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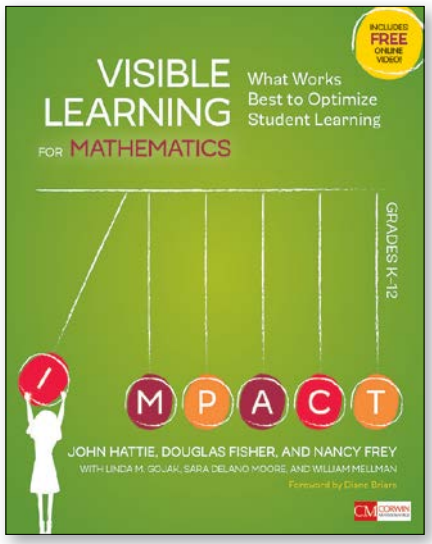

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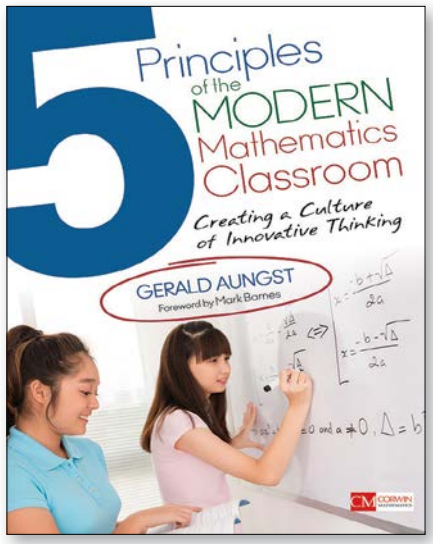

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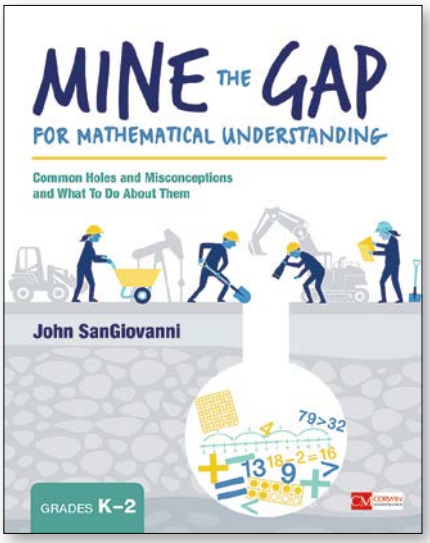

