My daughter, Alli, was a big fan of the show *Cake Boss*. She loved seeing the creative and sometimes unbelievable cake designs come to life on the show and how the different cake designers, especially Buddy, could work through challenges and crises. The show actually inspired her to pursue a hobby of cake decorating, and she quickly accumulated a wide assortment of cake-decorating tools. I remember one of her first creations, which was a haunted-house cake for a Halloween party we were attending. She asked for my help (big mistake), so we broke out all the tools and ingredients and set to work. We discovered very quickly that cake decorating looks a lot easier on TV than in our kitchen. We had all the appropriate tools, but we lacked real strategies and techniques to use them well. We needed help (see Figure 5.1).

My daughter’s birthday was that next month, and I got her a cake-decorating lesson at the *Cake Boss* studio in Hoboken, New Jersey. She and I took the class together and were blown away by the experience. There were only eight of us in the class with two of Buddy’s nieces as our instructors. They walked us through the basics of how to mix and press...
fondant, how to frost and wrap a cake, and how to strategize our design. Then we moved on to actual decorating techniques. For our fall-themed cakes, we learned how to make multicolored maple and oak leaves using presses and special cutters. We learned how to properly handle a piping bag to make flowers and write words. They taught us how to select the proper tool for the specific type of design we wanted to create.

After a lot of practice we started to get the hang of it. The once-overwhelming array of tools and options soon became manageable, and we even started to have fun using them. Alli and I talked about what kind of cake design we wanted and then strategically planned how to accomplish it. It was amazing to see how fast she could select the right tool and use it to create the image she had in her head. When the lesson was over, we had two great-looking cakes to take home with us and the knowledge and skills to use our own tools to make more like them (Figure 5.2).

In our mathematics classrooms, we have a similar scenario. Students have access to a wide assortment of tools that they must learn to use for their mathematical work. The sheer volume of possibilities can seem overwhelming, but with time and experience, students can learn how to choose the right tool for the task at hand and how to use it strategically to reach their goal.

For this to happen, we need to have a solid understanding of the kinds of tools available, the purpose of each tool, and how students can learn to use them flexibly and strategically in any given situation. This also means that we have to make these tools readily available to students, encourage their use, and provide them with options so they can decide which tool to use and how to use it. If we make all the decisions for them, we remove that critical component of MP5 where students make decisions based on their knowledge and understanding of the tools and the task at hand.

MP5 puts forth the idea that tools are a natural part of any K–12 classroom and aren’t used just with students who are struggling in mathematics. All students benefit from using tools and learning how to use them for a variety of purposes.
If we don’t make tools readily available and value their use, our students miss out on major learning opportunities. Additionally, if we use them only to help students who are having difficulty, we communicate that you need tools only when you struggle. In doing so, we may inadvertently create a stigma around the use of tools whereby students choose not to use them (even if they need them) for fear of looking like they aren’t as smart as their peers.

MP5 also brings to light that tools aren’t used just for problem solving. Although many math sessions encompass problem-solving elements, there are lots of other ways in which students engage in mathematical thinking where using tools strategically is quite useful. For example, second graders can use manipulatives such as connecting cubes to make representations that highlight the part-part-whole relationship in addition and subtraction to deepen their understandings of the operations. A kindergartner may use pattern blocks to explore how new shapes can be made by combining smaller shapes.

As we explore the components of MP5, let’s consider the kinds of tools primary students use before we look at how they learn to use them strategically. In the broadest sense within the context of this practice standard, a tool is anything that helps students with a task. This includes not only standard mathematical tools such as rulers and graph paper, but unconventional tools as well. If a kindergartner uses her classmates’ shoes to measure the length of a table, the shoes are tools that help her accomplish the task. For the purposes of this book, we will focus on more conventional tools, but the ideas presented in this chapter can easily be applied to nontraditional tools as well.

According to the Elementary Elaborations of the Standards for Mathematical Practice from the Illustrative Mathematics website (illustrativemathematics.org), tools can be clustered together based on common characteristics. I have taken it a step further by formalizing these clusters into five distinct categories of tools: supplies, manipulatives, representational tools, digital tools, and mathematical tools. The lists below provide examples of specific tools used in primary grades for each category, but the lists are not exhaustive. As you read through them, think about other specific tools you use in your classroom that might fit into each category.

