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The New Instructional Leadership: Creating Data-Driven Instructional Systems in School

ABSTRACT: The recent press for high-stakes accountability has challenged school leaders to use data to guide the practices of teaching and learning. This article considers how local school leaders build data-driven instructional systems to systematically improve student learning. Such systems are presented as a framework involving data acquisition, data reflection, program alignment and integration, program design, formative feedback, and test preparation. The article reviews data collected in a yearlong study of four schools to describe how leaders structure opportunities to engage in data-driven decision making.

In June 2005, the New York City Public Schools announced that fifth-grade test scores had made impressive gains across the city—15.2 percentage points in math (for students testing proficient and above) and nearly 20.0 percentage points in reading. Some of the most impoverished, lowest-achieving schools were responsible for the largest gains. Although politicians and policymakers wrangled to claim credit or question the legitimacy of the results, school leaders, teachers, parents, and students offered a simpler explanation: hard work. But what did they mean by *hard work*? Leaders and teachers emphasized "a relentless focus on literacy and math" and a "ceaseless scrutinizing of tests, quizzes and writing samples" to understand what students did not know (Herszenhorn & Saulny, 2005). Others highlighted after-school tutoring and preparation,

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improved attendance, prekindergarten, smaller classes, fear of grade retention, community outreach, and intense political pressure to succeed. However, leaders, teachers, and parents could not "agree on any one primary reason for the gains."

In part, the reason was that there was no one primary reason, no silver bullet, to explain the gains. The gains did not result from a particular program, a new policy, or new personnel. Rather, the broad improvements in student learning achieved in schools across the country have paralleled the development of complex, data-driven instructional systems (DDISs) designed by school leaders and teachers. The capacity of school leaders and teachers to transform traditional schools into organizations able to respond to the feedback of standardized testing represents a significant step in our understanding of the next generation of school leadership practice. This new form of instructional leadership, which follows directly from the push toward accountability, pushes the debate about the nature of leadership practice beyond the traditional generic categories of instructional, managerial, and transformational leadership to a more specific conception of creating data-driven teaching and learning systems in schools. In many schools throughout the country, evidence is mounting that leaders are currently engaging in new practices to help their schools systematically improve student learning. The purpose of this article is to develop a framework—the DDIS—to provide an empirical perspective on these new practices, intended to develop organizational capacity to use data to improve student learning.

THE NEW INSTRUCTIONAL LEADERSHIP

The work of school leadership is undergoing a revolution. The recent policy press for standards and accountability has led policymakers and the public to hold schools responsible for improvements in student learning. Policymakers have created the idea of accountability systems to capture the variety of instruments developed to direct and monitor school change. Hanushek and Raymond (2002) describe how accountability systems will come to reshape local practices:

> [A] focus on student outcomes will lead to behavioral changes by students, teachers, and schools to align with the performance goals of the system. Part of this is presumed to be more or less automatic (i.e., public reporting of outcomes will bring everybody onto course with those outcomes). But part also comes from the development of explicit incentives that will lead to innovation, efficiency and fixes to any observed performance problems. (p. 81)

Accountability systems provide standards and incentives for schools to develop the instructional and assessment practices necessary to reach achievement standards.

The new instructional leadership that we describe here is a direct response to the demands of new accountability systems. The initial stage in understanding the new instructional leadership has been widely characterized by researchers and educators alike as a move toward helping schools engage in data-driven decision making. Spurred by the No Child Left Behind Act (2002), these discussions have described how schools can use achievement and other forms of data for school improvement (Bernhardt, 2003; Holcomb, 1999; Johnson, 2002; Love, 2002; Teddlie & Reynolds, 2000). From a local perspective, the central problem for data-driven decision making is that the new accountability systems are not implemented on clean slates. Schools already have robust, internal accountability systems that guide decisions about instruction and student placement by using a variety of data, including attendance; testing; discipline; budgets; and teacher, student, and parent reputations (Abelmann & Elmore, 1999; Carnoy, Elmore, & Siskin, 2003). These practices have evolved to form school cultures that provide considerable feedback about core instructional and managerial practices. Furthermore, the internal accountability systems at work in schools have developed mechanisms to resist new efforts to guide school practice. Research that describes schools as loosely coupled systems has demonstrated how organizational structures insulate local instructional practices from external interference (Weick, 1982, 1995). The press for data-driven decision making, then, is not a call for schools to begin to be accountable but a challenge for leaders to use achievement data to reshape the central practices and cultures of their schools. The heart of the new instructional leadership is the ability of leaders to shift school cultures of internal accountability to meet the demands of external accountability.

Just as accountability systems narrow expectations for what counts as student learning in schools, local responses to accountability pressures narrow what counts for school leadership. For better or worse, the work of school leaders is increasingly being measured in terms of how their schools improve student achievement scores. This press for leaders to help teachers collectively meet organizational outcomes reframes how leaders can learn from contemporary research on instructional leadership. New instructional leaders require knowledge and frameworks to guide their schools in the use of accountability data and structures that result in systematic improvements in student learning. This new work, to be sure, draws on traditional practices of program and teacher evaluation,

curriculum design, professional development, and creation of cultures of learning. Argyris and Schön (1978) and Argyris (1990), for example, describe how organizations could use feedback to redesign existing practices. Senge (1990) explains how learning organizations systematically use data to adapt to changing circumstances. High-stakes accountability pressures encourage school leaders to link these theories of data-driven learning organizations to build schools that can improve student test scores. New instructional leaders still need to build a professional community (Kruse & Louis, 1995), create instructional program coherence (Newmann, Smith, Allensworth, & Bryk, 2001), foster relational trust (Bryk & Schneider, 2002), develop intensive professional development experiences (Desimone, Porter, Garet, Yoon, & Birman, 2002), monitor instruction effectively (Goddard, Sweetland & Hoy, 2000), and establish academic press (Hoy, Hannum, & Tschannen-Moran, 1998). Although each of these strategies or consequences of instructional leadership certainly includes a focus on student learning, the new instructional leadership presses leaders to focus on how these ideas can improve test scores across schools. Professional community, for example, needs to be developed through a focus on achievement data, through engaging in tasks that systematically acquire data, reflect on data, use data to inform program design, and learn from program design efforts. At the same time, leaders need to demonstrate the value of the new practices in an effort to persuade teachers that their existing practices are worth changing (Murnane, Sharkey, & Boudett, 2005).

This article presents a DDIS model to describe how leaders seek to improve school achievement scores through data use. We posit that a successful DDIS provides a social and technical system to help schools link summative achievement test data with the kinds of formative data that help teachers improve student learning across schools. Our research has identified the component practices of a DDIS through a blend of deductive and inductive investigative processes. Building on research in organizational learning and distributed leadership theory, our DDIS framework describes how local school leaders reshape and refine internal accountability systems to meet the demands of external accountability systems. The data analysis section uses the framework to consider data from four schools in terms of the DDIS functions. We conclude with a discussion of the systemic effects of a DDIS on professional learning and a consideration of the tensions involved in adapting internal accountability systems to meet the demands of external accountability.

