

Data Literacy for Educators

**Making It Count
in Teacher Preparation
and Practice**

Ellen B. Mandinach

Edith S. Gummer

Foreword by Barbara Schneider



Ellen dedicates this book to the two men in her life, Eli and Houdi, without whom life would be so much less interesting and meaningful. You make every day better with your presence, love, support, and your humor. Both of you have taught me a great deal about using data to inform my decision making.

Edith dedicates this book to her two sons, who are engineers, and their families. Charles and Max know the importance of data and have weathered the emphasis on evidence all of the time they were growing up.

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PO Box 580, Moorabbin, Victoria 3189, Australia
Phone: (03) 8558 2444 Fax: (03) 8558 2400
Toll Free Phone: 1800 334 603 Fax: 1800 150 445
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Introduction to Data Literacy

Data-driven decision making is not new in education. Good teachers and administrators have been collecting and using data for a very long time. In classrooms teachers observe how students react, behave, or perform. They assess whether students are engaged, attentive, and alert. They determine if students understand materials covered in class. They identify learning strengths and weaknesses. And then they make decisions about what instructional steps, social and emotional supports, and accommodations are indicated for students to progress. A teacher might discover that a student's reading difficulties are based on a vision problem rather than a cognitive issue. A teacher might find out that a student is being bullied and that is impacting the ability to focus on classroom activities. A teacher might learn that a student's home conditions make it impossible to complete homework assignments. These are examples of how various sources of data can inform how teachers interact with students and seek remedial steps for cognitive, motivational, and other issues.

Administrators also rely extensively on data. Data are used to make personnel, hiring, and tenure decisions. Data are used to make curricular and programmatic decisions. They are used to make financial decisions, disciplinary decisions, and transportation decisions, as well as decisions in many other areas of education management. Data can help administrations make a decision about whether there is a need for new curriculum materials. Data can inform administrators about whether it is cost-effective to add classroom aides in a school. Data can inform administrators about the impact of transportation schedules on behavior patterns or student performance.

How important has data literacy become? In some school districts, data literacy has become an essential skill set. As part of the application process, candidates for school building leaders must demonstrate their ability to use data from simulated data sets to design school improvement plans. The ability to use data now impacts hiring decisions for teachers in some districts.

These are examples of decision making in education. A question, however, emanates from the examples. How do districts make such hiring decisions if it is unclear what data literacy is and what skills and knowledge are

needed? The intent is good, but how do the districts distinguish good data use from less effective data use? Are there instruments with predictive validity? Is it a matter of, when they see good or poor data use, they recognize it? Our effort to define what it means to be data literate and to outline specific skills and knowledge attempts to address these issues.

Data use has become essential in education. Pretty much every decision in education can and should be based on hard evidence. But that is not always the case. Educators sometimes rely on anecdotes, personal experience, and snapshots of behavior that may not be considered objective, accurate, or complete. Because of increasing pressure to improve the rigor of education as a profession, there has been a growing emphasis on educators' practice to become data-driven, data-based, or data-informed over the past 15 years.

THE USE OF DATA IN OTHER DISCIPLINES

Medicine and Business

Education has taken its cues from other disciplines, for example, medicine and business. Doctors now walk into examination rooms with digital tablets that are linked to patient histories and powerful databases to aid in diagnoses. Of course, just as in education, experience plays an important role. However, evidence from medical tests and face-to-face observations meld with results from clinical trials and research reports to inform the decision-making process. Medical professionals use such data for informed diagnoses that lead to decisions for appropriate courses of treatment. These decisions may be immediate or longer term, depending on the context. Good doctors have been making data-driven decisions for decades.

Businesses have some of the most sophisticated and comprehensive data systems that track inventory, purchasing histories, and pricing structures. Such systems provide information on what is or is not selling, how much has been sold, and projections for restocking. They can even determine how customers walk through stores to make purchases or where to place specific items to maximize attention that may lead to sales. Online sales rely on data systems that maintain data over time on customers' prior purchases, using the information to produce suggestions for future sales. Such emerging data systems have been developed to provide invaluable information to company officials and store managers, but the fundamental use of the data is not new. Before the technology, store owners took periodic and annual inventory from which decisions could be made about merchandising. They accumulated hand-written records of sales and examined shelf space before computing power was available.

