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A Framework for Designing Professional Development

This book introduces the big idea that effective professional development is carefully designed and implemented based on a number of important factors or inputs. It offers a conceptual framework for thinking about, planning, and implementing professional development called the *professional development design framework*. This chapter introduces the framework and its components. The subsequent chapters in this book discuss, in detail, each of the components and how to apply them in your work.

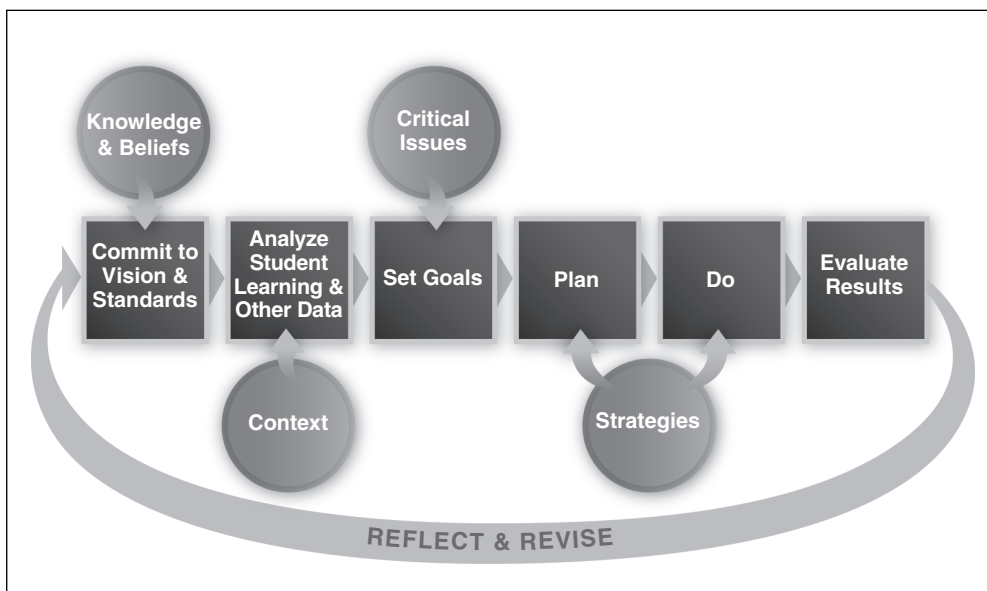
The framework emerged originally from collaborative reflection with outstanding professional developers about their programs for mathematics and science teachers. These professional developers felt very strongly that what they had to offer were not “models” that others could admire and adopt. Their programs were more complex than that, combining elements of different models, evolving and changing over time. They emerged out of and were uniquely suited to their own particular goals and context.

Equally complex was the process they used to develop their programs. As professional development “designers,” they consciously drew on research and “practitioner wisdom” and were guided by their own passionate beliefs about the nature of mathematics and science and student and adult learning. They had a repertoire of strategies from which to choose. They grappled with

challenging, critical issues related to the “big picture” of mathematics and science education reform. When confronted with critical issues that threatened to block their progress, they worked with other educators to problem solve and generate creative new solutions. They analyzed student learning data and student work and studied their own unique contexts to deliberately set goals to improve student and teacher learning and classroom practice. They thought carefully about what approach would be best in a particular time and place to advance their goals. Drawing on all of these elements, they carefully crafted their goals and plans. Once implemented, their designs never stopped evolving. They evaluated their programs not only in terms of teacher satisfaction but also on the basis of whether teacher and student learning goals were met. They reflected on results and made revisions based on what they learned. For these designers, professional development was not about importing models or following formulas. They engaged in a process of thoughtful, conscious choices and decision making.

It is this process of careful consideration and decision making by professional developers that we have attempted to capture, albeit greatly simplified, in Figure 1.1. At the center of the framework, illustrated in the boxes connected with horizontal arrows, is the professional development design and implementation process, incorporating the following actions: commit to a vision and standards, analyze student learning and other data, set goals, plan, do, evaluate results,

Figure 1.1 Professional Development Design Framework



plan, do, and evaluate results. Each action in the design and implementation process is influenced by several inputs.

INPUTS INTO THE DESIGN PROCESS

The circles above and below the design and implementation process represent four important inputs into the design process that help professional developers make informed decisions. They cue designers to consider the following:

1. *Knowledge and beliefs*. “Stand on the shoulders of giants” by consulting the extensive knowledge bases that can inform the professional development work, and consider how the beliefs operating in your context align with the research.
2. *Context*. Understand the unique features of the local context and use that information to inform the design.
3. *Critical issues*. Pay attention to issues that may influence the success and impact of any professional development, and plan ahead to address them.
4. *Strategies*. Consider a wide range of professional development strategies; choose ones most aligned with your goals, match the needs of the audience, and support teachers to learn and grow over time.

Another way of thinking about these four inputs is that the first, *knowledge and beliefs*, helps answer the question, “What knowledge should inform us, based on the research?” The second, *context*, signals the designer to ask, “What is needed most in our local site, and what resources and conditions may support or threaten us?” The next, *critical issues*, leads us to consider “how certain conditions should be addressed to better ensure our success.” The fourth, *strategies*, provides an opportunity to explore the question, “Which strategies, and in what combination, will contribute to enhanced teacher learning and practice?”

The arrows from the input circles into the design and implementation process boxes indicate when in the process these four inputs are most important to start to consider. For example, note that strategies are most important to consider after goals are clearly established. Otherwise, there is the danger of selecting trendy strategies that may not align with your goals, meet your student learning needs, or fit your context. Once an input is considered, it is assumed that it will continue to inform all subsequent stages in the process. For example, the input of knowledge and beliefs informs *commit to vision*

and standards and every subsequent step, including how the plan is designed, implemented, and evaluated. The input context determines the data you consider in the *analyze student learning and other data* step and helps identify the student, teacher, and organizational needs the professional development should address. Plans are made and implemented based on a solid understanding of contextual factors such as available time, resources, leadership, and school culture and are evaluated, in part, by the extent to which these and other context factors are positively impacted. Planners next consider critical issues like equity, scaling up, and building capacity to inform the *set goals* and *plan* steps, and they continue to attend to these critical issues as they are implementing and evaluating the program.

The input strategies has two arrows connecting it to both the *plan* and *do* steps in the design framework. At the plan step, one considers which strategies would best address the identified goals and outcomes, based on all prior inputs and implementation processes, and selects a combination of strategies. In the do step, those strategies are implemented based on the plan. However, this is also the point at which the final design and implementation process, *evaluate results*, plays a critical role. During the plan and do steps, designers develop plans for how they will evaluate the effectiveness and impact of the professional development plan and anticipate the data that will be gathered. Throughout the do step, designers monitor implementation based on data and refine the implementation of the selected strategies. For example, ongoing monitoring may reveal that teachers have achieved an intended outcome, and then additional strategies may be implemented to address new and emerging needs. Monitoring might also alert designers to the emergence of additional critical issues that need to be addressed in the plan.

Designers also engage in summative evaluation, again using data, to determine the extent to which the entire professional development plan has impacted changes in the context, facilitated achievement of the goals, addressed the critical issues, and contributed to closing the gap from the current status to the achievement of the vision. This formal step of evaluating results leads the designer into the *reflect and revise* process, indicated by the arrow that connects the final process box back into the commit to vision and standards process box. The reflection on results guides revision and refinement of the overall plan as designers continue to implement professional development. The reflect and revise arrow illustrates the cyclical and continuous process of designing, implementing, evaluating, and refining professional learning programs.

The process mapped out in the design framework can be used to design both small- and large-scale professional learning programs, ranging from those in an individual school to those for a statewide or national initiative. It

can guide designs that involve a single strategy, such as a workshop or study group, or a complex program, combining several strategies either simultaneously or over time. Whatever the grain size, the design framework provides a map for crafting professional development to achieve the desired goals for students and teachers.

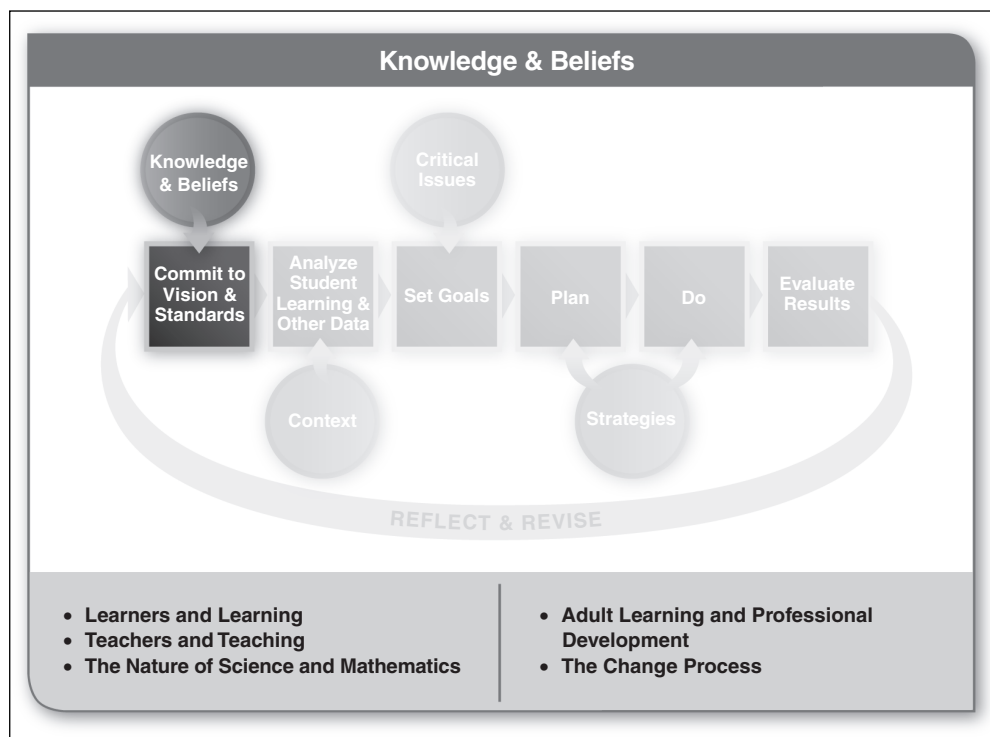
The framework describes professional development design at its best—an ideal to strive toward, rather than an accurate depiction of how it always happens or a lockstep prescription for how it should happen. Given limited resources, especially time, professional developers may not always have the luxury of giving their full attention to every one of the four inputs and the six design and implementation process steps in the model. The professional developers who helped to create the framework extracted its components from what they actually did and what they wished they had done better. With the benefit of hindsight, they helped to construct the framework that alerts planners to important bases to cover and pitfalls to avoid. For programs just being designed, planners can take advantage of the knowledge and experience of others who have preceded them down the path.

