RTI Toolkit: A Practical Guide for Schools

Best Practices in Secondary Math Interventions (7-12)

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

Contents

How To: Deliver Direct Instruction in General-Education Classrooms

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

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

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

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

understanding by posing frequent questions to the group (Rosenshine, 2008).	
☐ Group Responding. The teacher ensures full class participation and boosts levels of student attention by having all students respond in various ways (e.g., choral responding, response cards, white boards) to instructor questions (Rosenshine, 2008).	
☐ High Rate of Student Success. The teacher verifies that students are experiencing at least 80% success in the lesson content to shape their learning in the desired direction and to maintain student motivation and engagement (Gettinger & Seibert, 2002).	
☐ Brisk Rate of Instruction. The lesson moves at a brisk rate--sufficient to hold student attention (Carnine,1976; Gettinger & Seibert, 2002).	
☐ Fix-Up Strategies. Students are taught fix-up strategies (Rosenshine, 2008) for use during independent work (e.g., for defining unknown words in reading assignments, for solving challenging math word problems).	

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

4. Provide Opportunities for Review & Practice	
Instructional Element	Notes
☐ Spacing of Practice Throughout Lesson. The lesson includes practice activities spaced throughout the lesson. (e.g., through teacher demonstration; then group practice with teacher supervision and feedback; then independent, individual student practice) (Burns, VanDerHeyden, & Boice).	
☐ Guided Practice. When teaching challenging material, the teacher provides immediate corrective feedback to each student response. When the instructor anticipates the possibility of an incorrect response, that teacher forestalls student error through use of cues, prompts, or hints. The teacher also tracks student responding and ensures sufficient success during supervised lessons before having students practice the new skills or knowledge independently (Burns, VanDerHeyden, & Boice, 2008).	
☐ Support for Independent Practice. The teacher ensures that students have adequate support (e.g., clear and explicit instructions; teacher monitoring) to be successful during independent seatwork practice activities (Rosenshine, 2008).	
☐ Distributed Practice. The teacher reviews previously taught content one or more times over a period of several weeks or months (Pashler et al., 2007; Rosenshine & Stevens, 1995).	

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How Do We Reach Low-Performing Math Students?: Instructional Recommendations *Important elements of math instruction for low-performing students* (Baker, Gersten, & Lee, 2002; p. 51):	*IDEAS FOR IMPLEMENTATION*
"Providing teachers and students with data on student performance"	
"Using peers as tutors or instructional guides"	
"Providing clear, specific feedback to parents on their children's mathematics success"	
"Using principles of explicit instruction in teaching math concepts and procedures."	

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How To: Match the Student to the Right Academic Intervention with the Instructional Hierarchy

Teachers recognize that learning is a continual process of growth and improvement. The student who grapples with the rudiments of a skill such as reading appears very different from the more advanced student who is a proficient and self-motivated reader. Intuitively, then, educators understand that students advance through predictable stages of learning as they move from novice to expert in a particular skill.

The Common Core Standards, too, acknowledge advancing levels of learning, as can be seen in their wording. For example, a 6th-grade Common Core Standard for Mathematics on the Number System (CCSM.6.NS.2) states that the student will "fluently divide multi-digit numbers using the standard algorithm." (National Governors Association Center for Best Practices et al., 2010; p. 42). This standard assumes that the successful student is both (1) accurate and (2) proficient (i.e., fluent) in multi-digit division--and implies as well that the student (3) will retain the skill over time, (4) will have the endurance to complete grade-appropriate tasks that include the skill, and (5) can flexibly apply or generalize the skill to those situations and settings in which multi-digit division will be useful.

The Instructional Hierarchy-IH (Haring et al., 1978) is a helpful framework to analyze stages of student learning. The Instructional Hierarchy breaks the learning process into several levels, shifting from skill acquisition through skill mastery toward full integration of the skill into the student's academic repertoire. As presented here, the Instructional Hierarchy consists of 5 levels (Haring et al., 1978; Martens & Witt, 2004): Acquisition, fluency, retention, endurance, and generalization. Although initially formulated several decades ago, the Instructional Hierarchy is widely used as a model of learning in contemporary research into effective instruction and academic intervention (e.g., Ardoin & Daly, 2007).

By linking a particular student's target skill to the corresponding IH learning stage, the teacher can gain insight into what instructional supports and strategies will help that student to attain academic success. This linkage of learner to learning stage increases both teacher confidence and the probability for a positive student outcome. The table below (adapted from Haring et al., 1978 and Martens & Witt, 2004) gives instructors a brief description of each learning stage in the Instructional Hierarchy, along with suggested instructional strategies and a sample intervention idea:

1. Acquisition

Goal. At the beginning of the acquisition stage, the student has just begun to acquire the target skill. The objective is for the student to learn how to complete the skill accurately and repeatedly--without requiring the help of another.

Instructional Strategies. When just beginning a new skill, the student learns effectively through learning trials, in which the teacher: (1) *models* how to perform the skill, (2) *prompts* the student to perform the skill; and (3) *provides immediate performance feedback* to shape the student's learning in the desired direction. The teacher can maintain student motivation by providing frequent 'labeled praise' (that is, praise that specifically describes the student's positive academic behaviors and effort) and encouragement. As the student becomes accurate and more independent in the skill, the teacher can gradually fade prompting support.

Sample Intervention Idea. *Cover-copy-compare* is a student-delivered intervention that promotes acquisition of math-facts or spelling words (Skinner, McLaughlin, & Logan, 1997). The student is given a blank index card and a worksheet with spelling words or math-facts (with answers) appearing in the left column. One at a time, the student studies each original model (spelling word or math fact), covers the model with index card, from memory copies the model (spelling word or math-fact equation and answer) into the right column of the worksheet, then uncovers the model to confirm that the student work is correct. NOTE: This intervention is most appropriate for use as the student has acquired some accuracy and independence in the target skill.

2. Fluency

Goal. The student who advances into the fluency stage can complete the target skill with accuracy but works relatively slowly. The objective is for the student to maintain accuracy while increasing speed of responding (fluency).

Instructional Strategies. The student who has acquired the skill but must become more proficient benefits from (1) brief, frequent opportunities to practice the skill coupled with (2) instructional feedback about increasing speed of performance (Martens & Witt, 2004). To facilitate fluency-building, the teacher structures group learning activities to give the student plenty of opportunities for active (observable) responding. The student is also given multiple opportunities for drill (direct repetition of the target skill) and practice (combining the target skill with other skills to solve problems or accomplish tasks). The student receives feedback on the fluency and accuracy of the academic performance, as well as praise and encouragement tied to increased fluency.

Sample Intervention Idea. An example of a group strategy to promote fluency in math-facts is *explicit time drill* (Rhymer et al., 2002). The teacher hands out a math-fact worksheet. Students are told that they will have 3 minutes to work on problems on the sheet. The teacher starts the stop watch and tells the students to start work. At the end of the first minute 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.

3. Retention

Goal. At the start of the retention stage, the student is reasonably fluent but is at risk of losing proficiency in the target skill through lapses in use. At this point, the objective is to 'overlearn' the skill to insure its retention even after long periods of disuse.

Instructional Strategies. Frequent opportunities for practice can be an effective method to entrench a skill and help the student to retain it over time (Martens & Witt, 2004). The teacher can schedule numerous practice episodes within a short time ('massed review') to promote initial fluency and then reinforce longer-term retention of the skill by scheduling additional periodic review ('distributed review') across longer spans of several weeks or even months (Pashler et al., 2007).

Sample Intervention Idea. An illustration of an intervention to promote retention is *repeated reading* (Lo, Cooke, & Starling, 2011). This intervention targets reading fluency: The student is given a passage and first 'rehearses' that passage by following along silently as the tutor reads it aloud. Then the student reads the same passage aloud several times in a row, with the tutor giving performance feedback after each re-reading. If a teacher uses a fluency-building strategy such as repeated reading but sets an ambitious outcome goal that is *above* the minimum benchmark for success, the resulting 'overlearning' can support long-term retention of the skill. For example, a 4th-grade teacher uses repeated reading with a student during a mid-year intervention and tracks the student's reading fluency using timed 1-minute curriculum-based measurement oral reading fluency passages. Benchmark norms (Hasbrouck & Tindal, 2005) suggest that the student will cross over into the 'low-risk' range for reading fluency if he can read at least 87 words per minute according to the mid-year benchmark norms for grade 4. The teacher decides instead to overshoot, setting the outcome goal to a higher 95 words per minute ('overlearning') to give the student an additional margin of reading fluency to promote long-term skill retention.

4. Endurance

Goal. At the onset of the endurance stage, the student has become fluent in the target skill but will engage in it only reluctantly or for brief periods. The goal is to have the student persist in the skill for the longer intervals of time required in the classroom setting or expected for the student's age group. (Martens & Witt, 2004)

Instructional Strategies. Several instructional ideas can promote increased student endurance. In structuring lessons or independent work, for example, the teacher can gradually lengthen the period of time that the student spends in skills practice or use. The student can also be enlisted to self-monitor active engagement in skill-building activities--setting daily, increasingly ambitious work goals and then tracking whether he or she successfully reaches those goals. NOTE: If a student appears to lack 'endurance', the teacher should also verify that the fundamentals of good instruction are in place: for example, that the student can do the assigned work (instructional match), adequately understands directions, is receiving timely performance feedback, etc.

Sample Intervention Idea. An idea to increase student endurance provides breaks between gradually lengthening work intervals (*'fixed-time escape'*: adapted from Waller & Higbee, 2010). This strategy can be used with groups or individual students. The teacher first selects a target activity for endurance-building (e.g., independent reading). The teacher then sets the length of work periods by estimating the typical length of time that the student or group will currently engage in the activity (e.g., 5 minutes) before becoming off-task or disruptive. The teacher also decides on a length for brief 'escape' breaks (e.g., 2 minutes)--times when students can stop work and instead take part in preferred activities.

At the start of the intervention, the teacher directs the student or group to begin the target work activity. At the end of the work interval (e.g., 5 minutes), the teacher announces that the student or group can take a short break (e.g., 2 minutes). When that break is over, students are directed to again begin work. This sequence (work interval, escape interval) repeats until the scheduled work period is over. As students are able successfully to remain engaged during work periods, the teacher can gradually extend the length of these work periods by small increments, while reducing and then fading escape breaks, until work periods reach the desired length.

