

Coaching the 5 Practices: Supporting Mathematics Teachers in Orchestrating Productive Discussions

Margaret Smith
Mary Kay Stein
Bilge Yurekli

Prospectus submitted to Corwin 11/29/22; Accepted 2/13/23

Funding for his work was supported by a Teachers as Learners grant from the James S. McDonnell Foundation. The views and conclusions contained herein are those of the authors and should not be represented as official policies of the James S. McDonnell Foundation.

Book Vision

Proposed Title

Coaching the 5 Practices: Supporting Mathematics Teachers in Orchestrating Productive Discussions

Background

Discussions have been identified as the primary vehicle for developing students' conceptual understanding of mathematics. Yet, despite the importance of discussions to student learning, teachers face many difficulties when facilitating mathematics discussions—being prepared to react to what students do during a lesson, determining which ideas to highlight and which students to present, holding all students accountable for the ideas discussed, and ensuring that the key ideas targeted in the lesson are made public just to name a few.

The National Council of Teachers of Mathematics (NCTM) and Corwin co-published *5 Practices for Orchestrating Productive Mathematics Discussions* (Smith & Stein, 2011; 2018) to provide guidance to teachers seeking to improve the quality of mathematics discussions in their classrooms. The 5 practices (anticipating, monitoring, selecting, sequencing, and connecting) are meant to make student-centered instruction more manageable by moderating the degree of improvisation required by the teacher during a classroom discussion. Rather than focusing on in-the-moment responses to students' contributions, the practices instead emphasize the importance of planning. The *5 Practices* book introduced and illustrated this set of ideas. Using examples of student work and narrative cases of instruction, the book demonstrates how, through planning, teachers can anticipate likely student contributions, prepare responses they might make to them, and make decisions about how to structure students' presentations to further their mathematical agenda for the lesson.

The *5 Practices* has been on NCTM's best-seller list consistently since its publication. Despite the popularity of and enthusiasm for the *5 Practices*, however, many teachers found that enacting productive discussions in their classrooms remained elusive. In particular, teachers called for videos of teachers enacting the 5 practices so that they could see what they actually looked like in a real classroom. To address these requests, a three-book series¹, entitled "*The 5 Practices in Practice: Successfully Orchestrating Mathematics Discussions*," was published in 2019/2020 (Smith & Sherin, 2019; Smith, Bill, & Sherin, 2020; Smith, Steele, & Sherin, 2020). These books are meant to deepen teachers' understanding of the 5 practices by engaging them in reading, observing, and analyzing episodes of teachers' planning for, enacting, and reflecting on lessons in which they were endeavoring to orchestrate productive discussions.

One of the main contributions of the *5 Practices in Practice* series was the identification of specific challenges associated with implementing each of the practices. For example, teachers often struggle with "*Selecting only solutions that are most relevant to learning goals*" under the practice of *Selecting*. The *5 Practices in Practice* series not only unpack what it takes to do each practice well, but also help teachers to use their specific, self-identified challenges as focal points for their own improvement efforts. These books were written to speak directly to the teacher;

¹ There is one book for each of the following grade-bands: K-5, 6-8, or 9-12.

hence most of the suggested analytic activities around the challenges are designed to be performed solo by the teacher.

In the proposed book, we introduce the role that a coach can play in helping teachers to address their challenges. Increasingly, coaching is being viewed as a robust approach to the improvement of teachers' practice; one in four schools now have a math coach (Hill & Papay, 2022). The proposed book will identify the opportunities for teacher learning that are afforded through teachers' one-on-one interactions with a coach focused on the challenges that have been identified in the *5 Practices in Practice* series. Unlike the previous *5 Practices* books, the proposed book will talk directly to coaches about how to deepen teachers' understanding of their instructional practices through coaching conversations and through the provision of guides and tools that they can use in their work with teachers.

Audience

The proposed book is being written primarily for coaches and teacher educators/instructional leaders/professional developers who are committed to ambitious teaching practice that provides students with increased opportunities to engage in productive discussions in mathematics classrooms. It is likely, however, that any education professional working with teachers would benefit from the book's tools, guides, and discussions of how to support teachers as they engage students in classroom discussions.