If professional development programs are already underway, the framework can stimulate reflection and refinement. Wherever planners are in their process, they can hone in on the parts of the framework that best serve their purposes, knowing that no planning process is perfect and that even the “best-laid plans” are always subject to change. For example, if you are in the midst of setting goals, you might scan the research to see how your goals align. Is there evidence in the research that supports your goal? Also consider whether the contextual data support the goals. Are you inviting the right teachers, and have you targeted the areas of highest student learning need? If you are already providing the professional development, turn to the discussion of strategies to learn how different strategies might support your existing program. Reflect on your results, and then consider the inputs that are of most interest to you. Perhaps it would be a good time to think through critical issues that you have not yet addressed. The design framework supports such reflection and refinement wherever a program is in the process.

These next sections of this chapter briefly describe each element of the design framework. Chapters 2, 3, 4, and 5 provide more detail on each of the four major inputs into the design process. While the design framework looks rational and analytical, professional development design is more art than science. It is fueled by vision and passion; requires great skill, knowledge, and creativity; and continues to evolve as all of us who work in professional development strive for better results for students, teachers, and schools.

Knowledge and Beliefs

Figure 1.2 Professional Development Design Framework: Knowledge and Beliefs



We have a lifetime of knowledge to draw upon when planning professional development, and that is why the first input designers consider is the existing knowledge and beliefs about improving science and mathematics education. In the design framework, knowledge and beliefs are delineated as an important input into every phase of design, from the initial vision to the evaluation.

Much is known about effective professional development for mathematics and science education, and more is being learned every day. For those of us who design and provide learning programs for teachers, the knowledge and beliefs we have constitute our specialized expertise. They help shape our professional judgment about what to do and not do and inform every decision we make as we design and conduct professional development. By *knowledge* we mean those things that are supported by solid facts and research; *beliefs* refer to those things we are coming to know or believe based on personal experiences, observations, and convictions. We must consider both knowledge and beliefs and how they influence the design and implementation of professional development. Taking advantage of this knowledge can help planners jump-start their efforts, put them on solid footing, and avoid unnecessary and costly mistakes. The professional

development design framework suggests that designers start by consulting knowledge and beliefs reflected in five distinct, but related *domains* (see Figure 1.2).

The first domain is *learners and learning*. An explosion of cognitive research in the past few decades has resulted in a rich body of knowledge about how people learn in general and in mathematics and science in particular (Anderson, 1995; Bransford, Brown, & Cocking, 1999; Cobb, 1994; Donovan & Bransford, 2005; Driver, Asoko, Leach, Mortimer, & Scott, 1994; Duschl, Schweingruber, & Schouse, 2007; Mezirow, 1997). Professional developers use this knowledge to guide decisions about the content and the activities for professional learning.

A second domain is what is known about *teachers and teaching*. This includes how teachers develop their specialized knowledge and skills and learn to use effective instructional practices (Shulman, 1986). This domain further informs the decisions a designer makes about the content for the professional development (e.g., what should teachers know about the topics they teach, and what kinds of instructional strategies should teachers be learning?).

The third domain is *the nature of science and mathematics* (American Association for the Advancement of Science, 1989; Hazen & Trefil, 1991; National Council of Teachers of Mathematics, 2000; Paulos, 1992). Knowing that science and technology often entail investigation, design, and discovery and that mathematics involves problem solving and communication and both reflect unique dispositions, such as being analytical, skeptical, and inquiring, raises the question of how the professional development can model these actions and habits of mind so that teachers experience the true nature of the disciplines and consider how to provide similar experiences for their students.

The fourth domain is what is known about effective *adult learning and professional development* (Blank, de las Alas, & Smith, 2008; Darling-Hammond, 2000; Garet, Porter, Desimone, Birman, & Yoon, 2001; National Staff Development Council, 2001b; Wei et al., 2009). It guides designers to use research-based principles on effective teacher learning, such as making sure professional learning is linked to classroom practice; provides ample support for teachers to try out new learning in the classroom; and ensures programs are of an adequate duration and engage teachers as adult learners.

The last important domain is the knowledge base on *the change process* (Fullan, 1993, 2002; Hall & Hord, 2006; Wagner et al., 2006). Understanding this domain helps designers think about professional development as a process of individual and organizational change through which teachers transform their knowledge and apply new ideas to changes in practice. An understanding of the change process enables designers to anticipate and plan for how teachers will be supported to move from awareness to implementation to sustainability of new practices. When change involves deeply held beliefs, special actions are needed to open up new ways of thinking and support teachers to integrate new knowledge and abandon or reframe ideas that no longer work.

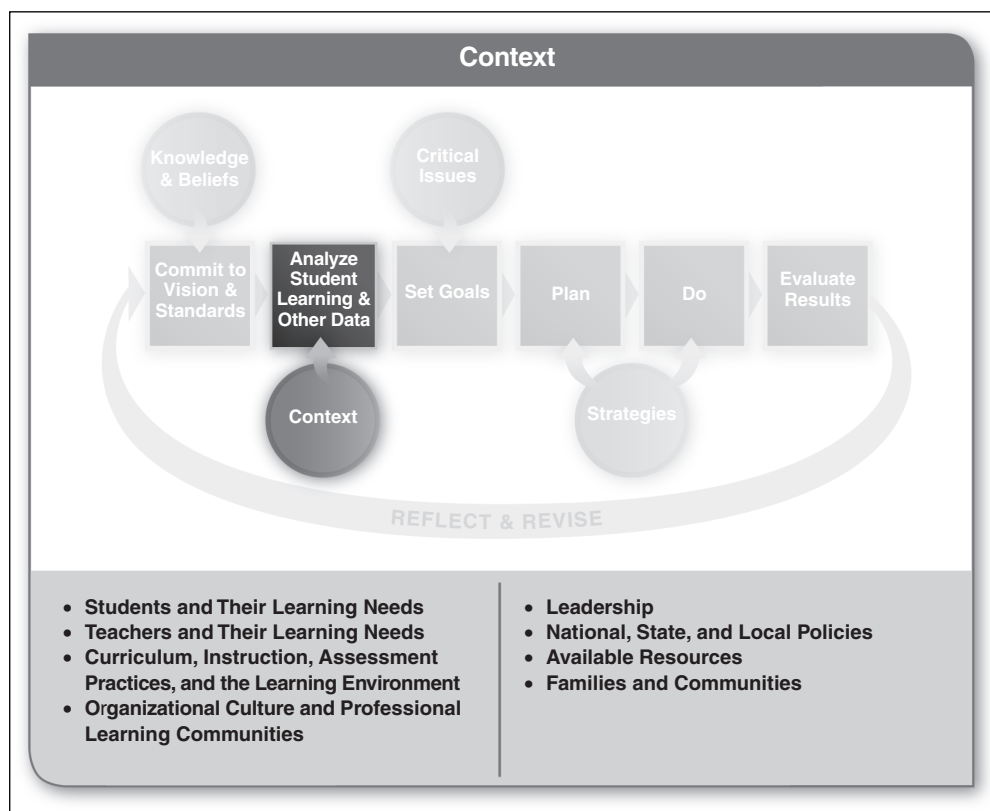
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Having an understanding of these domains helps professional developers clarify what they know and believe about learners and learning, teachers and teaching, the nature of the discipline, effective professional development, and the educational change process. They may identify areas where their own experiences and beliefs or those of their colleagues are not aligned with the research. This is a good opportunity to talk about and clarify what knowledge and beliefs will be reflected in a professional development program. As designers clarify and articulate their beliefs, these beliefs become the “conscience” of the program. They shape goals, drive decisions, create discomfort when violated, and stimulate ongoing critique.

In Chapter 2, we discuss in detail the growing consensus about what is known in each of these domains and summarize key points that professional development designers need to keep in mind.

