Assessment in *Math Expressions*

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Math Expressions has a robust and flexible set of assessments that give districts choice to match their needs and grading systems. I do not recommend that you use all of the assessments. Choose as few as possible to do the job for your district and especially select formative assessments that inform your teaching. Below I overview the assessments available for *Math Expressions* and my recommendations about which and how to use these.

Kinds of Assessments

Assessments can identify students who need support in learning specific things.
Assessments should not be used just to give a grade but to improve learning.
Students need to have feedback on errors and how to correct their errors.

Formative Assessments help teachers identify who needs help and on what.

Kindergarten Observational Assessments are important because so much knowledge at kindergarten can and must be observed. We are making new observational assessments for each of the five kindergarten units. These will be available on Think Central soon.

Math Talk observations: Math Talk during classroom lessons in all grades focuses on students explaining their thinking and helping other students with their thinking. Teachers can help students clarify their thinking and explanations and can build their Nurturing Math Talk Classroom to engage more students more deeply. Math Talk enables you to understand student methods and how students understand concepts. These observations every day are crucial formative assessments.

Check Understanding is at the bottom of the Student Activity Book page for each lesson. Do this if you could not tell enough about student thinking during the lesson. You do not need to do all of the Check Understandings.

Strategy or Fluency Check for each Big Idea: A Fluency Check should be a rapid test of fluency and not practice. Some Fluency Checks have way too many problems on them. There are also way too many Fluency Checks. They are really not needed. The single-digit fluency cards and other practice materials in Grades K to 3 are much more valuable because they can be targeted to the needs of individual students as students sort cards to practice only those numbers on which they are wrong or slow. These sorted decks also enable the teacher to know where students are in their learning of single-digit operations.

All fluency practice cards will soon be in Google slide decks that can be accessed from my website karenfusonmath.com: Click on Remote Teaching Materials at the top right and then click on Strategy Cards for Fluency Practice. The link to many helpful teaching materials for each grade is above this link to the strategy cards.

If you must do a few of the fluency checks, follow these guidelines:

Do not do those that alternate operations or at least discuss with students the strategy of doing all additions first and then all subtractions (or all multiplications and then all divisions).

For multidigit operations, only do 2 or 3 problems. That is enough for students to remember and practice that operation. It is better to do that occasionally than to waste time doing a lot of problems with the same operation. The other problems can be used as needed for practice, but students need some way of checking that they have the right answer or they may be practicing wrong steps.

Use the strategy practice cards for single-digit addition, subtraction, multiplication, and division so that practice time enables each child to practice what they do not yet know. Only very occasionally use the single-digit fluency pages.

Assessments for Grades

Districts vary considerably in their needs. Here are some ways I suggest that you gather evidence of student learning to determine a grade/report card score.

Kindergarten Observational Assessments; observations in other grades from your interactive lessons in which students share their thinking;

Selected work including the student in a video explaining a problem in the unit; post these on a secure district website;

Portfolio of selected corrected homework; erase and fix or correct with a colored pencil so you can keep it to remind of errors not to make;

Quick Quiz fixed and/or retaken again later;

Unit Test with errors fixed and/or Unit Test retaken again later.

The Performance Assessment can be used in various ways as extra work. It is not needed for grading purposes.

Assessing for Differentiating and Intervening As Needed: Use the Mastery Learning Loop to Target Intervention Help

Differentiate for one day after each Big Idea lesson chunk of 3 to 6 lessons and before and after the unit test. Read 5 lessons ahead to help you see the progression of the lessons and concepts and see how ideas are continued across lessons so you do not need to stop and review. JUST KEEP GOING using Math Talk in the lessons until you reach the Quick Quiz for a Big Idea.

Give the **Big Idea Quick Quiz** at the end of the last lesson for that Big Idea.

- Analyze the quiz results to plan differentiation.
- Differentiate instruction (flexibly group) for one day:
  - Above-level and on-level students work in self-directing groups on various tasks (see the later section on the Mastery Learning Loop for details).
  - The teacher works with students who need more support in a small group using the Quick Quiz results and formative assessment observations from teaching that Big Idea.
  - Students who need more help also attend teacher-led Response-to-Intervention meetings 3 times a week.

Repeat the above steps for each Big Idea in the unit.

Give the Unit Test that is in the Student Activity Book without any review.

