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# Making Sense of Data-Driven Decision Making in Education

## Evidence from Recent RAND Research

Julie A. Marsh, John F. Pane, and Laura S. Hamilton

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Educators proclaim, “We are completely data-driven.” In recent years, the education community has witnessed increased interest in data-driven decision making (DDDM)—making it a mantra of educators from the central office, to the school, to the classroom. DDDM in education refers to teachers, principals, and administrators systematically collecting and analyzing various types of data, including input, process, outcome and satisfaction data, to guide a range of decisions to help improve the success of students and schools. Achievement test data, in particular, play a prominent role in federal and state accountability policies. Implicit in these policies and others is a belief that data are important sources of information to guide improvement at all levels of the education system and to hold individuals and groups accountable. New state and local test results are adding to the data on student performance that teachers regularly collect via classroom assessments, observations, and assignments. As a result, data are becoming more abundant at the state, district, and school levels—some even suggest that educators are “drowning” in too much data (Celio and Harvey, 2005; Ingram, Louis, and Schroeder, 2004). Along with the increased educator interest in DDDM has come increased attention from the research community to understand the processes and effects of DDDM. Yet there remain many unanswered questions about the interpretation and use of data to inform decisions, and about the ultimate effects of the decisions and resulting actions on student achievement and other educational outcomes. Recent research has begun to address some of the key questions related to DDDM.

This occasional paper seeks to clarify the ways in which multiple types of data are being used in schools and districts by synthesizing findings from recent research conducted by the RAND Corporation.

Unlike past studies of data use in schools, this paper brings together information systematically gathered from large, representative samples of educators at the district, school, and classroom levels in a variety of contexts. The paper further provides a comprehensive examination of the many facets of current DDDM policies and practices and suggests a research agenda to advance the field.

Over the past five years, RAND researchers have examined the use of data in a variety of different educational contexts. This paper draws primarily on four studies, described in the table. Of the four, the Southwestern Pennsylvania (SWPA) study was the only project initiated with a primary focus on data use, but the topic emerged as a central focus in the other studies. The studies also varied in scope. For example, the Implementing Standards-Based Accountability (ISBA) study focused primarily on educators’ understanding and use of test score data, whereas the other three focused more broadly on a range of data types, including non-test data such as observational data on instruction and reform implementation, results from stakeholder satisfaction surveys, and reviews of student work. This group of studies was somewhat limited in that it did not capture all the data used by educators or all the influences on decision making. Thus, our evidence on the use of test data is more extensive than our evidence on the use of other forms of data. Further, although these studies vary in the samples from which data were collected, they were not deliberately designed to collect data from a representative sample of school districts in the United States. Nonetheless, the four studies provide evidence that illuminates DDDM practices in a variety of contexts across the country. They included three statewide samples in one case, large districts in a second, small districts in a third, and a large educational management organization in the fourth. Finally, like

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**Description of RAND Studies**

<b>Study</b>	<b>Funding Source</b>	<b>Purpose</b>	<b>Method</b>
Implementing Standards-Based Accountability (ISBA) <sup>1</sup> 2002–2007	National Science Foundation	To examine the implementation and effects of standards-based accountability systems	<ul style="list-style-type: none"> <li>• Statewide data collection in California, Georgia, Pennsylvania</li> <li>• Superintendent, principal, teacher surveys</li> <li>• Interviews with state officials</li> <li>• Case studies of 18 schools</li> </ul>
Data-driven decision making in South-western Pennsylvania (SWPA) <sup>2</sup> 2004–2005	Heinz Endowments Grable Foundation	To investigate district practices in using data to inform instructional, policy, and evaluation decisions	<ul style="list-style-type: none"> <li>• Case studies of 6 districts and 1 charter school in SWPA</li> <li>• Superintendent survey</li> <li>• State/regional interviews</li> </ul>
Instructional improvement efforts of districts partnered with the Institute for Learning (IFL) <sup>3</sup> 2002–2005	The William and Flora Hewlett Foundation	To examine districtwide efforts to improve teaching and learning as well as the contribution of the IFL, an intermediary organization, to reform efforts	<ul style="list-style-type: none"> <li>• Case studies of 3 urban districts in the South and Northeast</li> <li>• Principal and teacher surveys</li> <li>• Interviews; focus groups</li> <li>• Observations of trainings</li> <li>• Review of documents</li> </ul>
Evaluation of Edison Schools <sup>4</sup> 2000–2005	Edison Schools	To understand Edison’s strategies for promoting student achievement and examine how they were implemented; to assess the effect of Edison’s management on student achievement	<ul style="list-style-type: none"> <li>• Case studies of 23 schools</li> <li>• Interviews with Edison staff</li> <li>• Observations of trainings and meetings</li> <li>• Analysis of test scores for all Edison schools</li> </ul>
<p><sup>1</sup> For further details see Stecher and Hamilton (2006); Hamilton and Berends (2006); and Marsh and Robyn (2006).  <sup>2</sup> For further details see Dembosky et al. (2005).  <sup>3</sup> For further details see Marsh et al. (2005).  <sup>4</sup> For further details see Gill et al. (2005).</p>			

**... NCLB has presented new opportunities and incentives for data use in education by providing schools and districts with additional data for analysis, as well as increasing the pressure on them to improve student test scores.**

most of the literature to date on DDDM, these studies are primarily descriptive and do not address the effects of DDDM on student outcomes. Together they create a foundation for ongoing and future research on the topic, by helping to understand how data are being used, the conditions affecting use, and issues that arise in the process—information that will be crucial for effective implementation of DDDM and evaluations of its effects.

