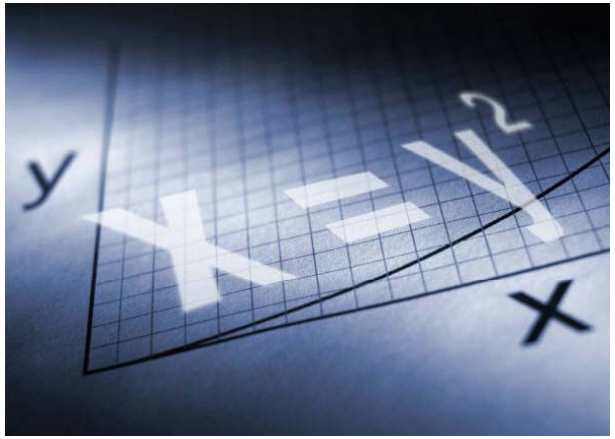
- Rubric
- Curriculum-based measurement
- Behavior report card
- Behavior checklist

Math Interventions: A Sampling

Focus of Inquiry: What are examples of math interventions for secondary-level students?



Sample Strategy to Promote…Math Vocabulary

-Classwide Peer Tutoring: Vocabulary

Building Vocabulary Knowledge through Classwide Tutoring pp. 62-68

Classwide vocabulary tutoring with constant time delay is an economical group-based intervention. Students use flash-cards to tutor each other in vocabulary of the teacher's choosing.

Source: *Hughes, T. A., & Fredrick, L. D. (2006). Teaching vocabulary with students with learning disabilities using classwide peer tutoring and constant time delay. Journal of Behavioral Education, 15(1), 1-23.*

Vocabulary Terms: 4 Levels of 'Knowing'

There are 4 stages, or levels, in 'knowing' a vocabulary term:

1. The student does not recognize the term at all.
2. The student vaguely recognizes the term.
3. The student can provide a formal definition of the term.
4. The student can independently use the term flexibly and correctly in various applied oral and written contexts.

Source: *Beck, I. L., McKeown, M. G., & Kucan, L. (2002). Bringing words to life: Robust vocabulary instruction. Guilford Press: New York.*

Vocabulary Terms: Mastery Through Repetition

According to one estimate, a student typically needs at least 12--and perhaps as many as 17--exposures to a vocabulary term before he or she is able to fully assimilate and use it.

Source: *Kamil, M. L., Borman, G. D., Dole, J., Kral, C. C., Salinger, T., & Torgesen, J. (2008). Improving adolescent literacy: Effective classroom and intervention practices: A practice guide (NCEE #2008-4027). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. Retrieved from http://ies.ed.gov/ncee/wwc.*

Building Vocabulary Knowledge through Classwide Tutoring

Create Student Pairs. Prior to starting the tutoring program the teacher assigns students to tutoring pairs:

1. The teacher rank-orders students in descending order by perceived vocabulary knowledge or reading skills.
2. The teacher puts the names of students from the top half of the class/group into one container , the names of the students from the bottom half into another.
3. The teacher creates each tutoring pair by drawing one name each from the top-half and bottom-half containers, continuing the process until all names are drawn.

Source: *Hughes, T. A., & Fredrick, L. D. (2006). Teaching vocabulary with students with learning disabilities using classwide peer tutoring and constant time delay. Journal of Behavioral Education, 15(1), 1-23.*

Vocabulary Tutoring: Student-Pair Assignments

Vocabulary Tutoring: Student-Pair Assignments

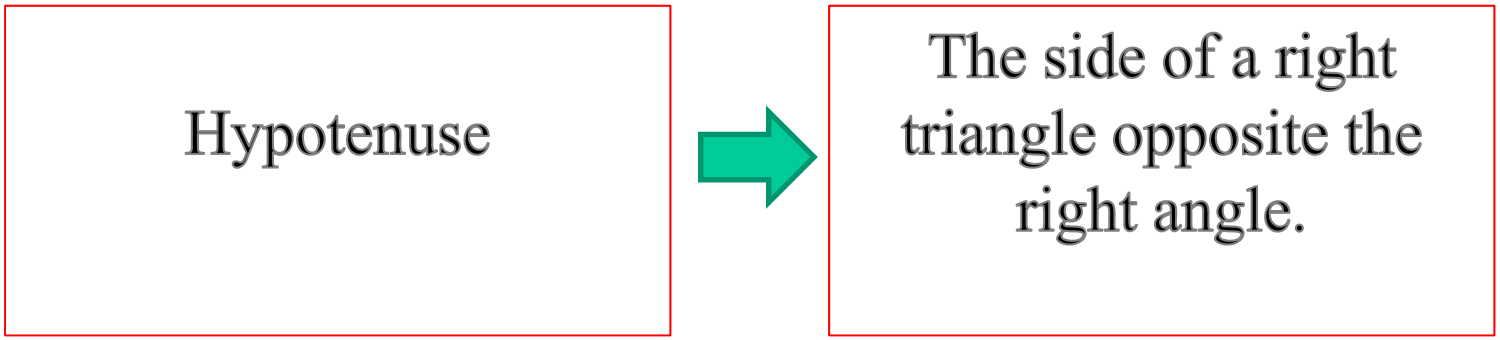
Class/Grade: _____ Date: _____ Teacher(s): _____

1	Student 1: _____ Student 2: _____	11	Student 1: _____ Student 2: _____
2	Student 1: _____ Student 2: _____	12	Student 1: _____ Student 2: _____
3	Student 1: _____ Student 2: _____	13	Student 1: _____ Student 2: _____
4	Student 1: _____ Student 2: _____	14	Student 1: _____ Student 2: _____
5	Student 1: _____ Student 2: _____	15	Student 1: _____ Student 2: _____
6	Student 1: _____ Student 2: _____	16	Student 1: _____ Student 2: _____
7	Student 1: _____ Student 2: _____	17	Student 1: _____ Student 2: _____
8	Student 1: _____ Student 2: _____	18	Student 1: _____ Student 2: _____
9	Student 1: _____ Student 2: _____	19	Student 1: _____ Student 2: _____
10	Student 1: _____ Student 2: _____	20	Student 1: _____ Student 2: _____

Building Vocabulary Knowledge through Classwide Tutoring

Prepare Materials. Prior to each tutoring session, the teacher prepares the following materials for each pair:

- Folder with pockets to hold tutoring materials
- 5 vocabulary flash-cards, with terms written on one side and definitions written on the other. Fresh vocabulary cards are prepared for each tutoring session. TIP: To save time, the teacher may display terms and definitions on an overhead and have students copy them on flash-cards.



Source: *Hughes, T. A., & Fredrick, L. D. (2006). Teaching vocabulary with students with learning disabilities using classwide peer tutoring and constant time delay. Journal of Behavioral Education, 15(1), 1-23.*

Vocabulary Tutoring: Session Form

Vocabulary Tutoring: Session Form

Date: _____

Tutee: _____	Tutor: _____
1. _____ 2. _____ 3. _____ 4. _____ 5. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____
1. _____ 2. _____ 3. _____ 4. _____ 5. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____
1. _____ 2. _____ 3. _____ 4. _____ 5. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____
1. _____ 2. _____ 3. _____ 4. _____ 5. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____
Total Vocabulary Words Correct: _____	**Total Vocabulary Words Incorrect (Words Crossed Out in Left Column):** _____

Percent Vocabulary Words Correct: _____%

Percent Correct is calculated as follows: (1) Total Correct ÷ (Total Correct + Total Incorrect); (2) Quotient is multiplied by 100.

Resp

Vocabulary Tutoring: Tracking Form

Date	Student 1: Josh	Student 2: Andrea
1 / 4 / 13	% Vocabulary Words Correct: 90 %	% Vocabulary Words Correct: _____ %
/ /	% Vocabulary Words Correct: _____ %	% Vocabulary Words Correct: _____ %
/ /	% Vocabulary Words Correct: _____ %	% Vocabulary Words Correct: _____ %
/ /	% Vocabulary Words Correct: _____ %	% Vocabulary Words Correct: _____ %
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Building Vocabulary Knowledge through Classwide Tutoring

Procedures. Whenever the teacher uses the classwide vocabulary tutoring program, these steps are followed:

1. *Introduce the Day's Vocabulary Terms.* In large-group, the teacher displays on an overhead the terms and corresponding definitions for each of the 5 vocabulary items to be the focus of the day's tutoring session. The teacher reads aloud each term and definition twice. The teacher then has the class chorally respond by reading each term and definition aloud twice.

Source: *Hughes, T. A., & Fredrick, L. D. (2006). Teaching vocabulary with students with learning disabilities using classwide peer tutoring and constant time delay. Journal of Behavioral Education, 15(1), 1-23.*

Building Vocabulary Knowledge through Classwide Tutoring

Procedures. Whenever the teacher uses the classwide vocabulary tutoring program, these steps are followed:

2. *Begin the Tutoring Session*. The teacher directs students to get their tutoring folders and join their tutoring partners. The teacher sets an audio or visual timer for 4 minutes and directs the students to decide which roles (tutor, tutee) each will take at the outset and to begin tutoring.

Source: *Hughes, T. A., & Fredrick, L. D. (2006). Teaching vocabulary with students with learning disabilities using classwide peer tutoring and constant time delay. Journal of Behavioral Education, 15(1), 1-23.*

Building Vocabulary Knowledge through Classwide Tutoring

Procedures. Whenever the teacher uses the classwide vocabulary tutoring program, these steps are followed:

3. *Conduct Integrity Checks*. While students are engaged in tutoring, the teacher circulates throughout the room using the *Vocabulary Tutoring Student Checklist* to conduct integrity checks of the tutoring and to intervene if needed with tutoring pairs.

Source: *Hughes, T. A., & Fredrick, L. D. (2006). Teaching vocabulary with students with learning disabilities using classwide peer tutoring and constant time delay. Journal of Behavioral Education, 15(1), 1-23.*

Vocabulary Tutoring: Student Checklist

Vocabulary Tutoring Student Checklist (Adapted from Hughes & Fredrick, 2006).

Students Directions: Use this checklist to remember these important steps as you tutor your student partner.

Carried Out?	*Intervention Step*
_Y _N	1. **Quickly Start the Session.** When the teacher starts the timer, I begin the tutoring session right away.
_Y _N	2. **Present Cards: 0-Second Time Delay.** The first time that I review the stack of 5 vocabulary cards, I read each definition aloud and then immediately say the vocabulary word on the back of the card that goes with the definition ('0-second time delay').
_Y _N	3. **Present Cards: 5-Second Time Delay.** For the rest of the session, when I present the stack of vocabulary cards, I read each definition aloud and then count silently to 5 ("1-banana...2 banana...") before giving the matching vocabulary word ('5-second time delay').
_Y _N	4. **Tutee Responds.** Whenever I read a vocabulary definition from a card (0-second delay or 5-second delay), I make sure that my student partner writes their vocabulary-word answers in the correct space in the LEFT ('Tutee') column on the *Vocabulary Tutoring: Session Form.*
_Y _N	5. **Give Performance Feedback.** Whenever the student I am tutoring writes the *correct* answer, I say, "Yes, the word [word] means [definition]." Then I go to the next flash-card. Whenever the student I am tutoring either writes an *incorrect* answer or takes 5 seconds or longer to write an answer: • I say "No/sorry/nice try, the word [word] means [definition]." • I draw a line through the space in the LEFT ('Tutee') column on the *Vocabulary Tutoring: Session Form* where my partner is supposed to write a vocabulary word. • I write the right vocabulary word in the correct space in the RIGHT ('Tutor') column on the *Vocabulary Tutoring: Session Form.* • Then I go to the next flash-card.
_Y _N	6. **Shuffle Cards.** Each time I finish reviewing the stack of vocabulary cards, I shuffle the cards before I show them again to my partner.
_Y _N	7. **Work Until End of Session.** I go on presenting vocabulary cards to my partner until I have gone through the stack 4 times or we run out of time.
_Y _N	8. **Record Tutee Responses.** At the end of the session:

Building Vocabulary Knowledge through Classwide Tutoring

Tutoring Steps. The tutor follows these self-check steps during tutoring:

1. **Quickly Start the Session.** When the teacher starts the timer, I begin the tutoring session right away.

Source: *Hughes, T. A., & Fredrick, L. D. (2006). Teaching vocabulary with students with learning disabilities using classwide peer tutoring and constant time delay. Journal of Behavioral Education, 15(1), 1-23.*

Building Vocabulary Knowledge through Classwide Tutoring

2. **Present Cards: 0-Second Time Delay.** The first time that I review the stack of 5 vocabulary cards, I read each definition aloud and then immediately say the vocabulary word on the back of the card that goes with the definition ('0-second time delay').

3. **Present Cards: 5-Second Time Delay.** For the rest of the session, when I present the stack of vocabulary cards, I read each definition aloud and then count silently to 5 ("1-banana...2 banana...") before giving the matching vocabulary word ('5-second time delay').

Source: *Hughes, T. A., & Fredrick, L. D. (2006). Teaching vocabulary with students with learning disabilities using classwide peer tutoring and constant time delay. Journal of Behavioral Education, 15(1), 1-23.*

Building Vocabulary Knowledge through Classwide Tutoring

4. **Tutee Responds.** Whenever I read a vocabulary definition from a card (0-second delay or 5-second delay), I make sure that my student partner writes their vocabulary-word answers in the correct space in the LEFT ('Tutee') column on the *Vocabulary Tutoring: Session Form*.

Source: *Hughes, T. A., & Fredrick, L. D. (2006). Teaching vocabulary with students with learning disabilities using classwide peer tutoring and constant time delay. Journal of Behavioral Education, 15(1), 1-23.*

Building Vocabulary Knowledge through Classwide Tutoring

5. **Give Performance Feedback.** Whenever the student I am tutoring writes the *correct* answer, I say, "Yes, the word [word] means [definition]."

   Then I go to the next flash-card.

Source: *Hughes, T. A., & Fredrick, L. D. (2006). Teaching vocabulary with students with learning disabilities using classwide peer tutoring and constant time delay. Journal of Behavioral Education, 15(1), 1-23.*

Building Vocabulary Knowledge through Classwide Tutoring

5. (Cont.) **Give Performance Feedback.** Whenever the student I am tutoring either writes an incorrect answer or takes 5 seconds or longer to write an answer:

- I say "No/sorry/nice try, the word [word] means [definition]."
- I draw a line through the space in the LEFT ('Tutee') column on the Vocabulary Tutoring: Session Form where my partner is supposed to write a vocabulary word.
- I write the right vocabulary word in the correct space in the RIGHT ('Tutor') column on the Vocabulary Tutoring: Session Form.
- Then I go to the next flash-card.

Source: *Hughes, T. A., & Fredrick, L. D. (2006). Teaching vocabulary with students with learning disabilities using classwide peer tutoring and constant time delay. Journal of Behavioral Education, 15(1), 1-23.*

Building Vocabulary Knowledge through Classwide Tutoring

6. **Shuffle Cards.** Each time I finish reviewing the stack of vocabulary cards, I shuffle the cards before I show them again to my partner.

7. **Work Until End of Session.** I go on presenting vocabulary cards to my partner until I have gone through the stack 4 times or we run out of time.