Context

Figure 1.3 Professional Development Design Framework: Context



There is no prescription for which designs are right for which situations—no “paint by numbers kit” for professional development. Skilled professional developers have one foot planted firmly in theory (knowledge and beliefs and vision) and the other in action (the local context, data about students, issues faced, and planning and doing professional development). As professional developers design their programs, they are influenced by their vision of what science and mathematics teaching, learning, and professional development should look like. They are equally concerned with providing teacher learning programs that are relevant, so they must carefully analyze and study their own context. There are *eight* important aspects of the local context that designers need to consider (see Figure 1.3).

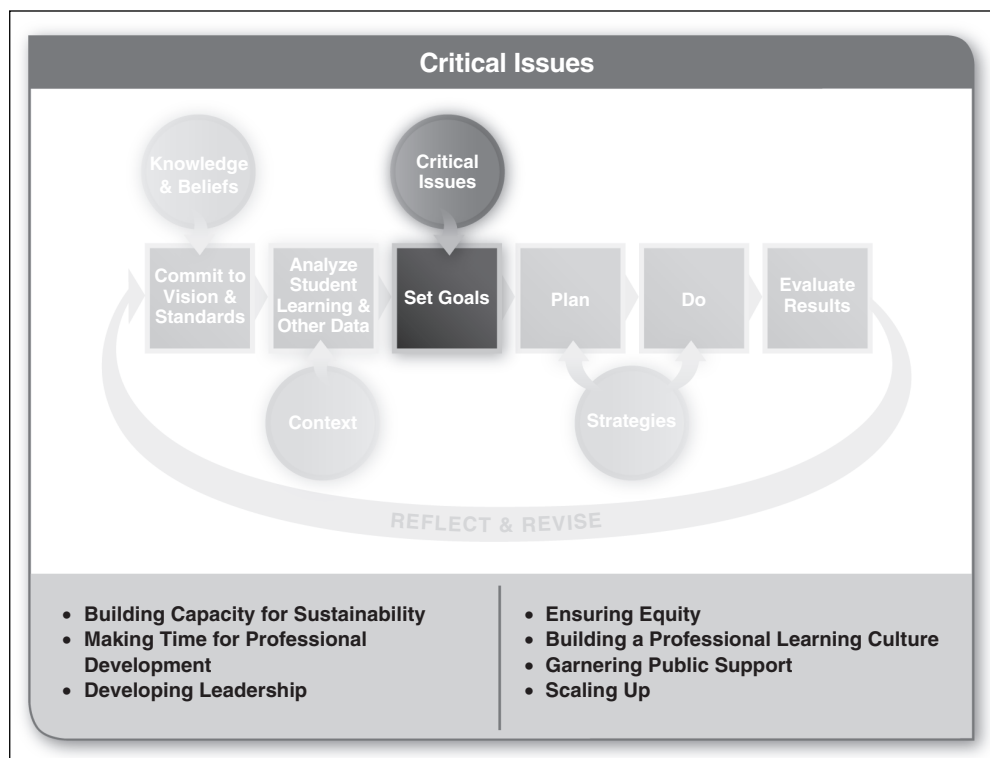
Designers must know who the students are, what learning results have been attained, and what learning problems exist. For example, designers should ask an array of questions, such as “Are students underperforming in certain subjects or specific topics?” “Are there achievement gaps between rich and poor, different student populations, males and females, and what practices are contributing to these gaps?” Designers also need to know about the teachers they will work with. They consider questions like “What knowledge do our teachers have, and what new knowledge do they need?” “What are their beliefs about teaching and learning, and how do they teach?” “Do they collaborate with other teachers?”

Designers also rely on information about current curriculum, instruction, and assessment practices and the kinds of learning environments created for students. It is also important to understand the culture and the extent to which there is a professional learning community among teachers. This information serves as the basis for professional development goals for students, teachers, instruction, and the organization and helps to ensure that professional development is linked with learning results. Other features of the context that are important to consider are the leadership; national, state, and local policies that must be observed; available resources such as time, money, and expertise; and families and communities. Considering these factors helps designers make better decisions as they plan, implement, and evaluate programs.

In Chapter 3, we provide more in-depth discussion of each of the eight contextual factors and help designers think about the unique ways in which their local contexts inform the professional development program.

Critical Issues

Figure 1.4 Professional Development Design Framework: Critical Issues



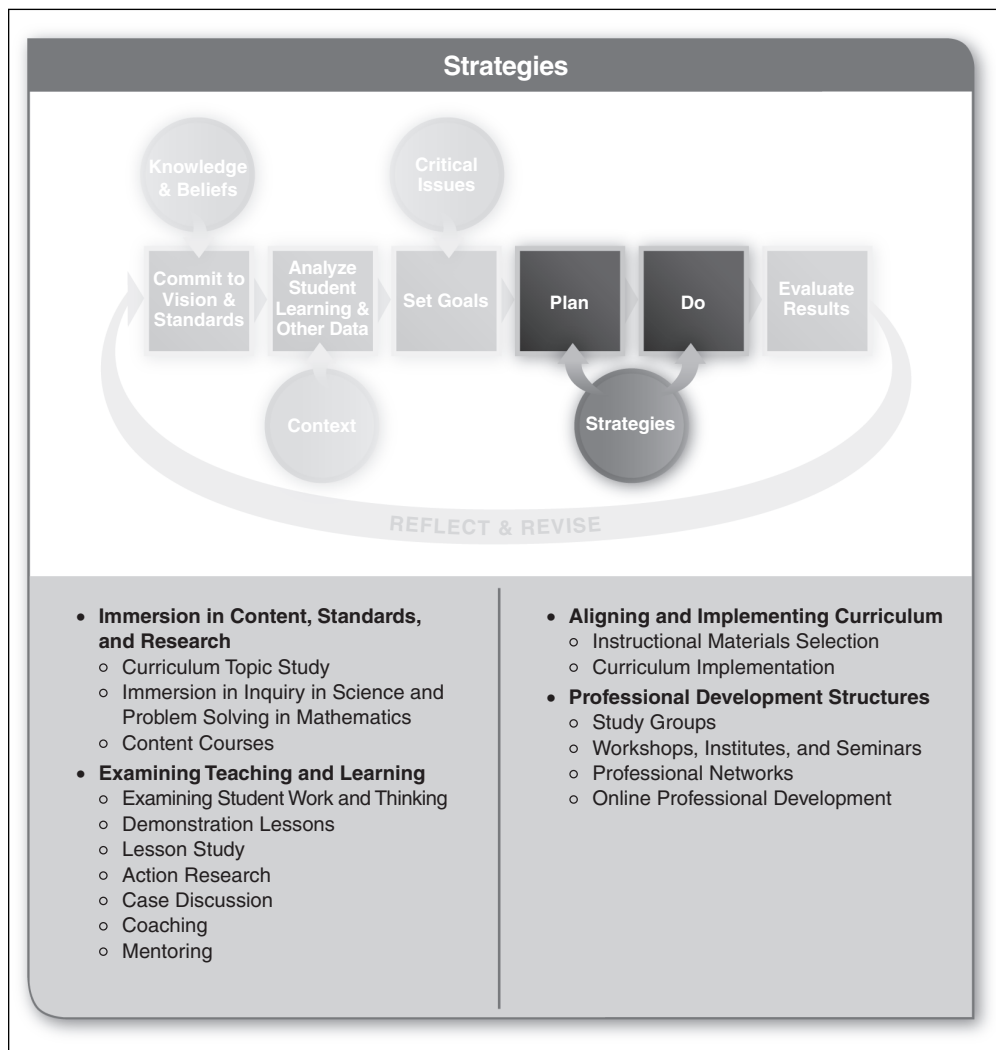
As we looked at professional development programs throughout the country, we discovered some common issues that designers were facing. These issues were critical to the success of programs everywhere, regardless of the context (although context will heavily influence how they take shape). We called these *critical issues* because it is essential for professional developers to consider how to address them as part of their planning, or they are likely to create problems for them later on.

There are seven critical issues: (1) building capacity for sustainability, (2) making time for professional development, (3) developing leadership, (4) ensuring equity, (5) building a professional learning culture, (6) garnering public support, and (7) scaling up (see Figure 1.4). Proactive planners anticipate these issues and begin grappling with them in the initial design phase. As the program is implemented, they keep these issues in the forefront, confronting obstacles and creating opportunities to better respond to these challenges. The critical issues defy easy solutions. They are the “tough nuts” that professional developers work to crack as they design and provide learning experiences for teachers.

Chapter 4 examines these issues in all of their complexity, summarizing research, offering examples of best practice, and posing enduring, unresolved questions.

Strategies for Professional Learning

Figure 1.5 Professional Development Design Framework: Strategies



After setting program goals, professional developers plan how they will implement the program. At this point, they consider another important input—the strategies they can use for professional learning (see Figure 1.5). Like classroom teachers, effective professional developers have a variety of

strategies to draw on and skillfully select and combine to achieve their goals and to support change over time. With a repertoire of strategies, professional developers can design programs that address different goals and embed professional learning into the daily lives of teachers. For example, if the goals are to build content knowledge and increase teachers' understanding of student thinking and learning progressions, the professional developer might choose two different strategies—a content course combined with sessions for groups of teachers to examine and reflect on student work and thinking.

In this book, we identify 16 professional development strategies that can be used in a variety of contexts for different purposes. The 16 strategies are organized into four clusters that define the set of strategies in that cluster (see Figure 1.5). The clusters are (1) immersion in content, standards, and research; (2) examining teaching and learning; (3) aligning and implementing curriculum; and (4) professional development structures. The fourth cluster includes strategies that are generic structures for providing professional development (e.g., study groups, workshops, institutes, seminars, professional networks, and online professional development). When planning, one considers which of the strategies will be used to provide professional development, and more important, what content and learning activities will be provided within the strategies to support the learning goals of the professional development.