Uses. The proposed book could be used in several different ways. Coaches who are already familiar with the 5 practices can read through the book on their own, stopping to engage in the activities as suggested or trying things out in their own coaching practice. Alternatively, and perhaps more powerfully, coaches can work their way through the book with coach-colleagues in whatever venue is available to them. In some districts, for example, coaches work in schools and classrooms Monday through Thursday and spend Friday meeting together to compare challenges and share new insights about coaching practice. Finally, individuals responsible for training coaches (e.g., central office curriculum and instruction staff; state department of education staff) could use this book to inform the design of their professional development.

Potential Course Adoptions. The *proposed book* would be appropriate in college or university courses for practicing or preservice instructional leaders.

Overview

The proposed book presents a model for guiding coaches as they work one-on-one with mathematics teachers.

Take home messages:

- Power of organizing coach-teacher conferences around teacher challenges
- The importance of preparation
- Building on teacher thinking

Power of Organizing around Challenges

We conceptualize the effort that teachers expend when working on challenges regarding the 5 practices as a process similar to the effort students expend when they work on challenging tasks

in the classroom (Yurekli & Stein, under review). As a key element of ambitious mathematics instruction, engaging students with challenging tasks is necessary for the development of meaningful learning because it provides students with opportunities to struggle with important mathematical ideas and relationships (Hiebert & Grouws, 2007).

In terms of coaching, we argue that engaging teachers in their own instructional challenges is a process necessary to improve their learning. Coach-teacher conversations create more opportunity to learn when teachers question and reflect critically on their practices rather than just discussing *what* to do next (Witherspoon et al., 2021). In our model, we engage teachers in their self-identified challenges so that teachers can reason their ways through these challenges and make sense of what they should do and how to resolve these challenges.

To ensure teacher engagement in instructional challenges that focus on the most critical aspects of ambitious instruction rather than superficial issues such as logistics and pacing, we constrain the challenges that are addressed during the coach-teacher conferences by asking teachers—at the very beginning of a coaching cycle—to select 3–5 challenges from a list of 19 challenges that appear in Appendix A. Based on our experiences, these 19 challenges represent the things that matter most for the successful enactment of classroom-based discussions. Having teachers select from this list provides a platform for delving deeply into their practices.

The Importance of Preparation

As noted in the earlier *5 Practices* books, because discussion-based lessons are challenging to implement in-the-moment, teacher preparation is key. The *5 Practices* books provide a set of tools and routines (with examples) that teachers can use in their preparations. These include templates that cue the teacher regarding how to anticipate student responses, how to monitor students' thinking, and how to select and sequence students' responses and connect them to the main mathematical goal of the lesson. This advanced preparation limits the amount of in-the-moment decisions teachers have to make during the lesson, which allows them time to listen more actively, question more thoughtfully, and respond in more tailored ways to student thinking.

Just as teachers must learn to prepare for lessons in which challenging tasks are used, coaches must learn to prepare for coach-teacher conferences in which instructional challenges are addressed. For the pre-lesson conference, coaches prepare in advance by identifying teachers' instructional challenges that they will focus on, planning how to address those challenges through building on teacher thinking (see “Building on Teacher Thinking” section below), and anticipating how teachers might react to those challenges. For the post-lesson conference, coaches prepare in advance by selecting and analyzing videoclips from the lesson. Just as in our earlier books, we provide tools and guides to cue the coaches how to anticipate and advance teachers' responses. This advanced preparation limits the amount of in-the-moment decisions coaches have to make during the conferences, which allows them time to listen more actively, question more thoughtfully, and respond in more tailored ways to teacher thinking.

Building on Teacher Thinking

We conceptualize building on teacher thinking as a process similar to building instruction on student thinking in ambitious mathematics classrooms, a process that includes teacher eliciting and responding to students' ideas. In order to learn mathematics with understanding, students need to connect a new mathematical idea, procedure, or fact to their existing mathematical ideas

(Hiebert & Carpenter, 1992). When instruction builds on student thinking teachers surface student ideas about mathematics and respond in ways to advance their thinking so that students can make connections to their own ideas.

In terms of coaching, we argue that building coaching on teacher thinking is necessary for coach-teacher conferences to be effective. That is, to support teacher learning with understanding, coaches must elicit and respond to teacher thinking in ways that will help teachers connect new information to their existing knowledge.