Source: *Hughes, T. A., & Fredrick, L. D. (2006). Teaching vocabulary with students with learning disabilities using classwide peer tutoring and constant time delay. Journal of Behavioral Education, 15(1), 1-23.*

Vocabulary Tutoring: Session Form

Vocabulary Tutoring: Session Form

Date: _____

Tutee: Josh	Tutor: Andrea	
1. hypotenuse	1.	Trial 1: 0-Second Delay
2. circumference	2.	
3. equilateral triangle	3.	
4. line segment	4.	
5. perpendicular	5.	
1. ~~equilateral triangle~~	1.	Trial 2: 5-Second Delay
2. ~~parallel~~	2. circumference	
3. hypotenuse	3.	
4. line segment	4.	
5. ~~parallel~~	5. perpendicular	
1. equilateral triangle	1.	Trial 3: 5-Second Delay
2. circumference	2.	
3. line segment	3.	
4. perpendicular	4.	
5. hypotenuse	5.	
1. ~~perpendicular~~	1.	Trial 4: 5-Second Delay
2. hypotenuse	2.	
3. circumference	3.	
4. line segment	4.	
5. equilateral triangle	5.	
Total Vocabulary Words Correct: 18	Total Vocabulary Words Incorrect (Words Crossed Out in Left Column): 2	

Percent Vocabulary Words Correct: 90 %

Percent Correct is calculated as follows: (1) Total Correct ÷ (Total Correct + Total Incorrect); (2) Quotient is multiplied by 100.

Resp

Vocabulary Tutoring: Tracking Form

Date	Student 1: Josh	Student 2: Andrea
1 / 4 / 13	% Vocabulary Words Correct: 90 %	% Vocabulary Words Correct: _____ %
/ /	% Vocabulary Words Correct: _____ %	% Vocabulary Words Correct: _____ %
/ /	% Vocabulary Words Correct: _____ %	% Vocabulary Words Correct: _____ %
/ /	% Vocabulary Words Correct: _____ %	% Vocabulary Words Correct: _____ %
/ /	% Vocabulary Words Correct: _____ %	% Vocabulary Words Correct: _____ %
/ /	% Vocabulary Words Correct: _____ %	% Vocabulary Words Correct: _____ %
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Sample Strategies to Promote…Acquisition & Fluency with Math Facts

-Cover-Copy-Compare: Math
-Explicit Time Drill
-Self-Administered Folding-In Technique (SAFI)
-Reciprocal Peer Tutoring in Math Computation

Cover-Copy-Compare: Math Facts

In this intervention to promote acquisition of math facts, the student is given a sheet with the math facts with answers. The student looks at each math model, covers the model briefly and copies it from memory, then compares the copied version to the original correct model (Skinner, McLaughlin & Logan, 1997).

Response to

Cover-Copy-Compare Math Fact Student Worksheet

Worksheet: Cover-Copy-Compare Student: _____ Date: _____

Math Facts	Student Response
1. 9 x 7 = 63	1a. 9 x 7 = 63
	1b.
2. 9 x 2 = 18	2a.
	2b.
3. 9 x 4 = 36	3a.
	3b.
4. 9 x 1 = 9	4a.
	4b.
5. 9 x 9 = 81	5a.
	5b.
6. 9 x 6 = 54	6a.
	6b.
7. 9 x 3 = 27	7a.
	7b.
8. 9 x 5 = 45	8a.
	8b.
9. 9 x 10 = 90	9a.
	9b.
10. 9 x 8 = 72	10a.
	10b.

The Importance of Math-Fact Fluency

- Math-fact mastery permits students to shift valuable cognitive capacity away from simple calculations toward higher-level problem-solving (Gersten, Jordan, & Flojo, 2005; National Mathematics Advisory Panel, 2008).

- An important goal for schools is to ensure that students are proficient in math-facts by the end of grade 5 (Kroesbergen & Van Luit, 2003) to better prepare them for the demanding middle-school math curriculum.

Explicit Time Drill

The teacher hands out a math-fact worksheet. Students are told that they will have 3 minutes to work on problems on the sheet. The teacher starts the stop watch and tells the students to start work. At the end of the first minute, the teacher 'calls time', stops the stopwatch, and tells the students to underline the last number written and to put their pencils in the air. Then students are told to resume work and the teacher restarts the stopwatch. This process is repeated at the end of minutes 2 and 3. At the conclusion of the 3 minutes, the teacher collects the student worksheets (Rhymer et al., 2002).

Building Math-Fact Proficiency: Self-Administered Folding Technique (SAFI)

The math-fact self-administered folding-in intervention (math-fact SAFI) trains students to take charge of their own intervention to acquire and develop fluency in math-facts. Using flash cards, the student reviews math-facts with immediate performance feedback, engages in repeated practice to correct errors, and records on a running log those math-facts that have been mastered. An additional advantage of this intervention is that it has been shown to be effective with middle-school students.

Source: *Hulac, D. M., Dejong, K., & Benson, N. (2012). Can students run their own interventions?: A self-administered math fluency intervention. Psychology in the Schools, 49, 526-538.*

Math-Fact Proficiency: Self-Administered Folding Technique

Prepare Materials. Prior to each tutoring session, the teacher prepares the following materials for the student:

- *Math-fact flash cards.* The entire collection of math-facts to be mastered are written onto flash-cards. One fact is written on each card, with the math-fact appearing on the front and the correct answer appearing on the back. For example, multiplication math-facts for 0 through 10 would require 121 flash cards to cover all possible number combinations for this fact-set.
- *Dry-Erase Board, Markers, and Eraser.* The student uses the dry-erase board to record all answers in the session.

Source: *Hulac, D. M., Dejong, K., & Benson, N. (2012). Can students run their own interventions?: A self-administered math fluency intervention. Psychology in the Schools, 49, 526-538.*

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Student Log:
Mastered
Math-Facts

www.

Student Log: Mastered Math-facts

Student: _____ School Yr: _____ Classroom/Course: _____

Directions to the Student: Record any math-facts that you are transferring to the 'known' weekly stack.

Item 1: _____ Date: ___/___/___	Item 25: _____ Date: ___/___/___
Item 2: _____ Date: ___/___/___	Item 26: _____ Date: ___/___/___
Item 3: _____ Date: ___/___/___	Item 27: _____ Date: ___/___/___
Item 4: _____ Date: ___/___/___	Item 28: _____ Date: ___/___/___
Item 5: _____ Date: ___/___/___	Item 29: _____ Date: ___/___/___
Item 6: _____ Date: ___/___/___	Item 30: _____ Date: ___/___/___
Item 7: _____ Date: ___/___/___	Item 31: _____ Date: ___/___/___
Item 8: _____ Date: ___/___/___	Item 32: _____ Date: ___/___/___
Item 9: _____ Date: ___/___/___	Item 33: _____ Date: ___/___/___
Item 10: _____ Date: ___/___/___	Item 34: _____ Date: ___/___/___
Item 11: _____ Date: ___/___/___	Item 35: _____ Date: ___/___/___
Item 12: _____ Date: ___/___/___	Item 36: _____ Date: ___/___/___
Item 13: _____ Date: ___/___/___	Item 37: _____ Date: ___/___/___
Item 14: _____ Date: ___/___/___	Item 38: _____ Date: ___/___/___
Item 15: _____ Date: ___/___/___	Item 39: _____ Date: ___/___/___
Item 16: _____ Date: ___/___/___	Item 40: _____ Date: ___/___/___
Item 17: _____ Date: ___/___/___	Item 41: _____ Date: ___/___/___
Item 18: _____ Date: ___/___/___	Item 42: _____ Date: ___/___/___
Item 19: _____ Date: ___/___/___	Item 43: _____ Date: ___/___/___
Item 20: _____ Date: ___/___/___	Item 44: _____ Date: ___/___/___
Item 21: _____ Date: ___/___/___	Item 45: _____ Date: ___/___/___
Item 22: _____ Date: ___/___/___	Item 46: _____ Date: ___/___/___
Item 23: _____ Date: ___/___/___	Item 47: _____ Date: ___/___/___
Item 24: _____ Date: ___/___/___	Item 48: _____ Date: ___/___/___

Math Facts SAFI: Student Checklist

Math-Facts SAFI: Student Checklist (Hulac, Dejong, & Benson, 2012).

Carried Out?	*Intervention Step*
_Y _N	1. Start with the daily stack of cards from the last session. Or create a new "daily stack" by taking 7 cards from your weekly "known" stack and 3 cards from your weekly "unknown" stack and shuffling them.
_Y _N	2. Take the first card from the top of the daily stack and place it flat on the table.
_Y _N	3. Read the math-fact on the card and write the answer on the dry-erase board ***within 3 seconds.***
_Y _N	4. Turn the card over and compare the answer that you wrote to the answer on the card.
_Y _N	5. If your answer is correct, sort that card into a "daily known" pile. If your answer is incorrect, sort that card into a "daily unknown" pile--then practice by writing the math-fact and correct answer on your dry-erase board **three times in a row**.
_Y _N	6. Continue until you have answered all 10 daily cards. Then look at the daily "known" and "unknown" card stacks. If all daily cards are in the "known" stack, draw a star in the bottom left corner of your dry-erase board.
_Y _N	7. Shuffle the 10 cards in the daily card deck.
_Y _N	8. Continue reviewing all 10 cards in the daily deck as explained in steps 2-7 until you have drawn three stars in the bottom left corner of the dry-erase board. (In other words, continue until you have answered all 10 cards without error in a single run-through and have accomplished this feat a total of three times in the session.)
_Y _N	9. When you have earned 3 stars, consider the entire daily stack to be "known" cards. So it's now time to update the daily deck.
_Y _N	10. Take any 3 cards from your current daily 10-card deck and transfer them to the weekly "known" deck. Then, on the *Student Log: Mastered Math-facts* form, record the math-facts and current date for the 3 cards that you transfer. Congratulations! These now count as mastered math-facts!
_Y _N	11. Next, take 3 cards from the weekly "unknown" stack and add them to your current daily deck to bring it back up to 10 cards.
_Y _N	12. Begin reviewing the daily stack again (as outlined in steps 2-7) until your time runs out.
_Y _N	13. Before ending the session, place rubber-bands around the weekly "known" and "unknown" decks and the daily stack that you are currently working on. Also, be sure that your *Student Log: Mastered Math-facts* form is up-to-date.

Math-Fact Proficiency: Self-Administered Folding Technique

Prepare Materials. In preparation for this intervention, the teacher also meets with the student to:

- *inventory those math-facts the student already knows.* The teacher reviews all math-fact cards with the student. The teacher shows each card to the student for 3 seconds. If the student responds correctly to the math-fact, the teacher sorts that card into the "known" stack. If the student answers incorrectly or hesitates for 3 seconds or longer, the teacher sorts the card into the "unknown" stack. The teacher then puts rubber bands around the "known" and "unknown" stacks for student use in the intervention.

Source: *Hulac, D. M., Dejong, K., & Benson, N. (2012). Can students run their own interventions?: A self-administered math fluency intervention. Psychology in the Schools, 49, 526-538.*

Math-Fact Proficiency: Self-Administered Folding Technique

Intervention Steps. The student follows these self-check steps during this SAFI intervention:

1. Start with the daily stack of cards from the last session. Or create a new "daily stack" by taking 7 cards from your weekly "known" stack and 3 cards from your weekly "unknown" stack and shuffling them.
2. Take the first card from the top of the daily stack and place it flat on the table.
3. Read the math-fact on the card and write the answer on the dry-erase board ***within 3 seconds.***

Source: *Hulac, D. M., Dejong, K., & Benson, N. (2012). Can students run their own interventions?: A self-administered math fluency intervention. Psychology in the Schools, 49, 526-538.*

Math-Fact Proficiency: Self-Administered Folding Technique

Intervention Steps. The student follows these self-check steps during this SAFI intervention:

4. Turn the card over and compare the answer that you wrote to the answer on the card.
5. If your answer is correct, sort that card into a "daily known" pile. If your answer is incorrect, sort that card into a "daily unknown" pile--then practice by writing the math-fact and correct answer on your dry-erase board **three times in a row**.

Source: *Hulac, D. M., Dejong, K., & Benson, N. (2012). Can students run their own interventions?: A self-administered math fluency intervention. Psychology in the Schools, 49, 526-538.*

Math-Fact Proficiency: Self-Administered Folding Technique

Intervention Steps. The student follows these self-check steps during this SAFI intervention:

6. Continue until you have answered all 10 daily cards. Then look at the daily "known" and "unknown" card stacks. If all daily cards are in the "known" stack, draw a star in the bottom left corner of your dry-erase board.
7. Shuffle the 10 cards in the daily card deck.

Source: *Hulac, D. M., Dejong, K., & Benson, N. (2012). Can students run their own interventions?: A self-administered math fluency intervention. Psychology in the Schools, 49, 526-538.*

Math-Fact Proficiency: Self-Administered Folding Technique

Intervention Steps. The student follows these self-check steps during this SAFI intervention:

8. Continue reviewing all 10 cards in the daily deck as explained until you have drawn three stars in the bottom left corner of the dry-erase board. (That is, continue until you have answered all 10 cards without error in a single run-through and have accomplished this feat a total of three times in the session.)
9. When you have earned 3 stars, consider the entire daily stack to be "known" cards. So it's now time to update the daily deck.

Source: *Hulac, D. M., Dejong, K., & Benson, N. (2012). Can students run their own interventions?: A self-administered math fluency intervention. Psychology in the Schools, 49, 526-538.*

Math-Fact Proficiency: Self-Administered Folding Technique

Intervention Steps. The student follows these self-check steps during this SAFI intervention:

10. Take any 3 cards from your current daily 10-card deck and transfer them to the weekly "known" deck. Then, on the *Student Log: Mastered Math-facts* form, record the math-facts and current date for the 3 cards that you transfer. Congratulations! These now count as mastered math-facts!
11. Next, take 3 cards from the weekly "unknown" stack and add them to your current daily deck to bring it back up to 10 cards.

Source: *Hulac, D. M., Dejong, K., & Benson, N. (2012). Can students run their own interventions?: A self-administered math fluency intervention. Psychology in the Schools, 49, 526-538.*

Math-Fact Proficiency: Self-Administered Folding Technique

Intervention Steps. The student follows these self-check steps during this SAFI intervention:

12. Begin reviewing the daily stack again in the same manner as before until your time runs out.
13. Before ending the session, place rubber-bands around the weekly "known" and "unknown" decks and the daily stack that you are currently working on. Also, be sure that your *Student Log: Mastered Math-facts* form is up-to-date.

Source: *Hulac, D. M., Dejong, K., & Benson, N. (2012). Can students run their own interventions?: A self-administered math fluency intervention. Psychology in the Schools, 49, 526-538.*

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Student Log:
Mastered
Math-Facts

www.

Student Log: Mastered Math-facts

Student: Andy S. School Yr: 2013 Classroom/Course: 7: Green Tm

Directions to the Student: Record any math-facts that you are transferring to the 'known' weekly stack.