Sports

Even sports have become data driven. The book *Moneyball* is a prime example of using data to make decisions at all levels of the baseball operation (Lewis, 2004). Other sports have also jumped on the data analytics bandwagon, particularly basketball and football. Recently an article titled “Considered a Data Dinosaur, Tennis Is Trying an Analytic Approach” appeared in the *New York Times* (Robson, 2015). The article describes how tennis coaches and players are beginning to analyze data about matches and trends in and across points to enhance player performance. Coaches are coming to matches armed with iPads with data analytics apps that can identify strengths and weaknesses of their players and their opponents. The data then can be used to provide performance feedback in the short term, such as in a match, or in the long term.

Coaches need to determine how to communicate the results to maximize impact. This kind of communication is also essential in classroom instructional data use. That means figuring out what the right information is and what it means. The article notes that tennis has been a dinosaur, a sport resistant to use statistics. In part this is because longitudinal data may be problematic to interpret because of players’ trajectories of performance and ratings. It also may be because the data cannot address specific performance-related issues, such as failing to follow through on a shot, over-running the ball, or tossing the ball in the wrong place. The data can help discern trends that can inform match strategies and tactics. In the case of classroom instruction, the data can also reinforce and confirm observations, informal data, and even gut feelings. According to Robson (2015),

Armed with new information, tennis coaches now have a more efficient way to gather, arrange, and disseminate critical metrics for on-court visits. They can also log into a database with thousands of matches on every player, which can facilitate practice sessions and scouting reports. (p. B8)

THE USE OF DATA IN EDUCATION

So is data-driven decision making new? Absolutely not. It has been around for a long time, particularly in other professions. However, the emphasis or importance of data use in education is increasing now, and for good reason. Educators are being confronted with more and diverse data than ever before. Data sources have proliferated. We name just a few sources here:

- Assessments: summative, formative, interim, benchmark, diagnostic
- Classroom activities: exercises, quizzes, reports, problem sets, lab exercises, projects, demonstrations

- Portfolios
- Observations: attentiveness, engagement, fatigue, hyperactivity, hunger, misbehavior
- Questions and answers
- Attendance, truancy, and tardiness
- Behavior: demerits, expulsions, socially supportive actions
- Health and nutrition
- Affect: motivation, attitude, attention, grit
- Special status: disabilities, special education status, accommodations, language, giftedness
- Transportation
- Demographics
- Home circumstances: parental status, parental education, number of siblings, homelessness, language barrier, immigration status, poverty level, parental support, home educational resources, technology

TOOLS TO SUPPORT DATA-DRIVEN DECISION MAKING

The myriad of data is quite mind-boggling and its diversity is certainly more than human memory capacity can handle. Consequently, one major and emerging trend is the increasing availability of technological tools to support the use of data. These tools range from huge data systems to mobile devices to simple spreadsheets. They include data warehouses, student information systems, instructional management systems, assessment systems, diagnostic devices, data dashboards, electronic grade books, spreadsheets, and much more. The technologies help educators access, store, and examine data. They can help manage instruction, develop assessments, create graphical representations of results, and produce reports. Some facilitate data interpretation. But to be clear, the tools should be used to provide assistance, not to replace the judgment of the educators. Teachers still need to interpret the data or results in light of the course content and then determine what instructional steps are appropriate. This is what we have termed data literacy for teachers (DLFT), a construct that is the focus of this book and is dealt with in depth in later chapters. Data literacy for teachers is an amalgam of skills, knowledge, and dispositions that teachers need to be able to use data effectively and responsibly.

THE ROOTS OF DATA USE: WHAT RESEARCH SAYS

Because data-driven decision making and data literacy reside within the context of a complex system, it is important for us to provide an overview of salient research that informs data use in classrooms, schools, and districts.

