RTI Toolkit: A Practical Guide for Schools

RTI Lab: RTI: Best Practices in Math Interventions

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School-Wide Strategies for Managing...
MATHEMATICS

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Mathematics instruction is a lengthy, incremental process that spans all grade levels. As children begin formal schooling in kindergarten, they develop 'number sense', an intuitive understanding of foundation number concepts and relationships among numbers. A central part of number sense is the student's ability to internalize the number line as a precursor to performing mental arithmetic. As students progress through elementary school, they must next master common math operations (addition, subtraction, multiplication, and division) and develop fluency in basic arithmetic combinations ('math facts'). In later grades, students transition to applied, or 'word', problems that relate math operations and concepts to real-world situations. Successful completion of applied problems requires that the student understand specialized math vocabulary, identify the relevant math operations needed to solve the problem while ignoring any unnecessary information also appearing in that written problem, translate the word problem from text format into a numeric equation containing digits and math symbols, and then successfully solve. It is no surprise, then, that there are a number of potential blockers to student success with applied problems, including limited reading decoding and comprehension skills, failure to acquire fluency with arithmetic combinations (math facts), and lack of proficiency with math operations. Deciding what specific math interventions might be appropriate for any student must therefore be a highly individualized process, one that is highly dependent on the student's developmental level and current math skills, the requirements of the school district's math curriculum, and the degree to which the student possesses or lacks the necessary auxiliary skills (e.g., math vocabulary, reading comprehension) for success in math. Here are some wide-ranging classroom (Tier I RTI) ideas for math interventions that extend from the primary through secondary grades.

Applied Problems: Encourage Students to Draw to Clarify Understanding *(Van Essen & Hamaker, 1990; Van Garderen, 2006)*. Making a drawing of an applied, or 'word', problem is one easy heuristic tool that students can use to help them to find the solution. An additional benefit of the drawing strategy is that it can reveal to the teacher any student misunderstandings about how to set up or solve the word problem. To introduce students to the drawing strategy, the teacher hands out a worksheet containing at least six word problems. The teacher explains to students that making a picture of a word problem sometimes makes that problem clearer and easier to solve. The teacher and students then independently create drawings of each of the problems on the worksheet. Next, the students show their drawings for each problem, explaining each drawing and how it relates to the word problem. The teacher also participates, explaining his or her drawings to the class or group. Then students are directed independently to make drawings as an intermediate problem-solving step when they are faced with challenging word problems. NOTE: This strategy appears to be more effective when used in later, rather than earlier, elementary grades.

Applied Problems: Improving Performance Through a 4-Step Problem-Solving Approach *(Pólya, 1957; Williams, 2003)*. Students can consistently perform better on applied math problems if they follow an efficient 4-step plan of understanding the problem, devising a plan, carrying out the plan, and looking back. (1) UNDERSTAND THE PROBLEM. To fully grasp the problem, the student may restate the problem in his or her own words, note key information, and identify missing information. (2) DEVISE A PLAN. In mapping out a strategy to solve the problem, the student may make a table, draw a diagram, or translate the verbal problem into an equation. (3) CARRY OUT THE PLAN. The student implements the steps in the plan, showing work and checking work for each step. (4) LOOK BACK. The student checks the results. If the answer is written as an equation, the student puts the results in words and checks whether the answer addresses the question posed in the original word problem.

Math Computation: Boost Fluency Through Explicit Time-Drills *(Rhymer, Skinner, Jackson, McNeill, Smith & Jackson, 2002; Skinner, Pappas & Davis, 2005; Woodward, 2006)*. Explicit time-drills are a method to boost students' rate of responding on math-fact worksheets. The teacher hands out the worksheet. Students are told that they will have 3 minutes to work on problems on the sheet. The teacher starts the stop watch and tells the students to start work. At the end of the first minute in the 3-minute span, the teacher 'calls time', stops the stopwatch, and tells the students to underline the last number written and to put their pencils in the air. Then students are told to resume work and the teacher restarts the stopwatch. This process is repeated at the end of minutes 2 and 3. At the conclusion of the 3 minutes, the teacher collects the student worksheets. TIPS: Explicit time-drills work best on 'simple' math facts requiring few computation steps. They are less effective on more complex math facts. Also, a less intrusive and more flexible version of this intervention is to use time-prompts while students are working independently on math facts to speed their rate of responding. For example, at the end of every minute of seatwork, the teacher can call the time and have students draw a line under the item that they are working on when that minute expires.

Math Computation: Motivate With 'Errorless Learning' Worksheets *(Caron, 2007)*. Reluctant students can be motivated to practice math number problems to build computational fluency when given worksheets that include an answer key (number problems with correct answers) displayed at the top of the page. In this version of an 'errorless learning' approach, the student is directed to complete math facts as quickly as possible. If the student comes to a number problem that he or she cannot solve, the student is encouraged to locate the problem and its correct answer in the key at the top of the page and write it in. Such speed drills build computational fluency while promoting students' ability to visualize and to use a mental number line. TIP: Consider turning this activity into a 'speed drill'. The student is given a kitchen timer and instructed to set the timer for a predetermined span of time (e.g., 2 minutes) for each drill. The student completes as many problems as possible before the timer rings. The student then graphs the number of problems correctly computed each day on a time-series graph, attempting to better his or her previous score.

Math Computation: Two Ideas to Jump-Start Active Academic Responding *(Skinner, Pappas & Davis, 2005)*. Research shows that when teachers use specific techniques to motivate their classes to engage in higher rates of active and accurate academic responding, student learning rates are likely to go up. Here are two ideas to accomplish increased academic responding on math tasks. First, break longer assignments into shorter assignments with performance feedback given after each shorter 'chunk' (e.g., break a 20-minute math computation worksheet task into 3 seven-minute assignments). Breaking longer assignments into briefer segments also allows the teacher to praise struggling students more frequently for work completion and effort, providing an additional 'natural' reinforcer. Second, allow students to respond to easier practice items orally rather than in written form to speed up the rate of correct responses.

Math Homework: Motivate Students Through Reinforcers, Interesting Assignments, Homework Planners, and Self-Monitoring *(Bryan & Sullivan-Burstein, 1998)*. Improve students' rate of homework completion and quality by using reinforcers, motivating 'real-life' assignments, a homework planner, and student self-monitoring. (1) Reinforcers: Allow students to earn a small reward (e.g., additional free time) when they turn in all homework assignments for the week. (2) 'Real-life' Assignments: Make homework meaningful by linking concepts being taught to students' lives. In a math lesson on estimating area, for example, give students the homework task of calculating the area of their bedroom and estimating the amount of paint needed to cover the walls. (3) Homework Planner: Teach students to use a homework planner to write down assignments, organize any materials (e.g., worksheets) needed for homework, transport completed homework safely back to school, and provide space for parents and teachers to communicate about homework via written school-home notes. (4) Student Self-Monitoring: Direct students to chart their homework completion each week. Have students plot the number of assignments turned in on-time in green, assignments not turned in at all in red, and assignments turned in late in yellow.

Math Instruction: Consolidate Student Learning During Lecture Through the Peer-Guided Pause *(Hawkins, & Brady, 1994)*. During large-group math lectures, teachers can help students to retain more instructional content by incorporating brief Peer Guided Pause sessions into lectures. Students are trained to work in pairs. At one or more appropriate review points in a lecture period, the instructor directs students to pair up to work together for 4 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 as a convenient way to monitor student understanding.

Math Instruction: Increase Student Engagement and Improve Group Behaviors With Response Cards *(Armendariz & Umbreit, 1999; Lambert, Cartledge, Heward & Lo, 2006)*. Response cards can increase student active engagement in group math activities while reducing disruptive behavior. In the group-response technique, all students in the classroom are supplied with an erasable tablet ('response card'), such as a chalk slate or laminated white board with erasable marker. The teacher instructs at a brisk pace. The instructor first poses a question to the class. Students are given sufficient wait time for each to write a response on his or her response card. The teacher then directs students to present their cards. If most or all of the class has the correct answer, the teacher praises the group. If more than one quarter of the students records an incorrect answer on their cards, however, the teacher uses guided questions and demonstration to steer students to the correct answer.

Math Instruction: Maintain a Supportive Atmosphere for Classroom "Math Talk" *(Cooke & Adams, 1998)*. Teachers can promote greater student 'risk-taking' in mathematics learning when they cultivate a positive classroom atmosphere for math discussions while preventing peers from putting each other down. The teacher models behavioral expectations for open, interactive discussions, praises students for their class participation and creative attempts at problem-solving, and regularly points out that incorrect answers and misunderstandings should be celebrated—as they often lead to breakthroughs in learning. The teacher uses open-ended comments (e.g., "What led you to that answer?") as tools to draw out students and encourage them to explore and apply math concepts in group discussion. Students are also encouraged in a supportive manner to evaluate each other's reasoning. However, the teacher intervenes immediately to prevent negative student comments or 'put-downs' about peers. As with any problem classroom behavior, a first offense requires that the student meet privately with the instructor to discuss teacher expectations for positive classroom behavior. If the student continues to put down peers, the teacher imposes appropriate disciplinary consequences.

Math Instruction: Support Students Through a Wrap-Around Instruction Plan *(Montague, 1997; Montague, Warger & Morgan, 2000)*. When teachers instruct students in more complex math cognitive strategies, they must support struggling learners with a 'wrap-around' instructional plan. That plan incorporates several elements: (a) Assessment of the student's problem-solving skills. The instructor first verifies that the student has the necessary academic competencies to learn higher-level math content, including reading and writing skills, knowledge of basic math operations, and grasp of required math vocabulary. (b) Explicit instruction. The teacher presents new math content in structured, highly organized lessons. The instructor also uses teaching tools such as Guided Practice (moving students from known material to new concepts through a thoughtful series of teacher questions) and 'overlearning' (teaching and practicing a skill with the class to the point at which students develop automatic recall and control of it). (c) Process modeling. The teacher adopts a 'think aloud' approach, or process modeling, to verbally reveal his or her cognitive process to the class while using a cognitive strategy to solve a math problem. In turn, students are encouraged to think aloud when applying the same strategy—first as part of a whole-class or cooperative learning group, then independently. The teacher observes students

during process modeling to verify that they are correctly applying the cognitive strategy. (d) Performance feedback. Students get regular performance feedback about their level of mastery in learning the cognitive strategy. That feedback can take many forms, including curriculum-based measurement, timely corrective feedback, specific praise and encouragement, grades, and brief teacher conferences. (e) Review of mastered skills or material. Once the student has mastered a cognitive strategy, the teacher structures future class lessons or independent work to give the student periodic opportunities to use and maintain the strategy. The teacher also provides occasional brief 'booster sessions', reteaching steps of the cognitive strategy to improve student retention.

