The Math Pact
The Book at a Glance

Consider this book your handbook and go-to guide for ensuring equitable, coherent instruction across grades, schools, and your district. You'll find a number of features throughout the book to aid you in your journey creating a Mathematics Whole School Agreement (MWSA).

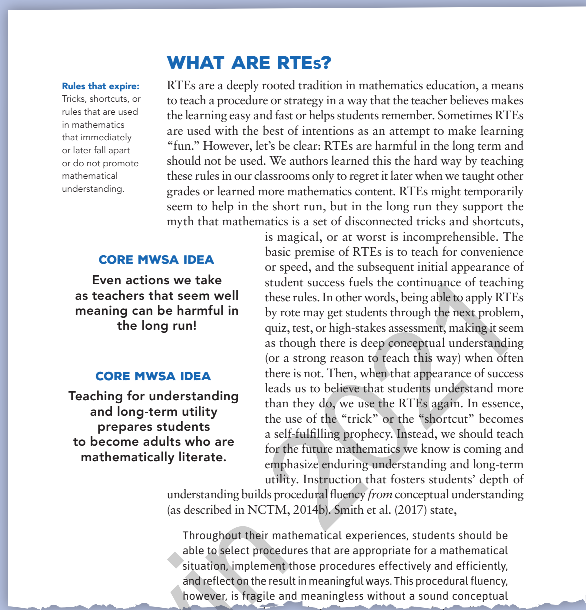
FIGURE 2.1 • WORDS THAT EXPIRE IN MIDDLE SCHOOL

Words that expire	Expiration details	MWSA-suggested alternatives
General		
"Show your steps"	"Show your steps" suggests that the student should be carrying out a procedure.	Instead, we recommend saying "Explain your thinking," as this phrase is inclusive of multiple options of the possible mathematical representations (e.g., concrete models, illustrations, words, graphs, symbols) and multiple strategy options.
Numbers		
Calling zero a *placeholder*	A placeholder is something that stands for something else. Zero is not a placeholder for another number.	Zero is a *number*, and as such it is a value that may in some cases represent no units or no tens, no tenths, no hundreds, no hundredths, and so on in the decimal representation of the number.
Reading a multidigit whole number such as 123 as either "one, two, three" or "one hundred *and* twenty-three"	Reading a number by its digits only does not promote understanding of the number's magnitude. When the word *and* is inserted, it implies that the number consists of a whole and a part, as in a decimal or fraction.	123 should be read as "one hundred twenty-three." The same is true for other multidigit whole numbers—no *and*. Meaning must be developed from the start, and there is no place value meaning given by calling out digits. However, the word *and* can be stated when you are reading a number that has a decimal point (as in 2.45 being read as "two *and* forty-five hundredths" or \$9.26 as "nine dollars *and* twenty-six cents") or a mixed number such as $3\frac{1}{2}$, read as "three *and* one half." When people in the media read a multidigit whole number and say, for example, for the year 2021, "twenty, twenty-one" or "two thousand *and* twenty-one," we hope your students catch those and say "No *and*!"
Saying *smaller than* or *bigger than* or *the*	*Bigger* and *smaller* are often used when making comparisons, such as in the case of area or length. *Greater*	The preferred language here is *greater than* and *less than*. If you are talking about a specific measure, you can say *longer*

In-depth charts will help you find a consistent approach to preferred and precise mathematical language, notation, representations, rules, and generalizations that will help clarify students' mathematics understanding.

FIGURE 5.3 • RULES THAT EXPIRE COMMONLY USED IN MIDDLE SCHOOL AND SUGGESTED ALTERNATIVES

Rule that expires	Expiration details	Suggested alternatives
Number		
Multiplication is repeated addition.	While multiplication can be thought of and written as a repeated addition equation, when students only think of multiplication in this way, they might overgeneralize this idea. For example, they might believe that 4^3 is $4 + 4 + 4$, instead of $4 \times 4 \times 4$. Or they may think that you can use repeated addition for fraction factors, such as in the problem $\frac{1}{4} \times \frac{1}{3} = ?$.	Write expressions such as 4^3 and others in expanded form to reinforce the meaning and help counteract any misunderstanding. Some students will try to add 18, 23 times to find the product of 23×18. This is inefficient and opens up more opportunity for error.
The absolute value of a number is just the number. Absolute value is like a magic hat: Whatever you put in comes out positive.	When finding the absolute value of a number, students are sometimes told that the absolute value is just the number with a positive sign. If the number is positive, it stays positive, and if it is negative, you simply drop the negative sign. For example, $\lvert -5 \rvert = 5$. This approach might seem harmless but causes confusion when students soon encounter $-\lvert -5 \rvert$. They will be unsure as to how the absolute value could be negative. This rule can cause further confusion when solving absolute value equations.	Focus on the definition of absolute value (i.e., its distance from 0 on a number line), and use that language consistently (and require students to use it) when discussing absolute value.



WHAT ARE RTEs?

