Introduction

Writing the third edition of *Designing Professional Development for Teachers of Science and Mathematics* has given us a chance to reflect on our learning from colleagues, new research and literature, and our work with dedicated and thoughtful professional developers in the field who have been using the ideas in this book since the first edition.

The intention of this introduction is to make visible for you, the reader, our process of reflecting and revising. If you are familiar with the first and second editions, you can take this retrospective look with us. If you are new to the book, you will understand its evolution into this revised edition. In either case, you will know why we took on the work of revising *Designing Professional Development for Teachers of Science and Mathematics* and how it has changed.

WHAT HAS HAPPENED SINCE THE FIRST AND SECOND EDITIONS

Since 1998, we have been watching with a sense of wonder and delight how *Designing Professional Development for Teachers of Science and Mathematics* has taken on a life of its own. We are professional developers. As such, we knew that writing the book was only the beginning, the easy part, as Susan Loucks-Horsley would say. The hard part, the "real work," was getting it used well. For the past 11 years, we have been on the ground actively disseminating and engaging others with the ideas in *Designing*

Professional Development for Teachers of Science and Mathematics along with many colleagues and collaborators.

Even so, when we first put fingers to keyboards 11 years ago, we could never have anticipated how well the book would be used. We have seen dog-eared, sticky note–marked copies in the hands of professional developers all over the country, some of whom fondly refer to it as the "yellow book" or the "clouds book" because of the first edition's cover design. With equal gratification, we have worked elbow-to-elbow with professional developers who have made the principles and processes come to life in the purposeful and imaginative professional development designs they have created—designs that are paying off in powerful learning for teachers and their students.

A long list of products and research that built on and extended the original work resulted from the first edition. For example, *Teachers as Learners: A Multimedia Kit for Professional Development in Science and Mathematics* (Corwin, 2003) is a set of videos and learning activities that provide visual examples of powerful professional learning strategies based on those identified in the 1998 edition of this book. The WestEd authors are currently developing a science professional development simulation and accompanying learning modules, with support from the National Science Foundation, to bring the professional development design framework and conceptual ideas in the book to life in the form of an engaging set of materials.

One of our reasons for updating the earlier editions of the book was to collect and bring together in one place all that we have learned through many people's efforts to translate the principles, framework, and strategies of the first and second editions into practice and to deepen our understanding of professional development design through further research and new resources. The original editions evolved by synthesizing and codifying what outstanding and effective professional developers do when they design programs. This edition has the design work of more professional developers from which to draw. It is truly from the field, to the field.

In addition to what we have learned through work that grew directly out of the earlier editions, the field as a whole is advancing. With a wide-angle lens, we have observed some encouraging changes that have influenced our thinking and informed our revisions.

The knowledge bases about learning, teaching, the nature of science and mathematics, professional development, and educational change are growing. A veritable explosion of cognitive research has occurred since the first edition of this book, increasing our understanding about how children and adults construct knowledge in mathematics and science. More also is known about what constitutes and supports transformative learning for teachers and how to combine professional learning strategies to address a multiplicity of teachers' learning needs.

We now better understand when and how professional development improves practice and student learning. Reports and studies emerge almost daily (e.g., Blank, de las Alas, & Smith, 2008; Carnegie Corporation of New York, 2009; Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009) that outline the current status of science and mathematics education and professional development and provide recommendations for continuous improvement. We are learning more and more about how professional learning communities support continuous improvement and their role in sustaining teachers' professional learning. Research is emerging on the impact of coaches and mentors on teachers' practice and the benefits generated through teacher induction programs. The knowledge base on evaluation of professional development programs, paired with ongoing monitoring, has influenced our thinking about the design framework and how designers collect data to improve programs. These developments and learnings are reflected throughout the chapters in the book, as well as in the professional development design framework itself.

National, state, and local standards are more widely known and consulted as school districts shape their vision of teaching and learning. Since we first convened as a team of authors and collaborators in 1996, the National Council of Teachers of Mathematics (NCTM) standards were only three years old, and the National Research Council's (NRC) National Science Education Standards had just been published. "The 1990s," we wrote, "are certain to be known as the decade in which standards became commonplace among educators and policymakers in the United States" (Loucks-Horsley, Hewson, Love, & Stiles, 1998, p. 215). We were right; standards are now commonplace. Most states and many school districts have adopted standards, some more closely aligned with national standards than others. In fact, as we write this introduction, the Common Core State Standards Initiative, led by the National Governors Association and the Council of Chief State School Officers (CCSSO), has the commitment of 49 states and territories to develop common academic standards in mathematics and English language arts (CCSSO, 2009).