**Supplies**

These tools are what we typically think of when we consider school supplies. They are the materials students use to do things such as record, create, draw, and measure as they work on math tasks. Supplies are often used in conjunction with tools in the other categories. For example, second graders use 1-inch graph paper
and colored pencils along with manipulatives such as 1-inch color tiles to create rectangles of various sizes. Below are some examples of supplies:

- Paper—blank, lined, grid, tracing, chart, construction, paper strips, and so on
- Writing utensils—pencils, pens, markers, colored pencils, chalk, crayons, dry erase markers
- Writing surfaces—whiteboards, chalkboards
- Scissors
- Tape
- Measuring tools—rulers, yard/meter sticks, tape measures, string
- Sticky notes
- Index cards

**Manipulatives**

Manipulatives include all the tangible, physical objects we often associate with primary mathematics classrooms. They are used for a variety of purposes, including, but not limited to, counting and/or comparing quantities; composing and decomposing shapes or quantities; building patterns, designs, or other creations; developing understandings of shapes, numbers, patterns, fractions, and the behavior of and relationship between the operations; creating representations; and developing and refining strategies for problem solving.

There are a lot of choices of manipulatives from a variety of companies. There are also subtle differences among manipulatives, such as interlocking cubes, that affect how students use them and the options available to them. For example, Unifix cubes connect in only one direction, whereas Multilink cubes can connect on each one of their sides. This distinction might come into play when a student wants to create a rectangular prism using cubes. In this case, the Unifix cubes are much harder to use because each row of cubes cannot connect to other rows, so the figure falls apart easily. That student may find that Multilink cubes are a better option for creating the structure.

The following are some common examples of manipulatives found in primary and elementary classrooms:

- Interlocking Cubes
  - Unifix cubes
  - Multilink cubes
  - Snap cubes
Mathematical Practice 5: Use Appropriate Tools Strategically

- Blocks
  - Pattern blocks
  - Geoblocks
  - Base ten blocks
  - Attribute blocks
  - Cuisenaire rods
  - Tangrams
  - Color tiles
- Geoboards
- Counters
  - Chips
  - Bears
  - Two-color counters
  - Colored chain links

Representational Tools

Representations serve a variety of purposes. They help students see structure within our number system (MP7), which contributes to the development of number sense. They can be used to solve addition and subtraction problems. They also allow students to represent mathematical ideas or express their reasoning. Representations are unique in that they can be made (or bought) and set out for students to use when they need them or created in the moment by students or teachers. The following are examples of representational tools:

- Number charts (hundreds, fifty, and so on)
- Number lines
- Ten frames
- Number racks
- Tally marks
- Line plots
- Tens and ones strips

Digital Tools

Digital tools involve the use of technology to help students complete math tasks. Some digital tools simply replicate physical or representational tools (such as virtual manipulatives or number lines on an interactive whiteboard). Other digital tools such as calculators or apps that allow students to show their work using mul-
timedia features serve specific purposes based on their capabilities.

We must decide which digital tools we want students to access and for what purpose. The technology can be exciting for students to use, and they may gravitate toward those options over traditional versions if both are available to them. However, getting out iPads and going through the process of opening an app that provides virtual interlocking cubes may not be as efficient as simply getting some interlocking cubes from the bin.

Other times, digital tools provide elements that other tools cannot. For example, when students want to build designs out of pattern blocks, the virtual manipulatives require them to consider the direction and degrees they need to turn the blocks to make them fit. This makes the rotational work much more explicit than when they just build with the blocks. Ultimately, it’s up to us to decide when and if a digital tool is an option we want students to explore for a particular lesson.

Here are some examples of digital tools:

- Calculators
- Tablets
- Interactive whiteboards
- Apps
- Virtual manipulatives
- Digital scales

**Mathematical Tools**

This category of tools is a bit more abstract, particularly for primary-grade students. The Elementary Elaborations of the Standards for Mathematical Practice talk explicitly about how estimation, strategies, and algorithms are all examples of mathematical tools. At first I had a hard time wrapping my head around the idea of strategies being mathematical tools. I was thinking about tools only as physical objects or representations and not as mental constructs. However, one day I was working with teachers on how we support students’ development of multiple strategies for solving addition and subtraction problems. In an effort to make my point I said that students having only one approach to solving a subtraction problem is equivalent to having only a hammer in your toolbox. Sure, if you needed to cut a piece of wood, you could hack through it with the back end of the hammer, but a saw would be much better for the job.

Mathematical tools are generalized mathematical approaches to use when working on a task. They are part of students’ mental toolboxes. For example, a first
A large part of our work with MP5 involves developing and supporting our students’ metacognition. A constant reflective process occurs when students work on mathematical tasks or engage in mathematical explorations. First, they must consider whether they actually need a tool. If so, they then need to decide which tool or tools would make the most sense in that particular situation and how they could best use it to achieve their goal. Finally, they must reflect on their results to
see if they make sense and if the tool they chose was in fact the best one for the job. If it was, they can work on refining its use. If it wasn’t, they must go back and consider what other tools might be more useful. Although the work is not always so straightforward and linear, those are the kinds of considerations students must make when working with tools.

