Improving Leadership for Learning

0 1 2 3 4 5 6

Data-Informed Leadership

Data-Informed Leadership in Education

Michael S. Knapp
Juli A. Swinnerton
Michael A. Copland
Jack Monpas-Huber
University of Washington

October 2006

ctp

Center for the Study of Teaching and Policy
UNIVERSITY OF WASHINGTON

The Leadership Issue Project

State-of-the-Field Reports: Improving Leadership for Learning

This report is one of a series produced by a research team at the Center for the Study of Teaching and Policy, a national research consortium home-based at the University of Washington. Developed with support from The Wallace Foundation during the early stages of an initiative that explores central issues in the exercise of educational leadership, the reports synthesize studies, conceptual work, and examples of current and emerging practice.

The reports are intended to clarify each leadership issue, while assembling what is known from empirical studies. The information in these reports lays the groundwork for further study and practical experimentation by leaders and reformers in states, districts, and schools.

The first report offers an overview of leadership and leadership support in relation to the overarching goal of improving learning. The remaining six explore in more detail particular issues within that terrain.

This document and the others within the series can be downloaded free of charge from the Center's Web site, **www.ctpweb.org**, and also from The Wallace Foundation's Knowledge Center site, **www.wallacefoundation.org.**

1 *Contents*

Introduction: Data in Decisionmaking and Leadership

An argument can be made that educational leaders have always had "data" of some kind available to them when making decisions intended to improve teaching and learning. Effective leaders gathered whatever information they could readily access, and then drawing on accumulated experience, intuition, and political acumen, they chose the wisest course of action to pursue. The data they collected was likely impressionistic and rarely systematic, complete, or sufficiently nuanced to carry the weight of important decisions.

Converging trends have shifted the basic terms of this equation, creating new possibilities for leaders to attain a deeper level of understanding about the complexities of teaching and learning, and to learn how to maximize educators' efforts to meet students' needs. Consider this example from a high school:

> Staff members at Canyon View High School (pseudonym) wanted to use their data to understand why more than half of the school's ninth grade students failed the state reading proficiency examination. Working backward through the students' education experiences to determine the earliest occurrence of a characteristic common to all students who had not passed the exam, the teachers were shocked to see that most of these students had missed up to 30 or 40 days in a 180-day school year when they were first graders.

> These ninth graders and the students in grades just below them were already getting remedial reading help, but the new data provided an opportunity to save younger students from the same fate. The district began more extensive screening of elementary and middle school students who were likely to suffer academically because of high absenteeism in early years. Teachers, counselors, and principals followed up by working closely with parents—setting up telephone trees, for example, and in some cases

making home visits—to make sure that the children got to school. (Bernhardt, 2003, p. 29)

Various forces and conditions, both local and national, encouraged the Canyon View staff to engage in data-based problem solving. Building on a robust evaluation movement in the 1960s and 1970s, a variety of techniques and strategies are now available for systematically evaluating the implementation, effects, and effectiveness of educational programs, policies, or initiatives. Standards-based reform has generated growing attention to outcomes and results, with a corresponding lessening of interest in inputs. Since the late 1980s, the accountability movement associated with standards-based reform has been steadily ratcheting up the demand for an evidence base to demonstrate the effectiveness of student learning and educational programs. Finally, the rapid increase in sophisticated technologies for handling digital information makes the prospect of making educational decisions with a strong evidentiary base more realistic, yet at the same time, more costly and complex.

In this context, forward thinking educators are beginning to envision a future in which in-depth data analysis focused on student learning will be a routine part of teachers' and administrators' daily work, and the most important means for continuous professional learning. Consider this example from a high-performing school district:

The Bodewell School District (pseudonym) is recognized regionally and nationally as a "high-performing" system, pursuing the clear and specific goal of providing a college-preparatory education for every student. For nine years, the district has realized strong and steady growth in various measures of student achievement; however, data analysis now reveals a "plateau effect" in key indicators. The district has stalled at about 80 percent of students taking at least one Advanced Placement (AP) course, and last year it saw a slight decline in state assessment scores in mathematics.

Despite a systematic approach to curriculum, professional development, and student support that extends to the earliest grade levels, Superintendent Mark Rogers (pseudonym) has come to the realization that the district has progressed as far as it can given

the current level of the knowledge and skills of its educators. He notes, "What Ron Edmonds said years ago simply isn't true—we don't have all the knowledge and skills we need to ensure every student's success. I'm saying, personally, that I've been at this work for a long time, and I don't know how to teach all kids in a way that will guarantee their success." Superintendent Rogers believes that the only way to get continued improvement is to turn the district into a real learning community, where experimentation with new ideas and forms of instructional practice and analysis of results of those experiments become the norm for teachers' work, rather than the heroic exception. He sees the need for more sophisticated data structures that enable teachers to gain even more clarity about the specific needs students bring and learn from their ongoing efforts to improve learning. The superintendent envisions a teacher community that is intimately linked by the Internet, working to continually develop the range and depth of the district's curriculum, and using those same Web-based structures to enable the sharing of knowledge about what works, both inside and outside the district. He wonders how the district can promote experimentation and harness new forms of data and data use to break through the ceiling.[1]

The growing attention to questions of what counts as data, the development of sophistication in understanding data, and the increase in technologies for manipulating data open up important possibilities for leaders and the exercise of leadership throughout school, district, and state systems. Coupled with support for continual professional and systemwide learning, as suggested by the Bodewell case, the capacity for educational improvement could increase significantly.

This paper explores these possibilities, both conceptually and in light of research on the use of data in educational decision making. Based largely on published accounts in the research literature and descriptive material on established or emerging practices, the paper synthesizes and interprets ideas, frameworks, beliefs, and activities concerning the availability, quality, and use of data in the work of leaders at state and local levels related to the improvement of teaching and learning. We concentrate primarily on those aspects of

this emerging domain that have been systematically and empirically studied, and therefore we have less to say about the burgeoning literature offering advocacy, advice, or technical assistance to those who might make data a bigger part of leadership practice, or are already doing so (e.g., Holly, 2003; Holcomb, 1999; Leavitt, McDaniel, & Skogstad, 2004; Council of Chief State School Officers, 2006). These latter bodies of work have much to offer leaders, but they are not particularly helpful in gauging the nature or impact of current practice, nor the conditions that enhance or limit that practice.

The paper unfolds as follows: First, following discussion of a broader way of construing the use of data in leadership, we present ideas that can help conceptualize the relation among the leaders' access to data, the meanings they give to it, and the uses to which they put this data, in the varying settings in which leaders seek to improve teaching and learning. Next, we briefly review the landscape of current practice, noting emerging strategies that purport to improve the leaders' access to, and use of, data for improvement purposes, as well as conditions that limit or complicate leaders use of data. Finally, we conclude with questions that emerge from the review and beg to be answered through further experimentation and research, while noting enduring tensions that will always be present in data-informed practice and cannot be "resolved" through further effort or study.

A Broader Focus: Data-Informed Leadership

In the current context of accountability and school reform, *data-driven decision making* is increasingly seen as an essential part of the educational leader's repertoire, yet more is at stake—and more is possible—than this term, or even the term *data-based decision making*, might imply. As might be inferred from the vignettes, it is not just a question of laying out test scores, noting areas of weakness, and mounting remedies that are clearly indicated by patterns in the data. We find the term *data-informed leadership* a more useful concept for considering what is, and might be, involved in this territory. The term broadens the scope of thinking and action in two productive ways.

First, shifting to the concept of data-informed leadership escapes the occasional deterministic implication of data "driving" action. Tempting as it may be to imagine educational leaders' actions as single-mindedly "driven" by "bottom-line numbers," wise leaders are likely to take more into account as they frame a response to the challenges they face. While they can be fully

informed by data when they take action, they also bring core values and insights into those aspects of practice for which there is not yet good data, and may never be. Moving away from the potentially appealing rhetoric that data can provide clear, indisputable direction for future action, the notion of data-informed leadership captures the complex and often ambiguous nature of data use in educational settings. According to Bernhardt (2004), "True data-driven decision making is only partly about data. A clear and shared vision and leadership play major parts in data-driven decision making" (p. 18). And Weiss (1995) reminds us that no matter how systematic and comprehensive the data gathering, several other factors are always likely to influence decision making, including interests, ideologies, and institutional context.

Second, the concept presumes that data are useful for more in the practice of leadership than the making of decisions per se. For one thing, given the inherent ambiguity and multiple meanings of much data in educational settings (Coburn & Talbert, 2006; Honig & Coburn, 2005), data may prompt questions and deliberation more than they point to specific decision options. For example, certain data points (e.g., disaggregated state test scores) may provide an awareness of a given situation, such as low scores for ninth grade students in Canyon View High School, but the data do not necessarily indicate how educators should address the issue at hand. In this example, assessment data certainly *inform* conversation about possible actions, but they do not necessarily "drive" decisions or provide information about how best to address the issue of low performance. In fact, while the vignette described district leaders' attempts to prevent students in elementary grades from experiencing similar struggles in high school, the data did not provide specific direction for addressing the needs of current ninth grade students whose performance was the basis for data analysis.

Because leaders do far more than make decisions, data can serve a range of purposes in the leaders' toolkit, as Table 1 suggests (e.g., Bernhardt, 1998; Boudett, City, & Murnane, 2005; Holcomb, 1999). Some of these situations imply internal, essentially "private" purposes, played out within a leadership team or the inner circle of individuals with whom a leader works most closely, while others imply audiences that are more public. Each implies different ways of representing what the data say and communicating it to intended audiences.

Table 1: A Range of Ways that Educational Leaders Use Data

Type of leadership activity (with and for internal or external audiences)	How data are used and what kinds of data are implied
Diagnosing or clarifying instructional or organizational problems (primarily internal to the decision making group)	State and local leaders seek to know whether, or to what extent, the learning that is occurring for students in the local context matches those overarching expectations for learning (standards) established at the top of the system. Therefore, leaders would seek out information such as disaggregated scores on criterion-referenced state assessments that reflect one measure of student learning in particular content areas.
Weighing alternative courses of action (primarily internal)	State and local leaders use data to evaluate existing programs or curriculum approaches and (where they have relevant data) to judge their potential in comparison with alternative programs, some of which may be implemented in pilot form. Comparative implementation and outcome data would therefore be especially helpful in such circumstances—e.g., to judge their relative contributions to a learning improvement agenda.
Justifying chosen courses of action (primarily external)	Data (e.g., concerning learner characteristics, learning outcomes, comparative program benefits, school closure decisions) are used selectively to make a compelling case for programs or courses of action that may or may not have been chosen on the basis of the data.
Complying with external requests for information (external)	State and local leaders are careful to generate information requested by external agencies, authorities, or groups on which their funding or legitimacy depend—for example, descriptions of how different learner groups are served on evaluations of services to these groups.
Informing daily practice (internal)	Data of various kinds are used by administrators and teachers to guide daily practice. The data are often informal, gathered in mid-stream, and in a form that can be immediately interpreted and used by a practitioner for refining teaching and learning.
Managing meaning, culture, and motivation (internal)	Data help leaders understand and guide the cultural aspects of the professional workplace, by representing to staff what the organization is accomplishing, how people feel about their work, what matters in the work, and what professional learning needs exist.

As the Table 1 categories make clear, not all of these leadership actions imply specific decisions, but rather imply a range of actions (including the investigation of new questions) in which data, appropriately interpreted, help leaders understand what is happening in educational organizations, represent it to others inside or outside of schools, and fashion courses of action. Furthermore, the policy and community environments in which educational leaders work are likely to prompt a variety of uses of data, by

- *Demanding information from the educational system about its performance* (as in accountability systems) or the effectiveness of particular programs (as in the evaluation requirements accompanying categorical program funding).