The remainder of this paper is divided into four sections. Section one describes what is meant by data-driven decision making, including its origins, a theoretical framework for thinking about its implementation in education, and a brief overview of existing literature. Section two draws on crosscutting findings to answer four fundamental questions about DDDM. The final two sections present emerging policy implications and suggested direction for future research.

**What Is Data-Driven Decision Making in Education?**

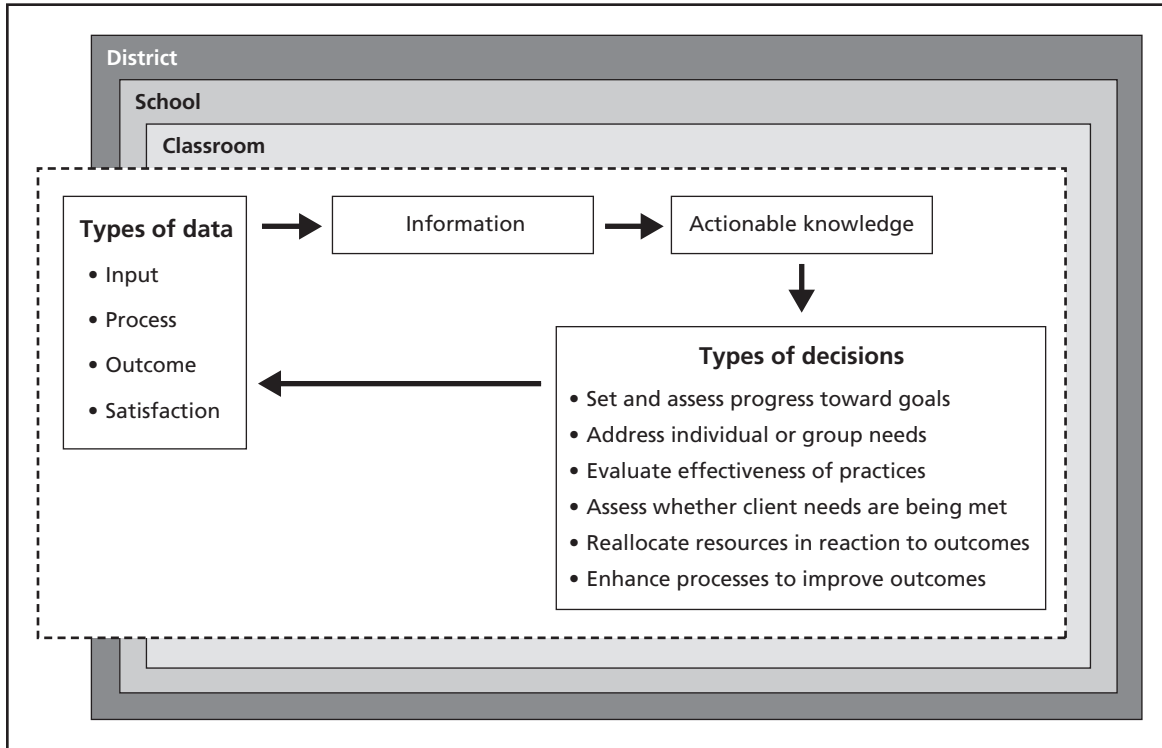
Notions of DDDM in education are modeled on successful practices from industry and manufacturing, such as Total Quality Management, Organizational Learning, and Continuous Improvement, which emphasize that organizational improvement is enhanced by responsiveness to various types of data, including input data such as material costs, process data such as production rates, outcome data such as

defect rates, and satisfaction data including employee and customer opinions (e.g., Deming, 1986; Juran, 1988; Senge, 1990). The concept of DDDM in education is not new and can be traced to the debates about measurement-driven instruction in the 1980s (Popham, 1987; Popham et al., 1985); state requirements to use outcome data in school improvement planning and site-based decisionmaking processes dating back to 1970s and 1980s (Massell, 2001); and school system efforts to engage in strategic planning in the 1980s and 1990s (Schmoker, 2004).

The broad implementation of standards-based accountability under the federal No Child Left Behind Act (NCLB) has presented new opportunities and incentives for data use in education by providing schools and districts with additional data for analysis, as well as increasing the pressure on them to improve student test scores (Massell, 2001). NCLB required states to adopt test-based accountability systems that meet certain criteria with respect to grades and subjects tested, the reporting of test results in aggregated and disaggregated forms, and school and district accountability for the improvement of student performance.

To help organize the discussion of DDDM in this paper, we utilize a conceptual framework (see the figure) adapted from the literature (e.g., Mandinach, Honey, and Light, 2006). This conception of DDDM recognizes that decisions may be informed by multiple *types of data*, including: *input* data, such as school

## Conceptual Framework of Data-Driven Decision Making in Education



expenditures or the demographics of the student population; *process* data, such as data on financial operations or the quality of instruction; *outcome* data, such as dropout rates or student test scores; and *satisfaction* data, such as opinions from teachers, students, parents, or the community. This framework also acknowledges that the presence of raw data does not ensure its use. Rather, once collected, raw data must be organized and combined with an understanding of the situation (i.e., insights regarding explanations of the observed data) through a process of analysis and summarization to yield *information*. Information becomes *actionable knowledge* when data users synthesize the information, apply their judgment to prioritize it, and weigh the relative merits of possible solutions. At this point, actionable knowledge can inform different *types of decisions* that might include, for example, setting goals and assessing progress toward attaining them, addressing individual or group needs (e.g., targeting support to low-performing students or schools), evaluating effectiveness of practices, assessing whether the needs of students and other stakeholders are being met, reallocating resources, or improving processes to improve outcomes. These decisions generally fall into two categories: decisions that entail using data to inform, identify, or clarify (e.g., identifying goals or needs) and those that entail using data to act (e.g., changing curriculum, reallocating resources). Once the decision to act has been made, new data can be

collected to begin assessing the effectiveness of those actions, leading to a continuous cycle of collection, organization, and synthesis of data in support of decision making.

