Preface

In this book, we present and discuss a framework for orchestrating productive discussions in science that are rooted in student thinking and that emerge from students' work on demanding tasks. Such tasks provide opportunities for students to engage in the disciplinary practices described in the Next Generation Science Standards (Achieve, Inc. 2013) while also developing understanding of key patterns and/or concepts in science. The framework presented throughout the book identifies a set of instructional practices that will help teachers effectively use student work as the launching point for discussions in which students address important science ideas, consider alternative explanations, identify contradictions between evidence and claims, and develop or consolidate understandings of new concepts. The premise underlying the book is that the identification and use of a codified set of practices can make student-centered approaches to science instruction accessible to and manageable for more teachers. By giving teachers a road map of things that they can do in advance and during whole-class discussions, these practices have the potential for helping them to more effectively orchestrate discussions that are responsive to both students' thinking and core practices and ideas within science disciplines.

Throughout the book, we illustrate the instructional practices with episodes that take the reader inside science classrooms. In particular, we make significant use of three narrative cases: the Cases of Kelly Davis, Nathan Gates, and Kendra Nichols. We introduce the Cases of Kelly Davis and Nathan Gates in chapter 2 to contrast the quality of instruction that does and does not utilize the Five Practices framework. We explore the Case of Kendra Nichols in considerable depth in chapters 3 and 4 as each of the five practices is examined in detail, and refer to it again in subsequent chapters as we consider broader issues related to integrating the five practices into everyday instruction. These cases, and other vignettes that appear in the book, are based on real events and are intended to make salient certain types of teacher-student interactions and the level and type of thinking required to teach with understanding. As such, these episodes of teaching reflect what we have observed, and they should be thought of as composites that have been enhanced at times in order to bring out specific aspects of instruction we wish to highlight.

Following research that has established the importance of learners' construction of their own knowledge (Bransford, Brown, and Cocking 2000), we have designed this book to encourage the active engagement of readers. In several places, we have provided notes (titled "Active Engagement") that suggest ways in which the reader can engage with specific artifacts of classroom practice (e.g., narrative cases of classroom instruction, transcripts of classroom interactions, instructional tasks, or samples of student work). Rather than passively read the book from cover to cover, readers are encouraged to take our suggestions to heart and pause for a moment to grapple with the information in the ways suggested. By actively processing the information, readers' understandings will be deepened, as will their ability to access and use the knowledge flexibly in their own professional work. In addition, within some chapters we have provided suggestions (titled "Try This!") regarding how teachers can explore the ideas from a chapter in their own classrooms.

Although the primary focus of the book (chapters 2, 3, 4, and 7) is the Five Practices model first established in *5 Practices for Orchestrating Productive Mathematics Discussions* (Smith and Stein 2011), we also explore other issues that support teachers' ability to orchestrate productive classroom discussions. Specifically, in chapter 1 we emphasize the need to set clear goals for what students

will learn as a result of instruction and to identify a task that is consistent with those learning goals prior to engaging in the five practices. In chapter 5 we focus explicitly on the types of questions that teachers can ask to challenge students' thinking and the moves that teachers can make to promote the participation of students in whole-class discussions. We situate the Five Practices model for facilitating a discussion within the broader context of instructional design in chapter 6. The book concludes with chapter 7, in which we describe the lessons learned by beginning secondary science teachers as they endeavored to conduct task-based discussions in science using the five practices.

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