- *Offering sources of data or help with assembling or interpreting data* (as technical assistance centers, universities, or vendors may do).

- *Creating occasions for inquiry* (as when an influx of new immigrant children raise questions about appropriate educational programs, school assignments, and so on).

- *Promulgating public images of the educational system's functioning* (as in media accounts that beg for response, clarification, or refutation).

- *Raising questions about the school system's policies or responsiveness to particular constituencies or needs* (as in legislative debate about support for teacher induction or school board debate about school closures).

Converging conditions in the field bring all of these forces into play. The federal No Child Left Behind Act (NCLB), for example, both demands information about school system performance and creates occasions for inquiry into the quality of its educational program. This legislation requires that all schools receiving federal funds shall make available report cards that provide specific data in three major areas: assessment, accountability, and teacher quality.[2] These reporting requirements have prompted a flurry of activity related to more fine-grained data collection, distribution, and analysis. Not only do states and districts have to provide the data to the federal government, the legislation also requires giving parents and other key stakeholders access to these reports, thereby creating an obvious reference point for media accounts and other public representations of school system performance, often negative. Most states have developed online Web portals that provide access to NCLB-related data organized by state, district, and school level. Such public availability of data has multiple implications for leaders as they interact with those both internal and external to their organizations, among the implications are the continuing questions about the effectiveness of the system. The

requirements have also stimulated the growth in the availability and sophistication of data systems targeted to education, often made available through private providers, which offer educational leaders a good deal of help (at a price) in using data as a leadership tool (Burch, 2005).

These instances and many more reflect the range of ways that external environments can prompt, support, or require educational leaders to make use of data in support of improving teaching and learning, and often point toward particular kinds of data that matter most to particular constituencies. At the least, these events make it hard to ignore the need for data; at best, they represent an opportunity to use data to strengthen the planning and execution of educational programs, as well as public support for them.

Scope of Discussion

To explore further what the concept of data-informed leadership might entail, we need first to clarify what we mean by *data* and what leaders might be using them. Here, we limit our attention to data implicated in what is arguably the central function of educational leaders—to guide, direct, assess, and support teaching and learning. For the purposes of this paper, we concentrate on data as information that

1. Represents the content or conduct of instruction or its effects on student learning and the student experience, as well as the factors and conditions that most immediately affect these matters.

2. Is, or could be, used in leadership actions aimed directly at the improvement of instruction, learning, and the student experience, or the organizational conditions that support instructional improvement.

A wide range of data, both quantitative and qualitative, fall within this boundary. While leaders and their audiences may often use data that can be quantified or averaged, such as grades, graduation rates, teachers' experience levels, and scores on state assessments—and they are likely to pay special attention to test scores to which accountability consequences are attached— there is clear evidence that many forms of qualitative evidence, such as capturing the qualities of student work, teachers' perceptions, or various features of classroom-based assessment, have as important a role in improving teaching and learning as their quantitative counterparts. As the boundary definition

makes clear, we are particularly interested in data that pertain most directly to instruction—though other aspects of school system functioning may be included as well. In other words, we are not focusing mainly on how leaders use data for budgeting (i.e., dollar figures) or space utilization (square feet of floor space in different buildings) or transportation planning (miles for bus routes) and so on.

We also acknowledge that *data* are not the same as *evidence*. Put another way, *data by themselves are not evidence of anything, until users of the data bring concepts, criteria, theories of action, and interpretive frames of reference to the task of making sense of the data*. In this regard, flooding leadership practice with data is unlikely to bring about much improvement, and even could get in the way, absent time and attention to the central issue of making sense of the data. We will return to this matter in more detail as we offer a framework for thinking about data-informed leadership.

Data and evidence are of potential importance to leaders working in different places within the educational system. We are especially interested in data use in four locations: (1) at the state level, among participants in the policy community who deliberate policies related to instructional improvement or who seek to implement such policies, e.g., agency officials and staff, legislators and their staffs, professional associations, and advocacy groups; (2) in district central offices, e.g., school board members, superintendents, directors, and other staff who are involved in decision making focused on instructional improvement; (3) in schools, e.g., principals, department heads, teacher leaders, and others who take part in instructionally related inquiry, and (4) in classrooms, as teachers themselves seek to improve their work or as others, e.g., instructional leaders, work with teachers on various aspects of their practice. All four are potentially engaged in data-informed leadership, broadly construed, and, hence, our discussion concerns the ways that data are or are not part of their daily practice.

Understanding Data-Informed Leadership

Three sets of ideas from recent lines of scholarly work help us understand what is—or could be—happening in the case vignettes from Canyon View High School and Bodewell School District, and in any settings in which data-informed leadership practice is in place or being attempted. The first set concerns conditions that anchor data-informed leadership—leadership focus, the users' beliefs and expertise, and the kinds of data available to the users. The second set highlights the building of cultures of inquiry and engagement of leaders and others in cycles of data-informed inquiry and action. The third set directs attention to activities in the policy environment that prompt, guide, and support leaders' work with data, especially through investments in the development of data infrastructures and leaders' data literacy. All three work together to shape whether and how leaders make use of data in the exercise of leadership.

Anchors for Data-Informed Leadership

Before considering the ways that leaders make use of data, several conditions can be identified that have enormous influence over their *capacity* to work with data: what they are focused on, what they believe and know how to do, what they are seeking to influence and how, and what data are either available to them or can be readily generated.

  Focus for data-informed leadership. Leaders are in a position to define the focus for the data they might generate and use, reflecting their own leadership priorities and their response to events that call for data and evidence. Absent focus, data-informed leadership is an empty exercise, consuming time and yielding little of consequence. While many foci are possible—such as the number of students enrolled in Advanced Placement (AP) courses—we would argue that a persistent, public focus on learning improvement offers an especially important reference point for the leaders' use of data, with emphasis on data concerning efforts to improve the quality of teaching and learning (e.g., Knapp, Copland, Talbert, 2003; Stoll, Fink, & Earl, 2003).[3] In keeping with this focus, data are a potentially useful resource for

- *Leadership that focuses attention and effort on improving student learning.* Both quantitative and qualitative data can help identify what students know and can do, and they can help suggest aspects of teaching that need to improve, e.g., through classroom assessment for differentiating instruction and grouping by ability; by formative assessment to refine instruction and enhance motivation; student self-assessment; and so on.

- *Leadership that guides the learning of individual professionals.* Quantitative and qualitative data about various aspects of professional practice can stimulate productive conversation and problem-solving by teachers and administrators. In the hands of a skilled leader, data become a tool for focusing professional learning on the improvement of daily practice.

- *Leadership that guides what has been called "system learning"* (Knapp et al., 2003, p. 16). Various data can provide a picture of the system's functioning as a whole, documenting accomplishments and helping to spot problems that need work.

This focus for leadership is not the only one that can be imagined, but it prompts numerous possibilities for bringing data to bear on the improvement of practice, while recognizing that the effort to improve practice entails more than just student achievement scores.

Core values and theories of action. Whatever the leaders' focus, data-informed leadership rests on a foundation of values and strategic thinking that guides the leaders' reach for data, engagement in inquiry, meaning-making, and subsequent actions. As noted in work on the moral dimensions of leadership (e.g., Fullan, 2001; Sergiovanni, 1992), leaders' work implies, and often is rooted in, *core values* that concern the ultimate purposes of schooling, principles of equity, and the justification for leadership strategies of all kinds. A number of such values underlie efforts to focus on learning improvement; among them are these five: ambitious standards for student learning, belief in human capacity, commitment to equity, belief in professional support and responsibility, and commitment to inquiry (Knapp, Copland, & Talbert, 2003). The latter value highlights the use of evidence to plan, evaluate, and change practice, if not to establish the scope and reach of the problems that the leaders hope to address.

Values such as these are implicated in the *theories of action* held by leaders and in some instances shared more widely in the organizations they lead. Treated as a set of assumptions about how the world works and a rationale for how one can intervene to improve it (Argyris & Schon, 1978), a theory of action is often implicit and may not be held by all parties in a given decision-making situation, but it can almost always be discerned and represented as the logic that connects the leaders' initial framing of the problem, subsequent leadership actions, consequences for teaching and learning (or the conditions that support these matters), and the learning that participants experience based on the results. Central to this aspect of the framework are two sets of ideas that leaders hold (Fullan, 1999):

- Ideas about what constitutes "good teaching and learning" and how it occurs, sometimes referred to as a "theory of education" or "theory of instruction."

- Ideas about what interventions by leaders and others will bring about good teaching and learning, or at least improve existing practices so that they come closer to a desired ideal, sometimes referred to as a "theory of change."

These ideas highlight certain actions, responses, and contextual conditions—and the relations among them—that become the "variables" in educators' inquiries into questions about practice and performance. In short, they define *what* data leaders might wish to collect and how they might interpret such data.

Leaders' data literacy. If core values and theories of action establish a sense of the ultimate purpose and rationale for engaging in inquiry, leaders' expertise with data—what may be referred to as their data literacy (Earl & Katz, 2002)—defines how much and what they are able to do with data. The challenge is more than a technical one limited to the assembling and manipulation of information, but rather it extends to what Fullan (2001) calls "knowledge building," the capacity to extract and share useful meaning from organizational experience. Thus subsuming the capacity of leaders and others to assemble and use data responsibly in their daily practice, data literacy presumes more than trial-and-error experience with data. It presumes an accumulating facility with the interpretation of data, not to mention a familiarity with data sources and creativity in assembling relevant data quickly and efficiently. As

implied by work on cultures of inquiry (Copland, 2003), members of a school, district, or other educational organization can become more literate in the use of data and committed to this feature of their collective practice.

Available data and data sources. Given a focus on learning, leaders' ability to bring data to bear on it is shaped in large measure by the actual data they can find or generate with a reasonable investment of time and resources. Some of this data, especially those which are likely to count in demonstrating accountability to district, state, or federal audiences, reside in information systems created through state policies and investments—such as those that have created data warehouses, management information systems, or reporting systems. Other sources are more likely to be homegrown, derived from the leaders' own efforts to put together data that has meaning and usefulness in the local situation, or from research and media accounts, or from other efforts to represent what is going on in schools (Weiss, 1995).

Table 2, adapted from Bernhardt's (1998) work, provides an overview of the kinds of data educators may use as they engage in data-informed decision making, especially in information-rich environments.

Table 2: Types of Data Available to Educational Leaders in Information-Rich Environments

Data Category	Sample Data Points
Student demographics	Enrollment, attendance, dropout rate, ethnicity, gender, grade level (by school, district, etc.)
Perceptions	Perceptions of learning environment, values and beliefs, attitudes, observations … (e.g., held by a school's teachers, districtwide educators, or the local community)
Student learning	Standardized tests, norm/criterion-referenced tests, teacher observations, authentic assessments …
School processes	Descriptions of programs, instructional strategies, classroom practices …
Teacher characteristics, behavior, and professional learning	Teacher assignment (grade, subject area, students served), qualifications, retention, participation in professional development …

(adapted from Bernhardt, 1998)

From these raw materials, leaders who treat information as a useful leadership tool may conduct various kinds of inquiries, including the use of simple indicator systems that offer "warnings and hints" about system performance such as the following seven indicators (Celio & Harvey, 2005): student achieve-

ment, trends in the achievement gap, student attraction (a school's ability to attract students), student engagement with school (e.g., attendance), student retention/completion, teacher attraction and retention, and funding equity.