This kind of metacognition is difficult with primary students, who don’t have a lot of experience thinking about their own thinking. To support them, we must make the metacognitive process explicit to students. We can do that during our whole-group time with the entire class, with small groups, or with individuals working on their own. By asking students a question such as *What math tool might help you work through this task?* we convey that first, there are multiple options, and second, students have a choice in the process. This puts the ownership of this responsibility on the students. It lets them know that they have to consider what tool might best serve them in their task or exploration.

Math discussions provide a great way to support students in this metacognitive process. They are opportunities for students to talk about their mathematical thinking with their peers, with the teacher acting more as a facilitator guiding the discussion and allowing students to own most of the ideas. Math discussions can be used to share strategies, talk about generalizations, discuss conjectures, ask questions, and so on. The following vignette from a first-grade class highlights how well math discussions support the development of MP5.

### Focus Questions

1. How does Ms. Mitchell help her students begin to pay attention to the tools that they’re using?
2. How does the math talk routine support this work?
3. What other tasks could you do with your students that would provide a context to make this work with tools explicit?

### When We Count, We Need Things, and When We Don’t, We Don’t

*Ms. Mitchell—Grade 1, January*

When I wanted to explore using appropriate tools strategically with my first graders, I immediately thought of using math talks as the launching point for this work. I
have been using math talks for a while now, and a large part of our work has involved students sharing their strategies and the tools they used to solve problems. However, I never really considered how this work was developing students’ facility with MP5 until I was in one of my graduate classes and my professor was talking about the differences between physical, digital, and mathematical tools. As he spoke, I thought about all the math talks I do with my kids and how they help students learn to use both physical and mathematical tools.

What I hadn’t done until then was make the use of tools explicit for students. We engaged in math talks as a way to share strategies and talk about our mathematical ideas, but I had never communicated to students that these strategies were a form of mathematical tools. For this math talk, I wanted to work with my first graders to develop a chart of tools to which they could refer in future math work.

I wrote $13 + 7$ on a sheet of chart paper and asked students to try to solve it. Lots of students started counting on their fingers, but others looked around the room at our number line or hundreds chart. A few asked if they could get some cubes to work it out. I also have a few students who can solve problems in their head fairly quickly, so I knew they were ready right away, but I wanted to give time for my counters to arrive at their answer. Once most students had their thumbs up (our nonverbal cue that they are ready), I began the talk.

Teacher: Before we begin sharing today, I want to talk to you about tools. Who can tell me what a tool is?

Cathleen: You mean like a screwdriver?

Teacher: That’s exactly what I mean. What does a screwdriver help us do?

Kash: Screw stuff together … like batteries.

Teacher: Great. So if we have a job to do like put batteries in one of our favorite toys, we can use a screwdriver to help open the place where we put the batteries.

At this point other students started calling out different tools such as hammers, saws, and so on. I didn’t want the conversation to focus too much on carpentry tools, so I shifted the discussion back to math.

Teacher: It seems like you know lots of tools we can use to make things or fix things. Did you know that you also use tools to help you do math? (Rosalie starts waving her hand.) Yes, Rosalie?

Rosalie: My dad uses a chain saw.

Teacher: For math?

Rosalie: (Giggles.) No, to cut wood and trees.
Teacher: Well, that is another good example for the tools we talked about earlier. Do you have an example for a tool we use to help us with math?

Rosalie: You mean like when we use cubes?

Teacher: Yes, exactly. Cubes are a great example of a tool we use to help us in math. I see a lot of hands up to share math tools. We’re going to talk a lot about math tools during our math talk this morning, so when you share your strategy for 13 plus 7, I’d like you to think about whether you used a tool to help you. Who’d like to go first?

Nick: I didn’t use a tool. I just did it in my head.

Teacher: Can you explain what you did?

Nick: I just counted in my head.

Teacher: That sounds like a great strategy. What number did you start counting with?

Nick: Thirteen.

Teacher: Then what did you do?

Nick: I counted 1, 2 . . . I mean, 14, 15, 16, 17, 18, 19, 20.

Teacher: How did you know when to stop counting?

Nick: I counted my fingers. (Holds up seven fingers.)

Teacher: So you used a counting strategy? I’m wondering about what you said about tools, though. You said you didn’t use any tools, but I’m thinking you did. Not every tool in math is something you get off the shelf.

