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Implementing Data-Informed Decision Making in Schools–Teacher Access, Supports and Use

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Executive Summary

The collection, analysis and use of educational data are central to the improvement of student outcomes envisioned by *No Child Left Behind* (*NCLB*). The use of data in educational decision making is expected to span all layers of the education system—from the federal to the state, district, school and classroom levels. The implementation of the NCLB legislation has been accompanied by a demand for data systems capable of providing a longitudinal record of each student's educational experiences and performance over time.

The national Study of Education Data Systems and Decision Making, sponsored by the U.S. Department of Education's Office of Planning, Evaluation and Policy Development, is documenting the availability of education data systems, their characteristics, and the prevalence and nature of data-informed decision making in districts and schools.[1] The study is examining both the implementation of student data systems per se and the broader set of practices involving the use of data to improve instruction, regardless of whether or not the data are stored in and accessed through an electronic system.

The conceptual framework developed for the study identifies six prerequisites and supports for data-informed decision making: (a) state, district and school data systems; (b) leadership for educational improvement and the use of data; (c) tools for generating actionable data; (d) social structures and time set aside for analyzing and interpreting data; (e) professional development and technical support for data interpretation; and (f) tools for acting on data.

This conceptual framework inspired the study's research questions:

- What kinds of systems are available to support district and school data-driven decision making? Within these systems, how prevalent are tools for generating and acting on data?
- How prevalent are organizational supports for school use of data systems to inform instruction?
- How are school staff members using data systems? Do they know how to interpret student data? How is school staff members' use of data systems and of data more broadly influencing instruction?

This interim report describes findings from multiple sources. It draws on case study findings from the first round of site visits in nine purposively sampled districts, nominated on the basis of the strength of their data use activities. Researchers interviewed district staff members as well as principals and teachers from three schools within each district. In addition, a set of scenarios involving hypothetical student data were presented to teachers at each school to probe their understanding of student data.[2] This report draws also on data from secondary sources

[1] The term *data-informed decision making* is used throughout this report in preference to the more common term *data-driven decision making* in recognition of the fact that few decisions are based wholly on quantitative data.

[2] Information on how districts, schools and respondents were selected for participation in the case study sample can be found on pages 6–9 of this report; additional information on the National Educational Technology Trends Study (NETTS) survey sample can be found on page 6 and in Appendix A.

(spring 2007 district and teacher surveys from the U.S. Department of Education's National Educational Technology Trends Study). Using these sources, the report describes the student data systems available to school staff members, how school staff members are using the systems and other forms of student data, teachers' understanding of data displays and data interpretation issues, and the supports and challenges for school-level use of student data in planning and implementing instruction.

Early Findings

The burgeoning activity around student data systems over the last five years is being felt at the district and school levels. The dramatic increase in teacher access to student data systems has been documented in the two NETTS teacher surveys. In case study schools and districts, teachers were receiving professional development around data use and were using data reports from systems for school improvement. School teams working on particular initiatives, such as Reading First, were using student data to guide their actions.

Data from student data systems are being used in school improvement efforts but are having little effect on teachers' daily instructional decisions as evidenced in case study districts. Despite progress in giving teachers access to student data, it is clear that in many districts, the use of locally generated data to inform instruction is an activity separate from use of data systems containing student scores on standardized tests. District and school uses of data systems to store, organize and report standardized test scores typically focus on accountability concerns and on efforts to ensure that local curriculum and instruction are well aligned with state assessments. Neither the type of assessment for which data are available nor the time frame of assessment activities serves the needs of classroom teachers making decisions on a daily basis. Case study schools did offer evidence that teachers and teacher teams were using data to guide classroom instruction, but these data generally came from assessments closely aligned with local instruction, and the data were typically not stored on the student data system containing state assessment scores. The integration of classroom and state assessment data in the same electronic system is not common, even in case study districts noted for their data systems and data-using culture.

More specific interim findings address the issues of data system availability, supports provided for data-informed decision making, schools' use of data and teachers' preparation for using data to inform instruction.

Data Systems Available to Local Educators

Although teacher-reported access to student data systems is growing rapidly, the data systems themselves are currently not supporting instructional decision making at the school level. District data systems often cannot share data across systems, are not user friendly, contain limited data, and lack instructional tools to help teachers act on the data provided to them.

Teacher-reported access to student data systems grew significantly, from 48 percent in 2005 to 74 percent in 2007. This growth in teacher access was estimated using national estimates based on responses of teachers to the National Educational Technology Trends Study (NETTS) teacher survey.

Even though teacher access to data systems is growing rapidly, systems often lack the kinds of data that teachers find most useful for instructional decision making. Among teachers who said they had access to a student data system (Exhibit 1), the data most frequently available to these teachers were student attendance data (74 percent) and grades (67 percent). Only 55 percent of the teachers with access to a student data system (or 41 percent of all teachers) had access to their current students' performance on benchmark or diagnostic tests.

Wayman (2005) describes four common types of educational data systems: (a) student information systems providing real-time accounting for school functions such as attendance, (b) assessment systems supporting the rapid organization and analysis of a wide array of assessment data, (c) data warehouses that link multiple databases to provide access to historical data of all types, and (d) instructional/curriculum management systems. The NETTS teacher survey data suggest that teachers are most likely to have access to the first of these system types. Exhibit 1 summarizes the survey findings.

Exhibit 1
Data Available to Teachers

Types of Data Available	Percentage of Teachers With System Access	Percentage of All Teachers
Attendance data	74	55
Student grade data	67	50
Performance on benchmark or diagnostic tests taken by your *current* students	55	41
Spring 2006 standardized test scores for the students you taught last year (2005–06)	46	34
Spring 2006 standardized test scores for your *current* students	44	33
Fall 2006 standardized test scores for your *current* students	33	25
Multiple years of standardized test scores for individual students	29	11
Course enrollment histories for students	22	16
Students' prior school(s) attended	16	12
Students' participation in supplementary education programs (e.g., tutoring)	8	6

Exhibit reads: Among teachers who had access to an electronic student data system in 2006–07, 74 percent reported that they had access to attendance data through the data system, which represents 55 percent of all teachers (with or without access to a data system).

Source: 2006–07 NETTS teacher survey.

At one point, proponents of data-informed decision making in education offered the vision of a single integrated system combining multiple sources of information. As states and districts have gained experience with data systems, most experts have come to agree that it is more practical to strive for interoperability among different education data systems so users can move data between systems or combine data from different systems easily rather than try to build a single education data system that would serve all purposes (Datnow, Park and Wohlstetter 2007; Wayman 2005). **Interoperability among data systems was an issue within the case study districts.** Staff members at the nine districts in the spring 2007 case study sample were all using two or more separate systems with limited interoperability. None had a fully interoperable set of data systems. Typically, the information needed for educational decision making was spread across multiple systems without mechanisms for regular transport of information from one system to another. As a result, neither teachers nor administrators see a comprehensive record of students' educational experiences and performances that is both longitudinal and up to date.

Barriers to data system use that teachers cited on the NETTS survey suggest that a significant proportion of teachers with access to an electronic student data system have difficulty getting the kinds of data they want to see out of the data system.[3] Teachers reported feeling hampered by their inability to use data queries to get pertinent data from their data systems and by the limited utility of the kinds of information available in the student data systems for deciding what and how to teach (each reported by 29 percent). Smaller but significant proportions of teachers reported that they had trouble finding the information they were looking for on the system (24 percent) and that the system was hard to use (20 percent). Among school staff members interviewed as part of the case study research, the three most commonly cited barriers were (a) lack of training in how to use the data system or to derive instructional implications from system data, (b) the lack of time to engage in data exploration and reflection, and (c) the weakness of the available data.

Tools in data systems to help teachers improve decisions about instructional practice are not the norm, even in case study districts identified as high data users. Data from the case studies suggest that only a minority of data systems incorporate resources such as instructional materials, model lesson plans, and formative assessment results linked to frameworks and curriculum guides. Only three case study districts had data systems that provided such resources. One additional district was developing a system with this capacity.

Supports for Data-Informed Decision Making

Effective data-informed decision making requires not only access to useful data but also well-designed supports such as leadership to model data use and supported time for reflection on data. Although districts are beginning to provide supports such as training and support staff for data-informed decision making, there is a great deal of variability in the depth and breadth of these supports, even among districts identified as model data users. Federal programs have played an important role in helping teachers examine data and apply this information to instructional practice.

Case study districts demonstrated their support and leadership for schools' use of data through purchasing systems, modeling data use, and providing school-based support positions. More specifically, district supports for schools' use of data included (a) making data-informed decision making a priority and purchasing or developing a data system; (b) considering ability to use data as a criterion for teacher hiring; (c) providing training and support positions for system implementation; (d) initiating districtwide, data-informed decision-making activities

[3] All percentages reported for teacher survey respondents in the remainder of the executive summary are for teachers who indicated they had access to an electronic student data system in 2006-07 unless otherwise indicated.

in addition to professional development; and (e) using the data system for decision making at the district level (e.g., evaluating programs, principals, teachers).

A number of federal programs have supported schools' use of data to inform instruction. Staff members at case study schools described the use of funds from Title I, Enhancing Education Through Technology (EETT) and Reading First to support school-based staff members who help teachers examine data and draw implications for instruction. Reading First appeared to be particularly effective in supporting data use because Reading First coaches could provide teachers with different instructional approaches appropriate for students with various patterns of assessment results.

Leadership for data-informed decision making at the school level can extend beyond the principal. Previous case studies of data-informed decision making in schools have stressed the importance of leadership by the principal (e.g., setting the context for using student data, providing the time for reflection on data, and communicating expectations for teachers' data use). Although these functions are important, the case studies suggest that they may be performed by individuals in a variety of job roles; instructional coaches, department lead teachers, and instruction and assessment coaches were providing leadership for using data in many of the case study schools.

Districts appear to be responding to the need for professional development for teachers that focuses on data analysis skills or data-informed decision making more generally. On the 2006–07 NETTS teacher survey, 39 percent of teachers reported that the professional development they received about data-informed decision making had prepared them to use data to improve student achievement. At the same time, most teachers reported that they would benefit from additional professional development on data-informed decision making. All case study districts provided some form of districtwide professional development, but it varied in terms of (a) who received the training and (b) the training's content, duration and format.

Organizational structures that support data use at the school level can include designated time for teachers to review and discuss data in small groups, assigned support staff, and the adoption of procedures for discussing data. On the 2006–07 NETTS teacher survey, most teachers reported having positive perceptions of support for using and interpreting data that they could access from data systems. For example, a majority of teachers with access to a data system (71 percent) agreed or agreed strongly that when they needed help making sense of the data in district systems, they knew someone who could help. Case study districts provided even stronger support for data-informed decision making than the typical level indicated in the NETTS teacher survey responses. Six out of nine offered some sort of district-funded, school-based staff to support teachers' data use. In some schools and districts, individuals in these positions extracted relevant data from the system and guided teachers in drawing inferences for action. In other cases, the coaches' role involved helping teachers learn to analyze data themselves, with coaches motivating teachers to examine data and providing just-in-time informal professional development for data interpretation and connecting data to instructional strategies.

How Schools Are Using Data

A significant barrier to implementing data-informed decision making is a lack of expertise among school staff members in the area of data analysis. Districts and schools are addressing this challenge by supporting collaborative activities to discuss student data, but more training is required through both pre-service and in-service programs to provide teachers with a full range of data literacy skills.

Most teachers who use a student data system do so not only on their own but also in collaboration with colleagues. Among NETTS teacher survey respondents, the most commonly reported context for using a student data system was on one's own (78 percent), followed closely by data use with colleagues in a department or grade (71 percent). In the case study districts, the most frequently cited groupings for data use were the grade-level team, sometimes facilitated by a coach, and all-staff faculty meetings.

Both teachers and district staff members in the case study sample express concerns about teachers' ability to understand data. The majority of NETTS teacher survey respondents also reported that they would benefit from additional professional development on data-informed decision making. To better assess teachers' understanding of data, project staff incorporated data scenarios into the case studies, which were presented individually to several teachers at each school. The scenarios consisted of hypothetical sets of classroom, school and district data as well as a set of questions about the data and its implications for practice. These data scenarios were administered to a sample of teachers in each case study school to elicit their thinking about data and reveal the concepts and skills that teachers can bring to data-informed decision making. An expert panel identified the necessary data skills and concepts, which were clustered within five aspects of data-informed decision making: Question Posing, Data Location, Data Comprehension, Data Interpretation, and Data Use (making instructional decisions based on data).

Teachers' responses to scenarios concerning hypothetical student data suggest that teachers can locate the data they want within complex tables or graphs but often lack other data literacy skills. Exhibit 2 presents the average proportion of teachers earning full credit for their responses to data scenario items of various types.

Data Location items, which required the literal reading of a table or graph, were easy for most teachers. Teachers had some difficulty with Data Comprehension items such as those involving multiple data points for both school and district performance over time or where proportion and absolute value had to be distinguished. Data Interpretation items, which involved drawing inferences from data patterns, also proved difficult. These findings have implications for in-service and pre-service teacher education programs.

Exhibit 2

Percentage of Correct Responses, by Item Type Across Schools

Skill	Percent Correct	Sample Item
Data Location	81	What was Oak School's average Total Math Score in 2003–04?
Data Comprehension	64	Oak School's progress in narrowing the Grade 4 math achievement gap with the rest of the district has been in problem solving rather than computation. (Teacher must agree or disagree and explain reasoning.)
Data Interpretation	48	This year all African American students should get more intensive instruction in mathematics. (Teacher must agree or disagree and explain reasoning.)

Exhibit reads: For the Data Location items, the average percentage of teachers in a school earning full credit on the item was 81 percent.

Note: Question Posing and Data Use categories are not included in the table because they were represented by only one scored item each (percentage correct of the related items were 56 percent and 87 percent, respectively).

Source: 2006–07 data scenarios.

1. Introduction and Approach

Over the past six years, meeting the data requirements of NCLB and adapting or acquiring database systems capable of generating the required student data reports have consumed much of the attention of district and state assessment and technology offices. This work has been necessary but insufficient for data-informed decision making to influence education. Data-informed educational decision making consists of much more than just a data system: it includes a set of expectations and practices around the ongoing examination of data to ascertain the effectiveness of educational activities to improve outcomes for students. The implementation of data-informed decision making cannot occur without leadership and supporting conditions such as tools for generating actionable data, professional development and technical support for data interpretation, and time set aside for analyzing and interpreting data. For definitions of terms used in this report, see Exhibit A-1 in Appendix A.

To understand the role of data systems and the supports necessary for teachers to use data from any source (electronic and nonelectronic) to inform educational practice, the U.S. Department of Education's Office of Planning, Evaluation and Policy Development is sponsoring a national study, the Study of Education Data Systems and Decision Making. The study is addressing a set of basic questions:

1. What kinds of systems are available to support district and school data-driven decision making? Within these systems, how prevalent are tools for generating and acting on data?
2. How prevalent are organizational supports for school use of data systems to inform instruction?
3. How are school staff members using data systems? Do they know how to interpret student data? How is school staff members' use of data systems and of data more broadly influencing instruction?

This report describes interim findings from the first round of data collection and analysis for that study.

Conceptual Framework of Data-Informed Decision-Making Process and Supports

The conceptual framework on which the study design and instrumentation were based is presented here as a prelude to the description of the study approach and early findings. Proponents of data-informed decision making call on educators to adopt a continuous-improvement perspective with an emphasis on goal setting, measurement and feedback loops so teachers and administrators can reflect on their programs and processes, relate them to student outcomes, and make refinements suggested by the outcome data.[4] To make this process continuous, educators must then implement the refined practices, again measuring outcomes and looking for places for further refinement. An important distinction between this practice and

[4] It should be noted that in business, a continuous improvement process is feasible under conditions where there is standardized implementation of a set of processes and standardized measurement of outcomes. Under these conditions, monitoring of outcome measures typically results in small, incremental improvements to the standard process. Within schools, standardized implementation of teaching practices is not the norm, so implementing continuous improvement processes becomes more difficult.

most educational programs or reforms is that this improvement cycle does not end with the first set of program refinements—it is a way of thinking and a way of life rather than a discrete event or process (Schmoker 1996).

Exhibit 1-1 shows the stages in a data-informed, continuous-improvement process: plan, implement, assess, analyze data and reflect (as a precursor to more planning and a refined implementation). As the graphic suggests, components of data-informed decision making are part of a continuous cycle. The starting point may vary, and there is no fixed end point. In addition, key prerequisites and supporting conditions are essential for this process to be successful.

Exhibit 1-1

Conceptual Framework for Data-Informed Decision Making

Prerequisites and Supporting Conditions					
1. Data systems	2. Leadership for improvement and use of data	3: Tools for generating data	4. Social structures and time set aside for reflection on data	5. Professional development and technical support for data interpretation	6. Tools for acting on data

The Process of Using Data for Improvement

The stages in this cycle, though often closely linked and overlapping in execution, can be characterized as follows:

Reflect. As educational decision makers review their current practices and outcomes, they identify areas in which improvement is needed. A formal needs assessment may be conducted.

Plan. In response to concerns about existing practices or outcomes, educational decision makers may devise a plan. For example, a district concerned about low or uneven reading levels among students in the primary grades may decide to adopt a particular reading curriculum for all its primary classrooms. A school may design a "safety net" program for students who scored below grade level on the prior year's mathematics test. Often, a group of teachers or administrators will jointly design the new process or materials.

Implement. Once an intended educational change is planned, it must be implemented within the school or classroom. Implementation includes (a) disseminating documentation and supporting materials concerning the new approach and (b) training the teachers, administrators or other personnel responsible for making it happen. It also includes the decisions that these individuals make in deciding how to implement the mandated or agreed-on change within their particular school or classroom.

Assess. An organization dedicated to continuous improvement does not just implement a new program or process. The organization builds in opportunities to measure the outcomes obtained with the educational change. Often, this effort will include some kind of student assessment such as district end-of-unit tests or teachers' quarterly appraisals of students' writing fluency. Depending on the nature of the innovation, the measured outcomes could be of many different types, including, for example, student attendance or parent attitudes toward the school as expressed on a survey or through participation in parent-teacher conferences.

Analyze data. Having accumulated assessment data, educators then need to analyze the data in ways that relate the outcomes to processes and turn the data into actionable information. Often this analysis includes segmenting the findings by student subgroups or by groupings used within the school or classroom (because students in different groups received different services). It may also include the analysis of data trends over time and the search for patterns in multiple measures related to a given change or issue.

Reflect. Having analyzed the data, educators then must make sense of observed changes or the lack of change. This reflection stage is where participants interpret the findings of the data analysis and draw implications for action—that is, where they develop ideas for how they can refine and improve their program. The inferences drawn in this stage lay the groundwork for developing a new plan.

Supports for the Process of Using Data for Improvement

Making the continuous-improvement perspective and the processes of data-informed decision making part of the way in which educators function requires a major cultural change. Such a change will not occur without leadership, effort and well-designed supports. The bottom portion of Exhibit 1-1 identifies six major types of prerequisites and supports for data-informed decision making: (a) state, district and school data systems; (b) leadership for educational improvement and the use of data; (c) tools for generating actionable data; (d) social structures and time set aside for analyzing and interpreting data; (e) professional development and technical support for data interpretation; and (f) tools for acting on data. The national Study of Education Data Systems and Decision Making, part of the National Technology Activities (NTA) task order, is collecting data on the prevalence and quality of student data systems and associated supports. The nature of these systems and supports are described below.

Data systems. NCLB has stimulated an unprecedented level of state activity directed at improving education data systems. Federal requirements for reporting schools' year-to-year progress in raising achievement overall and for specific student categories have led to an examination of information system adequacy and the adoption or development of new software systems in many states. State systems typically include student enrollment information, basic demographic data, special program designation (if applicable), and scores on state-mandated achievement tests (in most cases, an annual spring testing in language arts and mathematics and often a proficiency or "exit" examination required for a high school diploma).[5]

The National Center for Educational Accountability (NCEA) has undertaken a systematic review of the characteristics of state-level education data systems. Over the last four years, states have made major strides toward putting in place data systems that will support longitudinal analysis of student progress. In 2005, for example, 36 states used unique student identification numbers statewide so students could be followed if they changed districts. In 2007, 45 states did so. As of 2007, a majority of state systems also included student-level enrollment, demographic and program participation information; the ability to match individual students' test scores from year to year to measure academic growth; and student-level graduation and dropout data. Less prevalent were the inclusion of scores on college readiness examinations (such as the SAT, ACT or Advanced Placement exams); the ability to match students' Pre-K–12 records with the state's higher education system records; and a data audit system for assessing data quality, validity and reliability.[6]

School districts typically maintain their own data systems. In addition to student scores for state-mandated tests, which they get from the state or the state-designated vendor, district systems often include information about a student's teachers, grades, attendance, disciplinary infractions and scores on district tests.

