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# Building a High-Performing Data Culture

*By Nancy Love*

*Nancy Love is currently the director of Program Development at Research for Better Teaching in Acton, Massachusetts. She is the former director of the National Science Foundation–funded Using Data Project, a collaboration between TERC and WestEd that developed a professional development program to prepare science and mathematics educators to lead a process of collaborative inquiry with Data Teams and to influence the culture of schools to be one in which multiple data sources are used effectively, continuously, and collaboratively to improve teaching and learning. The project developed a structured approach to collaborative inquiry known as the Using Data Process, which is described in detail in Chapter 3. The product of the project is a book titled *The Data Coach’s Guide to Improving Learning for All Students: Unleashing the Power of Collaborative Inquiry*, available from Corwin Press (2008). This chapter is largely based on material from that guide and made available for this publication with permission from Corwin Press.*

**D**espite the endless pessimistic messages about the state of public education and the resignation many educators feel about high-stakes testing, we believe there is much to celebrate. Our purpose in this chapter

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Based on material from *The Data Coach’s Guide to Improving Learning for All Students: Unleashing the Power of Collaborative Inquiry* (2008) by Nancy Love, Katherine E. Stiles, Susan Mundry, and Kathryn DiRanna. Adapted with permission from Corwin Press.

is to bring to life how schools are overcoming resignation and producing results by unleashing the power of collaborative inquiry, a process where teachers work together to use multiple data sources to continuously improve teaching and learning.

Just as the inquiry process can make the classroom come alive with discovery, discourse, and deep learning, inquiry among teachers into improving student learning can breathe new life into schools and classrooms. Teachers possess tremendous knowledge, skill, and experience. Collaborative inquiry creates a structure for them to share that expertise with each other, discover what they are doing that is working and do more of it, and confront what isn't working and change it. It is the ongoing investigation into how to continuously improve student learning for more and more students, guided by the following simple questions:

- How are we doing?
- What are we doing well? How can we amplify our successes?
- Who isn't learning? Who aren't we serving? What aren't they learning?
- What in our practice could be causing that? How can we be sure?
- What can we do to improve? To deepen our knowledge of our content and how to teach it?
- How do we know if it worked?
- What do we do if they don't learn?

When teachers ask these kinds of questions, engage in dialogue, and make sense of data together, they develop a much deeper understanding of what is going on relative to student learning. They develop ownership of the problems that surface, seek out research and information on best practices, and adopt or invent and implement the solutions they generate. The research base on the link between collaborative, reflective practice of teachers and student learning is well established (Little, 1990; Louis, Kruse, & Marks, 1996; McLaughlin & Talbert, 2001). When teachers engage in ongoing collaborative inquiry focused on teaching and learning and make effective use of data, they improve results for students.

*We couldn't wait to get our CRT [criterion-referenced test] results to see how much we had improved.*

—Florence Barker, principal and Data Coach, Cartwright Elementary School, Las Vegas, Nevada

## THE POWER OF COLLABORATIVE INQUIRY

As staff of the National Science Foundation–supported Using Data Project, we have seen the true power of collaborative inquiry, its potential to improve student learning, firsthand. We developed a model for collaborative inquiry known as the Using Data Process, along with the professional development

program and materials to support its implementation, and piloted this approach in schools across the country. Project staff worked with schools that are serving among the poorest children in this country—children from Indian reservations in Arizona, the mountains of Appalachia in Tennessee, and large and midsize urban centers in the Midwest and West. A few years ago, some of these children were simply passing time in school with “word search” puzzles or other time fillers; some were permanently tracked in an educational system that doled out uninspired, repetitive curriculum. Some of the schools in which we worked had not a single student pass the state test, and most students were performing at the lowest proficiency level.

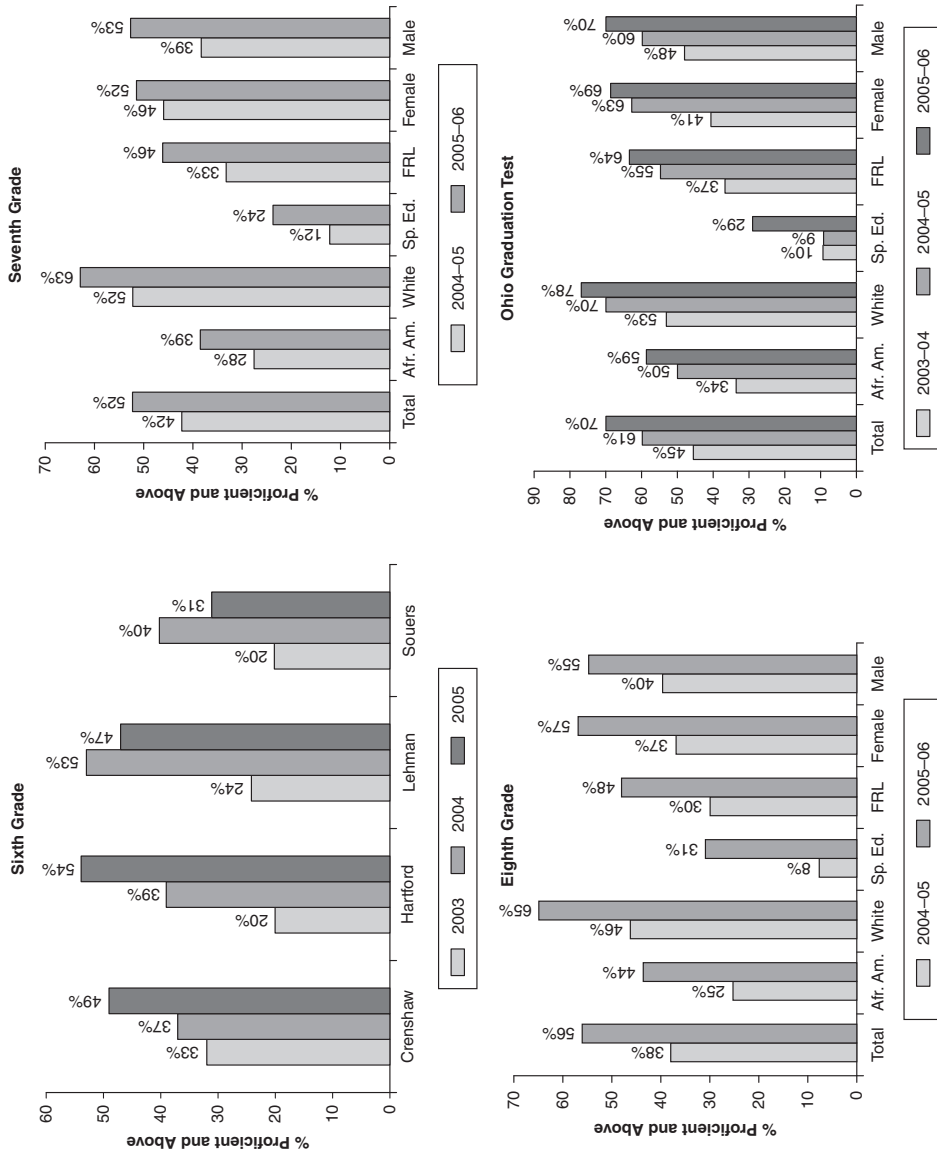
### **Collaborative Inquiry Improves Student Learning**