Item 1:	6X8=48	Date:	1 1 13
Item 2:	9X9=81	Date:	1 1 13
Item 3:	9X3=27	Date:	1 1 13
Item 4:		Date:	___/___/___
Item 5:		Date:	___/___/___
Item 6:		Date:	___/___/___
Item 7:		Date:	___/___/___
Item 8:		Date:	___/___/___
Item 9:		Date:	___/___/___
Item 10:		Date:	___/___/___
Item 11:		Date:	___/___/___
Item 12:		Date:	___/___/___
Item 13:		Date:	___/___/___
Item 14:		Date:	___/___/___
Item 15:		Date:	___/___/___
Item 16:		Date:	___/___/___
Item 17:		Date:	___/___/___
Item 18:		Date:	___/___/___
Item 19:		Date:	___/___/___
Item 20:		Date:	___/___/___
Item 21:		Date:	___/___/___
Item 22:		Date:	___/___/___
Item 23:		Date:	___/___/___
Item 24:		Date:	___/___/___
Item 25:		Date:	___/___/___
Item 26:		Date:	___/___/___
Item 27:		Date:	___/___/___
Item 28:		Date:	___/___/___
Item 29:		Date:	___/___/___
Item 30:		Date:	___/___/___
Item 31:		Date:	___/___/___
Item 32:		Date:	___/___/___
Item 33:		Date:	___/___/___
Item 34:		Date:	___/___/___
Item 35:		Date:	___/___/___
Item 36:		Date:	___/___/___
Item 37:		Date:	___/___/___
Item 38:		Date:	___/___/___
Item 39:		Date:	___/___/___
Item 40:		Date:	___/___/___
Item 41:		Date:	___/___/___
Item 42:		Date:	___/___/___
Item 43:		Date:	___/___/___
Item 44:		Date:	___/___/___
Item 45:		Date:	___/___/___
Item 46:		Date:	___/___/___
Item 47:		Date:	___/___/___
Item 48:		Date:	___/___/___

Peer Tutoring in Math Computation with Constant Time Delay

Peer Tutoring in Math Computation with Constant Time Delay

- DESCRIPTION: This intervention employs students as reciprocal peer tutors to target acquisition of basic math facts (math computation) using constant time delay (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:

Math Computation Fluency: When Do You Give Up & Switch to a Calculator?

There is no easy answer to the question of when to acknowledge that a student is not likely to master math facts and should have access to a calculator, even when peers might compute similar facts in their head.

Before switching a student to a calculator, however, the school should be able to show evidence that it has tried and documented several unsuccessful interventions to promote math-fact fluency.

Group Activity: *Math Interventions*

At your tables:

- Consider the math-intervention ideas shared here.
- Discuss how you might use one or more of these strategies in your classroom or school.

1. Classwide Vocabulary Tutoring
2. Cover-Copy-Compare: Math Facts
3. Explicit Time Drill
4. Math-Facts: Self-Administered Folding-In Technique
5. Peer Tutoring in Math Computation with Constant Time Delay
6. Customized Math Self-Correction Checklists

Sample Strategy to Promote…Student Self-Monitoring

-Math Self-Correction Checklist

Student Self-Monitoring: Customized Math Self-Correction Checklists

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

Sources: *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

	Mon ___/___/___	Tue ___/___/___	Wed ___/___/___	Thu ___/___/___	Fri ___/___/___
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 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
For fractions problems with division, my answers were larger than the fractions in the problem. Did the student succeed in this behavior goal? ❑ YES ❑ NO	__Y __N	__Y __N	__Y __N	__Y __N	__Y __N
For fractions problems with multiplication, my answers were smaller than the fractions in the problem. Did the student succeed in this behavior goal? ❑ YES ❑ NO	__Y __N	__Y __N	__Y __N	__Y __N	__Y __N

Sample Strategy to Promote…Use of Heuristic Approaches to Problem-Solving

-Interpreting Math Graphs: QARs
-Cognitive/ Meta-Cognitive Training

The Power of Heuristic Strategies

Heuristic: "a method or strategy that exemplifies a generic approach for solving a problem.“

A meta-analysis of effective math instructional practices found that heuristics had a mean effect-size of 1.56 (strong outcome).

Source: Gersten, R., Chard, D. J., Jayathi, M., Baker, S. K., Morphy, P., & Flojo, J. (2009). Mathematics instruction for students with learning disabilities: A meta-analysis of instructional components. Review of Educational Research, 79, 1202-1242.

Interpreting Math Graphics: A Reading Comprehension Intervention pp. 56-58

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 pp. 59-61

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." 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:** ""

Web Sites With Interventions: Scientifically Based Research

Res

Intervention Central

http://www.interventioncentral.org

Intervention Central has a range of free academic and behavioral intervention ideas that span the grade levels.

New additions to the site include online applications to create customized academic and behavioral intervention plans.

The site also allows users to create free accounts and to save documents created with IC tools.

Evidence-Based Intervention Network

http://ebi.missouri.edu/

The EBI Network is a source for intervention scripts for academic and behavioral problems, along with videos modeling intervention practices.

Sponsored by the School Psychology Program at the University of Missouri, the site contains other intervention resources as well, including documents to help schools to better define the presenting student problem(s) and match them to appropriate interventions.

Welcome to the EBI Network!

The EBI Network has been developed to provide guidance in the selection and implementation of evidence-based interventions in the classroom setting. To this end, four general sections have been developed for your use.

Evidence Based Intervention Section

In this section a collection of evidence based intervention (academic and behavioral) have been collected and sorted into categories to help you select the right EBI for the job. Short intervention briefs, modeling videos and overviews of the evidence base for the interventions are presented for each EBI. To start using this section please go to the "How to Select an EBI" page.

If you're interested in an in depth review of EBI using the functional framework used in the EBI network take a look at ***RTI Applications, Volume 1: Academic and Behavioral Interventions*** and the soon to be published ***RTI Applications, Volume 2: Assessment, Analysis, and Decision Making***. These books were written by the developer of the EBI Network with Dr. Matt Burns, Dr. Amanda VanDerHeyden and Dr. Kimberly Gibbons. These books provide a though overview of EBI selection at the whole schools, class wide and individual child level as well as guidance concerning assessment, analysis and decision-making. The books are a part of the **Practical Intervention in the Schools Series** Book Series which has a number of very useful books to support EBI use in the schools.

Problem Solving Team/RTI Resources

This section has assorted resources to assist teachers, school based problem solving teams and schools as they develop their problem solving teams. This section is geared to provide simple materials to help educators select EBI and track effectiveness in an RTI model.

Foundations of Problem Solving

This section has been added to house a series of documents outlining the foundational skills and information necessary for using a problem solving approach when working with children who exhibit academic or behavioral problems. The following is a list of examples of such skills/information;

- What is an evidence based intervention?
- What are the common reasons for academic and behavior problems?
- Building strong relationships in classrooms

Evidence Based
Intervention Network

Enter Keyword... search

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Foundations of Problem Solving
Foundations of Problem Solving Home

Workshops
Information about Workshops

Participating Programs
East Carolina University School Psychology
Indiana University School Psychology
Missou School Psychology
Missou Special Education

Contact
T. Chris Riley-Tillman
ESCP Department
16 Hill Hall
University of Missouri
Columbia, MO 65211

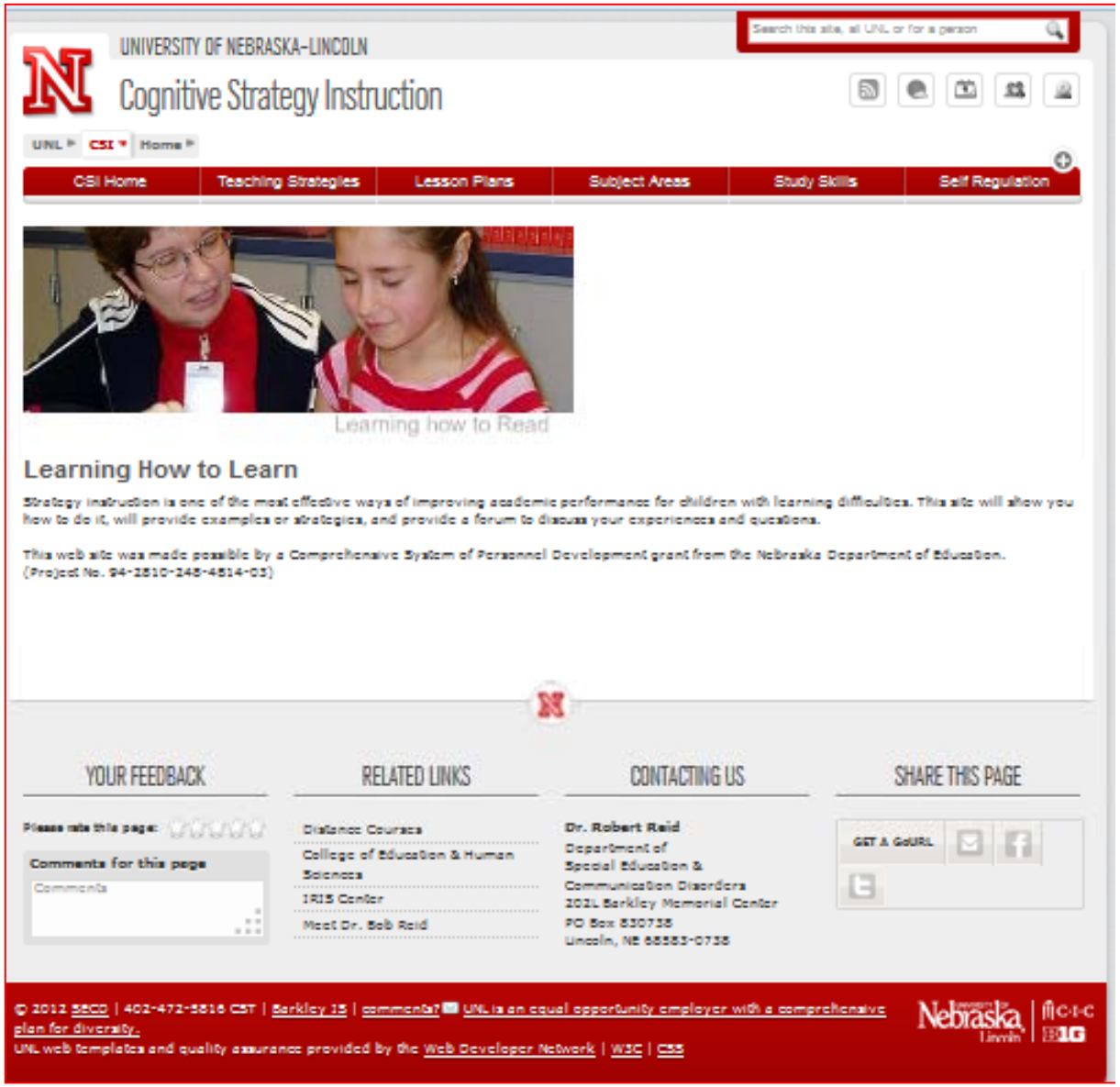
rileytillmanc@missouri.edu
Phone: (573) 882-7732
Fax: (573) 884-5989

Cognitive Strategy Instruction

http://cehs.unl.edu/csi/

The Cognitive Strategy Instruction site was developed by the Special Education Department at the University of Nebraska-Lincoln.

The site specializes in cognitive strategies that students can learn to be more successful and independent in completing academic tasks.



Group Activity: *Math Interventions*

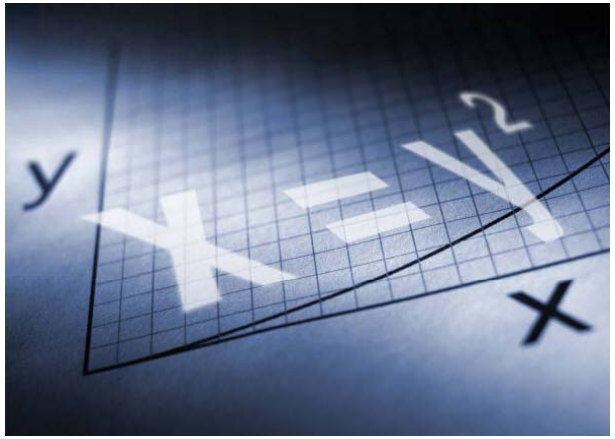
At your tables:

- Consider the math-intervention ideas shared here.
- Discuss how you might use one or more of these strategies in your classroom or school.

1. Math Self-Correction Checklists
2. Math Graphics: Question-Answer Relationships
3. Metacognitive 'Self-Coaching' Strategy

Fractions & the Struggling Student

Focus of Inquiry: What does research say about the difficulties that students have in mastering fractions?



2008 National Math Advisory Panel Report: Recommendations

"Proficiency with whole numbers, fractions, and certain aspects of geometry and measurement are the foundations for algebra. Of these, knowledge of fractions is the most important foundational skill not developed among American students."

Source: National Math Panel Fact Sheet. (March 2008). Retrieved on March 14, 2008, from http://www.ed.gov/about/bdscomm/list/mathpanel/report/final-factsheet.html

Some Qualities of Whole Numbers

1. Are 'counting tokens' (that is, can be assigned in 1:1 fashion to represent number of items in a set).
2. Are positive.
3. Have unique successors (e.g., 5 is always followed by 6).
4. Have a finite number of digits within an interval (e.g., between the whole-number line interval of 5-8, there are 4 number entities).
5. Always grow larger or remain unchanged during addition and multiplication operations.
6. Always decrease or remain the same during subtraction and division operations.

Source: *Siegler, R. S., Thompson, C. A., & Schneider, M. (2011). An integrated theory of whole number and fractions development. Cognitive Psychology, 62, 273-296.*

Some Qualities of Fractions

1. Can be negative or positive.
2. Have their magnitude determined by both numerator and denominator—rather than by either alone.
3. Are infinitely divisible (so that between any 2 fractions lie an infinite number of intermediate fractions).
4. Become larger as the numerator grows but become smaller as the denominator grows.
5. Multiplying proper fractions always results in a product smaller than either of the original terms.
6. Dividing proper fractions always results in a quotient larger than either of the original terms.

Sources: Siegler, R. S., Fazio, L. K., Bailey, D. H., & Zhou, X. (2013). Fractions: The new frontier for theories of numerical development. Trends in Cognitive Sciences, 17(1), 13-19.

Siegler, R. S., & Pyke, A. A. (2013). Developmental and individual differences in understanding of fractions. Developmental Psychology, 49, 1994-2004.

Whole-Number Bias: An Impediment to an Understanding of Fractions

"One challenge in acquiring conceptual knowledge [of fractions] is that children's massive prior experience with integers leads to a whole number bias, in which properties of positive integers are assumed to extend to fractions. For example, even high school students often claim that there are no numbers between fractions such as 5/7 and 6/7 (as there are no integers between 5 and 6)..."

Source: *Siegler, R. S., & Pyke, A. A. (2013). Developmental and individual differences in understanding of fractions. Developmental Psychology, 49, 1994-2004.*

Symbolic Fraction Arithmetic Problems: 2 Common Types of Student Errors

- **Independent whole-number errors:** The student performs the arithmetic operation independently on numerator and denominator: e.g., 1/2 + 2/3=3/5 This mistake shows a lack of understanding that, when 2 positive numbers are added, the sum must be larger than either addend.
- **Wrong-fraction-operation errors:** The student applies an incorrect solution (such as when multiplying fractions) that is actually correct for another fraction arithmetic operation (such as adding fractions): e.g., 1/6 x 2/6 = 3/6 This error indicates a lack of understanding that, when the multiplier is less than 1, the product must always be smaller than the number being multiplied.