DATA-DRIVEN DECISION MAKING, ARTIFACTS, AND INSTRUCTIONAL SYSTEMS

An aim of data-driven decision making is to link the results of summative testing to formative information systems that teachers can use to improve instruction across schools. Much of the research on data-driven decision making is inspired by Deming's cycle of continuous improvement (see Walton, 1986). Central to this cycle are feedback processes that translate organizational outputs into useful information to guide subsequent input behaviors. Feedback systems are essential for developing organizational capacity to learn from prior practices and to intentionally shape practice to achieve anticipated ends (Senge, 1990; Senge et al., 2000). Feedback systems rely on social structures to gather and provide opportunities to sort through relevant data, as well as technical structures to insert findings back into the core organizational processes (Watson, 2005). Because of the traditions of loose coupling, schools have proven notoriously difficult contexts for using feedback to intentionally guide systemwide instructional practices. Creating legitimate opportunities to collaborate on the chronic problems of schooling can tighten the coupling between teaching and leadership and thereby create conditions to effectively use output data to change teaching practices (Blink, 2005).

The research on data-driven decision making suggests that schools link several key organizational functions together into a cycle for collecting, reflecting on, and acting on feedback data (see, e.g., Bernhardt, 2003; Ingram, Louis, & Schroeder, 2004; Mason, 2002; Schmoker, 2004; Sharkey & Murnane, 2006; Wayman, 2005). First, schools and districts must establish practices to collect, store, and communicate relevant data. These data should include not only student achievement data but also behavioral data; parent, staff, and community surveys; financial information; and student services records. Second, schools need to establish social processes to reflect on these data and establish systemwide goals. Third, schools need to develop interventions designed to achieve their goals. And, finally, schools must develop practices to learn from their interventions and to integrate what is learned into subsequent cycle iterations. Our study is organized around research questions to investigate these central organizational functions:

Did school leaders create practices to collect, acquire, and store data? If so, how?

Did school leaders create practices to reflect on data and set goals? If so, how?
Did school leaders create interventions based on data? If so, how?
Did school leaders create practices to learn from their interventions? If so, how?

This study traces whether and how leaders have made efforts to implement these data-driven organizational functions in their schools.

The concept of artifact (cf. Dennett, 1990; Norman, 1993; Simon, 1996) plays a key role in tracing data-driven instructional practices. From a school leadership perspective, artifacts refer to designed programs, procedures, and policies intended to shape or reform existing organizational practices (Halverson, 2002; Spillane, Halverson, & Diamond, 2004). Leaders develop and use artifacts to influence the practices of teaching and learning in schools. They develop and deploy artifacts to shape social interactions in organizations. Leaders regularly use such familiar artifacts as faculty meetings, planning sessions, and the master schedule to structure activities across schools, just as teachers use artifacts such as quizzes, outlines, and syllabi to structure student learning. The artifacts that leaders and teachers in a school identify as contributing to school improvement provide fertile occasions for investigating essential characteristics of leadership practice (Halverson, 2004). Our DDIS framework acts as a guide to help us sort through the kinds of artifacts that leaders and teachers design to link summative and formative data in their schools. Tracing the development and interaction of artifacts in a local school provides access to how leaders create the social and technical systems that influence local cultures of teaching and learning (Halverson, 2003).

METHOD

This article represents data collected during the initial stages of a 5-year National Science Foundation–funded research project designed to study how leaders create social and technical systems to help teachers use achievement data in their instruction. Our approach to data collection and analysis involves (1) constructing an initial theory of data-driven decision making—the DDIS framework—based on prior research on how schools meet the demands of external accountability and (2) using the DDIS framework to relate the practices of school leaders who have established reputations for successful use of data to improve instruction. Our analysis draws on a data set composed of individual school case studies. Yin (1994) proposes that a variety of data be collected for case study research,

including documentation, archival records, interviews, direct observations, participant observations, and physical artifacts.

This study's method lies midway between hypothesis testing and grounded theory. As with a hypothesis-testing approach, we began our analysis with an initial coding scheme based on our research questions and literature review and our site selection strategy to identify schools with established reputations for using data effectively and with records of improved student learning. The resulting DDIS framework emerged as we traced how the research questions described leadership practices in our schools. In this way, the DDIS framework served as a selective coding filter to help us organize narratives that described the data-related practices present in each school (Glasser, 1992). The use of the DDIS in coding helped us to refine the DDIS definitions and better understand the relation between DDIS functions. The data we present here reflect the practices of formal and informal leaders and staff who took on key roles in facilitating data-driven conversations, reflections, and redesign efforts in their schools. In upcoming research, we plan to investigate the participation of teachers qua teachers in DDISs to better understand the effects of leadership practices within schools.

SITE SELECTION

Our study was designed to study the practices of schools with strong records for improving student achievement scores and reputations for using data effectively. We focused our site selection on elementary and middle schools in a midwestern state. We also collected data on data-based practices at the district level for each school. Site selection began with our consulting educational leaders at the university, state, and district levels. We generated a list of elementary and middle schools identified by improving test scores and school leaders with a reputation for effectively helping teachers to use data. From our initial list, we selected four schools recognized for strong data-driven decision making and records of improving student achievement, described in Table 1.

Table 1. Data-Driven Instructional Systems Schools

	Grades	*Location*	*Students (n)*	*Free/reduced lunch*[a]	*Principal tenure*[a]
Pearson	K–6	Rural	300	42%	8 years
Malcolm	K–5	Urban	250	72	6
Harrison	K–8	Urban	800	70	3
Walker	7–8	Suburban	500	3	9

[a]As of 2004.

DATA COLLECTED AND ANALYZED

To document and describe the DDIS in each of our four schools, we collected a variety of data, including structured interviews with formal and informal leaders at the school and district level, observations, publicly available student achievement data, and a collection of relevant documents. Over the course of a school year, we conducted 52 structured interviews of formal and informal leaders across the schools. In addition, we conducted 53 observations of faculty meetings, professional development sessions, data retreats, and other important events as identified by the staff, and we collected a variety of artifacts from every school, such as school improvement plans, staffing charts, budgetary information, and parent and community handouts. To make sense of the over 1,000 pages of field notes and artifacts collected, we used a qualitative data analysis program (NVIVO 2.0) to code our data. We developed a coding system based on the emerging DDIS framework (see appendix). The research team began the process by coding common data documents to work out the details of the coding process, and they completed the data coding process by fall 2006.

FINDINGS

We found clear evidence of the operation of the organizational function described in our research questions in every school. Each school collected and used data; aligned, redesigned, and analyzed its instructional program; and provided feedback. We developed the DDIS model from our initial research questions to describe six organizational functions. *Data acquisition* describes how leaders create practices to collect, acquire, and store data; *data reflection* and *program alignment* describe how leaders create practices to reflect on data and set goals; *program design* describes the interventions that leaders develop to guide instruction; and *formative feedback* describes the systems that leaders establish to learn from program design. Additionally, we found schools engaged in a sixth activity, *test preparation*, which links the school instructional program to explicitly summative testing practices. Together, these six DDIS functions (see Figure 1) helped us to see how leaders created artifacts to structure social interaction around data in their schools. We found considerable variation in how each of the functions was developed in each school. Here, we consider the ways in which the schools in our study demonstrated each of the six DDIS functions in practice.