The framework also recognizes that DDDM must be understood within a larger context. First, the types of data that are collected, analyses that are performed, and decisions that are made will vary across levels of the educational system: the classroom, school, and district (although not depicted, state and federal levels are also relevant, but are not addressed in this paper). Second, conditions at all of these levels are likely to influence the nature of the DDDM process. For example, at a particular level of the system, the accuracy and accessibility of data and the technical support or training can affect educators' ability to turn data into valid information and actionable knowledge. Without the availability of high-quality data and perhaps technical assistance, data may become misinformation or lead to invalid inferences. As an example of the former, data from a local test that is poorly aligned with the state test and standards might misinform teachers about their students' preparation for the annual state exam; as an example of the latter, incomplete understanding of statistics might lead educators to interpret non-significant changes in test scores as meaningful indicators. Third, the DDDM process is not necessarily as linear or continuous as the diagram depicts. For example, in the act of

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synthesis, it might be discovered that additional data collection is necessary to produce the desired actionable knowledge. Further, organizational and political conditions at all levels and the individual and collective interpretations of the educators involved also shape and mediate this process (Coburn, Honig, and Stein, 2005).

Although a few studies have tried to link DDDM to changes in school culture or performance (Chen et al., 2005; Copland, 2003; Feldman and Tung, 2001; Schmoker and Wilson, 1995; Wayman and Stringfield, 2005), most of the literature focuses on implementation. In addition, previous work has tended to describe case studies of schools or has taken the form of advocacy or technical assistance (such as the “how to” implementation guides described by Feldman and Tung, 2001). This paper builds on the existing implementation literature by synthesizing work from a number of RAND studies that systematically examined DDDM in a wide variety of contexts.

### Research Questions and Data Sources

This paper addresses four fundamental questions:

- What types of data are administrators and teachers using?
- How are administrators and teachers using these data?
- What kinds of support are available to help with data use?
- What factors influence the use of data for decision making?

To answer these questions we relied on results from surveys, interviews and focus groups, observations, and reviews of documents collected by the four projects.

- *Surveys.* In the ISBA study, researchers surveyed a representative, nested sample of superintendents, principals, and teachers in three states for three years, during the period of 2004 to 2006 (we rely here on results from the first two years). The SWPA study included surveys of district superintendents, and the IFL study included surveys of principals and teachers in three districts. Sharing similar items, these surveys from all three studies assessed respondents’ familiarity with, use of, perceived usefulness of, and support received for using different types of data.
- *Interviews and focus groups.* In all of the studies, researchers conducted detailed case studies of schools and/or districts, interviewing administrators and teachers, and in some cases parents, to further identify the nature of data use at various levels and the factors influencing use or nonuse. Several studies also included interviews of education leaders such as Edison Schools staff, state-level officials, central office administrators, and

intermediary partners to further identify the design and implementation of programs or policies promoting DDDM.

- *Observations.* In the IFL and Edison studies, research staff conducted observations of training sessions and meetings to examine the nature and quality of support for DDDM.
- *Document review.* Researchers in all four studies also investigated how data were used and evaluated the support provided for data use by reviewing documents, such as training materials, school improvement plans, and tools designed to support data use (e.g., rubrics for analyzing classroom observations).

### What Types of Data Are Administrators and Teachers Using?

Compared to other types of data such as process or input data and other types of outcome data such as student work, achievement test scores clearly receive the most systematic attention within our research sites. State tests, one of the most popular types of student outcome data, are summative—most of them are designed to test students’ knowledge on a broad range of skills and topics that should have been learned by the time of the exam. Given the high stakes attached to these results and a federal mandate that states distribute these results in aggregate and disaggregated forms, it is not surprising that the vast majority of superintendents, principals, and teachers surveyed across our studies use them. Further, administrators often said they view test scores as useful for guiding decision making.

One approach intended to make test scores more informative for decision making is value-added modeling (VAM), which controls for prior achievement in estimating the contributions of schools or teachers to growth in student achievement. VAM intends to distinguish the educational contributions of schooling from non-educational factors such as family background (McCaffrey et al., 2003). Some case study districts in Pennsylvania participated in the state’s pilot of the Pennsylvania Value-Added Assessment System (PVAAS), which provides a school-level VAM measure. Although our ongoing research finds pockets of enthusiasm for PVAAS and other VAM approaches, general awareness and understanding of VAM among principals and teachers appear to be quite low.

Overall, it was generally reported that test results become available too late to be useful in making adjustments for the current school year. Typically, the tests are administered in the spring, and results do not become available until the end of the school year

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or later. By then the tested cohort of students has moved on to different classes and may have moved to a different school. For this reason and others, many districts and schools have adopted formal local tests, given more frequently throughout the year and providing diagnostic information that could be acted on immediately. More than 80 percent of superintendents in California, Georgia, and Pennsylvania found results from local assessments to be more useful for decision making than state test results.

Interim progress tests are one type of local assessment growing in popularity, particularly in the areas of mathematics and reading. Administered periodically throughout the year to monitor student progress at meeting state standards, progress tests often provide rapid, regular feedback to students, teachers, and administrators.<sup>1</sup> According to our survey results, 89 percent of Georgia's districts require some or all schools to administer mathematics progress tests, and half the districts require them in science. Approximately one-half of California districts and one-third of Pennsylvania districts require mathematics progress tests in some or all of their schools. Another indicator of the importance of progress tests is the rapid increase in availability of such products from commercial test providers. One reporter notes that the "formative assessment market"—one defined broadly to include software, item banks, and other services allowing teachers and districts to produce classroom assessments and interim progress tests aligned with state standards and tests—is "one of the fastest-growing segments of test publishing" (Olson, 2005). While some districts have purchased these commercial products, others have developed their own assessments in-house.