5. Generalization

Goal. At the beginning of the generalization stage, the student is accurate and fluent in using the target skill but does not always employ the skill where or when needed. The goal of this phase is to motivate the student to apply the skill in the widest possible range of appropriate settings and situations.

Instructional Strategies. The teacher can promote generalization of skills by first identifying the types of situations in which the student should apply the target skill and then programming instructional tasks that replicate or mimic these situations. So the teacher may create lessons in which students can generalize the target skills by interacting with a range of people, working with varied materials, and/or visiting different settings. The teacher can also use explicit prompts to remind students to apply skills in specific situations.

Sample Intervention Idea. For a student who does not always generalize the skill of carefully checking math assignments before turning them in, the teacher can work with that student to create a math *self-*

correction checklist (Uberti, Mastropieri, & Scruggs, 2004). Teacher and student meet to create a checklist of that student's most common sources of errors on math assignments. The student is then expected to use the checklist to review math work before submitting to the teacher. This intervention strategy can be adopted to other disciplines (e.g., writing assignments) as well. And completed checklists can be collected with assignments to verify student use.

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How To: Document Academic & Behavioral Interventions

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 Response to Intervention standards.

Teachers need a standard format to use in documenting their classroom intervention plans. The *Classroom Intervention Planning Sheet* that appears later in this article is designed to include all of the essential documentation elements of an effective intervention plan. The form includes space to document:

- *Case information*. In this first section of the form, the teacher notes general information, such as the name of the target student, the adult(s) responsible for carrying out the intervention, the date the intervention plan is being created, the expected start and end dates for the intervention plan, and the total number of instructional weeks that the intervention will be in place. Most importantly, this section includes a description of the student problem; research shows that 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).
- *Intervention.* The teacher describes the evidence-based intervention(s) that will be used to address the identified student concern(s). As a shortcut, the instructor can simply write the intervention name in this section and attach a more detailed intervention script/description to the intervention plan.
- *Materials.* The teacher lists any materials (e.g., flashcards, wordlists, worksheets) or other resources (e.g., Internet-connected computer) necessary for the intervention.
- *Training.* If adults and/or the target student require any training prior to the intervention, the teacher records those training needs in this section of the form.
- *Progress-Monitoring.* The teacher selects a method to monitor student progress during the intervention. For the method selected, the instructor records what type of data is to be used, collects and enters student baseline (starting-point) information, calculates an intervention outcome goal, and notes how frequently he or she plans to monitor the intervention.

A completed example of the *Classroom Intervention Planning Sheet* that includes a math computation intervention can be found later in this article.

While a simple 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 classroom 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.

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Classroom Intervention Planning Sheet

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

Case Information

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

Student:		Interventionist(s):		Date Intervention Plan Was Written:	
Date Intervention is to Start:		Date Intervention is to End:		Total Number of Intervention Weeks:	
Description of the Student Problem:					

Intervention

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

Materials

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

Training

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

Progress-Monitoring

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

Type of Data Used to Monitor:	
Baseline	Outcome Goal
How often will data be collected? (e.g., daily, every other day, weekly):	

Ideas for Intervention Progress-Monitoring

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

Classroom Intervention Planning Sheet: Math Computation Example

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

Case Information

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

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

Intervention

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

Math Computation Time Drill.(Rhymer et al., 2002)

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

Materials	Training
What to Write: Jot down materials (e.g., flashcards) or resources (e.g., Internet-connected computer) needed to carry out this intervention.	**What to Write:** Note what training--if any--is needed to prepare adult(s) and/or the student to carry out the intervention.
Use math worksheet generator on www.interventioncentral.org to create all time-drill and assessment materials.	*Meet with the student at least once before the intervention to familiarize with the time-drill technique and timed math computation assessments.*

Progress-Monitoring

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

Type of Data Used to Monitor: *Curriculum-based measurement: math computation assessments: 2 minute single-skill probes*		Ideas for Intervention Progress-Monitoring • Existing data: grades, homework logs, etc. • Cumulative mastery log • Rubric • Curriculum-based measurement • Behavior report card • Behavior checklist
Baseline	Outcome Goal	
12 correct digits per 2 minute probe	*24 correct digits per 2 minute probe*	
How often will data be collected? (e.g., daily, every other day, weekly): *WEEKLY*		

Using Accommodations With General-Education Students: Teacher Guidelines

Classrooms in most schools look pretty much alike, with students sitting at rows of desks attending (more or less) to teacher instruction. But a teacher facing any class knows that behind that group of attentive student faces lies a kaleidoscope of differences in academic, social, self-management, and language skills. For example, recent national test results indicate that well over half of elementary and middle-school students have not yet attained proficiency in mathematics (NAEP, 20011a) or reading (NAEP 2011b). Furthermore, 1 in 10 students now attending American schools is an English Language Learner (Institute of Education Sciences, 2012) who must grapple with the complexities of language acquisition in addition to the demands of academic coursework.

Teachers can increase the chances for academic success by weaving into their instructional routine an appropriate array of classwide curricular accommodations made available to any general-education student who needs them (Kern, Bambara, & Fogt, 2002). However, teachers also know that they must strike an appropriate balance: while accommodations have the potential to help struggling learners to more fully engage in demanding academics, they should not compromise learning by holding a general-education student who accesses them to a lesser performance standard than the rest of the class. After all, students with academic deficits must actually *accelerate* learning to close the skill-gap with peers, so allowing them to do less is simply not a realistic option.

Read on for guidelines on how to select classroom accommodations to promote school success, verify whether a student actually *needs* a particular accommodation, and judge when accommodations should be used in instruction even if not allowed on state tests.

Identifying Appropriate Accommodations: Access vs. Target Skills. As an aid in determining whether a particular accommodation both supports individual student differences and sustains a demanding academic environment, teachers should distinguish between *target* and *access* skills (Tindal, Daesik, & Ketterlin, 2008). *Target skills* are those academic skills that the teacher is actively trying to assess or to teach. Target skills are therefore 'non-negotiable'; the teacher must ensure that these skills are not compromised in the instruction or assessment of any general-education student. For example, a 4th-grade teacher sets as a target skill for his class the development of computational fluency in basic multiplication facts. To work toward this goal, the teacher has his class complete a worksheet of 20 computation problems under timed conditions. This teacher would not allow a typical student who struggles with computation to do fewer than the assigned 20 problems, as this change would undermine the target skill of computational fluency that is the purpose of the assignment.

In contrast, *access skills* are those needed for the student to take part in a class assessment or instructional activity but are not themselves the target of current assessment or instruction. Access skills, therefore, *can* be the focus of accommodations, as altering them may remove a barrier to student participation but will not compromise the academic rigor of classroom activities. For example, a 7th-grade teacher assigns a 5-paragraph essay as an in-class writing assignment. She notes that one student finds the access skill of handwriting to be difficult and aversive, so she instead allows that student the accommodation of writing his essay on a classroom desktop computer. While the access skill (method of text production) is altered, the teacher preserves the integrity of those elements of the assignment that directly address the target skill (i.e., the student must still produce a full 5-paragraph essay).

Matching Accommodations to Students: Look for the 'Differential Boost'. The first principle in using accommodations in general-education classrooms, then, is that they should address access rather than target academic skills. However, teachers may also wish to identify whether an individual actually benefits from a particular accommodation strategy. A useful tool to investigate this question is the 'differential boost' test (Tindal & Fuchs, 1999). The teacher examines a student's performance both with and without the accommodation and asks these 2 questions: (1) Does the student perform significantly better *with* the accommodation than without?, and (2) Does the accommodation boost that particular student's performance substantially *beyond* what could be expected if it were given to all students in the class? If the answer to both questions is YES, there is clear evidence that this student receives a 'differential boost' from the accommodation and that this benefit can be explained as a unique rather than universal response. With such evidence in hand, the teacher should feel confident that the accommodation is an appropriate match for the student. (Of course, if a teacher observes that most or all of a class seems to benefit from a particular accommodation idea, the best course is probably to revise the assignment or assessment activity to incorporate the accommodation!)

For example, a teacher may routinely allocate 20 minutes for her class to complete an in-class writing assignment and finds that all but one of her students are able to complete the assignment adequately within that time. She therefore allows this one student 10 minutes of additional time for the assignment and discovers that his work is markedly better with this accommodation. The evidence shows that, in contrast to peers, the student gains a clear 'differential boost' from the accommodation of extended time because (1) his writing product is substantially improved when using it, while (2) few if any other students appear to need it.

Classroom Accommodations and State Tests: To Allow or Not to Allow? Teachers may sometimes be reluctant to allow a student to access classroom accommodations if the student cannot use those same accommodations on high-stakes state assessments (TIndal & Fuchs, 1999). This view is understandable; teachers do not want students to become dependent on accommodations only to have those accommodations yanked away at precisely the moment when the student needs them most. While the teacher must be the ultimate judge, however, there are 3 good reasons to consider allowing a general-education student to access accommodations in the classroom that will be off-limits during state testing.

1. *Accommodations can uncover 'academic blockers'.* The teacher who is able to identify which student access skills may require instructional accommodations is also in a good position to provide interventions proactively to strengthen those deficient access skills. For example, an instructor might note that a student does poorly on math word problems because that student has limited reading decoding skills. While the teacher may match the student to a peer who reads the word problems aloud (texts read) as a classroom accommodation, the teacher and school can also focus on improving that student's decoding skills so that she can complete similar math problems independently when taking the next state examinations.

2. *Accommodations can promote content knowledge.* Students who receive in-class accommodations are likely to increase their skills and knowledge in the course or subject content substantially beyond the level to be expected without such supports. It stands to reason that individuals whose academic skills have been strengthened through the right mix of classroom accommodations will come to the state tests with greater mastery of the content on which they are to be tested.

3. *Accommodations can build self-confidence.* When students receive classroom accommodations, they are empowered to better understand their unique pattern of learning strengths and weaknesses and the strategies that work best for them. Self-knowledge can build self-confidence. And not only are such students primed to advocate for their own educational needs; they are also well-placed to develop compensatory strategies to manage difficult, high-stakes academic situations where support is minimal--such as on state tests.