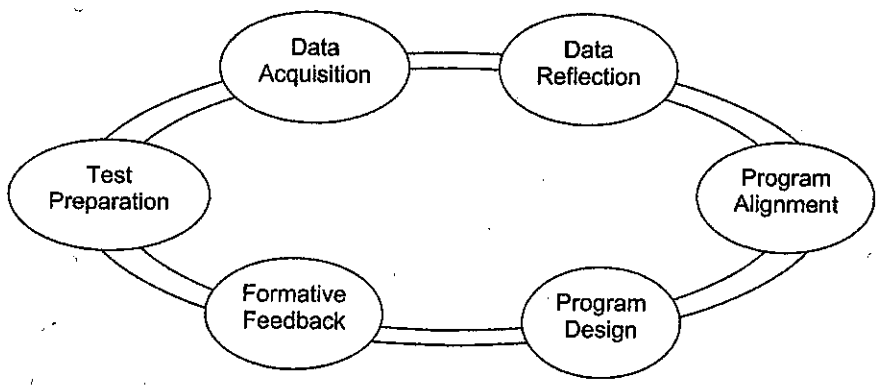

Figure 1. The Data-Driven Instructional Systems Model

DATA ACQUISITION

Data acquisition describes processes designed to seek out, collect, and prepare information to guide teaching and learning. The primary data collected and organized comprised standardized-student-achievement-test scores. However, many other types of information were used to guide teaching and learning, including guidance information (student placement and behavioral records), student demographics, classroom grades, teacher evaluations, community survey data, budgetary information, master schedule and calendar information, curricula, and technological capacity. Discussions about data storage (data warehousing) and reporting capabilities also played an important role in data acquisition, particularly at the district level.

A central assumption across our schools was that data fuel the improvement process: The data acquired must have the potential to inform teaching and learning, but it need not be limited to test score results. As a district official told us,

> the message that we give to schools is that they need to use student performance data from a variety of sources in order to put together the whole picture of student achievement. We don't want them to focus solely on standardized-test scores as they develop their educational plans, even though those are the most readily available because they are all electronic and the central office can neatly provide them with reports.

In the schools we studied, we found that data acquisition activities included three subsidiary functions: data collection, data storage, and data reporting.

Data Collection

Leaders in each school had access to standardized-test scores both through paper reports sent to the schools and through online data portals maintained by the state Department of Public Instruction and the test-publishing companies. In addition to obtaining summative test scores, each school collected information on attendance, student and community demographics, discipline referrals, expulsion and retention records, and student grades. Every school also collected a variety of data about the instructional program, such as student writing samples, teacher and class observations, survey-based climate data, and daily student assessments (usually in literacy). The district office played a central role in data collection in three of our four schools by making district and state assessment information available to principals online.

School leaders realized that data generated for summative accountability purposes were insufficient to support local change processes (see Thorn, 2001). Each school had developed a number of internal data acquisition systems to guide instructional improvement. Harrison School, for example, exploited the rigorous data collection system in its direct instruction (DI) program[1] to generate data about teaching and learning. Harrison's principal described how DI helped guide her data collection:

> We've really become quite talented, I think, at data collection, particularly with the use of direct instruction, because [data collection] is an integral part of that program. The teachers . . . [are regularly] collecting data on students, on how they're performing, on how they're doing. . . . We do checkouts, whether or not they pass tests after every five lessons in direct instruction, so all of that information gets collected; it gets compiled.

In addition to creating systems for recording student achievement data, our schools developed systems for other forms of information, such as attendance and discipline data. Malcolm School's Respect and Responsibility (R&R) program addresses the influence of student behavior and school environment on teaching and learning. The R&R program (which is described in detail in the program design section) is an example of a sophisticated local data collection system that does not rely on standardized-test scores and thus serves as the starting point for a DDIS designed addressing student behavior.

Data Storage

We observed a range of low- and high-tech data storage practices, from filing cabinets and binders to sophisticated data warehouses. Three of our schools relied on a significant district investment in data warehousing technology for storage purposes. Still, each of the four school principals relied primarily on low-tech printouts and notebooks to keep track of data relevant to the school program. Aside from standardized attendance and budgeting programs, schools' local data storage systems generally operated independently of district data systems. The mismatch between high-tech district storage and low-tech local collection and storage meant that (1) local leaders needed to be literate in both systems and (2) principals acted as data conduits between the district and the schools. Local school leaders seemed to realize that control over information storage would determine the kinds of information that they could legitimately collect and that integrating all relevant information into a single system would likely reduce their autonomy and flexibility. Relinquishing control over data storage to the district office would limit leaders' capacity to address emergent problems and thereby increase external control over school decisions.

Data Reporting

There were significant differences in approaches to data reporting between districts and schools. Schools tended to see data reporting in terms of building professional interaction among staff, whereas districts approached data reporting from a technological perspective. In Pearson School, for example, the principal and several lead teachers met regularly to develop reports on student learning, collected through regular testing and anecdotal information. The discussions surrounding report generation and results provided an occasion to develop shared understanding of purpose and strong professional community among the leadership team. Harrison School leaders and teachers developed a Critical Index to report weekly data. A Harrison administrator collected the data and compiled the Critical Index every month to expedite its review by the principal. The principal explained the origin of the Critical Index and the recognition that it has since received:

> Other schools have used our Critical Index, and they've used some of the other sheets that we've used to collect data because they've used it as an example. And that was really developed by our needs and looking at the needs of "What do we need to find out for information that will help us improve, and then how can we develop this form?"

The Critical Index was then used as the occasion for regular staff conversations about the current state of the school's instructional system.

From a district perspective, data reporting was often defined in terms of how schools queried the online data warehouse. The Malcolm School

district office, for example, assembled hundreds of online report templates for principals and trained them in accessing the system and determining which reports to use. Customized search guidelines served to narrow the data for principals. The data reduction function served by the district reporting system can be important for principals, who can feel, as one admitted to us, "somewhat overwhelmed with data." However, given that the selection of the data appropriate for local school inquiry still rested on the principal and the leadership team, the district's role in filtering data was heavily dependent on local capacity to determine which data were required for analysis.

DATA REFLECTION

Making sense of data proved a critical function of a DDIS. *Data reflection* describes the processes developed to make sense of student achievement data that result in setting collective goals for improving teaching and learning. Although reflection itself proved an intermittent and unpredictable consequence of working in data-rich environments, in a DDIS, data reflection refers to whole-school, grade-level, or subject-area meetings, opportunities for teachers and leaders to collaboratively make sense of data. We found two kinds of data reflection artifacts in our schools: district-led data retreats and local school reflection meetings.