Math Instruction: Unlock the Thoughts of Reluctant Students Through Class Journaling *(Baxter, Woodward & Olson, 2005)*. Students can effectively clarify their knowledge of math concepts and problem-solving strategies through regular use of class 'math journals'. Journaling is a valuable channel of communication about math issues for students who are unsure of their skills and reluctant to contribute orally in class. At the start of the year, the teacher introduces the journaling assignment, telling students that they will be asked to write and submit responses at least weekly to teacher-posed questions. At first, the teacher presents 'safe' questions that tap into the students' opinions and attitudes about mathematics (e.g., 'How important do you think it is nowadays for cashiers in fast-food restaurants to be able to calculate in their head the amount of change to give a customer?"). As students become comfortable with the journaling activity, the teacher starts to pose questions about the students' own mathematical thinking relating to specific assignments. Students are encouraged to use numerals, mathematical symbols, and diagrams in their journal entries to enhance their explanations. The teacher provides brief written comments on individual student entries, as well as periodic oral feedback and encouragement to the entire class on the general quality and content of class journal responses. Regular math journaling can prod students to move beyond simple 'rote' mastery of the steps for completing various math problems toward a deeper grasp of the math concepts that underlie and explain a particular problem-solving approach. Teachers will find that journal entries are a concrete method for monitoring student understanding of more abstract math concepts. To promote the quality of journal entries, the teacher might also assign them an effort grade that will be calculated into quarterly math report card grades.

Math Problem-Solving: Help Students Avoid Errors With the 'Individualized Self-Correction Checklist' *(Zrebiec Uberti, Mastropieri & Scruggs, 2004)*. Students can improve their accuracy on particular types of word and number problems by using an 'individualized self-instruction checklist' that reminds them to pay attention to their own specific error patterns. To create such a checklist, the teacher meets with the student. Together they analyze common error patterns that the student tends to commit on a particular problem type (e.g., 'On addition problems that require carrying, I don't always remember to carry the number from the previously added column.'). For each type of error identified, the student and teacher together describe the appropriate step to take to prevent the error from occurring (e.g., 'When adding each column, make sure to carry numbers when needed.'). These self-check items are compiled into a single checklist. Students are then encouraged to use their individualized self-instruction checklist whenever they work independently on their number or word problems. As older students become proficient in creating and using these individualized error checklists, they can begin to analyze their own math errors and to make their checklists independently whenever they encounter new problem types.

Math Review: Balance Massed & Distributed Practice *(Carnine, 1997)*. Teachers can best promote students acquisition and fluency in a newly taught math skill by transitioning from massed to distributed practice. When students have just acquired a math skill but are not yet fluent in its use, they need lots of opportunities to try out the skill under teacher supervision—a technique sometimes referred to as 'massed practice'. Once students have developed facility and independence with that new math skill, it is essential that they then be required periodically to use the skill in order to embed and retain it—a strategy also known as 'distributed practice'. Teachers can program distributed practice of a math skill such as reducing fractions to least common

denominators into instruction either by (a) regularly requiring the student to complete short assignments in which they practice that skill in isolation (e.g., completing drill sheets with fractions to be reduced), or (b) teaching a more advanced algorithm or problem-solving approach that incorporates--and therefore requires repeated use of--the previously learned math skill (e.g., requiring students to reduce fractions to least-common denominators as a necessary first step to adding the fractions together and converting the resulting improper fraction to a mixed number).

Math Review: Teach Effective Test-Preparation Strategies *(Hong, Sas, & Sas, 2006)*. A comparison of the methods that high and low-achieving math students typically use to prepare for tests suggests that struggling math students need to be taught (1) specific test-review strategies and (2) time-management and self-advocacy skills. Among review-related strategies, deficient test-takers benefit from explicit instruction in how to take adequate in-class notes; to adopt a systematic method to review material for tests (e.g., looking over their notes each night, rereading relevant portions of the math text, reviewing handouts from the teacher, etc.), and to give themselves additional practice in solving problems (e.g., by attempting all homework items, tackling additional problems from the text book, and solving problems included in teacher handouts). Deficient test-takers also require pointers in how to allocate and manage their study time wisely, to structure their study environment to increase concentration and reduce distractions, as well as to develop 'self-advocacy' skills such as seeking additional help from teachers when needed. Teachers can efficiently teach effective test-preparation methods as a several-session whole-group instructional module.

Math Vocabulary: Preteach, Model, and Use Standard Math Terms *(Chard, D., n.d.)*. Three strategies can help students to learn essential math vocabulary: preteaching key vocabulary items, modeling those vocabulary words, and using only universally accepted math terms in instruction. (1) Preteach key math vocabulary. Math vocabulary provides students with the language tools to grasp abstract mathematical concepts and to explain their own reasoning. Therefore, do not wait to teach that vocabulary only at 'point of use'. Instead, preview relevant math vocabulary as a regular a part of the 'background' information that students receive in preparation to learn new math concepts or operations. (2) Model the relevant vocabulary when new concepts are taught. Strengthen students' grasp of new vocabulary by reviewing a number of math problems with the class, each time consistently and explicitly modeling the use of appropriate vocabulary to describe the concepts being taught. Then have students engage in cooperative learning or individual practice activities in which they too must successfully use the new vocabulary—while the teacher provides targeted support to students as needed. (3) Ensure that students learn standard, widely accepted labels for common math terms and operations and that they use them consistently to describe their math problem-solving efforts.

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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.

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.

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.
- ❑ 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).

NOTE: Teachers may want to use the attached *Reciprocal Peer Tutoring in Math Computation: Teacher Nomination Form* to compile a list of students who would be suitable for the tutoring program.

Train the Student Tutors. Student tutors are trained through explicit instruction (Menesses & Gresham, 2009) with the teacher clearly explaining the tutoring steps, demonstrating them, and then having the students practice the steps with performance feedback and encouragement from the teacher. The teacher also explains, demonstrates, and observes students practice the progress-monitoring component of the program. (NOTE: Teachers can find a handy listing of all the tutoring steps in which students are to be trained on the attached form *Peer Tutoring in Math*

Computation with Constant Time Delay: Integrity Checklist. This checklist can also be used to evaluate the performance of students to determine their mastery of the tutoring steps during practice sessions with the teacher.)

When students have completed their training, the teacher has each student role-play the tutor with the teacher assuming the role of tutee. The tutor-in-training works through the 3-minute tutoring segment and completes the follow-up progress-monitoring activity. The teacher then provides performance feedback. The student is considered to be ready to tutor when he or she successfully implements all steps of the intervention (100% accuracy) on three successive training trials (Menesses & Gresham, 2009).

INTERVENTION STEPS: Students participating in the tutoring program meet in a setting in which their tutoring activities will not distract other students. The setting is supervised by an adult who monitors the students and times the tutoring activities. These are the steps of the tutoring intervention:

1. Complete the Tutoring Activity. In each tutoring pair, one of the students assumes the role of tutor. The supervising adult starts the timer and says 'Begin'; after 3 minutes, the adult stops the timer and says 'Stop'.

   While the timer is running, the tutor follows this sequence:

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

   b. *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.

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

   d. *Shuffles Cards*. When the tutor and tutee have reviewed all of the math-fact carts, the tutor shuffles them before again presenting cards.

   e. *Continues to the Timer*. The tutor continues to presents math-fact cards for tutee response until the timer rings.

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

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

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

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

d. *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.

3. Switch Roles. After the tutor has completed the 3-minute tutoring activity and assessed the tutee's progress on math facts, the two students reverse roles. The new tutor then implements steps 2 and 3 described above with the new tutee.

4. Conduct Tutoring Integrity Checks and Monitor Student Performance. 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.

   The adult supervisor also monitors student progress. After each student pair has completed one tutoring cycle and assessed and recorded their progress, the supervisor reviews the score sheets. If a student has successfully answered all 10 math fact cards three times in succession, the supervisor provides that student's tutor with a new set of math flashcards.

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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: 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 carts, 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.	

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.	

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:

Cover-Copy-Compare

Students who can be trusted to work independently and need extra drill and practice with math computational problems, spelling, or vocabulary words will benefit from Cover-Copy-Compare.

Preparing Cover-Copy-Compare Worksheets:

The teacher prepares worksheets for the student to use independently:

- For math worksheets, computation problems with answers appear on the left side of the sheet. The same computation problems appear on the right side of the page, unsolved. Here is a sample CCC item for math:
- For spelling words, correctly spelled words are listed on the left of the page, with space on the right for the student to spell each word.
- For vocabulary items, words and their definitions are listed on the left side of the page, with space on the right for the student to write out each word and a corresponding definition for that word.

Using Cover-Copy-Compare Worksheets for Student Review:

When first introducing Cover-Copy-Compare worksheets to the student, the teacher gives the student an index card. The student is directed to look at each correct item (e.g., correctly spelled word, computation problem with solution) on the left side of the page.

- (For math problems.) The student is instructed to cover the correct model on the left side of the page with an index card and to copy the problem and compute the correct answer in the space on the right side of the sheet. The student then uncovers the correct answer on the left and checks his or her own work.
- (For spelling problems.) The student is instructed to cover the correct model on the left side of the page with an index card and to spell the word in the space on the right of the sheet. The student then uncovers the correct answer on the left to check his or her work.
- (For vocabulary items.) The student is instructed to cover the correct model on the left side of the page with an index card and to write both the word and its definition in the space on the right side of the sheet. The student then uncovers the correct model on the left to check his or her work.

Troubleshooting: How to Deal With Common Problems in Using 'Cover-Copy-Compare'

Q: How do I respond if the student simply copies the correct answers from the models into the answer blanks and tries to pass this off as his or her own work?

An essential requirement of Cover-Copy-Compare is that the student cover the correct model and attempt independently to solve the item using his or her own skills. if the student simply copies the correct answer from the model math problem or spelling word, the review process is short-circuited and the student will not benefit. If you suspect a student will copy rather than attempt to solve items on a CCC worksheet, arrange to have a peer tutor, adult in the classroom, or parent sit with the student to provide encouragement and monitoring.

Q: I have a student who is so disorganized that he will lose the index card before he can complete a CCC worksheet. Any suggestions?

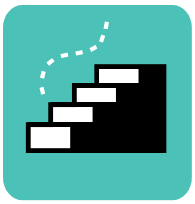
Here is an idea for getting rid of that index card: You can fold the worksheet in half length-wise so that the answers appear on one side of the folded worksheet and the answer blanks appear on the other side. For each item, the student will peer at the correct model, then flip the folded sheet over to the right side to independently solve the item (with the correct model neatly folded out of sight).