Today, students in these schools have a more rigorous curriculum and are experiencing significant and continuous gains in local and state assessments in mathematics, science, and reading. For example, in Canton City, Ohio, all four middle schools, serving 66 to 82 percent poor students and 30 to 45 percent African American students, increased the percentage of students scoring proficient or above on the Sixth-Grade Ohio Proficiency Test in mathematics between 2002–03 and 2004–05. One school more than doubled the percentage (Ohio Department of Education, 2005b, 2005c, 2005d, 2005e). On the Ohio Seventh- and Eighth-Grade Achievement Tests, all student groups, including all racial groups, students with special needs, those receiving free-and-reduced lunch, and males and females, made gains (Ohio Department of Education, 2005a, 2006; see Figure 1.1).

The percentage of Canton City high school students earning proficient or above on the Tenth-Grade Ohio Graduation Test in mathematics increased by 25 percentage points from 2004 to 2006. As in Grades 7 and 8, all student groups made progress (Ohio Department of Education, 2006). For example, the percentage of African American students passing the Ohio Graduation Test in mathematics increased by 74 percent from 2004 to 2006 (Ohio Department of Education, 2006; see Figure 1.1).

In Johnson County, Tennessee, a poor, rural area with over 70 percent of students on free-and-reduced lunch, the schools exceeded the growth rates of some of the wealthiest and highest-performing districts on the state assessment. Most impressive were gains for students with disabilities. In Grades 3, 5, and 8, mathematics, the percentage proficient for this group increased from 36 to 74 percent from 2004 to 2006. In reading for the same grade levels, the percentage proficient increased from 54 to 70 percent, and in science, in Grades 3 through 6, from 60 to 73 percent (Tennessee

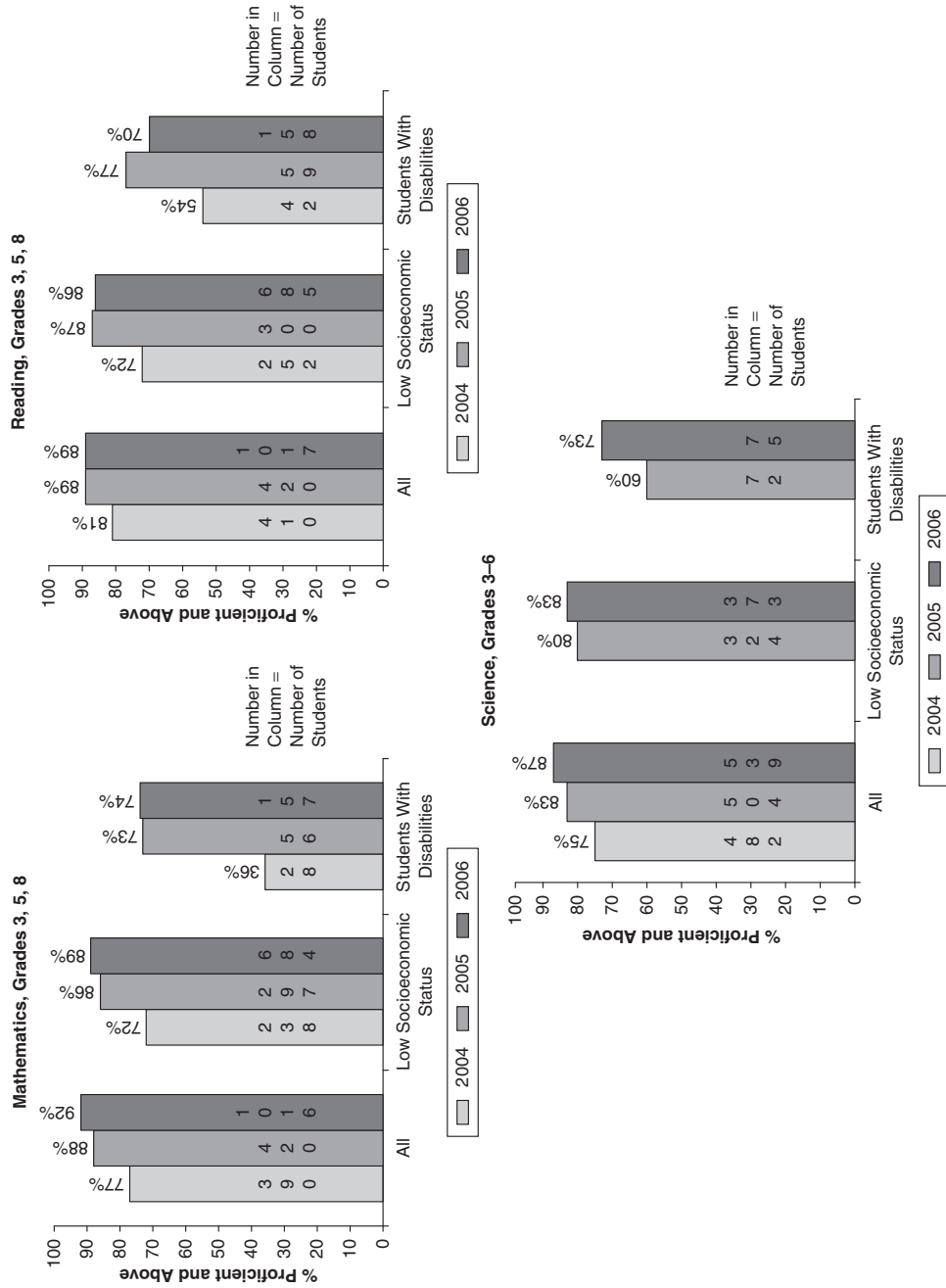
**Figure 1.1** Canton City, Ohio, Improves Mathematics Performance



SOURCE: Data from Ohio Department of Education, 2003, 2005a, 2005b, 2005c, 2005d, 2005e, 2006. Figure from *The Data Coach's Guide to Improving Learning for All Students: Unleashing the Power of Collaborative Inquiry* (CD-ROM, Handout H1.3), by N. Love, K. E. Stiles, S. Mundry, and K. DiRanna, 2008, Thousand Oaks, CA: Corwin Press. Reprinted with permission of Corwin Press.