Cultures and Cycles of Inquiry

The capacity for data-informed leadership—embodied in leaders' values, expertise, theories of action, and the availability of data—sets the stage for particular leadership activities that bring systematic information into consideration by leaders and others. Specifically, educational leaders who are so inclined build "cultures of inquiry" in their respective organizations and engage, along with others, in cycles of data-informed inquiry and action. This may mean being open to going beyond the initial boundaries of a given question or problem, as was the case when Canyon View teachers followed a data trail that began with ninth grade performance data and lead to actions at the elementary level.

The creation of organizational cultures that enable and motivate data-informed leadership. Data are only useful to the extent that leaders and those who work with them ask questions that can be answered with the data. Schools, districts, and other educational settings vary in the degree to which they make data a prominent feature of deliberation about the myriad issues that confront them on a daily basis. The literature is beginning to offer a number of examples of educational organizations in which participants accept—even hunger for—data, as they plan and implement their respective programs. Such instances appear in descriptions of "reforming districts" (McLaughlin & Talbert, 2002); schools engaged in "cycles of inquiry" (Copland, 2003); schools in the midst of school improvement planning or "self-reflective renewal" (Striefer, 2002; Portin, Beck, Knapp, & Murphy, 2003); and schools enacting, or responding to, accountability systems (Spillane et al., 2002; Lemons, Luschei, & Siskin, 2003).

In these cases, leaders have taken deliberate steps to *build a culture that supports inquiry* into the pressing problems facing the organization. Such a culture engenders trust and reduces the perceived risk from asking and answering questions about practice and performance (Copland, 2003), and it ultimately can support collective learning (Scribner, Cockrell, Cockrell, & Valentine, 1999).

Figure 1. Culture and Cycles of inquiry
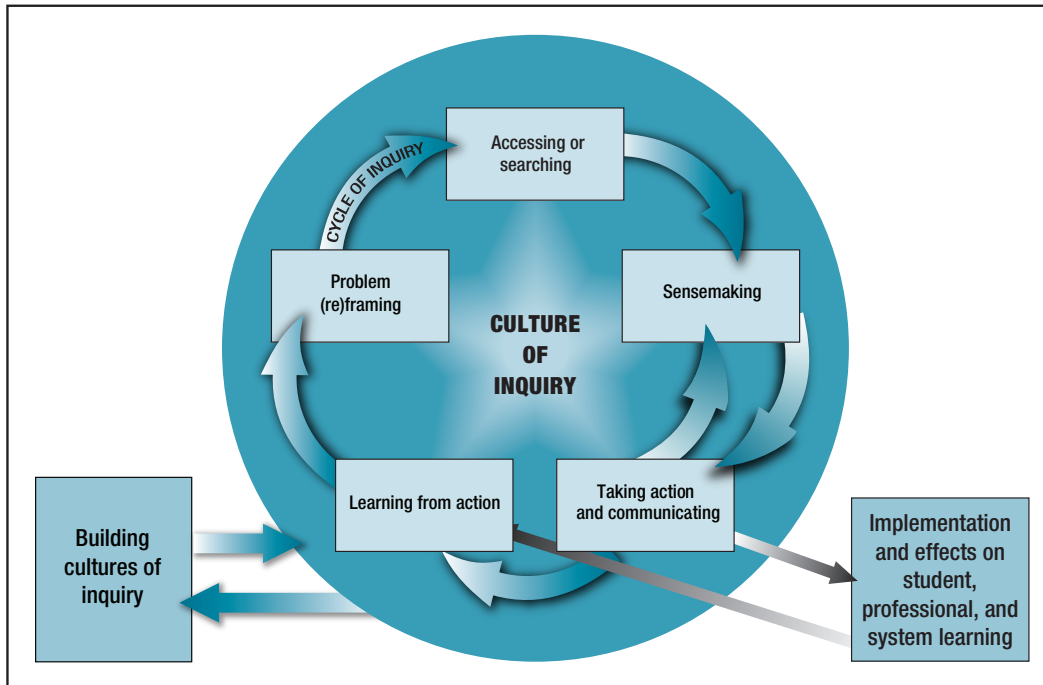
A central part of the culture of inquiry is that many players are participants in it, often implying that data-informed leadership is *distributed,* as are other aspects of the exercise of leadership. In line with recent formulations of the idea of distributed leadership (e.g., Elmore, 2000; Spillane, 2006), leaders who find ways to stimulate and sustain inquiry into problems of practice confronting a school, district, or state system invite others to share in the framing, conduct, and interpretation of the inquiry and the subsequent actions based on it. The participants often become co-leaders, and over time they develop shared norms and expertise in data-informed problem solving. Such activities emphasize expert over hierarchical authority, an essential attribute of distributed leadership arrangements (Bennett, Wise, Woods, & Harvey, 2003). Such arrangements also recognize that the knowledge and skills necessary to shape or exercise data-informed leadership may be located within a professional community of practice more than in a particular individual (Wenger, 1998). That said, leadership informed by data may not be shared equally among participants, as research on committee deliberations about math performance in a school indicates. When committee members held different beliefs about

what the data "said," it was the leader with positional power whose framing of the problem predominated (e.g., are we facing a curriculum problem or a professional development problem?) and whose beliefs largely informed the final decisions for action (Coburn, 2006).

Engaging in cycles of data-informed inquiry and action. Cultures of inquiry develop from repeated attempts to bring data to bear on key problems facing the school, district, or state system. In turn, having such a culture in place supports leaders' and colleagues' efforts to ask questions about the problems of practice that can be answered with data within such settings. At least five phases of activity, schematically represented in Figure 1, define this kind of "inquiry in action," work that connects data to learning improvement.

- *Focusing and (re)framing problems for inquiry.* In line with their expressed or implicit theories of action, leaders focus attention on problems of practice and frame them in terms that invite inquiry. Work that highlights problem-framing ability (Cuban, 1998) and the capacity to *reframe* problems from multiple vantage points or perspectives (Bolman & Deal, 1997; Copland, 2003) captures what leaders do, or can do, to set inquiry in motion, thereby giving context for the use of data.

- *Accessing or searching for data and evidence.* In relation to problems they choose to address, the leaders and their collaborators generate or search for data using available inquiry tools, sources, and strategies, as delineated in various works on "organizational learning" (e.g., Huber, 1991; Honig, 2006), or they simply access data that are already available. Leaders may or may not have the appropriate data and tools for manipulating it at their fingertips (Heritage & Yeagley, 2005), which has prompted rounds of developmental work in recent years, as scholars and others develop tools to support data-based leadership (e.g., Holcomb, 1999; Leithwood, Aitken, & Janzi, 2001); in a similar vein, vendors have been increasingly active in support of districts and school data use (e.g., Burch, 2005; Colgan, 2004; Wayman, Stringfield, & Yakimowski, 2004).

- *Making sense of data and its implications for action.* With data in hand, leaders create occasions for *making collective sense of the data* and probing the data for possible action implications. Here, drawing on underlying frameworks concerning sensemaking in organizations

(Coburn & Talbert, 2006; Weick, 1995), recent work has begun to outline how leaders approach the sensemaking task (Spillane, Reiser, & Reimer, 2002). The leap from data to action is not simple. However, scholarship that captures patterns of actual data use in school districts, for example, notes how ambiguous the data often are, a fact that can curtail the data's perceived usefulness but which can also stimulate deliberation about ways to serve student needs better (Honig & Coburn, 2005). In addition, individuals' conceptions of what counts as evidence, how evidence should be used, and how research informs practice vary across systems, often informed by where an individual sits within an organization (Coburn & Talbert, 2006). Thus, the same data may likely be interpreted differently and suggest different courses of action depending on who is engaged in decision making.

- *Taking action and communicating the action in different arenas.* Informed by the sense they make of the data, and by other matters not intrinsic to the data (e.g., the politics of the situation, basic values, reporting demands), leaders take action and communicate what the data say to relevant audiences. Some actions take place out of the public eye, but others are visible to relevant audiences and invite explicit communication by leaders (Witherspoon, 1997). Data become an integral part of the leaders' actions and communications, and so a central part of the leaders' work is "making it public" in ways that are respectful and politically astute (Holcomb, 1999).

- *Learning from action through feedback and further inquiry.* Inquiry-oriented leaders construct feedback loops so that they and other participants can learn about and from the implementation and effects of their actions and can reframe leadership problems (Halverson, 2003). Scholarship by cognitive scientists on short-term "quasi-repetitive feedback cycles" supports the notion that regular feedback can be a powerful influence on learning and, by implication, the learning of leaders who receive such input (Schwartz, Bransford, & Sears, 2005). Not surprisingly, syntheses of work on effective school leadership draw attention to the role that feedback can play as an influence on leaders' and others' learning (e.g., Hattie, 1992, as cited in Marzano, Waters, & McNulty, 2005).

Presented this way, leaders' attempts to make use of data within cycles of inquiry sound logical, rational, and orderly. In actual practice, these cycles are likely to be more "messy," and they are likely to differ considerably depending on the participants' experience and comfort with inquiry, as in research that has identified schools exhibiting "novice," "intermediate," and "advanced" cultures of inquiry (Copland, 2003), as well as on where data users reside in relation to the organization (Coburn & Talbert, 2006). But the underlying impulse is the same, regardless of the sophistication with data use: to raise questions about practice and to develop insights into these problems by considering what can be learned from data about practice.

Relevant Conditions in the Policy Environment

As noted earlier, events in the policy environment surrounding schools—especially federal accountability pressures and related requirements from state standards-based reform policies—compel leaders to use data in their daily practice. But other environmental events affect the exercise of data-informed leadership, in particular, two kinds of investments.

Investments in the development of leaders' data literacy (e.g., through leadership development or certification programs) coupled with *ongoing support for leaders' use of data* (e.g., through relations with third-party groups and vendors, or through in-house experts such as those who may reside in district research-and-testing offices) are likely to increase the chances that leaders learn what they need to know to work efficiently with data. However, naïve overreliance on external support from external parties or software tools may result in leaders bypassing important questions that grow out of core values, institutional priorities, and local issues.

Investments in the development of data infrastructures. The design of data systems by state or local agencies seeks to anticipate data elements that will matter to leaders or their audiences. The extent to which they succeed in doing so has a lot to do with how useful leaders find them. Such data systems can also be cumbersome, as they often involve large-scale, routine data collection from sources such as district central offices. The quality and timeliness of the data they collect vary, in part a reflection of how the system attends to "data cleaning," a prerequisite for maintaining data accuracy (Mieles & Foley, 2005; Stringfield, Wayman, & Yakimowski, 2005). Based on discussions of quantitative data infrastructures in the literature, the fol-

lowing aspects of such systems are of particular concern to the practice of data-informed leadership:

- The *specific data elements* that reside in the data infrastructure.

- The *accuracy and completeness of the data*, and whether it is updated regularly.

- The *timing and timeliness of data availability*. Local educators, for example, often lament the lag time between state assessment administration and its availability to school and district audiences four to five months later, often in the school year following the year the test was administered.

- The *architecture of the data storage and retrieval system*, and whether it enables easy, flexible, disaggregated queries that relate one data element to others.

- The *ease of access to the data system* by a variety of users, with sufficient safeguards to maintain confidentiality (where necessary) and counter attempts at tampering.

- The *cost* of building and maintaining the data infrastructure.