Enculturating data use requires many necessary components, supports, and resources (Hamilton, Halverson, Jackson, Mandinach, Supovitz, & Wayman, 2009), such as strong leadership, a vision for data use, data teams and data coaches, appropriate technology, and educators who know how to use data. We briefly describe the components and how they relate to the need for data literacy.

Implementation Components

As is noted in the review of research found in the Institute of Education Sciences (IES) Practice Guide titled *Using Student Achievement Data to Support Instructional Decision Making* (Hamilton et al., 2009), the major components of effective data use are the following: establishment of a data culture, an explicit vision for data use, strong leadership, provision of data teams and data coaches, and technology to support data use.

A Data Culture. It is essential for schools and districts to create a data culture in which data use is expected, supported, and sustained (Hamilton et al., 2009; Mandinach, 2012). Data cultures are typically built on the notion of collaborative inquiry (Love, Stiles, Mundry, & DiRanna, 2008) where educators identify problems of practice, collect and analyze data, implement a potential solution, determine impact, and iterate as needed (Easton, 2009, 2010; Hamilton et al., 2009; Mandinach, Honey, Light, & Brunner, 2008; Means, Padilla, & Gallagher, 2010). Data cultures have strong leadership and resources in which educators can explore, examine, and discuss data within a trusting environment.

Schools where leadership have given teachers the chance to have open and frank discussions about student performance tend to have a strong data culture. Teachers feel free to discuss where they may be struggling with particular students and seek advice from colleagues about potential strategies that might be implemented. The teachers do not fear that admitting a problem will negatively impact their evaluations or that colleagues will deem them ineffective.

Another example of enculturation is the provision for common meeting time around data work. Some school districts have set aside time to be used solely for data inquiry. For example, one large urban district has no classes that meet on Wednesday afternoons. They are called “Wednesday outs.” Teachers meet in data teams to discuss student performance or receive additional training on data use. Setting aside such dedicated time makes a strong statement about the importance of data.

The cultures are guided by an explicit vision for why data are being collected and used to inform their work. Leadership expects educators to use data in their practice. The expectation resonates throughout the school from the principal’s office to the data clerks. Leaders make it clear that the

use of data is expected. They model the use of data. They use data. They communicate with data, not gut feelings. They are armed with data. Data become completely integrated into the practices of all educators.

Love and colleagues (2008) provide information about seven components they see as essential for the establishment of data cultures:

- Enculturate the notion of continuous improvement
- Build support from stakeholders
- Strengthen collaboration
- Empower a data coach
- Organize a data team
- Create time for collaboration
- Provide timely access to data (pp. 29–30)

Datnow and Park (2009) also outline a process for enculturating data within a school. Their structure is a six-step process:

1. Schools must lay a foundation for data-driven decision making.
2. There must be an emphasis on continuous improvement.
3. A school must incorporate the use of an information management system.
4. Educators must select the right data.
5. They need to build capacity.
6. The school needs to analyze and act on data to improve performance. (p. 195)

A Vision for Data Use. Staff in schools and districts need to understand why they are being asked or required to use data. Such a rationale can be found in the form of a vision statement that comes from leadership at all levels. Ideally, the vision is aligned between central and building leadership so the purposes for district and school data use are understood. It must be explicit so that educators understand its purpose, and it should be linked to and integrated with school improvement plans and educational objectives (Hamilton et al., 2009) and incorporated into a written plan. Having explicit norms and expectations are an important part of the vision (Wohlstetter, Datnow, & Park, 2008).

Showing how systemic and interconnected the components of data-driven decision making are, a vision for data can be communicated by establishing data cultures (Datnow, Park, & Wohlstetter, 2007; Rose, 2006), by creating collaborative data teams (Datnow et al., 2007; Feldman & Tung, 2001; Knapp, Swinnerton, Copland, & Monpas-Huber, 2006; Wayman, Cho, & Johnston, 2007), by developing a data plan (Armstrong & Anthes, 2001; Datnow et al., 2007; Mason, 2002), and by providing common planning time for data teams to meet.