In terms of the software applications designed to support access to and analysis of data from these systems, most of the commercial products are targeted to districts. If districts have developed and implemented districtwide assessments that students take throughout the school year, these products typically support school-level access to the assessment results.

Other software applications are targeted for school use, and these tend to include features such as electronic grade books and the capability to incorporate teacher-developed formative assessments. Some of these applications have the capability to store examples of student work in an "electronic portfolio."

In theory, state-, district- and school-level data systems could be interoperable (U.S. Department of Education 2004), and there could be "one-stop shopping" for educational data

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[5] *NCLB* requires that states create annual assessments that measure what children know and can do in reading and mathematics in grades 3 through 8 and that they test at least once between grades 10 and 12 by 2005–06 for reading and mathematics and by 2007–08 for science.

[6] See http://www.dataqualitycampaign.org/survey_results/ for a complete report of NCEA's 2007 state survey.

coming from sources ranging from the individual school to the U.S. Department of Education (what one vendor characterizes as the "secretary to Secretary" solution). Such a set of integrated systems does not yet exist, but federal efforts are moving toward uniform and consolidated reporting of data to the federal level, and some states are attempting to incorporate features in state systems that will make them more useful to districts and schools (Palaich, Good and van der Ploeg 2004).

Leadership for educational improvement and use of data. Pioneering efforts to promote data-informed decision making within districts and schools have found that the active promotion of the effort on the part of the superintendent or principal is vital (Cromey 2000; Halverson et al. 2005; Herman and Gribbons 2001; Marsh, Pane and Hamilton 2006). District and school leaders need to issue the "call to arms" for improving education and using data as a tool to bring about that improvement. Typically, they play a major role in framing targets for educational improvement, setting expectations for staff participation in data-informed decision making, and making resources such as supported time available to support the enterprise.

Tools for generating actionable data. Increasingly, student achievement data are available at the school level in a form that can be disaggregated by student category (ethnicity, free or reduced-price lunch status, special education status and so on). Software systems to support data-informed decision making all generate standard student achievement reports, and many also produce custom reports for user-designated student groups (an important feature for school staff members who want to examine the effects of locally developed services for specific student groups). Research indicates, however, that often, school staff members do not find the kinds of data these systems provide particularly useful for guiding instruction (Mandinach et al. 2005; Marsh, Pane and Hamilton 2006). School staff members are frustrated by the fact that the data available to them are typically data reflecting performance on a state achievement test taken six or more months earlier. Teachers want up-to-date information on their current group of students, not the students in the same grade level last year. They want a greater level of detail concerning individual students' strengths and weaknesses than they can get from standardized test scores (Thorn 2002). Although far less common than systems that provide data from prior testing, there are examples of systems that produce additional information for decision making through tools such as formative assessments that students may take online. In addition, some system design companies are working on education information systems that would integrate data on a broad range of transactions such as daily school attendance, grades and even library book checkouts, with the ultimate goal of automatically recording each interaction a student has with the school and student's assessment and program participation data.

Social structures and time set aside for analyzing and interpreting data. The most sophisticated data warehouse in the world will have no effect on instruction if no one has—or takes—the time to look at the data, reflect on them, and draw inferences for instructional planning. Given that time is one of the most basic resources in any organization, there need to be strong expectations that educators will take the time to examine data and use those data to guide improvements in their programs and practices. Teacher survey data show that setting time aside for such activities is not business as usual in American schools (U.S. Department of Education 2008b). Case studies of schools that are active in data-informed decision making suggest that organizational structures that include time set aside for reviewing and discussing data in small groups greatly increase the likelihood that the examination of data will be conducted and will lead to well-informed decisions (Choppin 2002; Cromey 2000).

Professional development and technical support for data interpretation. Teacher training generally has not included data analysis skills or data-informed decision-making processes in the past (Choppin 2002). Few administrators have this kind of training either (Herman and Gribbons 2001). Moreover, the measurement issues affecting the interpretation of assessment data—and certainly the comparison of data across years, schools or different student subgroups—are complicated. Data misinterpretation is also a real concern (Confrey and Makar 2005). For this reason, districts and schools are devoting increasing amounts of professional development time to the topic of data-informed decision making. Many argue that the practice of bringing teachers together to examine data on their students and relate those data to their practices is a valuable form of professional development in its own right (Feldman and Tung 2001). Some districts are using Enhancing Education Through Technology (EETT) professional development funds to underwrite these activities. In addition, some districts that have been active in this area provide data "coaches" or other means for accessing technical expertise to school teams engaged in looking at data.

Tools for acting on data. The examination of data is not an end in itself but rather a means to improve decisions about instructional programs, placements and methods. Once data have been analyzed to reveal weaknesses in certain parts of the education program or to identify students who have not attained the expected level of proficiency, educators need to reflect on the aspects of their processes that may contribute to less-than-desired outcomes and to generate options for addressing the identified weaknesses. Some of the data-informed decision-making systems incorporate resources that teachers can use in planning what to do differently. These resources are typically organized around state content standards and may include lesson plans, instructional materials or descriptions of best practices (Palaich, Good and van der Ploeg 2004). Resources for differentiated instruction can help teachers adapt their instructional approach to students with differing strengths and weaknesses.

Data Sources for the Interim Report

Findings from this report are drawn from both survey and case study data. The survey data include two data sets from the U.S. Department of Education's National Educational Technology Trends Study (NETTS). The primary data set for this report consists of responses of a random sample of K–12 teachers to a survey administered to 2,509 teachers in spring 2007. The teachers were clustered in schools sampled from districts participating in a NETTS district survey. The NETTS district survey was sent to a nationally representative sample of 1,039 districts also surveyed in spring 2007. Both teachers and districts were asked to report on activities during the 2006–07 school year.[7]

For the case studies, the site selection process began with identifying districts that have been active in using student data to inform instruction. The research team then worked with the selected districts to identify appropriate schools. By focusing fieldwork on districts where many

[7] The response rate for the teacher survey was 86 percent, and the response rate for the district survey was 94 percent. Additional information about the NETTS survey samples can be found in Appendix A.

teachers could be expected to be actively looking at student data, the study team increased the likelihood of seeing effects of data use on practice, compared with a sample of schools drawn at random.

District sites were identified through three methods:

- Nominations by TWG members and other leaders in educational technology, researchers, vendors and staff of professional associations such as The Consortium for School Networking and State Educational Technology Directors Association, supplemented by a search of conventionally published and Web-published literature on data-informed decision making, to identify schools and districts with reputations as leaders in this area
- Recommendations by ED staff members
- Phone interviews with relevant staff members in nominated districts

The final set of 10 districts for the first round of site visits in 2006–07 comprised three districts using their own locally developed systems and seven using commercial systems (each district using a different commercial system). They represented nine different states and comprised six large and four medium-size districts, with student enrollments ranging from fewer than 6,000 to more than 164,000 students.[8] Student poverty levels ranged from 13 percent to 70 percent of student enrollment, and the percentage of minority students ranged from 12 percent to 87 percent.

For each of the 10 districts selected for study, the study team contacted the district representative by phone to gain recommendations for three case study schools, based on the following criteria:

- One elementary or middle school that the district considers *high* in its data use practices
- One school that has shown improvement in its use of data to guide instruction (*emerging*)
- One school that is *typical* of the district with respect to use of data systems

Researchers asked the district to recommend, to the extent possible, three schools serving demographically similar students at the same grade level (either elementary or middle school).

[8] Conclusions based on the case study districts should not be extended to all districts because they are not a nationally representative sample, but they do provide more in-depth information about data use practices that can be brought to bear in interpreting data gathered through national surveys. In particular, the generalizability of data from the case study sample to small districts (enrollments of fewer than 5,000 students) is limited; none of the districts visited in 2006–07 was small because small districts could not satisfy the requirement for three schools from the same grade span (i.e., three elementary or three middle schools). These smaller districts serve approximately 32 percent of the student population in public elementary and secondary districts in the nation as reported in the National Center for Education Statistics Common Core of Data (Hoffman 2007). District size can have a significant effect on the resources that school districts can apply to technology and professional development.

Within each school, the principal, an instructional or data coach (if applicable), and six teachers were interviewed.

One of the 10 selected districts (large with a locally developed system) was unable to accommodate a site visit until the 2007–08 school year. The demographic and achievement data for the nine districts in the 2006–07 site visit sample are shown in Exhibit 1-2. For each district visited, respondents included key staff members involved in the district's data-informed decision making activities (e.g., chief information officers, directors of curriculum and instruction, directors of research and evaluation, directors of accountability, directors of professional development).

Exhibit 1-2
2006–07 Case Study Districts

District and Schools	Demographics	Percentage Attaining 2006 Proficiency Levels	State Average Proficiency Levels
District 1 3 middle schools	Student enrollment = 132,482 (very large) Percentage minority = 74% Percentage poverty = 62% No. of schools = 211	Reading (Gr. 8) = 48% Math (Gr. 8) = 11%	Reading (Gr. 8) = 41% Math (Gr. 8) = 26%
District 2 3 elementary schools	Student enrollment = 164,295 (very large) Percentage minority = 50% Percentage poverty = 20% No. of schools = 238	Reading (Gr. 4) = 87% Math (Gr. 4) = 83%	Reading (Gr. 4) = 87% Math (Gr. 4) = 81%
District 3 3 elementary schools	Student enrollment = 137,798 (very large) Percentage minority = 59% Percentage poverty = 39% No. of schools = 199	Reading (Gr. 4) = 90% Math (Gr. 4) = 89%	Reading (Gr. 4) = 86% Math (Gr. 4) = 86%
District 4 2 elementary schools & 1 middle school	Student enrollment = 39,213 (large) Percentage minority = 82% Percentage poverty = 64% No. of schools = 61	Reading (Gr. 4) = 84% Math (Gr. 4) = 86% Reading (Gr. 8) = 88% Math (Gr. 8) = 86%	Reading (Gr. 4) = 84% Math (Gr. 4) = 88% Reading (Gr. 8) = 89% Math (Gr. 8) = 71%
District 5 3 elementary schools	Student enrollment = 26,229 (large) Percentage minority = 87% Percentage poverty = 70% No. of schools = 55	Reading (Gr. 4) = 39% Math (Gr. 4) = 32%	Reading (Gr. 4) = 63% Math (Gr. 4) = 54%
District 6 3 elementary schools	Student enrollment = 5,599 (med.) Percentage minority = 64% Percentage poverty = 43% No. of schools = 14	Reading (Gr. 4) = 51% Math (Gr. 4) = 43%	Reading (Gr. 4) = 56% Math (Gr. 4) = 48%
District 7 3 elementary schools	Student enrollment = 9,685 (med.) Percentage minority = 58% Percentage poverty = 61% No. of schools = 19	Reading (Gr. 4) = 82% Math (Gr. 4) = 63%	Reading (Gr. 4) = 88% Math (Gr. 4) = 81%

Exhibit 1-2 (continued)
2006–07 Case Study Districts

District 8 3 elementary schools	Student enrollment = 10,780 (med.) Percentage minority = 71% Percentage poverty = 62% No. of schools = 22	Reading (Gr. 4) = 39% Math (Gr. 4) = 50%	Reading (Gr. 4) = 64% Math (Gr. 4) = 71%
District 9 3 middle schools	Student enrollment = 22,174 (med.) Percentage minority = 12% Percentage poverty = 13% No. of schools = 29	Reading (Gr. 8) = 63% Math (Gr. 8) = 60%	Reading (Gr. 8) = 43% Math (Gr. 8) = 42%

Note: Numbers have been used to label districts for confidentiality reasons. The same number for a district is used throughout the report to support comparisons of data. Achievement data refer to the percentages of students who have scored proficient or above in reading and math in comparison with state standards based on state Web-site data. The number of district schools excludes early childhood centers and charter schools.

Teachers to be interviewed were nested within the purposive sample of schools. Even though schools were selected because they used student data systems in instructional decision making, variability was expected across teachers with respect to how they were using data for instructional decision making. (Such variability is typical for educational reforms and was found for data-informed decision making in earlier school case studies (Marsh, Pane and Hamilton 2006)). Therefore, project staff members requested that the principal of each case study school nominate three active practitioners of data-informed decision making and three teachers who represented average use. In this way, the study expected to capture "best practices" within the school but still maintain a realistic perspective with regard to the pervasiveness of those practices.[9]

An additional round of case studies will be conducted in school year 2007–08. A second sample of districts has been drawn from the pool of districts that remained after the initial selection of 10 districts, supplemented by additional districts identified as being involved in data-informed decision making activities. These districts included Broad prize winners and nominees as well as selected districts participating in focus groups at the U.S. Department of Education to discuss issues related to education technology (i.e., districts using data to support instructional decision making).[10] The 2007–08 case study sample also includes a small district (for which an exception was made to the requirement of having three schools serving the same grade levels).

Contents of This Report

This interim report focuses primarily on describing the types of data available to school staff members, how school staff members use electronic data systems, school practices with respect to data-informed decision making, and the supports and challenges for school use of

[9] It is quite possible that the teachers whom principals described as typical in terms of data use were in fact better than average for the school. When this potential bias is considered along with the fact that the study conducted case studies in districts that were considered leaders in the instructional use of data, the reader should be aware that the teachers' understanding of data described herein is likely to be better than that of average teachers.

[10] The districts participating in the focus groups were identified through expert nominations and purposively sampled to obtain a balance by size (small, medium, large) and geographic region.

student data in planning and implementing instruction. In addition, Chapter 4 describes findings from the presentation of data scenarios to teachers who were asked a series of questions related to how they could understand and use hypothetical data sets. The chapters of the report are organized around these issues, with survey and case study data on the same issue presented together. Chapter 5 summarizes the study's early findings.

2. School Data Practices

Most states and districts have relied on cohort data to document academic achievement. This type of data is often used to present results of student performance on annual assessments and to compare schools and districts. What cohort data do not provide is information on the progress of individual students over time or the capability to disentangle changes in achievement from changes in the composition of the student cohort.

Recently, considerable effort has been put into building data systems at the state level that are capable of tracking performance of students over time. For example, the Institute of Education Sciences in the U.S. Department of Education awarded grants of $52.8 million in 2006 and $62.2 million in 2007 to state education agencies (SEAs) for the design and implementation of statewide longitudinal data systems. The Data Quality Campaign, a national collaborative effort to encourage and support the implementation of state longitudinal data systems to improve student achievement, has sponsored an annual survey of states to assess how many of the 10 "essential elements" of a longitudinal data system each state currently has (Data Quality Campaign 2007).[11]

The data collected in this study suggest that the extensive state-level activity around longitudinal data systems has not yet had a major effect on local use of student data. Much of the data available to educators comes from local data systems. In the 2006–07 NETTS teacher survey, among teachers reporting access to an electronic data system that provided them with student data, the vast majority (79 percent) reported that the data system was provided by their district. Just a third of these teachers (33 percent) reported that the data system was by their school, and just 17 percent said that it was provided by their state (respondents could indicate more than one source).[12] Teachers in the nine NTA case study districts also relied on their districts' electronic information systems as the primary source for student data. Case study districts were located in states with state data systems that represented a broad continuum in terms of implementation of a longitudinal data system: the systems within these nine states had between three and nine of the Data Quality Campaign's 10 essential elements of a longitudinal data system (a summary is provided in Exhibit A-2 in Appendix A).

District Data Systems

Proponents of data-informed decision making in education offer the vision of an integrated system of systems, combining longitudinal information on each individual student's school history, data needed for accountability as well as finance, personnel, food service, and even transportation data (U.S. Department of Education 2004; Wayman 2005). This vision is valuable in setting a direction for policy-makers, but even in districts nominated as leaders in the use of student data systems, it is still not a reality. Typically, the information needed for educational decision making is spread across multiple systems without mechanisms for regular transport of

[11] In 2007, among the 50 states and the District of Columbia, three had one to three elements, 11 had four to five elements, 21 had six to seven elements, 12 had eight to nine elements, and four had all 10 elements.

[12] Even though teachers using a data system are most likely to be using a system provided by their district, a good portion of the data in the district's system may have come from the state system.

information from one system to another.[13] When asked what system provided student data that schools use for decision making, staff members at the nine districts in the spring 2007 case study sample all mentioned two or more separate systems. A summary of the types of data systems used in the case study districts is included in Exhibit A-3 in Appendix A.

This state of affairs is a natural outgrowth of the multiple purposes for which student information is collected and the fact that systems have tended to be developed (and marketed) over time around a range of specific needs. The typical district has a data system for tracking required special education services, for example, which is separate from the system that maintains the longitudinal enrollment histories of students generally. Some systems are geared to capturing daily transactions such as attendance and grades while others are designed for access to longitudinal records (Wayman 2005). Although it is not necessary to have all types of data in a single system, lack of interoperability between systems creates inefficiencies in data input, and differences in system interfaces increase training requirements for district and school staff.

Wayman (2005) defines four kinds of student data systems in widespread use:

1. Student information systems provide real-time access to student data such as attendance, demographics, test scores, grades and schedules.
2. Data warehouses are electronic data collection and storage systems that provide access to current and historical data on students, personnel, finance, etc.
3. Instructional/curriculum management systems provide a unifying framework to support access to curriculum and instructional resources such as planning tools, model lesson plans, creation of benchmark assessments, linkage to state content or performance standards, communication and collaboration tools (e.g., threaded discussion forums).
4. Assessment systems support rapid organization and analysis of benchmark assessment data.

The most frequent types of electronic data maintained by districts—based on all districts responding to the 2006–07 NETTS district survey—were student attendance (96 percent), grades (93 percent), demographics (92 percent), special education information (91 percent) and course enrollment histories (88 percent)—basic elements of a student information system. Student test scores on statewide assessments were maintained in electronic form by 86 percent of districts. Fewer districts stored electronic data on teacher qualifications (62 percent) and on participation of students in particular educational programs such as those using an innovative classroom curriculum (77 percent).[14]

The nine districts in the spring 2007 case study sample were similar to the national sample. They all had student information systems, but, as noted above, the data typically were captured in several different systems with some limitations in interoperability. Data warehouses with

[13] National estimates on the types of student data systems in districts and how long they have been available will be provided through the 2007–08 NTA district survey (Questions 3 and 4).

[14] Information on the types of data in district information systems will be updated through the 2007–08 NTA district survey (Question 5).

longitudinal data were available in about half of the case study districts, but curriculum management systems were used by just two.

One theme that emerged from the case studies was the extent to which multiple systems were used to house education data, without necessarily having any efficient procedures (or sometimes without any capability at all) for connecting data from different systems. One district described the use of four different data systems: one for state and district assessment scores, one for student demographic and enrollment information, one for discipline reports, and one for special education. Across case study districts, it was typical to find separate systems for longitudinal data, teacher professional development data and special education data. None of the districts had an integrated data system and data warehouse of the kind described in the 2004 National Technology Plan (U.S. Department of Education 2004, 44).

Teacher Access to Student Data Systems

Among the nationally representative sample of teachers taking the NETTS teacher survey, roughly three-quarters (74 percent) reported having access to an electronic student data system in school year 2006–07, up from 48 percent in the NETTS teacher survey conducted in 2005.[15] Although this trend in the survey data is encouraging, the school case studies provided an opportunity to get a deeper understanding of data system access issues. The question of data access is actually surprisingly complex. Does access mean that a teacher can get the data out of the system herself or just that there is a way that she can get data from the system if she asks someone for it? What if a teacher is allowed to see some kinds of data for his students but not other kinds, or what if he can see data for some of his students but not all? Does a teacher have access if she can get only standard reports and cannot frame any of her own data queries?

Teachers in all of the case study districts had some form of access to student data, but teachers could get assessment data for their students out of the data system themselves in only four of the nine districts.[16] Many districts consider having relevant data extracted for teachers to be a more efficient, reliable practice than trying to train teachers to extract data for themselves. Teachers could extract some but not all assessment data for their students in an additional two districts. In three districts, teachers received data reports from the district office but could not extract student data on their own.[17]

Although case study districts were selected because of their activity in promoting data systems, teachers in the selected schools reported little firsthand use of data systems. It was rare for case study teachers to describe accessing student assessment data from a system themselves for any purpose other than analysis of their students' responses to individual assessment items. In

[15] The 2005 NETTS teacher survey was administered to a nationally representative sample of K–12 teachers in fall and winter 2005. Teacher respondents were asked to report on activities in the 2004–05 school year. Teachers were sampled from 957 schools within districts selected for the NETTS district survey. These are the same districts that participated in the 2007 NETTS district survey (see U.S. Department of Education 2008a for additional information on these surveys).