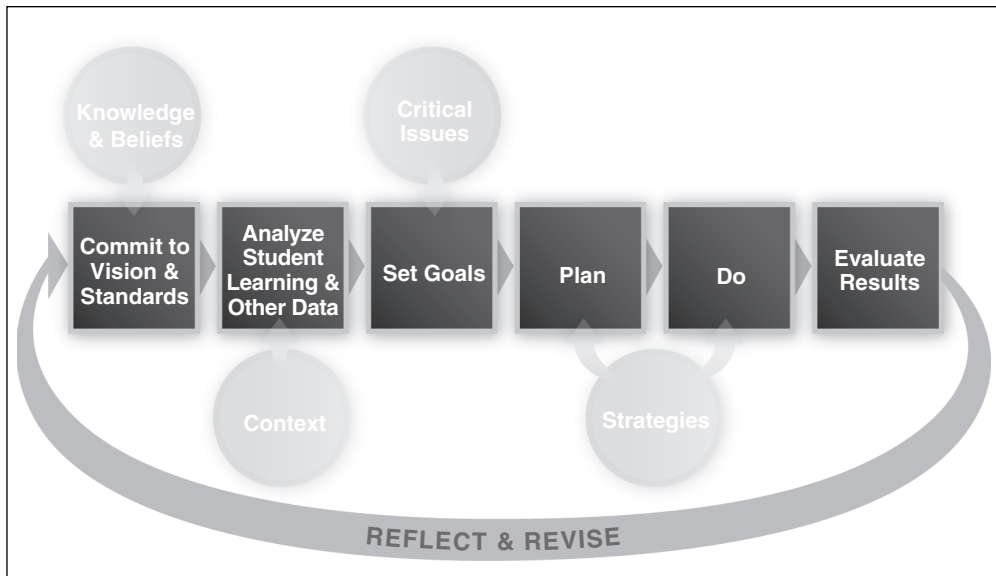
A professional development program can be made up of multiple strategies offered simultaneously to groups of teachers to meet their different needs or accommodate varied learning styles. For example, novice teachers might benefit from a multiday immersion in science inquiry followed by mentoring by an experienced teacher to learn to teach through inquiry. More expert teachers might follow up on the immersion experience with an action research project to study what students learn through inquiry. Different strategies can also be phased in over time, such as working with external experts initially and then moving to more teacher-directed strategies such as study groups, demonstration lessons, and action research as teachers' confidence and skill increase. Rather than models, these 16 strategies are the palette from which professional developers can select and blend individual colors to give life and form to their professional development programs.

Each of the clusters and strategies is further described in Chapter 5. For each cluster, we provide a discussion of the underlying assumptions that are foundational to the strategies within the grouping and the implementation requirements for the cluster of strategies. Each strategy is then illustrated through a vignette, followed by discussion of the key elements, the way in

which the strategy addresses specific intended outcomes, suggestions for combining with other strategies, reflections on the issues to consider, and a list of resources to gain more in-depth information about the strategy and how to implement it within a program. The information about the clusters and strategies contained in Chapter 5 is intended to assist planners in selecting and combining strategies to align with their specific goals and contexts.

THE DESIGN AND IMPLEMENTATION PROCESS

Figure 1.6 Professional Development Design Framework: The Design and Implementation Process



The important inputs in the framework described above—knowledge and beliefs, context, critical issues, and strategies—influence the professional development design process. While it is essential to take each of these into account, the design process has a life of its own. It sometimes follows a logical sequence from committing to a vision, to analyzing student learning data, to setting goals, planning, doing, and evaluating as the framework suggests. Yet most professional developers are already in the midst of implementing their programs. They can enter the step or stage of the framework wherever they find themselves and loop back to prior steps to consider how they may influence future decisions.

A brief look at each of the phases of the design and implementation process (commit to vision and standards → analyze student learning and other data → set goals → plan → do → evaluate results → reflect and revise) follows (see Figure 1.6).

Commit to Vision and Standards

Figure 1.7 Professional Development Design Framework: The Design and Implementation Process: Commit to Vision and Standards



The reform of mathematics and science education rests firmly on a commitment to enhance teaching and learning to reach much higher levels of learning as reflected in national and international standards for all students. The vision of mathematics and science teaching and learning, based on the standards developed by the National Council of Teachers of Mathematics (NCTM, 1989, 1991, 1995, 2000), the National Academy of Science's National Research Council (National Research Council [NRC], 1996), and the American Association for the Advancement of Science (AAAS, 1993), is one in which all students engage in inquiry into significant questions in science and investigate complex problems in mathematics in supportive, collegial communities. Students come to deeply understand important science and mathematics ideas and master complex skills and reasoning processes that are essential to scientific and mathematical literacy. To achieve this vision, teachers need strong content knowledge and the skills, behaviors, and dispositions of the science and mathematical disciplines. Teachers need to have ownership in the vision of high standards and quality education for all

and feel competent to create appropriate learning environments for their students. This includes feeling secure in the knowledge of the content they will help their students learn and possessing a wide array of instructional strategies known to support successful learning.

For this to happen, teachers need opportunities for ongoing professional growth—ones in which they learn what they need to know to achieve the vision, in ways that model how they can work with their students. Schools need to break down the barriers to teacher collaboration and promote the sharing of effective practice. Schools themselves must become learning communities. The National Staff Development Council's (2001b) professional development standards and the teaching standards and professional development standards in the NCTM and NRC documents clearly articulate a vision for science and mathematics teaching and professional development. Because it is difficult, if not impossible, to teach in ways that one has not learned, teachers also need opportunities to inquire into significant questions in science and to learn challenging mathematics and reflect on their own learning and teaching in supportive, collegial communities. That is why effective professional development programs start with committing to a vision of quality teaching and learning and begin the design process by asking: "What do classrooms in which the vision of science and mathematics teaching and learning, based on local, state, and national standards, is playing out look like?" And following from that question, "What do professional development opportunities in which teachers learn in that way and learn to teach in that way look like?"

Supporting standards is more than an issue to be considered; standards set the course for professional development (see Figure 1.7). Providing teachers with the knowledge and skills they need to help every student achieve high standards is the central purpose of professional development. Standards guide the selection of content for professional development, which helps teachers explore the "big ideas" of the disciplines and deepen their content knowledge. Standards themselves are often the subject of professional development, as teachers immerse themselves in studying what the standards mean and what their implications are for learning and teaching and professional development. And standards serve as the foundation of the vision that inspires the professional development design process from beginning to end.

Dennis Sparks (1997) wrote, "It's been said that someone who has a 'why' can endure any 'how'; few things are more important to motivation than purpose that is regarded as profoundly and morally compelling" (pp. 24–25). The vision of learning, teaching, and professional development based on standards is the "why" of professional development design. It is the desire to reach the vision that motivates professional developers to create powerful learning opportunities for teachers. It is the tension between the vision and the current reality that fuels goal setting and planning, drives the desire to change, and

gives meaning to the daily tasks of implementing professional development programs. And as professional developers reflect on and evaluate their programs, they gauge how well the school community is moving closer to its vision and recommit to the future they want for students, teachers, and schools.

What actually happens in the phase “commit to vision and standards” of the design process? How does a school community solidify its commitment to a vision and a set of standards for science and mathematics reform? Many educators have experienced the process of developing a vision as a meaningless exercise of putting words on paper that are either promptly ignored, written and embraced by only a few, or so general as to inspire no one. Because the vision for science and mathematics reform is rooted in deeply held beliefs and assumptions, developing a truly shared and compelling vision is a complex and long-term process. Notice in the design framework that an important input into the vision is knowledge and beliefs—the knowledge bases about learning, teaching, the nature of science and mathematics, professional development, and the change process. It is important that the vision statements are based on shared knowledge, not shared ignorance, and that school staff take the time to study relevant research and national standards and supporting documents. Without exception, the professional developers who worked on this book reported drawing on these knowledge bases to formulate the purpose, guiding principles, and core outcomes for their work. Schools can do the same by asking a few key questions (see Table 1.1).

Table 1.1 Committing to a Vision and Standards: Questions to Consider

Questions to Consider
1. What is our vision for science and mathematics teaching and learning?
2. What do students need to know and be able to do in mathematics and science?
3. How will we know if they have gained this knowledge?
4. What will we do if they do not gain this knowledge?
5. What do classrooms in which this new vision is playing out look like?
6. What do teachers need to know and be able to do if students are to achieve these standards?
7. What is our vision for teachers' learning?
8. What does professional development in which this new vision is playing out look like?
9. To support this vision of science and mathematics teaching, learning, and professional development, what kind of an organization do we need to be?