- Based on what students missed on the test, differentiate as above for 1 or 2 days. Do any more needed remediating during the teacher-led Response-to-Intervention sessions.
- If needed for grading, give Form A of the test in the Teacher Assessment Guide. Use the results on the first Unit Test for those students who did well on that test.
- Students who need help beyond 1 or 2 days attend teacher-led RtI meetings 3 times a week (see below).

Repeat the above for each new unit.
A more detailed description of the Mastery Learning Loop is at the end of this document.

Assessing for Response-to-Intervention Meetings for Tier 2 and Tier 3 Catch-Up and Intensive Remediation

The Mastery Learning Loop process outlined above identifies students who need more help for a given Big Idea and helps to keep as many students as possible on grade level. Students who need help beyond 1 or 2 days after a Quick Quiz or a Unit Test can attend teacher-led Response-to-Intervention sessions 3 times a week. It is important that the teacher lead the intervention sessions to be able to use knowledge that has accumulated about intervention students from the classroom teaching. Reteaching the same *Math Expression* lesson eliciting Math Talk and explanations from the intervention students is better than using an unrelated intervention program. The out-of-class interventions can be a combination of post-teaching concepts to meet the needs remaining after the Mastery Loop intervention, pre-teaching class lessons to reduce the need for the next Mastery Loop intervention, and teaching and practicing concepts from earlier grade levels to support on-level learning. Such intervention sessions ordinarily are at least three 20-minute periods with 3 to 5 students at a time. Students who have missed school may benefit from the sessions on content they missed. Tier 3 students may require even more time.

Assessing for Cumulative Review

The Remembering pages are the *Math Expressions* systematic cumulative review. Students who have difficulty with these items can attend the Response-to-Intervention teacher-led sessions and focus on those items. Sometimes it only takes a short time to clarify issues. Students who have trouble on the Remembering pages during any Big Idea also can self-report such issues and get help from peers on those items during the extra practice day after a Quick Quiz. Helping fellow students with Remembering pages is a good choice for the self-directed activities for those who do not need intervention after a Quick Quiz.

Other quick cumulative review activities during a class:

A couple of days after a Quick Quiz, do a 5-minute review eliciting from students and especially from students who need more support.

Have some students plan a quick review during the extra review day after a Quick Quiz and then carry out the review for the class at a later time.

Use the vocabulary cards in the student books to review vocabulary. You or students can choose the best cards to review.

Use selected pictures and words in the student glossary to review vocabulary and concepts.

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Assessing at the Beginning of the Year

The Assessment Guide has two tests at the beginning called the Prerequisite Skills Inventory Test that tests skills from the previous year and the Beginning of Year Test that tests skills that will be learned in the coming year. These tests are there because some districts requested them. I think that starting the year by testing students is one of the worst things you can do. Some younger children cry. I stopped doing pretesting even though some research grants wanted me to do it. Testing students on skills they have not yet had an opportunity to learn (the Beginning of Year Test) is especially indefensible. It can do nothing but make students feel stupid and dislike school. If you must give the Prerequisite Skills Inventory Test, wait at least a week so that you can get your Math Talk Nurturing Classroom underway. Students also need at least this much time to get their "school brains" going after the summer off so the test will be more valid if given a bit later.

Notes on Changes in Unit Tests for 2018

Students Need Practice on Format Issues

The Unit Tests for 2018 were modified to reflect the more difficult formats of some high-stakes test items. These formats do not necessarily appear in lessons, quizzes, or homework. Your students may need an opportunity to see and practice these new test item formats. So you may need to review the format as well as the math content when students do the Unit Review/Test that is in the student books at the end of each unit. Have your students go through the test and discuss which items seem to them to have a new format and how they would solve that format. This approach will help students become more aware test takers. These formats include yes/no and true/false, more than one correct choice, choose from a list, sorting, use given numbers in an answer, and matching. All of these formats require more thinking than just finding the answer, so they merit practicing and discussion by students about how a format might be tricky and might be solved. You can then give the whole test in the student books as a practice test for the mathematical content as well as for the format. Do not review before the test. You want to find out what students remember well. You can then review what students missed. You can give the Form A in the Assessment Guide as needed for grading purposes and afterward discuss any format issues students may have on those test items. As students get used to the new formats, the need to discuss them will decrease. When retesting, you can just give items that students missed and not the whole test.