Although it is tempting to treat infrastructure issues as solely or primarily concerned with statewide quantitative databases, leaders may also access or create local data sources, both quantitative and qualitative, that are especially pertinent to the problems they face. In this regard, a variety of leadership activities—such as "walk-throughs," fast becoming a feature of school and district instructional leadership work (e.g., Kerr, Marsh, Ikemoto, & Barney, 2006), local action research projects of various kinds (e.g., Stringer, 2003), and local data collection for school improvement planning (e.g., Striefer, 2002)—have an important role in providing immediate, often qualitative, information to leaders about their improvement strategies and effects.

The Elements of Data-Informed Leadership at Work

The elements just discussed bear a straightforward relation to one another, as suggested in Figure 2 below. The anchors for data-informed leadership define direction and capacity for this facet of leadership activity. Cultures and cycles

of inquiry bring participants together in the act of seeking, interpreting, and acting on information they gather around problems they come to frame in increasingly sophisticated terms, depending on their continual use of data. Policy environments prompt the use of data in the first place and also provide the wherewithal to support development of data literacy and the expansion of data infrastructures.

Figure 2. Element of Data-Informed Leadership
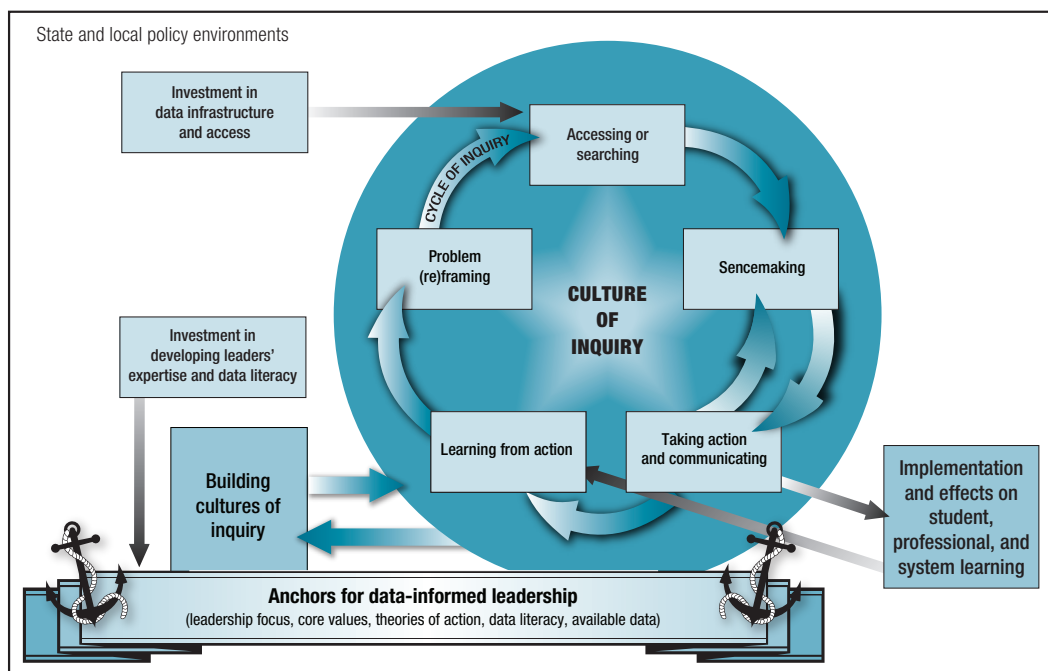
These elements may appear to suggest an idealized picture or model of how data-informed leadership should work. That is not our intention, although we have purposefully phrased the elements in terms that would capture the activities of educational systems in which data play a central, vital role in leadership. But the elements are more properly understood as variables. Cultures of inquiry, for example, can be developed to varying degrees; leadership development to enhance data literacy may or may not be a focus of state or local investment; and so on. This framework for data-informed leadership presents ways of identifying and understanding what is—or is not—taking place in particular state or local settings.

Data-Informed Leadership in Education

Common Practices and Emerging Strategies in States, Districts, and Schools

The categories of the previously described framework offer a useful organizer for considering the evidence from published literature, much of it descriptive, concerning the nature, extent, and effects of data-informed leadership in contemporary practice. The literature sheds light on four primary streams of activity at state and district levels, each of which relates to a central element of the framework:

- *Anchors for data-informed leadership*: Efforts to increase leaders' data literacy and expertise.

- *Cultures of inquiry*: Efforts to develop and sustain cultures of inquiry in schools, districts, and state agencies.

- *Cycles of inquiry*: Efforts to use data for school improvement planning, demonstrating accountability, and managing district programs.

- *Conditions in the policy environment:* Efforts to create data infrastructures and instructionally focused data systems.

The examples of emerging practices below highlight attempts to make teaching and learning the central focus of data-informed leadership.[4] These examples are by no means exhaustive; they simply offer illustrations of what is happening across the country. Understandably, there is little empirical research to date on many of the more recent experiments aimed at promoting or bolstering data-informed leadership.

Efforts to Build Leaders' Data Literacy and Expertise

Not all leaders exhibit the same degree of data literacy. While numerous scholars (e.g., Dembosky, Pane, Barney, & Christina, 2006; Earl & Fullan, 2003; Wayman & Stringfield, 2006) note the role that educators' expertise plays in using data to inform action, educators' ability to interpret and apply data has been described as "woefully inadequate and sometimes very wrong" in some instances (Earl & Katz, 2002, p. 1,013). For many leaders, becoming

data literate means developing new capacities for using data effectively. While there have often been modest attempts to boost educational leaders' ability to understand data tables, interpret statistics, and present quantitative information about performance more effectively, attempts to develop a deeper level of data literacy are seldom reported in the literature.

One state is taking several steps in this direction. New Mexico's Office of Educational Accountability has developed an initiative based on the premise that educational leaders need skills in "accountability literacy" to use data wisely to support students. To be literate in accountability, leaders need to be competent in a number of areas, including having the ability to interpret data; negotiate support for education in political, professional, and community settings; and understand what data can and cannot tell about students. This kind of deep understanding about appropriate data use goes far beyond the ability to use technology tools; it "requires not only capturing and organizing ideas but also turning the information into meaningful actions" (Senge, 1999, as cited in Earl & Katz, 2002, p. 1,005). The efforts of educators at Canyon View High School provide an example of this type of interpretative process that led to meaningful action. Beginning with questions related to potential causes of student performance, teachers and leaders explored relationships captured by data and ultimately targeted efforts at the elementary level. As in this case, leaders who understand how data, properly interpreted, fit into a larger picture of leadership practice will likely be better equipped to leverage such tools in the service of learning improvement.

Data literacy also includes the use of data with various stakeholders, such as school staff, the media, and parents. Often, these contexts call for different kinds of data-informed leadership. For example, leaders may frame conversations about data differently with teachers seeking to identify instructional gaps than with community leaders interested in tracking the schools' progress over time. Several states and districts, including New Mexico, are engaging in targeted efforts to support leaders' development of data literacy for this range of potential uses.

Efforts to Develop and Sustain Cultures of Inquiry

The development of leaders' data literacy does not by itself create a milieu in which leaders or other educators make it a common practice to engage in such use. As highlighted in our framework, a critical aspect of data-informed lead-

ership is the ability to prompt, support, and sustain conditions that encourage other staff, along with the leaders, to turn to data, ask questions of the data, reflect on the data's meanings, and take action that references the data. This stream of activity flourishes when an *organizational culture* has evolved that encourages inquiry into problems of practice. Whether using school improvement planning tools (e.g., Boudett, City, & Murnane, 2005; Celio & Harvey, 2005) or high-tech data warehouses, leaders in such cultures make it possible or even attractive to engage others in cycles of inquiry that maximize the potential benefits of such tools. Such cultures develop over time through repeated activity by many individuals, but data-oriented leadership is often a "driving force" behind data use (Supovitz & Klein, 2003). In such instances, leaders generally work from a theory of action that gives data a central place in planning and problem solving. Consider what is taking place in the following middle school:

> A middle school uses biweekly, two-hour faculty study groups to examine samples of student work for evidence of learning progress and areas of need, and to identify future instructional steps to take with particular students or groups of students. In these sessions, staff are learning about high-quality student work as well as planning ways to make that happen in classrooms. Nothing is allowed to interfere with this standing commitment. Each study group posts a public record of their work, to which the principal provides feedback, questions, and affirmation. In addition, study groups report their progress and evidence of student learning improvement to the whole staff at staff meetings. Student achievement is steadily increasing. (Knapp et al., 2003, p. 39)

Something is happening in this school that makes data common currency in efforts to improve teaching practice. The school leaders have orchestrated an ongoing, schoolwide conversation about the improvement of practice and engaged the staff in considering systematically local data sources (e.g., student work samples) that can inform their work. In so doing, the process of inquiring into school practices presumes a kind of collective sharing of leadership responsibility for the matter, punctuated by an internal accountability mechanism (sharing study group results with the whole faculty). The ability

of such a process to be helpful depends on the staff's willingness and skill, though in this instance both those conditions appear to pertain.

Leadership for creating and supporting cultures of inquiry does not necessarily depend upon a single person such as a school principal, even though principals are in a strong position to set the basic conditions supporting data use. Positions such as data coaches, often filled by teacher leaders, have been established in some schools and districts to help build capacity for using data to inform practice. Data coaches of this sort engage in a range of inquiry-based activities such as helping teachers understand their students' strengths and weaknesses and identifying instructional strategies, structures, programs, or curricula to address identified needs (Killion & Harrison, 2005). The coaches also "frequently facilitate data dialogues with teams of teachers. Coaches often work with building administrators to identify necessary data to examine ways to display the data so the analysis process with teachers is effective and efficient" (Killion & Harrison, 2005, p.1).

Coaches may sometimes be put in place with a specific support mission, as in the case of the 76 regional "value-added specialists" hired by the state of Ohio to help local educators understand and make use of the value-added student assessment information that is becoming available in that state. Elsewhere, coaches concentrate on a broader role, as in the Bay Area School Reform Collaborative (BASRC), where "reform coaches" focus on helping educators use data as part of a continuous data-based improvement process. In this process, the cycle of inquiry, educators identify a high-priority student achievement problem; pose questions about the causes of the problem; implement strategies to address the causes; and then analyze data to determine the effectiveness of their strategy (McLaughlin & Talbert, 2002). Data use is infused throughout the inquiry process, and as such it becomes an unavoidable part of how things are done in the school, as one high school teacher involved with BASRC reform efforts noted:

> Data in and of itself isn't useful. It's what you do with it. Before, we had data. Probably we could have guessed that a lot of those things were the case. But once you formalize it, that implies that you have to do something. (pp. 5–11)

Leaders use different kinds of devices for establishing a culture of inquiry. On one end of a continuum, the process may be informal, as in New Mexico's Aztec Municipal School District—the superintendent meets quarterly with principals to discuss the following questions: How is business going? How do you know? (L. Paul, personal communication, Dec. 6, 2005). Although very simple, these questions allow for both flexibility and accountability, rather than a standardization of effort. The structure of quarterly meetings ensures that leaders are using more than annual test data to assess performance. A parallel process, in place at the state educational agency (SEA) in New York, required heads of the SEA's departments to engage in a formal review on a regular basis.