Despite widespread agreement that building coaching moves on teacher thinking is important, there is limited guidance on how to do so. In our model, we have designed a set of moves that coaches can use during their pre- and post-conferences: invite, rehearse, suggest, and generalize. The **invitation** allows the coach to assess where the teacher is at with respect to an instructional challenge with the 5 practices. The **rehearsal** provides the opportunity for the teacher and coach together to think through how a particular strand of reasoning might play out (contingent on student thinking). **Suggest** represents a more directive stance on the part of the coach in order to steer the conversation in a more productive way. Finally, **generalize** is a teacher-coach discussion of why the move was important and how it might be used to address the challenge in similar situations or future lessons.

Rationale

Coaching is one of the fastest growing forms of professional development across the United States (Darling-Hammond et al., 2009). “In fact, state-level officials have responded to this growth by developing endorsements in instructional coaching (e.g., in mathematics, currently 18 states have approved mathematics specialists’ certifications, with an additional 8 states in process; see mathspecialists.org²). These states have charged university educators with designing curricula for supporting future coaches. Similarly, district content specialists in those states and beyond are charged with specifying coaching responsibilities and designing learning opportunities to support coaching practices” (Gibbons & Cobb, 2017, p. 411).

All of this activity suggests the need for an undergirding framework that can guide what coaches do when they work with teachers. Research suggests that mathematics coaching is highly personal and idiosyncratic, with coaches’ practice varying significantly from school to school and district to district (Coburn & Russell, 2008). There is a small set of books written by practitioners on which coaches can draw, but most of these do not address mathematics coaching.

The authors of the proposed book bring a unique set of skills to the explication of coaching practices that support teacher learning of how to orchestrate productive discussions in mathematics classrooms. As the lead author of the current set of *5 Practices* books, Smith has a track record for transforming research-supported findings into tools and guides that support teacher learning. Stein has led research efforts that have identified key elements of successful teaching (Stein et al., 1996, 2008), and more recently, features of effective coaching (Stein et al.,

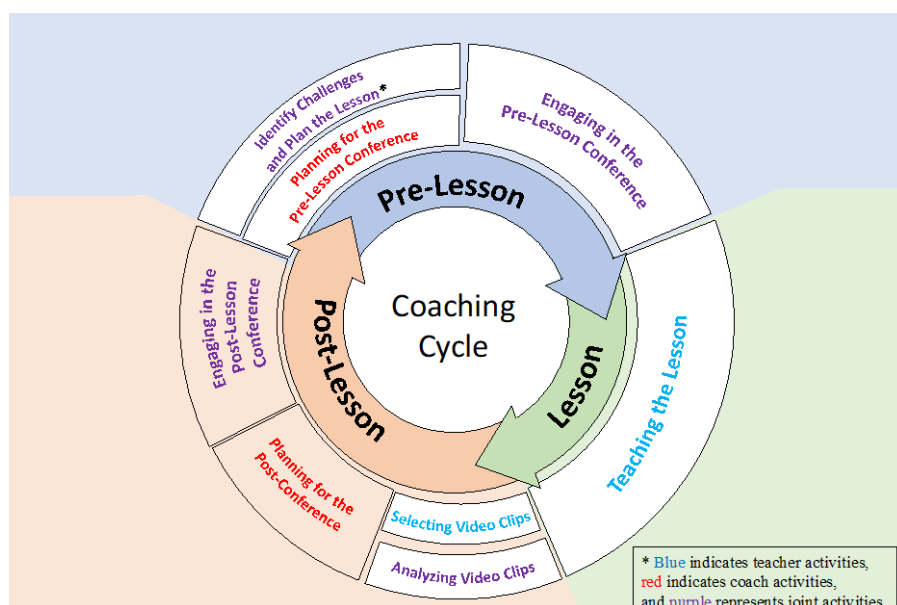
² As of 2022, 23 states have approved mathematics specialists’ certifications, with an additional 4 states in process.

2022). Yurekli has served as lead researcher on several studies of mathematics teaching and coaching (e.g., Yurekli & Stein, under review).

The Content

Approach. The authors' approach to the design of the book differs from other coaching books because we situate the coaching model in the *5 Practices* and hence are able to provide rationales—to both coaches and teachers—regarding not only *what* to do, but also *when* and *why* to do it. One of the most helpful aspects of our coaching model is coaches' and teachers' understanding and adoption of the desired outcome (whole-class discussions that build on student thinking and connect it to the mathematical goal of the lesson).