Errors corrected

A few test items were recently modified to be clearer and more accurate. Some red answers or explanations in the TE were also modified. The modifications appear in the TE and student books online and in recent student books.

Word problems where the picture is not the word written in the answer label

Some word problems in the lower grades have a picture with each word problem. These pictures are to help children understand the problem context. But we do not want children to learn the old solution technique of looking at the numbers in the problem and doing something without reading the problem. If every picture for every problem was the word that needed to be written on the blank to label the answer, children could begin to follow that bad approach. Therefore some of the pictures are about things in the story but are not the answer label. Make it a game for children to find the word problems for which the picture is not the label for the answer. Children can underline the word in the problem that is the label for the answer, write the label for the answer in the blank, and can even draw a picture of that answer if they wish. You and they can call such problems *tricky picture problems*.

The *Math Expressions* Mastery Learning Loop: Keeping All Students on the Grade-Level Learning Path by Giving More Time and Support in Periodic In-Class Interventions and Out-of-Class Tier 2 & Tier 3 Follow-Up Interventions

Karen Fuson, Pam Richards, and Robyn Decker

Differentiating During Whole-Class Lessons

Math Expressions provides high quality classroom instruction using **a Four-Phase Learning Path Teaching-Learning model implementing a Math Talk Community** in the classroom (see Figure 1 below). This model allows for considerable differentiation within whole-class instruction as students solve and explain a variety of solutions to problems. Teachers in Phase 1 help students learn math drawings for concepts and elicit student methods. In Phase 2 *Math Expressions* provides research-based mathematically desirable and accessible methods that enable less-advanced students to advance rapidly. Math drawings made by students help with meaning-making and explaining. In Phase 3 students practice a general math method without math drawings to obtain fluency. Phase 4 focuses throughout the year on maintaining and integrating fluency as students use the Remembering pages and relate old topics and concepts to new topics/concepts.

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Student Methods Used in Learning Path Topic Phases

Phases for a Math Topic	Student Methods Used
Phase 1. Guided introducing *Introduce topic, very short phase, visual models* **Students** share methods. *Teacher elicits solution methods and addresses common errors when necessary.*	Phase 1 methods Methods-with-Errors Concrete & Slow methods Phase 2 methods are possible
Phase 2. Learning unfolding *Student Activity pages, Solve and Explain classroom structure* **2a. Students** explain methods with drawings to stimulate correct relating of concepts and symbols. Model (show) & Instruct/Explain **2b. Students** discuss and compare methods so the math aspects become explicit. Focus: Clarify, Question Extend: Question, Give Feedback *Teacher models and explains only when necessary.*	Phase 1 methods begin to disappear Phase 2a good Helping Step methods and good Compact methods appear Phase 2b good 2a Helping Step methods and good Compact methods are still used 2b less-good Compact methods appear
Phase 3. Kneading knowledge *Student Activity Pages, Homework, Quick Practice* Students gain fluency with reflection and some explaining as needed.	Phase 3 and Phase 4 Fluency with one 2a good Compact method or one 2b less-good Compact method without a visual model (some students are fluent with more than one method)
Phase 4. Maintaining fluency & relating to later topics *Remembering pages are cumulative review* Occasionally discuss and relate old and new methods/concepts.	Methods in Phases 1, 2a, 2b are initially linked to a visual model/math drawing to support understanding.