Nick: Ohhhh. My fingers! I get it.

Teacher: Yes, your fingers were a tool you used to keep track. But there’s another kind of tool in math that I like to call thinking tools. These are the strategies you use. Nick said he counted to get his answer and he started at 13. Does anyone remember what we call that strategy?

Olivia: Count-on!

Teacher: Yes! Nick used a thinking tool of counting-on, and he used his fingers as a tool to keep track. I’m going to write these on this chart here:

<table>
<thead>
<tr>
<th>TOOLS FOR MATH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thinking Tools</strong></td>
</tr>
<tr>
<td>Count-On</td>
</tr>
</tbody>
</table>
Teacher: Did anyone else count on using their fingers? (A few hands go up.) What did others do?

My goal here was to get students noticing that their specific strategies are considered tools. At some point I’d like to create a visual for them to see these as tools in their mental toolbox, but for now I just wanted get them thinking about their strategies as thinking tools.

Loie: I used the cubes. (Holds up two stacks of cubes.) I went 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 and got 13, and then I went 1, 2, 3, 4, 5, 6, 7 and got 7. Then I went 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20. So it’s 20.
Teacher: What tools did Loie use?
Ezra: Cubes and her brain (giggles).
Teacher: Yes, she used cubes and she did use a thinking tool. What strategy did she use as her thinking tool?
Chen: She counted.
Teacher: Yeah, she did. Did she count the same way as Nick?
Anastasia: No, she counted cubes and Nick counted his fingers.
Teacher: True, they both counted different things, but I’m wondering if there was something different about the way they counted. We said Nick used the count-on strategy. Did Loie use the count-on strategy? (Some kids shake their heads.)
Mikal: She did count-everything.
Sage: It’s count-all.
Teacher: We can say it either way. Count-everything and count-all mean the same thing, right? Let’s add that to the chart.

<table>
<thead>
<tr>
<th>TOOLS FOR MATH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thinking Tools</strong></td>
</tr>
<tr>
<td>Count-On</td>
</tr>
<tr>
<td>Count-All (everything)</td>
</tr>
</tbody>
</table>

I was glad we spent time earlier in our math talks naming strategies. I feel like it helped make this section run more smoothly. We heard from many more students and added each new idea to our chart. Over time it looked like this:
I was impressed with our list. They included the physical tools we typically use, and we didn’t try adding things to the list that we haven’t used. I was kind of expecting some kids to start making up some tools just to be original. Instead, they focused on what they were using. Kids noticed that we used a lot of counting tools (either counting-on or counting-all). Ezra closed our session by making a really astute observation.

**Ezra:** It’s like when we count, we need things, and when we don’t, we don’t.

He was referring to the list where we had lots of things students used when they used a counting strategy. He noticed that for the numerical strategies of using a fact we know or decomposing numbers, no physical tools are used. This seemed like a great place to leave the discussion. My plan is to leave the list up so we can refer to it for future math work involving addition or subtraction. I also plan to have us add to the list as we discover and use new tools.

In this vignette Ms. Mitchell made the use of tools explicit for her students by directly raising the topic at the start of their math talk. She began by asking students about their knowledge of tools in general before making an analogous comparison to the tools we use in math class. By starting the conversation this way, Ms. Mitchell was helping her students become cognizant of the fact that there are a variety of
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tools they can use and that she was interested in hearing about their choices.

When Nick announced that he didn’t use a tool because he solved the problem in his head, Ms. Mitchell used that opportunity to raise the idea of mathematical tools. In this case she named them thinking tools because that phrasing seemed more accessible to her students. Before this work they had been naming strategies as a way of discussing how different students approached problems. Ms. Mitchell linked this work to the current conversation by referring to these strategies as tools. This was a great way to help students see that in addition to physical tools available in the classroom, their particular strategies were another form of tools. She also helped them see they have choice in those as well by valuing the different mathematical tools that were shared.

By naming our strategies as tools, we can analyze each of them to determine when one is particularly useful and when it is not. This gets at the crux of this practice standard, which is using appropriate tools strategically. As Ms. Mitchell brings this tool chart into future math conversations, she can ask her students questions such as these:

- When is a counting strategy useful?
- Which number should you hold in your head when using the count-on strategy?
- What is a more efficient way to draw pictures to count?
- Which strategy has fewer steps?
- Can we count the cubes by groups?
- How can knowing 5 plus 5 help us think about 5 plus 6?