District-Led Data Retreats

Data retreats provide an opportunity for large groups within districts and schools to make sense of achievement data and to set organizational goals (Sargent, 2003). Such retreats require schools to assemble a variety of data, to discern patterns in what they have assembled, and to generate hypotheses and action plans to address these concerns. Two of our schools engaged in district-led data retreats just after the close of the school year. Attendance was voluntary, although one district arranged for college credit, to encourage teachers to attend. The Walker district used its data retreat to tie data reflection practices into its annual visioning process. The district administrator explained how, once the participants identified an issue, they examined more data to determine contributing factors. This deeper reflection, as he referred to it, came only after the initial recognition of the problem:

> We also dug deeper and said, "Okay, of those students who are performing at the lowest levels, what kind of classes are they taking?" We found out that the boys are taking lower-level classes and they're taking fewer core academic classes than the girls.

Collaborative reflection on the data helped them narrow the problem of student achievement to the issue of gender equity and thus led to discussions about how to resolve the issue through the instructional program.

We found that district data retreat leaders were quite directive in their efforts to lead reflection. Tensions arose between the directed agendas and the staff's open exploration of the data. One district leader explained how they tried to resolve this tension at their retreat:

> Our philosophy is not to do the PowerPoint and then say, "Okay, guys, get to work." We feel as though it's more powerful if we give them what the task is and then let the teachers and principals at the building level dig into it and have their own conversations. We may ask leading questions, [but] we want them to have the "ah-ha!" themselves.

The desired district outcome of a data retreat was the development of shared goals for teaching and learning. One Walker district administrator explained how their goals developed:

> We narrow down what we feel is critical goals for the district, and that's basically what we do, and we end up with four, or maybe five at the most, district goals because I think if we get over that many, you're never going to achieve them.

Local Data Reflection Activities

Each of our schools structured a number of reflection activities to develop local instructional goals as well as to plan how to meet the goals formulated at district data retreats. We observed three to four scheduled local data reflection sessions during the year in each school. Pearson School, for example, used professional development time for implementation days that involved the whole faculty's discussing student achievement and student behavior reports. The inclusion of special education staff in all Pearson data discussions afforded robust communication between specialists and classroom teachers, enabling the staff to discuss the needs of struggling students. Malcolm School convened its administrative team on a weekly basis to review the school's behavior data reports. The principal used these meetings to identify emergent issues in the school and to develop strategies to share the academic and behavior data with teachers during regularly scheduled grade-level meetings. She used these data to create a "shared culture around children" and establish "collaborative conversations around kids," particularly to identify "what's going on or not

going on with the kids." After one such meeting, she described the discussions that resulted from sharing data with her staff as "the beauty of data—we can have these conversations."

The Harrison School principal described how she had developed an increasingly collaborative system for data reflection that started with a small group of trusted colleagues and then expanded to include more staff members:

> I did this a couple of years, and my school psychologist did this a couple years with us and with the program implementer—you know, the three of us would sit down and actually do some item analysis and pull it out and extrapolate it for the staff and hand it over. That's what we did like 4 years ago. . . . But now we're more focused on having the committees do it so that everybody's involved in it, so that's been the push.

A Harrison teacher commented that the faculty committees now focused on data as well: "Individual committees sit down and look at the actual data and notice trends. . . . If the education plan is based on data, then we have to look at it." Harrison's student intervention process—problem-solving teams—focuses on making sense of achievement data. A school social worker explained,

> Every problem-solving team meeting involves deciding what kind of data we're going to collect on that particular issue, and then usually in 3 or 4 weeks we all meet back together to look at it and figure out what to do with it.

The value of local data reflection sessions seems to lie not in the sophistication of the statistical analysis but in the frank discussions of practice. The school-level reflection sessions typically rely on simple graphs and tables of achievement data. These reflection sessions address data disaggregation, item analysis, and individual student progress. Data disaggregation activities at the school level begin with breaking the state standardized-achievement-test data down to the individual student level, which then allows teachers to relate additional behavioral and social data to an understanding of the achievement results. One teacher said,

> I think the [state test] item analysis is really grabbing what we're doing—like, when I did the item analysis last year, it was sentence structure and supporting details that the kids . . . aren't as high as we expect these scores to be, I suppose. . . . Those are the areas that we're really struggling, so now that's what we do writing or when we're reading; we're always talking about finding these supporting details in the papers and in the stories—and that's based upon just doing that item analysis and the [state test] results.

We found that the majority of discussions focus on using several pieces of achievement and behavioral data to help struggling students achieve proficiency; few discussions concern how to raise student achievement from proficient to advanced levels. We also found that teachers seem more interested in discussions about individual students than in consideration of schoolwide or grade-level issues. In each of the schools, the formal leader takes the role of shifting discussions from individual student interventions to schoolwide issues.

PROGRAM ALIGNMENT

Program alignment processes link the relevant content and performance standards with the actual content taught in classrooms. Program alignment has long been a staple of school and district professional development activities, and it proved a key aspect of planning and program evaluation in our schools. The program alignment activities that we identified served two key purposes in our schools. First, alignment activities served a problem-finding function by pointing to areas where the current instructional program did not address student learning needs. Second, alignment activities helped schools to understand the degree to which their current programs fit together and addressed relevant content and curricular standards.

Program alignment activities show how schools analyze whether their programs are able to reach instructional goals. To illustrate the dimensions of problem finding, we highlight Harrison School's decision to adopt DI as a schoolwide instructional program. DI has proven a controversial curriculum that breaks learning goals into smaller, scripted chunks to guide classroom teaching and learning. Our interest here is not to engage in the debate over the merits of DI but to note how the leaders and teachers at Harrison use DI as a sophisticated tool for finding systemic student learning problems.

The path toward DI at Harrison began with the principal's arrival in 1998. Faced with a disjointed curriculum and declining test scores, the principal saw as her first step to create some coherence in the instructional program. She understood program alignment activities as a condition for determining the schoolwide effort to improve student learning. She also used them to spark an action agenda by helping the staff see how fragmented the current program was.

> I started the discussion when I first got here with some of the staff in the fall. . . . The one thing that I did notice was that everybody was doing their own thing. . . . There was no consistency within the building. We did an investigation. . . . I looked for volunteers to go out and look at programs in other schools, go out and do some research, go online, speak to parents—we had

parents involved in that—and we basically developed an investigative committee, and we went out to various schools.

As staff began to shop for comprehensive curriculum programs, the Harrison alignment process quickly bloomed into a program solution activity.

> They came back with a great interest in the direct instruction curriculum because they saw it in another school. I had known about it because I came from a DI school, and that was one of the schools that I had sent them to so they could see the great things that can happen with that curriculum. But they were actually the ones that saw it, and they were the ones that wanted to start the program.