The proposed book is about ways in which coaches can deepen teachers' understanding of the 5 practices through coaching conversations and through the provision of guides and tools that they can use in their work with teachers³. Coach-teacher interactions are organized by cycles with each cycle having a preparation, enactment, and reflection phase. There are 8 activities (with associated tools and guides) in each cycle. One cycle typically takes 2-3 weeks.



Features. The book will be focused on the challenges that teachers face in orchestrating productive discussions in their classrooms and how coaches can help teachers address these challenges. The book will include narrative examples of coaches and teachers working in diverse settings engaged in talking about and doing the 5 practices⁴. In addition, the book will include teacher lesson plans, coach pre-lesson and post-lesson conference plans, and other artifacts collected from real coaching sessions and real classrooms. The tools and guides that will be available in the appendix will support coaches and teachers as they create and enact 5 practices lessons in their own classrooms.

³ See Appendix B for the list of coaching activities with brief description of the tool/guide found in the specific activity.

⁴ Grades 3–8 will be covered in these examples. Although the examples will focus on a specific grade-level content, the ideas will transcend the grade level.

Throughout the proposed book, readers will have the opportunity to actively engage in three types of activities. Readers will be asked to “stop and consider” something (e.g., look at the Teacher Challenges Tool, lesson plan, and monitoring tool that the teacher has completed and determine which teacher challenges the coach should focus on during the pre-lesson conference) or “analyze the work of a coach” through the supplied artifacts (e.g., analyze a coach-teacher conference) before reading our analysis of what is going on. Also through “putting into practice,” readers will put the ideas discussed in the chapter to work in their own contexts. (Both of these types of activities are similar to what is found in the original *5 Practices* book and in the *5 Practices in Practice* series.)

Length. The book will contain 6 chapters and appendices and will be between 200-250 pages in length. The artifacts (e.g., lesson plans) referred to in the book could be accessed through a designated website at Corwin.

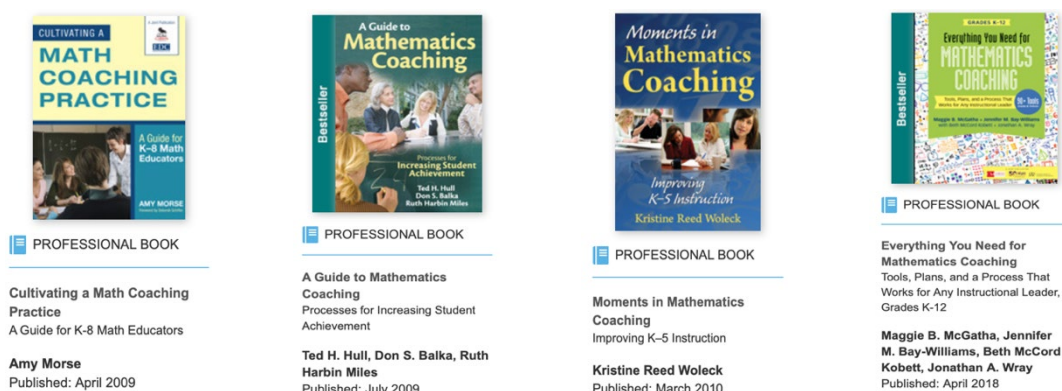
Research base. Although the number of studies that have focused on the effectiveness of coaching programs is small, they have found that coaching programs can lead to positive changes in mathematics teachers’ knowledge, beliefs, instructional practices, and student achievement (e.g., Campbell & Malkus, 2011; Chapin, 1994; Kraft & Hill, 2020). A set of studies done in Tennessee using a coaching model that had some similarities to our model found that the coaching model can be taught to and learned by coaches and lead to desired student outcomes (Russell et al., 2020; Stein et al., 2022; Correnti et al., under review).

Format. Print or electronic books will work well in all of the venues described. In professional development settings or in college and university courses, a copy of the book is generally available (either purchased individually or provided to them).

Schedule. We expect to have a completed first draft of the book done within a year from the contract date.