Jim's Hints

When using CCC worksheets, add an occasional item (e.g., vocabulary word, math problem) that the student has already mastered. These review items are great for refreshing student skills on learned material and can also give the teacher an indication of how well the student is retaining academic skills.

You can boost student motivation by praising the student for his or her efforts in completing the worksheets. You might also want to have the student build a portfolio of completed CCC worksheets. In reviewing this portfolio of work periodically, the student can see tangible evidence of improvement in his or her academic skills.

Math Review: Promote Mastery of Math Facts Through Incremental Rehearsal



Incremental rehearsal builds student fluency in basic math facts ('arithmetic combinations') by pairing unknown computation items with a steadily increasing collection of known items. This intervention makes use of repeated, or massed, practice to promote fluency and guarantees that the student will experience a high rate of success..

Materials

- Index cards and pen

Steps to Implementing This Intervention

In preparation for this intervention:

1. The tutor first writes down on an index card in ink each math fact that a student is expected to master-but without the answer. NOTE: Educators can use the A-Plus Math Flashcard Creator, an on-line application, to make and print flashcards in addition, subtraction, multiplication, and division. The web address for the flashcard creator is: *http://www.aplusmath.com/Flashcards/Flashcard_Creator.html*

2. The tutor reviews the collection of math-fact cards with the student. Any of the math facts that the student can orally answer correctly within two seconds are considered to be known problems and are separated into one pile. Math facts that the student cannot yet answer correctly within two seconds are considered 'unknown' and collected in a second pile -- the 'unknown facts' deck.

3. The tutor next randomly selects 9 cards from the pile of known math facts and sets this subset of cards aside as the 'known facts' deck. The rest of the pile of cards containing known math facts is put away ('discard deck'), not to be used further in this intervention.

During the intervention:

The tutor follows an incremental-rehearsal sequence each day when working with the student:

1. First, the tutor takes a single card from the 'unknown facts' deck. The tutor reads the math fact on the card aloud, provides the answer, and prompts the student to read off and answer the same unknown problem.

2. Next the tutor takes one math fact from the 'known facts' deck and pairs it with the unknown problem. When shown the two problems in sequence, the student is asked during the presentation of each math fact to read off the problem and answer it. The student is judged to be successful on a problem if he or she orally provides the correct answer to that problem within 2 seconds. If the student commits an error on any card or hesitates for longer than two seconds, the tutor reads the math fact on the card aloud, gives the answer, then prompts the

student to read off the same unknown problem and provide the answer. This review sequence continues until the student answers all cards within two seconds without errors.

3. The tutor then repeats the sequence--taking yet another problem from the 'known facts' deck to add to the expanding collection of math facts being reviewed ('review deck'). Each time, the tutor prompts the student to read off and answer the whole series of math facts in the review deck, beginning with the unknown fact and then moving through the growing series of known facts that follow it.

4. When the review deck has expanded to include one 'unknown' math fact followed by nine 'known' math facts (a ratio of 90 percent 'known' material to 10 percent 'unknown' material), the last 'known' math fact that was added to the student's review deck is discarded (put away with the 'discard deck'). The previously 'unknown' math fact that the student has just successfully practiced in multiple trials is now treated as a 'known' math fact and is included as the first item in the nine-card 'known facts' deck for future drills.

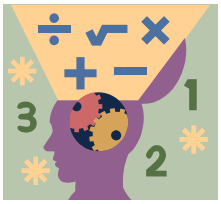
5. The student is then presented with a new math fact to answer, taken from the 'unknown facts' deck. With each new 'unknown' math fact, the review sequence is again repeated as described above until the 'unknown' math fact is grouped incrementally with nine math facts from the 'known facts' deck—and on and on.

Daily review sessions are discontinued either when time runs out or when the student answers an 'unknown' math fact incorrectly three times.

Reference

Burns, M. K. (2005). Using incremental rehearsal to increase fluency of single-digit multiplication facts with children identified as learning disabled in mathematics computation. *Education and Treatment of Children, 28*, 237-249.

Math Computation: Increase Accuracy By Intermixing Easy and Challenging Problems



Teachers can improve accuracy and positively influence the attitude of students when completing math-fact worksheets by intermixing 'easy' problems among the 'challenging' problems. Research shows that students are more motivated to complete computation worksheets when they contain some very easy problems interspersed among the more challenging items.

Materials

- Math computation worksheets & answer keys with a mixture of difficult and easy problems

Steps to Implementing This Intervention

1. The teacher first identifies one or more 'challenging' problem-types that are matched to the student's current math-computation abilities (e.g., multiplying a 2-digit number by a 2-digit number with regrouping).

2. The teacher next identifies an 'easy' problem-type that the students can complete very quickly (e.g., adding or subtracting two 1-digit numbers).

3. The teacher then creates a a series of student math computation worksheets with 'easy' computation problems interspersed at a fixed rate among the 'challenging' problems. (NOTE: Instructions are included below for creating interspersal worksheets using a free online application from *www.interventioncentral.org*.)

    - If the student is expected to complete the worksheet independently as seat work or homework, 'challenging' and 'easy' problems should be interspersed at a 1:1 ratio (that is, every 'challenging' problem in the worksheet is followed by an 'easy' problem).

    - If the student is to have the problems read aloud and then asked to solve the problems mentally and write down only the answer, the items should appear on the worksheet at a ratio of 3:1 (that is, every third 'challenging' problem is followed by an 'easy' one).

Directions for On-Line Creation of Worksheets With a Mix of Easy and Challenging Computation Problems ('Interspersal Worksheets')

By following the directions below, teachers can use a free on-line Math Worksheet Generator to create computation worksheets with easy problems interspersed among more challenging ones:

- The teacher goes to the following URL for the Math Worksheet Generator: http://www.interventioncentral.org/htmdocs/tools/mathprobe/allmult.php

- Displayed on that Math Worksheet Generator web page is a series of math computation goals for addition, subtraction, multiplication, and division. Teachers can select up to five different problem types to appear on a student worksheet. Each problem type is selected by clicking on the checkbox next to it.

- It is simple to create a worksheet with a 1:1 ratio of challenging and easy problems (that is, with an easy problem following every challenging problem). First, the teacher clicks the checkbox next to an 'easy' problem type that the student can compute very quickly (e.g., adding or subtracting two 1-digit numbers). Next the teacher selects a 'challenging' problem type that is instructionally appropriate for the student (e.g., multiplying a 2-digit number by a 2-digit number with regrouping). Then the teacher clicks the 'Multiple Skill Computation Probe' button. The computer program will then automatically create a student computation worksheet and teacher answer key with alternating easy and challenging problems.

- It is also no problem to create a worksheet with a higher (e.g., 2:1, 3:1, or 4:1) ratio of challenging problems to easy problems. The teacher first clicks the checkbox next to an 'easy' problem type that the student can compute very quickly (e.g., adding or subtracting two 1-digit numbers). The teacher then selects up to four different challenging problem types that are instructionally appropriate to the student. Depending on the number of challenging problem-types selected, when the teacher clicks the 'Multiple Skill Computation Probe' button, the computer program will create a student computation worksheet and teacher answer key that contain 2 (or 3 or 4) challenging problems for every easy problem.

Because the computer program generates new worksheets each time it is used, the teacher can enter the desired settings and –in one sitting-- create and print off enough worksheets and answer keys to support a six- or eight-week intervention.

Reference

Hawkins, J., Skinner, C. H., & Oliver, R. (2005). The effects of task demands and additive interspersal ratios on fifth-grade students' mathematics accuracy. *School Psychology Review, 34,* 543-555.

Applied Math Problems: Using Question-Answer Relationships (QARs) to Interpret Math Graphics

Students must be able to correctly interpret math graphics in order to correctly answer many applied math problems. Struggling learners in math often misread or misinterpret math graphics. For example, students may:

- overlook important details of the math graphic.
- treat irrelevant data on the math graphic as 'relevant'.
- fail to pay close attention to the question before turning to the math graphic to find the answer
- not engage their prior knowledge both to extend the information on the math graphic and to act as a possible 'reality check' on the data that it presents.
- expect the answer to be displayed in plain sight on the math graphic, when in fact the graphic may require that readers first to interpret the data, then to plug the data into an equation to solve the problem.

Teachers need an instructional strategy to encourage students to be more savvy interpreters of graphics in applied math problems. One idea is to have them apply a reading comprehension strategy, Question-Answer Relationships (QARs) as a tool for analyzing math graphics. The four QAR question types (Raphael, 1982, 1986) are as follows:

- 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 the making of connections between disparate pieces of factual information found in different sections of the reading.
- 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.

Steps to Implementing This Intervention

Teachers use a 4-step instructional sequence to teach students to use Question-Answer Relationships (QARs) to better interpret math graphics:

1. Step 1: Distinguishing Among Different Kinds of Graphics

   Students are first taught to differentiate between five common types of math graphics: 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 types of graphics, while the teacher

records those observations on a wall chart. Next students are shown examples of graphics and directed to identify the general graphic type (table, chart, picture, line graph, bar graph) that each sample represents.

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

2. Interpreting Information in Graphics

Over several instructional sessions, students learn to interpret information contained in various types of math graphics. For these activities, students are paired off, with stronger students matched with less strong ones.

The teacher sets aside a separate session to introduce 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. The graphics sequence in order of increasing difficulty is: Pictures > tables > bar graphs > charts > line graphs.

At each session, student pairs examine examples of graphics from the category being explored that day and discuss questions such as: "What information does this graphic present? What are strengths of this type of graphic for presenting data? What are possible weaknesses?" Student pairs record their findings and share them with the large group at the end of the session.

3. Linking the Use of Question-Answer Relations (QARs) to Graphics

In advance of this lesson, the teacher prepares a series of data questions and correct answers. Each question and answer is paired with a math graphic that contains information essential for finding the answer.

At the start of the lesson, students are each given a set of 4 index cards with titles and descriptions of each of the 4 QAR questions: RIGHT THERE, THINK AND SEARCH, AUTHOR AND YOU, ON MY OWN. (TMESAVING TIP: Students can create their own copies of these QAR review cards as an in-class activity.)

Working first in small groups and then individually, students read each teacher-prepared question, study the matching graphic, and 'verify' the provided answer as correct. They then identify the type of question being posed in that applied problem, using their QAR index cards as a reference.