The decision to adopt DI helped to address the student achievement issue, although it did not solve it. At Harrison, DI was not seen as a one-stop solution for student learning issues. Once adopted, the Harrison staff used DI to determine the fit between their instructional program and relevant learning standards. DI provides prodigious amounts of data through direct, ongoing measurement of student learning in relation to curricular goals. The staff used these data as sophisticated problem-finding tools to identify gaps in the instructional program. The Harrison principal explained how, in an effort to meet the needs of all children, the staff began to consider the alignment of DI with learning standards:

> In the 3rd year [of DI], we were really focusing on "Okay, where are the gaps?" . . . So we're growing each year as we're learning more and being better at what we're doing. It's been easier and easier each year in regards to understanding how to align it and what materials we may need.

Harrison's commitment to DI helped teachers and leaders to align the instructional program with student services, community outreach, and other programs. The Harrison staff used ongoing alignment activities to determine where the DI program needed to be supplemented to meet the needs of particular student groups. One kindergarten teacher noted,

> And also for the lower levels with DI, to get more comprehension and a love of literature and those kinds of things, we do a lot more extension activities with literature so that the kids learn about author and title and all those kinds of literacy skills that they need and that they're not going to get out of DI specifically, so we supplement those things.

Program alignment activities provide schools with information about the range and organization of their current programs. From a DDIS perspective, alignment activities come to life as problem-finding tools to determine where the current instructional program falls short.

PROGRAM DESIGN

Program design represents the school's efforts to build or use interventions to improve student learning. Schools use program design to act on perceived instructional needs by creating or adapting a variety of programs, such as curricula, pedagogies, and student service programs. In the DDIS, program design is linked to the school's interpretation of the student achievement data and program alignment efforts. We found three categories of artifacts used to shape school instructional program activities: *faculty-based programs*, used to develop staff capacity; *curriculum-based programs*, for students in conventional classroom settings; and *student-based programs*, designed to customize institutional resources to the needs of individual students.

Faculty-Based Programs

The faculty-based programs that we observed consisted of a variety of professional development, coaching, evaluation, and meeting artifacts designed to restructure faculty interaction. The development of cross-functional staff teams seemed to have a critical influence on data use. School leaders helped organize three levels of staff organization: leadership teams, faculty teams, and student intervention teams.

LEADERSHIP TEAMS

Each school developed a whole-school leadership team composed of a select group of leaders and teachers who use data to shape the instructional program. Team members include principals, assistant principals, lead teachers, special educators, and specialist teachers. Leadership teams serve an executive function in the schools by setting the agenda for reformed practice, implementing the school improvement plan, and acquiring and coordinating resources for improvement. The leadership teams play a central role in determining which data are emphasized in school improvement discussions.

FACULTY TEAMS

Faculty teams provide structured opportunities for teachers to use data in discussing curriculum issues. Each school had grade-level faculty teams, and schools developed additional faculty teams for different aspects of the program. Harrison School requires all staff to serve on educational plan

teams, which use data to develop and measure the school instructional plan. The Harrison principal commented,

> I know our Ed Plan committees are really key as far as looking at data. I mean, because they're the ones that develop the planning for the school. There's people on the Ed Plan, on each of the Ed Plan committees that are familiar with it, that are trained in it, in data collection and analysis, and can help try to move the others along.

Malcolm School faculty served on teams such as the literacy action team and the climate and order team to coordinate school improvement efforts. Walker School had district-based K–12 curriculum articulation teams, which organized faculty members across schools into disciplinary groups, and Pearson School used study groups to provide local professional development about school curricular initiatives.

STUDENT INTERVENTION TEAM

A final form of staff team structure was developed for using student-level data to address the needs of individual students. Although special educators have long relied on these types of team structures to identify and serve special education students, the student intervention teams that we observed were designed to allow staff to customize instructional plans for students identified as struggling in terms of standardized tests, without resorting to special education placement. Harrison's problem-solving teams, for example, helped identify unmotivated and struggling students and provided a process for teachers to discuss the students' needs, contact parents, or connect the students with other instructional or behavioral resources. The problem-solving teams consisted of a special-education-like staff, including parents, classroom teachers, the school psychologist (or social worker), and an administrator, to develop and implement a customized student instructional plan. The student intervention teams provide an opportunity to bring together summative, formative, and informal data on student achievement to clarify and address the needs of individual students.

Although staff teams are certainly not new to consideration of reform efforts, our investigation confirms prior research about how collaborative teams helped to create the capacity for staff to engage in data-driven decision making (Chrispeels, Brown, & Castillo, 2000; Feldman & Tung, 2001). We do not, however, want to paint an ideal picture of staff members' gladly contributing all their preparation time for teamwork. Some teams seemed far stronger and more purposeful than others, and the teams that included administrators tended to meet more often and have clearer agendas than did the primarily faculty teams. Schools also had problems communicating

data-driven insights across teams. As one special education teacher noted, the learning team would identify students in need of special help, but the message would not get across to the grade-level teams: "So here's this list of kids in your classroom or at your grade level, and you try to give it to the grade-level planning committees, but nothing happened with it." Still, because leaders and teachers served on several kinds of teams in each school, the team structures allowed staff to participate in data-based inquiry on multiple levels.

Curriculum-Based Programs

Curriculum-based programs include the variety of conventional programs that schools use to guide classroom instruction. We found that each of our schools had selected a variety of reading, writing, and math curricula to meet the state accountability demands in these subjects. The literacy curricula ranged from comprehensive programs such as DI to balanced, blended literacy approaches. In math, three of the schools followed their districts' leads in adopting curriculum packages such as Everyday Math. Each school's leaders believed that the comprehensive approach to math had significantly improved teacher capacity and student learning. Consequently, math received less attention in the DDIS-related discussions that we observed. Improving literacy scores, however, continued to prove a stubborn challenge and served as the central topic of data reflection and program design in the our observation of DDIS activities.

Program design was also used to provide targeted solutions to problems that surfaced through the data reflection. For example, leaders at the Walker School reacted to their failure to meet the 2004–2005 No Child Left Behind adequate yearly progress requirements for special education by seeking out an effective curricular intervention. District and school leaders researched other local district solutions and settled on Read 180, a pullout program designed to offer intensive reading remediation through a combination of classroom and computer-aided instruction. The district decided to purchase the program after investigating how it was used in other schools. Approval of this purchase was voiced by a reading teacher: "I'm very pleased with that [Read 180] investment the school has decided to make. And I believe that it came about because we looked at the yearly progress for last year's students." The principal and staff used achievement data to help place students into a pilot program. The Walker principal explained,

> [We] took the kids that . . . would need this the most. We also made a very conscious decision of the kids that we're going to target for the pilot. . . . I created a template or a table that took the [scores] from the kids' most recent

> math test, their reading and writing scores, . . . their language use percentile. I documented the types of support [the students received]. Then I looked at their schedules to determine what would be the least disruptive method of pulling them [out for Read 180].

Acquiring programs to address emergent student achievement issues is certainly not new in schools. However, the Walker example stands in contrast to the pattern of schools' adopting a number of incompatible programs, resulting in incoherent systems of practice, or what Bryk, Sebring, Kerbow, Rollow, and Easton (1998) label the *Christmas tree* phenomenon. Integrating program design through data-based decision making helped schools use data as a check against program bloat. The Walker example shows how achievement data were used to determine program weakness and to select a program to carefully address the perceived problem.