[16] Among teachers sampled from six case study districts who responded to the NETTS teacher survey, 80 percent reported having access to an electronic data student data system in 2006–07 compared with 74 percent of teachers in non-case-study districts.

[17] Information on the access that school staff have to student data systems will be updated through the 2007–08 NTA district survey (Questions 9–11).

two-thirds of the districts, there were one or more staff members at the school site who would produce data reports for teachers. In a number of cases, this practice was a deliberate decision on the part of the district to provide this resource, either because teachers were viewed as already overburdened or because there were doubts about teachers' ability to use the system or understand the data by themselves. Even a district that began by purchasing a laptop for every teacher to use for accessing the data system concluded that teachers would not do so with any frequency on their own and ended up creating assessment and instructional coach positions to help teachers connect data to instruction. Staff members in one case study district made it clear that they did not think that school access to student data systems would be a good practice. District staff members expressed concern that principals might use data from the system inappropriately to evaluate teachers.

Types of Data Available to Teachers

Among the 74 percent of NETTS teacher survey respondents who said that they had access to a student data system, the most common types of data available to teachers were attendance data (74 percent) and student grade data (67 percent)—the same types of data that districts reported frequently having in their electronic data systems. Teachers also reported access to data on their current students: 77 percent said that they could get access to standardized test scores (spring and fall 2006) for the students they were teaching currently, and over half (55 percent) had performance data on benchmark or diagnostic tests taken by their current students. Less than half (46 percent) of teachers with access to a student data system reported having access to data for students they had taught the preceding year. A much smaller percentage of teachers (29 percent) reported being able to access multiple years of test scores for individual students. Only 8 percent said that they could get information on any supplemental services their students were receiving. Exhibit 2-1 summarizes these survey findings.

Another perspective on teachers' access to data from a student data system can be gained by examining responses of district personnel completing the NETTS district survey. Less than half of the districts (46 percent) responding to the survey reported that their teachers are provided with all or most of the data available for their students. Forty-four percent indicated that they provide teachers with only a limited set of data on their students. Another 9 percent of districts reported that they do not make any data available to teachers on the students in their classrooms.

Exhibit 2-1
Data Available to Teachers in 2006–07

Types of Data Available	Percentage of Teachers With System Access	Percentage of All Teachers
Attendance data	74	55
Student grade data	67	50
Performance on benchmark or diagnostic tests taken by your *current* students	55	41
Spring 2006 standardized test scores for the students you taught last year (2005–06)	46	34
Spring 2006 standardized test scores for your *current* students	44	33
Fall 2006 standardized test scores for your *current* students	33	25
Multiple years of standardized test scores for individual students	29	11
Course enrollment histories for students	22	16
Students' prior school(s) attended	16	12
Students' participation in supplementary education programs (e.g., tutoring)	8	6

Exhibit reads: Among teachers who had access to an electronic student data system in 2006–07, 74 percent reported that they had access to student attendance data through the data system, which represents 55 percent of all teachers (with or without access to a data system).

Source: 2006–07 NETTS teacher survey.

The purposes for which teachers reported using data from student data systems are shown in Exhibit 2-2. The most common purposes reported by teacher survey respondents were informing parents about student progress (68 percent),[18] tracking individual student scores (65 percent), and estimating whether students are making adequate progress (64 percent). Additional purposes cited by a majority of teachers with data system access were tracking other measures of student progress (59 percent) and identifying skill gaps for individual students (55 percent). (Unless otherwise indicated, all percentages reported for teacher survey respondents in the remainder of this report are for the 74 percent of teachers who reported that they had access to an electronic student data system in 2006–07.)

[18] Teachers responded that they used an electronic student data system for a specified activity for one of a set of specified frequencies during the 2006–07 school year (i.e., a few times, once or twice a month, or once a week or more).

Exhibit 2-2

Teachers' Use of Student Data

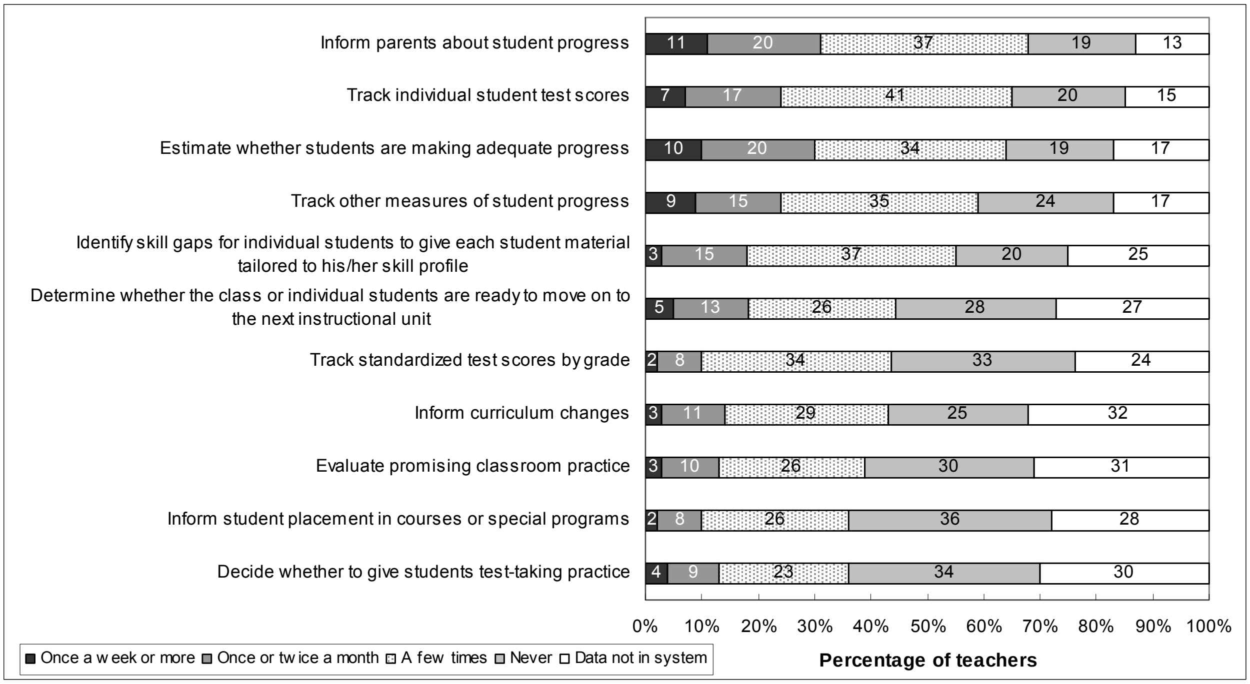

Exhibit reads: Among teachers who had access to an electronic student data system in 2006–07, 11 percent responded that they used data to inform parents about student progress once a week, 20 percent once or twice a month, 37 percent a few times, and 19 percent never; 13 percent indicated the system did not provide data for this purpose.

Note: Totals may not add to 100 percent because of rounding.

Source: 2006–07 NETTS teacher survey.

The extent to which teachers conduct these data use activities is likely to be influenced by teachers' perceptions of system capabilities. For example, about a third of teachers reported that the system they had access to did not provide data to inform curriculum changes (32 percent) or to evaluate promising classroom practices (31 percent). A potential source of ambiguity in teachers' data use reports is teachers' varying interpretations of their roles (as well as the role of data) in functions such as curriculum change and evaluation of practices; these functions may be seen as district responsibilities. In addition, districts may have policies that run counter to teachers' use of data for some kinds of decision making. For example, 63 percent of teachers reported knowing how to use student data to refine what and how they teach, but 60 percent also reported that regardless of what the data tell them, they need to keep up with state- and district-mandated pacing plans.

In the case study schools, teachers commonly described the use of data for placing students in different classes or programs and as a basis for grouping students within classes for differentiated instruction. Teachers reported that the use of assessment data for this purpose had increased their confidence in their decisions. As one reported, "Before, we had nothing to back up our professional judgment. Now we can pinpoint where a student has a problem. It has increased our workload, but it has made us better at diagnosing." Teachers also reported using data (from benchmark assessments) to decide whether to reteach. It was less common for teachers to report the use of data as a stimulus for reflection on their own teaching approach, but instances of this use were observed in four districts. For example, at one school, teachers use a team approach to problem solving. Teachers work together in their grade-level teams to analyze and talk about data. If teachers find that their classes are performing at low levels on a particular standard compared with those of some of their colleagues, they work with other teachers to get ideas for ways to better teach that standard.

A use of data reported in case study schools that was not included in the NETTS survey item was for school improvement planning. Interviewees described cases in multiple districts in which the state mandated annual improvement planning, and either the district or the principal brought in school data as part of this process.

Social Context for Data Use

Among NETTS teacher survey respondents, the most commonly reported context for using a student data system was on one's own (78 percent), followed closely by data use with colleagues in a department or grade (71 percent). Fifty-nine percent of teachers said that they had used data as part of a district-run activity for staff members from their school. Just 28 percent had done so as part of a district activity for teachers from multiple schools, suggesting that districts view the school as the appropriate unit for professional development in this area.

In each of the case study districts, the study team found schools where teachers looked at data on their own and in groups. The most frequently cited groupings for data use were the grade-level team, sometimes facilitated by a coach, and all-staff faculty meetings. Other types of groupings in which teachers used data included cluster team meetings, curriculum groups (department teams in middle schools), schoolwide special-purpose teams, and cross-grade teams. In one district, teachers at the high-data-use school are actively involved in data discussions during weekly grade-level meetings, where they examine data collectively and use the data to help them form cross-class groupings for reading. Additionally, there are cross-grade meetings during which teachers discuss student scores, skills that students are struggling with, and how teachers should work collaboratively across grades. These cross-grade meetings were initiated when data identified low math scores as a schoolwide problem. The school has also set up its own server where teachers can share instructional materials, assessment data and student work and where primary-grade teachers can store reading assessment data that are not kept on the district's electronic data system.

Teachers at a school in another district are encouraged to use data collaboratively and on an ongoing basis. The assistant principal and reading specialist retrieve data monthly from the district data system for each tested grade level and put it into a spreadsheet so school staff members can examine student performance by teacher, by grade, by subgroup or by educational program. These spreadsheets are updated after every test window in reading and math so teachers can bring the reports to their team meetings to discuss student grouping. Twice a week, the school holds grade-level team meetings where teachers bring their own data and discuss which students need academic support, which students can graduate from academic support, which students need coaching in an accelerated class, and which students need to be moved out of the accelerated class. Teachers find it very important to learn how well students in other classes are doing because this information is useful when they plan their lessons collaboratively. In addition, grade-level teams meet with the principal three times a year to discuss data and instructional strategies—how well students have performed overall, how the academic support works in the classroom, what new goals they have set, and what they need to achieve their objectives. The principal at this school believes that teachers should know how to access and use data. To support this process over the past three years, the principal has provided all teachers with school-based training on how to use the data system and Excel.

Barriers to Use of Data Systems to Inform Instruction

Mandinach et al. (2005) have identified a set of factors that contribute to teachers' use of technology tools for data-informed decision making: easy access; short feedback loops (between taking assessments and receiving results); information comprehensibility; flexibility (allowing data to be examined in different ways); and alignment with standards, instructional goals and classroom practice. Teachers participating in the NETTS survey and those in case study schools cited shortcomings in these areas.

A sense of what issues are getting in the way of teachers' use of data can be gleaned from teachers' ratings of attitude-related statements on the NETTS teacher survey (displayed in Exhibit 2-3). The biggest concern expressed by surveyed teachers was with their ability to use a system to form data queries. Whether teachers feel hindered because they do not know how to frame queries or because the system they have does not support user queries, only 33 percent of teachers said that they could form data queries to get pertinent data from the system. The other most commonly cited issues were the limited utility of the kind of information available in the student data systems for deciding what and how to teach (cited as a barrier by 29 percent); difficulty finding the information they are looking for on the system (24 percent); and difficulty in using the system (20 percent). Among school staff members who were interviewed as part of the case study research, the three most commonly cited barriers to school use of data were (a) lack of training in how to use the data system or to derive instructional implications from it, (b) the lack of time to engage in data exploration and reflection, and (c) the weakness of the available data. State assessment data were criticized as coming too late in the year to be very useful in some districts and as being too gross a level to provide guidance on anything more specific than major topics or proficiency categories. District benchmark assessment data are collected more frequently and made available while teachers are still responsible for the examinees, but teachers in multiple case study districts questioned the quality of their districts' tests and their alignment with the curriculum.

Exhibit 2-3

Teacher Experiences Using Electronic Student Data Systems in 2006–07

Statement	Percentage of Teachers Who Agreed or Strongly Agreed
I am capable of forming data queries (asking specific questions and getting the pertinent data from the system)	33
The student data available are not really that helpful in deciding what or how to teach	29
I have trouble finding the information I want on the electronic student data system	24
The electronic student data system available to me is hard to use	20

Exhibit reads: Among teachers with access to an electronic student data system, 33 percent felt capable of forming data queries.

Source: 2006–07 NETTS teacher survey.

District staff members who were interviewed as part of the case study site visits provided their opinions concerning the barriers to data system use and data-informed decision making. District staff members voiced concerns similar to those articulated by teachers. Staff members at seven of the nine case study districts cited limitations in their data systems, including lack of system operability, cumbersome processes for generating custom reports, and lack of technology at the school level that would support teachers' access to and use of the data system. Staff members at seven districts cited limitations in the nature or timing of the data in the systems. As with teachers, the major complaints from district staff members were that the standardized test data do not provide enough information about students' specific skills and weaknesses to support instructional planning, that the system does not have data from formative (mid-year) assessments, and that state test data come too late (typically in the fall for the prior spring's examinations) to support school planning. Equally common among district respondents was concern that school staff members (both principals and teachers) lack the skills needed to use the data system and to analyze data effectively (seven districts). Other common district concerns (each expressed in five districts) were lack of buy-in from school (and some district) staff members, lack of assessments well aligned with curriculum standards or for primary grades, and lack of school-level staff members who could help teachers learn to access and use data from the system. Staff members at four districts expressed concern with resource requirements; administering assessments, implementing a data system, entering data and discussing data were all cited as activities consuming large amounts of staff time.[19]

An issue underlying many of the tensions around local use of data systems is the tradeoff between standardization and customization. The more powerful software systems for storing, manipulating and reporting student data require major expenditures, not only for software

[19] The NTA district survey will provide national estimates on current barriers to expanding data-informed decision-making practices (Question 25) and areas where districts and schools need more support for data system use and data-driven decision making (Question 24).

purchase but also for the hardware needed to host it and to provide school-level access, for staff and teacher training around system use, and so on. On the one hand, district investments in such systems typically are predicated on the assumption of a uniform set of reporting and data use practices across schools. Teachers and schools, on the other hand, often feel that the kinds of information available in a district system do not address the questions and decisions most important to them. School staff members often work with less formal, home-grown data sets such as student performance on school-developed final examinations that are kept in electronic spreadsheets. Districts like to see districtwide benchmark assessment data in the districtwide system, but (as noted above) teachers often expressed misgivings about the quality of the district assessments and therefore the usefulness of the data.

There may be strategies for resolving this tension. In one case study district, implementation of their student information system made district staff members aware of teachers' need for formative assessments and of the lack of districtwide tools for measuring end-of-course achievement. The data system prompted a district effort to have the curriculum specialist in each content area work with teacher representatives from each school to craft end-of-course assessments that all schools would use. Implementation of these assessments and a new data system designed to support teacher access to the resulting data is expected in school year 2007–08.

Districts do not necessarily want teachers to have direct access to student data. Although those advocating for educators' use of data for decision making describe active involvement by teachers in data-based inquiry (Brunner et al. 2005), school districts are far from unanimous in promoting this model. Even among the nine districts known for their promotion of data-informed decision making that constituted the case study sample, only four had direct teacher access to the data system as an active goal. An additional four districts viewed teacher access as a goal for the longer term, after the system is made more user friendly or after more teacher training. One district said that it had decided to limit teachers' access to the data system out of concern that data would be used inappropriately. Even principals in that district had access only to standard reports.

Having school-based staff members who can act as bridges between teachers and the data system appears to be an important facilitator. Six of the nine case study districts have school-based positions to support teachers' use of student data. A seventh district instituted district-level coach positions to help schools work with data. These positions are held by various types of staff members in different districts. The potential downside to this practice, as noted by Boudett and Moody (2005), is the risk that the generation and examination of data will come to be regarded as the responsibility of a single person within the school, without involving the school staff as a whole. The benefit of having this position is that this staff person can promote data use among teachers, provide access to data that teachers otherwise would not see, and model data analysis and reflection. For the most part, individuals in these positions in schools in the case study sample were involved in working with teachers on instructional issues. In several districts, an instructional coach or advisor led the school-level data use activities, sometimes in connection with a particular initiative such as Reading First. In some cases where there was no school-based position to support data use, principals or vice principals were trained on data system use and then expected to lead their teachers in these activities.

Although teacher access to student data systems has increased over time, the types of data available to teachers are not necessarily useful for instructional decision making. Survey and case study data suggest that many barriers still exist to the effective use of data by teachers, including the need for more user-friendly data systems, coupled with the need for additional training on how to use these systems and how to analyze data. In addition, many of the supports required for data-informed decision making are lacking. The district and school supports that are available to teachers are described in greater detail in the next chapter.

3. District and School Supports for Data-Informed Decision Making

The idealized model of data-informed decision making supports that are described in Chapter 1 provides a framework for examining the practices of districts and schools with respect to data use. This chapter explores the issues of data system integration, district and school leadership for data use, tools for generating and organizing data, and tools for acting on data that were found in actual practice in the case study districts and schools.

Data System Integration

Although schools are being exhorted to base their decisions on data, the systems available to them were not necessarily designed with their needs foremost in mind. Case study data suggest that most student data systems were built to address uses other than school-level instructional decision making. Moreover, the multiplicity of systems used by local educational agencies works against the integration of different kinds of information (e.g., discipline and attendance data, program placement information, district benchmark and state test scores) and requires school personnel to go through the ramp-up time to learn to use multiple systems.

All the districts in the case study sample had student data systems, but none had a fully integrated set of data systems. One district, for example, had an instructional management system that included the district curriculum standards, curriculum guides, instructional resources, all student assessment data and student demographics. A data warehouse stored the district's longitudinal data, and an online professional development data system was used to develop teacher professional development plans. Another district used three data systems. The student information system provided historical test information for each student, including past state and district tests (but not current scores). A separate Web-based transactional system was used by schools to transmit to the district information such as attendance, school lunch data and scores on district benchmark tests. This system included a grade book that was available, but not required, for teacher use. A separate system housed special education data.[20]

In general, it was quite common not only for districts to have separate systems for transaction capture (attendance and grades) and assessment data but also for these systems to be detached from instructional resources geared to standards. Hence, although the two NETTS teacher surveys suggest that teacher access to data systems increased dramatically between 2005 and 2007, the systems themselves do not necessarily support integrated planning and self-evaluation.

District and School Leadership for Data Use

Districts were nominated for case study on the basis of their leadership in the use of data for decision making, and not surprisingly, evidence of leadership in this area was found in all of them. Case study districts demonstrated their support and leadership for schools' use of data through a number of actions:

- Making data-informed decision making a priority and purchasing or developing a system that supported these activities

[20] The district was in the process of developing a data warehouse to link data from all these systems.

- Considering ability to use data as a criterion for teacher hiring (One district had developed interview questions on the use of data for instructional decision making and used these when hiring teachers.[21] Another had developed this kind of question for use when hiring district staff members.)
- Providing training and support positions for system implementation (and tracking usage).
- Districtwide data-informed decision making activities in addition to professional development (An example of this kind of activity is provided in Exhibit 3-1.)
- Using the data system for decision making at the district level (e.g., evaluating programs, principals, teachers).