4. Using Question-Answer Relationships (QARs) Independently to Interpret Math Graphics

Students are now ready to use the QAR strategy independently to interpret graphics. They are given a laminated card as a reference with 6 steps to follow whenever they attempt to solve an

applied problem that includes a math graphic:

- ✓ Read the question,
- ✓ Review the graphic,
- ✓ Reread the question,
- ✓ Choose a Question-Answer Relationship that matches the question in the applied problem
- ✓ Answer the question, and
- ✓ Locate the answer derived from the graphic in the answer choices offered.

Students are strongly encouraged NOT to read the answer choices offered on a multiple-choice item until they have first derived their own answer—to prevent those choices from short-circuiting their inquiry.

References

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

Raphael, T. (1982). Question-answering strategies for children. The Reading Teacher, 36, 186-190.

Raphael, T. (1986). Teaching question answer relationships, revisited. The Reading Teacher, 39, 516-522.

Math Computation: Increase Accuracy and Productivity Rates Via Self-Monitoring and Performance Feedback

Students can improve both their accuracy and fluency on math computation worksheets by independently self-monitoring their computation speed, charting their daily progress, and earning rewards for improved performance.

Materials

- Collection of student math computation worksheets & matching answer keys (NOTE: Educators can use a free online application to create math computation worksheets and answer keys at http://www.interventioncentral.org/htmdocs/tools/mathprobe/addsing.php)

- Student self-monitoring chart

Steps to Implementing This Intervention

In preparation for this intervention:

- the teacher selects one or more computation problem types that the student needs to practice. Using that set of problem types as a guide, the teacher creates a number of standardized worksheets with similar items to be used across multiple instructional days. (A Math Worksheet Generator that will create these worksheets automatically can be accessed at http://www.interventioncentral.org).

- the teacher prepares a progress-monitoring chart. The vertical axis of the chart extends from 0 to 100 and is labeled 'Correct Digits' The horizontal axis of the chart is labeled 'Date'.

- the teacher creates a menu of rewards that the student can choose from on a given day if the student was able to exceed his or her previously posted computation fluency score.

At the start of the intervention, the teacher meets with the student. The teacher shows the student a sample math computation worksheet and answer key. The teacher tells the student that the student will have the opportunity to complete similar math worksheets as time drills and chart the results. The student is told that he or she will win a reward on any day when the student's number of correctly computed digits on the worksheet exceeds that of the previous day.

During each day of the intervention:

1. The student is given one of the math computation worksheets previously created by the teacher, along with an answer key. The student first consults his or her progress-monitoring chart and notes the most recent charted computation fluency score previously posted. The student is encouraged to try to exceed that score.

2. When the intervention session starts, the student is given a pre-selected amount of time (e.g., 5 minutes) to complete as many problems on the computation worksheet as possible. The student sets a timer for the allocated time and works on the computation sheet until the timer rings.

3. The student then uses the answer key to check his or her work, giving credit for each correct digit in an answer. (A 'correct digits' is defined as a digit of the correct value that appears in the correct place-value location in an answer. In this scoring method, students can get partial credit even if some of the digits in an answer are correct and some are incorrect.).

4. The student plots his or her computational fluency score on the progress-monitoring chart and writes the current date at the bottom of the chart below the plotted data point. The student is allowed to select a choice from the reward menu if he or she exceeds his or her most recent, previously posted fluency score.

References

Bennett, K., & Cavanaugh, R. A. (1998). Effects of immediate self-correction, delayed self-correction, and no correction on the acquisition and maintenance of multiplication facts by a fourth-grade student with learning disabilities. *Journal of Applied Behavior Analysis, 31*, 303-306.

Shimabukuro, S. M., Prater, M. A., Jenkins, A., & Edelen-Smith, P. (1999). The effects of self-monitoring of academic performance on students with learning disabilities and ADD/ADHD. *Education and Treatment of Children, 22*, 397-414.

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 student must have the capacity to reliably implement the specific steps of a particular problem-solving process, or cognitive strategy. At least as important, though, is that the student must also possess the necessary metacognitive skills to analyze the problem, select an appropriate strategy to solve that problem from an array of possible alternatives, and monitor the problem-solving process to ensure that it is carried out correctly.

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).

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.

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').

While the Say-Ask-Check sequence is repeated across all 7 problem-solving steps, the actual content of the student self-coaching comments changes across the steps.

Table 1 shows how each of the steps in the word problem cognitive strategy is matched to the three-part Say-Ask-Check sequence:

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."
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."
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."
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."
5. Predict/estimate the	'Say' (Self-Instruction) Target: *The student uses estimation or other strategies to predict or*	Say: "I will estimate what the answer will be."

Answer.	*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.*	Ask: "What numbers in the problem should be used in my estimation?" Check: "I did not skip any important information in my estimation."
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."
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: ""

Students will benefit from close teacher support when learning to combine the 7-step cognitive strategy to attack math word problems with the iterative 3-step metacognitive Say-Ask-Check sequence. Teachers can increase the likelihood that the student will successfully acquire these skills by using research-supported instructional practices (Burns, VanDerHeyden, & Boice, 2008), including:

- Verifying that the student has the necessary foundation skills to solve math word problems
- Using explicit instruction techniques to teach the cognitive and metacognitive strategies
- Ensuring that all instructional tasks allow the student to experience an adequate rate of success
- Providing regular opportunities for the student to be engaged in active accurate academic responding
- Offering frequent performance feedback to motivate the student and shape his or her learning.

References

Burns, M. K., VanDerHeyden, A. M., & Boice, C. H. (2008). Best practices in intensive academic interventions. In A. Thomas & J. Grimes (Eds.), *Best practices in school psychology V* (pp.1151-1162). Bethesda, MD: National Association of School Psychologists.

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Montague, M., & Dietz, S. (2009). Evaluating the evidence base for cognitive strategy instruction and mathematical problem solving. *Exceptional Children, 75*, 285-302.

Documenting Tier 1 (Classroom) Interventions: A Sample Form

When general-education students begin to struggle with academic or behavioral issues, the classroom teacher will typically select and implement one or more evidence-based intervention strategies to assist those students. But a strong intervention plan needs more than just well-chosen interventions. It also requires 4 additional components (Witt, VanDerHeyden, & Gilbertson, 2004): (1) student concerns should be clearly and specifically defined; (2) one or more methods of formative assessment should be used to track the effectiveness of the intervention; (3) baseline student data should be collected prior to the intervention; and (4) a goal for student improvement should be calculated before the start of the intervention to judge whether that intervention is ultimately successful. If a single one of these essential 4 components is missing, the intervention is to be judged as fatally flawed (Witt, VanDerHeyden, & Gilbertson, 2004) and as not meeting minimum RTI standards.

Teachers need a standard format to use in documenting their 'Tier 1' (classroom) intervention plans. The attached form, *Tier 1/Classroom Intervention Planning Sheet*, is designed to include all of the essential RTI elements of an effective intervention plan. The form includes space to document:

- *Definition of up to two student academic or behavioral problems*. The most significant step in selecting an effective classroom intervention is to correctly identify the target student concern(s) in clear, specific, measureable terms (Bergan, 1995). The teacher selects no more than two student concerns to address on the intervention plan.
- *Intervention description.* The teacher describes the evidence-based intervention(s) that will be used to address the identified student concern(s).
- *Intervention delivery.* The teacher writes down details necessary for implementing the intervention in the classroom (e.g., where and when the intervention will be used; the adult-to-student ratio; how frequently the intervention will take place; the length of time each session of the intervention will last; materials needed for the intervention, etc.
- *Checkup date.* The teacher notes the date at which the intervention will be reviewed to determine whether it has been sufficiently effective. NOTE: For academic interventions, it is advisable to allow at least 4 instructional weeks before deciding whether the intervention has been effective.
- *Assessment data.* For each intervention, the teacher selects the type(s) of classroom data that will be collected formatively throughout the intervention period to judge its effectiveness. For each data source, in turn, the teacher collects baseline data on student performance—and calculates an outcome goal that the student is expected to attain if the intervention is successful. (During the period in which the intervention is in effect, the teacher collects ongoing data to judge student performance and attaches that data to the classroom intervention documentation form.)

While a Tier 1/classroom intervention documentation form is a helpful planning tool, schools should remember that teachers will need other resources and types of assistance as well to be successful in selecting and using Tier 1 interventions. For example, teachers should have access to an 'intervention menu' that contains evidence-based strategies to address the most common academic and behavioral concerns and should be able to get coaching support as they learn how to implement new classroom intervention ideas. A future blog entry will review necessary Tier 1 teacher supports in greater detail.

References

Bergan, J. R. (1995). Evolution of a problem-solving model of consultation. *Journal of Educational and Psychological Consultation, 6(2),* 111-123.

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

Tier 1/Classroom Intervention Planning Sheet

Teacher/Team: _____ Date: _____ Student: _____

Student Problem Definition #1: _____

Student Problem Definition #2: _____

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

Interventions: Essential Elements (Witt et al., 2004)
- Clear problem-definition(s)
- Baseline data
- Goal for improvement
- Progress-monitoring plan

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

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

Intervention & Related RTI Terms: Definitions

Educators who serve as interventionists should be able to define and distinguish among the terms *core instruction*, *intervention*, *accommodation*, and *modification*. (In particular, interventionists should avoid using modifications as part of an RTI plan for a general education student, as they can be predicted to undermine the student's academic performance.) Here are definitions for these key terms.

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

- Intervention. An academic *intervention* is a strategy used to teach a new skill, build fluency in a skill, or encourage a child to apply an existing skill to new situations or settings. An intervention can be thought of as "a set of actions that, when taken, have demonstrated ability to change a fixed educational trajectory" (Methe & Riley-Tillman, 2008; p. 37). As an example of an academic intervention, the teacher may select question generation (Davey & McBride,1986.; Rosenshine, Meister & Chapman, 1996), a strategy in which the student is taught to locate or generate main idea sentences for each paragraph in a passage and record those 'gist' sentences for later review.

- Accommodation. An accommodation is intended to help the student to fully access and participate in the general-education curriculum without changing the instructional content and without reducing the student's rate of learning (Skinner, Pappas & Davis, 2005). An accommodation is intended to remove barriers to learning while still expecting that students will master the same instructional content as their typical peers. An accommodation for students who are slow readers, for example, may include having them supplement their silent reading of a novel by listening to the book on tape. An accommodation for unmotivated students may include breaking larger assignments into smaller 'chunks' and providing students with performance feedback and praise for each completed 'chunk' of assigned work (Skinner, Pappas & Davis, 2005).