Creating opportunities for constructive dialogue around the questions in Table 1.1 can contribute to developing a shared vision for education in schools, but it is important to keep in mind that this is not just a one-time, linear process. Designers may not get everyone on the same page before they need to move ahead. It is important to start the process and then move ahead, revisiting these questions at different points. Very often, the shared vision and commitment to creating an educational environment that is based on research and the standards is generated over time as teachers engage in professional development experiences. It is important not to wait to provide professional development until the entire school community is united around a common vision. Michael Fullan (1993) reminds us that “vision emerges from, more than it precedes, action” (p. 28) and that “ready, fire, aim” may be a more productive sequence (p. 31). *Ready* implies that professional development design starts with some notion of purpose, especially for those designing the effort, but does not bog down in perfecting the shared vision. *Fire* is implementing the professional development program. It is through doing, learning, reflecting, evaluating, and applying new knowledge and skills that the vision is clarified. *Aim*, according to Fullan, is crystallizing new beliefs and clarifying and strengthening the sense of shared purpose. While commitment to vision and high standards for all students comes first in the sequence of the design framework, this phase is in fact iterative and interactive with all other phases of the process.

Analyze Student Learning and Other Data

Figure 1.8 Professional Development Design Framework: The Design and Implementation Process: Analyze Student Learning and Other Data



Relevant Student Learning and Other Data

- Demographic data about students and teachers
- Multiple measures of students' achievement of standards
- Student learning data disaggregated by race and ethnicity, economic status, English language learners, students with special needs, and gender
- Data about classroom practice and students' opportunity to learn
- Data about professional development, the school culture, and leadership

In this phase of the professional development design and implementation process, professional developers take stock of their reality as they explore the gap between the current and the desired state—based on the vision and standards—and set targets for improvement (see Figure 1.8). When a school community has a shared commitment to high standards for all students, it is better prepared to take an honest look at student learning data and is more likely to experience dissatisfaction with results that fall short of its commitments, rather than complacency, resignation, or defensiveness (Love, Stiles, Mundry, & DiRanna,

2008). The purpose of analyzing student learning and other data is to identify specific targets for improving student learning that will determine the goals for teacher learning and form the basis for a professional development program clearly focused on results for students. When designing professional development for a local school or district, it is crucial that the professional development plan is linked with school or district goals for improving mathematics or science learning.

Student Learning Data

Most important in this phase, professional developers examine multiple sources of student learning data to determine what essential knowledge and skills students are and are not learning and what performance gaps exist between rich and poor, males and females, and different student populations. Data analysis can begin with readily available data such as state and district assessments, including both standards-based and norm-referenced test results.

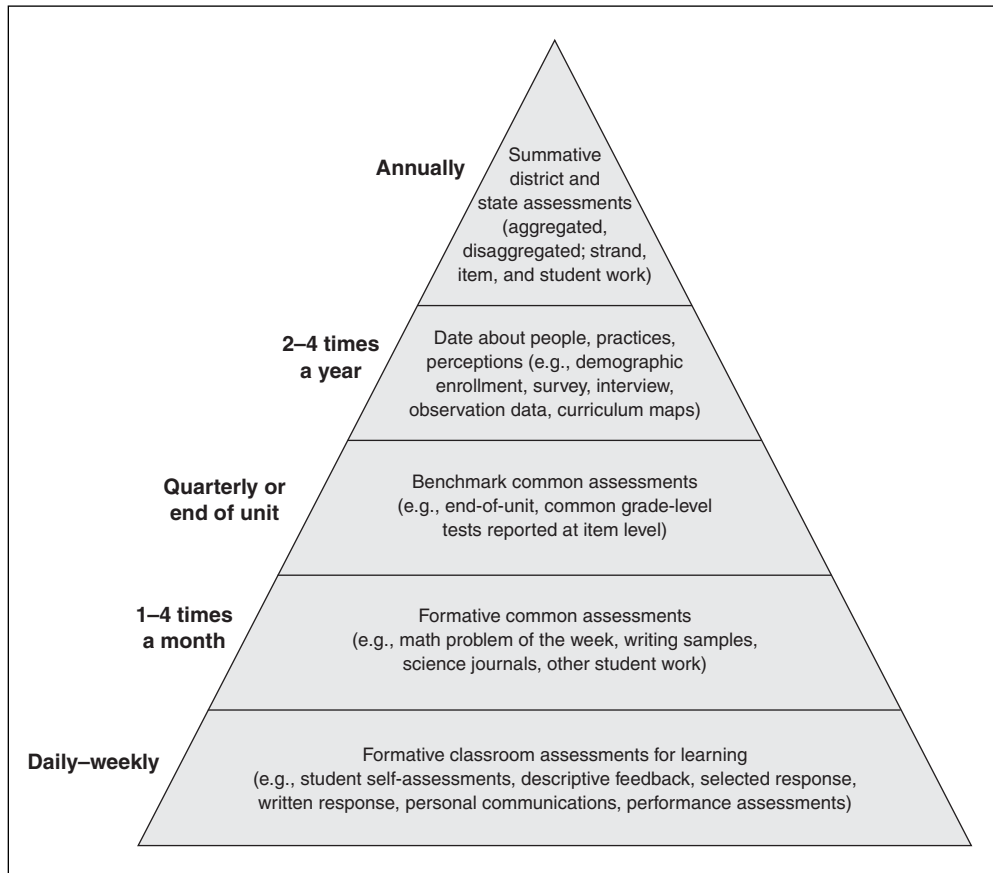
These assessments, however, do not provide adequate evidence of achievement of all the knowledge, skills, and dispositions that local communities may value and that national standards and many state and local standards call for, such as mathematical reasoning, problem solving, communication, inquiry skills, or in-depth understanding of important mathematical and scientific concepts.

An important part of enacting a vision based on standards is putting into place a comprehensive local assessment system that complements high-stakes tests with more formative assessments tied to local standards and curriculum. This assessment system would include performance tasks,

portfolios, and scoring and examination of student work as well as short-answer and multiple-choice tests. In addition to classroom and school or district local assessments, common assessments administered periodically by teachers who teach the same grade level or course can provide teachers with timely and relevant feedback on the extent to which students are mastering agreed-on standards (Love et al., 2008). Figure 1.9 illustrates the different types of data and the frequency of analysis that schools and districts will want to use during this step in the design process.

By using multiple measures, professional developers verify their perceptions of student learning needs with more than one data source. Goals for professional development are not arbitrary or based on the latest fad but instead are grounded in the needs that are showing up consistently in the

Figure 1.9 The Data Pyramid



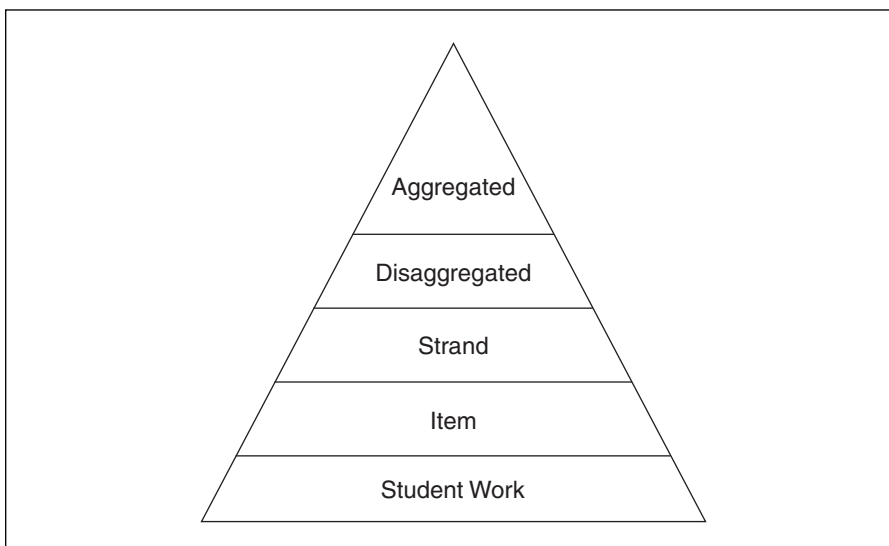
Source: Love, N., Stiles, K. E., Mundry, S., and DiRanna, K. (2008). *The Data Coach's Guide to Improving Learning for All Students: Unleashing the Power of Collaborative Inquiry* (p. 129). Thousand Oaks, CA: Corwin. Used with permission.

data. Another advantage of using both classroom and common grade-level assessments along with state and district assessments to target needs is that teachers become actively involved in analyzing results and reflecting on how they can be enhanced. When teachers embrace the problems and identify potential solutions, they are more willing participants in the professional development programs designed to solve them. They also become active agents in testing out new instructional strategies and monitoring progress toward improvement (DiRanna et al., 2008; Love et al., 2008).

It is important not only to use multiple sources of assessments of student learning but also to go beyond superficial analyses of summary or aggregate reports to derive the maximum value for goal setting. Figure 1.10 illustrates a process for digging deeply into state- and local-assessment results to get a better idea of the learning goals and, therefore, what areas professional development needs to address. The process begins with examining aggregate or summary reports. These reports provide the headlines such as, overall, what percentage of students met standards in mathematics or science. Aggregated data, examined over time, also provide information that reveals trends, such as progress in increasing the percentage of students who meet standards.

To explore performance gaps, professional developers need to go beyond the aggregate or summary reports to examine disaggregated results, results separated out by different populations of students, such as students receiving lunch assistance and those not, racial and ethnic groups, language groups, and males and females.

Figure 1.10 Drill Down Into Student Learning



Source: Love, N., Stiles, K. E., Mundry, S., and DiRanna, K. (2008). *The Data Coach's Guide to Improving Learning for All Students: Unleashing the Power of Collaborative Inquiry* (p. 132). Thousand Oaks, CA: Corwin. Used with permission.