Source: Siegler, R. S., Fazio, L. K., Bailey, D. H., & Zhou, X. (2013). Fractions: The new frontier for theories of numerical development. Trends in Cognitive Sciences, 17(1), 13-19.

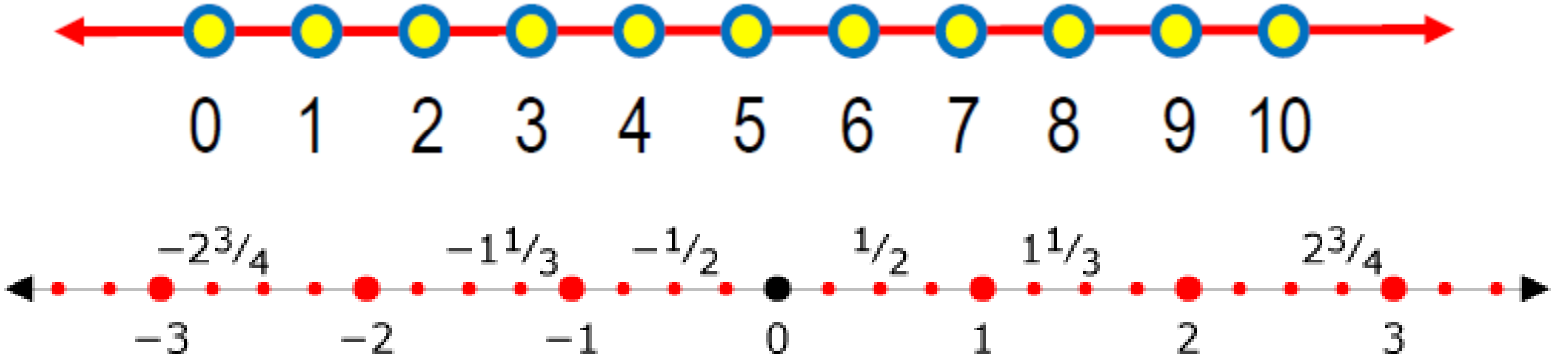
Student Fraction Errors Stem from Multiple Sources

"[Findings such as these] suggest that many children's fraction arithmetic knowledge includes a mix of correct procedures, components of procedures detached from the relevant arithmetic operation, and whole number arithmetic procedures. These children's strategy choices seem to be constrained little -- if at all -- by conceptual knowledge, which leads to the observed mixture of correct strategies and errors, even on highly similar problems."

Source: Siegler, R. S., Fazio, L. K., Bailey, D. H., & Zhou, X. (2013). Fractions: The new frontier for theories of numerical development. Trends in Cognitive Sciences, 17(1), 13-19.

Real Numbers: All Have a Place on the Number Line

"One property that all real numbers share is magnitudes that can be ordered on number lines."



Source: Siegler, R. S., Fazio, L. K., Bailey, D. H., & Zhou, X. (2013). Fractions: The new frontier for theories of numerical development. Trends in Cognitive Sciences, 17(1), 13-19.

Teaching Fractions by Starting With What Kids Know: Whole Numbers & the Concept of 'Half'

A promising approach (Moss & Case, 1999) introduces students to fractions instruction by:

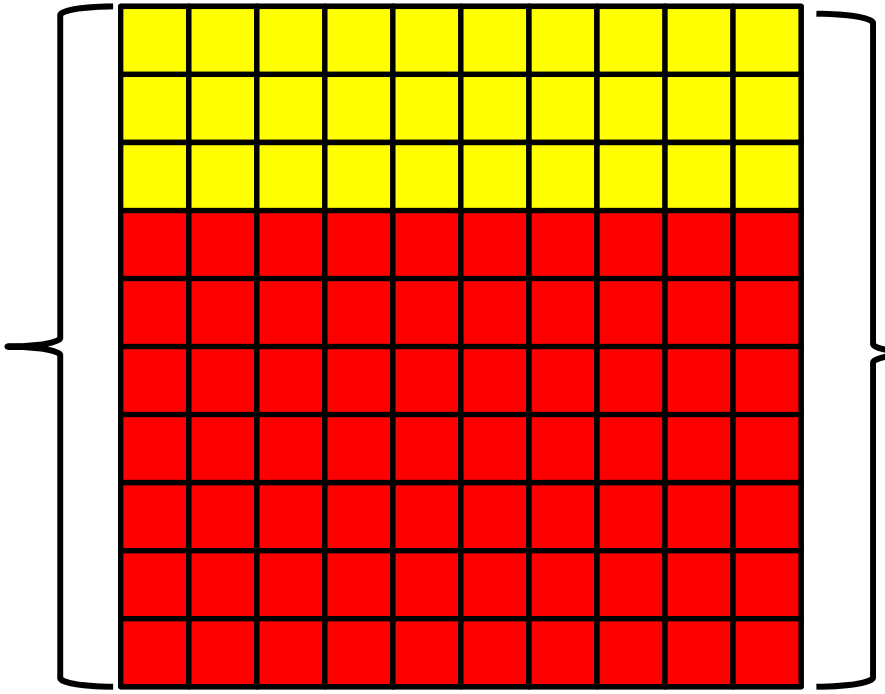
- using a hands-on linear-measurement approach with 'halving' as a shortcut method for computing & estimating amounts.
- leveraging existing student knowledge of whole numbers to transition to 2-decimal numbers (e.g., 20 parts of 100 > 20 percent > 0.20).
- illustrating the open-ended divisibility of fractions by next introducing 3- and 1- decimal numbers.
- introducing fractional notation as an alternate way to depict ratio, percentage, and decimal values.

Source: Moss, J., & Case, R. (1999). Developing children's understanding of the rational numbers: A new model and an experimental curriculum. Journal for Research in Mathematics Education, 30(2), 122-147.

Percentages: A Way to Leverage Whole-Number Concepts to Learn About Rational Numbers

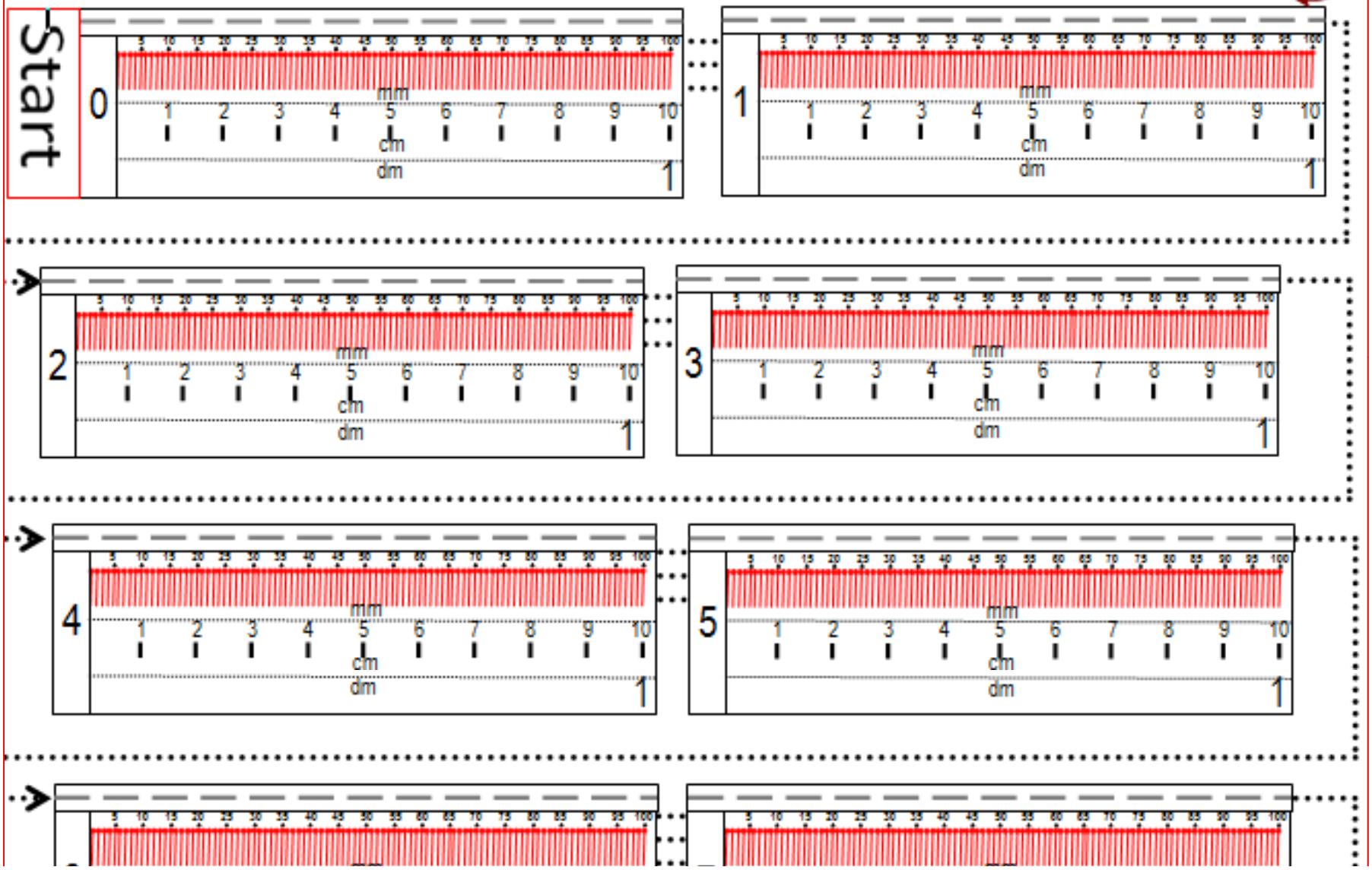
Students can leverage their knowledge of whole numbers to their advantage and discover qualities of rational numbers by starting fractions instruction with an exploration of percentages. (By grade 2, students have typically acquired familiarity with the 0-100 number line.)

1 = sum of 100 parts- mapping rational numbers to the 0-100 number line



30 parts of 100 = 30 percent of whole or 0.30 or 30/100 (reducing to 3/10)

The Dragon Game: A Competitive Race Across a Decimal Landscape

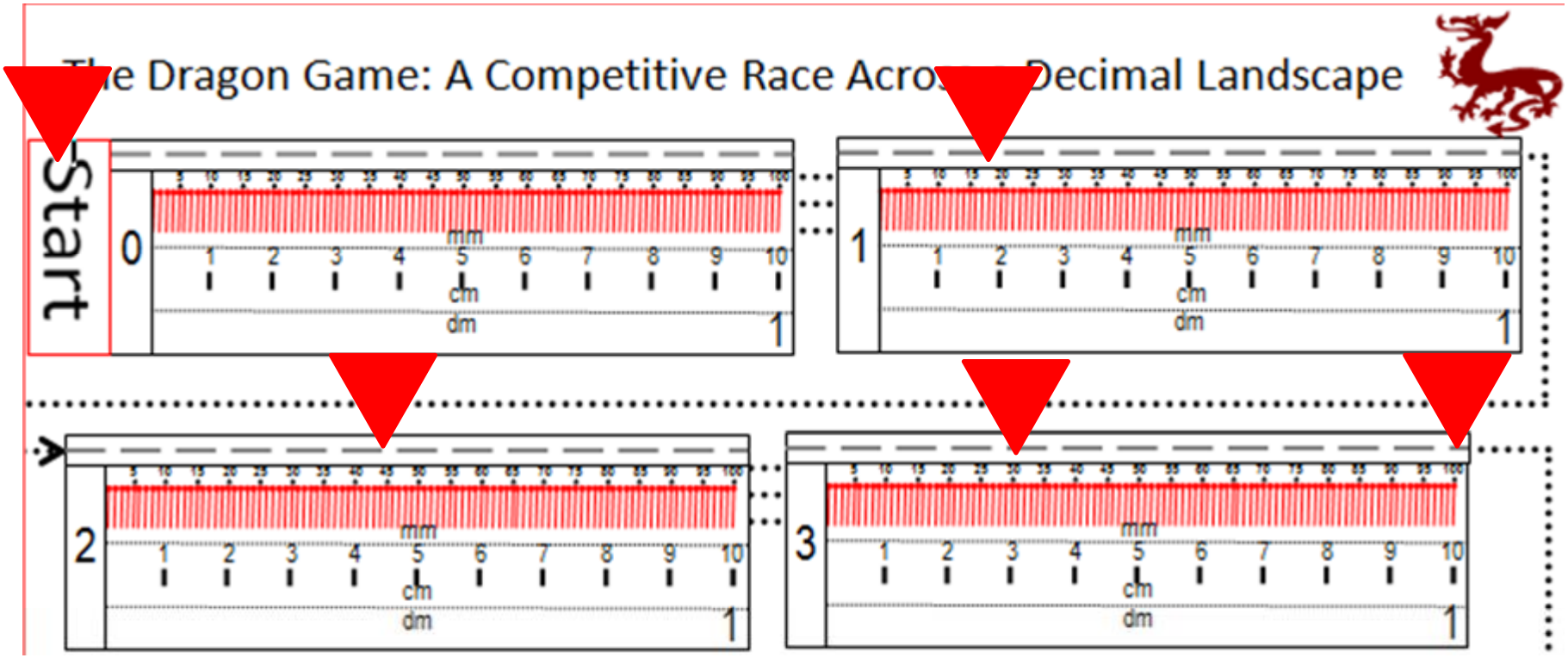


Source: Moss, J. (1997). Developing children's rational number sense: A new approach and an experimental program. (Unpublished doctoral dissertation). University of Toronto, Canada. Retrieved from https://tspace.library.utoronto.ca/bitstream/1807/13522/1/MQ51566.pdf

Dragon Game: Rules

The Dragon Game can be played by up to 3 players.

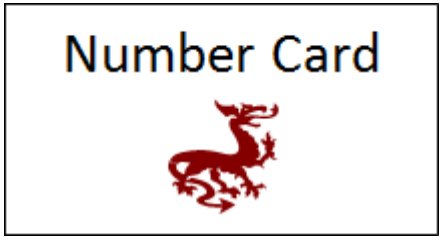
- Players take turns drawing a number card, tossing the +/- cube, and moving their game piece. The purpose of the game is to be the first to advance one's game piece from the start line to the finish line.