Our research also suggests that administrators perceive these systems of local progress tests as powerful tools for school improvement—particularly when compared to state tests. For example, approximately 80 percent of principals in one IFL district that implemented standards-aligned progress tests reported that these results were moderately to very useful for guiding decisions about instruction.

Similarly, computerized progress tests also are a prominent component of the Edison Schools design (where they are referred to as "benchmark tests"), and our interviews suggest that these data are highly valued by teachers and principals for guiding instructional decisions, as well as by Edison's corporate and regional staff who use the results to monitor schools. In California, Georgia, and Pennsylvania, elementary school teachers who administered progress tests were asked if test results helped them identify and correct gaps in their teaching; the proportion reporting that progress tests were helpful was higher than the proportion reporting that state tests were helpful. The frequent administration of these tests, quick turnaround for receiving results, and close alignment with curriculum all contribute to favorable opinions of these data relative to state test data. Further, the lack of consequences associated with results in most, but not all sites, may have lessened the pressure on teachers to perform well on progress tests and may have reinforced an understanding that these were diagnostic, instructional tools intended for an internal audience. This too may contribute to the large basis of support for these results among teachers who tended to view state tests as accountability tools intended for an external audience.

Although progress tests provide more frequent information than do end-of-year state tests, many teachers and principals rely on other data sources for even more continuous information about student performance, such as classroom tests, assignments, and homework. For example, tests that are closely integrated with daily instruction and that include reflective questioning of and feedback to learners—sometimes called "assessments *for* learning"—are often viewed as powerful tools for learning (Black and William, 1998; Boston, 2002; National Council on Measurement in Education [NCME], 2005). In some cases, educators find these test results and other forms of classroom-generated outcome data even more useful than local or state test results. For example, in one IFL district, more than 60 percent of teachers reported that classroom assessments provide more useful information for instructional planning than do district quarterly progress tests. Many noted that these assessments are more thorough and timely than district progress tests, and that district tests take time away from instruction or duplicate what they already know from classroom assessments and student work. Majorities of principals and teachers in all three IFL districts also reported systematically reviewing student work (e.g., writing samples) and said they find these reviews to be useful for guiding their practice.

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<sup>1</sup> Progress tests come in many forms. Some are cumulative assessments of what students know coming into the school year, and at various other points throughout the year, relative to what they need to learn by the end of the year. These assessments can provide an early prediction of how well students might perform on the year-end state-mandated test; as such, they are referred to as prospective. Another type of local assessment is retrospective, focusing only on topics students should have already learned by the time of the test. Often drawn from item banks, these tests can be customized by educators to a particular curriculum, pacing, and needs of individual schools, classrooms, and students. Finally, another type of local assessment is structured around units of study. These might be administered before a unit begins, to help the teacher determine what to focus on, or afterward to gauge student mastery of the material.

Nonachievement student outcome measures are also used for decision making in many districts. Edison factors student attendance, student mobility, and graduation rates into its annual monitoring of school performance and ratings of schools and uses this information to evaluate principal effectiveness. In the IFL study, many schools and districts reported looking at attendance, mobility, graduation, retention, and dropout data to inform instructional planning.

In contrast, the use of process data was less prevalent than was the use of outcome data in our study sites. In a few cases, particularly schools and districts adopting a reform approach or model, we found educators systematically examining data on school and classroom practices. Edison's Star Rating System includes an assessment of schools' implementation of 10 fundamental elements of the Edison design, such as school organization, instruction and pedagogy, curricular programs, assessment and accountability, and partnerships with family. In another example, IFL district and school staff reported that they frequently conduct Learning Walks to assess the quality of instruction. In these organized walks through a school's halls and classrooms, educators systematically collected information on, among other things, the nature and quality of student dialogue (e.g., the extent to which students participated in discussion, explained their thinking, and used reasoning) and the clarity of instructional expectations (e.g., the extent to which teachers communicated criteria for evaluating student work and meeting standards). These data—collected by questioning students, examining their work, and observing instruction and materials on classroom and school walls—were meant to inform staff about current practices as they relate to best practices in teaching. The IFL provided educators with protocols, tools, and training to assist in recording observations, comparing the data with notions of best practices, and guiding reflections and next steps. As noted, these examples of the use of process data were seen less frequently in our studies than were uses of outcome data.

Finally, the Edison study revealed some use of satisfaction and opinion data. For example, Edison annually commissions the Harris Interactive polling organization to administer surveys to measure the satisfaction of teachers, students, and parents in each school and includes the results in the calculation of each school's Star Rating. Historically, low response rates have rendered these data of limited value, although new incentives added to the Edison Star Rating System at the end of our study may help improve future response rates.

## How Are Administrators and Teachers Using These Data?

Our analysis suggests that certain types of decisions are more likely to be informed by data than others. Across studies, we found that district and school staff often use data, primarily test scores, to set improvement goals and targets. Driven in large part by state and federal requirements to create school improvement plans (SIPs), majorities of superintendents and principals reported using state test data to identify areas for improvement and to target instructional strategies. For example, one IFL district invested significant resources into developing a computer-based template and training to help school staff analyze data to develop the SIP. Compared to the other two districts in this study, teachers in this district demonstrated a higher level of awareness about the content of the SIP and what they were doing to implement it. Staff described these plans as meaningful documents that truly guide their work, but acknowledged that the process is more labor-intensive than it should be. Staff in the other two districts were more likely to characterize the plans as compliance documents.