For the most part, today the debate has shifted from whether or not standards should guide mathematics and science education to how to implement them and how to ensure that they are met. There are many recent resources to help guide the efforts to implement the standards, including NCTM's *A Research Companion to Principles and Standards for School Mathematics* (2003a) and *Curriculum Focal Points for Prekindergarten Through Grade 8 Mathematics: A Quest for Coherence* (2006), new tools from the American Association for the Advancement of Science (AAAS) such as the two volumes of the *Atlas of Science Literacy* (2001, 2007), the work under development at the National Science Teachers Association (NSTA) on the Science Anchors pro-

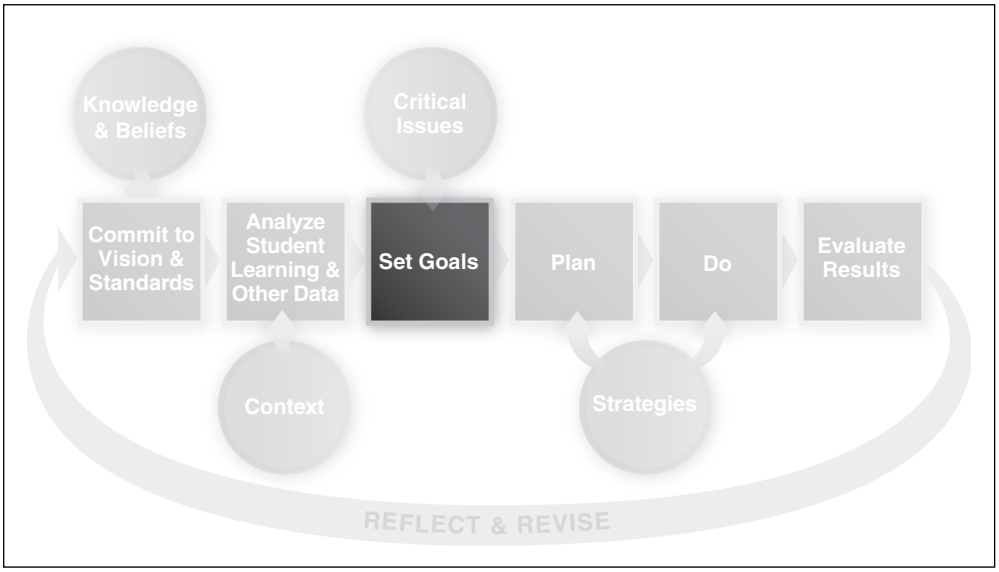
Data About Practice

Complementing data about student achievement and opportunities to learn are data about teachers' needs. What knowledge and skills do teachers need if students are going to reach specific standards? Identifying teachers' specific learning needs as they directly relate to student learning needs forms the basis for setting the goals and outcomes for the professional development program. In addition, data about the school, district, or organization can help designers assess the quality of leadership, the strength of the professional learning community, and the capacity of the organization to implement and sustain mathematics and science reform. Equally important is obtaining data related to prior professional development efforts. These data enable planners to consider what has been successful in the past to address teachers' and students' learning needs. These data can also help planners steer clear of efforts that did not result in changes in teachers' knowledge or practices.

As a result of engaging in the "analyze student learning and other data" step in the design process, professional developers have delved into data about student learning, opportunities to learn, and classroom practice to ensure that their goals focus on critical areas of need for student and teacher learning.

Set Goals

Figure 1.11 Professional Development Design Framework: The Design and Implementation Process: Set Goals



lessons of leadership for reform. They constantly need to be challenged as learners, expanding their own understanding of mathematics, teaching, and learning. The initial design of the Renaissance failed to account for this need, and much of the statewide professional growth opportunities have been funded catch-as-catch-can.

Cluster leaders created their own version of professional development for participating teachers, and regional directors provided guidance, inspiration, and support. Here, another tension emerged. The program's commitment to shared leadership and delegated authority did not always produce results matching its goals. Messages sometimes got distorted as individual cluster leaders constructed their own understanding of the reform and the Renaissance. The program continued to struggle with the degree of control and guidance cluster leaders received. Does one intervene and risk damaging a cluster leader's credibility and opportunity to learn? How is quality maintained while leadership develops?

Supporting Reforms

Other important elements supported the Renaissance efforts. Enlisting parents as partners is one example. Schools throughout the Renaissance pilot tested the middle school version of Family Math, anticipating that more than 500 parent nights would be conducted during the 1995 and 1996 school year. Administrative support offers yet another example. Principals need time with teachers and other principals, and district administrators must understand and support the reforms.

Efforts of the Renaissance also moved beyond the middle school, in part due to conflicts that arose between some Renaissance middle schools and high schools they feed. Middle school teachers expressed concerns that their students went on to high school eager and excited about mathematics only to have their enthusiasm squelched by the high school placement tests and traditional course work. In many districts, these conflicts were seized as opportunities to promote discussions between middle and high schools. As a result of these discussions, some high schools began to revise their programs using new innovative high school curricula.

Guiding Principles

As the Renaissance engaged in this process, much about teacher change and professional development was learned. Principles that guided the Renaissance program, and all future Renaissance programs, are elaborated on in the following sections.