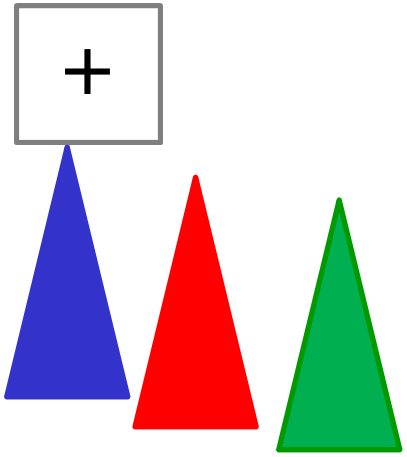


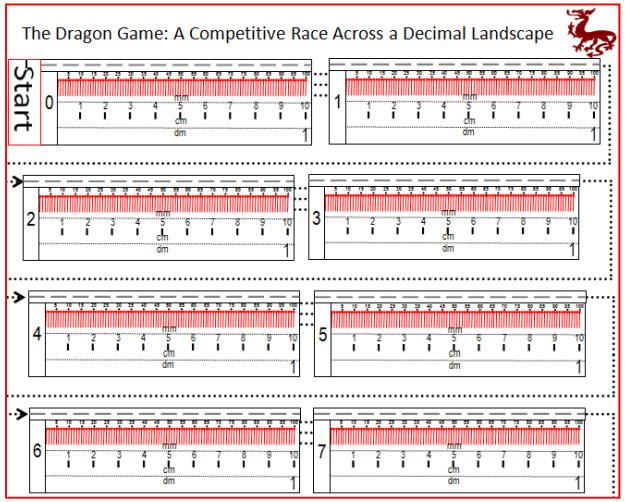
Source: Moss, J. (1997). Developing children's rational number sense: A new approach and an experimental program. (Unpublished doctoral dissertation). University of Toronto, Canada. Retrieved from https://tspace.library.utoronto.ca/bitstream/1807/13522/1/MQ51566.pdf

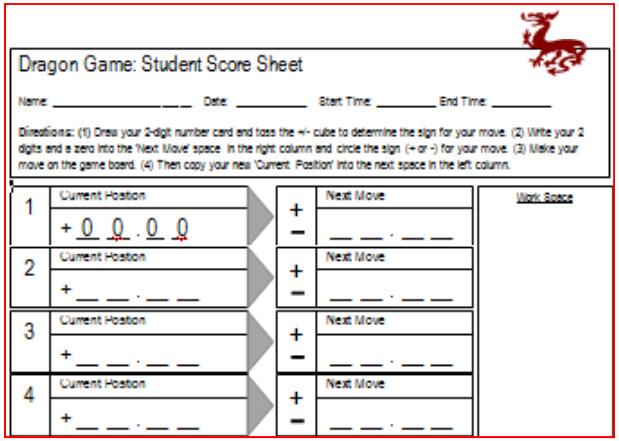
Dragon Game: Materials

- Dragon Game Board
- Dragon Game: Student Score Sheet
- Number Cards
- Wild Cards
- +/- cube (cube with equal number of plus and minus signs appearing on sides)
- Game pieces (small pieces of paper cut into pointer triangles)









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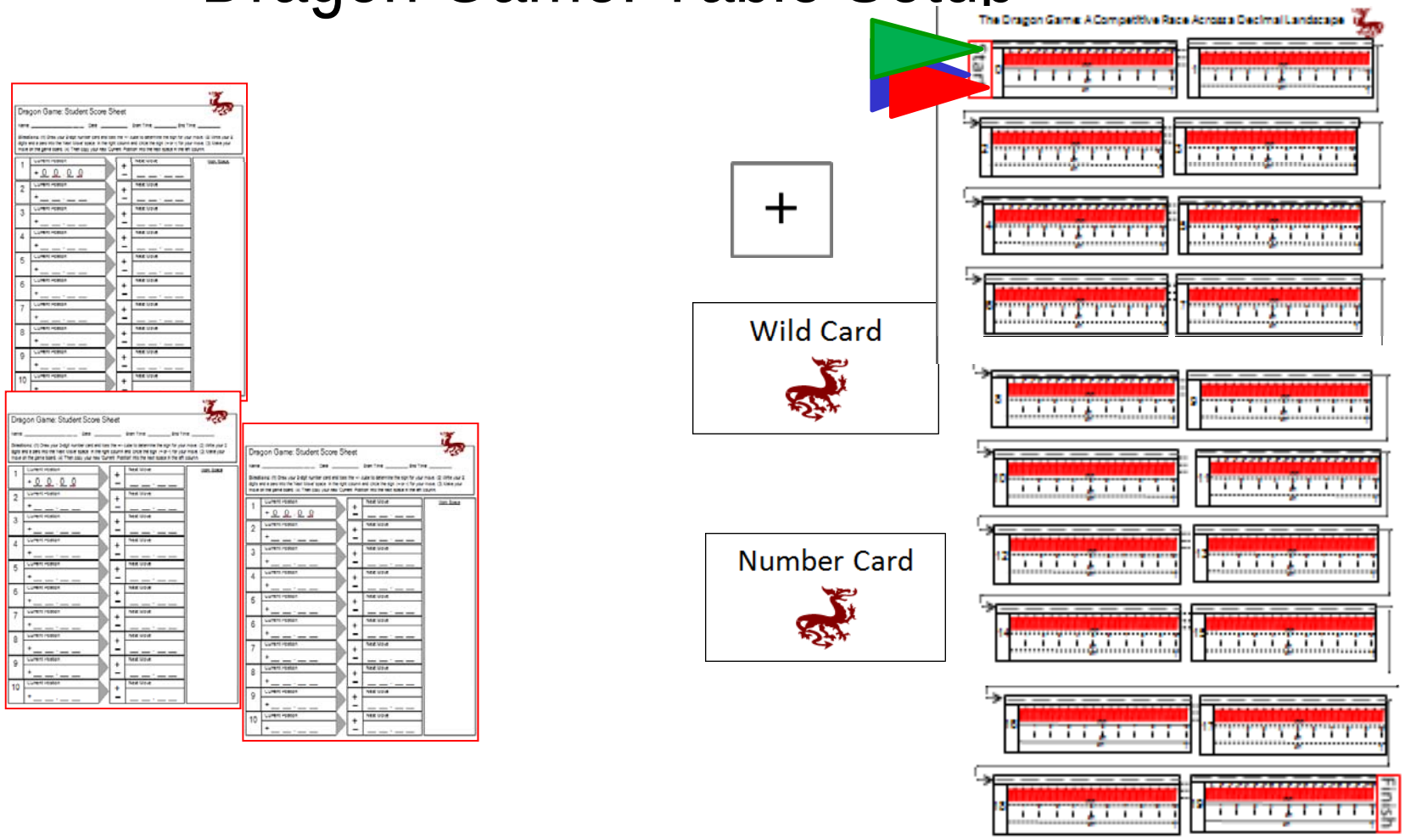
Dragon Game: Table Setup



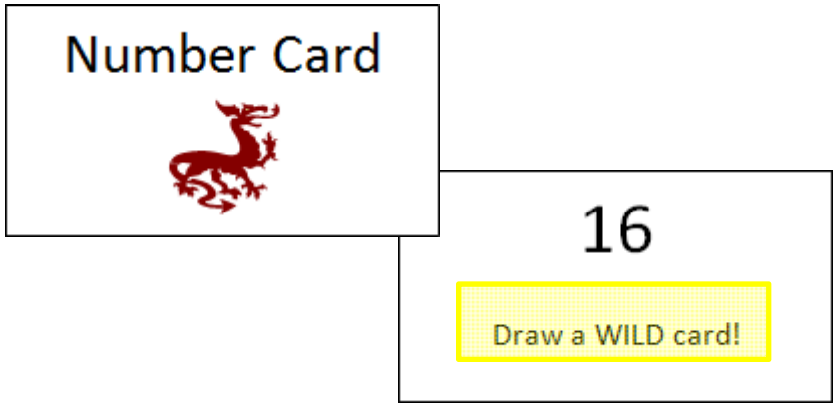
Source: Moss, J. (1997). Developing children's rational number sense: A new approach and a doctoral dissertation). University of Toronto, Canada. Retrieved from https://tspace.library.utoronto.ca/bitstream/1807/13522/1/MQ51566.pdf

Dragon Game: Rules

- Directions:

  For each move, a player:

1. draws a 2-digit number card.-- and draws an additional wild card if the number card directs the player to do so.



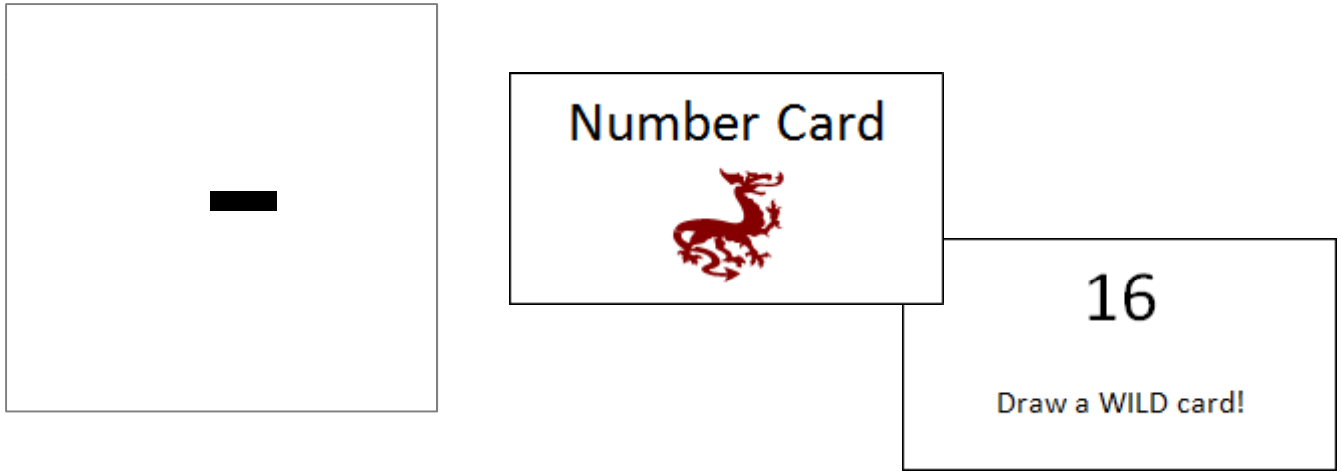
Source: Moss, J. (1997). Developing children's rational number sense: A new approach and an experimental program. (Unpublished doctoral dissertation). University of Toronto, Canada. Retrieved from https://tspace.library.utoronto.ca/bitstream/1807/13522/1/MQ51566.pdf

Dragon Game: Rules

- Directions:

  For each move, a player:

2. tosses the +/- cube to determine the sign of the number.



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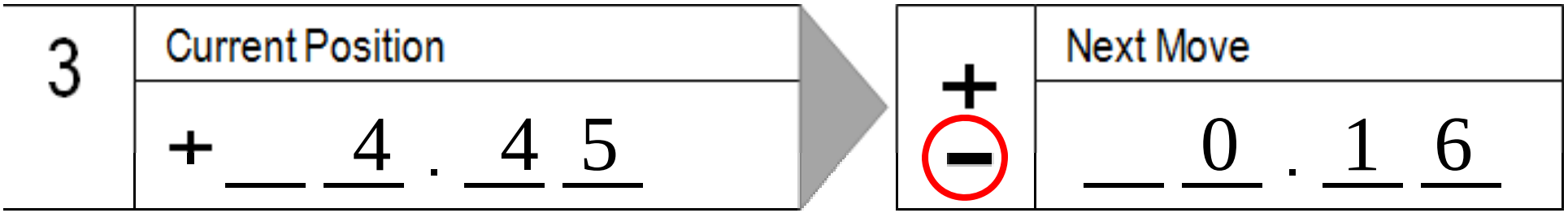
Dragon Game: Rules

- Directions:

  For each move, a player:

3. generates a 'number solution' by taking the drawn number and adding a zero and a decimal in places of his or her choosing. NOTE: Within the 2-digit number drawn, the **decimal** can be placed in front of the first digit, between first and second digit, or immediately after the second digit. The **zero** must go immediately before or after the 2-digit number.



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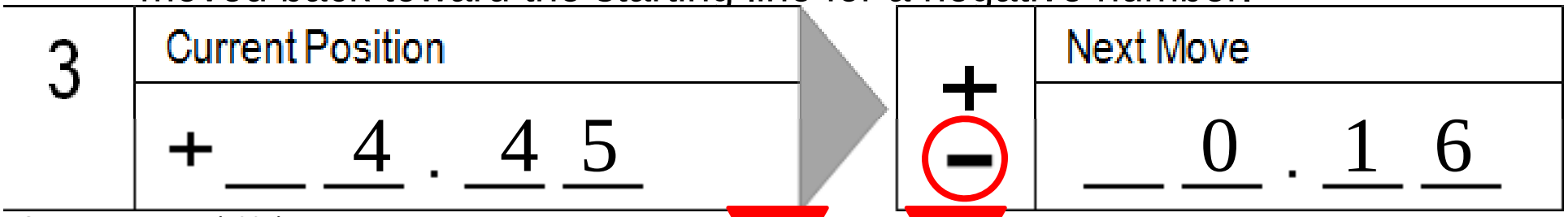
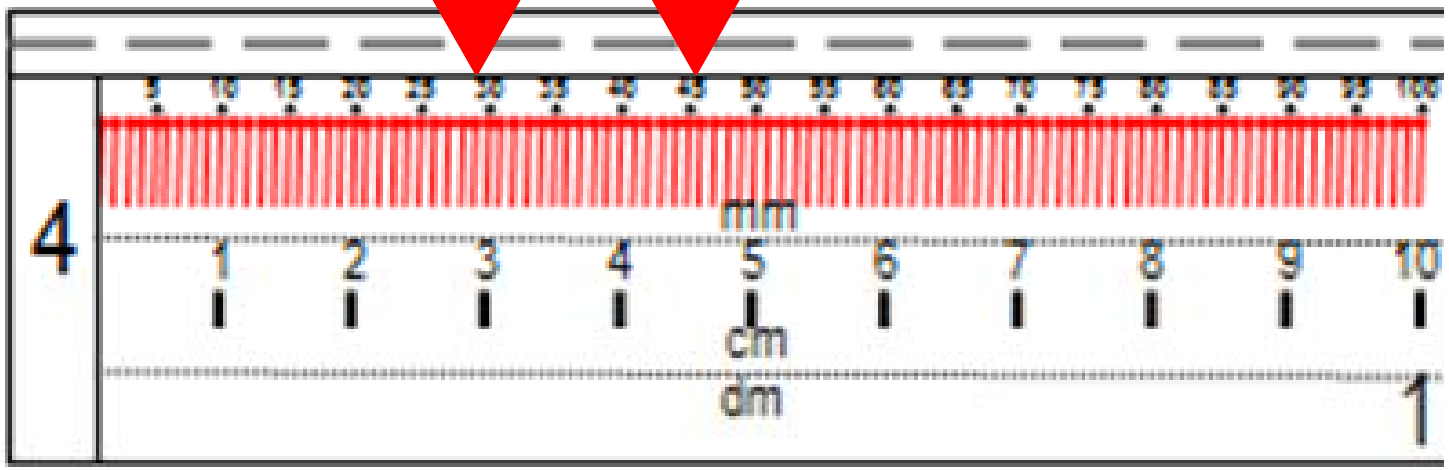
Dragon Game: Rules

- Directions:

  For each move, a player:

4. moves the player's game piece on the Dragon Game board the correct number of spaces to match the number just generated. The game piece is moved forward toward the finish line for a positive number and moved back toward the starting line for a negative number.