Student-Based Programs

Student-based program design approaches the instructional question from the perspective of individual student need rather than collective student need. Drawing on the powerful precedent of the special education individualized education plan (IEP), we found that several of the schools used student-based program designs to create customized instructional plans for struggling students. The resulting quasi-IEP student instructional planning processes developed customized support plans for students grounded in the school's instructional program. These processes supplemented program-level designs by providing ways for teachers to plan individual student-level paths through school and district instructional resources.

The Malcolm School's R&R program provides a good example of how IEP-like processes were adapted to serve the interests of a range of students. R&R was designed to provide timely information about student behavior to teachers and school leaders. Leaders reasoned that students who were unable to cope with the restrictions of the classroom environment would have a much lower chance of experiencing success in the instructional program. A teacher involved in the R&R design remarked, "We might hand out a little discipline [in R&R], a little consequence to solve the problem, but discipline still comes from the principal."

The R&R program grew out of a comprehensive school audit during the initial year of the school principal. The audit resulted in the creation of four problem-solving teams, including one dedicated to climate and order, which designed R&R, a student-based program that describes a set of escalating steps for intervention with a disruptive student. The R&R team consisted of the school psychologist, the social worker, an educational assistant, a school facilitator, and the school's assistant principal. R&R team members had several responsibilities. The R&R team member on duty was called in if the teacher could not successfully resolve problems caused by a misbehaving student. Chronic cases of misbehavior resulted in a referral process crafted by the R&R team in consultation with the parents and classroom teachers. This intermediate intervention step helped make the behavior problems of a number of students manageable without special education identification.

From a DDIS perspective, the key aspect of R&R was the range of student data generated and analyzed by the staff during the referral process. All referrals were documented, tallied, and analyzed in weekly meetings by teams of school administration, staff, and teachers. The focus of the analysis was to make sense of the frequency, severity, and patterns of behavior as indicated by the R&R referral system. Both cumulative and student-level behavioral data were integrated into the data reflection process at Malcolm to help teachers move beyond test scores and get a handle on the education of the whole student. The R&R program provided the Malcolm staff with the information necessary to help teachers make adjustments in the classroom. One teacher noted,

> Every room in this building [has children] with incredible issues—enough to scare people. But kids still learn, they come and they produce, [and] they have good test scores. Teachers and kids are doing what they need to do in order to teach and learn.

FORMATIVE FEEDBACK

The formative feedback function was perhaps the most critical, expensive, and difficult-to-implement aspect of a DDIS. Formative feedback structures are designed to create ongoing timely flows of information to improve student learning and instructional program quality across the school. Like with data reflection, formative feedback practices occur in classrooms throughout the school in the form of classroom quizzes, teacher comments on student work, and classroom question and answer. For the purposes of a schoolwide DDIS, however, we focused on the structures that coordinated formative feedback efforts to track student learning progress across classrooms and programs. Formative feedback differed from data acquisition and reflection in that it concentrates on the local information generated to inform teachers and school leaders about the progress of school students and programs.

We hypothesize that because of the intensive attention and frequent discussion required to collectively make sense of formative feedback, most schools find it expensive to develop a range of systematic feedback processes. None of the schools in our study demonstrated the capacity to provide systematic feedback on student learning across their instructional programs. However, several schools did provide examples of how formative feedback structures were developed to enhance student learning and assess program quality in specific domains.

The Pearson Title I/Literacy program provides an illustrative example of a formative feedback system, which has three parts: a shared instructional program; a battery of regular assessments directly tied to the instructional program and outcomes; and structured opportunities to discuss the data, revise the curriculum, and develop individual student learning plans. The Pearson Title I/Literacy program was designed by local school leaders to provide systematic feedback on early-childhood literacy initiatives. The Title I teacher, a veteran reading specialist with training in the Reading Recovery program, had worked with teachers for 6 years to redesign the Pearson K–2 reading program. The cornerstone of the program was Guided Reading (GR), a program that helps early readers develop effective strategies for processing text at increasing levels of difficulty (Fountas & Pinnell, 1996). The Title I teacher commented,

> Collecting data on how much kids understand and where their understanding breaks down helps us understand where they need more help. This gives our kids a chance to feel comfortable with what they are doing so they can say, "I am a reader."

GR relies on *running records*—individualized, ongoing formative student assessments—to help teachers organize groups for reading activities. The Title I teacher assembled binders of running records information to track student progress over time, and she supplemented the GR assessments with assessment tools, such as Reading Recovery and the Developmental Reading Assessment.

Pearson's leaders realized the value of structured opportunities for reflection to make these formative data useful. The Title I teacher organized her schedule to spend time working with groups of students in each classroom to get a sense of teachers' practice and student performance. The Title I teacher described meeting weekly with every teacher and monthly with the K–2 and special education teachers to analyze the data:

> Data disaggregation time lets us discuss our children and our program. We look at home life—we know that when families go through a divorce, children lose a year of academic progress. We also look at the data during our [schoolwide] implementation days.

Professional time dedicated to data discussion helped to develop a strong professional community at Pearson around literacy instruction and to identify problems with the existing program. In the early days, teachers unwittingly used different reading vocabulary with children:

> When we started, we found that one teacher was saying "sound it out," another teacher was saying "stretch it out," [and] another said "say it slowly." Our top kids were figuring it out, but the kids who were struggling were saying, "I gotta do something else?" They didn't get it. . . . We have a common language now. Once they established a common language, the struggling readers could figure out that the skills sought by teachers were the same.

This complex system of formative measures served several key functions. First, it helped Pearson staff develop a sense of shared ownership of transformed practice. K–2 teachers felt more connected to each other's practice as a result of participating in the GR assessment system. One teacher remarked,

> I think that we use the data [to] communicate with each other. We'll come to each other [and ask], "Do you have an idea of what we can do to get past this point? What can you do? Do you have any other ideas?" So, so we're sharing that data to help the child in a way to get over the hump. I think we use it every day at some point in talking with each other.

This sense of professional community also helped the staff use formative feedback as an effective measure of program design. When teachers began to realize that GR was not addressing the needs of several students struggling with decoding, a teacher shared her experience at a phonics-based program workshop. Several other teachers then attended the workshop, and the Pearson team began to integrate phonics activities and assessments into the literacy program for selected students. The formative assessment system in literacy helped staff anticipate the results of the state exam. The Title I teacher described how she was "rarely surprised, because the running records help to determine where the children should be on the [Developmental Reading Assessments], which predict the [state exams] well."

TEST PREPARATION

Test preparation evokes images of teachers' bypassing the instructional program to teach to the test or game the assessment systems. In the DDIS, test preparation activities are designed to motivate students and develop

strategies for improving their performance on state and district assessments. We observed a variety of test preparation activities that seemed to supplement, rather than supplant, school instructional programs. We identified four categories of test preparation activities: curriculum-embedded activities, test practice, environmental design, and community outreach.

