

CHAPTER 1

Introduction



At the heart of efforts to help middle school students learn mathematics is the idea of *ambitious teaching*. It's referred to as *ambitious* because of the substantial student learning goals that it encompasses—that all students have opportunities “to understand and use knowledge ... [to] solve authentic problems” (Lampert & Graziani, 2009, p. 492). The Common Core State Standards (CCSS) for Mathematics (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010) provide a powerful vision of these goals through their description of grade-level, domain-specific content standards and the cross-cutting Standards for Mathematical Practice.

We believe that the phrase *ambitious teaching* is also appropriate because teaching in ways that align with these goals is a formidable task! To help you and other teachers understand what this looks like, *Principles to Actions: Ensuring Mathematics Success for All* (National Council of Teachers of Mathematics, 2014) describes a set of eight teaching practices that serve as a foundation for ambitious teaching (Figure 1.1). These practices are based on what we know from research about how to effectively support students' learning of mathematics.

Ambitious teaching also requires attention to equity. Mathematics has long been considered a gatekeeper, limiting opportunities for some

Figure 1.1 • Eight effective mathematics teaching practices

Establish mathematics goals to focus learning. Effective teaching of mathematics establishes clear goals for the mathematics that students are learning, situates goals within learning progressions, and uses the goals to guide instructional decisions.
Implement tasks that promote reasoning and problem solving. Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies.
Use and connect mathematical representations. Effective teaching of mathematics engages students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures and as tools for problem solving.
Facilitate meaningful mathematical discourse. Effective teaching of mathematics facilitates discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments.
Pose purposeful questions. Effective teaching of mathematics uses purposeful questions to assess and advance students' reasoning and sense making about important mathematical ideas and relationships.
Build procedural fluency from conceptual understanding. Effective teaching of mathematics builds fluency with procedures on a foundation of conceptual understanding so that students, over time, become skillful in using procedures flexibly as they solve contextual and mathematical problems.
Support productive struggle in learning mathematics. Effective teaching of mathematics consistently provides students, individually and collectively, with opportunities and supports to engage in productive struggle as they grapple with mathematical ideas and relationships.
Elicit and use evidence of student thinking. Effective teaching of mathematics uses evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning.

Source: National Council of Teachers of Mathematics, *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: National Council of Teachers of Mathematics, 2014. Reprinted with permission.

students while promoting opportunities for others (Martin, Gholson, & Leonard, 2010). The middle school years in particular often play a significant role in determining students' future mathematics course-taking options (Balfanz & Byrnes, 2006). Ambitious teaching requires you to challenge these long standing practices and provide access and opportunity for every student so that they can develop strong positive identities as learners of mathematics (Aguirre, Mayfield-Ingram, & Martin, 2013).

At the center of ambitious teaching is a focus on classroom discourse. As you facilitate meaningful discussions with students, you will typically engage in several of the effective mathematics teaching practices, including asking purposeful questions, eliciting and using evidence of student thinking, connecting to various mathematical representations, and supporting productive struggle among students as they learn mathematics (Figure 1.1). In addition, allowing students to share their thinking with the class can help to position all students as valuable resources for learning and promote an equitable learning environment.

In these ways, organizing discussions around students’ ideas becomes critical for successfully enacting ambitious instruction.

What does it take then to organize and implement effective discussions? In this book, we present guidelines for using the five practices described by Smith and Stein (2018) in their book *5 Practices for Orchestrating Productive Mathematics Discussions*.

The Five Practices in Practice: An Overview

The five practices are a set of related instructional routines that can help you design and implement lessons that address important mathematical content in ways that build on students’ thinking (Figure 1.2). Warning: There is actually a Practice 0, which serves as a foundation for the remaining practices—yup, this means there are six practices in total, but for historical reasons, we will still call the set “the five practices.” (In case you are wondering how this could have happened, here is the scoop: After some early articles about the five practices were published, a mathematics coach with whom Peg was working suggested to her that a practice was missing—that before