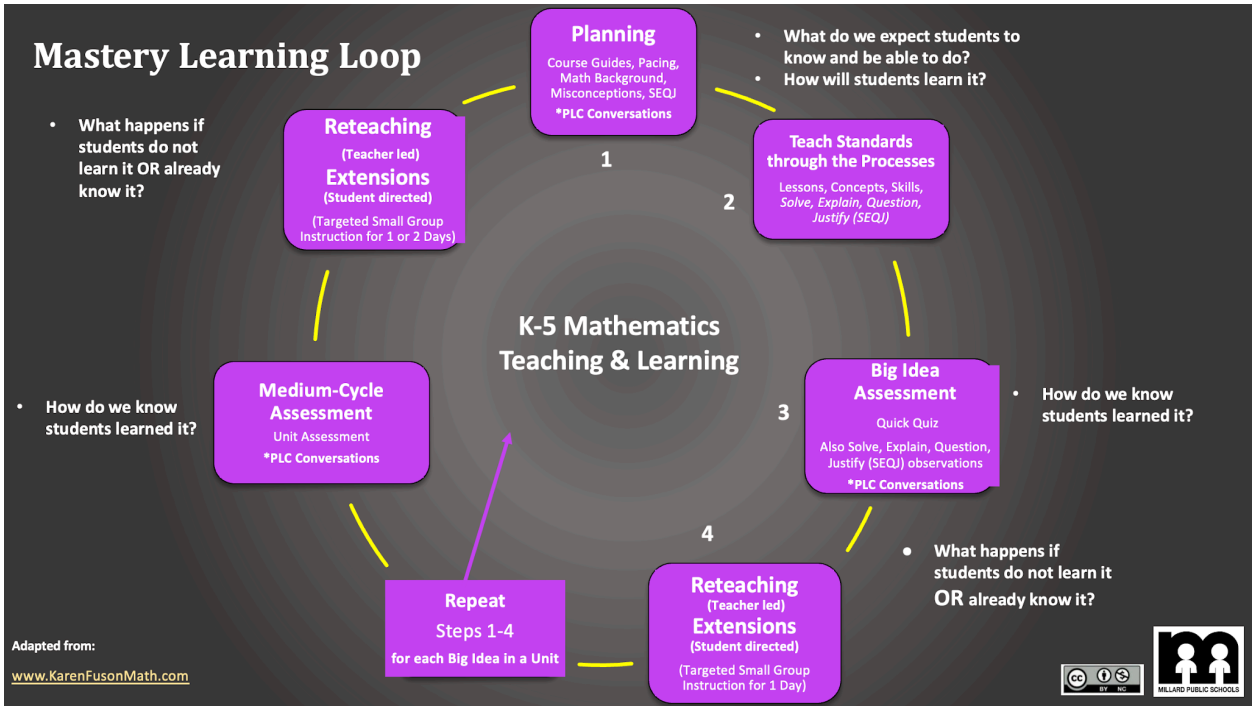
Use the Mastery Learning Loop to Target Intervention Help

The Math Talk Community allows the teacher to do continual formative assessment to modify instruction so as to address errors and extend good mathematical thinking during lessons. But some students need more time and help than others. The *Math Expressions* Mastery Learning Loop was designed to provide **periodic in-class interventions** for students who need this additional support **without slowing down instruction so much** that on-level students cannot learn all of the grade-level content. This approach is usually sufficient to keep most students on grade level throughout a unit.

Math Expressions units are divided into Big Ideas of 3 to 6 lessons. A Quick Quiz is given at the end of each Big Idea. This quiz provides data for the teacher to differentiate the class **in one intervention day at the end of that Big Idea**. The Unit Test in the Student Activity Book given without review provides data for **one or two more intervention days at the end of each unit.**

After each Big Idea Quick Quiz differentiate for one day.
After the unit test differentiate for one or two days.

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Teachers need to read 5 lessons ahead to help see how the lessons build on each other and reduce the need for mastery of each lesson before going on. Some concepts and methods take multiple days for most students to understand, so you do not need to stop and review. **JUST KEEP GOING** using Math Talk in the lessons until you reach the Quick Quiz for a Big Idea.

Then give the **Big Idea Quick Quiz** at the end of the last lesson for that Big Idea.

- Analyze the quiz results to plan differentiation and intervention.
- Flexibly group to **differentiate instruction for one day** during which:
  - above-level and on-level students work in self-directing groups on various tasks (see details below in Differentiation Days and Response to Intervention);
  - the teacher works with students who need more support in a small group using the Quick Quiz results and formative assessment observations from teaching that Big Idea;
  - students who need more help also attend teacher-led Response-to-Intervention (RtI) meetings 3 times a week (see below).

Repeat the above steps for each Big Idea in the unit.

Then **give the Unit Test** that is in the Student Activity Book without any review.

- Based on what students missed on the test, **differentiate as above for 1 or 2 days**. Do any more needed remediating during the teacher-led Response-to-Intervention sessions.
- If needed for grading, give Form A of the test in the Teacher Assessment Guide. Use the results on the first Unit Test for those students who did well on that test.
- Students who need help beyond 1 or 2 days attend teacher-led Response-to-Intervention meetings 3 times a week (see below).

Repeat the above for each new unit.