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Dragon Game: Rules

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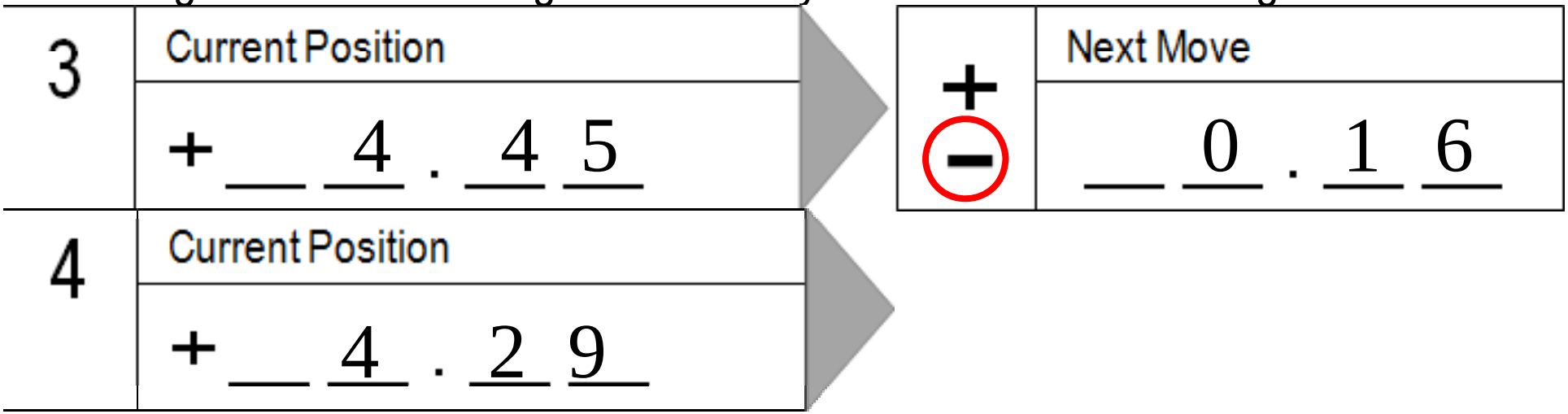

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Dragon Game: Rules

Directions (Cont.):

Here are two more rules governing play:

- A player does not toss the +/- cube on the first move. Instead, the initial number drawn is assumed to be positive-- to get the player on the board.
- A player can cross the finish line to win the game only with a number solution that has the 2 digits from the number card appearing **after the decimal** in the tenths and hundredths places.

Source: Moss, J. (1997). Developing children's rational number sense: A new approach and an experimental program. (Unpublished doctoral dissertation). University of Toronto, Canada. Retrieved from https://tspace.library.utoronto.ca/bitstream/1807/13522/1/MQ51566.pdf

Dragon Game: Collaboration

The Dragon Game is perfect as an opportunity for player collaboration. Consider:

- having students play in pairs.
- playing the game as a large-group activity, with the board displayed on an overhead and up to 3 groups participating. In this scenario, 2 students from a team can go to the overhead to play their turn and can request help from the team if desired.
- having an adult monitoring the game who can give hints or use open-ended questions to guide students toward appropriate strategies to construct the most strategic numbers and add and subtract decimal values.

Source: Moss, J. (1997). Developing children's rational number sense: A new approach and an experimental program. (Unpublished doctoral dissertation). University of Toronto, Canada. Retrieved from https://tspace.library.utoronto.ca/bitstream/1807/13522/1/MQ51566.pdf

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Random Calendar Date Generator

Here is your calendar date:

It was picked randomly out of 365 possible dates between January 1, 2013 and December 31, 2013.

Timestamp: 2013-10-01 10:23:35 UTC

Again! Go Back

Some Qualities of Fractions

1. Can be negative or positive.
2. Have their magnitude determined by both numerator and denominator—rather than by either alone.
3. Are infinitely divisible (so that, between any 2 fractions lie an infinite number of intermediate fractions).
4. Become larger as the numerator grows but become smaller as the denominator grows.
5. Multiplying proper fractions always results in a product smaller than either of the original terms.
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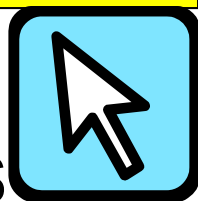
Siegler, R. S., & Pyke, A. A. (2013). Developmental and individual differences in understanding of fractions. Developmental Psychology, 49, 1994-2004.

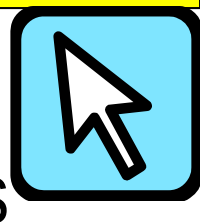
TUTORIAL: How To…Select Appropriate Accommodations for General-Education Students pp. 13-15



- Teachers can increase the chances for academic success by making available an appropriate array of class-wide curricular accommodations to any general-education student who needs them (Kern, Bambara, & Fogt, 2002).

- THE CHALLENGE: However, while accommodations can help struggling learners to more fully engage in demanding academics, they should **not** hold a general-education student who accesses them to a lesser performance standard than the rest of the class.

TUTORIAL: How To…Select Appropriate Accommodations for General-Education Students



- **Identifying Appropriate Accommodations: Access vs. Target Skills.** As an aid in determining whether a particular accommodation both supports individual student differences and sustains a demanding academic environment, teachers should distinguish between *target* and *access* skills (Tindal, Daesik, & Ketterlin, 2008).

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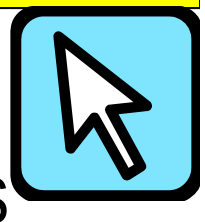

- *Target skills* are those academic skills that the teacher is actively trying to assess or to teach.

- Target skills are therefore 'non-negotiable'; the teacher must ensure that these skills are not compromised in the instruction or assessment of any general-education student.

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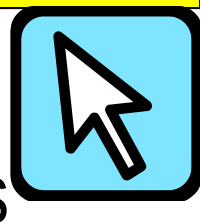

- TARGET SKILLS EXAMPLE: An 8th-grade teacher sets as a target skill for his class the demonstration of computational fluency in basic multiplication facts.

  The teacher has his class complete a worksheet of 20 computation problems under timed conditions.

  This teacher would *not* allow a typical student who struggles with computation to do fewer than the assigned 20 problems, as this change would undermine the **target skill** of computational fluency that is the purpose of the assignment.

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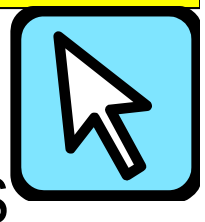

- *Access skills* are those needed for the student to take part in a class assessment or instructional activity but are not themselves the target of current assessment or instruction.

- Access skills, therefore, *can* be the focus of accommodations, as altering them may remove a barrier to student participation but will not compromise the academic rigor of classroom activities.

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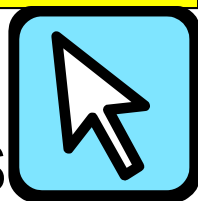
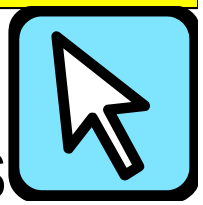


- ACCESS SKILLS EXAMPLE. A teacher assigns her class 5 word problems to translate into math equations, solve, and write a journal entry explaining each solution.
- She identifies as non-negotiable **target skills** the conversion of word problems to numerical terms , calculation of the correct answer, and articulation of the reasoning behind the solution.
- She notes that one student has limited proficiency with writing skills. The teacher decides that writing is an **access skill.** The teacher therefore allows the student to supplement her journal explanations with oral explanations of her problem-solving steps.

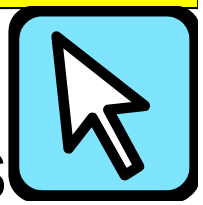
TUTORIAL: How To…Select Appropriate Accommodations for General-Education Students



- **Matching Accommodations to Students: Look for the 'Differential Boost'.** A useful tool to investigate whether an individual actually benefits from a particular accommodation strategy is the 'differential boost' test (Tindal & Fuchs, 1999).

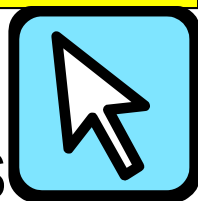
  The teacher examines a student's performance with and without the accommodation to answer these 2 questions: (1) Does the student perform significantly better *with* the accommodation than without?, and (2) Does the accommodation boost that particular student's performance substantially *beyond* what could be expected if it were given to all students in the class?

TUTORIAL: How To…Select Appropriate Accommodations for General-Education Students



- DIFFERENTIAL-BOOST EXAMPLE: A teacher routinely allocates 10 minutes for her class to complete a weekly in-class math mini-quiz and finds that all but one of her students are able to complete the assignment within that time.
- She therefore allows this one student 5 minutes of additional time for the min-quiz and discovers that his work is noticeably better with this accommodation. The evidence shows that the student gains a clear 'differential boost' from the accommodation of extended time because (1) his completion rate improves substantially when given it, while (2) few if any other students appear to need it.

TUTORIAL: How To…Select Appropriate Accommodations for General-Education Students



- **Classroom Accommodations and State Tests: To Allow or Not to Allow?** There are 3 good reasons to consider allowing a general-education student to access accommodations in the classroom that will be off-limits during state testing:

- *Accommodations can uncover 'academic blockers'.*
- *Accommodations can promote content knowledge.*
- *Accommodations can build self-confidence.*

A Sampling of Accommodation Ideas for **Motivation**

Instructional Adjustments/Accommodations: Motivation

- INCORPORATE STUDENT INTERESTS. Structure or rework instruction or academic tasks to incorporate topics of student interests. If students are interested in NASCAR or fashion, for example, the teacher can work these topics into writing or math lessons.

Source: Kern, L, & Clemens, N. (2007). Antecedent strategies to promote appropriate classroom behavior. Psychology in the Schools, 44(1), 65-75.

Instructional Adjustments/Accommodations: Motivation

- OFFER CHOICE IN MODES OF TASK COMPLETION. Allow the student two or more choices for completing a given academic task. For example, a student may be given the option to use a computer keyboard to write an essay instead of writing it by hand -- or to respond orally to math-facts on flashcards rather than recording answers on a math worksheet.

Source: Kern, L, & Clemens, N. (2007). Antecedent strategies to promote appropriate classroom behavior. Psychology in the Schools, 44(1), 65-75.

Instructional Adjustments/Accommodations: Motivation

- OFFER CHOICE VIA ASSIGNMENT SUBSTITUTION. Present the student with two or more alternative activities to choose from that contain equivalent academic requirements. For example, an instructor who wants students to review a section of the course math textbook might allow them the choices of reading the passage independently or discussing that passage in a structured cooperative learning activity.

Source: Kern, L, & Clemens, N. (2007). Antecedent strategies to promote appropriate classroom behavior. Psychology in the Schools, 44(1), 65-75.

Instructional Adjustments/Accommodations: Motivation

- OFFER CHOICE: TASK SEQUENCE. When the student has several tasks to complete during independent work time, allow the student to select the order in which she or he will complete those tasks. When the student begins the independent work, provide encouragement and prompting as needed to keep the student engaged.

Source: Kern, L., Bambara, L., & Fogt, J. (2002). Class-wide curricular modification to improve the behavior of students with emotional or behavioral disorders. Behavioral Disorders, 27, 317-326.

Instructional Adjustments/Accommodations: Motivation

- PROVIDE ADULT ATTENTION. Provide the student with brief, regular, repeated doses of positive adult attention ('scheduled attention') at times when the student is behaving appropriately. Examples of positive teacher attention are greetings, brief conversations, encouraging notes written on assignments, and non-verbal signals (e.g., thumbs-up).

Source: Kern, L, & Clemens, N. (2007). Antecedent strategies to promote appropriate classroom behavior. Psychology in the Schools, 44(1), 65-75.

Instructional Adjustments/Accommodations: Motivation

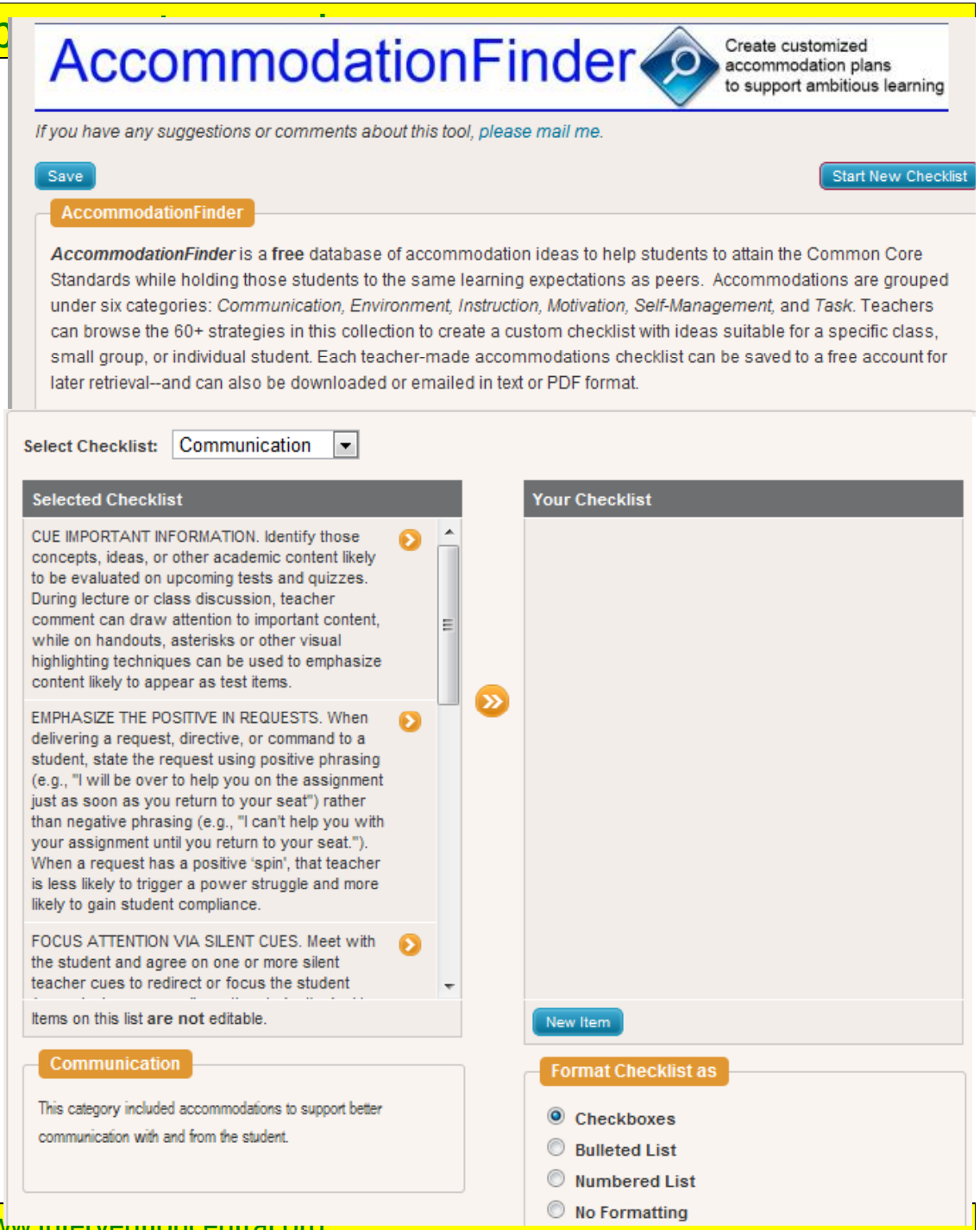
- REWARD ACCURACY AND EFFORT FOR BEGINNING LEARNERS. For the student just acquiring an academic skill who is not yet proficient, provide encouragement and/or incentives for overall effort and accuracy of any work completed-- rather than focusing on speed or total number of problems finished.