Digging deeper into the data in this way enables professional developers to uncover achievement and performance gaps so that equity issues take center stage in the professional development plan. Often, schools do not even recognize that they have racial, economic, or cultural performance gaps until they examine disaggregated data. By uncovering these gaps, professional developers can direct attention to improving the achievement of specific groups of students who are not learning well. Their designs may include opportunities for teachers to diversify their instructional strategies, to better understand the racial and cultural backgrounds of their students, and to surface educators' beliefs, practices, and policies that may act as obstacles to some students' achievement of standards.

The next two levels of analysis are examining strand and item data. These levels of analysis require looking at how students performed on strands, such as geometry or physical science, and on particular test items within the strands. Getting inside the assessment and analyzing the actual items enables designers to identify the knowledge and skills the assessment items are actually measuring and to look for patterns in correct and incorrect answers. This level of analysis helps planners gain a much better sense of what knowledge and skills students are struggling with (e.g., not just mathematics problem solving in general but specific aspects of problem solving that are most challenging for students) and to pinpoint needs more precisely. Finally, examining student work often proves to be the most fruitful data source, providing rich insights into students' thinking. Examining student work is both a way to set goals for professional development and a way to engage teachers in professional development. Having them examine student work often creates many insights into what students are learning and what areas need improvement.

Opportunities-to-Learn Data

Performance gaps are often the result of inadequate opportunities for particular student populations to learn a rigorous mathematics and science curriculum. A study by Weiss, Banilower, McMahon, and Smith (2001) found that ability grouping was still widely practiced in mathematics and science and that classes labeled low ability are more likely to contain a high proportion of students of color. Another study by Weiss, Matti, and Smith (as cited in Weiss, 1997) found that students in low-ability classes had fewer opportunities to engage in inquiry-based science or write about reasoning when solving mathematical problems. Professional development programs should be geared not just to closing achievement gaps, but also to closing opportunities-to-learn gaps. In this phase of the design process, professional developers can also use data about course enrollment, special program placement, teachers' qualifications, and curriculum, instruction, and assessment practices to uncover what practices may be preventing some students from achieving standards (Love, 2002).

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



Rigorous analysis of student learning and other data sets the stage for setting goals for the professional development program (see Figure 1.11). If the vision describes the desired future and the data analysis describes the current reality, goals are the benchmarks or milestones to assess progress toward the vision. “Vision may inspire, but goals foster immediate accountability,” says Richard DuFour and Robert Eaker (1998), who liken goals to the “ports of call on the journey toward improvement” (p. 203). A few clear, concrete, and attainable goals motivate, energize, and focus professional development and school improvement. On the other hand, according to Michael Schmoker (1999), the absence of explicit learning goals is “the most striking, self-defeating, contradictory characteristic of schools and our efforts to improve them” (p. 23). Since professional development is to be linked to student achievement, four kinds of goals are relevant: goals for student learning, goals for teacher learning, goals for teaching practice, and goals for the organization, such as developing leadership and building a professional community focused on student learning results.

Four Goals for Professional Development

- Goals for student learning
- Goals for teacher learning
- Goals for teaching practice
- Goals for the organization

1. *Goals for student learning.* The driving force behind a professional development program is a small number of specific, attainable, and measurable student learning goals. Learning goals, according to Schmoker (2002), should target the lowest-scoring subjects or courses and target specific standards where achievement is low. Improvement efforts can bog down with long laundry lists of goals or vague or overly ambitious goals. As designers set goals for student learning, they tap into knowledge about teaching and learning and the nature of mathematics and science treated explicitly in the national and some state standards. In addition, setting goals for students involves analyzing students’ needs and confronting disparities in achievement between different populations of students. It is essential that goals for student learning specifically address closing achievement gaps where applicable and expanding learning opportunities to all students.
2. *Goals for teacher learning.* Goals for teachers flow directly out of goals for students. If students are going to develop a set of understandings, skills, and predispositions, then what do teachers need to know to

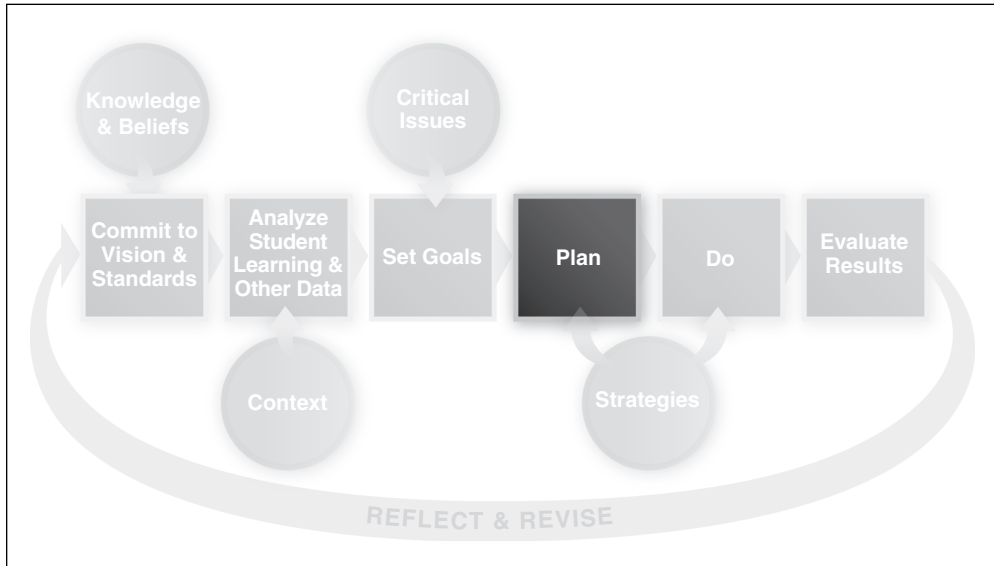
realize those outcomes for students? Learning goals for teachers are also informed by referring to the standards, as well as data about teacher performance, knowledge and skills, needs, and supports available. These goals should attend equally to teachers' need to enhance their content knowledge of the discipline they teach and their pedagogical content knowledge (their understanding of how to make content accessible to their students).

3. *Goals for teaching practice.* Professional development that is linked to improving student learning should also set goals for teacher practice. How will teachers translate the new knowledge they are gaining into classroom practice? For example, many professional development programs focus on increasing teachers' content knowledge, and this is important. However, they often lack a clear emphasis on how teachers should translate their new knowledge into the classroom. For programs that aim to increase science or mathematics content knowledge, designers need to clarify what practices they would expect to see in the classroom and communicate these expectations to the teachers.
4. *Goals for the organization.* Professional development goals can also encompass goals for the organization, such as the development of leadership or the strengthening of the professional learning community. Often these goals are set to support the central goal of improving teaching and learning. For example, the professional development program may set goals to establish a core of teacher leaders who will support other teachers' growth through coaching and other collaborative work to improve practice. The inputs of knowledge and beliefs and critical issues also suggest that having explicit goals for leadership development and for building a professional learning community are essential for sustaining any changes in practice that the professional development program is designed to bring about.

Clarifying clear and worthwhile outcomes for student learning, teacher learning, teaching, and the organization not only brings focus and coherence to the professional development program but also lays the groundwork for future program evaluation. An important part of the goal-setting process, according to Guskey (2000), is to consider how goals will be assessed and what evidence will be used to determine whether goals are met.

Plan

Figure 1.12 Professional Development Design Framework: The Design and Implementation Process: Plan



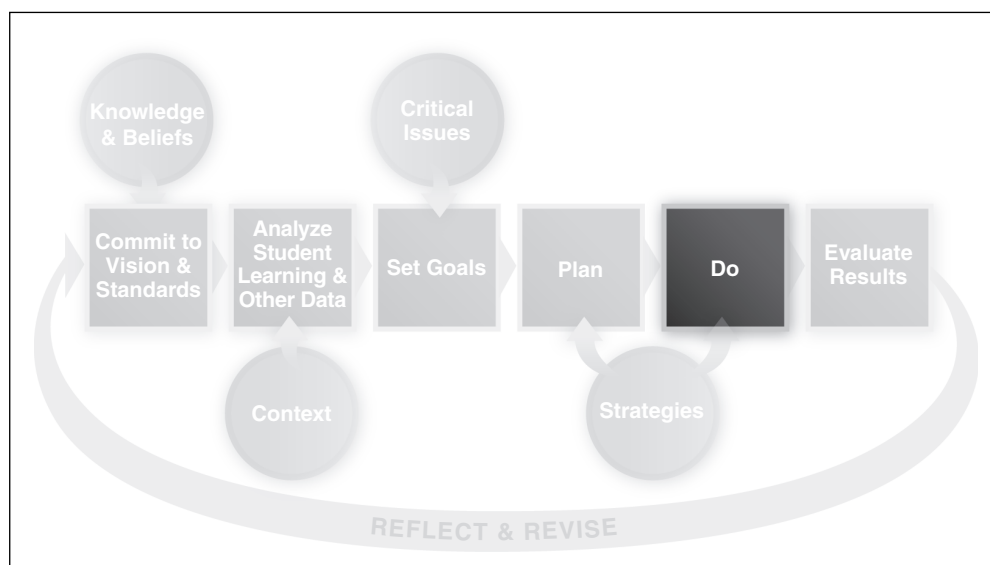
Once goals are set, planners begin to sketch out their design and think about how they will measure results. They ask themselves, “Given our goals, what is the best combination of strategies we should implement?” “If our goals are focused on increased content knowledge, what strategies should we use?” “What strategies will help teachers translate their new knowledge into improved classroom practice?” “Do we have the leadership we need to make it all happen, and if not, what strategies do we need to develop leaders?” Planners revisit what they know about the context, unearthing important factors to consider as they tailor their program to their own circumstances and review the student learning and other data they have collected to connect plans to goals.