- Modification. A modification changes the expectations of what a student is expected to know or do—typically by lowering the academic standards against which the student is to be evaluated. Examples of modifications are giving a student five math computation problems for practice instead of the 20 problems assigned to the rest of the class or letting the student consult course notes during a test when peers are not permitted to do so. Instructional modifications are essential elements on the Individualized Education Plans (IEPs) or Section 504 Plans of many students with special needs. Modifications are generally not included on a general-education student's RTI intervention plan, however, because the assumption is that the student can be successful in the curriculum with appropriate interventions and accommodations alone. In fact, modifying the work of struggling general education students is likely to have a negative effect that works *against* the goals of RTI. Reducing academic expectations will result in these students falling further behind rather than closing the performance gap with peers

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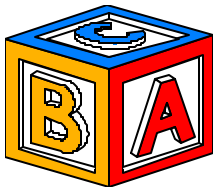
Building Blocks of Effective Instruction



Good classroom instruction is no accident. Two powerful tools for analyzing the quality of student instruction are the *Instructional Hierarchy* and the *Learn Unit*.

Instructional Hierarchy. As students are taught new academic skills, they go through a series of predictable learning stages. At the start, a student is usually halting and uncertain as he or she tries to use the target skill. With teacher feedback and lots of practice, the student becomes more fluent, accurate, and confident in using the skill. It can be very useful to think of these phases of learning as a *hierarchy* (See chart on page 2). The learning hierarchy (Haring, Lovitt, Eaton, & Hansen, 1978) has four stages: *acquisition*, *fluency*, *generalization*, and *adaptation*:

1. **Acquisition.** The student has begun to learn how to complete the target skill correctly but is not yet accurate or fluent in the skill. The goal in this phase is to improve accuracy.
2. **Fluency.** The student is able to complete the target skill accurately but works slowly. The goal of this phase is to increase the student's speed of responding (fluency).
3. **Generalization.** The student is accurate and fluent in using the target skill but does not typically use it in different situations or settings. Or the student may confuse the target skill with 'similar' skills. The goal of this phase is to get the student to use the skill in the widest possible range of settings and situations, or to accurately discriminate between the target skill and 'similar' skills.
4. **Adaptation.** The student is accurate and fluent in using the skill. He or she also uses the skill in many situations or settings. However, the student is not yet able to modify or adapt the skill to fit novel task demands or situations.

The 'Learn Unit'. At the core of good instruction lies the ''Learn Unit', a 3-step process in which the student is invited to engage in an academic task, delivers a response, and then receives immediate feedback about how he or she did on the task (Heward, 1996). Here is an explanation of the stages of the 'Learn Unit':

1. **Academic Opportunity to Respond**. The student is presented with a meaningful opportunity to respond to an academic task. A question posed by the teacher, a math word problem, and a spelling item on an educational computer 'Word Gobbler' game could all be considered academic opportunities to respond.
2. **Active Student Response**. The student answers the item, solves the problem presented, or completes the academic task. Answering the teacher's question, computing the answer to a math word problem (and showing all work), and typing in the correct spelling of an item when playing an educational computer game are all examples of active student responding.
3. **Performance Feedback**. The student receives timely feedback about whether his or her response is correct—often with praise and encouragement. A teacher exclaiming 'Right! Good job!' when a student gives an response in class, a student using an answer key to check her answer to a math word problem, and a computer message that says 'Congratulations! You get 2 points for correctly spelling this word!" are all examples of corrective feedback.

The more frequently a student cycles through complete 'Learn Unit' trials, the faster that student is likely to make learning progress. If any one of these steps is missing, the quality of instruction will probably be compromised.

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Instructional Hierarchy: Matching Interventions to Student Learning Stage (Haring, et al., 1978)

Learning Stage	*Student 'Look-Fors'…*	*What strategies are effective…*
Acquisition: Exit Goal: The student can perform the skill accurately with little adult support.	• Is just beginning to learn skill • Not yet able to perform learning task reliably or with high level of accuracy	• Teacher actively demonstrates target skill • Teacher uses 'think-aloud' strategy-- especially for thinking skills that are otherwise covert • Student has models of correct performance to consult as needed (e.g., correctly completed math problems on board) • Student gets feedback about correct performance • Student receives praise, encouragement for *effort*
Fluency: Exit Goals: The student (a) has learned skill well enough to retain (b) has learned skill well enough to combine with other skills, (c) is as fluent as peers.	• Gives accurate responses to learning task • Performs learning task slowly, haltingly	• Teacher structures learning activities to give student opportunity for active (observable) responding • Student has frequent opportunities to *drill* (direct repetition of target skill) and *practice* (blending target skill with other skills to solve problems) • Student gets feedback on *fluency* and *accuracy* of performance • Student receives praise, encouragement for *increased fluency*
Generalization: Exit Goals: The student (a) uses the skill across settings, situations; (b) does not confuse target skill with similar skills	• Is accurate and fluent in responding • May fail to apply skill to new situations, settings • May confuse target skill with similar skills (e.g., confusing '+' and 'x' number operation signs)	• Teacher structures academic tasks to require that the student use the target skill regularly in assignments. • Student receives encouragement, praise, reinforcers for using skill in new settings, situations • If student confuses target skill with similar skill(s), the student is given practice items that force him/her to correctly discriminate between similar skills • Teacher works with parents to identify tasks that the student can do outside of school to practice target skill • Student gets periodic opportunities to review, practice target skill to ensure maintenance
Adaptation: Exit Goal: The Adaptation phase is continuous and has no exit criteria.	• Is fluent and accurate in skill • Applies skill in novel situations, settings without prompting • Does not yet modify skill as needed to fit new situations (e.g., child says 'Thank you' in all situations, does not use modified, equivalent phrases such as "I appreciate your help.")	• Teacher helps student to articulate the *'big ideas'* or core element(s) of target skill that the student can modify to face novel tasks, situations (e.g., fractions, ratios, and percentages link to the 'big idea' of *the part in relation to the whole*; 'Thank you' is part of a larger class of *polite speech*) • Train for adaptation: Student gets opportunities to practice the target skill with modest modifications in new situations, settings with encouragement, corrective feedback, praise, other reinforcers. • Encourage student to set own goals for adapting skill to new and challenging situations.

Defining Academic Problems: The First Step in Effective Intervention Planning

Students who struggle with academic deficits do not do so in isolation. Their difficulties are played out in the larger context of the school environment and curriculum—and represent a 'mismatch' between the characteristics of the student and the instructional demands of the classroom (Foorman & Torgesen, 2001). It may surprise educators to learn that the problem-identification step is the most critical for matching the student to an effective intervention (Bergan, 1995). Problem identification statements should be defined in clear and specific terms sufficient to pass 'the stranger test' (Howell, Hosp, & Kurns, 2008). That is, the student problem can be judged as adequately defined if a person with no background knowledge of the case and equipped only with the problem-identification statement can observe the student in the academic setting and know with confidence when the problem behavior is displayed and when it is not.

Here are recommendations for increasing teacher capacity to frame student skills in relation to curriculum requirements, describe student academic problems in specific terms, and generate a hypothesis about why the problem is occurring.

1. Be knowledgeable of the school academic curriculum and key student academic skills that are taught. Academic abilities can best be described in terms of the specific curriculum skills or knowledge that students are required to demonstrate. Therefore, the general-education teacher should have a good survey-level knowledge of the general academic skills that students at a given grade level are expected to have mastered as well as key curriculum goals for that course. If the curriculum alone is not adequate for describing a student's academic deficit, the instructor can make use of research-based definitions to further define the academic problem area. Here are guidelines for consulting curriculum and research-based definitions of academic skills:

    - *Curriculum*. The teacher can review the school's curriculum and related documents (e.g., score-and-sequence charts; curriculum maps) to formulate specific academic skill or performance goals. Of course, if the student is performing well below grade-level (e.g., in math skills), the teacher may want to go 'off-level' by reviewing curriculum goals from earlier grades. First, determine the approximate grade or level in the curriculum that matches the student's skills. Then, review the curriculum at that alternate grade level to find appropriate descriptions of the student's relevant academic deficit(s).

    - *Research-Based Skill Definitions.* Even when a school's curriculum identifies key skills, schools may find it useful to corroborate or elaborate those skill definitions by reviewing alternative definitions published in research reports, journals or other trusted sources.

      For example, an algebra teacher had a student with delays in solving quadratic equations. The instructor found that the school's math curriculum did not provide a detailed description of the various skills required to successfully complete quadratic equations. So the teacher reviewed the report issued by the National Mathematics Advisory Panel (Fennell et al., 2008) The teacher discovered in that document a detailed description of the component skills for solving quadratic equations, including "factors and factoring of quadratic polynomials with integer coefficients" , "completing the square in quadratic expressions" and "quadratic formula and factoring of general quadratic polynomials". By combining the skill definitions from the school curriculum with the more

detailed descriptions taken from the research-based document, the teacher was better able to pinpoint the student's area of academic deficit in specific terms.

2. Describe the academic problem in specific, skill-based terms with a meaningful instructional context (Batsche et al., 2008; Upah, 2008). Write a clear, brief description of the academic skill or performance deficit that focuses on a specific skill or performance area. Include information about the conditions under which the academic problem is observed and typical or expected level of performance.

   - *Conditions*. Describe the environmental conditions or task demands in place when the academic problem is observed.
   - *Problem Description*. Describe the actual observable academic behavior in which the student is engaged. Include rate, accuracy, or other quantitative information of student performance.
   - *Typical or Expected Level of Performance*. Provide a typical or expected performance criterion for this skill or behavior. Typical or expected academic performance can be calculated using a variety of sources,

Academic Problems: Sample Definitions		
Environmental Conditions or Task Demands	Problem Description	Typical or Expected Level of Performance
When completing a beginning-level algebra word problem…	…Ann is unable to translate that word problem into an equation with variables…	…while most peers in her class have mastered this skill.
During social studies large-group instruction…	…Franklin attends to instruction an average of 45% of the time…	… while peers in the same room attend to instruction an average of 85% of the time.
For science homework…	… Tye turns in assignments an average of 50% of the time…	… while the classroom median rate of homework turned in is 90%.
On weekly 30-minute in-class writing assignments…	… Angela produces compositions that average 145 words…	…while a sampling of peer compositions shows that the typical student writes an average of 254 words.

3. Develop a hypothesis statement to explain the academic skill or performance problem. The hypothesis states the assumed reason(s) or cause(s) for the student's academic problems. Once it has been developed, the hypothesis statement acts as a compass needle, pointing toward interventions that most logically address the student academic problems. Listed below are common reasons for academic problems. Note that more than one hypothesis may apply to a particular student (e.g., a student may have both a skill deficit and a motivation deficit).