> At the Chief State School Officer's insistence, and resonating well with business interests and other constituents, there is a strong emphasis on data to demonstrate how school and system performance measures up to the state's strategic goals. This rhetoric is regularly put into practice within the agency, as well as throughout the state's educational system. As the Chief put it, "Two and a half years ago, it was not possible for superintendents in the big urban districts to be in a room and have the data shared publicly. Now it's commonplace. Back about four weeks ago, I had them all together and we looked at the data in detail for about five hours and then together sketched a strategy, a very powerful simple strategy to close the gap …"
>
> This emphasis on data as a basis for practice extends to the state education bureaucracy itself, which could be a predictable obstacle to a comprehensive, multi-faceted reform strategy. Just the opposite has happened. As a result, the state education agency has become a fairly integrated, unified entity, pursuing the implementation of a teacher quality improvement initiative in an efficient and single-minded manner. … In contrast to what took place under the previous Chief, performance in each unit within the agency is now reviewed quarterly in relation to the agency's Strategic Plan. Unit staff assemble and present data to the Chief that sheds light on their work in relation to strategic goals. These reviews engender some fear and trepidation; Agency staff are

expected to jump—and they appear to do just that. The data-based flavor of the agency's work under this Chief—an explicit feature of the state's Strategic Plan—appears in various places, including the otherwise empty main hallway of the agency's main office building, which now displays numerous large graphs and other representations of performance indicators (all going up, by the way). Some staff report that morale at the agency is also on the way up, under the current Chief's tenure.[5]

In this instance, data-informed leadership has played a central role in building a culture within the state agency, and to an extent within the larger state system, that connects agency action to strategic goals, both as a matter of accountability and as an expectation of daily practice. While in some ways uncomfortable, the exercise appears to provide direction for the agency's efforts at the same time that it affects the interaction between the state and districts. Here, and elsewhere, data-informed leadership may also be creating a climate of fearful compliance as much as a culture of inquiry. Therein lies another set of issues connected to data-informed leadership, concerning cycles of inquiry that encourage participants to take ownership for a learning improvement agenda and generate or use information accordingly (as in the middle school example above), as opposed to assuming a more defensive posture in response to external accountability pressures.

Engaging in Data-Informed Inquiry for Planning, Accountability, and Performance Tracking

What we know about actual use of data in states, districts, and schools comes from a small but growing body of scholarly research (e.g., Booher-Jennings, 2005; Herman & Gribbons, 2001; Ingram et al., 2004; Kerr, Marsh, Ikemoto & Barney, 2006; Massell, 2001; Wayman & Stringfield, 2006; Young, 2006). Informed by this research and reports from practitioners, three categories of data use in states, districts, and schools are especially common:

- School improvement planning.

- Responses to external accountability requirements.

- Public tracking of educational performance.

School improvement planning. School improvement planning, a central focus of much writing in the field (Bernhardt, 1998; Holcomb, 1999; Streifer, 2002), aligns not only with the current accountability context in U.S. schools, but also reflects longer term efforts associated with the standards-based reform movement and models of "continuous improvement" often adopted from the business community (e.g., balanced scorecard, totally quality management).

Data can inform school improvement planning in several ways, by providing planners with a means to set organizational performance goals and measure progress toward meeting them. Schmoker (1996) advocates the use of data as a measure of school performance, but asserts that data analysis must be a collaborative activity focused on clear, measurable, attainable goals. Bernhardt's (1998) conceptual framework identifies several types of data variables—demographics, school processes, perceptions, and student outcomes— and a variety of sources to guide educators in their efforts to isolate problem areas, set goals for improvement, and measure progress toward meeting the goals. Both of these writers provide images of how data are used in the context of school improvement planning, and how these activities connect to the inquiry process, that take various forms in accounts of actual data use in school improvement planning (e.g., Boudett, City, & Murnane, 2005; Copland, 2000; Ingram et al., 2004).

Response to external accountability requirements. Clearly connected to school improvement planning, a second category of data use reflects a response to specific requirements, rather than voluntary participation in reform activities. For example, schools participating in the federally funded Reading First literacy program must provide assessment information three times per year. Many schools use a standard assessment called Dynamic Indicators of Basic Early Literacy Skills (DIBELS) to track individual student progress in grades K–3 throughout the year. In some cases, schools showing improvement receive additional money while those unable to meet identified targets are at risk of losing funds.

There are numerous examples of data use in the context of increasing external accountability requirements (Booher-Jennings, 2005; Lemons, Luschei, & Siskin, 2003; Massell, 2001; Spillane et al., 2002). One investigation of high schools in Ohio and Texas found a variety of ways that schools used assessment data to respond to accountability pressures (Lemons et al., 2003).

But given that the responsibility of interpreting and using assessment data to guide school improvement in such high-stakes environments tended to fall primarily on the principal, data use in these schools depended on the interests and skills of the individual cast in this role. The high-stakes environment could also lead to unintended, and possibly counterproductive uses, as in a different investigation, this time, concerning one elementary school in Texas (Booher-Jennings, 2005). In this instance, principal(s) and teachers, rather than helping those students who tended to score lowest on the state assessments and thus needed the most assistance, directed their instructional efforts toward "bubble kids"—those students whom they predicted were most likely to score closest to the passing score on the tests.

Public tracking of educational performance. Data are also used as means for comparing and ranking performance in a variety of ways (e.g., growth over time, among various groups of students, between particular schools). Web-based tracking systems have been set up on a national basis, such as Just for the Kids, sponsored by the National Center for Educational Accountability, and School Matters, sponsored by Standard & Poor's.[6] Both offer performance profiles of states, districts, and schools, all available to the public via the Internet. Many states and districts also offer Web-based comparisons. For example, the Seattle Public Schools Research, Evaluation, and Assessment site provides a variety of information on individual schools,[7] ranging from state test scores and value-added data to district writing scores and school demographic reports. Although the kinds of comparisons provided by these and many other Web sites are not new to educators, the public availability of this information creates both opportunities and challenges for leaders. While some leaders use tools like those listed above to "prove" the quality of their school or district, others encounter new challenges given the sometimes grim picture portrayed in charts, graphs, tables, and other data displays. In some cases, the data are not accurate, or they may be misinterpreted by users who may not understand the meaning behind the charts, graphs, and various statistics (Earl, 1995).

Efforts to Create Data Infrastructures and Data Systems

State education systems have embraced data use increasingly, building on an older tradition within federal categorical programs, which made extensive use of testing data and other indicators to track and justify interventions (e.g., test-

ing in the Title I program). Over the years, states, districts and schools have engaged in routine data collection of various kinds, though these informational resources have generally not been used extensively for making decisions about the improvement of teaching and learning, but rather have used these data sources for compliance monitoring, tracking funds, and generating descriptive profiles of educational programs in the state. It has been a natural outgrowth of the state standards-based reform movement, in particular, as well as other trends mentioned above, to engage in or encourage the following:

- Developing better data infrastructures, i.e., merging silo systems.

- Creating district and school profiles, as an informational device and also part of an accountability system available to the public through Web sites.

- Using data as a means for comparison, i.e., among schools and districts.

- Using data to inform instructional improvement.

- Creating partnerships to enhance technical and procedural support for the use of data.

- Responding to federal reporting and performance demands.

Much of the activity at the state and district level revolves around the creation of technical infrastructures, e.g., student information systems, Web sites and data warehouses, and paying more attention to the usability of their data systems (Snow-Renner & Torrence, 2002). However, according to a 2005 survey conducted by the National Center for Educational Accountability, no state has all ten "essential elements of a robust longitudinal data system.[8] In fact, only 36 states reported having a unique student identifier that allows for tracking student information from kindergarten through 12th grade.[9]

These systems contain various data elements—often collected annually—ranging from demographic information and student performance measures to data about instructional programs (Armstrong & Anthes, 2001). States and districts typically issue periodic reports in a standardized format that summarizes descriptively what is in the database—for example, test score patterns by grade, student demographics, and so on. Besides providing a basic descriptive record of important aspects of the educational system's functioning, these databases offer a possible tool for decision makers, though

more often than not this may be wishful thinking, as state databases are not always easy to access, are not set up for queries, may not be particularly timely, and the data are not always accurate. Data "cleaning," e.g., correcting errors, omissions, and redundancies, is a critical process that happens as states and districts implement new data systems (Mieles & Foley, 2005; Wayman, Stringfield, & Yakimowski, 2004).

Although NCLB does not require a state or district to implement a technology solution for data management, most systems have taken advantage of technology tools for data collection, management, and distribution. According to Wayman (2005), these systems fall into three general categories: student information systems, assessment systems, and data warehousing systems. Although related, each system performs different, nearly mutually exclusive functions, ranging from real-time tracking of attendance and performance data to dynamic systems designed for data manipulation and analysis. For example, The Kentucky Department of Education, the Education Professional Standards Board, and the Council on Postsecondary Education are all working together to develop the MAX Education Data Warehouse.[10] The system offers leaders, teachers, parents, and policymakers various ways to access information about school and district profiles, financial data, and assessment results.

School districts are also investing in their own data infrastructures, as in Jefferson County (KY) Public Schools (JCPS), which recently invested in a major upgrade to their data warehouse, growing from an initial eight gigabytes to the new system with a 1.5 terabyte capacity. According to the vendor,

> [s]chool systems of JCPS's size are not much different than Global 1,000 businesses. In such large enterprises, optimum performance and productivity are critical to meeting strategic goals and satisfying stakeholders. The warehouse supports more than 1,000 discrete users, generating as many as 500 queries per day.[11] (News Release, 2006)

Currently at least 25 to 30 different corporate vendors offer data warehouse solutions to K–12 systems, including such major market players as TetraData, EDmin, Cognos, and SchoolNet. Common features include traditional storage capabilities, customized queries, visual displays of infor-

mation, and interactive statistical analyses of data (Sarmiento, 2004; Stein, 2003; Wayman, Stringfield, & Yakimowski, 2004). Although these systems are becoming increasingly more robust and user-friendly, educators are the ones who ultimately determine the value of these tools in supporting and improving student learning.

While student information systems and data warehouses, like those described above, hold some utility for school leaders and teachers, other systems have been created to more specifically target instructional decision making. Project SOAR (Schools' On-line Achievement Reports) in Ohio and Georgia's "Balanced Scorecard" system are two examples (Project SOAR, 2005). The former, Project SOAR, claims to provide users with easy-to-understand Web-based data charts that provide school comparisons and measurements of student progress over time, in an effort to get at the "value-added" effects of schooling on students learning. While there is debate about the technical issues associated with value-added analyses (McCaffrey, Koretz, Lockwood, & Hamilton, 2004) this system puts a relatively simple and accessible form of this analysis at the fingertips of a large number of users. Participants can view district, building, grade, and student-level data.

Other state supported data-systems try to provide the user with a greater variety of data that could be useful to the decisions leaders have to make, as in Georgia's "Balanced Scorecard (BSC) approach to data-informed leadership practice.[12] As opposed to a single focus on lagging indicators such as student achievement data, the BSC focuses on accurate, relevant, leading indicators of success that drive continuous improvement. As an official involved in creating this system puts it, "Like business enterprises, schools are not stagnant organizations …. The same BSC benefits of alignment, communication, and strategic planning will be realized by the managers in the education sector" (Duffy, 2005, p. 4). The BSC includes specific performance objectives, performance measures, the units of measure, and rating information. Under this arrangement, districts are also encouraged to determine, at the local level, what measures matter most for inclusion in their "scorecard," leading to some variability in the kinds of data that are included by each local district. In addition to this tool, the Georgia Department of Education offers professional development for school leaders and leadership teams on data use, targeting eight roles of leadership,[13] including what it means to be a "data analysis leader." In addition, Georgia's Leadership Institute for School

Improvement specifically sponsors BSC training and supports professional learning for district leadership teams.