Not surprisingly, educators also used test and other data to monitor schools, teachers, and students, and to identify those needing assistance. For example, Edison regional staff systematically used a broad range of information about discipline, quality of curriculum and instruction, leadership, and implementation of benchmark tests to monitor overall school performance. In monthly calls with supervisors, these staff members rated schools and discussed strategies to address the problems in schools receiving the lowest ratings. In several IFL districts, administrators used information gathered in Learning Walks to determine whether teachers and principals were implementing district policies, such as district-mandated curriculum guides. Across all of the studies, test results were commonly used to identify struggling students and to develop interventions and supports. Some districts used progress test results to identify students that may need tutoring and other remedial services to help them achieve proficiency on state tests.

One specific use of test scores common to many of the study sites was the identification of "bubble kids" or students whose current levels of achievement place them near the state's cutoff for determining proficiency in reading and mathematics. This is a rational response to NCLB, which sanctions schools and districts based on the percentage of students who meet or exceed proficiency targets (for further discussion of this practice, see Booher-Jennings, 2005; Pedulla et al., 2003). The bubble kids are those students who

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are most likely to convert extra support into institutional improvements on the accountability measure. One indicator of the prevalence of this phenomenon comes from the ISBA study: More than three-quarters of principals in all three states reported that their school or district encourages teachers to focus on these students and between one-quarter and one-third of teachers said they in fact do focus on these students. Edison's benchmark system gives schools good information for identifying these students, and corporate staff encourage schools to identify bubble kids and develop interventions to prepare them for state exams. Although many educators across our studies said they see this as an appropriate way to use data to drive instructional decisions, others expressed concerns about consequences for students at both ends of the achievement spectrum who might be neglected in favor of the bubble kids in the middle.

Data are also used for a variety of action decisions around instruction, curriculum, and professional development. In several studies, we found that state and local test data were used to identify problems with, and to modify, curriculum and instruction. Examples include central office leaders using progress test results to discover and correct a misalignment between local curriculum and state tests, and teachers using prior year achievement results from state tests to revise lesson plans and tailor instruction to individual student needs. At the classroom level, teachers in SWPA reported using assessment data to make adjustments to their teaching in three distinct ways: tailoring instruction for the whole class based on aggregate results; dividing students into small groups and providing differentiated instruction to these groups; and customizing instruction for individual students (the least frequently cited strategy). Educators also commonly reported that they used data to focus professional development. In fact, majorities of teachers in all three ISBA states reported that state results were useful for identifying areas where they need to strengthen content knowledge or teaching skills. Staff in IFL districts also frequently used Learning Walk data to identify areas where teachers needed additional support and to tailor specific training to address those needs.

With a few exceptions, administrators were much less likely to report using data for decisions that have high stakes for students and teachers. A number of factors may explain this trend, including policies, contracts, or beliefs about appropriate practice, as well as features of data and data systems. For example, few principals in ISBA states found state test data useful for promoting and retaining students, although principals in Georgia were more

likely to do so than their counterparts in California and Pennsylvania. This may be due to Georgia's mandated promotion gateways and more complete testing system. District and school administrators in SWPA were least likely to report using data to evaluate teachers compared to a range of other decisions such as evaluating and adjusting curricular programs. This may be due to the limited scope of the state's testing system—leaving administrators with student test results for some but not all teachers—as well as teacher union contracts and district regulations that limit their ability to formally use data in this way. In contrast, Edison explicitly used data for high-stakes decisions, most notably rewarding schools and personnel who demonstrate strong performance in the areas of student achievement and financial management with monetary bonuses (where allowed by contract), awards, and public recognition.

Looking at patterns within and across our studies, we find that the use of data has varied over time as well as across and within systems. Between the 2003–04 and 2004–05 school years, the vast majority of principals in California, Georgia, and Pennsylvania reported increasing the use of student achievement data to inform instruction. Yet we observed significant variation *within* schools, suggesting that some teachers are using data frequently to inform their practice, while others remain untouched by this new trend. To illustrate, approximately 80 percent or more of the variability in teacher survey reports of several forms of data use in the ISBA project was *within* rather than *between* schools. Despite these within-school differences, we also found that some schools and districts as a whole were more advanced than others in their development and use of data. Specifically, Pennsylvania districts appear to be at the very early stages of this type of work, while Edison schools and regional management offices were more advanced in both infrastructure and use of data. Similarly, two of the three IFL districts were more advanced: Compared to their counterparts in the third district, staff at all levels reported more extensive use of data. We return to this topic later in the paper to examine factors contributing to this variation.

### **What Kinds of Support Are Available To Help with Data Use?**

The most common form of support for DDDM is workshops or training on how to examine test data—yet the content and perceived quality of this support varies. Although most teachers and principals reported having access to workshops that present and explain test results, they often did not find these sessions to

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be helpful. For example, majorities of teachers and principals in only one of three ISBA states rated these workshops as helpful. Although training on use of test results for instructional planning was less often available, educators tended to rate this type of support as more useful. Edison schools provide an example of this kind of training for principals, teachers, and supervisors. The schools consistently focus on how to interpret and translate data defined broadly into usable knowledge. Most of Edison's professional development conferences featured sessions on how to formulate questions and how to interpret and use progress test results and other diagnostic assessments to answer the questions.

Another common source of support came from leaders on school campuses, although the quality and capacity of leadership clearly affect the perceived utility of this support. Principals were a widespread source of support in two of the three IFL districts, where three-quarters of teachers said their principal helps them adapt their teaching according to analyses of state or district test scores. This compares to one-half of teachers in the third district. One IFL district also trains site-based, full-time coaches to facilitate the interpretation of data to inform school improvement planning.