Curriculum-Embedded Activities

Curriculum-embedded activities integrate the conceptual content of standardized tests into the regular instructional program. This strategy seems to assume that what is tested is worth learning. As one of our principals explained, embedding standardized content in curriculum is an outcome of a design strategy for aligning curriculum, standards, and evaluation:

> We honestly provide them with the curriculum that the board has approved, and you know, our logic is that if the test is aligned to the standards and our curriculum is aligned with the standards, . . . [then] the curriculum is aligned with the test. [And if] the curriculum is aligned with the test, . . . we should be fine.

In data analysis meetings, we saw how teachers and leaders across schools linked exam and lesson content. At Pearson School, for example, teachers were particularly interested in understanding how the problems that surfaced through testing could be translated into lesson design. In fact, the Pearson School data reflection discussions were marked by contrasting agendas: The principal emphasized analyzing the results of testing, whereas teachers consistently moved from the results to how they could address the emergent issues in their classrooms. These discussions demonstrated how test preparation discussions could be seen as a microcosm for the DDIS as a whole.

Test Practice

Test practice focused on helping students practice test taking outside the regular classroom curriculum. The schools in our study focused on developing test-taking skills rather than on engaging in test drills. Test practice activities ranged from providing students with opportunities to try out similar types of tests to reviewing the test format with children. One school provided planning time for some classroom teachers while other staff taught testing skills to the students; another school created a program in which guidance counselors provided skills preparation. One principal declared, "We don't teach them the test. Research has shown it's not an effective way to get students to do well, and so we are not going to waste our time with that."

Environmental Design

Schools developed environmental design strategies to create a positive atmosphere for students during the testing. The strategies that we observed included grouping, organizing the testing environment, proctoring, and exciting students to motivate them for the tests. One principal discussed how she and her staff use grouping to prepare students for testing:

> When we're testing, we'll do small groups. Some will be whole class, but in other situations we will have . . . special ed kids or ESL students, a small group with a specialist or an educator. And that time during testing—it's usually like a 2-week period in November—we will cancel all of our specialists' [responsibilities], and they will assist with testing. So it's a schoolwide effort; all the teachers lose their assistant time. So everybody in the community is involved and assists during testing time.

Student grouping also provides for special testing accommodations allowed by state regulations, such as reading exams aloud and providing extra time, for certain groups of special-needs students. Some schools tried to create an exciting atmosphere to motivate children for the test. One school held a pep rally with the high school cheerleaders and band to kick off testing week, then provided healthy snacks and slippers to help students feel comfortable with the exam process.

Community Outreach

Community outreach practices described how the school informed parents and the community about the value and importance of testing. Now that schools are held accountable for standardized-testing results, leaders created a variety of artifacts to facilitate communication with parents and the community. One official described district outreach efforts as follows:

> We'll have newsletters that go home to parents . . . [that give] strategies to help. We say [what] we've done at school for test preparation. . . . We talk about the superficial "get your kids to bed at a certain time" so we let parents know . . . when the testing is, when the tests are coming up. . . . [Our] belief is that testing and its importance must be communicated from day one to the parents and school community.

Back-to-school nights and teacher conference nights also provide opportunities to prepare the community for testing. Teachers at one school

explained how they develop reports based on a combination of state exams and their formative tests to explain student performance so that parents understand reports of school performance in the local press.

DISCUSSION

The DDIS framework allowed us to see how leaders sought to meet the demands of external accountability by carefully and gradually adapting new policy, curriculum, and professional development artifacts to their existing instructional systems. We saw how data discussions served to set problems for subsequent DDIS activities, how data acquisition led to opportunities for data reflection, how the goals determined through reflection activities set the program alignment and design conversations, and how formative feedback activities were organized around questions of whether program design commitments worked as planned. Teacher professional development activities gained coherence through organization as learning activities about teaching and assessing the current program design commitments. Starting with the concept of an already flourishing internal accountability system allowed us to see the organic development of data-driven decision making as a matter of how leaders build on and alter existing capacity.

Still, this initial analysis of the DDIS study data has clear limitations. First, although the functions that we observed seemed to operate as a system through which data flowed, it was not clear that the artifacts involved in the DDIS were designed as a system. The organic processes of solving the problems at hand seemed to result in artifacts that, over time, aggregated to form structures to facilitate schoolwide data use. Translating the organic systems of data use into prescriptive school organization models would prove a task beyond the scope of this article. Still, we argue that understanding how these organic systems function in schools would help frame efforts to design school systems for effective data use. Second, the practices that we highlight were present in schools with reputations and with records of effective data use to improve student learning, but we cannot conclude that the DDIS practices caused the improvements in student learning. Although we feel comfortable making the weaker claim that school leaders identify many data-related practices as the reasons for student learning improvement, we would have to conduct a different kind of study to establish the stronger causal claim between these structures and learning gains. Finally, because our study focused primarily on leadership practices, faculty meetings, and interviews, we were not able to trace the

degree to which the practices described here actually played out in classrooms. Although we have teacher reports about how their teaching was influenced by DDIS functions, we cannot claim to know precisely how these reports accord with day-to-day teaching practices. Our lack of certainty about the effects of DDIS activities on classroom teaching again limits our ability to make the stronger claim that DDIS practices caused improved student learning.

Studying how the DDIS functions played out in schools raised several issues that warrant further investigation: the role of meetings in developing professional community, subject matter differences, and district–school relations.

THE ROLE OF MEETINGS

Each function of the DDIS showed how school leaders and teachers used meetings to create data-driven activities in their schools. The development of DDIS functions in each school seemed to rest on staff ability to engage collectively around issues of student learning. Feldman and Tung (2001) found that data use can help school professional culture to become collaborative and instructional practice to become a legitimate topic for public discussion. Our study suggests that data-based professional meetings, such as implementation days, program design meetings, and school improvement planning, provide opportunities for staff to interact around issues of teaching and learning, a key ingredient for developing strong professional communities (Bryk & Schneider, 2002; Friedkin & Slater, 1994). Yet, as most people who work in schools know, proliferating meetings can damage professional community as easily as they can build it. Here is where the role of leaders as mediators for organizational change played a critical role. The leaders in our schools were able to use data-driven discussions to create powerful information feedback loops that linked achievement scores to design efforts and output measures. Leaders worked to build these loops in several ways. First, most of the professional development and faculty meetings that we observed had clear agendas and expected outcomes linked to analyses of student achievement. Second, school leaders made concerted efforts to limit the number of instructional and student management initiatives that teachers were expected to master. Third, leaders used professional development time and money to create longer, more intensive opportunities for interaction beyond the allotted faculty meeting times. Data-driven discussions played an important role in each of these strategies as leaders sought to persuade teachers to give up classroom autonomy in the interest of

better, collaboratively developed tools for improved teaching and learning (see Chrispeels et al., 2000; Earl & Katz, 2002).