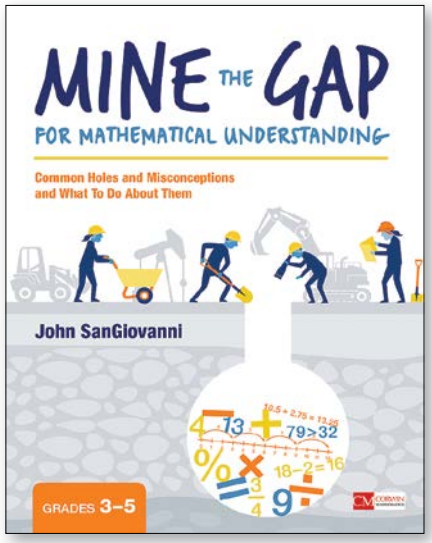

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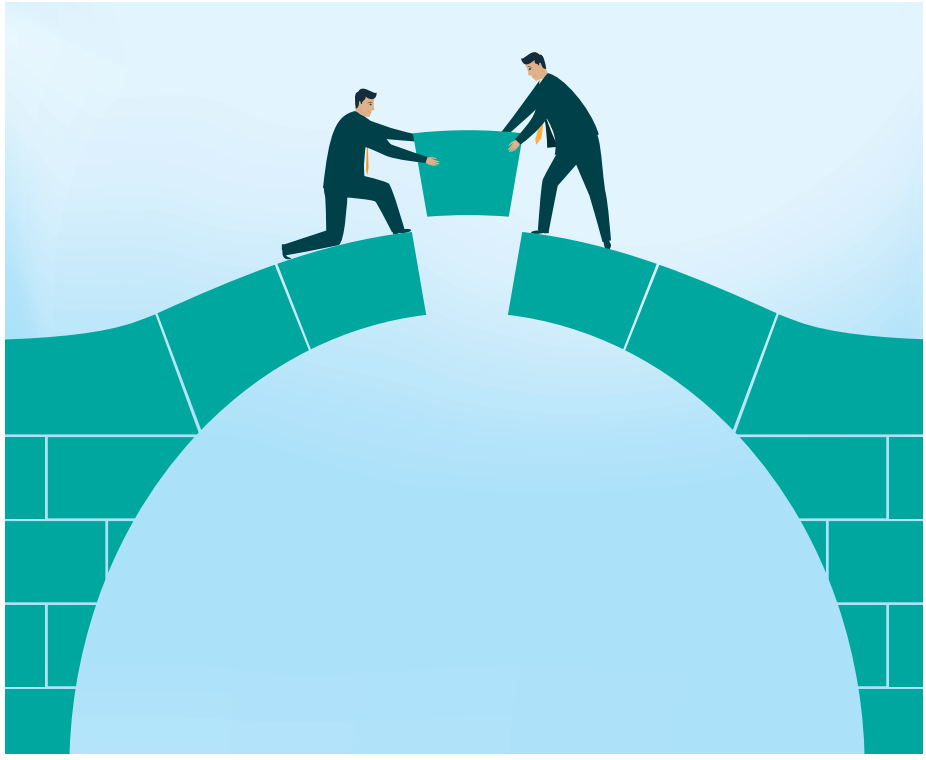
Establishing a mathematics whole-school agreement

KAREN S. KARP, SARAH B. BUSH, AND BARBARA J. DOUGHERTY

A whole-school agreement is one in which all educators in a school community agree that mathematics is better taught when everyone shares in consistent language, symbols and notation, models and schema, and rules that support developing learners. The idea behind this comprehensive agreement is not unlike a schoolwide behavior management policy—whereby children hear the same phrases, share identical expectations, and experience practices that are common and consistent year after year across classrooms and throughout the school. Having a similar common approach in mathematics reduces the need for reteaching and provides a level of familiarity. It also lessens students' cognitive load and diminishes confusion while increasing students' ability to "hit the ground running" each year in learning new mathematical content and processes.



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This agreement requires buy-in from the school community—teachers, paraprofessionals, and administrators. Once the norms of the agreement are established, they should be communicated to parents and guardians so that they too can model the approaches that will best support their children. Through strategic professional development and full school commitment, the same language, symbols and notation, models and schema, and rules are shared across the grades and build on each other vertically.

Moving to this whole-school model, teachers must not only focus on their own grade-level standards but must also keep a broader goal in mind: How will students in the school be prepared to be successful as they move from grade to grade? All building administrators and supervisors of instruction should be leaders and advocates for the whole-school agreement.

Areas to consider

We suggest four main areas for consideration as a starting point as you create your own whole-school agreement, after which we highlight several examples from each of the four areas.

1. Language
2. Symbols and notation
3. Models and schema
4. Rules

Language

Outdated and less conceptual mathematical language—for example, *borrowing, carrying,* and *reducing fractions*—could be replaced with more mathematically appropriate language, such as *regrouping* and *simplifying fractions to lowest terms* (Karp, Bush, and Dougherty 2014). The use of "cute" or "fun" language might

confuse students as they carry that terminology to subsequent grades. For example, the commutative property of addition might be referred to as the *Ring around the Rosie* property by students in early grades. Later, those students may notice a similar pattern in multiplication and refer to it again as the "Ring around the Rosie" property rather than the commutative property of multiplication. This is not a mathematically appropriate term. Agree to the language that will be used, then hold to it.

Symbols and notation

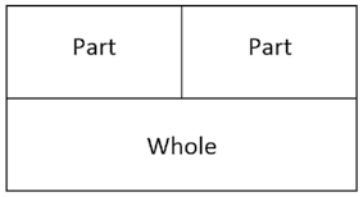
Fractions are symbolic representations that should be represented accurately and appropriately when they are initially introduced. When fractions are represented with a slanted fraction bar (3/8), we have noticed that elementary school students may confuse the diagonal bar as the number 1 and thereby read what they have written as 318. A more appropriate representation is a stacked fraction ($\frac{3}{8}$) so that the denominator is distinct. Essential schoolwide discussion should also emerge around the use of a symbol to represent an unknown. From early grades, an empty box or a question mark can be placed in the equation in the appropriate position. Later, those symbols can segue to a letter as a variable.