Those are just a few suggestions, but they give you a sense of the kinds of question we can ask students to get them thinking about how to use a particular tool strategically. It doesn’t matter if the tool is a physical tool or a mathematical tool. Some students consciously make decisions with regard to using tools, whereas others follow what their peers are doing or use tools that are familiar to them. When choices are brought to the attention of the whole class and discussed, students who already make these decisions can become more mindful of using these tools strategically, and others can learn they have options.

We want to make a habit of involving our students in deciding which tools to use and asking them to talk about their choices and the reasons behind them. Then we want them to reflect on the effectiveness of those choices so they can revise their thinking and become more strategic. Using tools strategically is a habit of mind that develops when students are involved in the process and made aware of
the effects their choices have on their solution pathways for a given task or the kind of information that is revealed in a math exploration. For example, a student might notice that his cube representation highlighted the tens and ones relationship of his place-value strategy for addition while his number line representation hid those elements.

Math discussions provide a great way for students to talk about their own thinking, the choices they made, and the questions they still have. In terms of supporting MP5, this format allowed students to discuss what tools they used and how they used them, and to connect their strategies to the ones used by other students. These conversations help topics like these rise to the surface. Also, by allotting math time to discuss these ideas, Ms. Mitchell was communicating to her students that these decisions are important and deserve our attention.

We can imagine future math conversations in which Ms. Mitchell and her students talk about how they can best use a count-on approach and when that strategy might not be as helpful. Or another conversation later in the school year about whether using base ten blocks is a more efficient way to solve a problem using place value than drawing sticks and dots. As a result of these kinds of discussions, students become more mindful about the choices they make regarding the tools they choose and how they use them.

This shift is key. Once students start thinking about how they are using the tools available to them, there is more intention behind their work. They work on tasks more purposefully instead of simply trying to get an answer. They consider which strategy makes the most sense given the set of information they have and refine their approach over time. Problem solving and mathematical explorations require strategic thinking, and MP5 really gets at the heart of this.

The next vignette looks a bit more specifically at how we get students to become more mindful of how to use physical tools strategically. It is from my own classroom when I was working on MP5 with my students. It was early in the year, but I wanted my second graders to think about how we use tools and to make this metacognition part of our natural math conversation.

One main idea I want to highlight with this vignette is that we can modify just about any unit, lesson, or task to bring out the elements of MP5, because regardless of how tasks and activities are framed in a book, students will need at least one kind of tool listed at the beginning of this chapter to engage with them. Even if the
Mathematical Practice 5: Use Appropriate Tools Strategically

If your math program does not emphasize elements of MP5 in their materials, you can add it in by making some minor changes: providing additional materials, allowing students to choose among them, and then having a discussion about how the materials helped or didn’t help; giving students one tool but asking them to consider the best way to use it; or allowing students to solve tasks or explore mathematical ideas using strategies that make sense to them rather than requiring them to use only one method.

Focus Questions

1. What are the benefits of making students’ strategies and choices a central focus of the discussion?
2. What are the challenges of doing this?
3. Can you think of other classroom routines in your room that you can use to help students think about using tools more strategically?

I’m Not Sure About Just Dumping and Counting

Mr. Flynn—Grade 2, September

In the following vignette from my second-grade class, my students were learning about one of our routines from the Investigations curriculum called Pocket Day. For this routine, students had to determine the number of pockets they each had on their clothes and then get one cube for each pocket. Then, as a class, they had to figure out how many pockets the class had in total. This was their first day with the activity, and it seemed like a prime opportunity to explore MP5 because there were a variety of ways they could approach the task.

When I knew I wanted to make MP5 more explicit in this task, I thought about modifying it by not directing students to get a cube for each pocket and instead allowing them to choose how they wanted to keep track of that information. I was thinking that they could try different tools and then we could decide which was best. But when I considered the mathematical goals of the lesson, it felt like having students do all that work in the beginning when they were first learning the routine would be too much. I made a note to explore the idea with them at a later time when we did Pocket Day again.

Instead, I decided to focus on having the students work out how to use the cubes strategically. In this case, I gave them the tool and asked that they work out the best
way to use it to determine the total number of pockets in the class. I wanted them
to come up with a bunch of different strategies and then analyze which were most
helpful. At this point in the vignette, each student has determined the number of
pockets he or she has, taken the equivalent number of cubes, and joined us on the
floor in a large circle.

**Teacher:** You each found out how many pockets you are wearing today. Now we want
to figure out how many pockets we have altogether. How can we do that? (A bunch
of hands shoot up.)

**Maya:** We can count the cubes.

**Teacher:** Was anyone else thinking of this same strategy? (Most hands go up.) What
other things can we do?

**Casey:** We can add up each of our pockets. Like I have 4 and Justin has . . . (looks at
his cubes) 5. So that’s 9. We can just keep adding.