Exhibit 3-1

A District and School Data Analysis Process

Every year, schools in this medium-size district get together to conduct "data digs" where school leadership teams have the opportunity to review and discuss their state test data. The teams use a collaborative inquiry process called the Data-Driven Dialogue to analyze and interpret their data. The process, adapted from Bruce Wellman and Laura Lipton (2004), can be used with any kind of data from any source. The process includes four steps:

- Predict—activate and engage interest in the data, access prior learning, name frames of reference, and establish common ground for dialogue.
- Explore—interact with the data, look for patterns and trends, identify data facts and surprises, make observations without inference, identify questions raised by the data, and develop problem statements.
- Explain—generate theories of causation, stay open to multiple possibilities, deepen thinking and identify "root causes" rather than symptoms, make inferences about data, and identify the additional data that will validate the theories of causation.
- Take Action—move from problems to solutions based on validated theories of causation, identify goals and specific related action steps, and identify data to be monitored to determine whether action steps lead to the solution.

All schools were initially provided training on the process by the State Consortium for Data-Driven Dialogue—District 8 is the lead district. The consortium was established with support from a $3.5 million, three-year grant from the SEA with federal EETT funds.

Information from the data digs is used to inform the development of the school's improvement plan, which is a requirement of the state accreditation process. Schools are then encouraged to continue to review their data throughout the year by means of a monthly action plan that implements and monitors progress on goals in the school improvement plan. School leaders who have embraced the use of data-informed decision making use the same data inquiry cycle to develop their monthly action plans and to work with grade-level teams to monitor student progress and progress on school improvement goals. Principals reported that the data digs have helped them to structure conversations with their staff members about data. Teachers can look at student progression in a particular skill or content area as a way to monitor their own instruction.

[21] Any increase in entry-level requirements has the potential to screen out job candidates with otherwise desirable attributes. However, no evidence was identified, one way or another, specific to any entry-level requirements for teachers' ability to use data.

Two districts were judged to have weaker leadership for data use than the other seven because one had a very compartmentalized approach to data use (there was little sharing across departments even though the district was an advocate of data use) and the other district was just beginning to address a more comprehensive approach to data use at the district level. Neither district is currently providing school-based staff members to support teachers' use of data (both districts have faced declining resources that have forced support staff cutbacks). Although both districts are acquiring new data systems that will enhance data accessibility and analysis capabilities, currently, neither has a plan for how it will provide the necessary professional development and ongoing support to school staff members to use these new systems.

At the school level, principals can show leadership with regard to data use by setting a personal example of data use, establishing expectations for data-informed decision making and working with teachers to interpret data. (An example of such a principal is provided in Exhibit 3-2.) Across case study schools, principals showed strong leadership in less than half of the schools. In two of nine districts, principals at all three schools set an example of data use. There was no clear pattern evident between principal leadership and school type (typical, emerging and high) in the case study sample, although principals who acted as data leaders were slightly more common in high-use and emerging schools than in typical schools. Principal leadership may appear less strongly related to data-informed decision-making activity in this study's sample than in prior case studies because of the presence of other school leaders or coaches assigned to work with teachers on data use.

Exhibit 3-2

Principal as Data Leader

The principal at a school identified for its exemplary use of data uses a broad range of data, including students' report cards and grades. She believes that grades, like behavior and attendance, are a reflection of student engagement. She also looks at enrollment data (e.g., if students selected the school by choice) and reviews individual target students' data with their teacher teams. The principal feels that teachers need data in their hands, and even though they have access to the district data system, she cleans and organizes school-level standardized testing data from the system for her teachers. Her philosophy is that it is much more important that teachers work with the data to understand it rather than work to organize it. She meets with teachers twice a month to talk about the instruction behind the test scores and provides ongoing data to support them. As the school year progresses, school staff members are encouraged to use a variety of data from individualized education programs (IEPs) and from in-house, district and specialized benchmark assessments to monitor students within their classes and departments. Teachers are expected to use these data to reflect on and discuss with their grade-level teams what is and what is not working instructionally. Teachers also base their initial referrals to have students assessed for special education on this review process. As a result, a culture of data-informed decision making has taken root at the school.

Schools set expectations for data use when they set aside time during school hours to discuss data. All schools in the case study sample provided at least minimal opportunities to discuss data (e.g., at department meetings or during a common planning time available to teachers of a particular grade or subject). The amount of time available for these discussions varied widely across districts and was only loosely correlated with schoolwide data practices. One district provided opportunities to discuss data in all schools two to three times per week. In another district, the high-use school used common preparation times and monthly professional development meetings to talk about data. This type of discussion occurred less frequently at departmental meetings in the emerging and typical schools in the same district, where principals often shared data only at the beginning of the school year.

School leaders can also encourage data use by working with teachers to help interpret their data. In some cases, the principal filled this role; in other cases, specialists and lead teachers did so. As research on school leadership has shown (e.g., Camburn, Rowan and Taylor 2003), when there are subject leaders in the school, they can play a role equal to that of the principal in terms of influencing instruction. In some case study districts, designated instructional or data coaches took on—or at least shared with the principal—the role of data leader. When coaches were present in a school, teachers were more likely to work with the coaches than with their principals on data interpretation, but in some of these schools, principals supplemented teacher meetings with the coach with their own meetings where they led the data discussions with teachers. In one district that did not have school-based coaches (they had been lost to budget cuts), the principal in the school nominated by its district as “high” in terms of data use was more active in working with teachers to review their data and discuss instructional implications than were the principals in schools described by the district as “emerging” or “typical” in terms of data use. In general, however, school-level supports for data use were more similar within than across districts.

Tools for Generating and Organizing Data

Another way for districts to promote data-informed decision making is to provide tools for generating and organizing data. Data systems that provide student achievement data in a form that can be disaggregated by student category through standard or custom reports help reduce the burden of analyzing data for school staff members. Some systems can provide data not only from standard and formative assessments but also from daily transactions such as school attendance or from receipt of special services such as tutoring.[22]

The case study districts represent a range of system capabilities with regard to providing formative assessment data, but all provided some form of reporting of student scores broken down by skill areas that schools could use for planning purposes. Four districts had data systems that incorporated student scores on interim assessments that were aligned with the state standardized tests, and a fifth district had some of its interim assessment data available through its data system. Two districts provided interim assessments that were not aligned with the state test, and another two districts were developing benchmark assessments that will be available in the data system at some future date. Even though all districts had systems that allowed analysis of student performance in specific skill areas, some district systems were more robust than others. For example, in one district, skill areas were sometimes covered by only one item on the assessment, making it easy for teachers to dismiss the assessment data. In another district, skill-level analysis of test data was possible for grades 3 and above, but not for primary-grade students. The systems in two districts provided standard reports by skill area, and they system in a third district allowed custom reports to be generated.

[22] The 2007–08 NTA district survey will provide prevalence estimates for tools for gathering data (Question 8).

Online assessments were less common in case study districts, with only two districts providing online assessments for any subject. Several other districts that did not provide online assessments did have other technology supports for assessment. Three had digital item banks that allowed schools to develop their own formative assessments, either in addition to or in place of district benchmark tests. Other districts used handheld computers, which allowed teachers to enter data as they administered tests and to generate reports instantly. In the three districts where use of handheld computers was a relatively common practice, handhelds were used for reading assessments in the early grades.

Organizational Structures Supporting Data Use at the School Level

Organizational structures that support data use at the school level can include (a) time set aside for teachers to review and discuss data in small groups, (b) designated support staff and (c) the adoption of procedures for discussing data. On the 2006–07 NETTS teacher survey, most teachers reported having positive perceptions of support for using and interpreting the data that they could access from data systems. A majority of teachers with access to a student data system (71 percent) agreed or agreed strongly that when they needed help making sense of the data in the system, they knew someone who could help, and 45 percent reported that someone else usually extracted the relevant data from the system for them.

Of those teachers who indicated on the NETTS 2006–07 teacher survey that they had access to a student data system, 58 percent reported that they received support for using data to guide instructional decisions from professional development received at their school and 56 percent reported receiving encouragement for using data from their school principal. A quarter of these teachers (25 percent) also reported receiving support from a consultant or mentor teacher skilled in data analysis.

Working in small groups can also support teacher use of data. Of the teachers who indicated that they had access to a data system on the 2006–07 NETTS teacher survey, 70 percent said that they were comfortable having their colleagues around when they examined performance data for their students, and 59 percent said that they knew how to work with colleagues in using student data to monitor progress and set goals.

In many districts, teachers were not compensated for the time they spent working with data. Less than a quarter of teachers (23 percent) had time available during the regular day for examining data, and a majority (59 percent) reported accessing the data system on their own time. Only 12 percent reported that they had other paid time set aside for examining student data and using data to guide decision making about practice.[23]

Case study districts provided stronger support for data-informed decision making than the typical level indicated in the NETTS teacher survey responses. As mentioned in the preceding chapter, a majority of case study districts had used school-based staff members to act as bridges between teachers and the data system. Six out of nine offered some sort of district-funded, school-based staff to support teachers' data use, but these staff varied in number, amount of time available and expertise. One district had just two district-level coaches to serve all 10 of its

[23] The 2007–08 NTA district survey will provide prevalence estimates for district supports for school use of data systems to inform instruction (Question 20).

elementary schools, while others had a coach assigned to each school. School-based coaches went by different titles such as data facilitator, technology specialist, system certified trainer or staff development teacher and often had other responsibilities such as instruction or serving as the curriculum specialist in reading, math or early childhood education. In some cases, there was additional personnel or more staff time provided to schools through the support of federal programs such as Title I Reading First. The activities of school-based support staff members are described further in Exhibit 3-3.

Exhibit 3-3

Activities of School-Based Support Staff Members

One key to the use of data to improve instructional practice at the elementary level in this large district (District 4) is the availability of full-time instructional advisors (supported by Title I funds) and certified data system trainers. Instructional advisors combine expertise in accessing data, understanding data, and designing instructional practices to address student needs identified by available data. Certified trainers are school-based staff members who are trained by the district to support the use of the district's data system. Trainers are involved in ongoing professional development by the district and an annual full-day certification update during the summer. Certified trainers initially provided training to their colleagues on how to get data out of the system, then moved to how to read data, and are now focusing on talking about data, using data and reviewing data. The extent to which the certified trainer role is combined with the instructional advisor role (not possible in every school) affects the availability of support to school staff members. That is, when certified trainers are full-time teachers, the time available for supporting their colleagues is more limited.

Two large districts have instituted a combination of school-based support staff and district policies such as common planning periods focused on data discussions to encourage data-informed decision-making practices at their schools.

District 2 is focusing its efforts on school-based professional development through teams of specialists provided to each school. There is a full-time technology specialist in every school who has responsibility for training school staff members on using the district data system as well as on the use of technology in instruction and the use of assessment tools; the specialists have received training on the district benchmark assessments. (Principals and secretaries are also trained on how to access the system.) In addition, there are assessment and instructional coaches who support school staff members. All high schools have full-time assessment coaches who work with teacher leaders and principals on data access, data interpretation and instructional planning. The assessment coaches also help manage testing systems. There are 20 instructional coaches who provide full-time support to the neediest schools, while other schools share a coach. Instructional coaches have expertise in curriculum and provide teachers with instructional strategies based on test results. Coaches also train and support teachers on how to use the district data system and analyze their data. All district elementary schools close early on Monday afternoons so teachers can meet either within their grade level or across grade levels to examine data and collaboratively plan instruction.

District 5 provides literacy and math coaches to all its elementary schools (although their numbers are shrinking because of declining funding from federal programs). Coaches are responsible for clarifying data reports with teachers, reviewing data trends, and modeling lessons and practices for teachers. Principals are required to print out and deliver data reports to their teachers on their students' academic performance. The district has incorporated data discussions into weekly teacher common planning times (one hour every week). In elementary schools, these common planning times almost always involve reading data displays, interpreting data, and using data to change classroom practices. Coaches also hold after-school workshops to look at school data.

Professional Development and Technical Support

Teacher professional development focusing on data analysis skills or data-informed decision making is a relatively recent phenomenon, but districts appear to be responding actively to the need for this kind of teacher support. Almost three-quarters (73 percent) of all districts responding to the 2006–07 NETTS district survey indicated that they supported professional development in the past 12 months "to help teachers and administrators in data-driven decision making."

Recent years have seen an increase in the proportion of teachers receiving professional development on data-informed decision making. On the 2005 NETTS teacher survey, 30 percent of teachers said that they had received professional development from their school on this topic, and 9 percent said they had received this kind of support from another source. On the 2007 survey, the proportions receiving professional development on data use rose to 43 percent of all teachers for professional development from one's school and 15 percent for development from other sources.

Teacher survey responses suggest that teachers receiving professional development in this area view it as beneficial. On the 2006–07 NETTS teacher survey, 39 percent of teachers with access to a data system reported that the professional development they received about data-informed decision making had prepared them to use data to improve student achievement.

At the same time, most teachers reported that they would benefit from additional professional development on data-informed decision making (see Exhibit 3-4). Fifty-eight percent of teachers with access to a data system thought that additional professional development on how to develop diagnostic assessments for their classes would be beneficial, and 55 percent said that they would like additional professional development on adjusting the content and approach used in their class in light of student data. Almost half (48 percent) reported the need for more professional development on the proper interpretation of test score data, and over a third (38 percent) for more professional development on how to formulate questions that can be addressed with data.[24] Half (50 percent) reported that they could benefit from additional professional development on how to identify types of data to collect to monitor school progress against goals for improvement, and 44 percent reported a need for more professional development on the mechanics of using their data system. Over a third (37 percent) of teachers with access to a data system said that they would like professional development on techniques for collaborating with colleagues on the use of data.

[24] As noted earlier, only 33 percent of teachers reported feeling capable of forming queries of the data system available to them. It may be that some teachers feel that they can formulate questions that can be addressed with data (and hence do not see a need for more professional development on this topic), but find their data system difficult to use because of interface issues.

Exhibit 3-4
Topics for Additional Teacher Professional Development

Topic	Percentage of Teachers Who Wanted More Professional Development
How to develop diagnostic assessments for your class	58
How to adjust the content and approach used in your class in light of student data	55
How to identify types of data to collect to monitor school progress against goals for improvement	50
Proper interpretation of test score data	48
The mechanics of using the electronic data system	44
How to formulate questions that can be addressed with data	38
Techniques for collaborating with colleagues on the use of data	37

Exhibit reads: Among teachers with access to an electronic student data system, 58 percent indicated that they would benefit from additional professional development on how to develop diagnostic assessments for their class.

Source: 2006–07 NETTS teacher survey.

NETTS survey data also show that teachers' desire for professional development depends on their personal confidence in using a data management system, the perceived support for system use, and whether or not their school is making adequate yearly progress (AYP). For example, a significantly higher percentage of teachers in schools not meeting AYP indicated that they would benefit from additional professional development in six of the seven types of training listed in the survey compared with teachers in schools making AYP. Teachers who express a lower confidence in their ability to interpret data and to use a data management system are more likely to believe that they could benefit from further professional development.[25]

All case study districts provided some form of districtwide professional development on data use, but it varied in terms of who received the training as well as the training content, duration and format. For example, Exhibit 3-1 (presented earlier in this chapter) describes how a district provides school leadership teams with the opportunity to come together annually to review and discuss their state test data and provides them with the tools to carry out this process on an ongoing basis to monitor their school improvement goals. In another district, university staff members were brought in to provide professional development to kindergarten through grade 3 teachers on how to disaggregate and interpret early literacy assessment data. An example of district-supported professional development that combines an online professional development system and in-person support is provided in Exhibit 3-5.

[25] The survey included a block of questions asking teachers to reflect on their use of data management systems using a 5-point Likert response scale. Additional information on these data can be found in *Teachers' Use of Student Data Systems to Improve Instruction 2005 to 2007* (U.S. Department of Education 2008b).

Exhibit 3-5

Professional Development Online and In Person

Professional Development Online (PDO) was built jointly by District 3 and a private company. This electronic system delivers training on demand to all district staff members and allows them not only to view their professional development plan for the year but also to manage their training. The district includes required courses in the system, and staff members can monitor their course-taking progress. Professional development information is tailored to each individual staff member according to his or her position through targeted announcements, information and highlighted displays of required and recommended courses. In addition, the PDO Web site includes training on how to use the system (PDO Help), professional development resources, and a list of professional development conferences. As part of its ongoing professional development activities, the district also assigns a staff development teacher to every school. He or she focuses on helping teachers improve their instructional practice. Staff development teachers in an elementary school, for example, might meet with the third-grade teachers as they are planning a lesson, observe a third-grade teacher, work on instruction and lesson planning, or model a lesson for some teachers. Staff development teachers also work with teachers to examine and analyze data and to design instructional programs based on data.

Three of the case study districts were focusing their professional development activities on data use primarily at the school level. The presence of school-based support staff members provides opportunities for professional development to be ongoing and tailored to individual teacher needs. As noted above, six case study districts provided some sort of school-based staff to support data use. Their role included providing professional development to teachers through mentoring and serving as a resource to teachers on how to analyze and interpret data. Schools also spent some of their professional development time on analyzing school- and grade-level data, supported by informal data-related discussions at grade-level or department meetings.

One district was exploring the issue of school- versus district-based professional development, while two districts planned to maintain a balance of district- and school-based training. Another district was moving toward more tailored training on how to use the district data system. When user statistics indicated that there had been a decline in use of the system, the district decided to offer professional development to individual schools based on teacher needs (e.g., how to extract the data they need from the system).

Tools for Acting on Data

Data systems can help promote data-informed decision making by providing tools to help teachers improve decisions about instructional practice. Some of the resources provided include instructional materials, model lesson plans, and formative assessment results linked to frameworks and curriculum guides.[26] Data from the case studies suggest that these types of tools are currently not common resources in district systems. Only three case study districts had data systems that provided such resources, and one district was developing a system with this

[26] The 2007–08 NTA district survey will provide prevalence estimates for tools for acting on data (Questions 7 and 8) and the frequency with which district staff use their data systems to carry out data-driven decision making activities (Questions 18 and 19).

capacity. In one of the three districts, its commercial data system offered modules that included curriculum and lesson planning features along with an assessment bank that allowed the district to administer benchmark tests tied to state standards and to display results to show which students passed a particular objective, generating skills and item analysis reports. In another district, the data system contained curriculum information aligned with state and local standards, instructional frameworks for teachers, and a curriculum guide to help teachers with their pacing and content coverage. Teachers could access assignments and lesson plans online so they could share resources to supplement instructional materials.

To link formative test data with instructional resources, the data system must have both components. Only four of the nine case study districts had benchmark assessment data on their systems (one additional district had some of its benchmark data on the system), and only one of these districts had instructional resources on the system that were aligned with the assessments. School staff members in several districts used systems outside the district for this purpose. For example, one of the districts used a Northwest Evaluation Association (NWEA) test as a benchmark assessment, and the NWEA Web site provides instructional resources tied to each skill area in its assessments.

One of the barriers illuminated by the case study data was the need for greater alignment between the district curriculum and benchmark assessments. Lack of alignment presented challenges to districts trying to help schools link formative assessment data to instructional practice. One case study district had undergone a curriculum audit by the state that identified as a weakness the lack of a clear, comprehensive curriculum aligned with standards. As a result, the district was developing a uniform curriculum linked to state standards and supported by benchmark assessments that were tied to both the curriculum and state standards. The audit was also the impetus for the district's selecting a data system with a curriculum management component so instructional resources would be available to teachers for skill areas in which their students are identified as being below proficiency on the basis of benchmark data. Until the new district curriculum is completed, teachers cannot take full advantage of this component. In another district, there was a common districtwide curriculum, but the benchmark assessments were not well aligned with the curriculum; the math assessment did not follow the district curriculum scope and sequence, and the language arts assessment did not cover all the skills in the district curriculum, making it more challenging to support instructional decision making. The district reported that these alignment problems would be rectified by a new data system that was under development.

Summary of District and School Supports

Case study districts' supports for data-informed decision making are summarized, by district, in Exhibit 3-6. For each type of support, a district was given a rating: the support was widely available in the district (coded as 2); the support was partially present, for example, professional development provided to some staff members but not all (coded as 1); or the support was not currently present in the district (coded as 0). The districts are ordered by size, from largest to smallest. To some extent, the larger districts (those with student enrollments of 25,800 or more) provide a greater number of supports than the medium-size districts. The mean number of fully present supports in very large and large case study districts is 5, compared with an average of 3 in medium-size districts. But there are exceptions to the general pattern. District 1, a very large district of more than 130,000 students, provides the smallest number of widely available supports because of recent resource constraints (e.g., budget cuts eliminated instructional coach positions). District 8, a medium-size district, has benefited from external funding sources and expertise (e.g., EETT funds, regional consortia) and provides the largest number of supports compared with the aforementioned very large district.