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How To: Increase Motivation in Students: High-Probability Requests

Non-compliance is a frequent source of problem classroom behavior--driven by student attempts to escape or avoid challenging academic tasks (Packenham, Shute & Reid, 2004). For instance, when transitioning between educational activities a work-avoidant student may stall in beginning the next assignment. Or, during independent assignments, that same student may run out the clock by dawdling between work items. To increase compliance and work completion, teachers should identify strategies that prevent off-task behaviors but must also continue to hold students accountable for attaining rigorous academic standards.

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

As the student completes several embedded high-probability tasks in succession, he or she builds 'behavioral momentum' in responding that increases the likelihood that the student will apply full effort when encountering the 'main event'--the more challenging, low-probability activity. (See the table *Use of High-Probability Requests to Increase Student Compliance: Examples from Research Studies* for descriptions of how high-probability requests have been used successfully in school settings.)

Use of high-probability requests offers the twin advantages of motivating students while encouraging high academic standards. Students can find the experience of completing simple, high-probability tasks to be intrinsically reinforcing--which fuels the behavioral momentum that gives this strategy its power (Lee et al., 2004). At the same time, this approach offers teachers a means of holding non-compliant students to the same high academic expectations as their more cooperative classmates (Belfiore et al., 2008).

A potential instructional advantage of the high-probability request strategy should also be noted. Research suggests that student retention of learned material is heightened if that material is reviewed at intervals of several months or more from the initial learning (Pashler et al., 2007). If teachers are able to fold previously learned academic material (e.g., math

Use of High-Probability Requests to Increase Student Compliance: Examples from Research Studies

Transitioning within academic tasks: Letter/word copying (Lee et al., 2004). During independent work, two 2nd-grade students were directed to copy a letter several times from a model (a preferred, high-probability task) before being asked to copy a whole word from a model (less-preferred, low-probability task).

Transitioning within academic tasks: Math computation (Lee et al., 2004). Three students with IEPs from intermediate grades were presented with flashcards containing math computation problems. The students were to read off and solve each problem, flip the card over to check the actual answer against their solution, and then advance to the next card. For the activity, the teacher first created a series of cards containing low-probability computation problems that were less-preferred because of their difficulty. Then, before each low-probability problem, the teacher inserted flashcards with three easy (more-preferred, high-probability) computation problems.

Transitioning between academic tasks: Independent math assignment (Wehby & Hollahan, 2000). This study focused on a middle-school student who often would not initiate independent math assignments. The teacher compiled a list of high-probability requests related to the independent math assignment that the student would typically responded to--e.g., 'write your name on the worksheet", "pick up your pencil", "take out a sheet of paper for the assignment", "look over the first problem". At the start of the independent seatwork activity, the teacher approached the student and randomly select and deliver 3 requests from the high-probability list. If the student ignored a request, the teacher would simply deliver another from the list until the student had successfully complied with 3 high-probability requests. Then the teacher delivered the less-preferred, low-probability request: "Begin your independent assignment."

computation facts; course vocabulary items) into high-probability requests, they can both boost student work compliance and promote retention of essential skills or knowledge.

Here are more detailed teacher guidelines from Lee (2006) for embedding high-probability requests to build behavioral momentum sufficient to motivate students to tackle less-preferred, low-probability academic activities:

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

2. *List high-probability tasks.* Next, the teacher generates a list of high-probability tasks that the student is likely to comply with. These tasks should be brief (i.e., take 5 seconds or fewer to complete) and should logically link to the low-probability activity. For example, if the low-probability event is getting the student to start the writing of a journal entry (transitioning between academic activities), easy, high-probability tasks associated with beginning the writing task might include 'organize your writing materials', 'write a title', and 'list 3 ideas for the journal entry'. If the low-probability event is having the student complete a worksheet with reflective questions tied to an assigned reading (within-task), sample high-probability tasks associated with the worksheet could include questions asking the student to 'copy the title of this reading', or 'write down one interesting vocabulary term from the first paragraph'.

3. *Create activities with embedded high-probability tasks.* The teacher then reworks the low-probability work-situation to embed within it a series of high-probability tasks. If the target is to get the student to transition efficiently from one activity to another, the teacher inserts 3 high-probability requests at the start of the activity to create behavioral momentum. If the goal is to prod the student to efficiently complete an independent assignment without hesitating between items, the teacher inserts 3 high-probability requests before each challenging item on the assignment.

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

The guidelines offered here demonstrate how strategic use of high-probability requests can generate behavioral momentum and prevent compliance problems with individual students. However, teachers may also be able to creatively use high-probability sequences to motivate whole groups or even an entire class. For example, an instructor might decide to intersperse 3 'easy' (high-probability) items between each 'challenge' item on a math computation worksheet to be assigned to all students for independent seatwork. Or a teacher may routinely introduce in-class writing assignments by first verbally directing students to 'take out paper and pen', 'write your name on the paper', and 'copy this journal topic onto your paper'. The crucial factor in group use of high-probability sequences is that the teacher accurately identify what tasks are indeed motivating and likely to build behavioral momentum among the majority of students.

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How To: Improve Student Self-Management Through Work-Planning Skills: Plan, Work, Evaluate, Adjust

It is no surprise to teachers that, when students have poor work-planning skills, their academic performance often suffers. Work-planning is the student's ability to inventory a collection of related sub-tasks to be done, set specific outcome goals that signify success on each sub-task, allocate time sufficient to carry out each sub-task, evaluate actual work performance, and make necessary adjustments in future work-planning as needed (Martin, Mithaug, Cox, Peterson, Van Dycke & Cash, 2003).. When students are deficient as work planners, the negative impact can be seen on in-class and homework assignments as well as on longer-term projects such as research papers. Teachers can develop students' work-planning skills by training them in a simple but effective sequence: to plan upcoming work, complete the work, evaluate their work performance, and adjust their future work plans based on experience (Martin et al., 2003).

The vehicle for teachers to train students to develop strong work-planning skills is through conferencing: the teacher and student meet for a pre-work *planning* conference and then meet again after the work is completed at a *self-evaluation* conference. NOTE: The *Student Independent Work: Planning Tool* that appears later in this document is a graphic organizer that can be used to structure and record these 2-part teacher-student conferences.

Phase 1: Work-Planning Conference

Before the student begins the assigned academic work, the teacher meets with the student to develop the work plan. (While the teacher often initially assumes a guiding role in the work-planning conference, the instructor gradually transfers responsibility for developing the plan to the student as that student's capacity for planning grows.)

There are 3 sections in the work-planning conference: (1) inventory the sub-tasks to be done, (2) assign an estimated time for completion, and (3) set a performance goal for each item on the task list:

1. *Inventory the sub-tasks to be done*. The student describes each academic task in clear and specific terms (e.g., "Complete first 10 problems on page 48 of math book", "write an outline from notes for history essay"). For this part of the work plan, the teacher may need to model for the student how to divide larger global assignments into component tasks.

2. *Assign an estimated time for completion*. The student decides how much time should be reserved to complete each task (e.g., For a math workbook assignment: "20 minutes" or "11:20 to 11:40"). Because students with limited planning skills can make unrealistic time projections for task completion, the teacher may need to provide additional guidance and modeling in time estimation during the first few planning sessions.

3. *Set a performance goal.* The student sets a performance goal to be achieved for each sub-task. Performance goals are dependent on the student and may reference the amount, accuracy, and/or qualitative ratings of the work: (e.g., for a reading assignment: "To read at least 5 pages from assigned text, and to take notes of the content"; for a math assignment: "At least 80% of problems correct"; for a writing assignment: "Rating of 4 or higher on class writing rubric"). The teacher can assist the student to set specific, achievable goals based on that student's current abilities and classroom curriculum expectations.

Phase 2: Self-Evaluation Conference

When the work has been completed, the teacher and student meet again to evaluate the student's performance. There are 2 sections to this conference: (1) Compare the student's actual performance to the original student goal; and (2) adjust future expectations and performance in light of the experience gained from the recently completed work.

1. *Compare the student's actual performance to the original student goal.* For each sub-task on the plan, the student compares his or her actual work performance to the original performance goal and notes whether the goal was achieved. In addition to noting whether the performance goal was attained, the student evaluates whether the sub-task was completed within the time allocated.

2. *Adjust future expectations and performance*. For each sub-task that the student failed to reach the performance goal within the time allocated, the student reflects on the experience and decides what adjustments to make on future assignments. For example, a student reviewing a homework work-plan who discovers that she reserved insufficient time to complete math word problems may state that, in future, she should allocate at least 30 minutes for similar sub-tasks. Or a student who exceeds his performance goal of no more than 4 misspellings in a writing assignment may decide in future to keep a dictionary handy to check the spelling of questionable words before turning in writing assignments.

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Student Independent Work: Planning Tool

Student: ______________________________ Teacher/Staff Member: ________________________ Date: ___/___/___

		Planning	Planning	Planning	Self-Evaluation	Self-Evaluation
	Date:	Sub-Task: Describe each assignment sub-task to be completed.	Time Allocated: Estimate the time required for this task. E.g., "20 mins"; "11:20-11:40"	Performance Goal: Write your goal for the amount, accuracy, and/or quality of work to be completed.	Actual Performance: After the assignment, record the amount, accuracy, and/or quality of the work *actually completed*.	Goal Met?: Did you achieve the goal within the time allocated?
1	__/__/__					☐ YES ☐ NO
2	__/__/__					☐ YES ☐ NO
3	__/__/__					☐ YES ☐ NO
4	__/__/__					☐ YES ☐ NO

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

Number of Goal Not Met & Action Plan to Fix: ______ ____

Number of Goal Not Met & Action Plan to Fix: ______ ____

Number of Goal Not Met & Action Plan to Fix: ______ ____

How To: Help Students to Complete Missing Work: The Late-Work Teacher-Student Conference

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

The reasons that students fall behind in assignments are many. Students who are just developing homework skills , for example, often need more time than peers to complete independent assignments, can find it challenging to focus their attention when working on their own, and may not have efficient study skills (Cooper & Valentine, 2001). To be sure, student procrastination and avoidance in work assignments is a widespread problem. And many students who fall behind in their work also develop a maladaptive, self-reinforcing pattern of escape-maintained behavior: as these students owe ever-increasing amounts of late work, they respond to the anxiety generated by that overhang of overdue assignments by actively avoiding that work. And thus the problem only grows worse (Hawkins & Axelrod, 2008).