Academic Problems: Possible Hypotheses & Recommendations	
Hypothesis	Recommendation
□ *Skill Deficit.* The student has not yet	Provide direct, explicit instruction to acquire the

acquired the skill.	skill. Reinforce the student for effort and accuracy.
□ *Fluency Deficit.* The student has acquired the basic skill but is not yet proficient.	Provide opportunities for the student to practice the skill and give timely performance feedback. Reinforce the student for fluency as well as accuracy.
□ *Generalization Deficit.* The student possesses the basic skill but fails to use it across appropriate situations or settings.	Train the student to identify the relevant characteristics of situations or settings when the skill should be used. Provide incentives for the student to use the skill in the appropriate settings.
□ *Motivation (Performance) Deficit.* The student is capable of performing the skill and can identify when use of the skill is appropriate—but nonetheless fails to use the skill.	Use various strategies to engage the student in the skill (e.g., select high-interest learning activities; offer incentives to the student for successful use of the skill, etc.).
□ *Escape or Avoidance.* The student may or may not be able to perform the academic task. However, the student's behavior is intended to stop the academic activity (escape) or to prevent them from participating in the activity (avoidance).	Check for appropriate instructional match to ensure that the student experiences sufficient success in the activity. Use motivation strategies (see above) to promote student interest and engagement. Offer the student opportunities for choice in the academic activity.

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Academic Problems: Sample Definitions		
Environmental Conditions or Task Demands	Problem Description	Typical or Expected Level of Performance

Academic Interventions 'Critical Components' Checklist (Excerpt)

This checklist summarizes the essential components of academic interventions. When preparing a student's Tier 1, 2, or 3 academic intervention plan, use this document as a 'pre-flight checklist' to ensure that the academic intervention is of high quality, is sufficiently strong to address the identified student problem, is fully understood and supported by the teacher, and can be implemented with integrity. NOTE: While the checklist refers to the 'teacher' as the interventionist, it can also be used as a guide to ensure the quality of interventions implemented by non-instructional personnel, adult volunteers, parents, and peer (student) tutors.

Directions: When creating an academic intervention plan, review that plan by comparing it to each of the items below.

- If a particular intervention element is missing or needs to be reviewed, check the 'Critical Item?' column for that element.
- Write any important notes or questions in the 'Notes' column.

Incorporating Effective Instructional Elements

These effective 'building blocks' of instruction are well-known and well-supported by the research. They should be considered when selecting or creating any academic intervention.

Critical Item?	Intervention Element	Notes
☐	Explicit Instruction. Student skills have been broken down "into manageable and deliberately sequenced steps" and the teacher provided" overt strategies for students to learn and practice new skills" (Burns, VanDerHeyden & Boice, 2008, p.1153).	
☐	Appropriate Level of Challenge. The student experienced sufficient success in the academic task(s) to shape learning in the desired direction as well as to maintain student motivation (Burns, VanDerHeyden & Boice, 2008).	
☐	Active Engagement. The intervention ensures that the student is engaged in 'active accurate responding' (Skinner, Pappas & Davis, 2005).at a rate frequent enough to capture student attention and to optimize effective learning.	
☐	Performance Feedback. The student receives prompt performance feedback about the work completed (Burns, VanDerHeyden & Boice, 2008).	
☐	Maintenance of Academic Standards. If the intervention includes any accommodations to better support the struggling learner (e.g., preferential seating, breaking a longer assignment into smaller chunks), those accommodations do not substantially lower the academic standards against which the student is to be evaluated and are not likely to reduce the student's rate of learning (Skinner, Pappas & Davis, 2005).	

Documenting the Intervention & Collecting Data

Interventions only have meaning if they are done within a larger data-based context. For example, interventions that lack baseline data, goal(s) for improvement, and a progress-monitoring plan are 'fatally flawed' (Witt, VanDerHeyden & Gilbertson, 2004).

Critical Item?	Intervention Element	Notes
☐	Intervention Documentation. The teacher understands and can manage all documentation required for this intervention (e.g.,	

	maintaining a log of intervention sessions, etc.).	
☐	Checkup Date. Before the intervention begins, a future checkup date is selected to review the intervention to determine if it is successful. Time elapsing between the start of the intervention and the checkup date should be short enough to allow a timely review of the intervention but long enough to give the school sufficient time to judge with confidence whether the intervention worked.	
☐	Baseline. Before the intervention begins, the teacher has collected information about the student's baseline level of performance in the identified area(s) of academic concern (Witt, VanDerHeyden & Gilbertson, 2004).	
☐	Goal. Before the intervention begins, the teacher has set a specific goal for predicted student improvement to use as a minimum standard for success (Witt, VanDerHeyden & Gilbertson, 2004). The goal is the expected student outcome by the checkup date if the intervention is successful.	
☐	Progress-Monitoring. During the intervention, the teacher collects progress-monitoring data of sufficient quality and at a sufficient frequency to determine at the checkup date whether that intervention is successful (Witt, VanDerHeyden & Gilbertson, 2004).	

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

Profile of a Student with This Motivation Problem: The student lacks essential skills required to do the task. Areas of deficit might include basic academic skills, cognitive strategies, and academic-enabler skills. Here are definitions of these skill areas:

- *Basic academic skills.* Basic skills have straightforward criteria for correct performance (e.g., the student defines vocabulary words or decodes text or computes 'math facts') and comprise the building-blocks of more complex academic tasks (Rupley, Blair, & Nichols, 2009). The instructional goal in basic skills is for students to become 'automatic' in the skill(s) being taught.

- *Cognitive strategies.* Students employ specific cognitive strategies as "guiding procedures" to complete more complex academic tasks such as reading comprehension or writing (Rosenshine, 1995). Cognitive strategies are "intentional and deliberate procedures" that are under the conscious control of the student (Rupley, Blair, & Nichols, 2009; p. 127). The instructional goals are to train students to use specific cognitive instruction strategies, to reliably identify the conditions under which they should employ these strategies, and to actually use them correctly and consistently.

  Question generation is an example of a cognitive strategy to promote reading comprehension (Rosenshine, Meister, & Chapman, 1996); the student is trained to locate or write main-idea sentences for each paragraph in a passage, then write those main ideas onto separate note cards with corresponding questions.

- *Academic-enabling skills.* Skills that are 'academic enablers' (DiPerna, 2006) are not tied to specific academic knowledge but rather aid student learning across a wide range of settings and tasks. Examples of academic-enabling skills include organizing work materials, time management, and making and sticking to a work plan. The instructional goal is to train students to acquire these academic-support skills and to generalize their use to become efficient, self-managing learners.

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

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

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

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

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

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Motivation Challenge 2: *The student is unmotivated because the 'response effort' needed to complete the assigned work seems too great.*

Profile of a Student with This Motivation Problem: Although the student has the required skills to complete the assigned work, he or she perceives the 'effort' needed to do so to be so great that the student loses motivation.

What the Research Says: Research indicates that (1) as the perceived effort to complete an academic task or other behavior ('response effort') *increases*, people are *less* likely to engage in that behavior, while (2) as the effort to complete the same behavior *decreases*, people are *more* likely to engage in it (Friman & Poling, 1995).

How to Verify the Presence of This Motivation Problem: The teacher first checks to see that the student has the requisite skills needed for academic success. The teacher then looks for evidence that, in specific situations, the student is reluctant to undertake academic tasks because they are perceived to require too much effort. Tell-tale signs that a student may be unmotivated because of the required response effort include procrastination, verbal complaining, frequent seeking of teacher help, and other avoidant behaviors.

How to Fix This Motivation Problem:

- ❑ Teachers can increase student motivation through any method that reduces the apparent 'response effort' of an academic task (Friman & Poling, 1995). - so long as that method does not hold the student to a lesser academic standard than classmates (Skinner, Pappas, & Davis, 2005).

Try These Ideas to Improve Motivation by Reducing Response Effort: Here are ideas that use reduction in response effort as a motivation tool:

- *Start Assigned Readings in Class.* Whenever the teacher assigns a challenging text for students to read independently (e.g., as homework), the teacher (or perhaps a skilled student reader) reads the first few paragraphs of the assigned reading aloud while the class follows along silently in their own texts. Students are then expected to read the remainder of the text on their own.

- *Begin Challenging Homework Assignments in Class.* When assigned challenging homework, students are paired off or divided into groups and given a small amount of class time to begin the homework together, develop a plan for completing the homework, formulate questions about the homework, or engage in other activities that will create the necessary momentum to motivate students then to complete the work independently.

- *'Chunk' Assignments.* The teacher breaks a larger student assignment into smaller 'chunks'. The teacher provides the student with performance feedback and praise for each completed 'chunk' of assigned work (Skinner, Pappas, & Davis, 2005).

- *Select a Supportive Peer or Adult to Get a Student Started on Assignments.* If a student finds it difficult to get organized and begin independent seatwork activities, a supportive peer or adult in the classroom can get the student organized and started on the assignment.

- *Provide a Formal Work Plan.* In advance of more complex assignments such as research papers, the teacher gives the student an outline of a work plan for completing those assignments. The plan breaks a larger assignment into appropriate sub-steps (e.g., 'find five research articles for the paper', 'summarize key information from research articles into notes', etc.). For each sub-step, the plan provides (1) an estimate of the minimum amount of 'seat time' required to complete it and (2) sets a calendar-date deadline for completion. The teacher then touches base with the student at least weekly to ensure that the student is staying current with the work plan. (TIP: Over time, the teacher can transfer increasing responsibility for generating work plans to the student.)

References:

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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.

Preventing Students from Falling Behind Through Proactive Teacher Communication

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

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

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

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

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

When students fall behind in their classwork, they can quickly enter a downward spiral. They must stay caught up in their current assignments and also submit late assignments; as the work piles up, some students become overwhelmed and simply give up.

In such cases, the teacher may want to meet with the student to help that student to create a work plan to catch up with late work. (It is also recommended that the parent attend such a conference, although parent participation is not required.) 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. Teacher, student (and parent, if attending) then sign off on the work plan. The teacher also ensures that the atmosphere at the meeting is supportive, rather than blaming, toward the student. And of course, any work plan hammered out at this meeting should seem attainable to the student.

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.

2. *Negotiate a Plan to Complete Missing Work*. The teacher and student create a log with entries for all of the 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. It is important that the submission dates for late assignments be realistic--particularly for students who owe a considerable amount of late work and are also trying to keep caught up with current assignments. A teacher and student may agree, for example, that the student will have two weeks to complete and submit four late writing assignments. NOTE: Review the form *Student Late-Work Planning Form: Middle & High School* that appears later in this handout as a tool to organize and document the student's work plan.

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. If penalties are given, they should be balanced and fair, permitting the teacher to impose appropriate consequences while allowing the student to still see a path to completing the missing work and passing the course.