Figure 1.2 • The five practices in practice

Practices that take place while planning for instruction		Practice 0: Setting goals and selecting tasks (Chapter 2) Specifying learning goals and choosing a high-level task that aligns with those goals
		Practice 1: Anticipating student responses (Chapter 3) Exploring how you expect students to solve the task and preparing questions to ask them about their thinking
Practices that take place during instruction but are considered while planning	Students work individually or in small groups	Practice 2: Monitoring student work (Chapter 4) Looking closely as students work on the task and asking questions to assess their understanding and move their thinking forward
	As you move from small group work to whole class discussion	Practice 3. Selecting student solutions (Chapter 5) Choosing solutions for students to share that highlight key mathematical ideas that will help you achieve lesson goals
		Practice 4: Sequencing student solutions (Chapter 5) Determining the order in which to share solutions to create a coherent storyline for the lesson
	Whole class discussion	Practice 5: Connecting student solutions (Chapter 6) Identifying connections among student solutions and to the goals of the lesson that you want to bring out during discussion

teachers could engage with the five practices, they needed to set goals and select a task. Though this idea was already implied in the five practices, the coach persuaded Peg to make it explicit, and hence Practice 0 was born!)

Teachers often think that ambitious teaching requires you to make all your instructional decisions during instruction based on what students say and do in class. The five practices, however, help you think through all aspects of the lesson *in advance* of teaching, thus limiting the number of in-the-moment decisions you have to make during a lesson. Careful planning prior to a lesson reduces what you need to think about during instruction, allowing you time to listen more actively, question more thoughtfully, and respond more acutely.

The first two practices, *setting goals and selecting tasks*, lay the groundwork for the remaining five practices. It is essential to be clear on what you want students to learn and to choose a cognitively demanding task that aligns with those goals. Once you have the task in mind, you can move to *anticipating student responses*. Here, the purpose is to think about how students might solve the problem, what challenges they might face, and how you will respond to their thinking. One benefit to doing so is that you can develop—before class—targeted questions you might want to ask students about these different approaches.

Although the next four practices take place during instruction, you will also want to think them through carefully during planning. *Monitoring student work* involves giving students time—usually in groups—to work on the task, while you circulate among them. As you look closely at how students are progressing, you can use the questions you developed earlier to assess what students understand and to try to move their thinking forward. As you prepare to transition students into a whole-class discussion, you will engage in *selecting student solutions*—deciding which solutions you want to have shared in the discussion and who should present those solutions—as well as *sequencing student solutions*—deciding how you want to order the presentation of the solutions. Selecting and sequencing require close attention to the mathematical ideas that are highlighted in different solutions and to helping all students have access to the ideas shared in the discussion. As you plan the lesson you will consider what you want to be on the lookout for as you monitor students' work, what solutions will help you surface the mathematical ideas you are targeting, and what order of solutions will provide access to all students.

The final practice, *connecting student solutions*, takes place as the discussion unfolds in your classroom. The purpose is to make explicit the connections between students' solutions and the mathematical goals of the lesson. Drawing out these connections for students is essential to ensure that students take away from the discussion what you intended. This too is something you can consider as you plan the lesson!

Together, the five practices can help you prepare for and carry out meaningful discussions with your students, discussions that revolve

around the thinking of your students. And that is the essence of ambitious instruction!

Purpose and Content

The purpose of this book is to deepen your understanding of the five practices as described by Smith and Stein (2018). Toward that end, Chapters 2 to 6 comprise two parts: unpacking the practice (Part One) and challenges teachers face in enacting the practice (Part Two). In Part One, we describe in some detail what is involved in engaging in the practice, provide questions that you should ask yourself as you undertake the practice, and use an example from a middle school classroom to illustrate the components of the practice. In Part Two, we highlight aspects of the practice that have proven to be challenging for teachers, suggest ways you can address the challenge, and provide examples of how teachers are overcoming the challenge.

Throughout these chapters, we encourage you to actively engage with the content. Towards this end, we have create three types of opportunities for engagement: *Pause and Consider* questions (reflection), *Analyzing the Work of Teaching* activities (analysis), and *Linking the Five Practices to Your Own Instruction* assignments (implementation). The Pause and Consider questions give you the opportunity to think about an issue, in some cases drawing on your own classroom experience, prior to reading more about it. The Analyzing the Work of Teaching activities engage you in analyzing aspects of teachers' planning for and enacting of grade-level lessons. The Linking the Five Practices to Your Own Instruction assignments provide you with the opportunity to put the ideas discussed in the chapter to work in your own classroom.