When a student begins to slip in the completion and submission of assignments, the teacher can take steps proactively to interrupt this work-avoidant pattern of behavior by meeting with the student to create a plan to catch up with late work. (It is also recommended that the parent attend such a conference, although parent participation is not required.) In this 'late-work' conference, the teacher and student inventory what work is missing, negotiate a plan to complete that overdue work, and perhaps agree on a reasonable penalty for any late work 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.

Below in greater detail are the steps that the teacher and student would follow at a meeting to renegotiate missing work. (NOTE: Teachers can use the *Student Late-Work Planning Form: Middle & High School* that appears later in this document to organize and document these late-work conferences.):

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 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.

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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

How To: Assess Mastery of Math Facts With CBM: Computation Fluency

Computation Fluency measures a student's accuracy and speed in completing 'math facts' using the basic number operations of addition, subtraction, multiplication, and division. Computation fluency in the elementary grades is a strong predictor of later success in higher-level math coursework (Gersten, Jordan, & Flojo, 2005).

For students to attain 'computational fluency', however, they must be both accurate and speedy in solving basic math facts--ideally through automatic recall (VanDerHeyden & Burns, 2008). In an influential report, the National Mathematics Advisory Panel (2008) stressed the need for students to become proficient in math facts, calling on schools to make it a priority to "develop automatic recall of addition and related subtraction facts, and of multiplication and related division facts." (p. xix).

The Common Core Standards also recognize the importance of computation fluency. For example, a 4th-grade math standard in Number and Operations in Base Ten (CCSM.4.NBT.4) states that the student will "fluently add and subtract multi-digit whole numbers using the standard algorithm" (National Governors Association Center for Best Practices et al., 2010; p. 29). However, the challenge for teachers is to define specifically what level of performance is required to identify a student as fluent in compuation.

CBM-Computation Fluency is a brief, timed assessment that can indicate to teachers whether a student is developing computation fluency and is thus on track to master grade-appropriate math facts (basic computation problems). This assessment can be administered to an individual student or to larger groups. The student is given a worksheet containing math facts and is given 2 minutes to answer as many problems as possible. The worksheet is then collected and scored, with the student receiving credit for each correct digit in his or her answers. Teachers can then compare any student's performance to research norms to determine whether that student is at risk because of delayed computational skills (Burns, VanDerHeyden, & Jiban, 2006).

Computation Fluency Measures: How to Access Resources. Teachers who would like to screen their students in grades 1 through 6 for possible delays in computation skills can obtain these free Computation Fluency assessment resources: (1) materials for assessment, (2) guidelines for administration and scoring, and (3) research-based norms.

- *Materials for assessment*. Schools can customize their own CBM Computation Fluency assessment materials at no cost, using the Math Worksheet Generator, a free online application: *http://www.interventioncentral.org/teacher-resources/math-work-sheet-generator*

  This program generates printable student and examiner assessment sheets for CBM Computation Fluency.

- *Guidelines for administration and scoring.* Instructions for preparing, administering, and scoring CBM-Computation Fluency assessments appear later in this document:

- *Research-based norms.* A table, *Curriculum-Based Measurement: Computation Fluency Norms* is included in this document. The table contains fluency benchmarks for grades 1-6, drawn from several research studies (e.g., Burns, VanDerHeyden, & Jiban, 2006).

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Curriculum-Based Measurement-Computation Fluency: Guidelines for Use

CBM-Computation Fluency: Description

CBM-Computation Fluency measures a student's accuracy and speed in completing 'math facts' using the basic number operations of addition, subtraction, multiplication, and division. CBM-Computation Fluency probes are 2-minute assessments of basic math facts that are scored for number of 'correct digits'.

There are 2 types of CBM math probes, single-skill worksheets (those containing like problems) and multiple-skill worksheets (those containing a mix of problems requiring different math operations). Single-skill probes give instructors good information about students' mastery of particular problem-types, while multiple-skill probes allow the teacher to test children's math competencies on a range of computational objectives during a single CBM session.

Both types of math probes can be administered either individually or to groups of students. The examiner hands the worksheet(s) out to those students selected for assessment. Next, the examiner reads aloud the directions for the worksheet. Then the signal is given to start, and students proceed to complete as many items as possible within 2 minutes. The examiner collects the worksheets at the end of the assessment for scoring.

CBM-Computation Fluency: Materials

The following materials are needed to administer CBM-Computation Fluency:

- Student and examiner copies of CBM Computation Fluency Probes
- Stopwatch
- Pencils for students

CBM-Computation Fluency: Preparation

After computational objectives have been selected, the instructor is ready to prepare math probes. The teacher may want to create single-skills probes, multiple-skill probes, or both types of CBM math worksheets. The teacher will probably want to consult the Common Core State Standards for Mathematics or district math curriculum when selecting the kinds of problems to include in the single- or multiple-skill probe.

Creating the single-skill math probe. As the first step in putting together a single-skill math probe, the teacher will select one computational objective as a guide. The worksheet, then, will consist of problems randomly constructed that conform to the computational objective chosen.

Figure 1: A Sampling of Math Computational Goals for Addition, Subtraction, Multiplication, and Division (from Wright, 2002).

<u>Addition</u>
Two 1-digit numbers: sums to 10
Two 3-digit numbers: no regrouping
1- to 2-digit number plus 1- to 2-digit number: regrouping

<u>Subtraction</u>
Two 1-digit numbers: 0 to 9
2-digit number from a 2-digit number: no regrouping
2-digit number from a 2-digit number: regrouping

<u>Multiplication</u>
Multiplication facts: 0 to 9
2-digit number times 1-digit number: no regrouping
3-digit number times 1-digit number: regrouping

<u>Division</u>
Division facts: 0 to 9
2-digit number divided by 1-digit number: no remainder
2-digit number divided by 1-digit number: remainder

Wright, J. (2002) *Curriculum-Based Assessment Math Computation Probe Generator: Multiple-Skill Worksheets in Mixed Skills*. Retrieved from *http://www.interventioncentral.org/ teacher-resources/math-work-sheet-generator*

For example, the instructor may select any of the computational objectives in Figure 1 as the basis for a math probe. The teacher would then construct a series of problems that match the computational goal, as in Figure 2. In general, single-skill math probes should contain between 80 and 200 problems, and worksheets should have items on both the front and back of the page. Adequate space should also be left for the student to show his or her work, especially with more complex problems such as long division.

Figure 2: Example of a single-skill math probe: Three to five 3- and 4-digit numbers: no regrouping

105 + 600 + 293	2031 + 531 + 2322	111 + 717 + 260	634 + 8240 + 203

Creating the Multiple-skill Math Probe. To assemble a multiple-skill math probe, the instructor will first select the range of math operations and of problem-types that will make up the probe. Once the computational objectives have been

Figure 3: Example of a multiple-skill math probe:

- *Division: 3-digit number divided by 1-digit number: no remainder*
- *Subtraction: 2-digit number from a 2-digit number: regrouping*
- *Multiplication" 3-digit number times 1-digit number: no regrouping*
- *Division: Two 3-digit numbers: no regrouping*

9/431	20 -18	113 x 2	106 + 172 + 200 + 600

chosen, the teacher can make up a worksheet of mixed math facts conforming to those objectives. Using our earlier example, the teacher who wishes to estimate the proficiency of his 4th-grade math group may decide to create a multiple-skills CBM probe. He could choose to sample only those problem-types that his students have either mastered or are presently being taught. Figure 3 shows four computation skills with matching sample problems that might appear on a worksheet of mixed math facts.

NOTE: Schools can customize their own CBM Computation Fluency assessment materials at no cost, using the Math Worksheet Generator, a free online application:
http://www.interventioncentral.org/teacher-resources/math-work-sheet-generator

CBM-Computation Fluency: Directions for Administration

1. The examiner distributes copies of math probes to all the students in the group, face down. (Note: These probes may also be administered individually). The examiner says to the students: "The sheets on your desk are math facts."
2. If the students are to complete a single-skill probe, the examiner says: "All the problems are [addition or subtraction or multiplication or division] facts."

If the students are to complete a multiple-skill probe, the examiner then says: "There are several types of problems on the sheet. Some are addition, some are subtraction, some are multiplication, and some are division [as appropriate]. Look at each problem carefully before you answer it."

3. The examiner then says: "When I say 'begin', turn the worksheet over and begin answering the problems. Start on the first problem on the left on the top row [point]. Work across and then go to the next row. If you can't answer a problem, make an 'X' on it and go to the next one. If you finish one side, go to the back. Are there any questions? ".
4. The examiner says 'Start' and starts the stopwatch. While the students are completing worksheets, the examiner and any other adults assisting in the assessment circulate around the room to ensure that students are working on the correct sheet and that they are completing problems in the correct order (rather than picking out only the easy items)..
5. After 2 minutes have passed, the examiner says, "Stop" and collects the CBM computation probes for scoring.
6. *Initial Assessment:* If the examiner is assessing the student for the first time, the examiner administers a total of 3 computation probes during the session using the above procedures and takes the median (middle) score as the best estimate of the student's computation fluency.
   Progress-Monitoring: If the examiner is monitoring student growth in computation (and has previously collected CBM-Computation Fluency data), only one computation probe is given in the session.

CBM-Computation Fluency: Directions for Practice

If the student is not yet familiar with CBM-Computation Fluency probes, the teacher can administer one or more practice computation probes (using the administration guidelines above) and provide coaching and feedback as needed until assured that the student fully understands the assessment.

CBM-Computation Fluency: Scoring Guidelines

Traditional approaches to computational assessment usually give credit for the total number of correct answers appearing on a worksheet. If the answer to a problem is found to contain one or more incorrect digits, that problem is marked wrong and receives no credit. In contrast to this all-or-nothing marking system, CBM assigns credit to each individual correct digit appearing in the solution to a math fact.

On the face of it, a math scoring system that awards points according to the number of correct digits may appear unusual, but this alternative approach is grounded in good academic-assessment research and practice. By separately scoring each digit in the answer of a computation problem, the instructor is better able to recognize and to give credit for a student's partial math competencies. Scoring computation problems by the digit rather than as a single answer also allows for a more minute analysis of a child's number skills.