NOTE: FRL = Free and reduced lunch.

**Figure 1.2** Johnson County, Tennessee, Improves Mathematics, Reading, and Science Performance



SOURCE: Data from Tennessee Department of Education, 2006. Figure from *The Data Coach's Guide to Improving Learning for All Students: Unleashing the Power of Collaborative Inquiry* (CD-ROM, Handout H1.3), by N. Love, K. E. Stiles, S. Mundry, and K. DiRanna, 2008, Thousand Oaks, CA: Corwin Press. Reprinted with permission of Corwin Press.

Department of Education, 2006; personal communication, David Timbs, February 21, 2007; see Figure 1.2).

Several of the schools participating in the Arizona Rural Systemic Initiative in Mesa, Arizona, serving a high percentage of Native American children, made substantial gains in student achievement on the Arizona State Assessment. For example, San Carlos Junior High School in San Carlos, Arizona, cut the percentage of students in the “Falls Far Below” category from 95 percent in 2002 to 46 percent in 2005 in eighth-grade mathematics and met Adequate Yearly Progress that same year (Arizona Department of Education, 2002, 2005).

### Collaborative Inquiry Creates Data Cultures

Equally exciting, schools implementing collaborative inquiry not only improved student achievement on state tests and other local measures, they changed their school culture by increasing collaboration and reflection on practice among teachers. Teachers increased the frequency with which they used multiple data sources and engaged in Data-Driven Dialogue, and they made improvements in their teaching in response to data (Love, Stiles, Mundry, & DiRanna, 2008; Zuman, 2006). According to Using Data Project’s external evaluators,

*I don’t think we can ever go back. Using Data has become a part of our culture.*

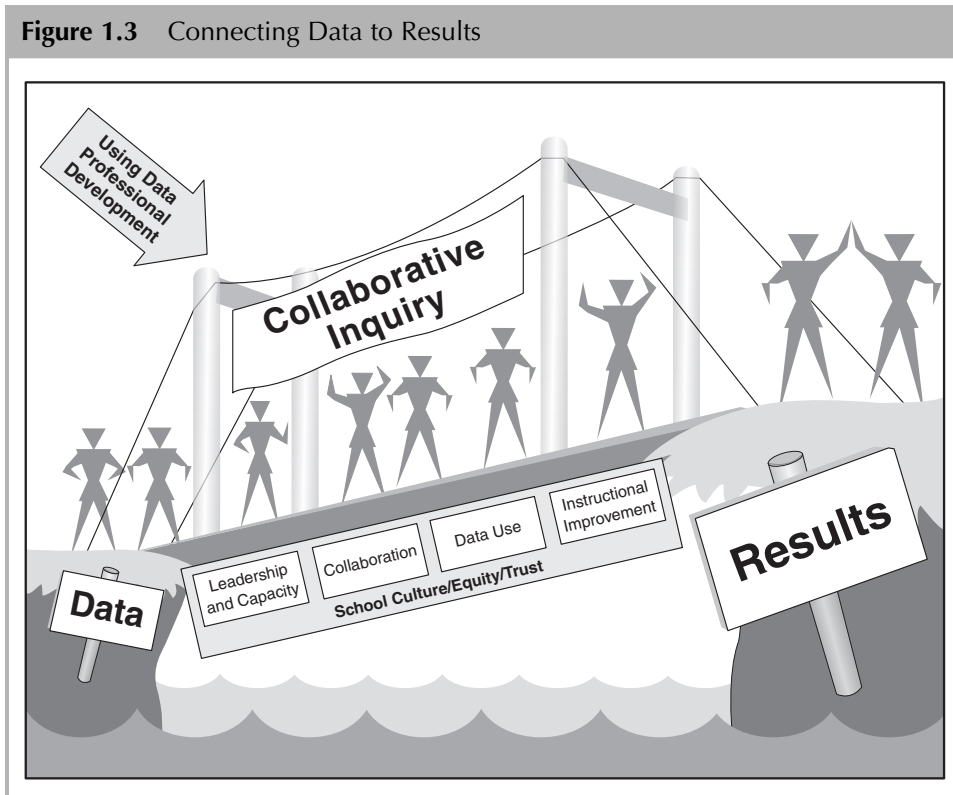
—Mary Ann Wood, Data Coach,  
Salt River Elementary School,  
Mesa, Arizona

As a result of UDP participation, many teachers have reported a significant shift in their [school] culture of using external factors to explain lack of student achievement. Many acknowledged that the process of discussing student test data has made them more accountable for the results and more mindful that teachers are in a position to influence gains in student outcome. (Zuman, 2006, p. 2)

Despite seemingly insurmountable barriers (e.g., limited resources, no common course or grade-level assessments, historically low performance), these schools managed to solve one of the biggest problems educators face: how to make effective use of the increasing amounts of school data now available to improve results for students.

## BUILDING THE BRIDGE BETWEEN DATA AND RESULTS

Imagine two shores with an ocean in between. On one shore are data—the myriad data now inundating schools: state test data sliced and diced every which way, local assessments, demographic data, dropout rates,



SOURCE: From *The Data Coach's Guide to Improving Learning for All Students: Unleashing the Power of Collaborative Inquiry* (p. 18), by N. Love, K. E. Stiles, S. Mundry, and K. DiRanna, 2008, Thousand Oaks, CA: Corwin Press. Reprinted with permission.

graduation rates, course-taking patterns, attendance data, survey data, and on and on. On the other shore are the desire, the intention, the moral commitment, and the mandate to improve student learning and close persistent achievement gaps. But there is no bridge between the shores with an ocean in between. What is often lacking is a process that enables schools to connect the data they have with the results they want. Sadly, it is children who are drowning in the data gap, particularly children of color, English language learners, children living in poverty, and those with exceptional needs.