Exhibit 3-7 summarizes the supports available at each case study school, organized by district. Each school was rated on the extent to which each type of support was available at the school: the support was fully present (coded as 2); the support was partially present, for example, a principal who occasionally worked with teachers (coded as 1); or the support was not present (coded as 0). Analysis indicated that there was greater consistency within districts than within school type (high, emerging, typical) across districts. The average number of fully present supports was 3.89, 4.11, and 3.78 for high, emerging, and typical schools, respectively. Averages across schools within individual districts ranged from 1.33 to 5.33. This pattern suggests that districts play a pivotal role in determining the level of support that teachers receive for the use of data systems and making data-informed decisions.

Exhibit 3-6
Case Study District Supports for School Use of Student Data

Support	District No.	1	2	3	4	5	6	7	8	9
	District Size	VL	VL	VL	L	L	M	M	M	M
Strong district leadership for data use		1	2	2	2	2	2	1	2	2
Availability of data disaggregated by student groups and skill levels		1	2	2	1	2	1	2	1	1
Districtwide data-informed decision-making activities		0	0	1	2	1	0	0	2	0
Professional development for data system implementation		1	2	2	2	1	2	1	2	2
Provides school-based staff members to support data-informed decision making		0+	2	2	2	2	2	0	2	0
Gives teachers direct access to extract data from system		1	2	2	2	0	0	0	1	2
District benchmark or formative assessment data on the system		2	2	2	0	2	1	2	1	0
System includes links from assessment results to instructional resources		0	0	2	0	2	0	0	0	0
Students can take assessments online		0	2	1	0	0	0	0	0	0
Total number of supports fully present		1	7	7	5	5	3	2	4	3

Exhibit reads: In District 1, strong district leadership for data use was partially present in 2006–07—that is, only some departments (not all) were strong advocates for data use.

Notes: District size categories include very large (VL), with more than 130,000 students, large (L), and medium (M). Codes indicate the degree to which each support was present in the district: 0 = not present, 1 = partially present, 2 = fully present/widely available. The + indicates that the district used to provide school coaches, but this position was not present in 2006–07 because of budget cuts.

Exhibit 3-7

Case Study School Supports for Use of Student Data

School Support	District 1			District 2			District 3			District 4			District 5		
	H	E	T	H	E	T	H	E	T	H	E	T	H	E	T
Principal sets example for data use	2	2	2	2	2	1	1	2	0	2	2	2	2	2	2
Principal works with teachers on data	2	2	2	2	2	1	0	2	0	0	2	2	0	0	0
School-based staff members available to support data use and/or other school leaders work with teachers on data	0	1	0	2	2	2	2	2	2	2	2	2	2	2	2
Specific procedures in place to discuss/act on data	1	0	0	1	0	0	2	1	1	1	1	1	1	2	2
School has own professional development on data use	2	1	2	2	2	2	2	2	2	1	2	2	1	1	1
Time allotted during school day for teachers to work with data	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2
Total number of supports fully present	4	3	4	5	4	3	4	5	3	3	5	5	3	4	4

School Support	District 6			District 7			District 8			District 9		
	H	E	T	H	E	T	H	E	T	H	E	T
Principal sets example for data use	2	2	1	0	2	0	2	2	2	2	2	2
Principal works with teachers on data	2	2	0	0	1	1	2	2	2	2	2	0
School-based staff members available to support data use and/or other school leaders work with teachers on data	2	2	2	2	0	0	2	2	2	1	0	0
Specific procedures in place to discuss/act on data	1	1	1	1	0	0	2	2	2	1	1	1
School has own professional development on data use	2	2	2	1	0	1	1	1	2	2	0	2
Time allotted during school day for teachers to work with data	2	2	2	2	1	2	2	2	2	2	2	2
Total number of supports fully present	5	5	3	2	1	1	5	5	6	4	3	3

Exhibit reads: In District 1, at the high-data-use school, the principal set an example for data use and also worked with teachers on using data.

Notes: Codes indicate degree to which each support was present in the school during 2006–07: 0 = not present, 1 = partially present, 2 = fully present. Schools were defined by district staff members for their level of data use: H = high data use, E = emerging data use, T = typical data use for the district.

4. Teachers' Preparation for Data Use

As noted in the preceding chapter, staff members in case study districts expressed reservations about teachers' ability to obtain student data from systems or to make sense of student data reports provided to them. Understanding the nature of teachers' proficiencies and difficulties in this arena is important for the design of both data-informed decision-making processes (e.g., whether or not to have specialists serve as mediators between teachers and data systems) and of teacher education and professional development programs. To provide insights into areas of teacher strength and weakness with respect to using data, project staff incorporated data scenarios into case study activities as a context for probing teachers' ability to engage in various aspects of data interpretation and use. The data scenarios were presented individually to six teachers at each school.[27]

Development of the Data Scenarios

The rationale behind the development of the data scenarios was to have a standard set of prompts that could be used to elicit teachers' thinking about student data and reveal the concepts and skills that they can bring to data-informed decision making. Study staff members assembled a group of internal and external experts in assessment and data-informed decision making, including two assessment experts, an expert on the use and functionalities of student data systems, a leading researcher in the area of mathematics education, and two researchers who had performed doctoral or postdoctoral research on the use of student data systems to inform educational decision making.[28]

Working with this group, the study's principal investigator first identified major processes involved in using student data to inform school-level decisions. These processes included the following:

- ***Question posing.*** In cases where a data system is available for exploration and educators must decide how to use it in a way that can improve their practice, the educator needs to be able to frame a question that can be addressed with available data. Doing so requires an appreciation of the kind of question that can be answered with data and alignment between the question's intent and the measure and student group specified in the data query.
- ***Data comprehension.*** Data are typically displayed in tables, graphs or printouts, which can be quite complex, and finding the desired data element is not a trivial matter. Further, the educator needs to understand the data display so he or she can answer the question, "What do the data say?"
- ***Data interpretation.*** Beyond the issue of literal data location and comprehension, particular elements of data comprehension require at least a qualitative understanding of basic concepts in statistics; for example, an educator who does

[27] Before the site visit, principals were asked to select six teachers to participate in the data scenario interviews: three teachers who actively use data to inform decision making and three teachers who represent average data use within the school.

[28] This group comprised TWG members Jeff Wayman and Ellen Mandinach, as well as Jere Confrey (then of Washington University) and SRI staff members Eva Chen, Geneva Haertel, and Viki Young.

not appreciate the effect of an extreme score on a sample mean can be misled by data sets with outliers.

- ***Data use.*** For student data and data systems to have a positive influence on instruction, data must be not only located and properly interpreted but also linked to appropriate instructional options. The educator must have alternative instructional strategies or choices available and a willingness to use data to inform decisions.

For each of these components of data-informed decision making, expert-group members identified specific skills and concepts that teachers should have to execute this aspect of data use successfully.

After identifying key skills and concepts for using data, the group brainstormed examples of situations or questions that would call on each of the concepts and skills in question. Screen shots from actual data systems and questions that had been used in prior research or teacher education also were reviewed by the group as possible item models.

The list of priority concepts and skills developed by the expert group and the example situations calling on those concepts and skills were then used by the research team as a starting point for generating eight data scenarios (see Appendix B). Draft scenarios were reviewed by an assessment expert and a mathematics education expert from the group for plausibility, accuracy and alignment with the identified skills and concepts.

One of these reviewers pointed out that data comprehension items could be classified into two types. Some items called simply for finding the correct data element in a display. These were subsequently labeled *data location* items. Others added a degree of difficulty by requiring the manipulation of displayed data (such as the addition of two percentages or the computation of a proportion) to answer a question about what the graph or table showed. After the review, the term *data comprehension* was reserved for this latter item type. Exhibit 4-1 shows the final set of concepts and skills identified by the group of experts.

The assessment scenarios were pilot-tested first with former teachers on SRI's staff and then with practicing teachers, with revisions made after each round of pilot testing. To cover all of the identified skill areas without extending interviews to an intolerable length, developers created three protocol "forms," each with five of the eight scenarios. The amount of content on the various forms was balanced to achieve roughly equivalent average administration times, estimated at 30 minutes each.

Exhibit 4-1

Data-Informed Decision-Making Components, Concepts and Skills

Component	Target Concept/Skill
Question Posing	Aligns question with purpose and data
	Forms queries that lead to actionable data
	Understands iterative nature of data exploration
	Understands value of multiple measures
Data Location	Finds relevant cells in a complex table
	Finds relevant cells in a complex figure
Data Comprehension	Manipulates data from a complex table or graph to support reasoning
	Maps between data in a table and a prose representation of the data
	Maps between data in a figure and a prose representation of the data
	Understands a histogram as distinct from a bar graph
	Interprets a contingency table
	Distinguishes between longitudinal and cross-sectional data
	Evidences data comprehension monitoring (metacognition)
Data Interpretation	Understands the advantages and disadvantages of using disaggregated subgroup data vs. individual student data
	Attends to distribution and extreme quartiles, not just mean or proportion above cut score
	Appreciates effect of a few extreme scores on the mean
	Realizes that more items on a scale or members in a sample produce more precise, reliable estimates
	Understands measurement error and variability; results not identical on every testing
	Understands that student cohorts differ from year to year
Data Use	Understands how to differentiate instruction based on data
	Seeks subscale and item data that can be mapped to curriculum
	Understands value of formative assessments

Scenario Administration

Within each of the 27 schools participating in the 2006–07 case study site visits, principals were asked to identify six teachers for participation in interviews and focus groups. They were asked to choose three teachers who were active in school use of data to inform instruction and three teachers who were typical of the school teaching staff in this regard. The data scenarios constituted the second part of the individual interviews for these teachers. For a majority of schools, six teachers participated in the study as planned. For a few schools, it was possible to meet with only two to four teachers because of schedule conflicts. In total, 147 teachers from 27 schools responded to a set of data scenarios in spring 2007. Each form included scenarios addressing multiple components of data-informed decision making. Scenarios contained a combination of open-ended and structured-response items. The data scenarios varied in the number of items they contained, but each included items that could be scored using either dichotomous or partial-credit rubrics.[29] Examples of items representing each stage in using educational data for decision making are presented in Exhibit 4-2. All items and rubrics, as well as item allocations to forms, are included in Appendix B.

Exhibit 4-2

Examples of Items Related to Each Component

Component	Item Prompt	Full-Credit Response
Question Posing	So now in January 2007, what specific data would you want to get from this system to help you decide how to improve your fourth graders' performance?	Teacher picks a logical group and selects a logical measure for that group.
Data Location	What was Oak School's average Total Math Score in 2003–04?	Teacher provides correct answer from graph within 5-point range.
Data Comprehension	Oak School's progress in narrowing the grade 4 math achievement gap with the rest of the district has been in problem solving rather than computation. (Teacher must agree or disagree and explain reasoning.)	Agrees. Teacher describes data illustrating that the gap between Oak School and district scores decreased more for problem solving than for computation.
Data Interpretation	These data suggest that next year's third-grade Asian/Pacific Island girls will score better than other third graders on this test.	Teacher disagrees and explains that students in a subgroup vary from year to year and you cannot generalize based on just a single Asian student the prior year.
Data Use	Teachers should obtain a detailed breakdown of last year's test results by item or content standard.	Teacher agrees with a reasonable explanation about *why* having detail is important.

[29] Analysis of other aspects of the protocols is ongoing, using a qualitative coding scheme to capture additional information about teachers' thinking. Findings from the qualitative coding will be presented in the final report.

Measures

Multiple questions were associated with each data scenario. Most questions were designed to get at a specific concept or skill and to have right and wrong answers. A teacher's response to each of these questions was assigned a 1 if correct and a 0 if incorrect. For some items, there were intermediate or partially correct responses for which a .50 was assigned. In addition, some questions were more open-ended, deliberately designed to elicit teachers' thinking. Responses to these questions are not included in the scores reported here. Teacher responses to these open-ended questions have been transcribed and are being coded for evidence of types of data-informed decision-making skills (e.g., indications of comprehension monitoring, descriptions of how data would be used to differentiate instruction).

Procedures

Interviewer training. Site visitors were involved in a full-day training session that included an overview of the study's conceptual framework, the data systems used by each district, and the various data collection activities, including the data scenarios. Site visitors were shown a video of the administration of the data scenarios to illustrate proper administration techniques and then given the opportunity to practice administering the data scenarios to one another. This activity was followed by a discussion period to answer questions that arose as a result of the practice session.

Data scenario interviews. Teachers participated in 45-minute interviews with two researchers. Approximately the first 15 minutes of the interview involved questions concerning the teacher's personal experience with the district's data system, including decisions he or she had made on the basis of student data. Teachers then responded to items from one of the three data scenario forms. They were told that the study wanted to investigate how different kinds of data displays are understood by teachers and were asked to think out loud as they looked at the various data presentations and responded to questions about them. When the data scenarios were presented, one researcher was responsible for asking teachers questions from the assigned data scenario form while the other researcher took notes. (Teachers were randomly assigned to forms before the interview.) Each form was administered to two teachers within a school, if all six teachers from the school participated in the study. Teachers were provided with copies of the graphs, tables and screen shoots included in each scenario. Teachers were also provided with paper, pencils and calculators they could use as they wished (e.g., to carry out basic arithmetic calculations). All interviews were audio-recorded and transcribed to facilitate later analysis.

Scoring. Before scoring, researchers reviewed each transcript to identify the beginning and end of the discussion of each item. Each item segment was coded with an item identification number in ATLAS.ti, a qualitative data analysis program. ATLAS.ti was used to produce data reports by item (i.e., all responses for a given item) to facilitate the scoring of a single item at a time. For each item, raters reviewed the rubric using a sample of transcripts and then refined the rubric on the basis of the range of teacher responses to the item.

Two raters scored each item, and at least 30 percent of all item responses were double-coded to permit the examination of interrater agreement. Interrater agreement was 90 percent or higher for 29 items, between 80 percent and 90 percent for four items, and 75 percent for one item. All discrepancies between raters' scores were resolved by consensus between the raters.

For two of the scenarios (those focusing on Question Posing and Data Use), all but one or two of the scenario-based questions were open-ended. The responses to these and other open-ended questions have been transcribed and are being coded for evidence of the skills and concepts of interest.

Preliminary Results and Findings

Exhibit 4-3 shows the mean score (percentage of full credit) for each data component for which five or more items could be scored as right or wrong. The data scenarios themselves and the distribution of responses to those questions that were scored as correct or incorrect are included in Appendix B. The proportion of respondents giving correct answers for each assessment item and information concerning the reliability of the data scenario assessment items as a set are included in Appendix C.

Exhibit 4-3

Frequency Distribution and Mean Percentage Correct for Scored Items Overall and Within Each Data Component

Component	Number of Scored Items	Mean Number of Respondents per Item	Mean Percentage Correct	Standard Error
Total score	33	84	67	1.13
Question Posing	1	85	NA	NA
Data Location	10	72	81	1.61
Data Comprehension	16	90	64	1.53
Data Interpretation	5	88	48	2.60
Data Use	1	77	NA	NA

Exhibit reads: The average percentage of a school's teachers responding correctly across all 33 data scenario items scored was 67 percent.

Note: NA = Insufficient data (fewer than 5 items).

The data in Exhibit 4-3 suggest that teachers are generally capable of finding specific pieces of information in a data table or graph (the mean percentage correct for Data Location items was 81 percent) but that their ability to translate between a statement and a set of data declines when they must do computation or make multiple comparisons using the numbers provided (for Data Comprehension items, the mean was 64 percent). When teachers are asked to go one step further and to reason about data issues that involve basic statistical concepts such as variability, measurement error or distribution, their likelihood of making a correct inference is still lower (48 percent correct).

The data scenarios provide insight into the nature of teachers' misconceptions related to use of student data. On Data Interpretation items calling for teachers to derive predictions from data, for example, a majority of teachers relied on subgroup means without consideration of the scores for specific students at risk. When looking at a school's or district's multiyear data, a majority of teachers lacked the understanding that the students in a particular grade cohort differ from year to year. When reasoning about the achievement trend of an individual school over time, teachers, on average, did not consider districtwide trends when interpreting year-to-year changes in the school's scores. The ongoing qualitative analysis of teacher responses will elucidate further teachers' reasoning about data.

Comparisons by District

Because different teachers responded to different data scenarios, depending on the form administered to them, teacher scores were aggregated to the school level. Mean school scores were examined by district to determine whether there were any district-level differences in performance (Exhibit 4-4). In general, the nine districts appeared comparable with respect to their teachers' average performance on the data scenarios, but two districts did stand out as potentially different. District 1 had the highest mean score, and District 5 had the lowest score. A one-way ANOVA revealed that variance by district was not statistically significant [$F(8,18) = 2.41$, $p = .06$, $\eta^2 = .52$].

Exhibit 4-4
Total Average Scores for Schools, by District

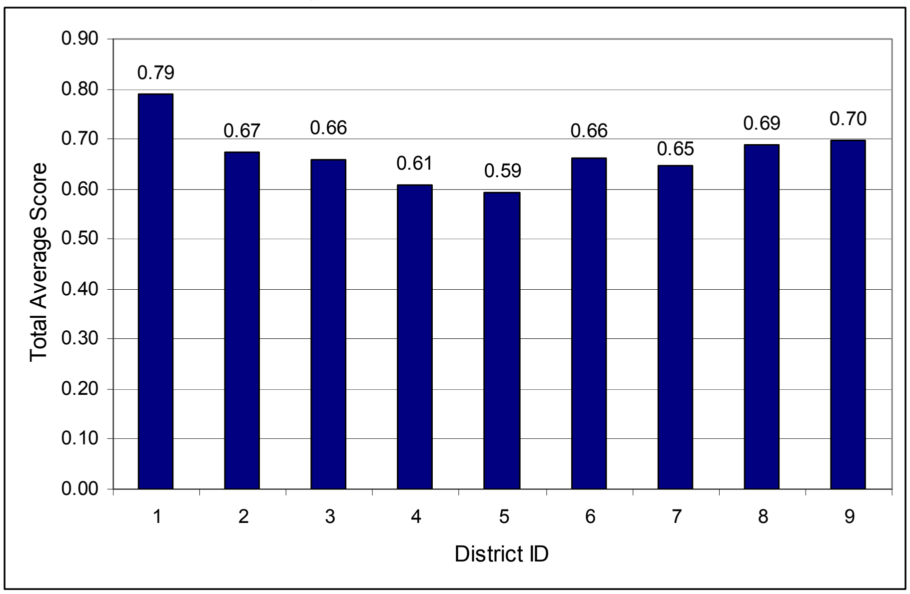

Exhibit reads: The total average score for schools in District 1 was 79 percent correct.

Remaining Analyses

The analyses presented in this report provide initial insight into variation in data-informed decision-making skills for schools and districts. The final report will contain findings from the qualitative coding of teacher responses to open-ended data scenario questions and provide greater detail about the types of knowledge and skills that teachers use as they develop questions, read data tables and graphs, interpret data, and use data to make instructional decisions. Also, for the final report, the teacher data set will be expanded with additional teachers interviewed in 2007–08 and with responses of small groups of teachers responding collectively rather than as individuals to the same or similar scenarios.

Summary

The data in Exhibit 4-3 suggest that teachers generally can locate specific information in a data table or graph but that they experience increasing difficulty if they need to manipulate the data in some way or make comparisons between multiple data points. Necessary manipulations required only basic arithmetic (subtraction, division), and teachers were provided with paper and pencil and with calculators they could use if they wished. Even with these tools, cognitive research would suggest that the cognitive load required for keeping in mind the issue at hand, multiple data points, and intermediate products of data manipulations have a role in the observed deterioration of teachers' accuracy (Ayres 2001). Upcoming administrations of data scenarios to small groups of teachers will test whether greater accuracy in data comprehension is achieved by spreading the comprehension burden across multiple individuals.

In terms of the ability to interpret data, teachers demonstrated limited understanding of basic statistical concepts such as variability and reliability. Teachers appeared to have particular difficulty (a) using individual students' scores, rather than their subgroup mean, as the basis for predictions and instructional prescriptions and (b) keeping in mind the fact that student groups differ from year to year when looking at multiyear data.

5. Summary of the Early Findings

The concept of using data as a basis for their decisions is novel to many school staff members, and there are multiple obstacles to institutionalization of this practice. By collecting data at the school and district levels, the research team sought a “bottom-up” perspective on the quality of the supports for data-informed decision making coming from the state and national levels. Policy-making in this area began with the assumption that federal requirements and national campaigns (e.g., the Data Quality Campaign, grants to states for enhancement of their data systems) would lead to higher-quality state data systems, which in turn would have a positive influence on the use of data in districts, schools and classrooms.