**Teacher:** That’s another strategy. Who else was thinking about that approach? (A
few hands go up.) Any other ideas? (No hands are raised.)

**Teacher:** If we were going to count the cubes, how should we do it? Make sure you
also tell us why you think that’s a good idea.

**Graham:** Dump them in the middle and count them. Then we’d know which ones we
still have to count.

**Teacher:** And how would you count them? What would you do?

**Graham:** I’d say 1, 2, 3 (mimics pointing to cubes as he counts).

**Teacher:** Okay, Graham suggested we dump them in the middle and then count them
by ones. Is there another idea of how we can count them?

**Joey:** I’m not sure about just dumping and counting. They’ll get mixed up. What if we
just count the ones we have and go around?

**Teacher:** I’m not sure I understand. Can you say more?

**Joey:** Well, if I go first and I have 2 pockets. I can say 2. Then Chelsea goes and she
has 4, so she would say 4 and then we go around.

**Chelsea:** I wouldn’t say 4. I have 4—

**Joey:** Oh yeah. I mean she would say 6, because 2 and 4 is 6. Then Kaylee goes and
says, 7, 8, 9, 10 ’cause she has 4, too.

**Teacher:** Okay, and did you tell us why you think that’s a good approach?

**Joey:** I don’t know. It’s just . . . they don’t get all mixed up like if we made a big pile.

**Teacher:** Graham suggests dumping them in the middle and then counting the pile
Mathematical Practice 5: Use Appropriate Tools Strategically

by ones so we can keep track of what’s been counted. And Joey is saying that we each take the cubes we have and take turns counting around the circle so we don’t get our cubes all mixed up. That’s kind of like what Casey suggested earlier, right? Didn’t you suggest we add up each of our pockets? (Casey nods.) Any other suggestions?

Jestina: Can we count them by tens?
Teacher: How might we try that?
Jestina: Like if you counted out ten and stuck ’em together. Make a bunch of tens. You know, like stacks? (There are some nods of agreement to this suggestion.) It’s easy to count by tens.
Teacher: Okay, so we can put them in a pile and count by ones, hold on to the cubes and go around the circle counting by ones, or make stacks of ten with the cubes and count them by ten. Any other ideas?

Although I thought Jestina’s suggestion was probably the most efficient and strategic use of the cubes for this activity, I did not want to stop gathering suggestions if there were still more out there. Earlier in my teaching I used to “fish” for the right answer, and once it was given, I would stop the idea generation. I learned from experience that keeping the conversation open removed my judgment from the discussion and kept the ownership with the students. In this case, it would be up to students to decide which approach was most strategic.

Fiona: We could make stacks of five and count by fives. I like counting by fives better.
Jeremiah: We can put them in twos. Twos are easy.
Maeve: How about stacks of twenty?
Stephen: Eights!
Chris: Twelves!
Teacher: Wow, lots of ideas are flying out. It seems like we could put the cubes in stacks of different amounts and count by that number? (Heads nod.) How are you coming up with the number you want to count by? What’s important here?
Fiona: You want something you know. Like I wouldn’t say sevens.
Teacher: Okay, Fiona says we should count by a number we can skip-count by. You’re saying counting by sevens is not one you know?
Fiona: Yeah. I can do tens and fives and twos and . . . well, ones obviously. But not things like eights or twelves.
Teacher: Of all the ones listed on our chart, which ones make the most sense to
count by?
Maeve: Twenties!
Teacher: Why?
Maeve: Because it gets rid of the most cubes. You only need like two stacks or something.
Joey: I don’t even know how to count by twenties.
Chris: I say count by twelves.
Teacher: And why do you think that’s the best way?
Chris: (Shrugs.) I don’t know. It’s easy, I guess.
Jestina: Counting by twelves is hard.
Teacher: It seems like some numbers are easy for some, but harder for others. How does counting by twelves feel to you all?
Students: Hard.
Teacher: What about counting by twenty? (There is a mixed response. Most seem to think it is hard, but a few students say that it’s just like counting by twos.)
Fiona: I say we do fives or tens because everyone knows how to count by those.
Students: Yeah.
Teacher: So you all agree that using the cubes to count by fives or tens is the best way for us to count right now?
Jestina: We can do both. Count by tens first. Then break the stacks in half and do it by fives after.
Teacher: Oh, kind of like a way to check our counting? (Lots of agreement from the students.) How come nobody is suggesting the counting by ones anymore? Fiona said we should pick numbers we know how to count by. You all know how to count by ones.
Maya: It’s faster to count the trains. (That’s what she calls stacks of cubes.)
Joey: We should also count by ones just to be sure we did it right.