Imagine, for instance, that a student was given a CBM math probe consisting of addition problems, sums less than or equal to 19 (incorrect digits appear in boldface and italics):

Figure 4: Example of completed problems from a single-skill math probe

105	2031	111	634
+ 600	+ 531	+ 717	+ 8240
+ 293	+ 2322	+ 260	+ 203
9***8***8	4884	108***7***	9***0***77

If the answers in Figure 4 were scored as either correct or wrong, the child would receive a score of 1 correct answer out of 4 possible answers (25 percent). However, when each individual digit is scored, it becomes clear that the student actually correctly computed 12 of 15 possible digits (80 percent). Thus, the CBM procedure of assigning credit to each correct digit demonstrates itself to be quite sensitive to a student's emerging, partial competencies in math computation.

The following scoring rules will aid the instructor in marking single- and multiple-skill math probes:

- Individual correct digits are counted as correct.
  Reversed or rotated digits are not counted as errors unless their change in position makes them appear to be another digit (e.g., 9 and 6).

- Incorrect digits are counted as errors.
  Digits that appear in the wrong place value, even if otherwise correct, are scored as errors.

Example

```
  97
  x9
----
8730  <--
```

"873" is the correct answer to this problem, but no credit can be given since the addition of the 0 pushes the other digits out of their proper place-value positions.

- The student is given credit for "place-holder" numerals that are included simply to correctly align the problem. As long as the student includes the correct space, credit is given whether or not a "0" has actually been inserted.

Example

```
  55
x 82
----
 110
4400  <--
----
4510
```

Since the student correctly placed 0 in the "place-holder" position, it is given credit as a correct digit. Credit would also have been given if the space were reserved but no 0 had been inserted.

- In more complex problems such as advanced multiplication, the student is given credit for all correct numbers that appear below the line.

Example

```
  33
x 28
----
 264
 660
----
 924  <--
```

Credit is given for all work below the line. In this example, the student earns credit for 9 correct digits.

- Credit is not given for any numbers appearing above the line (e.g., numbers marked at the top of number columns to signify regrouping).

Example

```
 1    <--
  46
+ 39
----
  85
```

Credit is given for the 2 digits below the line. However, the carried "1" above the line does not receive credit.

Curriculum-Based Measurement: Computation Fluency Norms

(Burns, VanDerHeyden, & Jiban, 2006; Deno & Mirkin, 1977; Fuchs & Fuchs, 1993; Fuchs & Fuchs, n.d.)*

CBM-Computation Fluency measures a student's accuracy and speed in completing 'math facts' using the basic number operations of addition, subtraction, multiplication, and division. Computation fluency in the elementary grades is a strong predictor of later success in higher-level math coursework (Gersten, Jordan, & Flojo, 2005). CBM-Computation Fluency probes are 2-minute assessments of basic math facts that are scored for number of 'correct digits'.

Grade	End of Year Benchmark: Correct Digits per 2 Mins (Fuchs & Fuchs, n.d.)	Weekly Growth: 'Realistic' (Fuchs & Fuchs, 1993)	Weekly Growth: 'Ambitious' (Fuchs & Fuchs, 1993)
1	20	0.3	0.5

Grade	Performance Level	Correct Digits per 2 Mins (Burns, VanDerHeyden, & Jiban, 2006)	Weekly Growth: 'Realistic' (Fuchs & Fuchs, 1993)	Weekly Growth: 'Ambitious' (Fuchs & Fuchs, 1993)
2	Mastery	More than 31	0.3	0.5
	Instructional	14-31		
	Frustration	Less than 14		
3	Mastery	More than 31	0.3	0.5
	Instructional	14-31		
	Frustration	Less than 14		
4	Mastery	More than 49	0.75	1.2
	Instructional	24-49		
	Frustration	Less than 24		
5	Mastery	More than 49	0.75	1.2
	Instructional	24-49		
	Frustration	Less than 24		

Grade	Performance Level	Correct Digits per 2 Mins (Deno & Mirkin, 1977)	Weekly Growth: 'Realistic' (Fuchs & Fuchs, 1993)	Weekly Growth: 'Ambitious' (Fuchs & Fuchs, 1993)
6	Mastery	More than 79	0.45	1.0
	Instructional	40-79		
	Frustration	Less than 40		

References:

- Burns, M. K., VanDerHeyden, A. M., & Jiban, C. L. (2006). Assessing the instructional level for mathematics: A comparison of methods. *School Psychology Review, 35*, 401-418.
- Deno, S. L., & Mirkin, P. K. (1977). *Data-based program modification: A manual.* Reston, VA: Council for Exceptional Children.
- Fuchs, L. S., & Fuchs, D. (n.d.). *Using curriculum-based measurement for progress monitoring in math*. National Center on Student Progress Monitoring. Retrieved from http://www.studentprogress.org
- Fuchs, L. S., & Fuchs, D. (1993). Formative evaluation of academic progress: How much growth can we expect? *School Psychology Review, 22*, 27-49.
- Gersten, R., Jordan, N. C., & Flojo, J. R. (2005). Early identification and interventions for students with mathematics difficulties. *Journal of Learning Disabilities, 38*, 293-304.

*Reported Characteristics of Student Sample(s) Used to Compile These Norms:

- Burns, VanDerHeyden, & Jiban, 2006: *Number of Students Assessed:* 434 students across grades 2-5/*Geographical Location:* Southwest: Sample drawn from 1 elementary school/ *Socioeconomic Status:* 15% rate of Free & Reduced Lunch/ *Ethnicity of Sample:* 74% Caucasian-non-Hispanic; 17% Hispanic or Latino; 6% African-American; 3% Asian-American; 1% Native American/*Limited English Proficiency in Sample:* 2% of students.
- Deno & Mirkin, 1977: *Number of Students Assessed:* Not reported/*Geographical Location:* Sample drawn from 1 elementary school; location not reported/ *Socioeconomic Status:* Not reported/ *Ethnicity of Sample:* Not reported/*Limited English Proficiency in Sample:* Not reported.
- Fuchs & Fuchs, n.d.: *Number of Students Assessed:* Not reported/*Geographical Location:* Not reported/ *Socioeconomic Status:* Not reported/ *Ethnicity of Sample:* Not reported/*Limited English Proficiency in Sample:* Not reported.
- Fuchs & Fuchs, 1993: *Number of Students Assessed:* Year 1: 177 students in grades 1-6; Year 2:1208 students across grades 1-6/*Geographical Location:* Upper Midwest: Sample drawn from 5 elementary schools/ *Socioeconomic Status:* 33%-55% rate of Free & Reduced Lunch across participating schools/ *Ethnicity of Sample:* Not reported/*Limited English Proficiency in Sample:* Not reported.

Where to Find Materials: Schools can create their own CBM Computation Fluency assessment materials at no cost, using the Math Worksheet Generator, a free online application:
http://www.interventioncentral.org/teacher-resources/math-work-sheet-generator

This program generates printable student and examiner assessment sheets for CBM Computation Fluency.

Limitations of These Research Norms: Norms generated from small-scale research studies--like those used here--provide estimates of student academic performance based on a sampling from only one or two points in time, rather than a more comprehensive sampling across separate fall, winter, and spring screenings. These norms also have been compiled from a relatively small student sample that is not fully representative of a diverse 'national' population. Nonetheless, norms such as these are often the best information that is publically available for basic academic skills and therefore do have a definite place in classroom instruction decision-making.

These norms can be useful in general education for setting student performance outcome goals for core instruction and/or any level of academic intervention. Similarly, these norms can be used to set performance goals for students with special needs. In both cases, however, single-sample norms would be used only if more comprehensive fall/winter/spring academic performance norms are not available.

Math Interventions: Sampler

	Academic Intervention Strategies	Research Citations
❑	MATH: INSTRUCTION: PEER-GUIDED PAUSE. During large-group math lectures, teachers can help students to retain more instructional content by incorporating brief Peer Guided Pause sessions into lectures: (1) 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. (2) 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) currently being reviewed in the lecture. The sheet also contains several additional, similar problems that pairs of students must work cooperatively to complete, along with an answer key. (3) 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. (4) The teacher can direct student pairs to write their names on the practice sheets and collect the work as a convenient way to monitor student participation and understanding.	Hawkins, J., & Brady, M. P. (1994). The effects of independent and peer guided practice during instructional pauses on the academic performance of students with mild handicaps. Education & Treatment of Children, 17 (1), 1-28.
❑	MATH: ARITHMETIC FACTS: ACQUISITION: COVER-COPY-COMPARE. To memorize arithmetic facts, the student can be trained to independently use Cover-Copy-Compare: The student is given a worksheet with computation problems and answers appearing on the left side of the sheet, and the right side of the page left blank. The student is also given an index card. For each arithmetic-fact item, the student is directed (1) to study the correct arithmetic problem and answer on the left, (2) to cover the correct model with the index card, (3) from memory, to copy the arithmetic fact and answer onto the work space on the right side of the sheet, and (4) to compare the student version of the arithmetic fact and answer to the original model to ensure that it was copied correctly and completely.	Skinner, C. H., McLaughlin, T. F., & Logan, P. (1997). Cover, copy, and compare: A self-managed academic intervention effective across skills, students, and settings. Journal of Behavioral Education, 7, 295-306.
❑	MATH: ARITHMETIC FACTS: ACQUISITION: INCREMENTAL REHEARSAL. Incremental rehearsal is a useful strategy to help the student to acquire arithmetic facts. Sessions last 10-15 minutes. In preparation for this intervention, the teacher prepares a set of arithmetic-fact flashcards displaying equations but no answers. The teacher reviews all of the flashcards with the student. Flashcards that the student correctly answers within 2 seconds are sorted into a 'KNOWN' pile, while flashcards for which the student gives an incorrect answer or hesitates for longer than 2 seconds are sorted into the 'UNKNOWN' pile. During the intervention: (1) the teacher selects a card from the UNKNOWN pile (Card UK1), presents it to the student, reads off the arithmetic problem, and provides the answer (e.g., '4 x 8=32'). The student is then prompted to read the problem and give the correct answer (2) Next, the teacher selects a card from the KNOWN pile (Card K1) and adds it to the previously practiced card (UK1). In succession, the teacher shows the student the unknown (UK1) and the known (K1) card. The student has 2 seconds to provide an answer for each card. Whenever the student responds incorrectly or hesitates for longer than 2	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.