Students who have trouble on the Phase 4 Cumulative Review Remembering pages can attend the Response-to-Intervention teacher-led meetings or get help from peers on those items during the intervention days.

In-Class Intervention Days and Extra Response to Intervention (RtI) Sessions

In the Mastery Learning Loop, an in-class intervention day occurs after each Big Idea and for one or two days after giving the Unit test without review. **On-level and advanced students will work in self-directed activities** alone, in pairs, or small groups on appropriate activities in the learning stations as described below. **The teacher will work with students who need more support** as identified through an item analysis of the quiz and/or by ongoing formative assessment in the classroom. *Math Expressions* has summative unit assessments with multiple forms that identify similar content and strategies. The unit test in the Student Activity Book is given at the end of the unit, and the results—as well as all of the teacher's knowledge about individual students for that unit—are used to determine the intervention levels for another day or two days as needed. Form A of the test in the Teacher Assessment Guide can be used to assess learning after the intervention days. Students who did well on the first unit test do not need to take it again.

When students demonstrate a need for **sustained and in-depth Tier 2 or Tier 3 intervention**, schools need to provide for additional time outside of class for students to receive support and more time with the *Math Expressions* lessons and concepts with which those students are experiencing difficulty. This will usually be most effective **when done by the regular classroom teacher**, who knows the individual students and their difficulties because of the on-going observational of student work on student activity book pages, homework, and formative assessment questions. Such Tier 2 and Tier 3 out-of-class intervention can be a combination of post-teaching concepts to meet the needs remaining after the Mastery Loop intervention, pre-teaching class lessons to reduce the need for the Mastery Loop intervention, and teaching and practicing concepts from earlier grade levels to support on-level learning. Such interventions usually require at least three 20-minute periods with 3 to 6 students at a time. Tier 3 students may require even more time.

The Mastery Learning Loop in-class intervention sessions will contain a mixture of high needs students who often need extra learning time and support and students who missed class or had special difficulties with the given Big Idea concepts on the Quick Quiz. Some students will be able to move fairly quickly during the intervention time to independent practice while others will need more problems and support directed at particular aspects of difficulty (and perhaps later additional out-of-class support). **The teacher plans systematic and explicit instruction focusing on the contextual representations and math talk during the intervention period.** This facilitates diagnosing individual student problems and aspects of needed support. The instruction can use earlier lessons and problems quite closely because many intervention students just need to consider and solve the same or additional problems when help is available.

Small Group and Learning Station Implementation on the Intervention Days

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Math Expressions **provides a wide range of resources to support teachers to arrange differentiated activities for on-level and advanced students** in flexible groups using learning stations. During the first Mastery Learning Loop intervention day, the teacher focuses on supporting all students in learning how to engage in purposeful practice and/or enrichment activities. On subsequent intervention days, **on-level and advanced students manage themselves with minimal teacher support** while **the teacher works with struggling students**. Having a whole-class period for the interventions allows students to understand how the learning stations function and experience more than one such station during the class period if they desire. If regular math class is more than 60 minutes, such differentiating can be done more frequently to enable the teacher to work with students who need it between quizzes. This approach should not slow up the rate at which lessons are done by extending lessons over to a second day.

Teachers who have followed the pacing guide for *Math Expressions* and used the Mastery Learning Loop rather than reteaching or differentiating more frequently **have time to finish all needed units before spring testing dates.** Teachers then can use the rest of the year to catch up students who need additional work and to extend and deepen learning for students already on grade level using learning stations.

Math learning stations can occur anywhere in the classroom: small clusters of desks, tables, and even on the floor. Students can work independently, with a partner, or a small group of 3 to 4 collaboratively to use materials that will expand their mathematical thinking. The purpose of each station is to provide activities that reinforce concepts, extend prior instruction, and/or allow students to deepen mathematical understandings.

The number of stations set up varies with class size and student needs. In the first unit there may be two or three stations with the same activity in order to establish routines, management, and teach students how to function independently in work stations. The station time can be shorter, with perhaps one or two rotations for the first few times. With experience, students will become familiar with the station structure, and the amount of independent time and number of rotations can be increased. Students can and should be involved in setting up the stations by finding the resources they need to complete the activities. Additional ideas for using stations or centers in the classroom can be found in the Center Planning Guide in the *Math Expressions* Math Activity Center Tri-fold and in the online version of the Math Activity Center.