Throughout the book we have included a range of different types of examples drawn from middle school classroom to illustrate aspects of the five practices and the associated challenges. The video excerpts and related classroom artifacts—featuring the three teachers who are introduced later in the chapter—provide vivid images of real teachers using the five practices in their efforts to orchestrate productive discussions. The narrative examples that appear in the book are based on our experiences working with middle school teachers through professional development initiatives and teacher education courses. These examples are intended to provide insights into specific challenges teachers face when engaging in the five practices and are not exact representations of a specific teacher's practice. Each of these teachers has been given a pseudonym (e.g., Neil Tanner, Elaine Richard, Nancy Haines, and Devon Washington featured in Chapter 2). The video and narrative examples are not intended as exemplars to be copied but rather as opportunities for analysis, discussion, and new learning.

If you are coming to the five practices for the first time, you might find it helpful to start with *5 Practices for Orchestrating Productive Mathematics*

Discussions by Peg Smith and Mary Kay Stein (2018). Smith and Stein’s book offers a wonderful, easy-to-read introduction to and overview of the five practices. The book you are reading now takes a much deeper dive into the five practices, asking you to stop and think, watch videos of the practices in action, and consider what is challenging about each practice. While you can certainly start here, the overview of the five practices provided by Smith and Stein (2018) may help you get the big picture before taking a deeper dive!

This book will be a valuable resource for looking closely at what it takes to be successful with the five practices. For each practice, we offer key questions, which identify the essential components of the practice. We suspect these questions will enhance your understanding of the practices and perhaps provide new information about the goals and expectations for each practice. This book also describes challenges associated with each practice that teachers we have worked with have encountered, as well as specific suggestions for successfully addressing these challenges. If you have already been using the five practices, we suspect that some of these challenges may be familiar to you and that these discussions will be particularly useful.

Classroom Video Context

In identifying teachers to feature on video, we felt that it was important to select a school district that would feel authentic to readers—one that faced challenges of diversity, poverty, and student performance but was working hard to improve mathematics teaching and learning. We selected Syracuse, New York, for several reasons—the district met our authenticity criteria. Peg had been working in the district for several years, and the district was willing to be featured in this book.

Syracuse City School District (SCSD) is an urban district located in Syracuse, New York. SCSD has a diverse student population K–12 (as shown in Figure 1.3) with 87 percent of students qualifying for free or reduced lunch and 17 percent of students classified as English Language Learners. The nearly 22,000 students attend 17 elementary schools, 11 middle and K–8 schools, and five high schools.

Figure 1.3 • Race/ethnicity of the SCSD students

American Indian/Alaska Native	1%
Black	49%
Hispanic	14%
Asian/Pacific Islander	8%
White	22%
Multiracial	6%

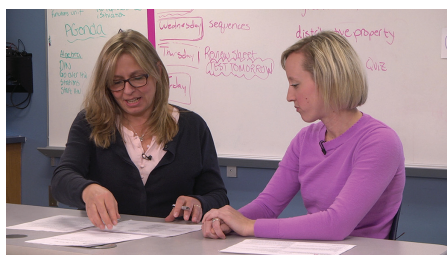
Source: Syracuse City School District, 2018

As stated on its website (<http://www.syracusecityschools.com>), SCSD is “Striving to become the most improved urban school district in America!” The vision for mathematics learning in the district is that “All students in the Syracuse City School District will graduate as *powerful thinkers* who are *mathematically proficient* and *persevere in solving problems in innovative ways*.”

Toward this end, SCSD has been providing ongoing professional development opportunities to teachers to improve instruction and, ultimately, student learning outcomes.



A District Engages in the Five Practices



Video Clip 1.1

In Video Clip 1.1, Melanie Cifonelli, director of mathematics, explains the district’s step-by-step journey to improve mathematics instruction over the past three years.



Videos may also be accessed at

resources.corwin.com/5practices-middleschool



To read a QR code, you must have a smartphone or tablet with a camera. We recommend that you download a QR code reader app that is made specifically for your phone or tablet brand.

A key feature of the professional development efforts in SCSD is a focus on the five practices. Melanie Cifonelli describes how the five practices support the vision for mathematics in SCSD.



These practices really help to highlight and help to build these skills within students. I’ve seen a mindset shift in many of our students when I walk into classrooms that use the five practices on a regular basis. I see students who are not afraid to stand up in front of the class and share their thinking. I see students who are not afraid to question each other, and I see students who are excited to share their thinking and who are okay with being incorrect or maybe having some faulty thinking.

