Preface

We wrote this book as a resource for educators who are interested in providing ongoing, structured learning opportunities for mathematics teachers. We present two models—the Problem-Solving Cycle model for mathematics teacher professional development and the Mathematics Leadership Preparation model for the preparation of mathematics PD leaders. Both were developed and field-tested as part of two research projects conducted over the past decade and supported by the National Science Foundation (NSF). These models offer a vision and a vehicle for site-based PD facilitated by teacher leaders, focused on topics of primary interest to mathematics teachers: mathematical content, classroom instruction, and student learning. We intentionally designed the models so that they can be tailored to meet the specific needs and interests of participating teachers and administrators. We encourage readers to consider whether and how these adaptable models might be useful in their own, unique circumstances, and in what ways they might adapt the models to ensure their effectiveness.

As a context for understanding the PSC and the MLP, it seems important to present the timeline of our research. Although our efforts at developing these models began over 10 years ago, in many ways we are still at the beginning of this journey. We recognize there is a long road ahead that involves disseminating our research findings, sharing our stories, conducting additional research, and learning from the experiences of our colleagues in the field. We hope that by writing this book we are opening a door and inviting interested others to join us on this journey.

We began envisioning and shaping the PSC in 2003 as part of a research grant to generate novel ways to support middle school teachers to teach algebra to their students. The grant was called "Supporting the Transition from Arithmetic to Algebraic Reasoning," or STAAR for short. Over the course of about 5 years, the PSC took shape as a structure for conducting teacher PD and showed clear promise for producing the desired outcomes.

At first, we imagined the Problem-Solving Cycle as a professional learning community in which teachers would dive deeply into selected mathematical problems and video from their own classrooms in order to improve their knowledge of algebra and their ability to effectively teach it. Over time, as we worked with a group of middle school mathematics teachers

across several school districts in Colorado, the PSC evolved into a more nuanced model for teacher professional development, and we identified both components of the model that are critical to maintaining its integrity and components that can be modified. For example, we determined that the PSC can be readily applied to support teachers in any mathematical content area, not just algebra. Components that are central to the integrity of the model include teachers collaboratively solving a selected mathematical problem, teaching that problem in their classrooms, and then examining video from these classroom lessons. In addition, the model is designed to be iterative, prompting teachers to engage in continuous cycles of professional learning.

One of our goals in the STAAR project was to document precisely what the PSC model entailed so that individuals outside of our research group could lead it. To this end, we created a PSC Facilitator's Guide, which can be accessed at cset.stanford.edu/psc, along with other supporting materials intended for use by individuals who are interested in carrying out the PSC with teachers.

In 2007, we began work on a new research grant, which involved an extensive investigation of the impact, scalability, and sustainability of the PSC. The project was entitled "Toward a Scalable Model of Mathematics Professional Development: A Field Study of Preparing Facilitators to Implement the Problem-Solving Cycle," or the iPSC project. A central goal of the iPSC project was to design, implement, and research a model to prepare and support teacher leaders to facilitate the PSC. This model, which we call the Mathematics Leadership Preparation model, consists of an annual Summer Leadership Academy and Leader Support Meetings throughout the following academic year, and develops leadership skills integral to the effective facilitation of the PSC. As part of the iPSC project, we worked closely with one large suburban school district in Colorado to prepare mathematics teacher leaders in that district to facilitate the PSC in their middle schools. In addition to providing information about how to support PSC teacher leaders, conducting the iPSC project helped our research team understand more about features of the PSC that are more and less challenging for facilitators and the potential of the model to impact teachers and students on a large scale over time.

The descriptions and analyses of the PSC and MLP models presented in this book are based on data from the two NSF grants discussed above—the STAAR project and the iPSC project. In some cases, our analyses draw only on data from the STAAR project, and in other cases they draw only on data from the iPSC project. Throughout each chapter, as we present these analyses we strive to make clear from which project the data are drawn, and when we highlight data from the iPSC project we reference the relevant project year(s).

In addition to these two projects, members of our research team have informally used the PSC and MLP models with a few other school districts

across several states for smaller-scale projects. Although we do not present specific data or analyses from those projects, they have informed our thinking over the years.

Working on this book together provided an opportunity for us to reflect on the knowledge we have gained by designing, implementing, and researching the PSC and MLP models, and to pull together research findings from the two initiatives and several cohorts of teachers and teacher leaders. We gained new insights into the PSC and MLP as we discussed the various sets of research findings, and as we wrote and rewrote the chapters. We hope that as you read the book and share our experiences, you will also gain new insights into the value of focused, ongoing mathematics PD. We are optimistic that the PSC and MLP models have much to offer the field of mathematics education, particularly as a vehicle to support K–12 mathematics teachers as they strive to ensure the success of all their students.