Collaborative inquiry is the bridge that enables schools to connect the increasing amount of school data available to improve student learning. To implement collaborative inquiry, Using Data schools, that is, schools participating in the National Science Foundation–funded Using Data Project, set out to build the four segments that make up the bridge and the cultural foundation that supports it (see Figure 1.3).

### Establishing Collaborative Inquiry

1. Distribute leadership and capacity.
2. Build collaborative teams.
3. Use data frequently and in depth.
4. Focus on instructional improvement.
5. Nurture a collaborative culture based on commitment to equity and trust.

As collaborative inquiry grows, schools shift away from traditional data practices and toward those that build a high-performing Using Data culture. These shifts are summarized in Table 1.1 and elaborated on below.

#### 1. Leadership and Capacity

The first segment of the bridge is building leadership and organizational capacity by equipping teachers and administrators with the requisite knowledge and skills to meet the challenges of accountability. It is important that these knowledge and skills are not just developed among formal leaders, but distributed among all members of the school community, especially teachers, who learn to act as leaders in improving student learning and influencing the school culture. As Michael Fullan (1993) points out, “Change is too important to leave to the experts” (p. 21). The problems schools face are simply too complex and ever-changing to leave improvement in the hands of few individual, charismatic leaders—no matter how skilled. Collaborative inquiry relies on every teacher becoming a change agent. When such leadership is widespread and institutionalized, with built-in mechanisms to sustain it, the result is organizational capacity. (See the Johnson County case study in Chapter 6 for a good example of how this is done.)

*With increased accountability, American schools and those who work in them are being asked to do something new—to engage in systematic, continuous improvement in the quality of the educational experience of students and to subject themselves to the discipline of measuring their success by the metric of students’ academic performance. Most people who currently work in public schools weren’t hired to do this work, nor have they been adequately prepared to do it either by their professional education or by their prior experience in schools.*

—Richard Elmore (2002, p. 5)



**Table 1.1** Moving Toward a High-Performing Data Culture

<i>Element</i>	<i>Less Emphasis On</i>	<i>More Emphasis On</i>
Leadership and capacity	Individual charismatic leaders; data literacy as a specialty area for a few staff	Learning communities with many change agents; widespread data literacy among all staff
Collaboration	Teacher isolation; top down data-driven decision making; no time or structure provided for collaboration	Shared norms and values; ongoing Data-Driven Dialogue and collaborative inquiry; time and structure for collaboration
Data use	Used to punish or reward schools and sort students; rarely used by the school community to inform action	Used as feedback for continuous improvement and to serve students; frequent and in-depth use by entire school community
Instructional improvement	Individually determined curriculum, instruction, and assessment; learning left to chance	Aligned learning goals, instruction, and assessment; widespread application of research and best practice; systems in place to prevent failure
Culture	External accountability as driving force; focus on opportunities to learn for some	Internal responsibility as driving force; focus on opportunities to learn for all
Equity	Belief that only the “brightest” can achieve at high levels; talk about race and class is taboo; culturally destructive or color-blind responses to diversity	Belief that all children are capable of high levels of achievement; ongoing dialogue about race, class, and privilege; culturally proficient responses to diversity
Trust	Relationships based on mistrust and avoidance of important discussions	Relationships based on trust, candid talk, and openness

SOURCE: From *The Data Coach's Guide to Improving Learning for All Students: Unleashing the Power of Collaborative Inquiry* (p. 19), by N. Love, K. E. Stiles, S. Mundry, and K. DiRanna, 2008, Thousand Oaks, CA: Corwin Press. Reprinted with permission.

The key to leadership and organizational capacity in the Using Data Project was developing Data Coaches, education leaders such as teacher-leaders, instructional coaches, and building administrators who were specially trained to guide Data Teams through collaborative inquiry. Their role was to facilitate the work of Data Teams, helping them develop and apply critical knowledge and skills needed for effective use of data. While Data

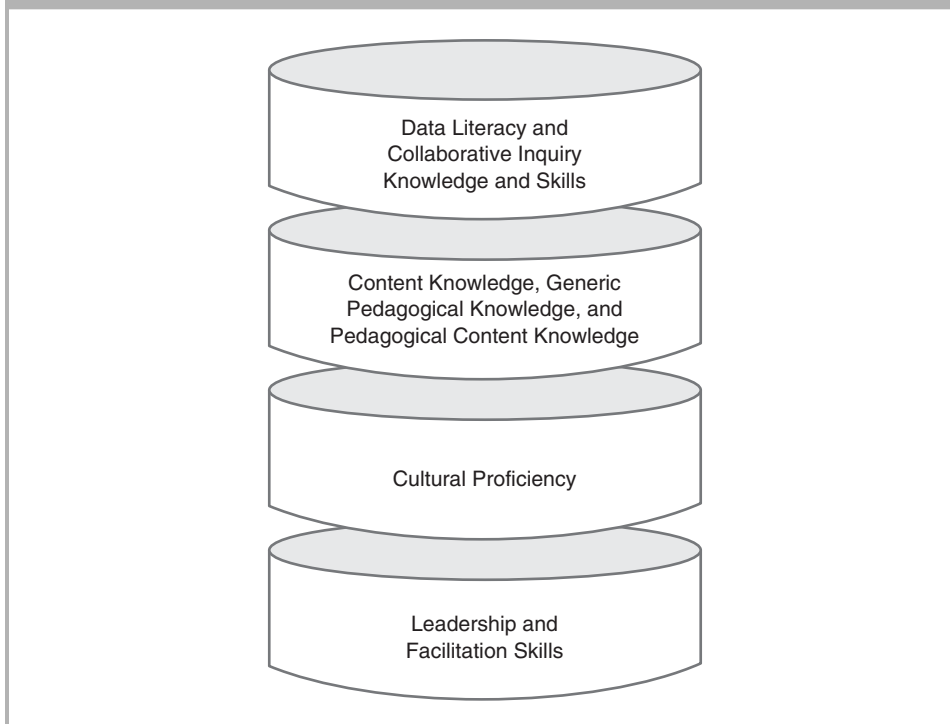
Coaches played a crucial role in gathering and preparing data and keeping the work of Data Teams focused on improving teaching and learning, their role extended beyond individual Data Teams. Data Coaches became the agents of distributed leadership and a vital part of the permanent improvement of infrastructure that built organizational capacity. They helped to influence the school culture toward the elements of high performance described above and to sustain continuous improvement. One clear conclusion from the Using Data Project evaluation is that the leadership of Data Coaches was the key to successful implementation of collaborative inquiry (Zuman, 2006). (For more on the Data Coach's role, see Chapter 2.)