Locally developed data infrastructures may also seek to inform classroom instruction directly. For example, Boston Public Schools used the Fast-Track system along with the MyBPS Web portal to support one of their six "essential" strategies for school improvement:[14] to examine student work and data to drive instruction and professional development. Together, these systems provide educators with classroom-level analysis of various data elements, including test scores, grades, attendance, and schedule information. Teachers can access the text of every question on the state exam as well as individual student responses. Principals and other leaders can access data associated with customized groups of students not normally associated with traditional data reports (Mieles & Foley, 2005).

Issues Arising in Patterns of Data Access and Use

A number of the examples reviewed above, and much of the case study research, concentrates on relatively atypical cases in which leaders and others are taking active steps to make the use of data a regular part of educational practice. In this sense, these cases may offer images of possibility, but they may also gloss over problematic aspects of basing leadership more squarely on systematic data, as the following case suggests.

Shifting accountability systems in one district. While some districts may call for, and in various ways support, the kinds of inquiry-oriented practice noted earlier (see for example, examples from Colorado in Massell, 2001), the dynamics of data-informed leadership at the district level are likely to be more complicated and often problematic. The case of Midvale School District (pseudonym) and its evolving accountability policies throughout the decade from 1995 – 2004 is instructive (Burch, 2005). A large urban district serving a population exceeding 100,000 students, Midvale engaged in a first phase of accountability reform that featured a low-stakes "balanced" accountability system with multiple measures including classroom-based assessment, systemwide performance measures, and standardized norm-referenced tests. Aided by an external assessment firm, the district developed and fine-tuned the system and provided systematic training and supports for teachers to help them make use of the array of assessment information that could inform their teaching. This phase of activity represented a significant step forwards

toward a richer environment of data, which could inform efforts to educate the students.

The picture changed in the year 2000 in anticipation of NCLB, as district leaders shifted gears toward a more high-stakes assessment and accountability system that emphasized primarily norm-referenced tests. To manage the increasing data demands, the district contracted with another outside firm, subsequently subsumed within a larger national firm, that created sophisticated new software for the district's performance information system and new rules affecting who could access the data, while offering relatively little useful technical assistance. The upshot of these changes balanced the following signs of progress towards data-informed leadership with developments that worked against a goal of improving the quality of instruction for all (Burch, 2005).

- Greater use of data by district-level administrators, in their efforts to address instructional issues and in their interactions with specific schools.

- Diminished access of teachers to the new data system, and greater *inequities* in data access and use by school staff, reflecting restrictions on teachers' access to the system, and considerable variation in school administrators' abilities to access and use data.

- More consistent attention to results in instructional improvement planning.

- More limited measures for representing the quality of teaching and learning.

- Greater investment of district resources in data systems and related management tools and services, primarily through contracts to outside vendors.

- Less direct and personal technical assistance and support to various users such as teachers and school staff.

The reasons for the mixed results are complex, but the case serves to underscore some important dimensions of the data-informed leadership story, among them, the power of external forces—both the strict accountability requirements and the nature of the outside vendors—to influence what data

were attended to, how they were used, and by whom. Furthermore, the case vignette underscores the delicate dynamic across levels within the district (district, school, and classroom), indicating that enhancing the use of data for users at one level does not necessarily help users at another level, and hints at the crucial role of support for data use. Finally, this case begs further questions about how, given the unevenness in school capacity and preferences within most or all districts, one can stimulate and support equitable data-informed leadership across a system of schools.

What complicates or limits leaders' use of data. The Midvale case points to a number of conditions and responses that are likely to discourage continual data use. Consider the following: fears about the consequences of systematic data; the belief that data representing what matters most in education cannot be secured; unwillingness to expose one's ignorance about the manipulation and interpretation of data; lack of interest in the prospect of changes in practice that might be suggested by data; limited knowledge of what is possible to do with data; and lack of resources to invest in data-based inquiry into problems of practice. These constitute major barriers to data-informed leadership, and they are not simple to overcome, in part, because there are sometimes sensible reasons for these responses to the prospect of data-informed leadership.

Take, for example, educators' fears concerning how data about their practice or performance may be used. There are enough examples in most educators' working experience of information "being used against them and their colleagues" (in fact or in perception) to prompt a healthy mistrust of data use, especially in the context of high-stakes accountability (Heritage & Yeagley, 2005). It is no wonder that in some instances of sustained data use within high-performing districts, leaders went to considerable lengths to "make it safe" for participants to consider data and their implications (Togneri & Anderson, 2003). Wayman & Stringfield (2006) described leaders who used a "non-threatening triangulation of data" approach, which relied on using multiple sources to ensure that teachers felt supported and empowered by data rather than threatened. And while leaders were able to prevail in these cases, elsewhere the struggle is not so successful. And in situations where accountability systems do lead to punitive action, there are clearly good reasons to be cautious about how one represents one's performance or practice.

Lack of capacity to engage in data-informed inquiry can work in similar ways to suppress the amount of data-informed leadership. Despite pressure to increase test scores, schools seem to vary considerably in their levels and types of assessment data use (Massell, 2001). Researchers have observed that educators are generally not skilled in interpreting systematically collected data (Baker & Linn, 2004; Bernhardt, 1998; Heritage & Chen, 2005; Schmoker, 1996). This lack of technical skills likely hinders most educators' abilities to both physically work with data and make valid interpretations of data. Ingram et al. (2004) found that teachers have their own metric for judging teaching effectiveness. Many choose to base their decisions on experience, intuition, and anecdote rather than systematically collected data. It is plausible to believe leaders approach data use in similar ways.

But even with increasing levels of data-informed leadership apparent at school and district level, especially strong evidence concerning the capacity of such activities to promote instructional improvement is scarce (Honig & Coburn, 2005; Kerr et al., 2006). What evidence there is of such a connection resides largely in the presence, in relatively small numbers of "high performing" schools or districts, of well-established routines for the use of data in decision making. Reports of "instructionally effective school districts" (Murphy & Hallinger, 1988) or "beating the odds" districts (e.g., Snipes, Doolittle, & Herlihy, 2002) are among those that display such correlations. While it is not possible from such research to isolate the effect of data-based decision making on learning outcomes, it is clearly plausible that, as part of a syndrome of learning-focused leadership activity, this facet of leadership makes a contribution to the improvement of performance.

One thing is crystal clear from the research to date: where it occurs, data-informed leadership is a direct reflection of aggressive, persistent attempts by leaders to create conditions in which this way of approaching the business of schooling can flourish. Several scholars put it this way:

> Marshalling the school's community to a collective sense of purpose about improving student learning, accepting that data use can and will improve learning, aligning data use to school planning and decisionmaking processes, and creating time for data analysis are key elements of leadership in creating a culture for data use. (Heritage &Yeagley, 2005, p. 335)

Others studying this phenomenon have come to similar conclusions about the centrality of leadership in bringing data into play (e.g., Kerr et al., 2006; Supovitz & Klein, 2003; Mason, 2002). Absent this kind of advocacy for the use of data, the natural forces and resistance are generally too strong to make data-informed leadership a feature of everyday practice.

Whether or not leaders are sharply attuned to the possible benefits of data, the drumbeat signaling the need for data has become more insistent in recent years, and is likely to continue. There is an "increasingly institutionalized assumption that data can and should be used to give credence to one's stated purposes, proposals, problems, and solutions" (Young, 2006, p.2). And in a world of persistent accountability expectations, leaders are increasingly in the position of "learning to live with data and like it" (Earl & Katz, 2002, p. 2). This assumption about data use drives many of the initiatives described in this paper. It is in this context that data-informed leadership may be a powerful bridge between desired improvement and educators' current capacity, but it also raises important issues concerning the way policy environments promote and discourage activities aimed at improvement. The persistent demand for performance data in the context of accountability can limit, as well as enable, inquiry into local educational problems and how to solve them.

Unanswered Questions and Enduring Dilemmas

The concept of data-informed leadership encompasses a wide range of issues and raises numerous questions that will need to be pursued, both by those who will be creating new approaches to the challenges this issue area presents and by researchers who wish to study it. Currently, the leadership literature does not provide a well-grounded conception of data literacy in the context of school, district, and state systems. In addition, this paper sets the stage to broaden and add cautions to the current call to use student performance data to *drive* decisions. Rather, our hope is to reframe the conversation among scholars and practitioners towards conceptions of how data *inform* leadership and professional practice, especially in the current accountability context.

Unanswered Questions

The framework and examples reviewed above suggest questions that beg for more complete answers from continued experimentation and related research. While there are many such questions, the following six, related to key elements in the framework, are arguably very important to answer.

A first question arises in relation to one of the main anchors for data-informed leadership: leaders' expertise in accessing, generating, managing, interpreting, and acting on data. This expertise concerns not only what a leader or leadership team might do with the data, but also what they might do to facilitate the process of using data as a primary reference point for their planning and practice.

1. *The development of data literacy among leaders.*

    a. What does data literacy consist of for practicing leaders in schools, districts, and state agencies? What knowledge, skills, dispositions, and beliefs enable and motivate leaders to bring data to bear on the challenges of improving teaching and learning? What balance of technical know-how, political savvy, and cultural understanding makes the leader fully literate in the practice of data-informed leadership?

b. How do leaders acquire data literacy? In what ways do events or conditions in the community, larger policy environment, or organizational setting support leaders' acquisition of data literacy—and explain *differential* acquisition of data literacy among leaders? Where do leaders go to get help, and how can all leaders be assured of the help they need, regardless of location, prior skills, etc.?

A second question zeroes in on cultures and cycles of inquiry, and what it may take to establish such cultures when policy reform pressures are acute:

2. *Building robust cultures of inquiry in the context of high accountability.* What conditions and support strategies are most likely to build organizational cultures that support inquiry and data use, especially in situations where accountability pressures are most keenly felt, e.g., low performing schools or districts? Conversely, how does continued engagement in data-based inquiry influence the organization's culture over time? How can it enable productive responses to accountability requirements?

A third and fourth question concerns activity in the policy environment that seeks to bolster data-informed practice through the creation of data infrastructures, while pushing leadership practice to focus single-mindedly on student achievement. The questions acknowledge that states and other entities are making increasing investments in support of data-informed leadership, but these investments are not always informed by the perspectives of users.

3. *The usefulness of increased investment in resources and supports for data-informed leadership.* To what extent, if at all, does the combination of state and local policies and investments enhance leaders' access to data they consider useful? For what range of decisions do leaders consider the data useful, and why?

A fourth question is prompted by the intense focus by current federal and state policy on student achievement, and addresses the clear temptation for leaders under many accountability systems to take student achievement levels as a sole and unambiguous measure of the worth of anything—a school program, a particular leader's tenure in the school or district—without

attempting to understand what the achievement numbers reflect in a more nuanced way. Hence the question:

4. *Responsible treatment of student performance data.* How can leaders and their audiences be helped to interpret student performance data in light of other relevant information, e.g., student characteristics, community conditions, teaching, and the teacher workforce, so that premature conclusions about the value of programs or personnel are avoided?

Two final questions concern the ultimate impact of this activity and its links to other aspects of leadership. Regarding the underlying concern that data-informed leadership contribute in some demonstrable way to improving teaching and learning, one can ask:

5. *The impact of data-informed leadership on teaching and learning.* What evidence suggests a direct connection between the practice of data-informed leadership and (a) the (re)allocation of resources to support specific instructional improvements; (b) teachers' attempts to engage in these forms of improved practice, and (c) students' learning gains that are attributable to these practices?

Finally, recognizing that data-informed leadership is not the only aspect of a leaders' work that matters, the issue arises about how to integrate data-informed leadership with other leadership activities aimed at improving teaching and learning:

6. *Integration of data-informed leadership with other aspects of learning-focused leadership.* In what ways can data-informed leadership be effectively aligned with other aspects of a leadership approach that places priority on the improvement of teaching and learning?