Models and schema

Students must be able to use multiple representations and connect those ideas from models to symbols to real-world situations. Such models as number lines or graphic schemas (see **fig. 1**) for interpreting the meaning of operations can be consistent across the grades. For each of these representational models that can be used for multiple grades with multiple ideas, decide on one and use it across all grade levels, building on the foundation as concepts become increasingly sophisticated.

FIGURE 1

Many representational models can be used for multiple grades with multiple ideas; decide on one and use it across all grade levels.



Rules

Sharing rules in a particular grade may cause confusion later on as students move to number systems or concepts that are more complex. For example, being told, "When you multiply a number by ten, just put a zero at the end of the number," would not go as planned for students working on 5.3 × 10; students would give 5.30 as the answer. For more information on thirteen of these rules that "expire" at the elementary school level, see Karp, Bush and, Dougherty (2014); and for twelve rules that "expire" at the middle school level, see Karp, Bush, and Dougherty (2015).

A unified, collaborative mathematics culture

A well-articulated and carefully aligned whole-school agreement supports students by keeping the language, symbols and notation, models and schema, and rules consistent or developing in a logical progression. This unified approach is particularly helpful for students who struggle, as it provides a recognizable component to new content. Additionally, all learners in a school can make connections among ideas in a unified and collaborative culture that promotes stronger learning in mathematics.

Join us for a chat

On the second Wednesday of each month, *TCM* hosts a lively discussion with authors and readers about a topic important in our field. You are invited to participate in the fun.

On **Wednesday, September 14**, at **9:00 p.m. EDT**, we will expand on the article "Evidence-Centered Assessment" by Kimberly Morrow-Leong (pp. 82–89). Follow along using #TCMchat. Unable to participate? Follow us on Twitter @TCM_at_NCTM and watch for a link to the recap.

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The News & Views department is edited each month by **Tonya Bartell, tbartell@msu.edu,** an associate professor of mathematics at Michigan State University, and **Anita Wager, awager@wisc.edu,** an assistant professor at the University of Wisconsin–Madison.

Math journals: A window into students' whole-school thinking

Robyn Silbey, PD and Campus Consultant

A math journal is one of the best ways to learn about your students' thinking in math class. Journals help students reflect on their knowledge as well as organize their thoughts on paper, which is especially useful when ideas are too complex to keep in their heads. How you use math journals will depend on your purposes, preferences, and the particular age and needs of your students. Here are a few popular uses of math journals:

- Record notes and solve problems during daily lessons. As students work through daily explorations and activities, their notes will help them retrace their thinking for easy application to new situations.
- Reflect on learning at the end of a math exploration or lesson. Students can complete sentences, such as (a) What I know about ____ so far is ____ or (b) What I learned about ____ today is _____.
- Students can write about the part of the lesson that they enjoyed most, providing you with insight about the activities and strategies that motivate your students to learn.
- Respond to a "big idea" question that will be discussed during whole-class time. Students might respond to a prompt, such as, "What are some situations in which multiplication is used in real life?" After recording their own ideas on paper, they can share with a partner or with the entire class.

Reading students' journal entries allows you to give valuable feedback to your students and provides crucial information for you. Think about these questions as you read:

- Is the mathematics correct and the terminology appropriate?
- Does the student include reasoning that supports the solution?
- What would you still like to know about the student's thinking or response, even after evaluating the entry?

Although responding to all entries is not an efficient use of your time, an occasional remark or question would indicate to students that you value the time they invest in journal writing. When you do decide to give individual reactions, avoid such comments as "Good job" or "Nice thinking," which do not offer a child authentic feedback. Instead, focus on the mathematics in the task and indicate your interest in how they think and reason, offering suggestions for further thinking.

Questions? Comments? Contact robyn@robynsilbey.com.