This is when they may decide they need more information about learning, teaching, mathematics or science, professional development, or the change process. Having a research-based vision of what effective programs can look like can generate some ideas for their plans. Learning about similar districts’ plans and consulting the education literature can also be helpful. Planning is the time to revisit and clarify the beliefs that underlie the program. Critical issues enter in as planners consider how to confront challenges such as “How will we scale up the program to reach large numbers of teachers or build leadership to sustain changes in teacher practice?” This is also the process step where the program would develop its plan and timeline for how to gather evaluation data and what data to gather.

The design framework has been used to plan small- and large-scale programs. Planners for small-scale efforts pick and choose among the contextual factors, critical issues, and knowledge and beliefs that are most relevant for their initiative and use the design and implementation steps in the framework to be more thoughtful and deliberate about their planning. For a small-scale effort such as one institute, professional developers do not consider every context factor but think carefully about the most relevant ones, especially about the participants' backgrounds and their learning needs. For example, when they are working with teams of teachers who have little planning time back in their districts, they are sure to provide productive planning time within the institute. Whether large- or small-scale, short- or long-term, professional developers draw on the most relevant inputs into the design process to develop their plans for the professional development program.

Do

Figure 1.13 Professional Development Design Framework: The Design and Implementation Process: Do



Having made the best decisions they can, designers move from “sketching” to “painting”—the actual implementation of their plan (see Figure 1.13). In this phase, they draw on their skills as content experts and facilitators and their knowledge about implementation and the change process (e.g., Fullan, 1991, 2001; Hall & Hord, 2006; Kegan & Lahey, 2009). For fundamental

change to happen, teachers need to experience learning the way they will implement it in the classroom and experiment with new behavior and gain new understandings, and that takes time. They will move through predictable developmental stages in how they feel and how they are using new approaches (Hall & Hord). Frequently, things get worse before they get better, as teachers experience what Fullan calls the “implementation dip.” Teachers try new instructional strategies, and they struggle to get it right. Without help and the opportunity to talk with others experiencing the same struggle, they may just go back to doing things the old way. This is when it is critical to provide follow-up help, classroom visits, and other support structures to help teachers make corrections and commit to changing their practice.

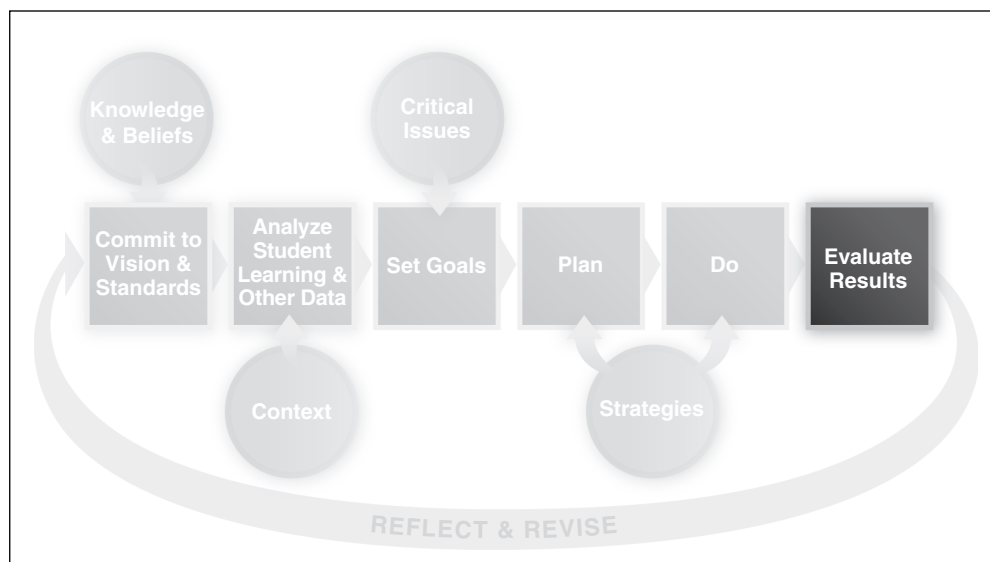
What is most important for professional developers in the do stage is to pay close attention and monitor how the professional development is working: “How are the teachers reacting to and engaging with the content?” “What adjustments do we need to make?” “What are they learning?” “What are they having difficulty with?” “How will we reteach content they are having difficulty learning?” “How can we support them to set realistic goals for taking their learning back to the classroom?” “What new teacher learning needs are emerging, and how will we address them?”

Despite the best-laid plans, it is impossible to predict how the initial design will work. As the action unfolds, designers discover what works and what doesn't. Like artists stepping back from the canvas and examining their work from different perspectives, professional developers continuously monitor their plan using a variety of data sources. They ask questions such as “Is this working?” “Are we moving toward our goals of improved student learning in mathematics and science?” “Are we meeting participants' needs?” “Is our program, in fact, a good match with our context?” “What conditions, if any, have changed, and how should we respond?” “What critical issues do we need to address now?” Sometimes their reflection is enhanced by interested visitors (sometimes called “critical friends”) who sensitize professional developers to important aspects of their programs seen from different perspectives.

Based on this feedback, planners often go back to the drawing board. It is rare that an entire program is carried out exactly as planned. As the examples in this book will illustrate, the most successful programs do not start out with flawless designs. They begin with a sound idea that then goes through many revisions and continues to evolve. Programs change over time both because planners figure out a better way and because conditions change, sometimes as a direct result of the professional development program. There is a live interplay between context and implementation. Far from linear or lockstep, implementing professional development is recursive and usually messy, demanding flexibility and continuous learning throughout the process.

Evaluate Results

Figure 1.14 Professional Development Design Framework: The Design and Implementation Process: Evaluate Results



An essential but often overlooked or underused part of the professional development design process is evaluation of results (see Figure 1.14). Professional development opportunities are designed for a wide variety of purposes and to achieve specific goals. It is the role of evaluation to determine whether and in what ways they are successful in meeting the goals.

Fulfilling that role, however, is rarely easy for several reasons. First, regardless of the purpose of a given program, people typically jump to measure what is easiest: satisfaction of participants. Because of this norm, it is difficult to get people to think more broadly about outcomes and measures. Second, there is increasing demand to assess the value of professional development based on the achievement of the students of those teachers who participate. This demand is well-founded, given the large investment of resources that has been made in professional development and the critical need to improve student learning and close achievement gaps. The challenge here is not to expect student learning outcomes prematurely, before the professional development program has been fully implemented and teacher learning and change in practice have been well supported and documented over time. Nonetheless, it is important that professional developers broaden the valued outcomes for in-depth, long-term professional development to include changes in classroom practice and in student learning results. Finally,

evaluation needs attention because it is underused as a valuable learning experience for professional developers, participants, and others. Reflection on evaluation results, as they are being gathered as well as when synthesized, is an important contributor to continuous improvement. There are several questions that professional developers can ask themselves that may help them address the challenges of evaluation of their programs and initiatives:

- What are the goals or desired outcomes of the program or initiative?
- What evidence would demonstrate accomplishment of the program's outcomes?
- How do you gather data on program outcomes and evaluate changes in practice over time?
- How do you take advantage of evaluation as a learning experience?

What are the goals or desired outcomes of the program or initiative?

Professional developers typically have a wide range of goals, but they are often not skilled at articulating them as outcomes. “What would you see if you were successful?” “What would have changed and for whom?” It is easier to think of activities than accomplishments; for example, conducting a summer institute and a series of follow-up problem-solving sessions is often cited as a goal, rather than teachers using inquiry-based strategies in their classrooms as a result of the summer institute and follow-up programs. The range of possible outcomes is quite large: development of new abilities (knowledge, skills, strategies, dispositions) by a variety of people (teachers, students, administrators) and organizations (departments, teams, schools, districts) in a variety of areas (teaching, leadership, change management). Being clear about desired outcomes and articulating what they would look like if they were present not only lays important groundwork for evaluation but also results in a more focused and purposeful program.

What evidence would demonstrate accomplishment of the program's outcomes?

Evaluation helps collect evidence of the extent to which a program's aims have been met. A wide range of instruments and sources of information are often used to amass evidence that teachers learn or gain something from professional development, that they later apply the learning to their practice, and that ultimately there is some change in the classroom. Content assessments, interviews, observations, document analysis (e.g., lesson plans), performance tasks, focus groups—all can contribute evidence. Teachers, students, colleagues, administrators, scientists, and mathematicians—all can be sources of

information about the outcomes of a professional learning experience. Obviously there are trade-offs for every instrument and source of information, for example, in cost, time, degree of self-report, or amount of inference required (Guskey, 2000). These are all considered in designing an evaluation keyed to a particular purpose, audience, and budget.