Developing answers to these questions will require various approaches, some through continued experimentation with data-informed leadership arrangements that include a feedback loop or other means to learn from the experience. Some can be addressed by formal research studies.

Enduring Dilemmas and Ideological Tensions

As educators and scholars seek answers to the questions just posed, it is well to keep in mind that some things about the use of data in educational leadership have not changed, and are unlikely to in the future. These matters reflect dilemmas or tensions that are always present in the act of using data within an organized setting, and cannot be eliminated by better technical solutions, more training, greater commitment to data use, etc. We see three such tensions among (1) state (or national) policy and local response, (2) the need for immediate feedback to inform practice current and longer-term documentation of performance, and (3) what is technically desirable and what is politically or culturally feasible.

The tension between state assessment policy and local response, in the context of shifting state politics and uncertain funding. To the extent that large-scale assessment data are intended to figure prominently in district and schools' data-informed leadership, the role of the state in shaping coherent assessment policy and building capacity to use data is critical. However, the vagaries of state politics and funding may challenge states' abilities to fund and provide statewide systems to support data-informed leadership or serve to obscure those aspects of school or district activity that most centrally concern sustainable improvements in teaching and learning. How are local districts to respond to changing policy from the state? Furthermore, whatever the state does and no matter how coherent its approach to reform may be, the fact that state reforms are externally imposed means that they will bump up against the local cultures of a district or school, which have much to do with whether and how reforms are implemented (Cuban, 1998). To the extent that data-informed leadership is a top-down mandate or is externally driven—or is seen as a tool of external control (as is often the case with accountability systems)—it will always be subject to the "bottom-up" reinterpretation, and even subversion, by local educators who do not wish to have their autonomy compromised.

The tension between the need for immediate feedback to inform current practice and the longer-term documentation of performance. Inevitably, data can be used to answer questions about the merit or worth of an activity, thereby helping certain audiences pass judgment on it, or it can be used to diagnose the ongoing qualities of work and areas in which the work can be altered, thereby contributing to its improvement. These summative and for-

mative purposes are not totally unrelated but they lead to different kinds of actions or decisions, and they can easily get in each other's way, especially if users do not understand the underlying purposes for each kind of assessment. Efforts to craft summative judgments, for example, about the nature of student achievement from annual state assessments, particularly when there are high stakes consequences attached to poor performance, may drive behaviors in the system to improve scores through whatever means possible: heavy emphasis on test prep strategies to the exclusion of other existing curricula; targeted teaching to students who are "on the bubble" to the exclusion of those far below grade level, etc. Formative uses of such data that help districts and schools to determine particular areas of instructional need may be lost or downplayed in the process. On the other hand, relying solely on formative data that is critical for instructional decision making (National Research Council, 2000) will not give leaders a systemwide perspective on achievement, especially in terms of performance trends over time.

The tension between what is technically desirable and what is politically or culturally possible. Recent research on schools which practice data-based decision making as part of their commitment to continuous improvement and organizational learning identifies barriers to data use that stem from natural and enduring dilemmas in the way technically advanced practices enter into the politics and culture of schools (Ingram, Louis, & Schroeder, 2004). As Table 3 emphasizes, these challenges are not easily resolved, and may ultimately not be fully resolvable.

Table 3. Cultural, Technical, and Political Challenges to Data-Based Decision Making in Schools

(based on Ingram et al., 2004)

- **Cultural challenges**

  1. Teachers have their own metric for judging teaching effectiveness.
  2. Many teachers and administrators choose to base their decisions on experience, intuition, and anecdote rather than systematically collected data.
  3. Consensus about which outcomes are most important, and what data are most meaningful is lacking.
  4. Some teachers disassociate their own performance from that of students. Entrenched cultural norms of teacher isolation and unwillingness to measure or define their teaching effectiveness in terms of student outcomes works against data-based decision making.

- **Technical challenges**

  5. Data that teachers want—"really important outcomes"—are rarely available and hard to measure. It is also difficult for many educators to see the connection between cause and effect in the data that they have.
  6. Schools rarely provide the time needed to collect and analyze data.

- **Political challenges**

  7. Data have often been used politically, leading to mistrust of data and data avoidance. The perception that others misuse data will make educators reluctant to trust data presented by others and to use data themselves.

Beneath the tensions just described, and throughout the use of data in decision making are ideological matters: competing belief systems about what is desirable and about how the world works or could be improved. These belief systems come to the fore in any large-scale system and the upshot reflects whichever set of beliefs prevails, and for how long. Also, because these beliefs rest on values more than empirical evidence, they are unlikely to disappear—that is, be dismissed by evidence. Consequently they and the competition among them will always be present.

For example, one continuum of ideology along which observers may stake positions and oppose each other might be views on the strength of accountability or the use of standardized testing as a lever for school change. At one end might stand advocates of strong accountability who see a need for incentives and sanctions (Hess, 2003). At the other end might stand writers who view strong accountability systems with considerable skepticism, on the grounds that such systems can do harm to certain groups of students (McNeil, 2000). The two ends of this ideological spectrum view data and how the data should be used quite differently. Educators may also advocate or oppose data-

informed leadership based on philosophical views of good ways to do educational business. Some educators may oppose data, especially if it is quantitative, on the ground that it threatens or misrepresents relationships they view as central to the educational process. This conflict may mirror conflicts in academic circles between quantitative and qualitative modes of inquiry.

Finally, there are inherent and longstanding tensions in people's assumptions about good teaching and the assessment of learning, rooted in behaviorist and constructivist theories. Lorrie Shepard (2000) may speak for many educators in her description of standardized testing as "crypto-behaviorism." Many educators may view data-informed leadership as little more than an extension of standardized testing. Other educators (e.g., Popham, 1987) see value in inquiry based on different kinds of data, including standardized test scores. No study or experimentation will fully bridge this divide. One quickly reaches the limit of what data can help leaders understand or do when basic differences in belief systems of this sort come into play.

References

Argyris, C. & Schon, D. A. (1978). *Organizational learning: A theory of action perspective.* Reading, MA: Addison-Wesley.

Armstrong, J., & Anthes, K. (2001). How data can help: Putting information to work to raise student achievement. *American School Board Journal, 188*(11), 38–41.

Baker, E. L., & Linn, R. L. (2004). Validity issues for accountability systems. In S. H. Fuhrman & R. F. Elmore (Eds.), *Redesigning accountability systems for education* (pp. 44–72). New York: Teachers College Press.

Bennett, N., Wise, C., Woods, P., & Harvey, J.(2003). *Distributed leadership* (full report). Oxford, UK: National College for School Leadership.

Bernhardt, V. L. (1998). *Data analysis for comprehensive schoolwide improvement.* Larchmont, NY: Eye on Education.

Bernhardt, V. L. (2003). Using data to improve student achievement. *Educational Leadership*, 60(5), 26–30.

Bernhardt, V. L. (2004). Continuous improvement: It takes more than test scores: Analyzing state assessment results is only the beginning of effective data-driven decision making. *Leadership, 34,* 16–19.

Bolman, L., & Deal, T. E. (1997). *Reframing organizations: Artistry, choice, and leadership* (2nd Ed.). San Francisco: Jossey-Bass.

Booher-Jennings, J. (2005). Below the bubble: 'Educational triage' and the Texas accountability system. *American Educational Research Journal, 42*, 231–268.

Boudett, K. P., City, E. A., & Murnane, R. J. (2005). *Data wise: A step-by-step guide to using assessment results to improve teaching and learning.* Cambridge, MA: Harvard Education Press.

Burch, P. (2005). The new educational privatization: Educational contracting and high-stakes accountability. *Teachers College Record* (online), at http://www.tcrecord.org/content.asp?contentid=12259. Retrieved August 16, 2006.

Celio, M. B., & Harvey, J. (2005). *Buried treasure: Developing a management guide from mountains of school data.* Seattle, WA: Center on Reinventing Public Education, University of Washington.

Coburn, C. E. (2006). *District evidence use: An analysis of instructional decision making.* Paper presented at the American Educational Research Association, San Francisco, April 7–11.

Coburn, C. E., & Talbert, J. E. (2006). Conceptions of evidence use in school districts: Mapping the terrain. *American Journal of Education 112*(4), 469–495.

Colgan, C. (2004). Data on demand. *American School Board Journal, 191*(09), 36–39. Washington, D.C.: National School Board Association.

Copland, M. (2000). Leadership of inquiry: Building and sustaining capacity for school improvement. *Educational Evaluation and Policy Analysis, 25*, 375–395.

Copland, M. A. (2003). The Bay Area School Collaborative: Building the capacity to lead. In Murphy, J., & Datnow, A. (Eds.), *Leadership lessons from comprehensive school reform* (pp. 159–184). Thousand Oaks, CA: Corwin Press.

Council of Chief State School Officers. (2006). *Validity threats: Detection and control practices for state and local educational officials*. Alexandria VA: Author.

Cuban, L. (1998). How schools change reforms: redefining reform success and failure. *Teachers College Record, 99*, 453–477.

Dembosky, J. W., Pane, J. F., Barney, H., & Christina, R. (2006). *Data driven decisionmaking in southwestern Pennsylvania school districts*: RAND Corporation.

Duffy, A. (2005). *Balanced scorecards for public schools: Accountability beyond test scores*. Atlanta: Georgia State University.

Earl, L. (1995). Moving from the political to the practical: A hard look at assessment and accountability. *Orbit, 26*(2), 61–63.

Earl, L., & Fullan, M. (2003). Using data in leadership for learning. *Cambridge Journal of Education, 33*(3), 383–394.

Earl, L., & Katz, S. (2002). Leading schools in a data-rich world. In K. Leithwood & P. Hallinger (Eds.), *Second international handbook of educational leadership and administration*. Dordrecht: Kluwer Academic Publishers.

Elmore, R. (2000). *Building a new structure for school leadership*. New York: The Albert Shanker Institute.

Fullan, M. (1999). *Change forces: The sequel*. London: Falmer Press.

Fullan, M. (2001). *Leading in a culture of change*. San Francisco: Jossey-Bass.

Hallinger, P., & Heck, R. H. (1996). Reassessing the principal's role in school effectiveness: A review of empirical research, 1980–1995. *Educational Administration Quarterly, 32*(1), 5–44.

Halverson, R. R. (2003). Systems of practice: How leaders use artifacts to create professional community in schools. *Education Policy Analysis Archives, 11*(37).

Heritage, M., & Chen, E. (2005). Why data skills matter in school improvement. *Phi Delta Kappan,* May.

Heritage, M. , & Yeagley, R. (2005). Data use and school improvement: Challenges and prospects. In Herman, J. L., & Haertel, E. H. (Eds.), *The uses and misuses of data for educational accountability and improvement—104th yearbook for the National Society of the Study of Education, Part II* (pp, 320–339). Malden MA: Blackwell Publishing.

Hermon, J., & Gribbons, B. (2001). *Lessons learned in using data to support school inquiry and continuous improvement: Final report to the Stuart Foundation*. Los Angeles: Center for the Study of Evaluation.

Hess, R. (2003). Refining or retreating? High-stakes accountability in the states. In Peterson & M. West (Eds.), *No child left behind? The politics and practice of school accountability* (pp. 55–79). Washington, D.C.: The Brookings Institution.

Holcomb, E. (1999). *Getting excited about data: How to combine people, passion, and proof*. Thousand Oaks, CA: Corwin Press.

Holly, P. J. (2003). *Data-driven school improvement series*. Princeton, NJ: Educational Testing Service.