Although federal and state policies have spurred districts and schools to initiate more data-informed activity, the study found no evidence of a tightly coupled system. The vast majority of the activity around data systems and data use in districts and schools involves district, not state data systems, according to the NETTS survey data. Two of the case study districts were in states with systems that use a unique student identifier that the district system also used, facilitating transfer of data across systems. But for the most part, the hoped-for efficiencies to be gained from integrating data systems at the state, district and school levels are not apparent from the vantage point of schools and districts. More progress in this area can be expected as new state systems come on line.

Direct district use of a state-provided software system appears to be relatively uncommon. This practice was found in only one of the nine case study districts. In this case, the state made available a performance improvement mapping system that the district could use to obtain test items linked to areas where the school needed to improve. In another case, the district was using a state software system for its data warehouse, but the state had since moved to a new software system with additional capabilities, and the district was left with an “orphan” system.

Among the nine case study districts (drawn from nine different states), only one cited training on data-informed decision making made available through its state education agency. In this case, principal training and some funds for laptop purchases were made available by the state.

It should be noted that a tightly coupled system is not necessarily the ideal solution in all cases. The fact that no such system was found in any of the case study districts, selected on the basis of perceived excellence in data use, suggests that implementation of such systems is difficult. Much of the value provided by a tightly integrated system can arguably be provided also by less tightly coupled systems.

Case study informants were more likely to describe federal funds supporting data use activities than state funds doing so. A number of federal programs have provided funds that have paid for extra staff positions or other activities to promote a data-using culture. In one district, for example, Title I funds paid for full-time school-based instructional advisors who helped teachers acquire and interpret data; the funds also supported the high-speed Internet access needed to use the data system. Another district used some of its Title I funds for professional development on the use of DIBELS[30] data for instructional decision making. Schools in three districts used Reading First grant funding for activities such as collecting and tracking longitudinal data on primary students' reading skills and for funding reading coaches who helped teachers incorporate assessment data into their practice. An EETT grant to a state consortium for school use of data was led by one of the case study districts; the consortium has provided professional development on data-informed decision making at no cost to the district.

University partners are an additional class of facilitators. One district is working with a literacy project run by a teachers' college to learn more about kinds of student data that can be collected and how they can be used to guide subsequent instruction. Another district had a university come in to work with its teachers on how to disaggregate and interpret data from a phonological awareness assessment.

Progress in the Use of Data Systems

This study encompassed both district and school use of student data systems and their data use practices to improve instruction. Across districts and schools in the case study sample, use of locally generated data to inform instruction and use of electronic data systems containing student scores on standardized tests appeared to be two parallel initiatives rather than a single, integrated effort. District and school use of standardized test scores obtained from data systems typically focused on accountability concerns and making sure that local curriculum and instruction were well aligned with the state's assessments. Locally generated data often came from instruments connected with an early literacy program or benchmark assessments. The two data activities were not necessarily integrated, and schools making progress in one of these areas were not necessarily doing much with the other.

Staff members at four of the nine case study districts reported having identified areas in need of improvement, corrections needed in curriculum alignment, or areas ripe for new programs on the basis of analysis of data from their data systems. Two of the districts described more mature data use, including using data on an ongoing basis to evaluate which of their initiatives were working and which were not. One of these districts won a state award as one of the most improved districts in the state.

The NETTS teacher survey and first round of case study data collection make it clear that the implementation of data systems and practices for their use in decision making at the school level is still in its infancy. Between the two NETTS teacher surveys, the proportion of teachers reporting access to a student data system rose by nearly 50 percent. This large a change over a two-year period is quite remarkable, but the optimism it engenders must be tempered by concerns over the perceived value of the data to which more teachers have access. On the latest NETTS survey, the roughly two-thirds of teachers with access to a student data system were divided in their perspective on whether or not school use of data had paid off: 42 percent agreed that their school had been improved through the use of data, while 45 percent neither agreed nor disagreed with the statement. Similarly, the case study

[30] The Dynamic Indicators of Basic Early Literacy (DIBELS) are a set of standardized, individually administered measures of early literacy development. They are designed to be short (1-minute) fluency measures used to regularly monitor the development of pre-reading and early reading skills.

interviews suggest that *even in districts with a reputation for leadership in using data, electronic data systems are barely influencing classroom-level decision making*. However, more progress can be seen in the use of data, coming from other sources such as diagnostic tests included in early reading programs, to shape instruction.

Staff members at all 27 case study schools described the use of student data that was not contained on their data system to guide instruction. Frequently mentioned were data from early reading assessments given in primary grades (for which state assessment data are usually unavailable), performance reports from computer-based instruction, running records, and examinations constructed by school departments.

Lessons Learned for Implementation

The reflections of the case study informants and the pattern of activity across their districts and schools with different practices suggest a number of guidelines for schools and districts embarking on the implementation of data-informed decision making.

1. ***Districts are finding that providing school-level data coaches is an important support for school-level use of data to inform instruction.*** In the majority of case study districts, some or all schools had on-site staff members designated to help teachers retrieve data from the data system, interpret data and make instructional decisions based on data. Not all districts started out with this intention, but it appears to be an emerging best practice that both encourages more use of data and lessens the likelihood of misinterpretation of data.

2. ***A common curriculum and curriculum-aligned benchmark assessments increase the likelihood that school staff members will make extensive use of a district's data system.*** State assessments are typically administered once a year, and school review and reflection on the resulting data is typically also a once-a-year event. Teachers in all nine case study districts looked more frequently at interim, benchmark or end-of-course assessments. In some cases, these data were available on a district-provided system, but in many cases they were accessed on a test developer Web site, either as reports generated by the assessment software itself or through a school-developed database. To the extent that the district data system contains more current data that teachers find relevant to their instructional decisions, teachers will have a greater motivation to use the system.

3. ***If teacher use of data is the goal, then it is desirable to have curriculum and instruction staff members involved in the initiative.*** The use of student data to inform instruction is necessarily a systemic effort, linking assessment and accountability, professional development, information technology, and curriculum and instruction functions that are typically separate offices within medium-size and large districts. All of these offices need to support the initiative. In two of the case study districts, the data use initiative was led by the assessment and accountability office, and other district offices were not deeply involved. In these cases, the data system was not being used to shape instruction.

4. ***Teacher buy-in for the data system and its use should be sought early and maintained continuously.*** Attention to teacher buy-in was not uniform across the case study districts. On one end of the continuum were districts that solicited input from a few principals or

teachers regarding what they wanted in the system and then proceeded to procure and adopt one. At the other end of the continuum was a district that instituted a nine-month process of convening stakeholder groups, including teachers, to help select the new system and involved the union in the media campaign for its launch. Several districts that had not involved teachers early on were dealing with teacher suspicions that the data system would be used to identify weak teachers and that data would be used against them.

5. ***Professional development should include training on how to interpret data and how to translate data into changes in instructional practice.*** Teachers in seven of the nine case study districts cited insufficient training on how to engage in data-informed decision-making practices, how to read and interpret the data that are given to them, and how to translate data into actionable plans for instruction. Teacher responses in the data scenario interviews suggest that these concerns are well-founded. Teachers could read data tables and graphs but had difficulty framing a question that could be answered through a data system query, and when they did have data in front of them, they had a hard time drawing defensible interpretations or inferences based on the data. On the NETTS teacher survey, a large proportion of respondents felt they could benefit from additional professional development around the use of data: 58 percent thought they could benefit from professional development on how to develop diagnostic assessments for their students,[31] 55 percent on how to adjust the content and approach used in their class on the basis of data, 50 percent on what data to collect to monitor school progress against improvement goals, and 48 percent on how to interpret data.

6. ***District policies should be examined to identify and remove policies and procedures that undermine teachers' use of data to inform instruction.*** Despite a commitment to the promotion of teachers' use of data in making instructional decisions and individualizing and optimizing students' educational experiences, districts often have policies in place that run counter to such efforts. An example is the imposition of district pacing plans that do not provide time for individualization or selective reteaching based on benchmark or formative assessment findings. On the NETTS Teacher Survey, of those teachers with access to a student data system, 60 percent said that no matter what the system tells them about their students' learning, they must keep up with state or district pacing plans.

7. ***School leaders need to build teachers' mutual trust to a point where teachers are comfortable working with colleagues to examine data that reflect on their teaching performance.*** Much of the examination of data in case study schools occurred in small groups—during common planning time or grade-level or department meetings. This practice was particularly well ingrained in the schools identified as "high use" by their districts. Staff members in seven districts said that data-informed decision-making practices had moved school staff members toward more open conversations about instructional practice and increased opportunities to learn from one another. One principal noted, "Using data eliminates distracters and keeps everyone focused on where they need to go. Data also helps to eliminate some of the interpersonal issues that can arise; it's not about who you are, it's about what the data shows." Some schools are actually

[31] Teachers are being encouraged to use diagnostic assessments but often express frustration with the fact that they do not have diagnostic instruments available to them that match their instructional program.

disaggregating assessment data by teacher to find areas where there is a marked difference across classrooms so teachers can learn from peers with the best outcomes in that area. Clearly, such activity requires a high degree of mutual trust, a characteristic that school reform research has found to be present in urban schools that make significant improvements (Bryk and Schneider 2002). The principals at two of the case study schools noted that they needed to spend several years building up an atmosphere of trust and a “blame-free” culture before their teachers could look at data together honestly.

The NETTS teacher survey data also underscore the importance of peer support in creating a culture of data use. Teachers who reported feeling well-supported by their colleagues in their efforts to use data were more likely than other teachers to use data in ways related to instruction, for example, to identify student skill gaps.

Data-informed decision making is not a simple intervention not only because it involves so many aspects of education (e.g., assessment, curriculum, accountability, information technology) but also because it requires fundamental improvements in the degree of mutual trust and changes in the way teacher time is used. The survey and case study data presented in this interim report suggest that the movement to incorporate student data in local education decision making is real (many districts, school leaders and teachers are making good-faith efforts), but there is a significant distance to go before it becomes well executed in practice. The picture in 2006–07 was one that showed various pieces of the complex requirements getting put in place in different locations but no single school or district demonstrating a totally integrated, consistent and pervasive continuous-improvement process. Mutual trust may prove to be the glue needed to hold together the district and school practices that involve using data to improve instruction and achievement.

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Appendix A

Case Study and Survey Data Sources

Exhibit A-1

Definitions of Terms

Term	Definition
Data systems	Electronic information systems to assist in the organization and management of data. They consist of hardware and software that provide many different functions to users such as storing current and historical data, rapidly organizing and analyzing data (e.g., examining relationships within data, specifying data subgroups), and developing presentation formats or interfaces.
Interoperability	The ability of different data systems or software packages to communicate with one another.
Software applications	Software applications consist of a wide range of specialized products to facilitate access to data, data analysis and interpretation, and presentations of data (e.g., formatted reports, graphing functions).
Schools Interoperability Framework (SIF)	Data exchange standards for K–12 education software developed to promote data sharing between different applications without further software intervention. SIF was launched in 1998 as a nonprofit initiative of the software and information technology industry to ensure that K–12 instructional and administrative software applications work together more effectively.
Data-informed decision making	A process that integrates the analysis of educational data, typically stored in educational data systems, to support decisions intended to improve teaching and learning at the school and classroom levels. The practice entails regular data collection and ongoing implementation of improvements.
Longitudinal student data	Data on individual students collected over time that allows users to compile an academic history for each student. This type of data enables more robust analyses of student performance to help differentiate instruction and improve student achievement.
Query tool	Software that allows for customized and ad-hoc data requests such as “drill down” capability to efficiently examine a subset of data at a grade, classroom or student level.
Data query	A request for specific records from a data system.
Transaction capture	Real-time accounting of daily school functions such as attendance and school lunch counts.
Electronic grade books	Online tools to help teachers manage classroom activities (e.g., generating seating charts, recording grades and test scores, managing attendance, tracking skills and standards, planning lessons, and generating report cards).
Electronic portfolios	Online storage of student work samples.
Electronic communication tools	Tools to facilitate communication of information such as use of e-mail, development of Web sites, and electronic discussion groups or “message boards” where users from multiple locations can discuss issues.
Formative assessment	Assessment conducted during instruction to provide feedback that can be used to adjust ongoing teaching and learning to improve student outcomes. Formative assessment can be contrasted with summative assessment, which takes place after a period of instruction, to judge how much learning has occurred.

Exhibit A-2

Data Available From the State Data System for Each Case Study District in 2007

District	1	2	3	4	5	6	7	8	9
Data Elements in State Information System	**CA**	**VA**	**MD**	**TX**	**RI**	**MA**	**NC**	**CO**	**MO**
Unique statewide student identifier that connects student data across key databases across years*	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No
Ability to match individual students' test records from year to year to measure academic growth*	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
State can measure year-to-year growth for individual students in any subject (state tests in the same subject in consecutive years and is able to connect data across years)	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Student-level enrollment, demographic, and program participation information*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Student-level transcript information, including information on courses completed and grades earned*	No	No	No	Yes	No	No	Yes	No	No
A teacher identifier system with the ability to match teachers to students*	No	No	No	No	Yes	No	No	No	No
Identifies which schools produce the strongest academic growth for their students	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No
Knows what achievement levels in middle school indicate that a student is on track to succeed in rigorous courses in high school	No	No	No	Yes	No	No	No	No	No
A state data audit system assessing data quality, validity and reliability*	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Number of the 10 DQC essential elements present*	7	7	3	9	6	8	7	6	4

Exhibit reads: In District 1, in 2007, the state data system has a unique statewide student identifier that connects student data across key databases across years.

Note: An asterisk identifies six of the 10 essential elements most relevant to the data issues discussed in the case studies. There are four additional elements not listed.

Source: Data Quality Campaign (2007).

Exhibit A-3
Case Study District Data Systems

TurnLeaf Achievement Management System serves as the data warehouse and assessment system; eSIS is the student information system; NWEA online database for analysis and reporting tools and instructional materials.
eScholar is the data warehouse; SIMS is student information system; Star_Base for student records; TestWiz managed by dataMetrics Software; TPD electronic registrar; PIMS performance improvement mapping system from the SEA; Edline for reporting teacher data to students and parents.
SchoolNet Account (report generation); Assess (assessment bank) and Align (data warehouse) modules; Pentamation is the student information system; Special Education Manager; discipline and attendance systems.
Education Decision Support Library is the data warehouse (EDSL is LEA developed); Benchmark Assessment and Reporting Tool (BART was jointly developed by LEA and Princeton Review); Schools Administrative Student Information (SASI) from Pearson, Educational Curriculum Assessment Resource Tool (ECART is being developed by LEA to replace BART).
SIMS is the state data system and serves as the LEA data warehouse (will be replaced by NC WISE); C-CASS for special education data; DIBELS online database for analysis and reporting tools (data uploaded from handhelds).
Data Warehouse was developed by the LEA; Instructional Management System (IMS designed by ADMIN.COM); Professional Development Online (PDO was built by LEA and a private company).
Registration (*Reg* was developed by the LEA) is a student information system and data warehouse; Socrates CRM (the library data system); Phonological Awareness Literacy Screening (PALS) Web site for analysis and reporting tools.
Infinite Campus houses student data and has a suite of reporting tools and parent portal; EdGate assessment system is being piloted.
Cognos (acquired by IMB) is the LEA’s data warehouse; Zangle is a Web-based transactional system to enter data (attendance, lunch, district test scores); Student Assessment Data System (SADS) provides historical test data and standard reports; Encore is the special education system (LEA-developed systems).

NETTS Survey Data

The primary survey data included in this report come from the U.S. Department of Education's National Educational Technology Trends Study (NETTS): 1,039 district technology directors surveyed during spring 2007 and 2,509 teachers surveyed in spring 2007. The teachers were clustered in schools sampled from districts participating in the NETTS district survey.[32] The NETTS district sample of 1,039 districts was nationally representative with respect to poverty status, student enrollments, and location (urban or rural status). The 60 largest urban school districts across the country were selected with certainty (i.e., included in the sample from the outset). Districts composed entirely of special education schools and vocational-technical schools, as well as independent charter schools that are their own districts, were excluded from the district sampling frame because of their dissimilarity to "typical" districts. The teacher sample was created by drawing a probability sample of 975 schools from respondents to the district survey, stratified by school type (elementary or secondary), and poverty level (high or low). Schools were randomly sampled in proportion to the number of teachers and in inverse proportion to district size to produce a sample of schools whose selection probabilities were roughly independent of the size of their district's enrollment.

Higher-poverty schools were oversampled (233 of the 975 schools) to obtain more precise data about their technology use. For schools, "higher poverty" was defined as above a specified cutoff in terms of the percentage of students who were eligible for the free or reduced-price lunch program. The dividing line between higher-poverty and lower-poverty schools was selected to ensure that for each school type (elementary, middle or high school), there would be the same number of teachers in the higher-poverty and the lower-poverty groups, as reported in the National Center for Education Statistics Common Core of Data (CCD). Elementary schools with 29.7 percent of their students eligible for free or reduced-price lunches were classified as higher poverty. For middle and high schools, the poverty thresholds were 24.3 percent and 15.9 percent, respectively.

NETTS researchers obtained teacher rosters for the 975 schools within the districts selected for the NETTS district survey. To be eligible for the teacher sample, a teacher had to be teaching at the same school in the school year before survey administration (i.e., teachers new to the school were excluded). Teachers who did not teach core academic subjects also were omitted from the sample. Targets of four teachers from each of the schools were randomly selected for the teacher sample. The final teacher sample in 2007 consisted of 1,779 teachers from 865 schools.

Response rates were 94 percent for the district survey in 2007 and 85 percent for the teacher survey. Sampling weights were applied to the teacher data to obtain nationally representative estimates. The district and teacher surveys were initially administered during the 2004–05 school year to the same sample of districts and schools that provide the basis of comparison between 2007 and 2005 for the teacher survey data. In fall 2005, 6,017 teachers

[32] Districts were sampled from among the 12,483 districts that received federal Enhancing Education Through Technology (EETT) funds in 2003 and from an additional 2,239 districts that had not received EETT funds.

were surveyed with a response rate of 82 percent; the larger sample was designed to provide robust, school-level estimates of technology use. For additional information on the comparisons between 2007 and 2005 teacher survey responses, see *Teachers' Use of Student Data Systems to Improve Instruction: 2005 to 2007* (U.S. Department of Education 2008b).

Appendix B

Scenario Exhibits, Items, Rubrics, Item Score Distribution and Mean Scores

Scenario A

Now I'm going to describe a hypothetical situation and a computer-based student data system to you and I'd like to see what kind of information you'd like to get from the system.

Suppose it's January 2007 and you're one of the fourth-grade teachers in a school that was surprised by fourth graders' relatively low performance on the state reading test last year (spring 2006). Your principal has encouraged you to use student data to gain insights into how you can get higher Grade 4 achievement this year.

The data system available to you [*show Figure A screen mockup*] contains data on both current (2006–07) fourth graders and last year's (2005–06) fourth graders (*show Student Groups table, pointing to student groups as you name them*) as well as other student groups. For each student, the data system has scores on last spring's state reading test and scores on a district test given in the fall (*point to relevant cells in Student Variables table*). It also has other information about students that can be used to create subgroups within a grade if you want to see how different subgroups compare. For example, ethnicity, gender, and whether the student is eligible for free or reduced price lunch (FRPL).