The framework for data collection includes the quality of the professional development activities; extent of teacher involvement in the activities; changes in teacher attitudes and beliefs; changes in science and mathematics curriculum, instruction, and assessment; nature of the culture or context for teaching; and the sustainability of the professional development system (Horizon Research Inc., 2001). There are several tested evaluation instruments in the public domain that can be used to gather information. Horizon Research, Inc.'s Web site (www.horizon-research.com/instruments) provides a set of evaluation instruments they developed for National Science Foundation projects. There are also a number of content and pedagogical content knowledge assessments in science and mathematics that can be used. Some examples are the *Learning Mathematics for Teaching Assessment* from the University of Michigan and the *Diagnostic Science Assessment* and the *Diagnostic Mathematics Assessment for Middle School Teachers* from the University of Louisville. These can be used as a pretest prior to starting the professional development and as a posttest after the program is complete to assess teacher gains. Teachers can be actively involved in looking at the results in their own classrooms by using formative assessments that provide evidence of what students know prior to and after instruction (e.g., Keeley, Eberle, & Farrin, 2005; Keeley, Eberle, & Tugel, 2007).

How do you gather data on program outcomes and evaluate changes in practice over time?

The impact of professional learning activities looks different at different times. This is why it is foolhardy to either expect or focus on measuring student learning when teachers have just begun to learn and experiment with new ideas and strategies. Well-designed evaluations unfold with expectations for change. For example, one might focus on measuring participants' satisfaction and whether they are developing basic understanding early in a program; change in classroom behavior and in the professional culture midway; and then on various kinds of student change, beginning with attitudes and evolving to demonstrating new, deeper understandings of concepts.

To address this issue, evaluators have used concepts and tools of the Concerns-Based Adoption Model (Hall & Hord, 2006) to answer questions about the implementation of changes in mathematics and science education (Loucks-Horsley et al., 1990; Pratt & Loucks-Horsley, 1993). Three kinds of questions can be asked: "How do teachers' concerns about the new program

or teaching strategy change over time?” “How does their use of the new program or teaching strategy change over time?” “To what extent do teachers implement the critical components of the new program or teaching strategy over time?” Two developmental scales—Stages of Concern (assessed using paper-and-pencil instruments) and Levels of Use (assessed through a focused interview procedure)—provide criteria for assessing progress along the change continuum. Components of the program or strategy can also be defined and assessed using a combination of interview and observation; the different configurations that the program components take on in different classrooms can then be represented and monitored over time.

After sufficient time has elapsed for teacher change to result in improvement in student learning, students are an appropriate focus for professional development evaluation. A unique evaluation scheme was used by the Mathematics Renaissance (see Chapter 6) in its final and fifth year to evaluate the impact on students of the professional development it provided to middle school teachers throughout the state of California. As part of the Third International Mathematics and Science Study (TIMSS), hundreds of hours of classroom instruction have been videotaped in mathematics classrooms throughout the United States (U.S. Department of Education, 1996), which have been compared to those of classrooms in Japan and Germany using a very sophisticated coding and analysis procedure. Videotapes of classrooms of teachers participating in Mathematics Renaissance professional development were made, and similarly coded and analyzed. They were compared with a sample of the TIMSS tapes of U.S. classrooms to address the question, “Do students of Mathematics Renaissance teachers have a greater opportunity to develop the kinds of mathematical understandings, skills, and attitudes called for in the NCTM Standards and the California Mathematics Framework than do students of teachers not involved in Mathematics Renaissance?”

A valuable resource for guiding the evaluation of professional development is the book *Evaluating Professional Development* (Guskey, 2000), which identifies five critical levels of professional development evaluation ranging from simple to more complex. Each level builds on the one before it:

- Level 1: Participants’ reaction
- Level 2: Participants’ learning
- Level 3: Organizational support and change
- Level 4: Participants’ use of new knowledge and skills
- Level 5: Student learning outcomes (p. 82)

For each level, Guskey lays out what questions are addressed, what information will be gathered through which evaluation methods, what is measured or assessed, and how the information will be used.

How do you take advantage of evaluation as a learning experience?

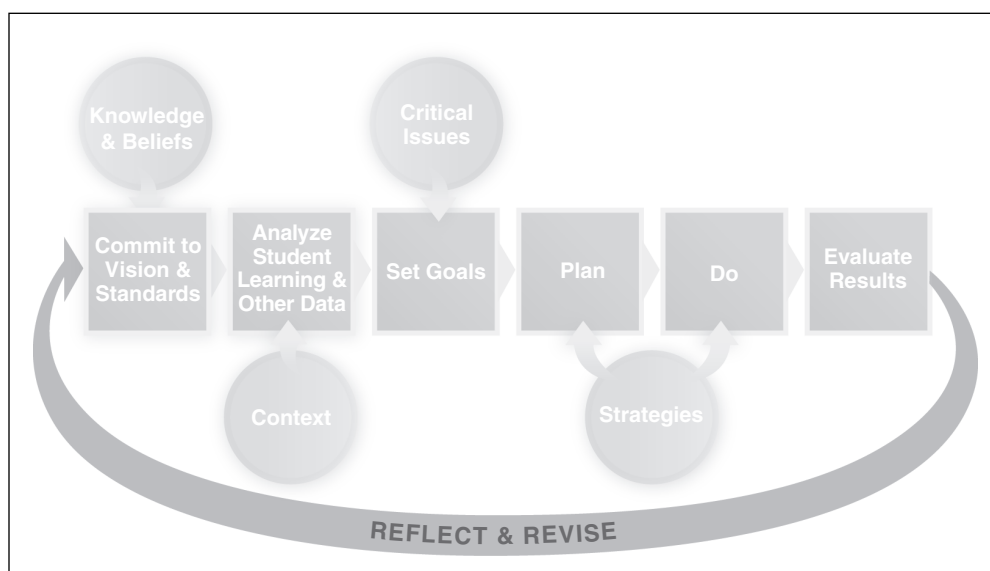
Increasingly, evaluators are becoming partners with professional developers in a commitment to continuous improvement of programs and their results. Involvement is the key word here, through such activities as

- engaging program staff, as well as participants, in specifying and discussing desired outcomes and identifying and prioritizing evaluation questions;
- involving staff and participants in the design or review of instruments or procedures for assessing outcomes;
- sharing responsibility with staff and participants for collecting data;
- engaging staff in analyzing and interpreting data; and
- sharing responsibility for reporting learning from the evaluation with a variety of audiences using a variety of formats.

Each of these activities can contribute to staff and participant understanding of their own learning and that of others, of a variety of methods to assess important learning outcomes as well as interpret information gathered, of ways to specify and then to investigate the answers to important questions, and of how to communicate to a variety of audiences and develop arguments for new ways of acting.

Reflect and Revise

Figure 1.15 Professional Development Design Framework: The Design and Implementation Process: Reflect and Revise



Although the professional development design framework illustrates this step in the process as emerging out of the “evaluate results” step (see Figure 1.15), reflecting and revising is a step that is continuous, ongoing, and embedded throughout all other process steps. For example, none of the inputs remain static over time. The knowledge base about learning, teaching, the nature of mathematics and science, professional development, and the change process is constantly growing. Designers, therefore, need to continuously reflect on emerging research and ask, “How does this new information influence our professional development?” Beliefs change, too. Seeing the impact of their work, professional developers begin to think differently about students, teachers, their disciplines, professional development, and change. These changes can influence the ways in which the plan is implemented. Critical issues are just as dynamic. Experience may lead designers to consider new issues or gain deeper understandings of the ones they have grappled with.

Continuous monitoring for evidence of impact and effectiveness of the overall program often leads planners back into prior steps in the process. Often programs may have an outside evaluator or internal “critical friend” who can support this ongoing reflection by providing timely feedback about how the program is meeting teacher needs, what is being learned, and what is needed next. For example, data gathered from pre- and postassessments of teachers’ content knowledge may indicate achievement of a specific goal. Feedback forms and “exit cards” that teachers complete after each learning experience provide critical input into whether the design is on track or if it has missed the mark for some teachers.

Designers use this formative feedback to ask, “How is the program working?” “Is it aligned with our goals and research, and what additional learning needs are emerging for teachers?” “Do they need more in-depth content learning of a specific concept or immersion into a different concept?” “What additional strategies for professional learning should we consider?” “Do some teachers need direct assistance in the classroom to apply learning, and if so, how will this be provided?” When data indicate goals are being met, designers may reflect on how to document what is being accomplished to share their successful results with others and to scale up the program to reach new teachers.

The reflection and revision process keeps designers out of a simplistic mind-set that can lead people to implement plans that are not working. Too often, professional development plans are so set in stone they prevent the kind of reflexive action needed to be effective. This process step reminds us all that even the best-laid plans must often be revised and sometimes even scrapped when the goals of professional learning are not being met. Reflecting and revising throughout the process can help to avoid costly mistakes and a waste of limited resources and demonstrate to teachers that you are willing to adjust your plans in the service of their learning.

The design framework presented here in Chapter 1 is not perfect. It creates artificial distinctions among components like critical issues and context, which are far more interconnected than separate circles depict. It simplifies an enormously complex process. And it may miss important feedback loops and connections. With that disclaimer, allow us to advocate strongly for the use of a design framework such as this to guide professional development. Since the publication of the first edition of this book in 1998, we have seen the design framework lead to more purposeful and reflective professional development designs. It has been used to look back on a program and ask, “How did our program reflect each of the inputs and approach each of the steps in the process?” “What would we do differently next time?” Its use helps professional developers make conscious choices and resist the quick-fix approach. We are more convinced than ever that only through thoughtful and careful design, based on sound principles and strategies, can professional development be elevated from its current state, treat all teachers as the professionals they are, and make the vision of schools as places of professional learning and quality science and mathematics education a reality in the United States.