The class agreed to make stacks of ten and to compare stacks to make sure they were the same height. We then counted the four stacks and three leftovers as a class. We checked our counting using Jestina’s idea of breaking the stacks in half and counting by fives. Both times the students correctly counted forty-three cubes. Finally, we had Joey lead us in counting the cubes by ones just to make sure our counting was correct. It was helpful to end on that, because it gave us a chance to compare counting by groups with counting by ones.
Teacher: When we started this task, we had lots of ideas about how we could count the cubes. This happens a lot in math. You choose a tool to help you, but you have to decide how to use that tool. Today our tool was the cubes, and you decided the best way to use it was to count them by tens and then check our counting by fives and ones. One thing we want to get in the habit of doing is thinking about our choices and how those choices worked or didn’t work for us. What did you think about our counting choices today?

Fiona: I liked them.
Teacher: Can you say more? What did you like about them?
Fiona: Uh . . . I don’t know. I just liked them.
Maeve: I would have counted by twenties because it was faster.
Teacher: Maeve would have preferred a different choice today. What’s nice is that a lot of times you’ll be doing tasks on your own and you can each make the choice that feels right to you.
Jestina: I think tens worked best because we all know how to do tens.
Teacher: Yeah, that makes sense. You chose a strategy that everyone knew since we were doing this as a group.

I ended this discussion by reminding students to think about the choices they have when counting and to think about those choices in future activities when they have to count. I wrote the counting strategies on a piece of chart paper to display in the room so we could refer to it during upcoming counting tasks. All in all, I think this was a very useful discussion to help us think about using cubes more strategically. It took a little longer than the lesson would have if we hadn’t emphasized MP5, but I think these conversations are important and worth the additional time.

The benefit of taking the extra time to discuss their strategies is that it allows the ideas to come from the students and not from me. That means they have opportunities to hear mathematical arguments from their peers and to critique their reasoning (MP3). It also helps create ownership of the ideas and changes the power structure in the classroom by showing that we all contribute to the learning in math class. Additionally, because we leave it open to discussion, a much greater variety of strategies reach the surface, making the activity accessible to everyone. It helped students see that there are a lot of choices and that we need to make decisions on what makes sense for us as we do this work.

At the same time, making decisions adds extra time to our math sessions, which
is a challenge. I could have just told the kids that at this point, counting by tens is best, and then just had them count. It would have cut the time in half, but it also would have robbed the students of that powerful discussion and the opportunity to make their own choices and have ownership of the work.

As teachers, we have to weigh these options and make decisions that we think make the most sense at any given time. What is helpful with all the MPs is that investing time in any of them is worthwhile because they embody the behaviors and habits of mind of mathematically proficient students. The MPs span the grades, and students will continually be asked to refine their facility with them. For these reasons, carving out extra time to bring students' attention to them seems like a worthy investment.

At the beginning of this chapter, I said the myriad of choices of tools and how to use them can be overwhelming for students, particularly young ones who are just entering this mathematical world. However, we can reduce that sense by being intentional in the tasks we set, the tools we make available, and the time we devote to having students discuss their reasons for choosing tools and the strategies behind their use of them.

**Tasks**

The tasks we select for students, whether they involve problem solving, a mathematical game, exploring an idea, or something else can have a significant influence on students’ work with MP5. Whether you’re using a specific math program or pulling from multiple resources, you can tell if a task supports this standard by considering a few key elements of it. First, does the task allow for various options in terms of tool selection and/or tool use, or does it tell students what to do and how to do it? Some tasks will actually say right in the directions, “To solve these addition problems, use cubes to make stacks of ten and ones, and then add them.”

If the task doesn’t allow for flexibility and student choice, consider changing the instructions a bit to add those elements when you want to focus on MP5. You can rephrase the above directions to say, “Solve these problems,” let students know they have lots of choices in resources, and allow them to make those choices. The task is still the same, but we put the onus of how what to use and how to use it on the students. Another option would be to give the modified version of the directions
but begin the session by asking students to brainstorm what the best tools would be and how they could best use them. The second way is a bit more targeted, but the ownership of the thinking still lies with the students.

Not every task has to be open-ended and allow for students to make choices, but when we make all the decisions for the students, we aren’t emphasizing the critical elements of MP5. There are some days when our mathematical focus is somewhere else and we want to use a more directed activity. However, when one of our goals for a given day is to emphasize this standard, we want to analyze the tasks and activities to make sure there are options for students and that we make time to discuss them.