**Data Coaches:** Educational leaders (teacher-leaders, instructional coaches, building administrators, or district staff) who guide Data Teams through the process of collaborative inquiry and influence the cultures of schools to be ones in which data are used continuously, collaboratively, and effectively to improve teaching and learning.

### *Core Competencies for High-Capacity Data Use*

If leadership is to be widely distributed, what do all educators need to know and be able to do to use data well, engage in productive collaborative inquiry, and exercise their leadership in the service of improving student learning? In other words, what are the core competencies for high-capacity uses of data—those that translate into sustained and significant improvements in instruction and learning and act as the antidote to unproductive and even destructive uses of data that are widespread today? Through our work in the Using Data Project, we identified four knowledge bases on which effective leaders of collaborative inquiry draw (see Figure 1.4). These are the ability to

- apply data literacy and collaborative inquiry knowledge and skills to collect, accurately interpret, and analyze multiple data sources and research to identify student-learning problems, verify causes and generate solutions, test hypotheses, and improve results;
- apply content knowledge, generic pedagogical knowledge, and pedagogical content knowledge (how to teach a particular body of content based on understanding of student thinking, key ideas that comprise the discipline, and ways of making content accessible to students) to generate uses and responses to data that result in effective interventions and improved teaching and learning;

**Figure 1.4** Core Competencies for High-Capacity Data Use

SOURCE: From *The Data Coach's Guide to Improving Learning for All Students: Unleashing the Power of Collaborative Inquiry* (p. 23), by N. Love, K. E. Stiles, S. Mundry, and K. DiRanna, 2008, Thousand Oaks, CA: Corwin Press. Reprinted with permission.

- apply cultural proficiency (the ability to interact knowledgeably and respectfully with people of diverse cultural backgrounds) to view achievement gaps as solvable problems, not inevitable consequences of students' backgrounds; generate solutions that reflect an understanding of diverse students' strengths, values, and perspectives; and handle cultural conflict effectively;
- apply leadership and facilitation skills to create high-functioning teams, facilitate productive dialogue focused on teaching and learning, foster commitment to rigorous content for all students, build collegial relationships based on trust and respect, and sustain collaborative inquiry.

## 2. Collaboration

The next segment of the bridge connecting data to results is collaboration. In *Using Data* schools, teachers were organized into collaborative Data Teams, generally of four to eight teachers and the building administrator or department chair, who worked together to use data to improve teaching and

**Figure 1.5** A Data Team at Work

SOURCE: Courtesy of David Timbs, Johnson County Schools.

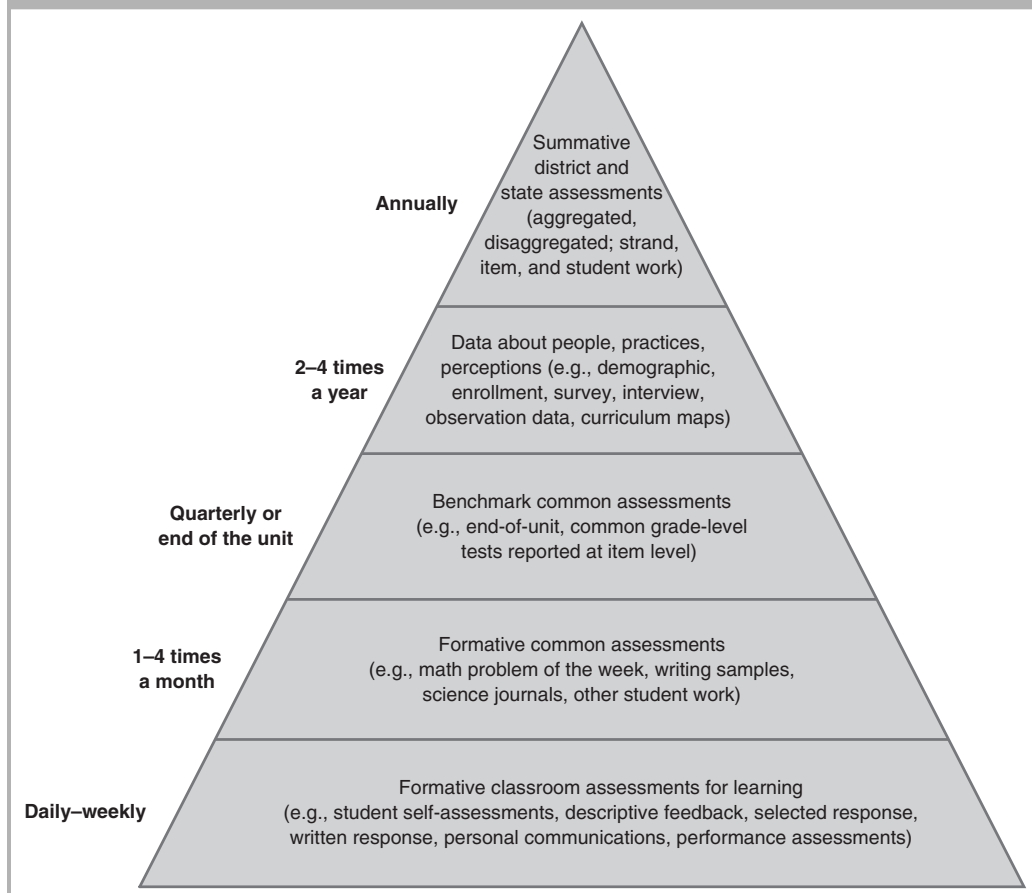
learning. At the elementary level, Data Teams were either grade-level teams or representatives of different grade levels who worked as content-area teams (e.g., mathematics or science) or as schoolwide improvement teams. At the middle or high school level, Data Teams were often organized by department or content area. However configured, Data Teams met regularly, ideally weekly during the school day.

**Data Teams:** Teams of four to eight teachers, other school faculty, and ideally, their building administrator who work together to use data to improve student learning.