Source: Barkley, R. A. (2008). 80+ classroom accommodations for children or teens with ADHD. The ADHD Report, 16(4), 7-10.

AccommodationFinder

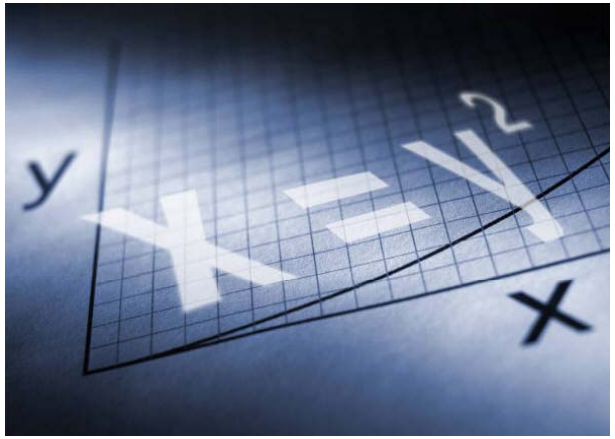
http://www.interventioncentral.org/tools/accommodationfinder

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



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.
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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 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.*

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

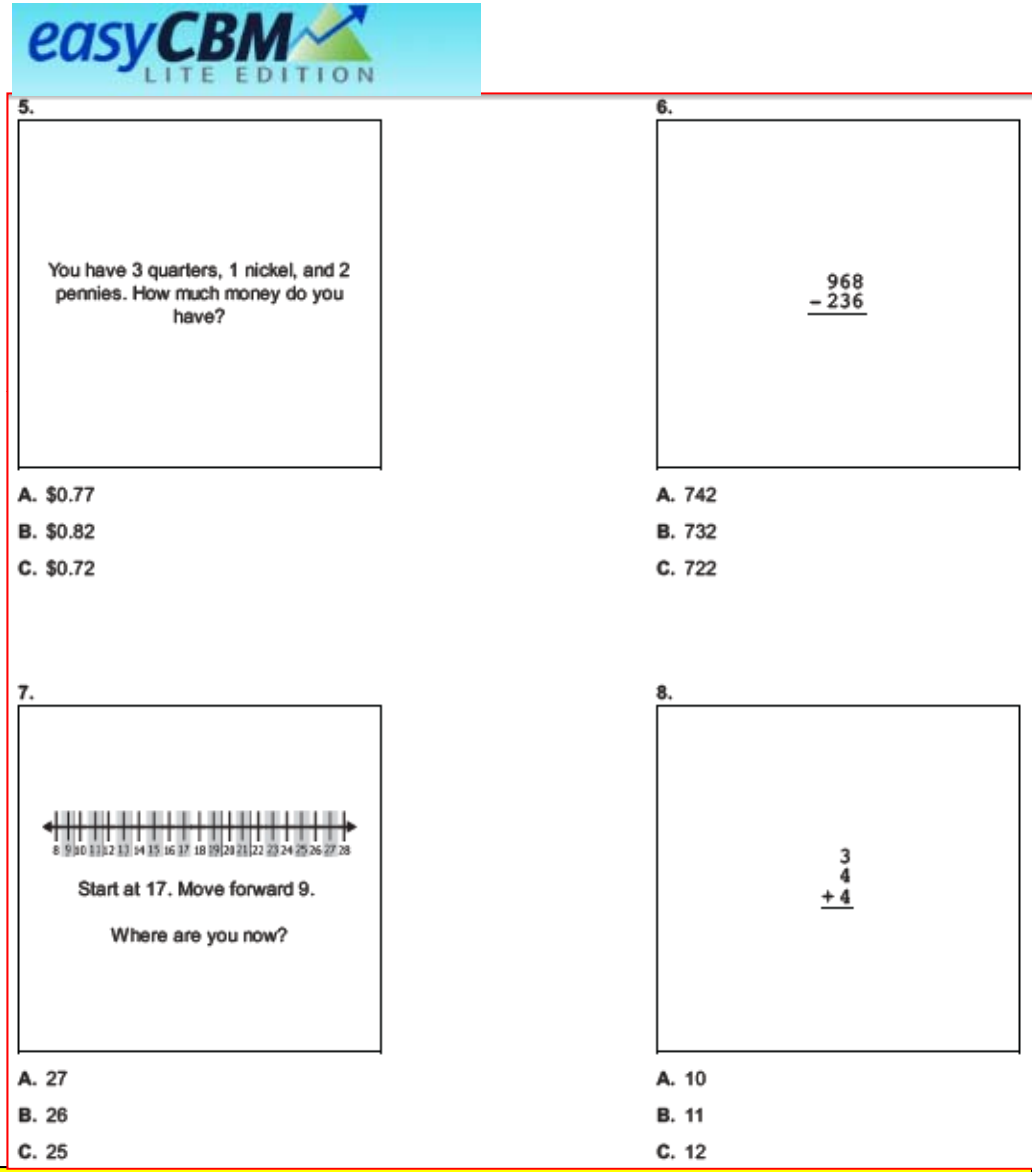
Screening/Progress-Monitoring

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	●	☐

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

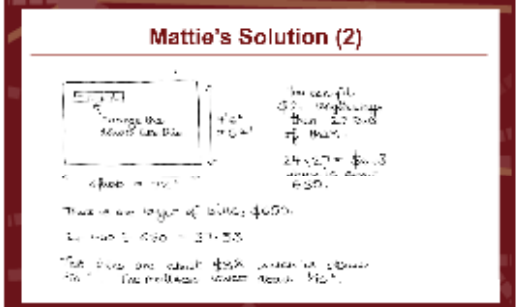
MAP: 'Classroom Challenges' Formative Assessment Lessons

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.

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.

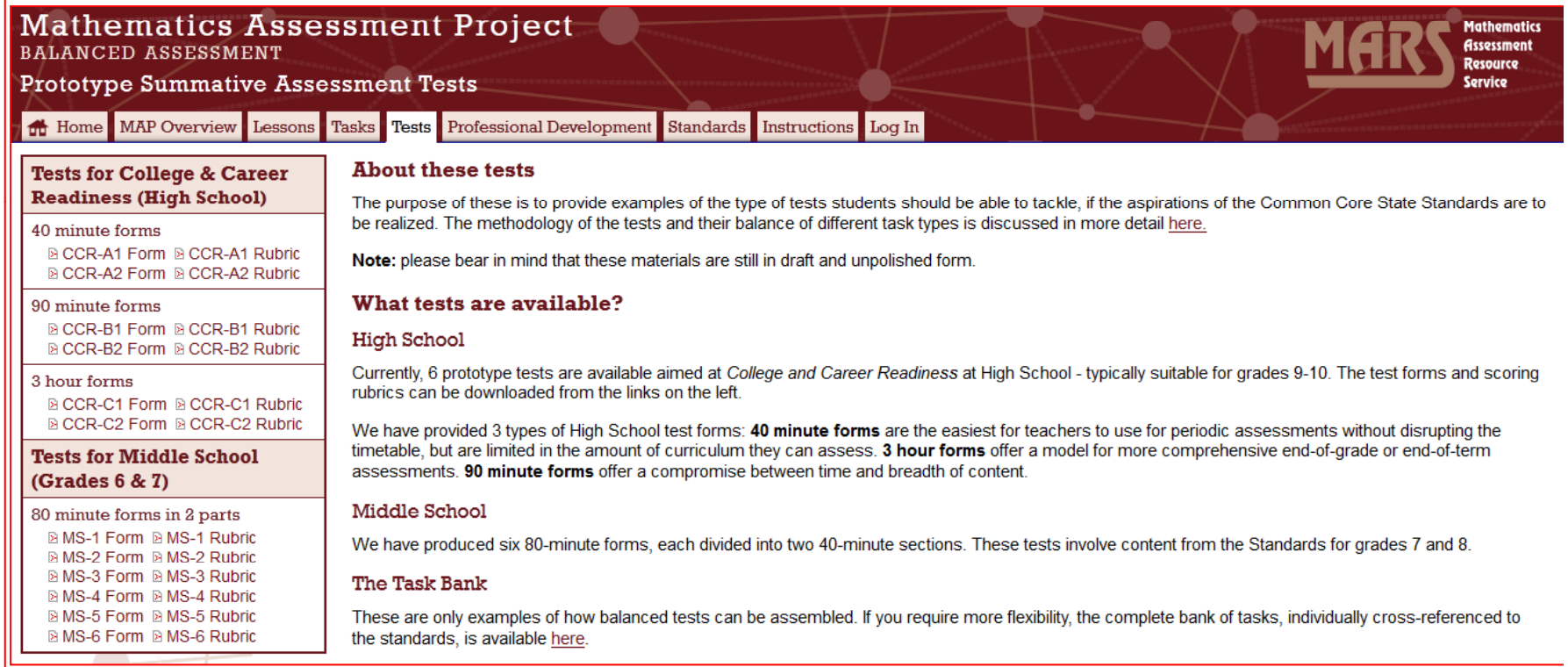
Tests for middle school are 80-minute exams, divided into 2 parts.

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



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:

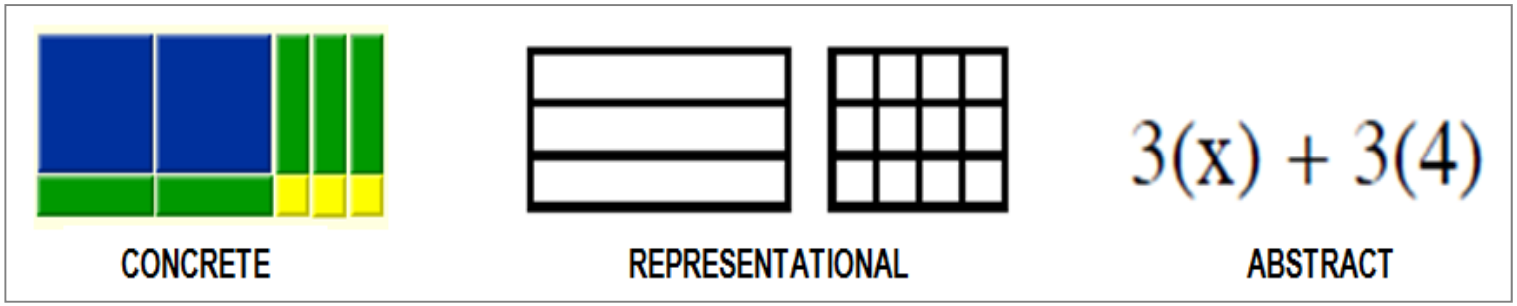
- CRA (Concrete-Representational-Abstract) Assessment
- Error Pattern Analysis
- Mathematics Interview

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.

Methods of RTI Math Assessment

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Activity: Data Collection and Math Interventions

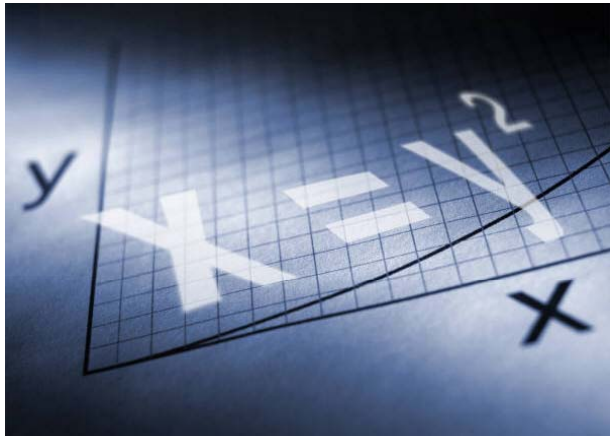
- In your groups, discuss what tools (formal or otherwise) your teachers and/or school have available to:

  1. assess student math performance
  2. track student math interventions

- Be prepared to report out!

Mathematics & the Unmotivated Student

Focus of Inquiry: What are ways that teachers can motivate middle- and high-school students to take responsibility for their math performance?



Teachers: Mathematics & the Unmotivated Student

- Issue: Poor student motivation is one of the chief reasons for underperformance in mathematics.

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.

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.

Student Motivation: Reframe the Issue in Observable (and Fixable) Terms

Step 1: Redefine 'motivation' as academic engagement: e.g., The student chooses "to engage in active accurate academic responding" (Skinner, Pappas, & Davis, 2005).

Step 2: Build staff support for this mission statement: "When a student appears unmotivated, it is the school's job to figure out why the student is unmotivated and to find a way to get that student motivated."

Source: Skinner, C. H., Pappas, D. N., & Davis, K. A. (2005). Enhancing academic engagement: Providing opportunities for responding and influencing students to choose to respond. *Psychology in the Schools, 42*, 389-403.

Academic Survival Skills Checklists (Available on Conference Web Page)

The Problem That This Tool Addresses:

Academic Survival Skills Checklist

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 Checklist: What It Is…

- The teacher selects a global skill (e.g., homework completion; independent seatwork). The teacher then breaks the global skill down into a checklist of component sub-skills. An observer (e.g., teacher, another adult, or even the student) can then use the checklist to note whether a student successfully displays each of the sub-skills on a given day.

Academic Survival Skills Checklist: Time Management Example

Time-Management Skills Checklist
1. CREATE A MASTER SCHEDULE. Develop a Sunday-through-Saturday weekly master schedule for the quarter, semester, or school year. In that schedule, (1) fill in school classes and study periods, (2) include any regularly scheduled activities such as commuting, sports, clubs, lessons, or part-time jobs, (3) block out time for essential activities such as eating and sleeping, and (4) include adequate time for recreation. In the remaining blocks of open time in the schedule, reserve a minimum amount of time each day for study. Update this schedule whenever a significant schedule change occurs. TIP: Consider labeling several time-blocks as 'open' in the master schedule to accommodate occasional unforeseen study or other time requirements.
2. KEEP A DAILY CALENDAR. Whether you use a paper or electronic version, keep a calendar to track your changing daily schedule. When constructing each daily calendar schedule, it is most efficient to start with the structure of the master schedule and then add any additional events scheduled to occur on that day.

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

Academic Survival Skills Checklist: Time Management Example

Time-Management Skills Checklist
3. SCHEDULE PREVIEW AND REVIEW TIME FOR DEMANDING COURSES. When possible, reserve time before a challenging class to preview material to be covered and time soon after the class session to review lecture notes. Write these preview and review slots into your master schedule.
4. WHEN SCHEDULING, START WITH OUTCOME GOALS. When developing a daily or weekly schedule, first list any important goals to be accomplished by the end of that scheduled time-period (e.g., to produce a 5-paragraph essay; to complete a college application; to transcribe a set of paper notes into electronic format). After developing the schedule, double-check to ensure that you have incorporated sufficient time and the correct sequencing of activities into that schedule to attain those key goals.

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

Academic Survival Skills Checklist: Time Management Example

Time-Management Skills Checklist
5. USE UNEXPECTED POCKETS OF FREE TIME EFFICIENTLY. Have a plan to make efficient use of small amounts of unscheduled time that become available. Tasks suitable for brief pockets of open time could include reviewing and revising lecture notes, starting a homework assignment, studying note-cards to prepare for an upcoming test, and updating your study schedule for the following day.
6. ALLOCATE DOUBLE TIME FOR SIGNIFICANT ACADEMIC TASKS. When deciding how much time to schedule for a substantial academic task, predict the time required--and then double that estimate. People often reserve too little time for demanding tasks--so doubling your time estimates can correct for this over-optimistic bias.