Two other less prevalent means of support in our studies were technology and partnerships with external organizations. Some districts and schools reported having access to computer software or systems to support data analysis; however, they often did not report these tools to be useful. For example, about one-third to one-half of mathematics teachers in the ISBA states had access to software or systems, and of them, only one-third to one-half found them useful. Also, many districts in SWPA, due to their small size and limited resources, generally lacked comprehensive, integrated data systems that give teachers or administrators easy access to multiple sources of data. For this reason, those districts tended to seek external support. Some of the publicly funded regional service agencies in Pennsylvania, known as Intermediate Units, provided technological and analytic support to districts with limited internal capacity. External organizations also support districts by providing professional development. The IFL trains district and school staff on how to collect process data on Learning Walks in order to analyze the data against standards of high-quality teaching, and to use the results to inform instructional decisions. One IFL district contracted with another external organization to facilitate high-school data teams by helping them formulate questions, use data analysis to answer the questions, and develop next steps.

## **What Factors Influence the Use of Data for Decision Making?**

Consistent with other research, the RAND studies reveal a common set of factors to help explain why some educators tend to use data more and with greater levels of sophistication than others. We review these factors here.

**Accessibility of data.** Lack of easy access to data was a significant obstacle to data use in several study sites. This was especially true for the use of input and test score data in small districts without data systems. In other sites, online access to data clearly enabled the use of data—particularly progress test results. These findings are consistent with other research that has found that many districts lack the technical capacity to facilitate easy access to data (Coburn et al., 2005). Similarly, the availability of qualitative data obtained via observations depends upon having access to schools and classrooms. For example, in one IFL district, staff and union officials halted the collection of observational data on Learning Walks for several years, because such walks were viewed as an unnecessary evaluation of teachers and principals.

**Quality of data (real or perceived).** Many educators questioned the validity of some data, such as whether test scores accurately reflect students' knowledge, whether students take tests seriously, whether tests are aligned with curriculum, or whether satisfaction data derived from surveys with low response rates accurately measure opinions. These doubts greatly affected some educators' buy-in, or acceptance of and support for the data, which research has identified as an important factor affecting meaningful data use (Feldman and Tung, 2001; Herman and Gibbons, 2001; Ingram, Louis, and Schroeder, 2004). Yet in the case of state test results, even though many educators questioned their validity, they nonetheless still reported using them. Thus, contrary to past research—which suggests that educators are hesitant to make decisions affecting students if they view the data as inaccurate or unreliable (Choppin, 2002)—our studies indicate that high stakes attached to results are likely to stimulate their use despite a real or perceived lack of quality.

**Motivation to use data.** External pressure and internal motivation also contributed to data use in several study sites. Federal, state, and local accountability policies—which often included the public reporting of results, as well as rewards and sanctions based on performance—created incentives and pressure to examine and use data, particularly test score results (in the case of Edison, Star Ratings and monetary bonuses may have motivated educators to look at a broader array of process, input, and outcome data).

The intrinsic desire to evaluate and improve one's practice and performance may have also contributed to data use. In several studies, self-described "data-driven" teachers (e.g., IFL district teachers who volunteered to have their classrooms regularly observed and videotaped in order to receive feedback, ISBA teachers who reported returning to school over the summer to review state test results for their previous year's students) attributed their use of data to internal motivation to reflect and improve on their craft.

**Timeliness of data.** Time delays associated with receiving state test results also affected educators' ability to use the information for decisions. In contrast, the immediacy of results from many progress test systems enabled their use throughout the year. The availability of progress test results at multiple points in time also enhanced their utility relative to end-of-year test results. Other studies confirm the importance of timeliness and the frequent mismatch between the fast pace of decision making in schools and the lag time involved in receiving results of tests or evaluations (Coburn et al., 2005).

**Staff capacity and support.** Various facets of staff capacity appeared to enable data use in our studies, including teachers' level of preparation and skills, access to professional development to bolster technical and inquiry skills, and support from individuals who were skilled in filtering data to make them more interpretable and usable. Other studies similarly identify capacity as a critical enabler of DDDM and find that school personnel often lack adequate skills and knowledge to formulate questions, select indicators, interpret results, and develop solutions (Choppin, 2002; Feldman and Tung, 2001; Mason, 2002; Supovitz and Klein, 2003).

**Curriculum pacing pressures.** Another obstacle limiting teachers' use of data was the pressure to stay on pace with curriculum—particularly mandated curriculum with pacing plans—and a perceived lack of flexibility to alter instruction when their analysis of data reveals problem areas that require time to remediate. As a result of these pressures, teachers often opted to follow the curriculum instead of the data.

**Lack of time.** Lack of time to collect, analyze, synthesize, and interpret data also limited use at multiple study sites. While online data systems and software may have reduced time needed to summarize, display, and even run basic analyses of quantitative data, deciding how to act on these results required time that many educators lacked. The use of process data also required significant time for preparation (e.g., knowing what to look for during classroom observation, agreeing on expectations and rubrics for evaluating student work) as well as analysis and

action (e.g., deciding how observed practice relates to best practices and how to address observed weaknesses). Past research confirms that few organizations have found ways to allocate and protect time for teachers to regularly examine and reflect on data, which is critical for effective DDDM (Feldman and Tung, 2001; Ingram et al., 2004).

**Organizational culture and leadership.** The culture and leadership within a school or district also influenced patterns of data use across sites. For example, administrators with strong commitments to DDDM and norms of openness and collaboration fostered data use. On the other hand, the collective examination of data was constrained in organizational settings where beliefs that instruction is a private, individual endeavor predominated. Other studies have consistently found that school leaders who are able to effectively use data for decision making are knowledgeable about and committed to data use, and thus they build a strong vision for data use in their schools (e.g., Detert et al., 2000; Mason, 2002; Lachat and Smith, 2005; Miele and Foley, 2005). Some studies also found that the existence of professional learning communities and a culture of collaboration facilitate DDDM (e.g., Chen, Heritage, and Lee, 2005; Holcomb, 2001; Love, 2004; Symonds, 2003).