	seconds, the teacher corrects student responses as needed and has the student state the correct response. (3) The teacher then selects a second card from the KNOWN pile (card K2) and adds it to the student stack--reviewing cards UK1, K1, and K2. (4) This incremental review process repeats until the student's flashcard stack comprises 10 cards: 1 unknown and 9 known. (5) At this point, the original unknown card (UK1) is now considered to be a 'known' card and is retained in the student's review-card stack. To make room for it, the last known card (K9) is removed, leaving 9 known cards in that student's stack. (6) The teacher then draws a new card from the UNKNOWN pile (card UK2) and repeats the incremental review process described above, each time adding known cards from the 9-card student stack in incremental fashion.	
❑	MATH COMPUTATION STRATEGY: ACQUISITION: STUDENT HIGHLIGHTING. Students who are inattentive or impulsive can improve their accuracy and fluency on math computation problems through student-performed highlighting. The student is given highlighters of several colors and a math computation sheet. Before completing the worksheet, the student is directed to color-code the problems on the sheet in a manner of his or her choosing (e.g., by level of difficulty, by math operation). The student then completes the highlighted worksheet.	Kercood, S., & Grskovic, J. A. (2009). The effects of highlighting on the math computation performance and off-task behavior of students with attention problems. Education and Treatment of Children, 32, 231-241.
❑	MATH: ARITHMETIC FACTS: FLUENCY: PERFORMANCE FEEDBACK & GOAL-SETTING. The student gets regular feedback about computation fluency and sets performance goals. In preparation for this intervention, the teacher decides on a fixed time limit for worksheet drills (e.g., 5 or 10 minutes) --with an equivalent worksheet to be prepared for each session. In each session, before the student begins the worksheet, (1) the teacher provides the student with feedback about the number of correct problems and errors on the most recent previous worksheet, and (2) the teacher and student agree on an improvement-goal for the current worksheet (e.g., to increase the number of correct problems by at least 2 and to reduce the errors by at least 1). Student performance on worksheets is charted at each session.	Codding, R. S., Baglici, S., Gottesman, D., Johnson, M., Kert, A. S., & LeBeouf, P. (2009).Selecting intervention strategies: Using brief experimental analysis for mathematics problems. Journal of Applied School Psychology, 25, 146-168.
❑	MATH: ARITHMETIC FACTS: FLUENCY: PROVIDE INCENTIVES. A student may benefit from incentives to increase fluency with math facts. BRIEF ANALYSIS: The teacher first conducts a brief experimental analysis to determine whether incentives will increase a particular student's performance: (1) The student is given a worksheet with arithmetic facts and allotted two minutes to complete as many items as possible. The student receives a point for each correct digit written on the worksheet. (2) The teacher next prepares an equivalent worksheet with different problems--but composed of the same type and number of problems. (3) Before administering the second worksheet, the teacher presents the student with a 'prize bag' with tangible items (e.g., markers, small toys) and perhaps edible items (e.g., packaged raisins, crackers, etc.). The student is told that if he/she can increase performance on the second worksheet by at least 30%, the student will earn a prize. The student is asked to select a preferred prize from the prize bag. (4) The student is given the second worksheet and works on it for 2 minutes. Again, the worksheet is scored for correct digits. (5) If the student meets the fluency goal, he/she receives the selected prize. If the student fails to meet the goal, he/she is given a sticker as a consolation prize. USE OF	Codding, R. S., Baglici, S., Gottesman, D., Johnson, M., Kert, A. S., & LeBeouf, P. (2009).Selecting intervention strategies: Using brief experimental analysis for mathematics problems. Journal of Applied School Psychology, 25, 146-168.

	INCENTIVES: The teacher uses incentives only if the preceding brief analysis indicates that incentives are an effective motivator. For this intervention, the teacher decides on a fixed time limit for worksheet drills (e.g., 5 or 10 minutes) --with an equivalent worksheet to be prepared for each session. In each session, before the student begins the worksheet, (1) the student is asked to select a potential prize from the prize bag, (2) the student reviews his/her most recent previous worksheet score, and (3) the student and teacher set an improvement goal for the current worksheet (e.g., to exceed the previous score by at least 2 correct digits). If the student meets the goal, he/she is given the prize; if the student falls short, the teacher provides verbal encouragement and perhaps a sticker as a consolation prize. Student performance on worksheets is charted at each session.	
❑	MATH: ARITHMETIC FACTS: FLUENCY: TIME DRILLS. Explicit time-drills are a method to boost students' rate of responding on arithmetic-fact worksheets: (1) The teacher hands out the worksheet. Students are instructed that they will have 3 minutes to work on problems on the sheet. (2) The teacher starts the stop watch and tells the students to start work. (3) At the end of the first minute in the 3-minute span, the teacher 'calls time', stops the stopwatch, and tells the students to underline the last number written and to put their pencils in the air. Then students are told to resume work and the teacher restarts the stopwatch. (4) This process is repeated at the end of minutes 2 and 3. (5) At the conclusion of the 3 minutes, the teacher collects the student worksheets.	Rhymer, K. N., Skinner, C. H., Jackson, S., McNeill, S., Smith, T., & Jackson, B. (2002). The 1-minute explicit timing intervention: The influence of mathematics problem difficulty. Journal of Instructional Psychology, 29(4), 305-311. 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.
❑	MATH: WORD PROBLEMS: ACQUISITION: USE WORKED EXAMPLES. Students acquiring math skills in the form of word-problems benefit from being given completed problems ('worked examples') to study. Teachers should observe these recommendations when formatting, teacher, and using worked examples as a student support: (1) FORMAT PROBLEM-SOLVING STEPS: the solution presented in the worked example should be broken down into discrete, labeled sub-steps/sub-goals corresponding to the appropriate process for solving the problem. (2) COMBINE TEXT AND GRAPHICS. If both text and visual elements appear in the worked example, they should be integrated into a single unitary display, if possible, rather than split into separate components--so as not to overwhelm the novice learner. (3) PAIR WORKED WITH UNWORKED EXAMPLES. Whenever the student is given a worked example to study, he or she should then immediately be presented with 1-2 similar examples to solve.	Atkinson, R. K., Derry, S. J., Renkl, A., & Wortham, D. (2000). Learning from examples: Instructional principles from the worked examples research. Review of Educational Research, 70(2), 181-214.
❑	MATH: WORD PROBLEMS: METACOGNITION: PAIRING WORKED EXAMPLES WITH SELF-EXPLANATION. Students who can coach themselves through math problem-solving steps ('self-explanation') demonstrate increased conceptual understanding of the task. The	Atkinson, R. K., Derry, S. J., Renkl, A., & Wortham, D. (2000). Learning from examples: Instructional

	student should be explicitly coached to 'self-explain' each of the steps to be used in solving a particular type of problem--starting with completed problems ('worked examples') before advancing to unworked problems: (1) INTRODUCTION TO SELF-EXPLANATION. The teacher first explains the importance of self-explanation as a student math self-help skill. (2) TEACHER MODELING. Next, the teacher models self-explanation, applying the appropriate problem-solving steps to a worked example. (3) STUDENT MODELING WITH TEACHER FEEDBACK. The teacher then coaches the student's own self-explanation efforts, as the student moves through the steps of a second worked example. (4) INDEPENDENT STUDENT APPLICATION. When the student has successfully mastered the process, he or she is directed to use self-explanation during the problem-solving steps with any unworked problems.	principles from the worked examples research. Review of Educational Research, 70(2), 181-214. Tajika, H., Nakatsu, N., Nozaki, H., Neumann, E., & Maruno, S. (2007). Self-explanation for solving mathematical word problems: Effects of self-explanation as a metacognitive strategy for solving mathematical word problems. Japanese Psychological Research, 49(3), 222-233.
❑	MATH: WORD PROBLEMS: STRATEGY: DRAW THE PROBLEM. The student can clarify understanding of a word problem by making a drawing of it before solving. To teach this strategy: (1) The teacher gives the student a worksheet containing at least six word problems. (2) The teacher explains to the student that making a picture of a word problem can make that problem clearer and easier to solve. (3) The teacher and student independently create drawings of each of the problems on the worksheet. (4) Next, the student shows his or her drawings for each problem while explaining each drawing and how it relates to the word problem. (5) The teacher also participates, explaining his or her drawings to the student. (6) The student is then directed to 'draw the problem' whenever solving challenging word problems.	Van Garderen, D. (2006). Spatial visualization, visual imagery, and mathematical problem solving of students with varying abilities. Journal of Learning Disabilities, 39, 496-506.
❑	MATH: WORD PROBLEMS: STRATEGY: 4-STEP PLANNING PROCESS. The student can consistently perform better on applied math problems when following this efficient 4-step plan: (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.	Pólya, G. (1957). How to solve it (2nd ed.). Princeton University Press: Princeton, N.J. Williams, K. M. (2003). Writing about the problem solving process to improve problem-solving performance. Mathematics Teacher, 96(3), 185-187.

Math Facts: Cover-Copy-Compare

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

GROUP SIZE: Whole class, small group, individual student TIME: Variable up to 15 minutes per session

MATERIALS:

- *Worksheet: Cover-Copy-Compare* (attached)
- *Log: Mastered Math-Facts* (attached)

INTERVENTION STEPS: Here are the steps of Cover-Copy-Compare for math facts:

1. *[Teacher] Create a Cover-Copy-Compare Math-Fact Sheet.* The teacher selects up to 10 math facts for the student to work on during the session and writes those math facts as correct models (equation plus answer) into the left column ('Math Facts') of the *Worksheet: Cover-Copy-Compare* (attached). The teacher then pre-folds the sheet using as a guide the vertical dashed line ('fold line') bisecting the left side of the student worksheet.
2. *[Student] Use the Cover-Copy-Compare Procedures.* During the Cover-Copy-Compare intervention, the student follows these self-directed steps for each math fact:
   - Look at the math fact with answer that appears in the left column of the sheet.
   - Fold the left side of the page over at the pre-folded vertical crease to hide the correct model ('Cover').
   - Copy the math fact and answer from memory, writing it in the first response blank under the 'Student Response' section of the math-fact sheet ('Copy').
   - Uncover the correct model and compare it to the student response ('Compare'). If the student has written the math fact and answer CORRECTLY, the student moves to the next math fact on the list and repeats these procedures. If the student has written the math fact and answer INCORRECTLY, the student draws a line through the incorrect response, studies the correct model again, covers the model, copies the math fact and answer from memory into the second response blank under the 'Student Response' section of the sheet, and again checks the correctness of the copied math fact..
   - Continue until all math facts on the sheet have been copied and checked against the correct models.
3. *[Teacher] Log: Math Facts Mastered by Student.* The teacher should select an objective standard for judging that the student using Cover-Copy-Compare has 'mastered' a math fact (e.g., when the student is able to copy a math fact plus answer from memory without error on three successive occasions). The teacher can then apply this standard for mastery to identify and log math facts mastered in each session, using the *Log: Mastered Math Facts* sheet (attached).

