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 ELEMENTARY 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		
Using the words *take away* as the generic way to read a subtraction sign in an equation—such as 14 – 8, read as "14 take away 8"	Not all subtraction problems are take-away situations and thus should not always be read that way.	Instead, simply use *minus* when reading such an expression or equation. Other ways to describe it include "14 subtract 8," "8 less than 14," or "the difference between 14 and 8."
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*!"
	Bigger and *smaller* are often used when …	

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 ELEMENTARY SCHOOL AND SUGGESTED ALTERNATIVES

Rule that expires	Expiration details	Suggested alternatives
Numbers and operations and algebraic thinking		
Addition makes numbers bigger, or you should always expect a larger answer when you add.	When students begin learning about the operations of addition, they are often given this rule as a means to develop a generalization relative to operation sense. However, the rule has many counterexamples—some immediate. For example, addition with zero does not generate a sum larger than either addend. It is also untrue when adding two negative numbers (e.g., –3 + –2 = –5), because –5 is less than both addends.	The main focus should be on teaching that the meaning of addition involves combining or joining quantities. Students should talk about the reasonableness of their answers, and giving them "fake" student work where mistakes can be discussed is far better than just giving them a rule that "bigger" answers are expected and that condition alone means that they have reasonable answers.
You cannot take away a larger number from a smaller number.	Students may first hear this phrase as they learn to subtract whole numbers. When students are restricted to only the set of whole numbers, subtracting a larger number from a smaller one results in a negative number—an integer that is not in the set of whole numbers—so this rule is true. But later, when students encounter applications or word problems involving contexts that include integers, they learn that this "rule" is not true for all problems.	In the early years, this rule can cause a great deal of confusion. When students are subtracting two-digit numbers as they think of this rule they might give this response: 32 – 15 23 The preferred way to present this idea is to use concrete materials—such as base 10 materials for the double-digit subtraction problem above. Start by representing the minuend with the materials; so in this case you would show 3 tens and 2 ones (preferably on a place value mat). Ask a student to remove 5 ones. Hopefully, they will not say you cannot take away a larger number from a smaller and instead say, "I can't do that." Ask them to consider the entire quantity of 32—can you

Remember, as you work through this chapter, you're actively establishing the RTE component of your MWSA—you're making great progress!

WHAT ARE RTEs?

RTEs are a deeply rooted tradition in mathematics education, a means to teach a procedure or a 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

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

CORE MWSA IDEA

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

CORE MWSA IDEA

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

REFLECTION

CONSTRUCTION ZONE—WHAT REPRESENTATIONS ARE MOST BENEFICIAL AND SPAN THE GRADES?

As you think about the representations you will use as part of your MWSA, consider these questions:

- Which representations can you agree on that will span multiple grades?
- Which representations have you used that are not productive in terms of helping students learn or for which you may not know all the options for using them?
- Which representations might cause confusion or create or perpetuate misconceptions?

Using the following space, record representations that are being used that need to be rethought, those that might need further explanation, and others that can and should be used across the grades. Then, as you continue reading this chapter, other suggestions may help you spark new ideas or prompt you to reconsider what can be used as appropriate alternatives.

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 (MWSA) 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 and members of the school community