Figure A:

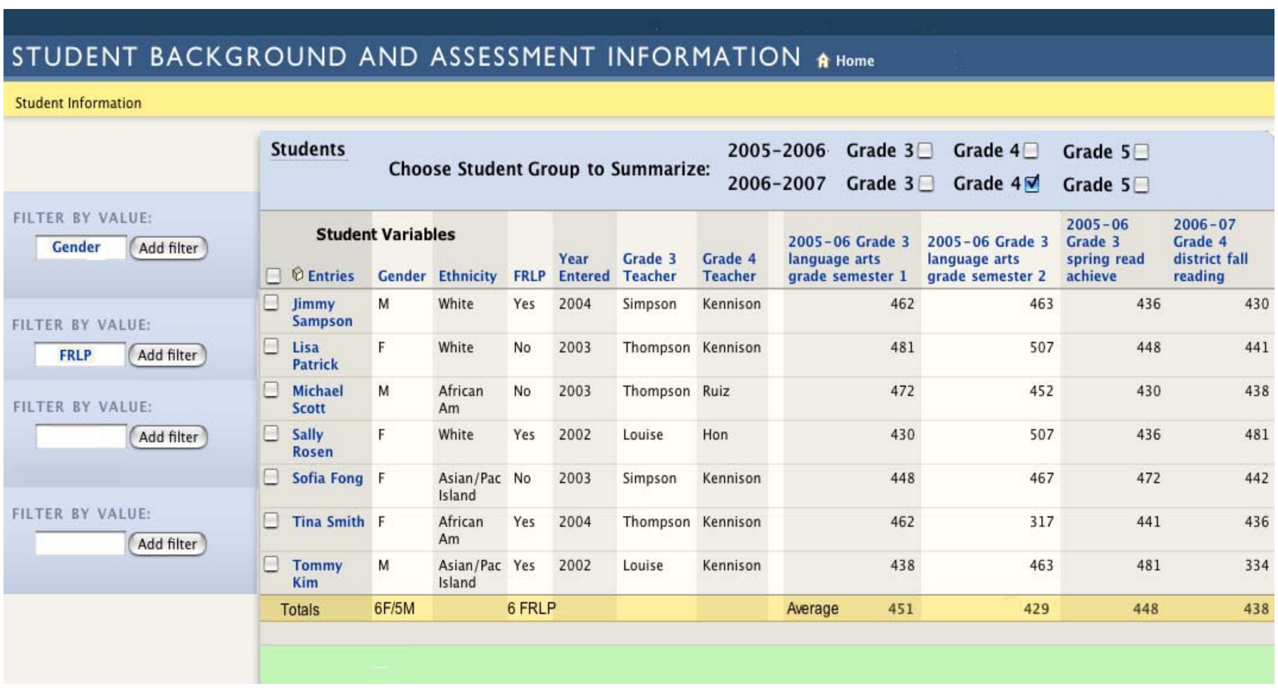
Student Groups

2005–06 Third graders	2005–06 Fourth graders	2005–06 Fifth graders
2006–07 Third graders	2006–07 Fourth graders	2006–07 Fifth graders

Student Variables

Ethnicity	2005–06 Grade 3 state spring reading achievement score
Gender	2005–06 Grade 4 state spring reading achievement score
Free or reduced-price lunch applicant	2005–06 Grade 5 state spring reading achievement score
Year entered district	2006–07 Grade 3 district fall reading test
Grade 3 teacher	2006–07 Grade 4 district fall reading test
Grade 4 teacher	2006–07 Grade 5 district fall reading test

Assessment System Output



Student Variables Entries	Gender	Ethnicity	FRLP	Year Entered	Grade 3 Teacher	Grade 4 Teacher	2005-06 Grade 3 language arts grade semester 1	2005-06 Grade 3 language arts grade semester 2	2005-06 Grade 3 spring read achieve	2006-07 Grade 4 district fall reading
Jimmy Sampson	M	White	Yes	2004	Simpson	Kennison	462	463	436	430
Lisa Patrick	F	White	No	2003	Thompson	Kennison	481	507	448	441
Michael Scott	M	African Am	No	2003	Thompson	Ruiz	472	452	430	438
Sally Rosen	F	White	Yes	2002	Louise	Hon	430	507	436	481
Sofia Fong	F	Asian/Pac Island	No	2003	Simpson	Kennison	448	467	472	442
Tina Smith	F	African Am	Yes	2004	Thompson	Kennison	462	317	441	436
Tommy Kim	M	Asian/Pac Island	Yes	2002	Louise	Kennison	438	463	481	334
Totals	6F/5M		6 FRLP				Average 451	429	448	438

A.1. So now in January 2007, what specific data would you want to get from this system to help you decide how to improve your fourth graders' performance? (*Follow-up probes*.) What data would you want to see first? Tell me what group of students and what test score or student characteristic you would like to see for those students.

Rubric:
1: Teacher picks a logical group (either 2005–06 fourth graders or 2006–07 fourth graders) **AND** selects a logical measure for that group (either Spring 2006 Grade 4 state test scores or Fall 2006 Grade 5 district fall test scores for 2005–06 fourth graders OR either Spring 2006 Grade 3 state scores or Fall 2006 Grade 4 district scores for 2006–07 fourth graders.

0.5: Teacher identifies group and scorer can infer measure based on teacher response.; **OR** Teacher picks a logical group (either 2005–06 fourth graders or 2006–07 fourth graders); **OR** Teacher selects a logical measure for that group (either Spring 2006 Grade 4 state test scores or Fall 2006 Grade 5 district fall test scores for 2005–06 fourth graders OR either Spring 2006 Grade 3 state scores or Fall 2006 Grade 4 district scores for 2006–07 fourth graders.

0: Incorrect; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

	Score Frequency (Proportion)			
$n_{Teachers}$	**0**	**0.5**	**1**	***M***
85	26 (.31)	23 (.27)	36 (.42)	.56

A.2. Would you like to make any other queries of the data system? Are there other kinds of data you would like to have to help improve this year's fourth graders achievement that you don't see represented in this system?

No Rubric: Coded only, not scored

Scenario B

This (*show Figure B*) is the kind of data table that some student data systems produce. I'm going to ask you to find some information from the table and then I'd like for you to tell me on a scale of 1 to 10, with 10 being extremely difficult, how hard or easy it was to find the information in the table. Ready?

Figure B

2005–06 Score Levels—English Language Arts (ELA)

English Language Arts
Hamilton Elementary

Grade	Gender	Ethnicity	Number of Students Tested	Percent of Tested Students	Mean Scale Score	Number Students at Each Proficiency Level: Below Basic	Basic	Proficient	Advanced
3	Female	African American	18	26%	439	5	7	5	1
		Asian/Pac Islander	1	1%	610	0	0	0	1
		Latino	17	24%	428	5	6	5	1
		White	34	49%	449	4	13	11	6
		Total Female	70	100%	444	14	26	21	9
	Male	African American	18	23%	436	6	6	5	1
		Asian/Pac Islander	2	3%	452	0	1	0	1
		Latino	31	40%	430	8	7	14	2
		White	27	35%	448	6	11	7	3
		Total Male	78	100%	438	20	25	26	7
4	Female	African American	18	24%	441	3	8	5	2
		Asian/Pac Islander	2	3%	462	1	0	1	0
		Latino	36	47%	436	8	12	12	4
		White	20	26%	472	2	7	8	3
		Total Female	76	100%	447	14	27	26	9
	Male	African American	16	23%	442	2	8	5	1
		Asian/Pac Islander	0	0%	NA	0	0	0	0
		Latino	29	42%	438	5	12	10	2
		White	24	35%	456	3	13	5	3
		Total Male	69	100%	445	10	33	20	6
5	Female	African American	19	26%	463	2	6	8	3
		Asian/Pac Islander	1	1%	317	1	0	0	0
		Latino	34	47%	452	4	14	10	6
		White	19	26%	507	1	6	7	5
		Total Female	73	100%	467	8	26	25	14
	Male	African American	17	23%	449	2	6	6	3
		Asian/Pac Islander	3	4%	560	0	0	1	2
		Latino	34	46%	448	7	13	11	3
		White	20	27%	468	3	6	8	3
		Total Male	74	100%	467	12	25	26	11

B.1. What was the mean (or average) scale score for the Latino fifth-grade girls who took the test? How easy was it to find this information in the table?

Rubric:
1: 452

0: Incorrect; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n Teachers	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
49	5 (.10)	N/A	44 (.90)	.90

B.2. Which student group had the highest average or mean ELA scale score in Grade 4? How easy was it to find this information in the table?

Rubric:
1: "White females" or "white girls"

0: Incorrect; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n Teachers	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
49	6 (.12)	N/A	43 (.88)	.88

B.3. How many African American third-grade boys took the test? How easy was it to find this information in the table?

Rubric:
1: 18

0: Incorrect; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n Teachers	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
48	0	N/A	48 (1.00)	1.00

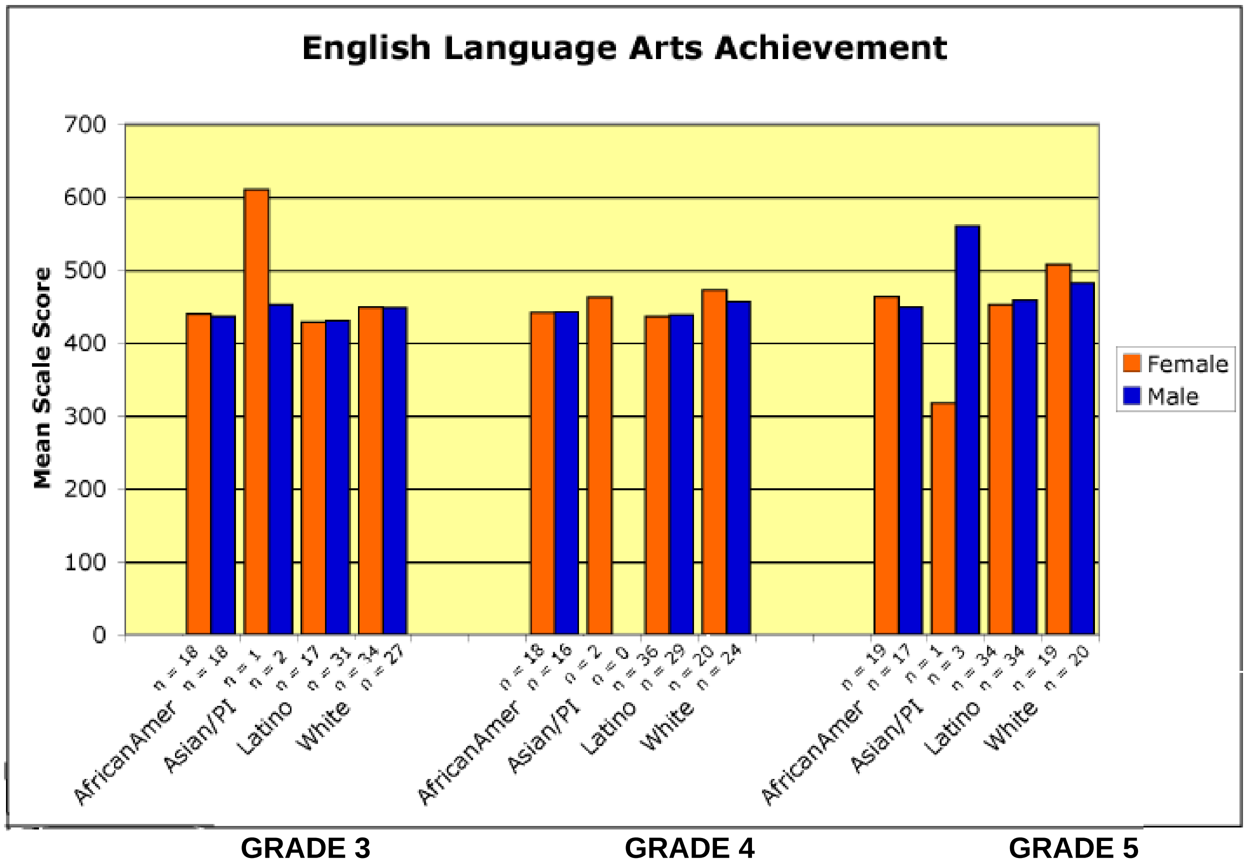
B.4. Overall, based on the Grade 3 data in this table, would you say that there was a difference between boys and girls in ELA test performance?

No Rubric: Coded only, not scored

Scenario C

This (*show Figure C*) is the kind of data chart that some student data systems produce. I'm going to ask you to find some information from the graph and then I'd like for you to tell me on a scale of 1 to 10, with 10 being extremely difficult, how hard or easy it was to find the information in the chart. Ready?

Figure C
ELA Bar Graph



n = Number of test takers

C.1 (II). Looking at this graph, can you find the average (or mean) English Language Arts scale score for the Latino fifth-grade girls who took the test? How easy was it to get this information from the chart?

Rubric:
1: Any answer from 449 to 455

0: Incorrect; Teacher does not know; Scorer cannot conclude whether answer is correct or incorrect

n Teachers	Score Frequency (Proportion)		
	0	**0.5**	**1**
97	25 (.26)	N/A	72 (.74)

C.2. Can you find the mean score for Asian/Pacific Islander fourth-grade boys who took the test? How easy was it to get this information from the chart?

Rubric:
1: “No” or “none took the test”; “There’s no data.”

0: Incorrect or “There’s no information.”; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n Teachers	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
97	30 (.31)	N/A	67 (.69)	.69

C.3. Which student group had the highest average ELA score in Grade 4? Question: How easy was it to get this information from the chart?

Rubric:
1: “White females” or “white girls”

0.5: “White”; “orange bar for white”

0: Incorrect; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n Teachers	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
95	4 (.04)	10 (.11)	81 (.85)	.91

C.4. How many African American third-grade boys took the test? How easy was it to find this information in the table?

Rubric:
1: 18

0: Incorrect; Teacher does not know; Scorer cannot conclude whether answer is correct or incorrect.

n Teachers	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
95	10 (.11)	0	85 (.89)	.90

Scenario D

This (*show Figure D*) is the kind of data table that some student data systems produce. I'm going to ask some questions about how you would interpret the data in this table.

Figure D
2005–06 Score Levels—English Language Arts (ELA)

English Language Arts Hamilton Elementary

Grade	Gender	Ethnicity	Number of Students Tested	Percent of Tested Students	Mean Scale Score	Number Students at Each Proficiency Level: Below Basic	Basic	Proficient	Advanced
3	Female	African American	18	26%	439	5	7	5	1
		Asian/Pac Islander	1	1%	610	0	0	0	1
		Latino	17	24%	428	5	6	5	1
		White	34	49%	449	4	13	11	6
		Total Female	70	100%	444	14	26	21	9
	Male	African American	18	23%	436	6	6	5	1
		Asian/Pac Islander	2	3%	452	0	1	0	1
		Latino	31	40%	430	8	7	14	2
		White	27	35%	448	6	11	7	3
		Total Male	78	100%	438	20	25	26	7
4	Female	African American	18	24%	441	3	8	5	2
		Asian/Pac Islander	2	3%	462	1	0	1	0
		Latino	36	47%	436	8	12	12	4
		White	20	26%	472	2	7	8	3
		Total Female	76	100%	447	14	27	26	9
	Male	African American	16	23%	442	2	8	5	1
		Asian/Pac Islander	0	0%	NA	0	0	0	0
		Latino	29	42%	438	5	12	10	2
		White	24	35%	456	3	13	5	3
		Total Male	69	100%	445	10	33	20	6

D.1. Suppose you're working with third-grade teachers at this school and they're interested in examining how their students performed in terms of the language skills measured on this test. What does the data in this table indicate about whether boys and girls performed differently in the third grade? [*Get open response*]

No Rubric: Coded only, not scored

D.2. OK. Now I'm going to read a series of statements that people might make about different aspects of the Grade 3 data in this table. I'd like you to tell me for each statement whether you agree or disagree and the reasons why. Remember to think aloud as you're deciding on your answer.

a. A majority of third graders at this school have not achieved proficiency in ELA as measured by this test.

Rubric:
1: Agree [57% are less than proficient; 85/148 = (14+26+20+25)/(70+78)]

0.5: Agree (no explanation)

0: Disagree; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

$n_{Teachers}$	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
97	16 (.16)	2 (.02)	79 (.81)	.82

b. In Grade 3, boys were more likely than girls to score Below Basic on this assessment.

Rubric:
1: Agree 25.6% boys > 20% girls (20/78 > 14/70)

0.5: Agree (20 boys > 14 girls); Agree (no explanation)

0: Disagree; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

$n_{Teachers}$	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
96	18 (.19)	47 (.49)	31 (.32)	.58

c. Of those students who scored Below Basic in Grade 3, most were Latino.

Rubric:
1: Disagree (*Less than half* of all of the students who scored Below Basic in Grade 3 are Latino.)

0.5: Disagree with no explanation

0: Agree; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

$n_{Teachers}$	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
96	71 (.74)	1 (.01)	24 (.25)	.26

D.3. Now let's assume that you're a fourth-grade teacher and these Grade 4 data are for mid-year performance on a benchmark test. If there is a particular group of fourth graders you think will be most likely to have trouble scoring basic or above on the state test at the end of the year, could you point out their data in this table? [if appropriate probe with *one* of the following] Which group would you be concerned about and what data trigger that concern? OR Why don't you think the subgroup data in the table point to a priority need for any particular subgroup?

Rubric:
1: Those scoring Below Basic

0: Incorrect; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

$n_{Teachers}$	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
96	86 (.90)	5 (.05)	5 (.05)	.08

Note:
Item responses did not correlate with those to other Data Interpretation items. Scores not included in analyses.

D.4. Now let's go back to the Grade 3 data. Remember that these are for last year's third graders. If there have been no major changes in the school's student body, teachers, or curriculum would you expect that:

a. On the basis of last year's test scores, girls can be expected to score higher than boys when this test is given to this year's third graders.

Rubric:
1: Disagree [Grade 3 girls and boys scored about the same, e.g., (21+9)/70 = (26+7)/78]

0.5: Disagree with no explanation

0: Agree; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

$n_{Teachers}$	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
93	44 (.47)	0	49 (.53)	.53

b. These data suggest that next year's third-grade Asian/PI girls will score better than other third graders on this test.

Rubric:
1: Disagree (Cannot predict next year's scores based on the one Grade 3 Asian/PI student represented in the table)

0.5: Disagree with no explanation

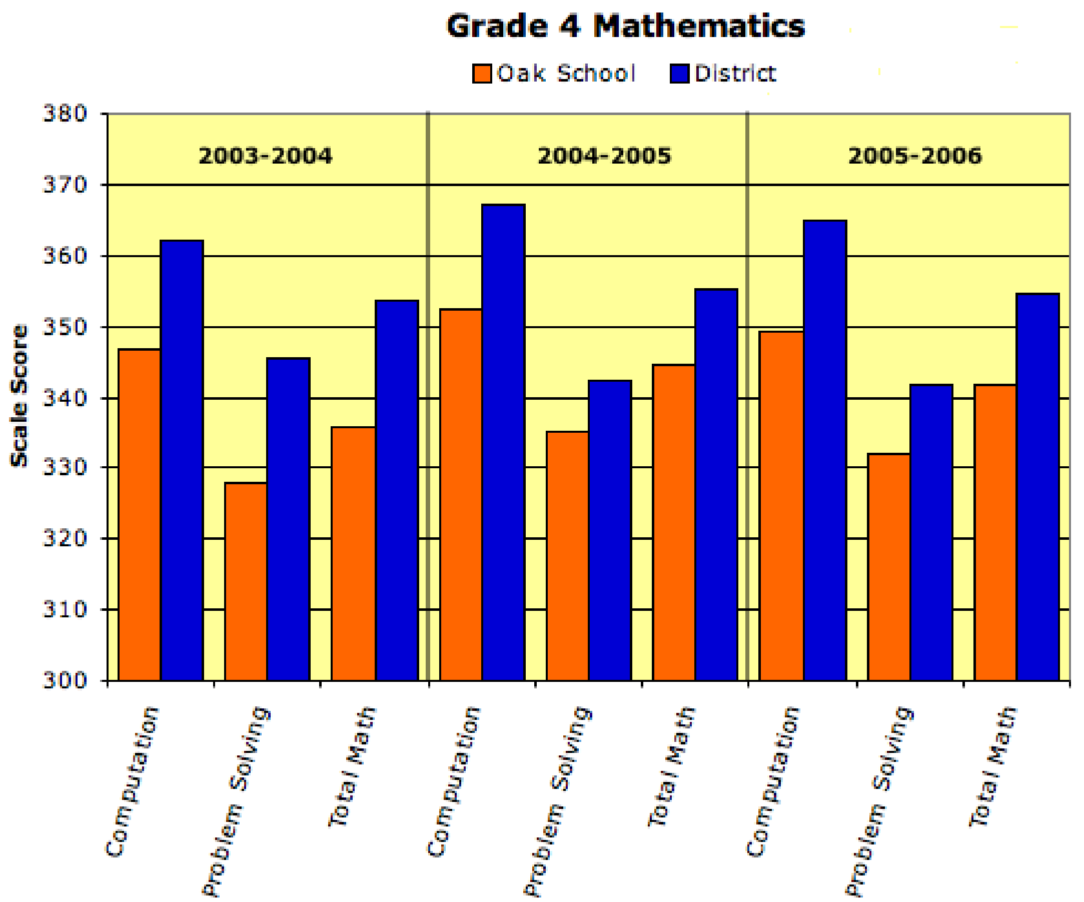
0: Agree; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

$n_{Teachers}$	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
93	39 (.42)	2 (.02)	52 (.56)	.57

Scenario E

This (*show Figure E*) is a different kind of data display—a bar graph of Grade 4 mathematics achievement separated into two components (computation and problem solving) as well as their total, for a school and its district for each of three years. Again, I'm going to ask you to find some information on the display and then tell me how easy or hard that was to do on a scale from 1 to 10 with 10 being "extremely difficult."