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.

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

Homework Contracts: Tapping the Power of Parents

Students who regularly complete and turn in homework assignments perform significantly better in school than those of similar ability who do not do homework (Olympia et al., 1994). Homework is valuable because it gives students a chance to practice, extend, and entrench the academic skills taught in school. Parents can be instrumental in encouraging and motivating their children to complete homework. This homework contract intervention (adapted from Miller & Kelly, 1994) uses goal-setting, a written contract, and rewards to boost student completion (and accuracy) of homework. Students also learn the valuable skills of breaking down academic assignments into smaller, more manageable subtasks and setting priorities for work completion.

Materials:

•Copy of Daily Homework Planner

Preparation:

Train Parents to Be Supportive 'Homework Coaches'. Parents are often very committed to helping their child successfully complete homework. To ensure that parents have positive interactions with students around homework, though, the school should sponsor one or more parent workshops to offer tips on how to be 'homework coaches'. In particular, parents should be offered strategies for listening in a careful and non-judgmental manner to their child, to avoid nagging about homework, and to brainstorm with their child about possible solutions for common homework difficulties (e.g., writing down all homework assignments correctly). Additionally, they should be taught the essentials for setting up and following through with a simple reward system at home (Miller & Kelly, 1994). At this introductory workshop, parents would also be trained in the steps of the homework contract (described below).

Steps in Implementing This Intervention:

1. *The Parent Creates a Homework Reward System for the Child*. The parent should put together a short menu of reasonable daily and weekly rewards that the child can earn for successfully completing homework. Good choices for daily rewards are those that do not cost a lot of money, and do not take much time to deliver. While weekly rewards should be somewhat larger than daily rewards, they should still be affordable and not require a great deal of the parent's time. Because any rewards that the parent chooses must appeal to the child, the parent should consult the child in the selection of rewards.

2. *The Parent Negotiates the Homework Contract Program With the Child*. Before starting the homework contract, the parent should meet with the child to introduce the program and to set up a reward system (see Step 1). Together, they agree on the percentage of homework goals the child must complete each day (e.g., 80%) to earn the daily homework reward. They also agree on the number of times in a week that the student must earn the daily reward in order to be eligible for the weekly reward (e.g., 3 times in a week).

3. *The Parent and Child Fill Out the Daily Homework Planner*. Each day when the student has assigned homework, the parent and student sit down with a copy of the Daily Homework Planner [web page; pdf document]. Together they preview the homework assignment for all subject areas. Then they break the assignment into manageable 'chunks' or subtasks. A description of each subtask is written into the Daily Homework Planner in enough detail so that both parent and student know what must be done to complete that homework chunk. A description for a math subtask, for example, might read "Complete 20 multiplication problems from pg. 40 of math book, then use

answer key to check work". The parent and child might write on the homework contract that the child will reserve 30 minutes to complete that subtask.

4. *The Parent Checks the Child's Homework Completion and Delivers Any Earned Rewards.* When the student has finished his or her homework, the parent and student hold a brief follow-up conference. They go through the Daily Homework Planner sheet, circling Y[es] or N[o] to indicate whether each subtask was completed within the time set aside for it.

    a. If the student earned the daily reward, the parent has the student choose an item from the reward menu. (Daily rewards should be given immediately if possible.)

    b. If the student also earned the weekly reward, the student can also select an item from the weekly reward menu (to be delivered in a timely manner but when convenient to the parent).

5. *Fade the Reward System.* As the child shows that he or she is able to complete daily homework assignments on a regular basis, the parent may want to start 'fading' the reward system. First, the parent may stop the daily rewards but continue the weekly rewards. Then the weekly rewards can be stretched out to biweekly and eventually monthly rewards. In the final stage of fading, the parent can stop giving out regular rewards altogether. Instead, the child's motivation can be kept high by the parent 'surprising' him or her occasionally with an unexpected reward.

Troubleshooting

The parent cannot or will not use the homework contract. If a parent is unable or unwilling to use the homework contract with a student, the intervention can be used in school instead. At the end of the school day, for example, the teacher or other staff member might meet with the child to preview all homework assignments and assist the student in filling out the Daily Homework Planner. If the student brings the Contract sheet and completed homework back to school the next day, the teacher can give him or her the earned daily (and perhaps weekly) reward.

Jim's Hints for Using...Homework Contracts: Tapping the Power of Parents

Identify Other People To Help the Parent With the Homework Contract . If the student attends an afterschool program where he or she completes homework, personnel from that program may be willing to set up and use the homework contract with the child. Or if there is a responsible older sibling in the home, he or she may be willing to administer a homework contract system. The parent would still be expected to deliver any rewards that the student may have earned.

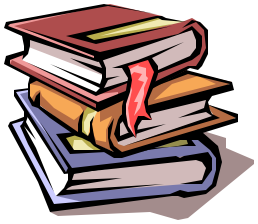
References

•Miller, D.L. & Kelly, M.L. (1994). The use of goal setting and contingency contracting for improving children's homework performance. Journal of Applied Behavior Analysis,27, 73-84.

•Olympia, D.E., Sheridan, S.M., Jenson, W.R., & Andrews, D. (1994). Using student-managed interventions to increase homework completion and accuracy. Journal of Applied Behavior Analysis,27, 85-99.

Daily Homework Planner (Adapted from Miller & Kelly, 1994)

Student: _____ Date: _____



Before starting my homework, do I:

- have all the materials that I need?
- know what homework has been assigned in all subjects?
- have a quiet place to work?

Task	Academic Subject	Description of Work Goal Set by Student	Time Needed to Complete	Goal Successfully Achieved?
1				Y N
2				Y N
3				Y N
4				Y N
5				Y N

- *Daily reward:* The student will earn the daily reward by completing at least _____ % of the homework goals for that day.
- *Weekly reward:* The student will earn the weekly reward by meeting the daily homework goals for _____ days of the week.
- *Percentage of Goals* Achieved Today (Number of Goals Achieved/Number of Goals Set)_____%
- Circle those days that the student has met the daily homework goal for this week:

S M T W Th F *S*

Parent Signature _____

Managing Test Anxiety: Ideas for Students

Tests and quizzes are more widely used in schools than ever. Teachers rely on written examinations to show whether students have learned the information presented in the course. Colleges and universities evaluate applicants' performance on entrance examinations such as the Scholastic Aptitude Test (SAT) to judge whether these applicants are likely to be successful in their programs.

With so much depending on test results, it is no wonder that students often become anxious about taking tests. But don't worry! You can master test-anxiety and improve your performance on exams by following a simple plan: develop good study habits, use effective techniques to memorize content, take steps to reduce test anxiety, and take advantage of smart strategies when taking the test. Read through the tips below for ideas that you can use:

Effective Study Habits

It is not enough just to schedule lots of study time. You also need to make sure that you use effective study *techniques*. Some smart study tips are to:

- *Create a quiet, neat study area.* Distractions and clutter interfere with studying. Select a quiet spot where you are unlikely to be interrupted and organize it so that you can study efficiently. If space is cramped at home, use a corner of the local library or other suitable spot as your 'study haven.'

- *Study from good notes.* Your study sessions will be productive only if you are studying from a legible and complete set of notes. If your notes are incomplete, see if your teacher has a loaner set of master class notes that you can review to get the missing information. Or ask a classmate who takes thorough notes if you can borrow them.

- *Use bits of unexpected free time to study*. Carry 'pocket work' with you to review whenever you have a few minutes of free time. For example, have a set of index cards with course notes on hand that you can conveniently pull out and look at during spare moments.

- *Make a study schedule to avoid 'time-drains'*. People often don't realize how much time they spend on activities such as watching TV, surfing the Internet, talking with friends on the phone, and so on. If we aren't careful, though, we may discover that our leisure activities 'drain away' time that could have been better used for study. Create a general study schedule, with time set aside for fun activities. Then be sure to limit those fun activities to the time allotted.

- *Take advantage of your peak energy levels.* Pick the time of day when you tend to have the most energy and try to schedule your study sessions at this time. Also, study your most difficult or challenging material first, while you are still fresh. When you study at the same time each day, you will also find that studying begins to turn into a habit!

- *Create a study group.* Gather together classmates to form a study group. Groups can make studying more fun. Another advantage of groups is that its members can consult multiple sets of notes whenever a course concept is unclear. (Just be sure that your group takes studying seriously and

doesn't spend too much time socializing!)

- *Teach content as a 'learning check'.* A very effective way to check whether you have learned course content is to try to teach that information to another person (e.g., to a study partner). The challenge of having to put key concepts into your own words and make them understandable to others will quickly reveal whether you have truly mastered that information.

- *Recite information aloud.* One study trick is to recite important information aloud. As you *say* the information, you also *hear* yourself saying it. These two channels for language, *speaking* and *hearing*, help to embed the information in your memory.

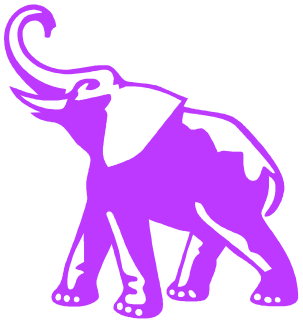
- *Pose difficult questions.* When studying, stop every so often and ask yourself, *"What question(s) or problem type(s) am I most afraid will be on the test?"* Your answer will give you a valuable hint about what parts of the course content you still find difficult and should spend the most time studying.

- *Don't forget to review previously learned material.* As you study, you start to learn the material. But a single pass through your notes is usually *not* enough to cement learning. During each study period, set aside time (e.g., at the start of the session) to review previously learned information or concepts. Remember, review, review, review!

- *Avoid cram sessions.* Pulling all-night study sessions only tires you out and leaves you exhausted on the day of the test. (And people seldom think clearly when they are tired…) Rather than cramming your review into one or two marathon sessions, break your study up into short periods and study more frequently. Also, start studying early in the course, well before the first test, to give yourself a head start in learning the material.

- *Reward yourself.* Select an activity that you find rewarding (e.g., watching a favorite videotape, going for a walk, calling a friend). Set a contract with yourself to complete a set amount of studying (e.g., to study chemistry for 90 minutes). If you have met your short-term study goal at the end of the study period, give yourself the reward.