**Available Tools**

If we want our students to have options in terms of tool selection and use, then we must ensure that we make those options available. You can use the categories of the initial lists at the beginning of the chapter to help you consider your own inventory. That way you’ll know if you have materials and resources that span each category and which ones you find useful for your classroom. You certainly don’t need every manipulative on the market, but it will be good to know if you are missing any key materials that might support your students during math.

It’s also very helpful to store the materials in specific places that are easily accessible to students. I used a low set of shelves and a bookcase to keep various plastic bins of manipulatives. These shelves always had interlocking cubes on them, but I would also swap other manipulatives in and out, depending on which unit we were doing. This helped limit the choice of materials but still provided options for students. I also had a supply station set up where students could find lots of the materials such as different kinds of paper and writing tools.

One strategy I found very helpful in terms of managing how students went about getting tools was to talk with them in the beginning of the school year about how we could build a mathematical community where students could move around and gather materials they needed in a safe and productive way. Essentially I worked with them to create a set of guidelines that served as our classroom rules during math class. Because they had ownership of the guidelines, the students often monitored their own behaviors, which significantly limited the number of issues.

Because materials were easily accessible to my students, using tools became a regular part of math class and there wasn’t a stigma that tools were for kids who struggled. The tools became a means of sense making in the class. Some students
used them to help them solve problems, and others used them to create representations of some of the complex numerical strategies. Had I kept them all in a closet and brought them out only when somebody was stuck or only for certain problems, I would have deprived my students of valuable resources to support their mathematical growth.

**Taking Time to Talk Tools**

By devoting classroom airtime to the topic of tool selection and use, we convey to our students that these decisions are important and that we value their choices and strategic thinking. Over time, students will internalize our interactions and classroom discussions that ask them to consider the tools they plan to use and how they plan to use them. When this happens, students will truly demonstrate that they can use appropriate tools strategically.

We can engage in this kind of talk in whole-group settings at any point during a math class. If we do it in the beginning of a session, we can help students think about these ideas before they engage in a particular task or activity. If we have the discussion at the end, we provide students an opportunity to reflect on their work with tools and to consider the choices they made. These whole-group discussions allow for students to hear from their peers about the range of tools they used and the different ways in which they used them. Connections can be made between different strategies to broaden students’ perspectives, and we can encourage students to construct viable arguments for their decisions (MP3).

We can also engage in these conversations in small groups or with individual students as they are working. As you approach a table where students are working, ask them to describe what they’re doing and why they chose a particular manipulative or representation. You can ask them to consider how another manipulative or representation would affect their work. This may prompt them to approach the task a second way with a new set of tools. We can then have a conversation about what they learned from engaging in this work in two different ways.

Making an effort to discuss why students choose certain tools and how they decide to use them is a powerful way to bring MP5 to life in your classroom. It communicates to the students that these ideas are important and that you value their thinking and the decisions they make. It also lets them know that we might have to revise our thinking or try other tools if our first choice didn’t produce the kinds of results we hoped for. In essence these discussions provide a narrative to support students in thinking about their intention behind the use of tools in class.
When I first considered this practice standard, it seemed very easy and obvious to me. We use tools constantly in the primary grades, and kids do get more strategic with them over time. However, once I began working specifically on MP5 with students, I realized that the complexity of the metacognition involved when students engage in this work is astonishing.

There is a lot to consider when someone is truly thinking about using tools strategically. Once we map out the thought process involved, we can see the complexity of this standard. This level of metacognition is a lot to expect of five- to eight-year-olds, which is why much of our work as teachers in the primary grades involves engaging in this process with the whole class or small groups. We model this habit of thinking when appropriate within our lessons and ask students about their choices when opportunities arise.

Ultimately, we can draw attention to using appropriate tools strategically during any lesson. Rarely are there moments when tools, whether physical or mathematical, are not appropriate. However, we do not need to make this work explicit in every lesson. As with other standards for mathematical practice, we can decide when to emphasize these ideas and when to let them stay on the back burner. Students have opportunities to use appropriate tools strategically in almost all facets of math class. All you have to do to bring that work to the surface is draw attention to it.

When we do this, we begin to take away the mystery behind the numerous supplies, manipulatives, representations, technology, and mathematical strategies. They’ll seem less daunting, and students will learn when each is appropriate to use and how to best use particular tools in particular circumstances. I think back to the Cake Boss studio and how lost and overwhelmed I felt when we first started. However, once the instructors helped us understand the functions of the various tools, we began to use the appropriate ones purposefully. We can do the same for our students in math class by valuing the use of tools and taking the time to address how to use them strategically.
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