Rules that expire: Tricks, shortcuts, or rules that are used in mathematics that immediately or later fall apart or do not promote mathematical understanding.

RTEs are a deeply rooted tradition in mathematics education, a means to teach a procedure or strategy in a way that the teacher believes makes the learning easy and fast or helps students remember. Sometimes RTEs are used with the best of intentions as an attempt to make learning "fun." However, let's be clear: RTEs are harmful in the long term and should not be used. We authors learned this the hard way by teaching these rules in our classrooms only to regret it later when we taught other grades or learned more mathematics content. RTEs might temporarily seem to help in the short run, but in the long run they support the myth that mathematics is a set of disconnected tricks and shortcuts, is magical, or at worst is incomprehensible. The basic premise of RTEs is to teach for convenience or speed, and the subsequent initial appearance of student success fuels the continuance of teaching these rules. In other words, being able to apply RTEs by rote may get students through the next problem, quiz, test, or high-stakes assessment, making it seem as though there is deep conceptual understanding (or a strong reason to teach this way) when often there is not. Then, when that appearance of success leads us to believe that students understand more than they do, we use the RTEs again. In essence, the use of the "trick" or the "shortcut" becomes a self-fulfilling prophecy. Instead, we should teach for the future mathematics we know is coming and emphasize enduring understanding and long-term utility. Instruction that fosters students' depth of understanding builds procedural fluency *from* conceptual understanding (as described in NCTM, 2014b). Smith et al. (2017) state,

CORE MWSA IDEA

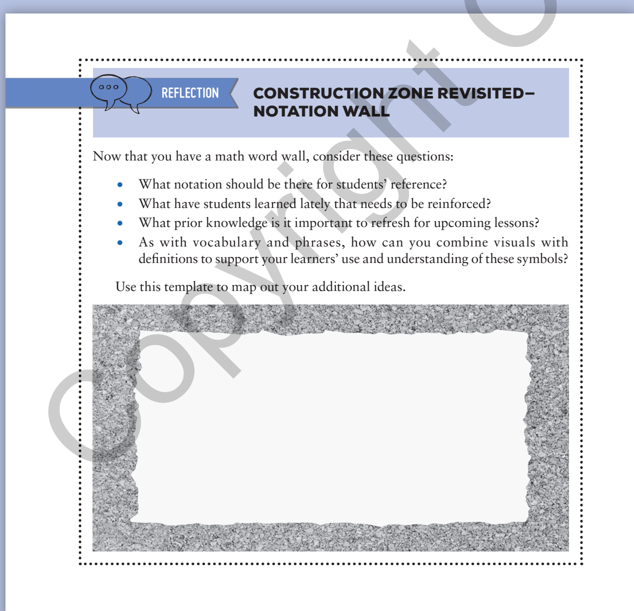
Even actions we take as teachers that seem well meaning can be harmful in the long run!

CORE MWSA IDEA

Teaching for understanding and long-term utility prepares students to become adults who are mathematically literate.

> Throughout their mathematical experiences, students should be able to select procedures that are appropriate for a mathematical situation, implement those procedures effectively and efficiently, and reflect on the result in meaningful ways. This procedural fluency, however, is fragile and meaningless without a sound conceptual

Throughout the book, find definitions of key terms and notes on core MWSA ideas.



REFLECTION

CONSTRUCTION ZONE REVISITED–NOTATION WALL

Now that you have a math word wall, consider these questions:

- What notation should be there for students' reference?
- What have students learned lately that needs to be reinforced?
- What prior knowledge is it important to refresh for upcoming lessons?
- As with vocabulary and phrases, how can you combine visuals with definitions to support your learners' use and understanding of these symbols?

Use this template to map out your additional ideas.

Reflection tasks help you consider how key ideas relate to your own instruction.

TRY IT OUT

MWSA HANDOUT FOR REPRESENTATIONS

Representations We Are Using in ______________________________________

Representations that may cause confusion	Agreed-on representations in our whole school agreement

Try It Out and Things to Do sections provide concrete opportunities to directly engage with your team in creating a Mathematics Whole School Agreement.

THINGS TO DO

Send the Letter

Hello ___________________________,

We have already written to you about the Mathematics Whole School Agreement that we are developing across the entire school this year. As you know, we are all working hard to align our instruction in mathematics across the grades. As you may remember, earlier this year you received a letter where we talked about the mathematical language and notation we use during instruction. We are now looking at the representations we use in mathematics. As a mathematics team, we have agreed on the physical materials we may use to model the mathematics and the ways in which we explain the mathematics by means of pictures or diagrams and mathematical symbols. Everyone in the school involved in the teaching and learning of mathematics is using these and is focused on teaching for students' depth of understanding and connection to mathematical ideas within and across grades. The way we model in mathematics has an effect on the way students understand mathematical ideas. We want your student to become an adult who knows mathematics and will succeed in whatever they choose to do in life. We thank you for joining us in making this shift to be consistent in how we support your student as we prepare them for their personal and professional future!

Thank you for your help,

Your student's teachers and principal