**History of state accountability.** As mentioned previously, high stakes may help to stimulate DDDM. Schools and districts situated in states with long-standing state accountability systems providing individual and school measures of student achievement demonstrated more extensive use of data than those located in states with more nascent accountability and testing systems. This contextual factor may mediate the motivation and capacity to use data for decision making, but it can also lead to questionable practices such as the "bubble kids" phenomenon.

### **Implications for Policy and Practice**

Together, the RAND work suggests that most educators view data as useful for informing aspects of their work and use various types of data in ways to improve teaching and learning. Most schools and districts in our studies are focusing significant attention on outcome data, particularly state test scores. Educators participating in the studies, with a few exceptions, do not appear to be using input, process, or satisfaction data as frequently or as systematically as they use outcome data. Further, it is not clear that all educators have the necessary elements of successful DDDM practice at their disposal. These include the skills, time, and motivation to analyze and interpret data; access to data that are timely and valid; and a repertoire of alternative actions to invoke when

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they detect a problem. In this section we present implications derived from these findings.

Our first implication is a cautionary one: DDDM does not guarantee effective decision making. Having data does not necessarily mean that they will be used to drive decisions or lead to improvements. The process of translating data into information, knowledge, decisions, and actions is labor-intensive, and practitioners need to consider the trade-offs of time spent collecting and analyzing data, as well as the costs of providing needed support and infrastructure to facilitate data use (e.g., professional development, online data systems).

Second, practitioners and policymakers should consider promoting the use of various types of data collected at multiple points in time. Many teachers and principals reported that state test results alone are not ideal for driving instruction because of limited content coverage, often limited grade levels tested, a significant time lag before results were released, and various other concerns about validity. Many educators also articulated the value of looking at multiple types and sources of data to inform their practice. Such triangulation of findings may help provide a more balanced approach to decision making, reduce the reliance on any single data source, and minimize the likelihood that any one indicator will become corrupted in a system that has high stakes (Copland, 2003; Herman, 2002; Keeney, 1998; Koretz, 2003). Educators' concerns about relying on single data sources and preferences for multiple measures suggests that educators and leaders should consider other outcome data such as student work and interim assessments, as well as process and input data that can provide crucial information for interpreting test results. For instance, behavioral indicators (e.g., absences, suspensions) and process measures (e.g., quality of instruction and school programs) can yield useful insights and help pinpoint where problems lie. Also, longitudinal, student-level data, and value-added measures may enable educators to answer questions that they believe are important but that cannot be answered with data currently available in most states.

Third, equal attention needs to be paid to *analyzing data* and *taking action based on data*. These are two different steps: taking action is often more challenging and might require more creativity than analysis. Yet, to date, taking action generally receives less attention, particularly in the professional development provided to educators.

School staff often lack not only the data analysis skills (e.g., knowledge of how to interpret test results), but also guidance in identifying solutions

and next steps in addressing diagnosed problems. To build this capacity at the school and central office level, policymakers might consider:

- *Providing focused training on analyzing data and identifying and enacting solutions.* Research is currently under way to identify models of professional development for improving data skills (Love, 2004; Chen et al., 2005). Other research confirms the importance of providing training on how to use data and connect them to practice (Mason, 2002; Supovitz and Klein, 2003). Further training and support are needed to assist educators in identifying how to act on knowledge gained from data analysis, such as how to identify best practices and resources that address problems or weaknesses that emerge from the analysis.
- *Allocating adequate time* for educators to study and think about the data available to them, to collaborate in interpreting data, and to collectively develop next steps and actions.
- *Partnering with organizations* whose mission is to support data use. Good partnerships can provide access to information and means of interpreting information that is sensitive to local needs (Coburn et al., 2005; Spillane and Thompson, 1997).
- *Assigning individuals to filter data* and help translate them into usable knowledge—a strategy found to be successful in several studies (e.g., Berhardt, 2003; Choppin, 2002; Herman and Gribbons, 2001).
- *Planning for appropriate and user-friendly technology and data systems* that allow educators easy access to data and appropriate options for analyzing, summarizing, organizing, and displaying results (see Bernhardt, 2003; Mandainach et al., 2005; Wayman, 2005; Wayman et al., 2004).

Fourth, RAND's research studies and others raise concerns about the consequences of high-stakes state testing and excessive reliance on test data (e.g., Hamilton, 2003). While some responses to testing and test results, such as individualization of instruction, have the potential to improve educational outcomes, others may be less productive, such as increased time spent on test-taking strategies, increased focus on problem styles and formats that appear on state tests, or targeting instruction on "bubble kids." In particular, the focus on bubble kids suggests a need for research to understand the effects of these activities on the quality of instruction and educational outcomes for the other students, i.e., the lowest and highest achievers. In addition, many of these activities may threaten the validity of

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the test results themselves by leading to artificially large test-score gains (see, e.g., Koretz and Barron, 1998). Other concerns about emphasis on test results revolve around the potential narrowing of instruction to the subject areas and content covered on state tests. Finally, there is a risk of excessive testing, due to the addition of progress tests and other assessments intended to prepare students for state tests. Reducing the number of assessments may be a useful reform strategy, as multiple assessments may take time away from instruction and may be perceived by some educators as overwhelming to students (Cromey, 2000). District and school staff should consider taking an inventory of all assessments administered to identify whether they serve a clear purpose, are aligned with state standards, and provide useful information. The benefit of reducing the number of assessments, however, should be weighed against the potential cost of removing valuable additional indicators of student performance and the potential negative consequences of relying on a single measure of student achievement.