Competition

We only focused on books about mathematics instructional coaching⁵. Corwin currently publishes 4 books that are specific to coaching mathematics:



⁵ The book by West and Staub (2003) is arguably the first book on coaching mathematics teachers, but it is old and has not been updated.

Three of these four books were published more than a decade ago. The most recent one was published 4 years ago. Three things distinguish the proposed book from any of these (and most other) prior works: (1) a specific target of the coaching enterprise—improving a teacher’s ability to orchestrate productive mathematical discussions; (2) a connection to an existing model for improving classroom discussions that has already been adopted by many districts, schools, and teachers—the *5 Practices*; (3) a coherent set of tools and guides that support the work of both the teacher and the coach as they seek to improve classroom discussion.

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Appendix A.

Below is a list of challenges that teachers have reported facing when trying to implement ambitious teaching practices. Review the 19 challenges listed and identify no more than 5 challenges that you struggle with. For each identified challenge briefly describe how the challenge plays out in your classroom.

	CHALLENGES	DESCRIPTION	The Challenge in My Classroom
GOALS AND TASKS	(1) Identifying learning goals	Goal needs to focus on what students will learn as a result of engaging in the task, not on what students will do. Clarity on goals sets the stage for everything else!	
	(2) Identifying a doing-mathematics task	While <i>doing-mathematics</i> tasks provide the greatest opportunities for student learning, they are not readily available in some textbooks. Teachers may need to adapt an existing task, find a task in another resource, or create a task.	
	(3) Ensuring alignment between task and goals	Even with learning goals specified, teachers may select a task that does not allow students to make progress on those particular goals.	
	(4) Launching a task to ensure student access	Teachers need to provide access to the context and the mathematics in the launch but not so much that the mathematical demands are reduced and key ideas are <i>given away</i> .	
ANTICIPATING	(5) Moving beyond the way <i>you</i> solve a problem	Teachers often feel limited by their own experience. They know how to solve a task but may not have access to the array of strategies that students are likely to use.	
	(6) Being prepared to help students who cannot get started on a task	Teachers need to be prepared to provide support to students who do not know how to begin work on the task so that they can make progress without being told exactly what to do and how.	
	(7) Creating questions that move students toward the mathematical goals	The questions teachers ask need to be driven by the mathematical goals of the lesson. The focus needs to be on ensuring that students <i>understand</i> the key mathematical ideas, not just on producing a solution to the task.	
MONITORING	(8) Trying to understand what students are thinking	Students do not always articulate their thinking clearly. It can be quite demanding for teachers, in the moment, to figure out what a student means or is trying to say. This requires teachers to listen carefully to what students are saying and to ask questions that help them better explain what they are thinking.	
	(9) Keeping track of group progress—which groups you visited and what you left them to work on	As teachers are running from group to group, providing support, they need to be able to keep track of what each group is doing and what they left students to work on. Also, it is important for a teacher to return to a group in order to determine whether the advancing question given to them helped them make progress.	
	(10) Involving all members of a group	All individuals in the group need to be challenged to answer assessing and advancing questions. For individuals to benefit from the thinking of their peers, they need to be held accountable for listening to and adding on, repeating and summarizing what others are saying.	