Tips to Memorize Content



The best way to remember information from your notes or reading is to set aside enough time to study it well. Some tips for memorizing information are to:

- *Read and review using SQ3R.* The SQ3R approach is a structured, thorough method for learning the content of a book chapter or section: (1) ***S****urvey* the chapter, to get an overview of what it contains. Read through the chapter summary and all headings. Also, briefly take note of figures, tables, and illustrations. (2) Create ***Q***uestions based on each of the chapter headings. The questions should be similar to those that you might find on a test. (3) ***R***ead through the chapter. As you read, do your best to answer the questions that you developed. (4) ***R***ecite the questions. From memory, verbally answer each question. (Hint: You can learn even more effectively if you write down your answers. Your responses can be written as single words or short phrases so long as they capture the main content of the answer.) (5) ***R***eview your answers. Compare your responses to the information in the text to make sure that your answers are complete and accurate.

- *Make up flashcards.* To memorize vocabulary, write the key word or term on one side of an index card and the definition on the other side. To review, read off the word and recite the definition from memory before flipping the card over and checking your answer. Then review the cards again, this time reading the definitions and recalling the key word or term from memory. To memorize other information, copy a fact or concept on one side of the card and a 'test' question matching the concept on the card's flip side. To review, read off each question and attempt to recall the answer before flipping the card over to check your work.

- *Create acronyms or acrostics.* When you want to remember words or concepts in sequence, you can sometimes combine the first letters of the words into an *acronym*. For example, the color spectrum of visible light is: ***R***ed-***O***range-***Y***ellow-***G***reen-***B***lue-***I***ndigo-***V***iolet. Generations of students have memorized this sequence as the acronym (and fanciful name) ROY G. BIV.

  An *acrostic* is a sentence made up of words whose initial letters are memory cues. For example, biology classifies living organisms according to their place in the following categories: ***K***ingdom-***Ph***ylum-***C***lass-***O***rder-***F***amily-***G***enus-***S***pecies. Many students have memorized this sequence using the sentence, "***K***ing ***Ph***illip ***C***ame ***O***ver ***F***rom ***G***ermany ***S***wimming."

- *Use visualization tricks.* Because we often think in pictures, we can use our 'mind's eye' to help to memorize information as mental images. (Hint: Silly images can often make the information even easier to recall!) Here are a couple of ideas for memorizing a list of words or key terms:

  1. *Chaining*. First, think of an object to represent each word or term that you must commit to memory. Then construct a mental 'chain' that connects the objects in a short sequence. If, for example, you wanted to memorize the first four planets (Mercury, Venus, Earth, Mars), you might visualize a winged god (*Mercury*) planting a *Venus* flytrap in a pile of *earth* and surrounding it with *Mars* bars.

  2. *Familiar places*. Select a location that is quite familiar to you (e.g., your house or apartment). Next, think of an object to represent each word or term that you must commit to memory. Then mentally 'place' the objects at various places in the location. If you wished to remember the first four planets, for example, you might first pick your kitchen as a familiar location. Then you might imagine that a statue of *Mercury* is sitting on the stove, a *Venus* flytrap is sitting in the sink, a pile of *earth* is spilled on the floor, and two *Mars* bars are sitting on the counter.

Tips to Reduce Anxiety About Tests

A little nervousness before a test can be good. It motivates us to work hard and put forth our best effort on the examination. When we become too anxious, though, that anxiety can undermine our confidence and interfere with our ability to solve problems. Some tips to reduce test anxiety are to:

- *Remember to take care of yourself first.* You should be sure to eat healthy foods and to get enough sleep before a test. After all, sleepy, hungry people are not in the best frame of mind to perform well on tests! You may also want to engage in moderate physical activity or exercise prior to taking the test to reduce body tension. A student who gets a full night's sleep, goes for a jog, and eats a balanced breakfast prior

to the test will improve the odds of doing his or her best on an examination and avoiding the 'testing jitters.'

- *Take practice exams.* People are less likely to become anxious when doing something that is familiar. If your instructor gives you the opportunity to take practice exams, take advantage of the opportunity to study the tests and become familiar with their format and style. During a study period, take the practice exam under the same conditions that you would take the real exam. (For example, if notes are not allowed during the test, do not look at your notes when taking the practice exam. If the test is timed, observe the same time limit when completing the practice exam.)

- *Come prepared.* Arrive at the test site early. Make a special effort to bring all materials, including extra pens, pencils, paper, etc. By showing up on time and prepared, you will not have to waste valuable energy worrying about small details and become distracted from the real goal: doing your best.

- *Make an effort to relax periodically during the test.* During a test, you may feel yourself becoming tense or nervous. Whenever you feel the tension building, take a brief relaxation break, using whatever method works for you. Here are some simple relaxation ideas:

  - Take several deep breaths, exhaling slowly after each one. Visualize the tension draining from your body as you breathe out.
  - Tense your muscles and hold for 5 seconds, then relax. Repeat 3 times.
  - Think of a peaceful, quiet setting (e.g., the beach). Imagine yourself calm and relaxed in that setting.

- *Engage in positive self-talk.* Replace irrational negative thinking with positive self-talk. When you have studied hard for a test, for example, your confidence will be shaken if you think negative thoughts such as "I don't have a chance of passing this exam!" Instead, adopt an upbeat but realistic attitude: "I prepared carefully for this test. If I do my best, I have a good chance of passing it." One more tip: If your friends are nervous about the test, try to avoid talking with them about it. You don't want their anxiety to rub off on you!

Effective Test-Taking Strategies

Become familiar with the test that you are about to take and have a mental plan for how you will spend your time most productively during the examination. If you follow a positive plan of action as you take the test, you will be less likely to feel helpless or to be preoccupied with anxious thoughts. Here are some useful test-taking strategies:

- *Listen carefully to directions.* Make a point to listen closely to any test directions that are read aloud. Read through written directions at least twice before starting on a test section to ensure that you do not misinterpret them. Hint: If you are confused or unsure of the test directions, ask the teacher or test proctor to explain or clarify them. It is better to seek help to clear up any confusion that you may have than to run the risk of misunderstanding the directions and completing test items incorrectly.

- *Perform a 'brain dump'.* At the start of the test, write down on a sheet of scrap paper any facts or key information that you are afraid that you might forget. This 'brain dump' will help you to feel less anxious

about forgetting important content. Plus, you can consult this sheet of information as a convenient reference during the test.

- *Preview the test.* Look over the sections of the test. Think about the total amount of time that you have to complete the test. Look at the point values that you can earn on each section of the examination. Budget your total time wisely so that you don't spend too much time on test sections that contribute few points to your score.

- *Multiple-choice: Don't get sidetracked looking for patterns of answers.* Some people claim that students can do better on multiple-choice tests if they look for patterns in the answers. For example, the advice is often given that, on questions with four possible answers, teachers most frequently choose "C" as the correct response. In rare cases, such patterns may actually exist--but it is never a reliable strategy to count on tricks and short cuts to do well on a test. Instead, your best bet is to study hard and rely on your own knowledge of the subject to do well.

- *Multiple-choice: Don't rush.* On multiple-choice items, force yourself to read each possible choice carefully before selecting an answer. Remember, some choices *appear* correct at first glance but turn out to be wrong when you take a closer look.

- *Essay questions: Underline key terms.* Before writing your essay, it is a good idea to underline important terms that appear in the test question as a check on your understanding. Words such as *compare*, *contrast*, *discuss*, and *summarize* will give you clear direction on the form that your essay should take and the content that it should include.

- *Essay questions: Outline your answer before you write it*. No teacher wants to read a rambling essay that fails to answer the test question. You can improve the quality of your essay by first organizing your thoughts into a brief outline on scrap paper before you write it. Even a few short minutes of planning time can significantly improve the readability and organization of your essays. And don't forget to write neatly!

- *When in doubt…guess!* If the test does not penalize guessing, be sure that you write in a response for each test item, even if you don't know the answer.

- *Skip difficult items until last.* On timed tests, you should avoid getting bogged down on difficult items that can cause you to use up all of your time. Instead, when you find yourself stumped on a tough test item, skip it and go on to other problems. After you have finished all of the easiest test items, you can return to any skipped questions and try to answer them.

- *Use leftover time to check answers.* If you finish a test early, use the remaining time to check your answers. On multiple choice items, check to see that you answered all questions. Reread each written response to make sure that it makes sense, uses correct grammar, and fully answers the question.

References

Boyd, R.T.C. (1988). *Improving your test-taking skills. ERIC Digest Number 101*. Retrieved 9 May 02 from: http://ericae.net/edo/ed302558.htm

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Hopper, C. (1998). *Practicing college study skills.* Boston: Houghton Mifflin.

Benchmarks for the Critical Foundations of Algebra (National Math Advisory Panel, 2008)	
Fluency with Whole Numbers	*NOTES*
By the end of Grade 3, students should be proficient with the addition and subtraction of whole numbers.	
By the end of Grade 5, students should be proficient with multiplication and division of whole numbers.	
Fluency with Fractions	*NOTES*
By the end of Grade 4, students should be able to identify and represent fractions and decimals, and compare them on a number line or with other common representations of fractions and decimals.	
By the end of Grade 5, students should be proficient with comparing fractions and decimals and common percents, and with the addition and subtraction of fractions and decimals.	
By the end of Grade 6, students should be proficient with multiplication and division of fractions and decimals.	
By the end of Grade 6, students should be proficient with all operations involving positive and negative integers.	
By the end of Grade 7, students should be proficient with all operations involving positive and negative fractions.	
By the end of Grade 7, students should be able to solve problems involving percent, ratio, and rate, and extend this work to proportionality.	
Particular Aspects of Geometry and Measurement	*NOTES*
By the end of Grade 5, students should be able to solve problems involving perimeter and area of triangles all quadrilaterals having at least one pair of parallel sides (i.e., trapezoids).	
By the end of Grade 6, students should be able to analyze the properties of two-dimensional shapes and solve problems involving perimeter and area, and analyze the properties of three-dimensional shapes and solve problems involving surface area and volume.	
By the end of Grade 7, students should be familiar with the relationship between similar triangles and the concept of the slope of a line.	

Reference

National Mathematics Advisory Panel (2008). *1. Report of the Task Group on Conceptual Knowledge and Skills*. P. 1-53.

Directions: Review the Benchmarks for the Critical Foundations of Algebra (National Mathematics Advisory Panel, 2008) that appear on the previous page.

Discussion Topic 1:Screenings/Criteria: Brainstorm ideas in your school or district to develop specific screening or assessment tools and criteria to measure these benchmarks

NOTES: _____

_____

_____

_____

_____

_____

_____

Discussion Topic 2:Curriculum Alignment: Brainstorm ideas in your school or district to ensure that the majority of students (at least 80 percent) successfully attain the benchmarks at the appropriate grade.

NOTES: _____

_____

_____

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Discussion Topic 3: Diagnostic Assessment: Brainstorm ideas to develop diagnostic assessments for individual students (e.g., in grade 9) to ensure that they have attained these benchmarks.

NOTES: _____

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