Data Teams used data frequently and in depth to guide instructional improvement. The most successful Using Data schools put in place benchmark common assessments and engaged teachers in regular analysis of item-level data and student work to identify and address student-learning problems (see data pyramid in Figure 1.6). They learned to stop blaming students and their circumstances

*Using data used to mean rubbing teachers' noses in poor performance. But that didn't get us anywhere. Now we have a process that gives teachers a voice and a lens for looking at data. With teachers as the change agents, we are starting to see real movement.*

—Richard Dinko, former coprincipal investigator, Stark County Mathematics and Science Partnership, Canton, Ohio

**Figure 1.6** The Data Pyramid

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

for failure and, instead, to use research and data about their instructional practice to generate solutions to identified gaps in student learning. Data Teams tried out new teaching strategies, such as use of graphing calculators, graphic organizers, or high-level questioning. They implemented new programs, such as maximum inclusion for students with disabilities, implementation of inquiry-based science instructional materials, and use of school-based instructional coaches. And they frequently monitored results. (See vignette that follows in this chapter for an example of a Data Team in action and Chapter 2 for more information on the role of the Data Team.)

### 3. Data Use

Let's focus further on the "data use" segment of the bridge. The days of using data in schools once a year are over. If continuous improvement is the

goal, there is little point in examining only one source of data, state test results, which often become available only after students have moved on to the next grade and it is too late to do anything about them. Data-literate teachers use a variety of different kinds of data, some on a daily basis, some monthly or quarterly, and some annually, to continuously improve instruction and engage in collaborative inquiry. These include both formative and summative assessments. Formative assessments are assessments *for* learning and happen while learning is still under way and throughout teaching and learning to diagnose needs, plan next steps, and provide students with feedback. Summative assessments are assessments *of* learning and happen after learning is supposed to have occurred to determine if it did (Stiggins, Arter, Chappuis, & Chappuis, 2004, p. 31). Figure 1.6 illustrates the different types of data recommended for use by Data Teams, including formative, summative, and other kinds of data, with suggestions for the frequency with which those data are analyzed.

*Teachers didn't know how to talk about data. It was at a surface level. It wasn't going down deep. Now we go into great detail.*

—Keith Greer, principal,  
Casa Grande High School,  
Casa Grande, Arizona

*We talked about standards. But it wasn't until we implemented common benchmark assessments that our teachers started teaching to the standards.*

—Pam Bernabei-Rorrer,  
mathematics and Data Coach,  
Canton City, Ohio

*Formative Classroom Assessment Data.* The widest part of the pyramid, at the bottom, illustrates the type of data that we suggest teachers spend the bulk of their time using—formative classroom assessments, done by teachers in their classrooms on an ongoing basis, including student self-assessments, descriptive feedback to students, use of rubrics with students, multiple methods of checking for understanding, and examination of student work such as science journals as well as tests and quizzes. These data inform teachers' instructional decisions—day-to-day, even minute-by-minute—and serve as the basis for feedback to students to help them improve their learning. For example, in Canton City, Ohio, middle school mathematics teachers use handheld electronic devices, Texas Instruments Navigator™ and graphing calculators, with their students to quickly assess student understanding of lessons while they are in progress. They then use this information to adjust their teaching, give specific feedback to students, and provide extra help for students who need it. Because of the strong research base indicating that these types of assessments improve student learning, we recommend that individual teachers spend the bulk of their data-analysis time developing, collecting, and analyzing these data (Black, 2003; Black & Wiliam, 1998; Bloom, 1984; Meisels et al., 2003; Rodriguez, 2004; Stiggins et al., 2004).

*Formative Common Assessment Data.* The next layer of the data pyramid represents formative common assessments, which are frequently analyzed by the Data Team—one to four times per month. These include some of the same sources of data as the formative classroom assessments, the difference being that teams of teachers administer these assessments together and analyze them in their Data Teams. For example, teachers meet weekly to examine student entries in their science journals and brainstorm ideas for improving instruction. These formative common assessments are important in identifying student-learning problems, generating short cycles of improvement, and frequently monitoring progress toward the overall student-learning goal.

*Benchmark Common Assessment Data.* The next layer of the data pyramid illustrates benchmark common assessments, administered at the end of a unit or quarterly to assess to what extent students have mastered the concepts and skills in the part of the curriculum recently taught. These are administered together by teachers teaching the same content, either at the same grade level or in the same subject or course. The “common” feature makes them an ideal source of data for collaborative inquiry. In fact, they are among the most important sources of student-learning data the team has because they are timely, closely aligned with local curriculum, and available to teachers at the item level (i.e., results are reported on each individual item and the items themselves are available for the teachers’ examination). Benchmark common assessments are most effective when they include robust performance tasks that provide evidence of student thinking and when multiple-choice items are analyzed item-by-item to uncover patterns in student choices and confusion underlying incorrect answer choices.

Benchmark common assessments can be used both formatively, to immediately improve instruction, and summatively, to inform programmatic changes in the future, such as increasing the amount of time spent on teaching a particular concept or changing the sequence in which it is taught. Whether developed by the team, included in curriculum materials, or purchased commercially, it is crucial that these tests are of high quality—valid (measure what is intended), reliable (would produce a similar result if administered again), and as free of cultural bias as possible.

*Data About People, Practices, and Perceptions.* The next layer in the data pyramid, data about people, practices, and perceptions, is one that is often overlooked in schools, but it is extremely important. This type of data includes demographic data about student populations, teacher characteristics, course enrollment, and dropout rates. The Data Team analyzes demographic data to understand who the people are that comprise the school community. This slice of data also includes student enrollment in various types and levels of

courses, such as in higher-level mathematics and science or advanced placement courses, and survey, observation, and interview data, which provide critical information about instructional practices, policies, and perceptions of teachers, students, administrators, and parents. These data become very important in exploring systemic causes of the student-learning problem identified through student-learning data, expanding opportunities for more students to learn, and monitoring implementation. They also help to assure that diverse voices—by role (e.g., student, teacher, parent, administrator), by race/ethnicity, and by economic, language, and educational status—are brought into the work of the Data Team. We recommend that Data Teams make use of these types of data two to four times per year to establish baseline data and monitor changes in practice.