References

Skinner, C. H., McLaughlin, T. F., & Logan, P. (1997). Cover, copy, and compare: A self-managed academic intervention effective across skills, students, and settings. Journal of Behavioral Education, 7, 295-306.

Worksheet: Cover-Copy-Compare

Student: ______________________ Date: ________

Math Facts	Student Response
1.	1a.
	1b.
2.	2a.
	2b.
3.	3a.
	3b.
4.	4a.
	4b.
5.	5a.
	5b.
6.	6a.
	6b.
7.	7a.
	7b.
8.	8a.
	8b.
9.	9a.
	9b.
10.	10a.
	10b.

Fold Line

Log: Mastered Math Facts

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

Math-Facts Cumulative Mastery Log: During the intervention, log each mastered math fact below with date of mastery.

Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___
Math Fact: __________________ Date: ___/___/___	Math Fact: __________________ Date: ___/___/___

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.

References

Deno, S. L., & Mirkin, P. K. (1977). Data-based program modification: A manual. Reston, VA: Council for Exceptional Children.

Menesses, K. F., & Gresham, F. M. (2009). Relative efficacy of reciprocal and nonreciprocal peer tutoring for students at-risk for academic failure. *School Psychology Quarterly, 24*, 266–275.

Telecsan, B. L., Slaton, D. B., & Stevens, K. B. (1999). Peer tutoring: Teaching students with learning disabilities to deliver time delay instruction. *Journal of Behavioral Education, 9*, 133-154.

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:

How To: Improve Proficiency in Math-Facts Through a Self-Administered Folding-In Technique

Students should develop automatic recall of basic math-facts in the elementary grades. Math-fact mastery permits students to shift valuable cognitive capacity away from simple calculations toward higher-level problem-solving (Gersten, Jordan, & Flojo, 2005; National Mathematics Advisory Panel, 2008). An important goal for schools, then, is to ensure that students are proficient in math-facts by the end of grade 5 (Kroesbergen & Van Luit, 2003) to better prepare them for the demanding middle-school math curriculum. Teachers, however, may have difficulty finding instructional time and adult support to deliver math-fact interventions to students.

One solution to this intervention-resource problem is the math-fact self-administered folding-in intervention (math-fact SAFI: Hulac, Dejong, & Benson, 2012). This approach trains students to take charge of their own intervention to acquire and develop fluency in math-facts. Using flash cards, the student reviews math-facts with immediate performance feedback, engages in repeated practice to correct errors, and records on a running log those math-facts that have been mastered. An additional advantage of this intervention is that it has been shown to be effective with middle-school students.

Preparation.

In preparation for this intervention, the teacher creates or obtains the following materials:

- *Math-fact flash cards.* The entire collection of math-facts to be mastered are written onto flash-cards. One fact is written on each card, with the math-fact appearing on the front and the correct answer appearing on the back. For example, multiplication math-facts for 0 through 10 would require 121 flash cards to cover all possible number combinations for this fact-set. Tip: Students can be given a master set of math-facts with answers (e.g., on the blackboard or on a handout) and directed to create their own math-fact cards.

- *Math-Facts SAFI: Student Checklist.* The student receives a copy of this checklist (attached) containing the essential steps of the self-administered intervention. The teacher can use this same checklist to observe the student and evaluate the integrity of the math-fact SAFI.

- *Dry-Erase Board, Markers, and Eraser.* The student uses the dry-erase board to record all answers in the session.

- *Student Log: Mastered Math-facts*. This recording-form (attached) is used by the student to log any math-facts mastered during the intervention.

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

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

- *train the student in the steps of the math-fact SAFI*. Using the intervention materials and *Math-Facts SAFI: Student Checklist,* the teacher trains the student to implement the intervention.

Procedure. Below are the steps the student follows in each session to implement the math-fact self-administered folding-in technique. (NOTE: Because the student is the interventionist, the steps are written as student directions):

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

References

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

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

Kroesbergen, E., & Van Luit, J. E. H. (2003). Mathematics interventions for children with special educational needs. *Remedial and Special Education, 24*, 97-114.

National Mathematics Advisory Panel. (2008). *Foundations for success: The final report of the National Mathematics Advisory Panel.* U.S. Department of Education: Washington, D.C.

Math-Facts SAFI: Student Checklist (Hulac, Dejong, & Benson, 2012).	
Carried Out?	*Intervention Step*
__Y __N	1. Start with the daily stack of cards from the last session. Or create a new "daily stack" by taking 7 cards from your weekly "known" stack and 3 cards from your weekly "unknown" stack and shuffling them.
__Y __N	2. Take the first card from the top of the daily stack and place it flat on the table.
__Y __N	3. Read the math-fact on the card and write the answer on the dry-erase board *within 3 seconds.*
__Y __N	4. Turn the card over and compare the answer that you wrote to the answer on the card.
__Y __N	5. If your answer is correct, sort that card into a "daily known" pile. If your answer is incorrect, sort that card into a "daily unknown" pile--then practice by writing the math-fact and correct answer on your dry-erase board three times in a row.
__Y __N	6. Continue until you have answered all 10 daily cards. Then look at the daily "known" and "unknown" card stacks. If all daily cards are in the "known" stack, draw a star in the bottom left corner of your dry-erase board.
__Y __N	7. Shuffle the 10 cards in the daily card deck.
__Y __N	8. Continue reviewing all 10 cards in the daily deck as explained in steps 2-7 until you have drawn three stars in the bottom left corner of the dry-erase board. (In other words, continue until you have answered all 10 cards without error in a single run-through and have accomplished this feat a total of three times in the session.)
__Y __N	9. When you have earned 3 stars, consider the entire daily stack to be "known" cards. So it's now time to update the daily deck.
__Y __N	10. Take any 3 cards from your current daily 10-card deck and transfer them to the weekly "known" deck. Then, on the *Student Log: Mastered Math-facts* form, record the math-facts and current date for the 3 cards that you transfer. Congratulations! These now count as mastered math-facts!
__Y __N	11. Next, take 3 cards from the weekly "unknown" stack and add them to your current daily deck to bring it back up to 10 cards.
__Y __N	12. Begin reviewing the daily stack again (as outlined in steps 2-7) until your time runs out.
__Y __N	13. Before ending the session, place rubber-bands around the weekly "known" and "unknown" decks and the daily stack that you are currently working on. Also, be sure that your *Student Log: Mastered Math-facts* form is up-to-date.

Student Log: Mastered Math-facts

Student: ______________________________ School Yr: ______ Classroom/Course: ________________

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

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

Student Log: Mastered Math-facts

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

Item 49: ______________ Date: ___/___/___	Item 75: ______________ Date: ___/___/___
Item 50: ______________ Date: ___/___/___	Item 76: ______________ Date: ___/___/___
Item 51: ______________ Date: ___/___/___	Item 77: ______________ Date: ___/___/___
Item 52: ______________ Date: ___/___/___	Item 78: ______________ Date: ___/___/___
Item 53: ______________ Date: ___/___/___	Item 79: ______________ Date: ___/___/___
Item 54: ______________ Date: ___/___/___	Item 80: ______________ Date: ___/___/___
Item 55: ______________ Date: ___/___/___	Item 81: ______________ Date: ___/___/___
Item 56: ______________ Date: ___/___/___	Item 82: ______________ Date: ___/___/___
Item 57: ______________ Date: ___/___/___	Item 83: ______________ Date: ___/___/___
Item 58: ______________ Date: ___/___/___	Item 84: ______________ Date: ___/___/___
Item 59: ______________ Date: ___/___/___	Item 85: ______________ Date: ___/___/___
Item 60: ______________ Date: ___/___/___	Item 86: ______________ Date: ___/___/___
Item 61: ______________ Date: ___/___/___	Item 87: ______________ Date: ___/___/___
Item 62: ______________ Date: ___/___/___	Item 88: ______________ Date: ___/___/___
Item 63: ______________ Date: ___/___/___	Item 89: ______________ Date: ___/___/___
Item 64: ______________ Date: ___/___/___	Item 90: ______________ Date: ___/___/___
Item 65: ______________ Date: ___/___/___	Item 91: ______________ Date: ___/___/___
Item 66: ______________ Date: ___/___/___	Item 92: ______________ Date: ___/___/___
Item 67: ______________ Date: ___/___/___	Item 93: ______________ Date: ___/___/___
Item 68: ______________ Date: ___/___/___	Item 94: ______________ Date: ___/___/___
Item 69: ______________ Date: ___/___/___	Item 95: ______________ Date: ___/___/___
Item 70: ______________ Date: ___/___/___	Item 96: ______________ Date: ___/___/___
Item 71: ______________ Date: ___/___/___	Item 97: ______________ Date: ___/___/___
Item 72: ______________ Date: ___/___/___	Item 98: ______________ Date: ___/___/___
Item 73: ______________ Date: ___/___/___	Item 99: ______________ Date: ___/___/___
Item 74: ______________ Date: ___/___/___	Item 100: ______________ Date: ___/___/___

Increase Student Math Success with Customized Math Self-Correction Checklists

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

MATERIALS:

- Customized student math error self-correction checklist (described below)
- Worksheets or assignments containing math problems matched to the error self-correction checklist

INTERVENTION STEPS: The intervention with customized math error self-correction checklists includes these steps (adapted from Dunlap & Dunlap, 1989; Uberti et al., 2004):

1. *Develop the Checklist*. The teacher draws on multiple sources of data available in the classroom to create a list of errors that the student commonly makes on a specific type of math computation or word problem. Good sources of information for analyzing a student's unique pattern of math-related errors include review of completed worksheets and other work products, interviewing the student, asking the student to solve a math problem using a 'think aloud' approach to walk through the steps of an algorithm, and observing the student completing math problems in a cooperative learning activity with other children.