Fifth, another implication of this research is the possibility that tying incentives to data such as local progress tests may lead to some of the same negative practices that appear in high-stakes state testing systems. For example, we received reports of educators undertaking test preparation for progress tests—which may be counterproductive if it takes time away from needed instruction of content—and a few cases of cheating on these tests. In another case, one district used progress test results to rank schools. Although advertised as a way to identify schools needing additional support, central office staff also used the information to limit the autonomy of educators in the lower-ranked schools (e.g., requiring and monitoring strict adherence to curriculum pacing guides). By limiting autonomy, district leaders sent the message that these tests were in fact not primarily for diagnostic purposes. Policymakers may need to be more explicit about the purposes of progress test data and more cautious in considering any repercussions before instituting explicit or implicit incentives that may motivate use of progress tests as high-stakes accountability data. Officials may also want to consider promoting the use of “assessments *for* learning” as an alternative to district progress tests.

Finally, policymakers seeking to promote educators’ data use might also consider giving teachers sufficient flexibility to alter instruction based on data analyses. As noted above, teachers often receive dual messages from district leaders to follow mandated curriculum pacing schedules and to use data to inform their practice. Without the discretion to veer from district policies such as pacing schedules, teachers will be limited

in their ability to respond to data, particularly when analyses reveal problem areas that require time for re-teaching or remediation.

### Directions for Future Research

The collective findings from RAND’s work on DDDM offer several directions to the broader research community. First, more research is needed on the effects of DDDM on instruction, student achievement, and other outcomes. Research to date has examined effects on instruction to a limited extent and has yet to measure effects on outcomes, although the ongoing ISBA study will be analyzing, among other things, the relationship between data use and student achievement. Future studies linking implementation and impact could shed light on the conditions under which positive effects are most likely to occur.

Second, our findings regarding the unintended consequences of state testing in these four studies suggest the need to further investigate the effects of using state test results to guide instruction on the validity of test-score information. For example, does the provision of subscale information lead to a narrowing of curriculum to focus on certain topics or skills or does it lead to a more efficient use of time to address student deficiencies? Does reporting whether students exceed a proficiency standard lead to reallocation of resources toward students performing near that standard, or does it lead to increased attention to achievement for all students? And if it does change resource allocation, does this reallocation in turn change the meaning of school-level measures of achievement that are based on percent proficient? Answers to these questions are critical for evaluating the validity and effects of state accountability tests.

A third avenue to pursue includes assessing the *quality of data being examined and the analyses educators are undertaking*. This research could address concerns about the quality of various types of data and the potential misuse of data occurring in schools and districts. Policymakers, for example, would benefit from better understanding the reliability and validity of progress test results, which are a popular yet relatively under-researched type of outcome data in districts across the country. Educators appear to be making fairly important decisions based on these data, yet we know very little about the quality of these tests, particularly those developed in-house by school districts. The research community could further determine whether various types of data are being interpreted correctly. We have examples from several studies in which teachers described making decisions based on faulty assumptions or incorrect analyses.

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Fourth, research also needs to better assess the *quality of the decisions* educators are making. One assumption in DDDM is that data can enhance the quality of decisions made. Yet it is not clear that district-, school-, and classroom-level decisions are always better as a result of test-score and other data. The challenges, of course, are determining how to accurately measure the quality of decisions and designing a study that recognizes the complexity of decision making in education, where many other factors contribute to decisions (e.g., politics, budgets, administrative and organizational issues, preexisting beliefs) (Coburn et al., 2005).

Fifth, it would be valuable to examine the relative utility of various types of data at all levels of the system and whether this can be changed. Our research suggests, for example, that principals and teachers differ to some degree in the types of data they find to be most effective for guiding their work. Future research could clarify which data types are most useful for various stakeholder groups or types of decisions. For example, it would be useful to understand the relative value for various stakeholders of results from state tests, district progress tests, and classroom “assessments *for learning*.” This information could help policymakers and practitioners better design and allocate resources within DDDM efforts. It also would be worthwhile to study more closely schools’ use, or lack of use, of process, input, and opinion data. Although these data types are an important component of DDDM in other settings such as manufacturing, our studies were not designed to focus on them. This implies that future studies should place some focus on the use of these types of data, attempt to identify any factors that may be hindering schools and districts from using them more fully, and seek to identify effective uses of data that might currently be neglected so that educators might become more aware of them and adopt them more widely.

Sixth, value-added modeling of student achievement data is another important line of inquiry to pursue, and one that RAND is currently examining. This line of work holds potential to create more precise indicators of progress and effectiveness, which could become the basis for better decisions. RAND studies, nevertheless, have raised some questions regarding the limitations of these analyses (McCaffrey et al., 2003). This research is particularly relevant given recent developments within the U.S. Department of Education to allow some states to use alternative growth models to judge the progress of schools and districts under NCLB. Despite the popularity of value-added modeling, little is known about how the information generated by these models is understood and used by educators. RAND is currently undertaking a study examining Pennsylvania educators’ use of value-added information. Further research expanding these efforts is needed.

Seventh, experimental studies are needed to more rigorously measure the effects of enhanced provision of data and supports to use it. Standardized interventions can be developed and tested in randomized trials. For example, studies might examine whether the provision of interim progress test data or value-added measures, combined with ongoing professional development for teachers on how to use the information, leads to better instruction and higher achievement than do classrooms without such data and training.

Finally, the research community can help practitioners by identifying ways to present data and help staff translate different types of data into information that can be readily used for planning and instruction. For example, researchers might develop or improve displays so that educators, particularly those without statistical backgrounds, can more easily distinguish trends that are significant from those that are not. ■

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