And they’re okay with changing their thinking in front of a group of people. This is a major shift in mathematics and it’s something that we really want to see in all of our students, that problem solving means we don’t really necessarily know the answer, we don’t necessarily know how to get there, but it takes questioning, it takes trying, it takes failing to move us forward.

Meet the Teachers

The video recordings and related classroom artifacts are drawn from the work of three Grades 6–8 teachers in SCSD—Jennifer Mossotti, Michelle Musumeci, and Michelle Saroney. The lesson taught by Jennifer Mossotti will be used in Part One of Chapters 2 to 6 to unpack the focal practice. By focusing on the same teacher across chapters, you will have a coherent picture of instruction in her classroom and a better understanding of how the practices provide synergy. The lessons taught by Michelle Musumeci and Michelle Saroney will be used in Part Two of Chapters 2 to 6 to provide illustrations of how specific challenges can be addressed.

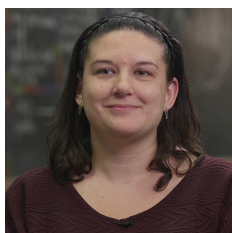


Jennifer Mossotti has been working in SCSD since she started teaching 12 years ago. She is certified to teach mathematics in Grades 7–12 as well as students with disabilities in Grades 7–12. She is currently teaching mathematics at HW Smith Pre-K–8 School, where she has been for the past two years. She became a teacher because she always loved school and working with children.

Jennifer feels many of her students think that past (bad) experiences in the mathematics classroom are indicative of future results. She wants to turn this thinking around by helping them first develop an understanding of the concepts underlying procedures they will be learning so that they are not simply mindlessly following a series of steps. She explains, “When students have the mindset that there is a reason for the steps that they are doing, it’s much easier for them to think about what comes next or what mistakes may have been made. And when they start to understand the ‘method to the madness,’ their confidence grows exponentially.”

Using the five practices has helped Jennifer plan lessons and orchestrate discussions that provide each and every student with the opportunity to learn mathematics with understanding. Jennifer explains:

Some students present challenging behavior, some are harder workers than others, some have language barriers, some have issues at home that are beyond my comprehension, and some are on grade level, and many are not. But at the end of the day, the work of the five practices will bring the largest opportunities for all students to show progress from their current level and will outweigh typical stand-and-deliver instruction.



Michelle Musumeci has a bachelor’s degree in mathematics and began her professional career as an actuary at Blue Cross and Blue Shield (BCBS). Although she had a great job at BCBS, she did not feel that she was making a difference in anyone’s life. She missed working with kids (she had worked in a summer counseling

program right after graduation) and decided to pursue a teaching career. She enrolled in a masters of arts in teaching program and became certified to teach mathematics in Grades 5–9 and 7–12.

Michelle currently teaches mathematics at Huntington pre-K–8, a position she has held for 13 years. She now realizes, even on the toughest days, that teaching was what she was meant to do. Michelle wants her students to feel like they can do mathematics no matter what their previous experience was. She believes *all* students can learn in her classroom, not just about math, but also about being part of a community, about teamwork, about positivity, and about perseverance.

Michelle feels that the five practices gave her a framework for organizing her thoughts about how she was going to run a lesson. According to Michelle, “The framework makes lesson planning less abstract, and it really helps me anticipate what’s going to happen. Instead of just trying to make decisions in the moment, it encourages me to think ahead. It pushes me to really get at the goal and move students toward that goal so they can get the most out of their thinking.”



Michelle Saroney has been teaching in SCSD for 15 of her 16 years in the profession. In her first career as a therapeutic recreation specialist, she taught people with addictions or disabilities how to enjoy life no matter what their circumstances. Through this work, she discovered a passion for teaching and enrolled in a program that offered a master’s degree in education with an elementary teaching certification.

Michelle is currently a sixth-grade mathematics teacher at Salem Hyde Elementary School where she has been working for the past nine years. She wants her students to have a passion for learning mathematics. She explains: “It makes me so sad when on the first day of school, students talk about how they hate math or they don’t understand why they have to learn it because they are ‘never going to use it.’” At the beginning of each school year, she tells her students that her goal is to make mathematics real to them and prove to them how we use mathematics every day and not just in school. She strives to make her classroom a problem-solving, safe place where students are collaborating with others to solve hands-on or real-world mathematical problems.

