



# Investigations

in Number, Data, and Space<sup>®</sup>

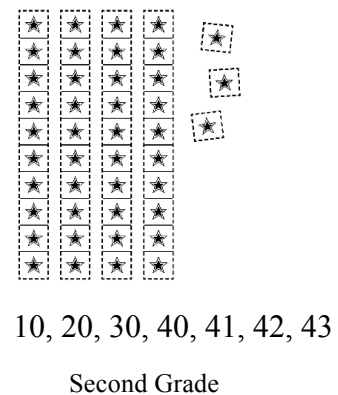
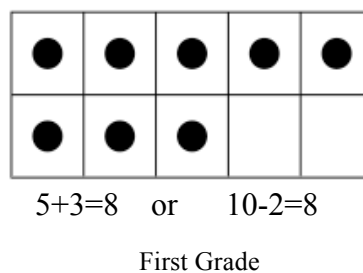
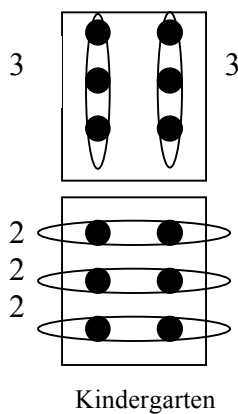
## Practice and Review in *Investigations*

Many adults have distinct memories of practice from when they went to school. Students worked alone, on sheets of many similar problems, or with flashcards. The goal of such drill was memorization and speed was key. Today's students need more than this. They must achieve fluency with the same content that their parents were expected to master, and more. They must be able to solve problems accurately, efficiently, flexibly, and with understanding.

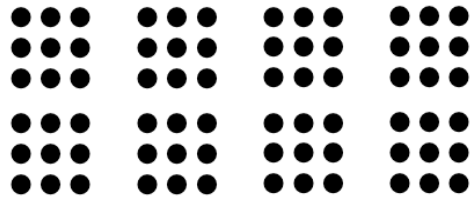
Students need repeated experience with an idea, concept, or skill in order to become fluent with it. To be effective, practice and review needs to be meaningful. It should provide repeated opportunities to become fluent with a skill while also deepening one's understanding of the operations. It should engage children and allow teachers to assess their students. Opportunities for such meaningful practice and review are embedded throughout *Investigations*.

**Classroom Routines (K-3) and Ten-Minute Math Activities (3-5).** One way that *Investigations* incorporates review and practice is through Classroom Routines and Ten-Minute Math. These brief activities, done in 10-15 minutes outside of the 60-minute math Session, are designed to provide practice with current concepts and skills, and to review previously introduced content.

Consider *Quick Images*, an activity in Kindergarten, a Classroom Routine in 1-2, and a Ten-Minute Math activity in 3-5. Students get three opportunities to briefly view an arrangement of dots. Their task is to figure out how many dots there are, and how they know. In K-2, images focus on counting and combining; on seeing and using groups; and on connecting numbers and notation to the different ways of seeing the images.



In grades 4-5, the images focus on groups of groups and on connecting multiplication (and division) notation to the different ways students see the image. For the following image, students might see and use groups of 3, 6, 9, and/or 10, and generate equations like those to the right of the image. The discussion of such an image provides far more practice than simply answering  $8 \times 9 = ?$ . It includes important topics about the operation of multiplication, in addition to “fact practice”.