Figure E. Trend Data Bar Graph



E.1. What was Oak School's average Total Math Score in 2003–04?

Rubric:
1: Any specific answer from 333 to 338

0.5: Vague, but correct answer range provided (e.g., "between 330 and 340")

0: Incorrect; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n *Teachers*	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
91	4 (.04)	3 (.03)	84 (.92)	.94

E.2. What was the difference in the district's total math score in 2005–06 compared with 2003–04?

Rubric:
1: Any answer from 1 to 3 points; "a few points" or "up a little bit" or "about the same" or "similar"

0.5: "exactly the same"; "the same"

0: Incorrect; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n *Teachers*	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
91	4 (.04)	10 (.11)	77 (.85)	.90

Now I'm going to ask you some questions about how you would interpret the data in this chart.

E.3. Looking at the chart as a whole, what would this data tell you about fourth graders' mathematics achievement at this school? [*Get open response*—**No Rubric: Coded only, not scored**] OK. Now I'm going to read a series of statements that people might make about the data in this graph and I'd like you to tell me for each one whether you agree or disagree and the reasons why. Remember to think aloud as you're deciding on your answer.

a. Oak School does better than the district as a whole in Grade 4 mathematics.

Rubric:
1: Disagree (Oak School total math scores are lower than the district's math scores.)

0.5: Disagree with no explanation

0: Agree; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n *Teachers*	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
91	2 (.02)	8 (.09)	81 (.89)	.93

E.3 (continued)

b. Oak School has made some improvement in Grade 4 mathematics over this time period.

Rubric:
1: Agree (Oak School total math scores are slightly higher in 2005–06 than in 2003–04.)

0.5: Agree with no explanation

0: Disagree; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n ***Teachers***	**Score Frequency (Proportion)**			***M***
	0	**0.5**	**1**	
91	31 (.34)	3 (.03)	57 (.63)	.64

c. Relative to the district as a whole, Oak School fourth graders have been getting better in their problem solving skills.

Rubric:
1: Agree (based on *clearly identifiable comparison* of problem-solving scores for Oak School and the district)

0.5: Agree (Based only on Oak School data; no clear, identifiable comparison with district); Agree with no explanation

0: Disagree; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n ***Teachers***	**Score Frequency (Proportion)**			***M***
	0	**0.5**	**1**	
92	38 (.41)	10 (.11)	44 (.48)	.53

d. Relative to the district as a whole, Oak School fourth graders have been getting better in their computation skills.

Rubric:
1: Disagree (Based on *clearly identifiable comparison* of computation scores for Oak School and the district)

0.5: Disagree (Based only on Oak School data; no clear, identifiable comparison with district); Disagree with no explanation

0: Agree; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n ***Teachers***	**Score Frequency (Proportion)**			***M***
	0	**0.5**	**1**	
88	32 (.36)	8 (.09)	48 (.55)	.59

E.3 (continued)

e. Oak School's progress in narrowing the Grade 4 math achievement gap with the rest of the district has been in problem solving rather than computation.

Rubric:
1: Agree (Gap between Oak School and district scores decreases more for problem-solving than for computation.)

0.5: Agree with no explanation

0: Disagree; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

$n_{Teachers}$	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
89	26 (.29)	6 (.07)	57 (.64)	.67

E.4. Suppose Oak School had started using a new mathematics program at the beginning of the 2004-05 school year while the rest of the district continued with the old program. Looking at these data, what are your thoughts about the new curriculum? [*Get open response*—**No Rubric: Coded only, not scored**] Which of these statements would you agree with and why?

a. The math program appeared to improve achievement the first year it was used but the benefit disappeared the next year.

Rubric:
1: Disagree (Oak School is still performing better in 2005–06 than it was in 2003–04.)**;** Agree with reservations (Teacher takes issue with word "disappear". For example, "I agree, it did improve achievement the first year and scores are lower in the second year, but the benefit did not totally disappear.")

0.5: Disagree with no explanation

0: Agree; Teacher does not know. Scorer cannot conclude whether answer is correct or incorrect.

$n_{Teachers}$	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
88	53 (.60)	1 (.01)	34 (.39)	.39

E.4 (continued)

b. The new math program appeared to help students with their computation skills.

Rubric:
1: Disagree (Based on *comparison* of computation scores for Oak School and the district; Gap stays relatively constant each year.)

0.5: Disagree (look at Oak School only); Disagree with no explanation; Agree with reservations (i.e., “gap is pretty consistent, but the program helped a little bit”)

0: Agree and focus only on 2 years of data (03–04 and 04–05); Agree and say that “05–06 is better than 03–04” but do not say “slightly better”; Other agree; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n* *Teachers	**Score Frequency (Proportion)**			***M***
	0	**0.5**	**1**	
90	69 (.77)	15 (.17)	6 (.06)	.15

c. You can’t be sure whether the program is having an effect because there may be differences between the different classes of fourth graders.

Rubric:
1: Agree (e.g., acknowledges that there are differences in the populations of students each year)

0.5: Agree with no explanation

0: Disagree (e.g., Program will have an effect regardless of the student population involved.) ; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n* *Teachers	**Score Frequency (Proportion)**			***M***
	0	**0.5**	**1**	
90	22 (.24)	20 (.22)	48 (.53)	.64

Note:

Item responses did not correlate with those to other Data Interpretation items. Scores not included in analyses.

E.4 (continued)

d. Scores move around from year to year, but the new math program appears promising and should be monitored for more years.

Rubric:
1: Agree (e.g., some indication that program benefits students; need more than 2 years of data to determine if a program is working)

0.5: Agree with no explanation

0: Disagree; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

$n_{Teachers}$	**Score Frequency (Proportion)**			*M*
	0	**0.5**	**1**	
91	10 (.11)	15 (.16)	66 (.73)	.80

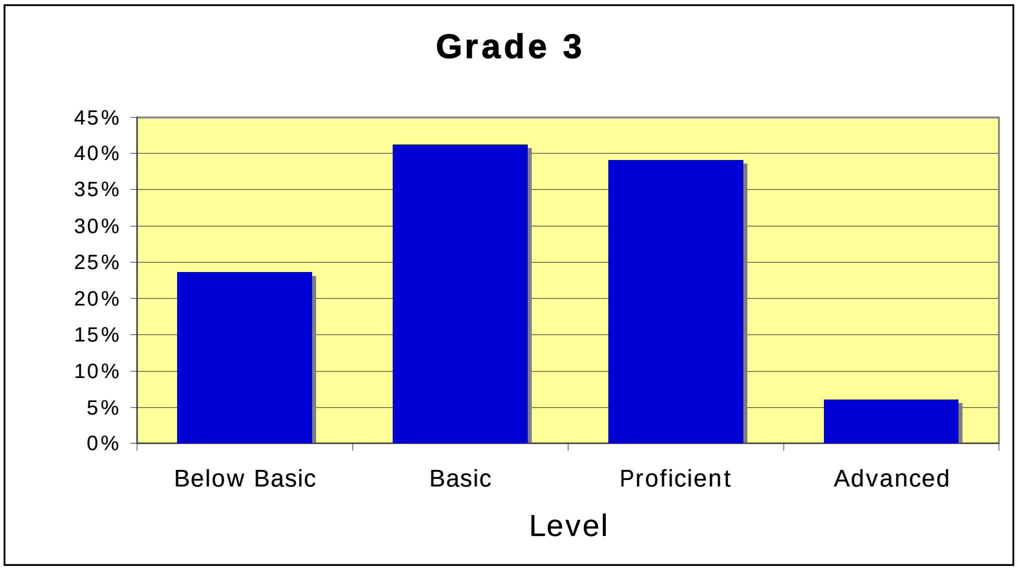
E.5. Are there other issues or possible explanations that should be taken into account as well?

No Rubric: Coded only, not scored

SCENARIO F

Suppose you're in a meeting to discuss 2005–06 reading data from the state assessment for your school's third grade and they hand out this data display. (*Show Figure F.*)

Figure F
Histogram



F.1v1. Based on this chart, what percentage of the school's third graders have achieved proficiency?

Rubric:
1: Any answer from 44 to 46

0.5: Evidence that correct math is being used, but no final answer (e.g., "I need to add 38% and 6%.")

0: Incorrect; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n Teachers	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
47	28 (.60)	1 (.02)	18 (.38)	.39

F.1v2. Based on this chart, what percentage of the school's third graders were less than Proficient in reading?

Rubric:
1: Any answer from 64 to 66

0.5: Evidence that correct math is being used, but no final answer (e.g., "I need to add 23% and 42%.")

0: Incorrect; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n Teachers	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
49	12 (.24)	6 (.12)	31 (.63)	.69

F.2. One of your colleagues, after looking at these data says, "There's something wrong with this chart." Would you agree? Why or why not?

Rubric:
1: If agrees AND says that "numbers don't add to 100" or "numbers add to more than 100"

0: Incorrect (Can't find anything wrong; Identifies something else as "wrong"); Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n Teachers	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
96	42 (.44)	N/A	54 (.56)	.56

Scenario G

Suppose you're teaching in a district that requires students to attain eighth-grade proficiency in mathematics in order to enroll in Algebra I in high school. Looking at students' performance the preceding year, you found the results in this table (*show Figure G*) for the Latino and African American students who make up your school's entire student body.

- A score of 65% on the district math test is considered proficient, and
- A school is considered "low performing" if less than 50% of students in any student subgroup reach proficiency.

Figure G

2005–06 Achievement in Grade 8 Mathematics

Group	Number of Students	Mean Math Score	Percentage Proficient	Number Proficient
Latino	228	67.5	61	139
African American	31	66	48	15

G.1o. What do these data tell you about how well students are doing at your school?

Rubric:
1: Any correct observation or inference from the table, including “About 60% of Latino students are proficient.” “A smaller proportion of African American than of Latino students are proficient.” “The average score in the school is just a little above the proficiency criterion.”

0: 1–2 correct general statements, but clearly is not reading the table correctly (e.g., “Latinos are doing better than African Americans, but both groups are not proficient.”); Other Incorrect (Do not reference anything in the table, very vague); Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

$n_{Teachers}$	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
82	24 (.29)	N/A	58 (.71)	.71

G.1. Now I’m going to read you some statements again and I’d like you to tell me whether you agree or disagree with each and why.

a. The majority of our eighth graders are proficient in eighth-grade math.

Rubric:
1: Agree [59% = 154/259 = (139+15)/(228+31)]

0.5: Agree with no explanation; Agree with incorrect reasoning; Disagree with different definition of majority (e.g., says 59% is not a majority; may state correct numbers involved in calculation, but still disagree)

0: Other Disagree; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

$n_{Teachers}$	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
85	16 (.19)	41 (.48)	28 (.33)	.57

b. Our school is not getting enough African American students to proficiency, but Latino students are meeting the required performance standard.

Rubric:
1: Agree (61% for Latinos is greater than the 50% requirement; 48% for African Americans is less than the 50% requirement)

0.5: Agree with no explanation

0: Disagree; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

$n_{Teachers}$	Score Frequency (Proportion)			*M*
	0	**0.5**	**1**	
86	30 (.35)	8 (.09)	48 (.56)	.60

G.1 (continued)

c. Our school is classified as low performing based on these mathematics scores.

Rubric:
1: Agree (African American subgroup is less than 50% proficient.)

0.5: Agree with no explanation

0: Disagree (e.g., “59% of all students are proficient.”); Agree based on 65% criteria (e.g., “Both groups are below 65% proficient); Other agree with incorrect reasoning; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n ***Teachers***	**Score Frequency (Proportion)**			***M***
	0	**0.5**	**1**	
86	25 (.29)	7 (.08)	54 (.63)	.67

G.2. What actions should your school consider to avoid being labeled “low performing” in the coming year? [*after open response*] Which of these statements do you agree with based on these data? (Explain your answer for each.) [*For each statement, give teacher an index card with the statement on it to keep handy as he/she looks at the data.*]

a. This year all eighth graders should get more intensive instruction in mathematics.
b. This year all African American students should get more intensive instruction in mathematics.

Rubric
1: Gives same answer for G.2a and G.2b with appropriate explanation

0.5: Same answer for G.2a and G.2b, but no explanation for one of the items; Gives the same answer for G.2a AND G.2b with no explanation for either item

0: Gives the same answer for a and b with an incorrect rationale (“I disagree because the table doesn’t show all students in the school.”; “I agree because all of the students are not up to the proficient level.”); Gives different answers for G.2a and G.2b; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

n ***Teachers***	**Score Frequency (Proportion)**			***M***
	0	**0.5**	**1**	
79	25 (.32)	20 (.25)	34 (.43)	.56

G.2 (continued)

c. Teachers should obtain a detailed breakdown of last year's test results by item or content standard.

Rubric
1: Agree (with reasonable explanation about *why* having detail is important)

0.5: Agree with no explanation

0: Disagree; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

***n** Teachers*	**Score Frequency (Proportion)**			***M***
	0	**0.5**	**1**	
77	0	20 (.26)	57 (.74)	.87

d. Our eighth-grade mathematics program isn't necessarily "broken," there's a good chance that 50% or more of African American students will meet the proficiency requirement this year.

Rubric:
1: Agree (e.g., acknowledges that sample size is small and would be possible for 1–2 students to do better thus bumping the percent proficient over 50%; states that 48% is close to 50% and would be possible to get to 50% this year)

0.5: Agree with no explanation (no detail, missing explanation regarding *why* African Americans could meet 50% level)

0: Disagree; Teacher does not know.; Scorer cannot conclude whether answer is correct or incorrect.

***n** Teachers*	**Score Frequency (Proportion)**			***M***
	0	**0.5**	**1**	
79	27 (.34)	10 (.13)	42 (.53)	.59

Scenario H

Now I'm going to ask you to think about some data from a hypothetical classroom.

Suppose you're teaching mathematics and at the end of a unit on measurement, you gave a 100-point test on measurement concepts and skills and your students obtained the scores shown in this class list. [*Show Figure H*.] You know that students from this school have had trouble with measurement items on the state test in previous years, and you're wondering whether you need to do more teaching in this area or can move on to the next topic. You takes these scores into the teachers' lounge and ask colleagues to take a look. When they ask about the test you explain that you designed it so that if a student gets a 70% or better on it, you are really quite confident that he or she understands the concepts. When a student's score is lower than that, you feel there is something they still don't understand.

One of your colleagues pulls out his calculator and shows that the mean for these scores is 70.5. "The mean score is greater than 70. You've done your job. Move on! There's lots more math to cover."

Figure H

Classroom Data Set

Student Number	Score
1	95
2	65
3	85
4	55
5	90
6	70
7	100
8	80
9	65
10	80
11	65
12	90
13	65
14	55
15	45
16	15
17	70
18	65
19	75
20	85
21	65

H.1. Do you agree with this colleague? Why or why not?

No Rubric: Coded only, not scored

H.2. What do you think would happen if you gave the same class of students another test on measurement the next day?

No Rubric: Coded only, not scored

H.3. If you were the teacher, what would you do?

No Rubric: Coded only, not scored

Appendix C

Scenario Development and Reliability Information

Data Scenario Development

Because of the project's interest in getting at multiple, distinct facets of teachers' use of data (question posing, data location, data comprehension, data interpretation and data use), an essentially criterion-referenced approach was taken to the development of the data scenario assessment items. The data scenarios were developed for this study with the advice and review of experts in data-informed decision making and assessment. The experts judged that the items represented the intended constructs. In addition, the scenarios were pilot-tested to make sure that they were comprehensible and tapped the intended skills and concepts. The mean scores for the individual items are displayed in Exhibit C-1.

Exhibit C-1

Frequency Distributions, Mean Scores and Reliabilities for Scored Items

Item ID	*n* (Teachers)	Score Frequency			*M* (SE)	Alpha		
		0	0.5	1		Form 1	Form 2	Form 3
Question Posing (1 item)								
A.1	85	26	23	36	.56 (.046)	.469	N/A	.589
Data Location (9 items)								
F.1v1	47	28	1	18	.39 (.071)	.520	N/A	N/A
F.1v2	49	12	6	31	.69 (.062)	N/A	.461	N/A
C.2	97	30	N/A	67	.69 (.047)	N/A	.450	.566
C.1	97	25	N/A	72	.74 (.045)	N/A	.493	.604
C.3	95	4	10	81	.91 (.025)	N/A	.481	.602
B.2	49	6	N/A	43	.88 (.047)	.478	N/A	.374
B.1	49	5	N/A	44	.89 (.032)	.466	N/A	.175
C.4	95	10	0	85	.90 (.044)	N/A	.451	.568
E.1	91	4	3	84	.94 (.023)	.471	N/A	.612
Data Comprehension (16 items)								
E.4b	90	69	15	6	.15 (.031)	.475	N/A	.589
D.2b	96	18	47	31	.57 (.036)	N/A	.414	.595
G.1a	85	16	41	28	.57 (.038)	N/A	.458	.610
E.4a	88	53	1	34	.39 (.052)	.502	N/A	.564
E.3c	92	38	10	44	.53 (.049)	.378	N/A	.526
E.3d	88	32	8	48	.59 (.050)	.469	N/A	.570
F.2	96	42	N/A	54	.56 (.051)	.479	.414	N/A
G.1b	86	30	8	48	.60 (.050)	N/A	.434	.595
E.3b	91	31	3	57	.64 (.050)	.469	N/A	.564

Exhibit C-1 (continued)

Frequency Distributions, Mean Scores, and Reliabilities for Scored Items

Item ID	*n* (Teachers)	Score Frequency			M (SE)	Alpha		
		0	0.5	1		Form 1	Form 2	Form 3
Data Comprehension (continued)								
G.1c	86	25	7	54	.67 (.049)	N/A	.455	.562
E.3e	89	26	6	57	.67 (.048)	.496	N/A	.596
G.1o	82	24	58	82	.71 (.051)	N/A	.455	.605
E.4d	91	10	15	66	.81 (.036)	.494	N/A	.586
D.2a	97	16	2	79	.82 (.038)	N/A	.456	.583
E.2	91	4	10	77	.90 (.026)	.496	N/A	.599
E.3a	91	2	8	81	.93 (.021)	.474	N/A	.591
Data Interpretation (5 items)								
D.2c	96	71	1	24	.26 (.044)	N/A	.434	.567
G.2ab	79	25	20	34	.56 (.048)	N/A	.471	.587
D.4a	93	44	0	49	.53 (.052)	N/A	.444	.603
G.2d	79	27	10	42	.59 (.052)	N/A	.480	.593
D.4b	93	39	2	52	.57 (.051)	N/A	.480	.558
Data Use (1 item)								
G.2c	77	0	20	57	.87 (.025)	N/A	.471	.573

Note: There were three forms of the data scenario interview and each item appeared on two of the three forms.

Reliability and Scores for Data Scenario Questions

For purposes of analysis, those questions on the data scenarios with right and wrong answers were considered to be assessment items. In a case such as the present one, in which the intent is to measure performance relative to a standard rather than performance relative to peers, professional test publishers would estimate reliability through techniques associated with item response theory. These procedures require several hundred examinees for each item, however, and thus were out of reach for a research project of the present scope.

Classical test theory can be applied with fewer respondents and examines the relationship of each item to performance on the rest of the items. The complication in the current instance is the matrix sampling of items done to manage the burden imposed on individual teachers. There were three forms of the data scenario interview, and each data scenario appeared on two of the three forms. To provide some indication of reliability, analysts computed alpha coefficients, examining the relationship between an individual item and the rest of the items in the data scenario interview, for each item and each of the two forms of the interview that included it. These coefficients and shown in Exhibit C-1.

However, the purpose of the data scenario interviews was not to produce individual teacher-level scores. The goal was to provide an estimation of data literacy at the school level. Different teachers took different assessment forms containing different subsets of the items, and different teachers' total scores are not directly comparable.

Scales were analyzed at the school rather than the individual teacher level. That is, the scores for all the teachers at a school who took item 1 were averaged and that mean score was assigned to the school; likewise for item 2, etc. Through this process, the data set was structured as 27 school-level records with a score for every item.

Reliability was estimated by computing an alpha coefficient for the total score. Despite the small school sample and the intentional inclusion of distinct abilities in the assessment, the reliability for the total score was fairly high, alpha = .74.

For all statistical comparisons reported in the body of the report, the school-level total score was the variable used in the analysis.

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