*Summative Assessment Data.* The top of the data pyramid represents summative assessment data, including state assessments as well as annual district tests. These data are used to determine if student outcomes have been met and for accountability purposes. Data Teams take full advantage of these data, drilling down into them and analyzing them in as much detail as possible, including aggregated (largest group level) and disaggregated (broken out by student populations, e.g., race/ethnicity, gender, poverty, language, mobility, and educational status) data trends, strand (content domains), item-level data (student performance on each individual test item), and student work when available. Along with other student-learning data sources described above, they become the basis for identifying a student-learning problem and setting annual improvement targets. However, they occupy a small part of the pyramid because they are only available annually and provide limited information about what to do to improve performance (especially if item-level data and released items are not available). In addition, these results often arrive too late for teachers who taught a group of students during the year of the test to respond to them. Finally, these tests can be poorly constructed, culturally biased, inaccurate in content, and lacking in rigor, underscoring the importance of using the rich array of data recommended in the data pyramid.

### Vignette

#### Using Multiple Data Sources to Improve Student Graphing Skills

*The following illustrative vignette shows how an eighth-grade science Data Team drew on state assessment data and open-assessment prompts as well as on national and state standards and misconceptions research to improve students' graphing skills.*

The analysis of the eighth-grade criterion-referenced test science strand data for "investigation and experimentation" indicated that only 42 percent of the students scored at the proficient level. Item-level data revealed that three questions about plotting and interpreting



graphs had the lowest percentage of correct answers. Even with this drill-down, the Data Team was left with lingering questions about why students were not able to answer these questions. It was evident to the team that analyzing only multiple-choice questions would not help them understand students' naive or alternate conceptions about graphing. The teachers knew that in order to enhance their instruction, they needed to know exactly the concepts or content students were struggling to master.

The Data Coach brought the national and state science standards to the table for discussion. Using the documents helped the team to clarify their own content knowledge and build a common understanding of what eighth-grade students should know about charting, graphing, and summary statements. The list of concepts included (1) appropriate graphic representation (e.g., bar, line, pie), (2) orientation of x- and y-axes, (3) parallel and perpendicular lines, (4) labeling of manipulated (independent) variables and responding (dependent) variables, and (5) analysis of the relationship of manipulated and responding variables.

The team also discussed their experiences with teaching graphing and where students seemed to "always struggle." Reviewing misconception research helped the team confirm that two of the most common misconceptions involved use of appropriate graphs to display the data and understanding the relationship between the variables.

This discussion piqued their interest. What could they do to gather student work on this subject? The team decided to create an open-ended assessment prompt that asked students to graph data from a table that clearly labeled the variables and to make a summary statement from the graphic representation. They asked all eighth-grade science teachers to randomly select ten students in their classes to take the open-ended assessment. This resulted in fifty pieces of student work, such as the one illustrated in Figure 1.7.

To interpret the student work, the Data Team invited all teachers who gave the assessment to join in the analysis. First the teachers reviewed the scoring criteria (rubric) for expected student answers. Then they sorted the work into high-, medium-, and low-quality piles based on the scoring criteria and discussed the characteristics of each group. How was student understanding represented in the high-quality pile? What was lacking in a student's knowledge that indicated an intermediate level of understanding? What types of instructional interventions would be necessary to move a student from the low-quality to the medium-quality pile?

To answer these questions, they began by making the following observations of the student work, without any interpretation or inference:

- Paper A uses a bar graph rather than a line graph.
- Papers A, B, and D have no title.
- Papers A and B have mixed up the variables, plotting the manipulated variable (ground temperature) on the y-axis instead of the x-axis.
- Most data points are plotted correctly.
- Papers A, B, and C don't use data from the graph to explain the changes, although they do state the change (colder temperature, taller plants).
- Paper D has a wrong relationship (warmer ground, taller plants).
- Paper E is the only one to use actual data numbers.

These rich discussions resulted in the team documenting the following inference about student understanding: students have difficulty understanding the difference between when to use a bar graph (discontinuous data) and a line graph (continuous data). They are also not using data as evidence when writing a summary statement of the data.

**Figure 1.7** Student Work Example

**Open-Ended Prompt**

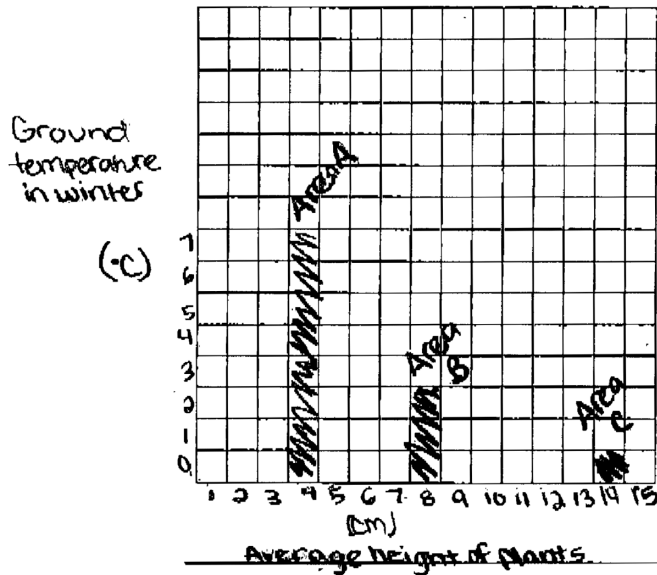
Please write (or draw) your answer directly on the lines or in the space provided.

- You are the owner of a company that supplies local florists with tulips. Last year the tulips you produced tended to be smaller than usual and you wonder if it had something to do with the soil temperature in the winter.
- You recorded the ground temperature where the tulip bulbs were dormant and the average height of the plants when they sprouted. Your data chart looks like this:

HEIGHT OF TULIP PLANTS  
ONE WEEK AFTER BREAKING THROUGH SOIL

	AREA A	AREA B	AREA C
Ground Temperature in Winter	7 C	2 C	0 C
Average Height of Plants	4 cm	8 cm	14 cm

1. Graph the data on the grid below. Remember to label the graph.



2. Based on the data from the graph, describe the relationship between ground temperature in winter and the height of tulip plants after a week of visible growth.

The relationship is the more the temperature goes  
down the height gets taller.

SOURCE: Adapted from the Fall 2004 Partnership for Student Success in Science student assessment. Designed by Dr. Shavelson of Stanford University. Reprinted with permission.

NOTE: This figure is also used in *The Data Coach's Guide to Improving Learning for All Students: Unleashing the Power of Collaborative Inquiry* (p. 219), by N. Love, K. E. Stiles, S. Mundry, and K. DiRanna, 2008, Thousand Oaks, CA: Corwin Press.