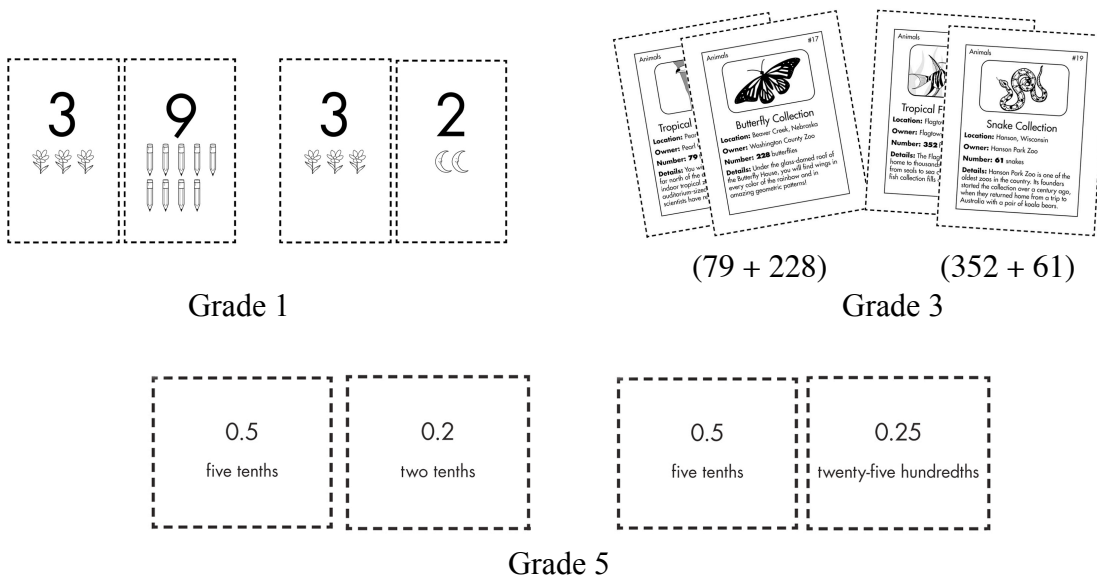


$9 \times 8 = 72$   
 $3 \times 3 \times 8 = 72$   
 $4 \times 2 \times 9 = 72$   
 $6 \times 3 \times 4 = 72$   
 $8 \times 10 - 8 = 72$

Typically, a class analyzes 2-3 images in one sitting. Imagine the amount of practice students get when this activity is revisited regularly throughout the year. Note that *Quick Images* is often used to provide targeted practice of particular ideas, and that variations also focus on things like coin names and values, and 2-D and 3-D shapes.

**Games and Activities.** Students also practice and review important math ideas as they work with a partner or small group to solve a problem, do an activity or play a game. Games provide a powerful form of practice because students like games, and they want to win. They choose to play again and again, and work to find more efficient strategies for playing. In addition, teachers can use the suggested variations to adapt the games, to provide appropriate practice for the range of learners.

Consider the *Double Compare* games that span the curriculum K-5. In these games, students compare two pairs of numbers to decide which has the larger sum. In the basic version, each player turns over two number (or dot) cards and the player with more says “Me.” K-1 students play with numbers to 6 and then to 10. In third grade, students compare 3- and 4-digit numbers, while fifth graders compare decimal numbers.



**Grade 1**  
 (3, 9) and (3, 2)

**Grade 3**  
 (79 + 228) and (352 + 61)

**Grade 5**  
 (0.5, 0.2) and (0.5, 0.25)

By the end of a game, students have solved numerous addition problems, compared many pairs of numbers, and encountered important ideas in place value.

**Individual Work.** The curriculum includes several components designed to provide opportunities for independent review and practice. The Student Activity Book provides pages for in-class work, homework sheets, and Practice Pages. The Student Math Handbook is a reference book that teachers, students, and families can use to review important math ideas and to learn how to play games that provide needed practice. (Read more about the components that provide practice and review at <http://investigations.terc.edu/components/practice-review/index.cfm>.)

One example of independent practice is students' work with "the facts." After encountering these familiar combinations in a variety of contexts, including whole and small group activities, each student receives a set of cards to use as a tool for determining which facts they know and which they are still working on. The cards include a Clue or Start With line that encourages students to use what they know to help them with the facts they find hard to remember. Working with these cards is one way students prepare for the assessments of the facts in grades 2-5.

$5 + 8 =$ $8 + 5 =$ Clue: $8 + 2 = 10$ , and 3 more
---

$6 \times 8$ $8 \times 6$ Start With: $6 \times 4 = 24$
---

## Conclusion

The development of the *Investigations* curriculum paid particular attention to practice and review. In addition to the components described above, practice is built into the structure and sequence of the *Investigations* units, both within and across grade levels. The result is a curriculum with an explicit, coherent, and comprehensive approach to review and practice, one that embodies NCTM's vision of meaningful practice:

"Practice needs to be motivating and systematic if students are to develop computational fluency, whether mentally, with manipulative materials, or with paper and pencil. Practice can be conducted in the context of other activities, including games that require computation as part of score keeping, questions that emerge from children's literature, situations in the classroom, or focused activities that are part of another mathematical investigation. Practice should be purposeful and should focus on developing thinking strategies and a knowledge of number relationships rather than drill isolated facts." (NCTM, 2000. *Principles and Standards in School Mathematics*, p. 87.)