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

Academic Survival Skills Checklist: Time Management Example

Time-Management Skills Checklist
7. TIME MANAGEMENT: REFLECT AND REVISE. At the end of each week, review your time-management planning efforts with a critical eye and note areas needing improvement. For example, investigate whether the amount of time that you typically set aside for study or other activities is sufficient, whether you are actually sticking to your general schedule, and whether there are important but overlooked activities or tasks that need to be added to your schedule.

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

Academic Survival Skills Checklist: Example

Background: A math instructor, Mr. Haverneck, is concerned that a student, Rodney, appears to be disorganized in class.

Define the Problem: Mr. Haverneck defines the problem as 'poor organizational skills' and breaks down this global skill area into its components by using a 9-item Academic Survival Skills Checklist in organizational skills.

Academic Survival Skills Checklist: Example

Decide How to Collect Data: Mr. Haverneck decides to use the checklist to verify (through direct observation and student interview) those sub-skills that the student does or does not dsplay.

Baseline Measure: Mr. Havernick monitors the student's compliance with elements of this organization -skills checklist across three days of math class. On average, Rodney successfully carries out only 4 of the 9 possible subskills.

Intervention Outcome Goal: Mr. Havernick sets the goal that by the last week of a 5-week intervention, the student will be found to use all 9 of the subskills on at least 4 out of 5 days.

Resi

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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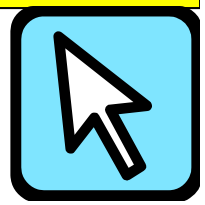
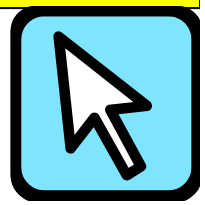
How To…Increase Motivation Through 'High-Probability' Requests pp. 16-18

TUTORIAL: How To…Increase Motivation Through 'High-Probability' Requests



High-probability requests are a useful technique to motivate students to engage in assigned classwork (Lee, 2006). The teacher first identifies an academic activity in which the student historically shows a low probability of completing because of non-compliance. The teacher then embeds within that low-probability activity an introductory series of simple, brief 'high-probability' requests or tasks that this same student has an established track record of completing (Belfiore, Basile, & Lee, 2008).

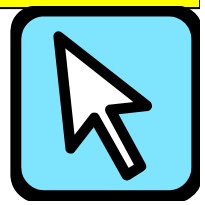
TUTORIAL: How To…Increase Motivation Through 'High-Probability' Requests (Cont.)



Here are 4 steps to using high-probability requests:

1. *Identify incidents of non-compliant behavior.* The teacher notes academic work-situations that initially have a low probability for completion because of student non-compliance (e.g., writing a journal entry; completing a worksheet with reflective questions tied to a reading assignment). The teacher also determines whether non-compliance in each situation occurs within that task or in transitioning to that task.

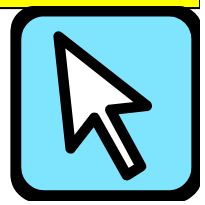
TUTORIAL: How To…Increase Motivation Through 'High-Probability' Requests (Cont.)



2. *List high-probability tasks.* Next, the teacher generates a list of high-probability tasks that the student is likely to comply with. These tasks should be brief (i.e., take 5 seconds or fewer to complete) and should logically link to the low-probability activity.

   For example, if the low-probability event is getting the student to start the writing of a journal entry (transitioning between academic activities), easy, high-probability tasks associated with beginning the writing task might include 'organize your writing materials', 'write a title', and 'list 3 ideas for the journal entry'.

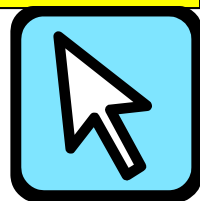
TUTORIAL: How To…Increase Motivation Through 'High-Probability' Requests (Cont.)



3. *Create activities with embedded high-probability tasks.* The teacher then reworks the low-probability work-situation to embed within it a series of high-probability tasks.

- *Starting an activity:* If the target is to get the student to transition efficiently from one activity to another, the teacher inserts 3 high-probability requests at the start of the activity to create behavioral momentum.
- *Continuing an activity:* If the goal is to prod the student to efficiently complete an independent assignment without hesitating between items, the teacher inserts 3 high-probability requests before each challenging item on the assignment.

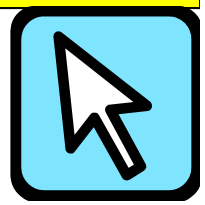
TUTORIAL: How To…Increase Motivation Through 'High-Probability' Requests (Cont.)



4. *Introduce the activities.* The teacher rolls out the activities, now retooled to include embedded high-probability tasks or requests.

   The teacher is careful, when presenting directives aloud to the student, to pace those directives briskly: letting no more than 10 seconds elapse between student completion of one request and teacher delivery of the next request. The teacher should also monitor the student's performance. If the student does not comply quickly with selected high-probability requests, the teacher should replace those requests on future assignments with others that elicit prompt compliance.

TUTORIAL: How To…Increase Motivation Through 'High-Probability' Requests (Cont.)



TIP: Consider using high-probability sequences to motivate whole groups or even an entire class.

- For example, an instructor might decide to intersperse 3 'easy' (high-probability) items between each 'challenge' item on a math computation worksheet to be assigned to all students for independent seatwork.
- Or a teacher may routinely introduce in-class writing assignments by first verbally directing students to 'take out paper and pen', 'write your name on the paper', and 'copy this journal topic onto your paper'.

How To…Help the Student Develop Work-Planning Skills: Plan, Evaluate, Adjust
pp. 19-21

TUTORIAL: How To…Help the Student Develop Work-Planning Skills: Plan, Evaluate, Adjust

The student is trained to follow a plan>work>self-evaluate>adjust sequence in work-planning:

- **Plan.** The student creates a work plan: inventorying a collection of related tasks to be done, setting specific outcome goals that signify success on each task, allocating time sufficient to carry out each task.
- **Work.** The student completes the work.
- **Self-Evaluate.** The student compares actual work performance to the outcome goals to evaluate success.
- **Adjust.** The student determines what to do differently in the future to improve performance and outcomes.

Source: Martin, J. E., Mithaug, D. E., Cox, P., Peterson, L. Y., Van Dycke, J. L., & Cash, M.E. (2003). Increasing self-determination: Teaching students to plan, work, evaluate, and adjust. *Exceptional Children, 69*, 431-447.

Independent Work: Student Planner

Student: _____ **Teacher/Staff Member:** _____ **Date:** ___/___/___

		Planning	Planning	Planning	Self-Evaluation	Self-Evaluation
	Date: ___/___/___	**Task:** Describe the assignment or task to be completed.	**Time Allocated:** E.g., "20 minutes"; "11:20 to 11:40"	**Performance Goal:** Your goal for the amount, accuracy, and/or quality of work to be completed.	**Actual Performance:** Amount, accuracy, and/or quality of the work *actually completed*.	**Goal Met?:** Did you achieve the goal within the time allocated?
1	___/___/___					☐ YES ☐ NO
2	___/___/___	p. 21				☐ YES ☐ NO
3	___/___/___					☐ YES ☐ NO
4	___/___/___					☐ YES ☐ NO

Adjustment: Find any 'NO' responses in the **Goal Met?** column. In the space below, write the number of that goal and your plan to improve on that goal next time.

Number of Goal Not Met & Action Plan to Fix: _____ _____

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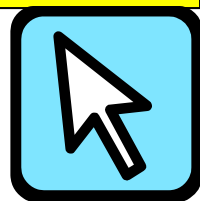

PLANNING: The teacher & student meet prior to the work to create a plan, with 3 phases to the meeting:

1. Task. The student describes each academic task in clear and specific terms (e.g., "Complete first 10 problems on page 48 of math book", "write an outline from notes for history essay").

   For this part of the work plan, the teacher may need to model for the student how to divide larger global assignments into component tasks. in the future to improve performance and outcomes.

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TUTORIAL: How To…Help the Student Develop Work-Planning Skills: Plan, Evaluate, Adjust

PLANNING: The teacher & student meet prior to the work to create a plan, with 3 phases to the meeting:

2. **Time Allocated.** The student decides how much time should be reserved to complete each task (e.g., For a math workbook assignment: "20 minutes" or "11:20 to 11:40").

   Because students with limited planning skills can make unrealistic time projections for task completion, the teacher may need to provide initial guidance and modeling in time estimation.

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TUTORIAL: How To…Help the Student Develop Work-Planning Skills: Plan, Evaluate, Adjust

PLANNING: The teacher & student meet prior to the work to create a plan, with 3 phases to the meeting:

3. **Performance Goal**. The student sets a performance goal to be achieved for each task. Performance goals are dependent on the student and may reference the amount, accuracy, and/or qualitative ratings of the work: (e.g., for a reading assignment: "To read at least 5 pages from assigned text, and to take notes of the content"; for a math assignment: "At least 80% of problems correct"; for a writing assignment: "Rating of 4 or higher on class writing rubric").

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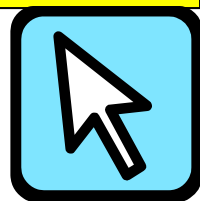

SELF-EVALUATION: The teacher & student meet after the work to evaluate with 2 phases to the meeting:

1. **Comparison of Performance Goal to Actual Performance**. For each task on the plan, the student compares his or her actual work performance to the original performance goal and notes whether the goal was achieved. In addition to noting whether the performance goal was attained, the student evaluates whether the task was completed within the time allocated.

Source: Martin, J. E., Mithaug, D. E., Cox, P., Peterson, L. Y., Van Dycke, J. L., & Cash, M.E. (2003). Increasing self-determination: Teaching students to plan, work, evaluate, and adjust. *Exceptional Children, 69*, 431-447.

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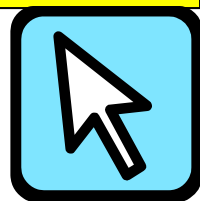

SELF-EVALUATION: The teacher & student meet after the work to evaluate with 2 phases to the meeting:

2. **Adjustment.** For each task that the student failed to reach the performance goal within the time allocated, the student reflects on the experience and decides what adjustments to make on future assignments. For example, a student reviewing a homework work-plan who discovers that she reserved insufficient time to complete math word problems may state that, in future, she should allocate at least 30 minutes for similar tasks.

Source: Martin, J. E., Mithaug, D. E., Cox, P., Peterson, L. Y., Van Dycke, J. L., & Cash, M.E. (2003). Increasing self-determination: Teaching students to plan, work, evaluate, and adjust. *Exceptional Children, 69*, 431-447.

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CCSS: Student Work-Plan Conference: Exercise

- Pair off at your tables. Review the structure for student work-planning conferences shared today. Discuss how you might use it to train students in work planning.
- Consider questions such as:
  - ✓ What assignments you might use it for: in-class?, homework? longer-term assignments?
  - ✓ Who might conference with the student: teacher? counselor? mentor?

STUDENTWORK-PLANNING

Pre- and Post-Planning Conferences

PLANNING

1. Task
2. Time Allocated
3. Performance Goal

SELF-EVALUATION

1. Comparison of Performance Goal to Actual Performance
2. Adjustment

Helping the Student Who is 'Under Water' With Late Assignments: A Structure for Teacher–Student Conferences

pp. 22-24

Negotiating Missing Work: Student-Teacher Conference

When students fall behind in their classwork, they can quickly enter a downward spiral. Some students become overwhelmed and simply give up.

In such cases, the teacher may want to meet with the student –and if possible, a parent--to help that student to create a work plan to catch up with late work.

At the meeting, the teacher and student inventory what work is missing, negotiate a plan to complete that overdue work, and perhaps agree on a reasonable penalty when late work is turned in. All attending then sign off on the work plan. The teacher also ensures that the atmosphere at the meeting is supportive.

Negotiating Missing Work: Student-Teacher Conference (Cont.)

Here in greater detail are the steps that the teacher and student would follow at a meeting to renegotiate missing work:

1. *Inventory All Missing Work*. The teacher reviews with the student all late or missing work. The student is given the opportunity to explain why the work has not yet been submitted.

Negotiating Missing Work: Student-Teacher Conference (Cont.)

2. *Negotiate a Plan to Complete Missing Work*. The teacher and student create a log with entries for all missing assignments. Each entry includes a description of the missing assignment and a due date by which the student pledges to submit that work. This log becomes the student's work plan. Submission dates for late assignments should be realistic--particularly for students who owe a considerable amount of late work and are also trying to keep caught up with current assignments.

Student Late-Work Planning Form: Middle & High School

Teacher: _____ Course: _____

Student: _____ Date: _____/____/_____

Directions: At a teacher-student conference, use this form to create a plan for the student to complete and submit missing or late work.

Assignment	Target Date for Completion	NOTES

What penalty–if any–will be imposed for these late assignments? _____

_____

_____ _____ _____

Student Signature Teacher Signature Parent Signature

Negotiating Missing Work: Student-Teacher Conference (Cont.)

3. *[Optional] Impose a Penalty for Missing Work*. The teacher may decide to impose a penalty for the work being submitted late. Examples of possible penalties are a reduction of points (e.g., loss of 10 points per assignment) or the requirement that the student do additional work on the assignment than was required of his or her peers who turned it in on time. If imposed, such penalties would be spelled out at this teacher-student conference. Any penalties should be balanced and fair, permitting the teacher to impose appropriate consequences while allowing the student to still see a path to completing missing work and passing the course.

Negotiating Missing Work: Student-Teacher Conference (Cont.)

4. *Periodically Check on the Status of the Missing-Work Plan*. If the schedule agreed upon by teacher and student to complete and submit all late work exceeds two weeks, the teacher (or other designated school contact, such as a counselor) should meet with the student weekly while the plan is in effect. At these meetings, the teacher checks in with the student to verify that he or she is attaining the plan milestones on time and still expects to meet the submission deadlines agreed upon. If obstacles to emerge, the teacher and student engage in problem-solving to resolve them.

Teachers: Mathematics & the Unmotivated Student

- Recommendation 1: Redefine ‘motivation’ in observable terms as ‘active academic engagement’.
- Recommendation 2: Use ‘high-probability’ requests to increase student compliance & work completion.
- Recommendation 3: Create sets of ‘academic survival skills’ checklists for use as student training tools to increase competency and motivation.
- Recommendation 4: Train students in ‘work-planning’ skills using the format shared at this workshop.
- Recommendation 5: Conduct ‘late-work’ meetings with students using the structure shared at this workshop.

Activity: 'Next Steps' Planning

- Review the key points discussed in this workshop (on right).
- Each participant should choose 2-3 'next steps' to act on this information.
- Be prepared to report out!

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

1. Strong Elements of 'Direct Instruction'
2. Sampling of Interventions to Support Math-Fact Fluency, Problem-Solving
3. Fractions: 'Whole-Number Bias' and Dragon Game
4. Ideas for Motivating Students: Academic Survival Skills, Checklists, High-Probability Requests, Work Plan Conferences, Late Work Conferences
5. Use of Accommodations in Math Classrooms
6. Online Tools:
   -Accommodations Finder
   -Academic Survival Skills Checklist Maker