Honig, M. (2006). Building policy from practice: Implementation as organizational learning. In Author (Ed.), *New directions in educational policy implementation: Confronting complexity*. Albany, NY: SUNY Press.

Honig, M., & Coburn, C. E. (2005). When districts use evidence for instructional improvement: What do we know and where do we go from here? *Urban Voices in Education 6*, 22–26.

Huber, J. (1991). Organizational learning: The contributing processes and the literatures. *Organization Science, 2(*1), 88–115.

Ingram, D., Louis, K. S., & Schroeder, R. G. (2004). Accountability policies and teacher decision making: Barriers to the use of data to improve practice. *Teachers College Record, 106*, 1,258–1,287.

Knapp, M. S., Copland, M., & Talbert, J. E. (2003). *Leading for learning: Reflective tools for school and district leaders*. Seattle, WA: University of Washington Center for the Study of Teaching and Policy.

Kerr, K. A., Marsh, J. A., Ikemoto, G. S., & Barney, H. (2006). Strategies to promote data use for instructional improvement: Actions, outcomes, and lessons from three urban districts. *American Journal of Education 112*(4), 496–520.

Killion, J., & Harrison, C. (2005). *Data coach*. Austin, TX: National Staff Development Council.

Leavitt, P., McDaniel, R., & Skogstad, E. (2004). *Disaggregating data in schools: Leveraging the information you have*. Houston TX: APQC.

Leithwood, K., Aitkin, R., & Jantzi, D. (2001). *Making schools smarter*. Thousand Oaks, CA: Corwin Press.

Lemons, R., Luschei, T. F., & Siskin, L. S. (2003). Leadership and the demands of standards-based accountability. In M. Carnoy, R. Elmore & L. S. Siskin (Eds.), *The new accountability: High schools and high-stakes testing* (pp. 99–127). New York: Routledge-Falmer.

Marzano, R. J., Waters, T., & McNulty, B. A. (2005). *School leadership that works*. Alexandria VA: Association for Supervision & Curriculum Development.

Mason, M. (2002). *Turning data into knowledge: Lessons from six Milwaukee public schools*. Madison, WI: Wisconsin Center for Education Research.

Massell, D. (2001). The theory and practice of using data to build capacity: State and local strategies and their effects. In S. H. Fuhrman (Ed.), *From the capitol to the classroom: Standards-based reform in the states* (pp. 148–169). Chicago: University of Chicago.

McLaughlin, M., & Talbert, J. (2002). *Bay Area School Reform Collaborative: Phase one (1996–2001) evaluation*. Stanford, CA: Stanford University, Center for Research on the Context of Teaching.

McNeil, L. M. (2000). *Contradictions of school reform: Educational costs of high-stakes testing*. New York: Routledge.

McCaffrey, D., Lockwood, J. R., Koretz, D., & Hamilton, L. (2004). *Evaluating value-added models for teacher accountability*. Washington D.C.: Rand.

Mieles, T., & Foley, E. (2005). *From data to decisions: Lessons from school districts using data warehousing*. Providence, RI: Annenberg.

Murphy, J., & Hallinger, P. (1988). The characteristics of instructionally effective school districts. *Journal of Educational Research, 81*(3), 175–181.

National Research Council (U.S.). Committee on Developments in the Science of Learning (2000). *How people learn: Brain, mind, experience, and school*. Washington, D.C.: National Academy Press.

Popham, J. (1987). The merits of measurement-driven instruction. *Phi Delta Kappan*, *68*(9), 679–682.

Portin, B., Beck, L., Knapp, M. S., & Murphy, J. (2003). The school and self-reflective renewal: Taking stock and moving on. In Authors (Eds.), *Self-reflective renewal in schools: Local lessons from a national school renewal initiative* (pp. 179–199). Westport, CT: Greenwood Publishing Group.

Project SOAR. Retrieved August 26, 2005, 2005, from http://www.battelleforkids.org/b4k/rt/about/our_work/data/SOAR

Sarmiento, J. W. (2004). *Technology tools for the analysis of achievement data: An introductory guide for educational leaders*. Philadelphia: Mid-Atlantic Laboratory for Student Success.

Schmoker, M. (1996). *Results: The key to continuous school improvement*. Alexandria, VA: Association for Supervision and Curriculum Development.

Schwartz, D. L., Bransford, J., & Sears, D. (2005). Efficiency and innovation in transfer. In J. Mestre (Ed.), *Transfer of learning: Research and perspectives*. Greenwich, CT: Information Age Publishing.

Scribner, J. P., Cockrell, K. S., Cockrell, D. H., & Valentine, J. W. (1999). Creating professional communities in school through organizational learning: An evaluation of a school improvement process. *Educational Administration Quarterly 35*(1), 130–160.

Senge, P. (1999). *The dance of change*. New York: Doubleday.

Sergiovanni, T. (1992). *Moral leadership: Getting to the heart of the matter*. San Francisco: Jossey-Bass.

Shepard, L. (2000). The role of assessment in a learning culture. *Educational Researcher, 29*, 4–14.

Snipes, J., Doolittle, F. & Herlihy, C. (2002). *Foundations for success: Case studies of how urban school systems improve student achievement*. Washington D.C.: Council of Great City Schools.

Snow-Renner, R., & Torrence, M. (2002). *No child left behind policy brief: State information systems*. Denver, CO: ECS.

Spillane, J. P. (2006). *Distributed leadership*. San Francisco: Jossey-Bass.

Spillane, J. P., Diamond, J. B., Burch, P., Hallett, T., Jita, L., & Zoltners, J. (2002). Managing in the middle: School leaders and the enactment of accountability policy. *Educational Policy, 16*, 731–762.

Spillane, J. P., Reiser, B. J., & Reimer, T. (2002). Policy implementation and cognition: reframing and refocusing implementation research. *Review of Educational Research, 72*, 387–431.

Stein, M. (2003). *Making sense of the data: Overview of the K–12 data management and analysis market*. Boston: Eduventures, Inc.

Stoll, L., Fink, D., & Earl, L. (2003). *It's about learning [and it's about time]: What's in it for schools?* London & New York: Routledge Falmer.

Streifer, P. A. (2002). *Using data to make better educational decisions*. Lanham, MD: Scarecrow Press.

Stringer, E. (2003). *Action research in education*. New Jersey: Prentice Hall.

Stringfield, S., Wayman, J. C., & Yakimowski, M. (2005). Scaling up data use in classrooms, schools and districts. In C. Dede, J. P. Honan & L. C. Peters (Eds.), *Scaling up success: Lessons learned from technology-based educational innovation*. San Francisco: Jossey-Bass.

Supovitz, J., & Klein, V. (2003). *Mapping a course for improved student learning: How innovative schools use student performance data to guide improvement*. Philadelphia: Consortium for Policy Research in Education.

Togneri, W., & Anderson, S. (2003). *Beyond islands of excellence: What districts can do to improve instruction and achievement in all schools*. Washington, D.C.: Learning First Alliance.

Wayman, J. C. (2005). Involving teachers in data-based decision-making: Using computer data systems to support teacher inquiry and reflection. *Journal of Education for Students Placed At Risk, 10*(3), 295–308.

Wayman, J. C., & Stringfield, S. (2006). Technology-supported involvement of entire faculties in examination of student stat for instructional improvement. *American Journal of Education 112*(4), 549–571.

Wayman, J. C., Stringfield, S., & Yakimowski, M. (2004). *Software enabling school improvement through analysis of student data*. Baltimore, MD: Center for Research on the Education of Students Placed At Risk, Johns Hopkins University.

Weick, K. E. (1995). *Sensemaking in organizations*. Thousand Oaks, CA: SAGE Publications.

Weiss, C. (1995). Nothing as practical as a good theory: Exploring theory-based evaluations for comprehensive community-based initiatives for children and families. In Connell, J., Kubisch, A., Schorr, L., & Weiss, C. (Eds.), *New approaches to evaluating community initiatives*. Washington, D.C.: The Aspen Institute.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge, UK, & New York: Cambridge University Press.

Witherspoon, P. D. (1997). *Communicating leadership: An organizational perspective*. Boston: Allyn & Bacon.

Young, V. (2006). Teachers' use of data: Loose coupling, agenda setting, and team norms. *American Journal of Education 112*(4), 521–548.

Endnotes

1. This vignette was derived from ongoing exploratory research currently undertaken by the Center for the Study of Teaching and Policy in several urban and suburban school districts in the Northwest.

2. For specific guidelines, see http://www.ed.gov/programs/titleiparta/reportcardsguidance.doc.

3. Though not all of the assertions made in this line of inquiry have yet been tested empirically, there is accumulating evidence that both directly and indirectly learning-focused leaders at both school and district level can realize substantial improvements in the performance of students. See summaries of this work in Hallinger, P., & Heck, R. H. (1996). Reassessing the principal's role in school effectiveness: A review of empirical research, 1980–1995. *Educational Administration Quarterly, 32*(1), 5–44; Leithwood, K., & Riehl, C. (2003). *What do we already know about successful school leadership?* Chicago: American Educational Research Association; Leithwood, K., Louis, K. S., Anderson, S., & Wahlstrom, K. (2004). *How leadership influences student learning.* New York: The Wallace Foundation.

4. Many of these examples now under way in state and local sites are supported by The Wallace Foundation.

5. Excerpt from an unpublished descriptive account of the state policy environment in one state included within the Study of Policy Environments and Teaching Quality, undertaken by the Center for the Study of Teaching and Policy, University of Washington. The account here reflects practices in place in the year 1999.

6. Just for the Kids can be found at http://www.just4kids.org and School Matters at http://www.schoolmatters.com.

7. See http://www.seattleschools.org/area/siso/test/smallsisoschoollist.xml.

8. See http://www.dataqualitycampaign.org/activities/elements.cfm.

9. Only 48 states responded to the survey. There are no data from New York and New Hampshire.

10. See max.kde.state.ky.us.

11. See http://www.teradata.com/t/page/145997/.

12. Sample Balanced Scorecard: http://www.fultonschools.org/media-bin/documents/BSC.pdf.

13. See http://www.galeaders.org/site/publications/publicationitems/pub_8roles.htm for a description of all eight roles.

14. See http://boston.k12.ma.us/bps/bpsglance.asp#improve for all Six Essentials for Whole School Improvement.

ctp

Center for the Study of Teaching and Policy
UNIVERSITY OF WASHINGTON

CTP—a national research consortium home-based at the University of Washington and including three other research partners (Stanford, University of Pennsylvania, and University of Michigan)—studies the way policies, leadership, and conditions in schools, districts, states, the federal government, and the education profession shape the quality of teaching and learning in the nation's schools. The Center pays particular attention to the ways these forces and conditions interact with each other to influence what teachers, learners, and educational leaders do in daily practice.

A major goal of the Center's program of research is to discover and document the means for improving practice so that the nation's young people experience a challenging and equitable education. To that end, the Center's research products are designed to inform policymakers, practicing leaders, and the educational reform community, along with scholars.

The Wallace Foundation®

Supporting ideas.
Sharing solutions.
Expanding opportunities.®

The Wallace Foundation seeks to support and share effective ideas and practices that expand learning and enrichment opportunities for all people.
Its three current objectives are:
- Strengthen education leadership to improve student achievement
- Enhance out-of-school learning opportunities
- Expand participation in arts and culture

For more information and research on these and other related topics, please visit our Knowledge Center at www.wallacefoundation.org.

ctp

Center for the Study of Teaching and Policy
UNIVERSITY OF WASHINGTON