Michelle indicated that using the five practices has improved her teaching. She explains:

I’ve always put a lot of time into planning, and I feel like I’ve always been really good at engaging students, but since I’ve been using the five practices in my planning, it has just taken it to a whole other level. I’m planning out the strategies ... planning my questioning around those strategies. ... It makes me more prepared to teach my students, to guide them to those goals, whatever the goals are for the lesson.

These three teachers are making their teaching practice public so that others can learn from their efforts. Hiebert, Gallimore, and Stigler (2003) argue that we must respect teachers “brave enough to open their classroom doors” (p. 56). To honor their courage, as you read about and view excerpts from their classrooms, we encourage you to avoid critiquing what you see or discussing what the teacher “should have done.” Instead, our goal is to use the access we have been given as an opportunity for learning—for serious reflection and analysis—in an effort to improve our own teaching in ways that open up new opportunities for our students to learn.

Using This Book

You will likely get the most out of this book if you are committed to ambitious teaching that provides students with increased opportunities to engage in productive discussions in mathematics classrooms. Through engaging with the ideas in the book, you will learn much about how to increase students’ engagement in and learning from classroom discussions.

This book can be used in several different ways. You might read through the book on your own, stopping to engage with the questions, activities, and assignments as suggested. Alternatively, and perhaps more powerfully, you can work through the book with colleagues in professional learning communities, department meetings, or when time permits. The book would also be a good choice for a book study with a group of peers interested in improving the quality of their classroom discussions. You might also encounter this book in college or university education courses for practicing or preservice teachers or in professional development workshops during the summer or school year. We will explore more ideas about ways to make the five practices central to your instruction in Chapter 7.

Norms for Video Viewing

The video excerpts that accompany this book are intended to provide authentic middle school examples on which to base discussions of the five practices. To take full advantage of these examples, we encourage you to consider the following three norms for video viewing. These norms are based on recent research that documents how video can support teacher learning and reflection (Sherin & Dyer, 2017; Sherin & van Es, 2009).

Focus on student sense-making. The majority of the video clips that you will watch in this book focus on students. That is intentional. While the five practices describe actions that you as the teacher will take, this work involves looking closely at what students do and say. The videos thus provide an opportunity for you to do just that outside of the immediate demands of teaching.

As you explore students' actions in the videos, we encourage you to look beyond simply whether a student's idea is correct or incorrect. Instead, examine what it is that the student understands. What is the student's idea? Where does it come from? Why is it sensible, given what the student understands? Focus on what it is that makes sense about the students' thinking.

Be specific about what you notice. Much of the value of video viewing is the sense that you can slow down classroom interactions and have the time to notice what is taking place in a detailed way. In addition, with video you can often focus on just a subset of events and look closely, for example, at what a particular student is saying and to whom, what gestures or drawings the student is making, and more.

As you view the video excerpts, we encourage you to be specific about what you notice. Provide detailed evidence to support your claims about what is happening. Explain what it is you see in the video that leads you to a particular interpretation.

Consider alternative interpretations. As you watch the video, you may find yourself quickly making assumptions about what is taking place and why. As teachers, we must often respond quickly, diagnosing student confusions, responding to student questions, and making changes in the direction of a lesson. Video, however, provides the luxury of time. Use this to your advantage!

Once you have an idea of what you think is taking place in the video, look for alternatives. How else might you understand what is happening? This is particularly important when examining students' ideas. Rather than assume you know the reason behind a students' strategy or statement, look for alternatives. Considering alternate interpretations is important because when we assume we understand what a student means, we often limit ourselves to what we have heard from students previously.

Getting Started!

You are now ready to begin a deep dive into the five practices. In the next five chapters, you will learn more about the practices. We encourage you to keep a journal or notebook in which you can respond to questions that are posed and make note of questions you have. Such a journal can be helpful in conversations with other teachers or in reflecting from time to time about how your thinking is evolving and changing.

“ The five practices help me make sure that I know the key points that I’m going to use as the foundation throughout the teaching that occurs from that point forward—so, knowing exactly why I’m doing this task at this point in my sequence of lessons, and exactly what points are like the big rocks and big understandings. ”

—JENNIFER MOSSOTTI, EIGHTH-GRADE TEACHER