SUBJECT MATTER DIFFERENCES

Like other researchers (e.g., Burch & Spillane, 2003; Nelson & Sassi, 2005), we found significant subject matter differences in the capacity to use data for instruction across schools. One teacher asserted that data conversations flourished primarily in subject areas critical to adequate yearly progress: "But where they really have the discussions, I think it's primarily in the areas where we're most concerned about—like the state tests and all that." This was particularly true for teachers outside the central subject matter domains of reading, writing, and math, who often struggled to cast their practice in terms of standards not assessed through standardized tests. Each school had developed a sophisticated, formative assessment model to gauge ongoing student progress in language arts. Although math learning was an expressed priority in the study schools, we did not observe a similar commitment to local program design and formative assessment that we found in language arts. Science and social studies, even though tested on the state exam, received less attention than either language arts or math. Indeed, even when schools discussed other topics in data disaggregation and item analysis sessions, teachers tended to consider science and social studies topics in terms of reading comprehension and vocabulary familiarity. One school addressed science education as a part of a larger district initiative; another used a general curriculum design process to guide grade-level development of social studies and science projects; in yet another school, teachers talked about science in terms of the comprehension sections of the state exam. Other topics, such as fine arts and physical education, were rarely addressed in data-driven discussions. This narrowing of the subject matter focus in elementary schools reflects the core-versus-noncore distinctions of high schools' instructional programs (see, e.g., Goodson, 1993; Siskin, 2003).

DISTRICT–SCHOOL RELATIONS

Our study focused on how local school leaders worked to build capacity for staff to use data for instruction. We quickly realized the key role that districts played in acquiring, collecting, and distributing data, even though these were not always the data required by local school leaders to support teaching. As Thorn (2001) suggests, districts and schools tend to consider achievement data from different perspectives: districts to summatively assess program success and schools to formatively influence instruction.

The development of school-based formative feedback systems can be seen as a local effort to supplement and apply the summative information provided through the district. The difference in the scale of action between district and school uses of data helps explain the differences in data reflection activities: District data retreats helped schools identify collective instructional goals, but school-level reflection activities were necessary for schools to determine local goals about what to do in each classroom and with each student.

The size and commitment of the district to data-based practices seemed an important but confusing factor in the study, mainly because of the tension between the autonomy of the school DDIS and the controlling influence of district practices. This tension was displayed differently in the study schools. At Walker School, for example, the district vision for data use—articulated through activities such as data retreats, collective visioning, and K–12 subject matter committees—seemed to constitute much of Walker's DDIS capacity. The Harrison experience, however, suggested that well-developed district capacity can run counter to the purposes of a local DDIS. The sometimes uneasy relation between the district and the school can play out as a turf war for control of the instructional program. Schools with a strong, locally developed DDIS run the risk of having core practices questioned and revamped by district efforts to impose control over the data-driven decision-making process.

CONCLUSION

The storm over the merits of standardized testing and high-stakes accountability has become our educational generation's version of an ideological litmus test. Yet leaders and teachers in schools are not often in a professional position to debate the merits of either side of the case. Education professionals must work to provide the best possible learning environments for students, regardless of the policy context. Our study showed how leaders in four schools dealt with the demands for high-stakes accountability by constructing sociotechnical systems to focus professional discourse and practice on measures of student achievement. Our DDIS framework allowed us to identify system components—professional development sessions, data retreats, curriculum planning meetings, and formative feedback assessments—built by school leaders to concentrate available resources to improve student learning. Although we found evidence of marginalized academic disciplines and considerable resources invested in test preparation, we also found strong communities of practice among teachers grounded in discussions of student achievement data and

improved performance on standardized tests. The initiative and ingenuity shown by local schools to meet the demands of accountability demonstrate our need as researchers to inform policy debates with accounts of how educational professionals use policies in practice.

We do not want to suggest that a prescriptive re-creation of these schools' DDISs will provide a universal template for the new instructional leadership. Our purpose is not to revive a technicist approach to school leadership that details a recipe for school improvement. Rather, we used the DDIS functions to draw attention to the organic interaction between artifacts and actors that seems to constitute school capacity for data-driven decision making. Capable leadership and well-designed artifacts were necessary to create DDIS functions: Artifacts without leaders are mere structures; leaders without artifacts are confined to interpersonal interaction. The organic development of each school's DDIS required that leaders and teachers used professional judgment to determine which artifacts to alter, which to import, and which to simply leave alone. Far from a technicist approach to school leadership, the DDIS provides access to new occasions to understand how school leaders use professional judgment to build and help teachers navigate complex DDISs. Understanding this process offers insight into the central tasks and innovative practices of the new instructional leadership.

ACKNOWLEDGMENT

Work on this article was supported by the National Science Foundation, the Wisconsin Center for Educational Research, and the Educational Leadership and Policy Analysis Department at the University of Wisconsin, Madison. The opinions expressed are those of the authors and do not necessarily reflect the views of the supporting agencies and institutions.

We wish to thank Erica Halverson, Jeffrey Watson, Jay P. Scribner, and Cathy Loeb for their contributions. We are particularly grateful to the school leaders and teachers who participated in the research.

APPENDIX: DATA-DRIVEN INSTRUCTIONAL SYSTEM CODING SCHEME

DATA ACQUISITION

Processes used by schools to seek out, collect, and prepare information to guide teaching and learning.

- Process
  - —Collection
  - —Storage—from filing cabinets to data warehouses
  - —Reporting—formal or informal reports, responses to queries
- Agent (code in addition to process)
  - —Internal—done by the school
  - —External—done by an outside entity, such as district, state, Northwest Evaluation Association

DATA REFLECTION

Structured processes to engage the school community in making sense of student learning data that result in goals for improving teaching and learning.

Question: What's going on? Focus on the students.

- District led
- School led
- Grade level led
- Content area led

PROGRAM ALIGNMENT

Program alignment processes make the school's curriculum congruent with relevant content and performance standards, as well as with what is taught in classrooms, to improve student learning.

Question: What do we need to change?

- Standards—set by district and state
- Practice—what is taking place in the classroom
- Curriculum—what is to be taught
- Assessment—how student progress is measured

PROGRAM DESIGN

How a school acts on perceived instructional needs through the creation or adaptation of curricula, pedagogies, student service programs, and instructional strategies to improve student learning.

Question: How are we going to change? (Always code for source in addition.)

- Curriculum-focused design
- Student-focused design

- Source
  - —Local design—modified or created locally
  - —Received—bought or given from outside
  - —Inherited—predates the principal

FORMATIVE FEEDBACK

Learner-focused iterative evaluation cycles designed to create ongoing timely flows of information used to improve student learning and instructional program quality across the school.

Question: Are our changes working as we want them to?

- Program level
- Administrator level
- Teacher level
- Student level
- Positive feedback

TEST PREPARATION

Activities designed to motivate students and to develop strategies for improving performance in taking state and district assessments.

- Community outreach
- Embedded in curriculum
- Environmental design
- Test practice

NOTE

1. The debate over the short- and long-term success of programs such as direct instruction have provided a pivot for the battle between structured and child-centered curricula (see, e.g., Gee, 1999; Schug, Tarver, & Western, 2001).

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