On the first day of use of the learning stations**, the teacher introduces the work stations** and can use much of the class period to allow for explanation of the stations, establish the expectations for self-management, and teach students the routine of what to do if they have a question while the teacher is working with other children. This first lesson should be used to:

- model how to use and find materials for using the leveled Activity Cards from the Math Activity Center;
- model how to write a good response to one of the writing prompts found on the back of the leveled Activity Cards from the Math Activity Center;
- discuss where to find materials for completing station work;
- discuss what to do if they finish before it is time to switch to a new station.

After students can function well independently, 10 to 20 minutes of a regular class period can be used with such activities while the teacher catches catch up and helps struggling students. Fewer learning stations might be used in this case. New kinds of work stations used later on in the year may take some extra time to introduce, but the initial expectation is that students will figure out and manage themselves in stations and can propose and design new stations for future days.

Learning Station Ideas

Station activities should allow students to practice problem solving, communicating, and making connections between big mathematical ideas as well as representing mathematics in many ways. Students also need opportunities for choice in how they engage in the mathematics. Many of the resources listed below are included in the *Math Expressions* Math Activity Center Tri-fold and in the online version of the Math Activity Center.

Literature Station

- The Math Readers from the Math Activity Center or the *Math Expressions* Literature Library books can help students broaden their understanding of the mathematical idea or even develop a stronger conceptual understanding of the big idea. Teachers can either use whole group time to read aloud the book (depending on the difficulty of the book) or have the students read the book in the station.
- The Math Readers include questions and activities at the end of each book. The Teacher Guides that come with the Literature Libraries offer suggestions or activities that students can do to engage with the text or content of the book.

Enrichment Station

- Challenge Activity cards and
- Challenge copy masters from the Math Activity Center.

Fluency Station (choose some and vary as needed):

- Strategy Cards
- Check ups
- Quick Practice activities
- Fact fluency triangle cards (Math Mountain cards)
- Board games from the Math Activity Center
- Interactive Games and Fluency Builders from the online Math Activity Center

Vocabulary Station

- Record vocabulary words in a math dictionary, use graphic organizers (for example, the Frayer Model) to define, draw, find similarities and differences, etc.
- Play matching/concentration games with vocabulary and definitions.
- A Vocabulary Game can be found in the Math Activity Center and additional activities are in the back of the Student Activity Book.
- Vocabulary Cards are at the beginning of every unit in the Student Activity Book.
- The free downloadable Study Pop App can also be used to practice vocabulary.
- Use suggestions in the lessons for English Learners.

Writing and Problem Solving Station

- Use the Math Writing Prompts found on the backs of the leveled Activity Cards in the Math Activity Center.
- Create your own word problem and make a drawing and explain the solution on the back.
- Solve or write multi-step problems.

- Anytime problem (Gr. 3-6): Students solve and then write 2 more related Problems of the Day.
- Solve problems written by classmates.
- Use questions from the PARCC, Smarter Balanced, or High Stakes test prep books online (Grades 3 to 6).

Catch up or Helping Station

- Student Activity book page
- Homework or Remembering page (past or present)
- Solve and Explain activities with word problems
- Reteach and Practice copy masters in the Math Activity Center.
- Interactive Response-to-Intervention Tier 1 or 2 in the online Math Activity Center

Place Value Station

- Hundreds board activities- patterns, hundred chart puzzles
- Math Board drawings representing various numbers
- Secret Code Card activities
- Daily Routines for K, 1, 2

The In-Class Interventions

Working with intervention students at the board where each can solve is one good approach because teachers can see student work easily, everyone can group around a given problem as it is explained, and the teacher can offer corrective feedback as students solve the problems. On-level or advanced students can help individuals or ELL students during this activity, differentiating their own thinking as they do the challenging task of helping someone else with their own ways of thinking.

Tier 2 and Tier 3 students may need to solve more problems than the on-level and faster learners, and **they often need help at different individual critical points** where they do not understand some specific concept or idea. Some children just need the extra practice with the teacher available to help (even if the teacher is not needed for most problems), and then the problem solving begins to come together and flow more smoothly and confidently. The intervention can reuse the same problems used in class. This gives confidence to students. Teachers can also make up similar problems or have students begin doing the homework with the teacher available to help. Resources for Tier 2 and 3 intervention can also be found in the online Math Activity Center.