   Based on this error analysis, the teacher creates a short (4-to-5 item) student self-correction checklist that includes the most common errors made by that student. Items on the checklist are written in the first person and when possible are stated as 'replacement' or goal behaviors. This checklist might include steps in an algorithm that challenge the student (e.g., "I underlined all numbers at the top of the subtraction problem that were smaller than their matching numbers at the bottom of the problem") as well as goals tied to any other errors that impede math performance (e.g., "I wrote all numbers carefully so that I could read them easily and not mistake them for other numbers").

   NOTE: To reduce copying costs, the teacher can laminate the self-correction checklist and provide the student with an erasable marker to allow for multiple re-use of the form.

2. *Introduce the Checklist.* The teacher shows the student the self-correction checklist customized for that student. The teacher states that the student is to use the checklist to check his or her work before turning it in so that the student can identify and correct the most common errors.

3. *Prompt the Student to Use the Checklist to Evaluate Each Problem.* The student is directed to briefly review all items on the checklist before starting any worksheet or assignment containing the math problems that it targets.

   When working on the math worksheet or assignment, the student uses the checklist after *every* problem to check his or her work—marking each checklist item with a plus sign ('+') if correctly followed or a minus sign ('-') if not correctly followed. If any checklist item receives a minus rating, the student is directed to leave the original solution to the problem untouched, to solve the problem again, and again to use the checklist to check the work. Upon finishing the assignment, the student turns it in, along with the completed self-correction checklists.

4. *Provide Performance Feedback, Praise, and Encouragement*. Soon after the student submits any math worksheets associated with the intervention, the teacher should provide him or her with timely feedback about errors, praise for correct responses, and encouragement to continue to apply best effort.

5. *[OPTIONAL] Provide Reinforcement for Checklist Use*. If the student appears to need additional incentives to increase motivation for the intervention, the teacher can assign the student points for intervention compliance: (1) the student earns one point on any assignment for each correct answer, and (2) the student earns an additional point for each problem on which the student committed none of the errors listed on the self-correction checklist. The student is allowed to collect points and to redeem them for privileges or other rewards in a manner to be determined by the teacher.

6. *Fade the Intervention*. The error self-correction checklist can be discontinued when the student is found reliably to perform on the targeted math skill(s) at a level that the teacher defines as successful (e.g., 90 percent success or greater).

Reference

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

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

SAMPLE: Math Self-Correction Checklist

Student Name: ______________________________ Date: ______________________________

Rater: Student ______________________________ Classroom: ______________________________

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

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

Math Self-Correction Checklist

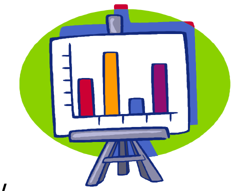
Student Name: ______________________________ Date: ______________________________

Rater: Student ______________________________ Classroom: ______________________________

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

	Problem#1	Problem#2	Problem#3	Problem#4	Problem#5
______________________________ Did the student succeed in this math goal? ❑ YES ❑ NO	__Y __N	__Y __N	__Y __N	__Y __N	__Y __N
______________________________ Did the student succeed in this math goal? ❑ YES ❑ NO	__Y __N	__Y __N	__Y __N	__Y __N	__Y __N
______________________________ Did the student succeed in this math goal? ❑ YES ❑ NO	__Y __N	__Y __N	__Y __N	__Y __N	__Y __N
______________________________ Did the student succeed in this math goal? ❑ YES ❑ NO	__Y __N	__Y __N	__Y __N	__Y __N	__Y __N

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

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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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How To: Build Vocabulary Knowledge through Classwide Tutoring

In academic content areas such as mathematics or the sciences, students must rapidly become familiar with specialized vocabulary terms that either are not encountered often in everyday situations or are used in unfamiliar ways (Adams, 2003). Further complicating this situation is the fact that there are different levels of 'knowing' a word. A student who masters a science term, for example, may pass successively through these following stages: (1) the term is completely unknown; (2) the student vaguely recognizes the term; (3) the student can provide a formal definition of the term; (4) the student can independently use the term flexibly and correctly in various applied oral and written contexts (Beck, McKeown, & Kucan, 2002). According to one estimate, a student typically needs at least 12--and perhaps as many as 17--exposures to a vocabulary term before he or she is able to fully assimilate and use it (Kamil, Borman, Dole, Kral, Salinger, & Torgesen, 2008).

Classwide vocabulary tutoring with constant time delay (Hughes & Fredrick, 2006) is an economical approach that teachers can employ to give a small or large student group repeated exposure to low-incidence, specialized academic vocabulary. In this intervention, students use flash-cards to tutor each other in vocabulary of the teacher's choosing. This explicit drill of terms and matching definitions accelerates students' movement through the stages of vocabulary acquisition and primes them to understand targeted vocabulary in large- and small-group discussions as well as on assignments. The directions outlined here for implementing a classwide vocabulary tutoring program are adapted from Hughes & Fredrick, 2006.

Preparation.

Prior to each tutoring session, the teacher ensures that the following materials are prepared or available for each tutor-pair:

- Folder with pockets to hold tutoring materials
- 5 vocabulary flash-cards, with terms written on one side and definitions written on the other. New vocabulary cards are prepared for each tutoring session. TIP: To save time, the teacher may display terms and definitions on an overhead and have students copy them on flash-cards.
- *Vocabulary Tutoring Student Checklist*: 1 copy to be used for the duration of the tutoring program: This checklist is a review tool for the tutor. It briefly outlines the non-negotiable steps for tutoring a peer.
- *Vocabulary Tutoring: Session Form*: 2 copies that are replaced after each session. The tutee and tutor use this form to record their responses during tutoring.
- *Vocabulary Tutoring: Tracking Form*: 1 copy to be used for the duration of the tutoring program: This form is used to record each tutee's percentage of correctly defined vocabulary terms across tutoring sessions.

Prior to starting the tutoring program the teacher matches students in tutoring pairs:

- The teacher first reviews the class or group list and rank-orders students in descending order by their perceived vocabulary knowledge or reading skills.
- The teacher then puts the names of students from the top half of the class/group into one container and the names of the students from the bottom half into another container.
- Finally, the teacher creates each tutoring pair by drawing one name each from the top-half and bottom-half containers, continuing the process until all names are drawn. These student pairings are recorded on the *Vocabulary Tutoring: Student-Pair Assignments* form. NOTE: If there is an odd number of students in the class/group, one tutoring 'trio' can be made up of 3 students. A student from this trio can be temporarily assigned to work with another student in the class as needed to cover absences.

Training. During several short sessions, the teacher trains students to work together as vocabulary tutors. The teacher has students sit with their assigned tutoring partners. Each tutoring pair has a work folder with all tutoring materials.

To introduce the sequence of tutoring procedures, the teacher sits with another adult or cooperative student and conducts a mock tutoring session. (The steps that tutors follow are outlined in the *Vocabulary Tutoring Student Checklist* that appears elsewhere in this document). The person role-playing the tutee deliberately makes several mistakes to allow the person role-playing the tutor to demonstrate how to handle and record student errors. The teacher then has the student pairs conduct several short tutoring sessions, circulating and providing feedback to each pair. During these practice sessions, students in each pair alternate between tutor and tutee roles. When in the teacher's judgment, the student pairs understand all tutoring procedures (usually after 2 practice sessions), the tutoring program can begin.

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

1. *Introduce the Day's Vocabulary Terms.* In large-group, the teacher displays on an overhead the terms and corresponding definitions for each of the 5 vocabulary items to be the focus of the day's tutoring session. The teacher reads aloud each term and definition twice. The teacher then has the class chorally respond by reading each term and definition aloud twice.
2. *Review Essential Tutoring Steps.* The teacher reminds students of the essential steps of the tutoring program--using the format outlined on the *Vocabulary Tutoring Student Checklist* form. NOTE: This review step can be shortened when--in the teacher's judgment--the students clearly know and can reliably follow the correct procedures in their tutoring pairs.
3. *Begin the Tutoring Session*. The teacher directs students to get their tutoring folders and join their tutoring partners. The teacher sets an audio or visual timer for 4 minutes and directs the students to decide which roles (tutor, tutee) each will take at the outset and to begin tutoring. NOTE: The steps that the students follow during the tutoring session are outlined on the attached *Vocabulary Tutoring Student Checklist*.
4. *Conduct Integrity Checks*. While students are engaged in tutoring, the teacher circulates throughout the room using the *Vocabulary Tutoring Student Checklist* to conduct integrity checks of the tutoring and to intervene if needed with tutoring pairs.
5. *Prompt Tutors to Record Data.* When the session-timer has expired, the teacher prompts tutors to tally their tutee's performance on the daily *Vocabulary Tutoring: Session Form* and copy the ' Percent Vocabulary Words Correct' on the *Vocabulary Tutoring: Tracking Form*.
6. *Have Students Switch Roles and Repeat*. The teacher tells students to switch tutor and tutee roles. The teacher then starts the timer and repeats steps 3-5.

References

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

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

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

	• I count up all of my partner's correct answers in the left ('Tutee') column on the *Vocabulary Tutoring: Session Form* and write the amount in the blank at the bottom of the page. • Then I count up all of my partner's incorrect (crossed-out) answers in the left ('Tutee') column on the *Vocabulary Tutoring: Session Form* and write the amount in the blank at the bottom of the page. • Finally, I calculate the percentage of correct responses and write that figure and the current date on the *Vocabulary Tutoring: Tracking Form*.

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

Vocabulary Tutoring: Student-Pair Assignments

Class/Grade: ______________________ Date: __________________ Teacher(s): __________________

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

Vocabulary Tutoring: Session Form

Date: ________________

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

Percent Vocabulary Words Correct: ____________%

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

Vocabulary Tutoring: Tracking Form

Date	*Student 1:* ___________________________	*Student 2:* ___________________________
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%
/ /	% Vocabulary Words Correct: _________%	% Vocabulary Words Correct: _________%