SELECTING & SEQUENCING	(11) Selecting only solutions that are most relevant to learning goals	Teachers need to select a limited number of solutions that will help achieve the mathematical goals of the lesson. Sharing solutions that are not directly relevant can take a discussion off track, and sharing too many solutions (even if they are relevant) can lead to student disengagement.	
	(12) Expanding beyond the usual student presenters	Teachers often select students who are articulate and on whom they can count for a coherent explanation. Teachers need to look for opportunities to position each and every student as a presenter and help students develop their ability to explain their thinking.	
	(13) Deciding what work to share when the majority of students were not able to solve the task and your initial goal no longer seems obtainable	Teachers may on occasion find that the task was too challenging for most students and that they were not able to engage as intended. This situation requires the teacher to modify her initial plan and determine how to focus the discussion so students can make progress.	
	(14) Moving forward when a key strategy is not produced by students	In planning the lesson, a teacher may determine that a particular strategy is critical to accomplishing the lesson goals. If the success of a lesson hinges on the availability of a particular strategy, then the teacher needs to be prepared to introduce the strategy through some means.	
	(15) Determining how to sequence incorrect and/or incomplete solutions	Teachers often choose not to share work that is not complete and correct for fear that students will remember incorrect methods. Sharing solutions that highlight key errors in a domain can provide all students with an opportunity to analyze why a particular approach does not work. Sharing incomplete or partial solutions can provide all students with the opportunity to consider how such work can be connected to more robust solutions.	
CONNECTING	(16) Keeping the entire class engaged and accountable during individual presentations	Often, the sharing of solutions turns into a <i>show and tell</i> or a dialogue between the teacher and the presenter. The rest of the class needs to be held accountable for understanding and making sense of the solutions that are presented.	
	(17) Ensuring key mathematical ideas are made public and remain the focus	It is possible to have students share and discuss a lot of interesting solutions and never get to the point of the lesson. It is critical that the key mathematical ideas that are being targeted in the lesson are explicitly discussed.	
	(18) Making sure that you do not take over the discussion and do the explaining	As students are presenting their solutions, the teacher needs to ask questions that engage the presenters and the rest of the class in explaining and making sense of the solutions. There is a temptation for the teacher to take over and tell the students what they need to know. When this happens, opportunities for learning are diminished. Remember whoever is doing the talking is doing the thinking!	
	(19) Running out of time	Teachers may not have enough time to conduct the whole class discussion the way they had planned it. In such cases it is important to come up with a <i>Plan B</i> that provides some closure to the lesson but does not turn into telling.	

Appendix B. Coaching Cycle Activities

Below we indicate the tools and guides that support specific coaching activities and provide brief descriptions of them. For each activity, **blue** indicates teacher activities, **red** indicates coach activities, and **purple** represents joint activities.

1. Preparing for the Lesson

Tool/Guide		Description
a)	Guide for Preparing the Lesson	A description of what is involved in supporting a teacher's lesson planning.
b)	Teacher Challenges Tool	A list of 19 challenges that teachers often face when engaging in ambitious teaching (Smith & Sherin, 2019). Teachers are asked to identify and describe the challenges that they have faced.
c)	Five Practices Guide	A brief description of the components of a model for supporting productive classroom discussions based on the thinking of students.
d)	Goal and Task Identification Guide	A list of challenges that teachers often face when identifying learning goals and/or selecting high-level tasks along with suggestions for how to deal with each of them and reasons for why addressing them is important.
e)	Lesson Planning Tool	A template for explicating key aspects of a lesson (e.g., learning goals, prior knowledge, materials needed). Adapted from Smith, Bill, and Hughes (2008).
f)	Monitoring Tool	A template for recording solution strategies that a teacher anticipates and questions that she can ask students who produce them. This is constructed prior to the lesson and can be used during the lesson to keep track of what occurs during the lesson.

2. Planning for the Pre-Lesson Conference

Tool/Guide		Description
g)	Pre-Conference Planning Guide	A description of the activities in which the teacher and coach need to engage in preparation for the pre-conference and the tools and guides that support the activities.
h)	Pre-Conference Planning Tool	A template for identifying the challenges or issues with which the teacher appears to be grappling, the ways in which the coach plans to engage the teacher in exploring the issue, and the reason this issue is worth addressing.

3. Engaging in the Pre-Lesson Conference

4. Teaching the Lesson

5. Selecting Video Clips

Tool/Guide		Description
i)	Video Selection Guide	Suggestions on how to identify video clips for discussion that will highlight challenges the teacher is facing and/or areas of teacher growth.

6. Analyzing Video Clips

Tool/Guide		Description
j)	Noticing and Wondering Guide	A description of what noticings and wonderings are along with examples (Smith, 2009; Hughes, Smith, Hogel, & Boston, 2009).
k)	Noticing and Wondering Tool	A template for recording what a teacher and coach notice and wonder about the selected video clips.

7. Planning for the Post-Lesson Conference

Tool/Guide		Description
l)	Post-Conference Planning Guide	A description of the activities in which the teacher and coach need to engage in preparation for the post-conference and the tools and guides that support the activities.
m)	Post-Conference Planning Tool	A template for identifying noticings and wonderings the coach plans to discuss with the teacher, the ways in which the coach engages the teacher in exploring the noticing further, and the reason this noticing is worth exploring.

8. Engaging in the Post-Lesson Conference