This led to a discussion of how graphing was taught. It soon was apparent that the mathematics and science teachers as a group were not articulating their content or their strategies. It was also clear that there were no common criteria for a quality graph or summary statements for Grades 6 through 8. The team set out to implement the following changes: (1) meet with mathematics teachers to articulate content and strategies, (2) develop common criteria for quality graphing across content areas, (3) teach the students the criteria, (4) collect and analyze student work on graphing on a monthly basis, and (5) give students specific feedback on how to improve. They were excited when their new samples of student work showed more students meeting the criteria for success.

SOURCE: From *The Data Coach's Guide to Improving Learning for All Students: Unleashing the Power of Collaborative Inquiry* (pp. 218–220), by N. Love, K. E. Stiles, S. Mundry, and K. DiRanna, 2008, Thousand Oaks, CA: Corwin Press. Reprinted with permission.

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#### 4. Instructional Improvement

The driving purpose for collecting all of the data described above is instructional improvement. There is no way to bridge the gap between data and results without changing what is taught, how it is taught, and how it is assessed. Instructional improvement is the last and essential segment of the bridge linking data to results. The above vignette illustrates several important features of using data for instructional improvement:

- Keep the conversation focused on improving instruction, and establish ground rules for not blaming students, their circumstances, other teachers, or factors outside of their control.
- Use multiple data sources, including state and local test data at the strand and item level to identify the specific knowledge and skills students may be having difficulty with.
- Use national and local standards and misconceptions research to deepen teachers' content knowledge about the particular content or skill students are struggling with, thereby enhancing teachers' ability to analyze the work for student thinking and misconceptions.
- Collect student work that will further elucidate student understanding relative to the learning problem being investigated.
- Clarify what quality student work looks like, using anchor papers and exemplars.
- When analyzing student work and other data, separate observations from inferences and further test inferences with additional data and research.
- When generating inferences, use the following questions to guide the dialogue:
  - Are our learning goals, instruction, and assessment aligned?
  - Did we teach this concept/skill? Did we teach it in enough depth?  
At the appropriate development level? In the best sequence?

- Did we use appropriate and varied instructional strategies to meet each student's needs?
- Did we use quality questions to extend student thinking?
- Did we use formative assessment data to give students feedback on their own learning and to identify student confusion and refocus our teaching?
- Did all students have access to this content and best practice?
- What content knowledge and pedagogical content knowledge will strengthen our ability to teach this content?
- Did we apply principles of cultural proficiency (knowledge and respect for people from diverse cultural backgrounds) to assure the best learning opportunities for culturally diverse learners?
- Use additional data (e.g., student and teacher surveys, classroom observations, student and teacher interviews, and student enrollment in advanced courses) and research to verify the causes of the student-learning problem and generate research-based solutions.
- Test solutions through ongoing monitoring of student learning in the problem area identified.

## 5. Collaborative Culture

As illustrated in Figure 1.3, the foundation of the bridge of collaborative inquiry is a school culture characterized by collective responsibility for student learning and the commitment to serve each and every child. Long before state tests, plenty of cues and data were available to let us know some students were not learning—students slumping down in their seats, going through day after day of school without being engaged, poor grades, poor attendance, high dropout rates. Educators working in isolation, however, literally could not respond to the data. Yet the addition of accountability testing also does not assure the ability to respond to data, or “response-ability.” This is a function of a collaborative culture, where everyone takes responsibility and is committed to improving learning for all students. Schools that have response-ability do not leave student learning to chance. As Rick DuFour and his colleagues (DuFour, DuFour, Eaker, & Karhanek, 2004) describe it, they “create a schoolwide system of interventions that provides all students with additional time and support when

*When people here say “data,” they usually think of that stuff they take care of in the office. Through the Using Data Project, we learn that we work together to analyze the data and that there are direct implications for classroom instruction. There is something that everyone can do to have all of our students be the best they can be.*

—Karen Croteau, Data Coach  
and teacher, Clark County  
School District, Las Vegas, Nevada

they experience initial difficulty in their learning” (p. 7). High-performing collaborative schools are organized in grade-level or course- or subject-based teams where this response-ability is enacted as part of the daily work of teachers.

A hallmark of such a high-performing school culture is a commitment to equity. Singleton and Linton (2006) define educational equity as “raising the achievement of all students while narrowing the gap between the highest- and lowest-performing students and eliminating the racial predictability and disproportionality of which student groups occupy the highest and lowest achievement categories” (p. 46). Equity does not mean that all students receive an equal level of resources and support, but that those with the greatest need receive the level of support they need to succeed.

A collaborative community committed to equity requires a high level of trust. In high-functioning school cultures, educators trust each other enough to discuss “undiscussables” such as race, reveal their own practices and mistakes, root for one another, and face together the brutal facts that data often reveal (Barth, 2006). For all of these reasons, districts that want to unleash the power of collaborative inquiry make a top priority of strengthening collaboration and internal responsibility for student learning, commitment to equity, and relationships based on trust. Collaborative inquiry both thrives in such a culture and helps to establish it. (See Chapter 3 and the case studies in Chapters 5 and 6 for more on how Data Teams and Data Coaches build the foundation for collaborative inquiry.)

## SUMMARY

How do schools go from simply having data to actually producing results for students by skillful use of that data? In this monograph the authors present a process that enables schools to connect the data that they have to the results they want. This process is collaborative inquiry—where teachers work together to construct their understanding of student-learning problems and embrace and test out solutions together through rigorous use of data and constructive dialogue. It acts as the bridge between data and results. The Using Data Process, described in detail in Chapter 3, provides one model of collaborative inquiry with demonstrated results for students.

As learned through implementation of the Using Data Process, building the bridge is not easy. It requires major changes in how schools do business, starting with a shift away from individual change agents and toward distributed leadership. The Data Coach is the agent for

distributing leadership, guiding Data Teams, and developing members' knowledge and skills in the four core competencies upon which the effective use of data depends:

1. Data literacy and collaborative inquiry knowledge and skills
2. Content knowledge, generic pedagogical knowledge, and pedagogical content knowledge
3. Cultural proficiency
4. Leadership and facilitation skills

Other building blocks of the bridge are collaboration, put into practice by organizing teachers into Data Teams or professional learning communities; frequent and in-depth use of multiple data sources; and ongoing instructional improvement. The foundation for the bridge—upon which all of these elements rest—is a collaborative culture characterized by trust and a commitment to every student's learning.

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