Data-Driven Instructional Decision-Making Using Technology-Based Tools

Objectives

A hallmark of No Child Left Behind ([NCLB], 2002) is the requirement that states develop annual assessments to measure school and student progress and that educators use data to help improve the learning of *all* students. As a result, practitioners are confronted with complex and diverse sources of data from which they must make informed instructional decisions. Increasingly districts are turning toward technology-based solutions that will help them use data more effectively. There are a growing number of technology-based products that enable districts to provide data to many levels of the system – teachers, administrators, parents, and policy makers - as a means to improve instruction, student learning, and communication.

Examining how technology-based tools can facilitate decision-making, and how administrators and teachers use such tools and data to enhance instruction is therefore essential if we are to understand how assessment data can be used effectively to inform educational decision-making. This three-year project brings together complimentary evaluation techniques, using systems thinking (Mandinach, in press; Mandinach & Cline, 2004) as the primary theoretical and methodological perspective, to examine the implementation and use of data-driven applications in school settings. Our goal is to build a knowledge base about how schools use data and technology tools to make informed decisions about instruction and assessment, using a theoretical framework currently being developed and tested (Light, Wexler, & Heinze, 2004; Mandinach, Honey, & Brunner, 2004).

Theoretical Framework

One consequence of the accountability movement is that district and school administrators are being asked to think differently about educational decision-making, and are beginning to use data to inform everything from resource allocation to instructional practice. The literature on systemic efforts to improve schools has focused on the role of data for accountability in developing, guiding, and sustaining organizational change that leads to improvements in student learning (Fullan & Stiegelbauer, 1991; Massell, 1998; Schmoker 1996). However, the research literature on data to support instructional decision-making is still limited. Some of the first research in this area was done in the 1980's (Popham, Cruse, Rankin, Sandifer, & Williams, 1985; Shepard, 1991); however, as a whole the field did not gain traction, especially at the classroom level, due to the technical limitations in assembling and disseminating data across complex systems.

Recently, the education community has again become interested in data-driven decision-making, largely because growing numbers of school systems and states have the capacity to process and disseminate data in an efficient and timely manner (Ackley, 2001; Thorn, 2002). This trend has been further accelerated by the requirements of NCLB to use data to improve school performance (Hamilton, Stecher, & Klein, 2002).

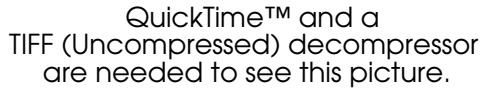
Of the nascent but growing body of literature on the use of data systems, tools, and warehouses to support decision-making processes in schools, research indicates that many complicated factors must be addressed if these tools are to be used to support instructional improvement. There are a number of initiatives being implemented across

the country for which research is only in the most formative stages. These projects include CRESST's Quality School Portfolio (QSP) (Mitchell & Lee, 1998), IBM's Reinventing Education initiative in Broward County, Florida (Spielvogel, Brunner, Pasnik, Keane, Friedman, Jeffers, John, & Hermos, 2001), the Texas Education Agency and the South Carolina Department of Education (Spielvogel & Pasnik 1999). Ongoing work being conducted on data-driven tools in New York, (Honey, 2001; Honey, Brunner, Light, Kim, McDermott, Heinze, Bereiter, & Mandinach, 2002), Minneapolis (Heistad & Spicuzza, 2003), Boston (Sharkey & Murnane, 2003), and Milwaukee (Mason, 2002; Thorn, 2002; Webb, 2002).

Wayman, Stringfield, and Yakimowski (2004) provide one of the first comprehensive reviews of the tools available, identifying some of the technical and usability issues districts face when selecting a data application to support instructional planning. Technical challenges include data storage, data entry, analysis, and presentation. Other challenges include the quality and interpretation of data, and the relationship between data and instructional practices (Cromey, 2000). Work done on the QSP in Milwaukee indicates that educators are hesitant to base decisions that affect students on data they do not necessarily believe are reliable and accurate (Choppin, 2002). The standardized test data provided in many of these data systems were often not originally intended for diagnostic purposes (Popham, 1999; Schmoker, 2000). Educators' knowledge and training in the use of data is also a confounding factor. While practitioners need not be experts in psychometrics, they must have some level of assessment literacy (Webb, 2002). However, most educators are not trained in testing and measurement and assessment literacy is therefore a major concern (Popham, 1999).

Light and colleagues (2004) examined organization and management theory in the use of data. In developing a theoretical framework for the use and transformation of data, they draw upon the work of Ackoff (1989), Drucker (1989), and Breiter, (2003). According to Ackoff (1989), data, information, and knowledge form a continuum from data, to information, to knowledge that can be applied to make decisions. Light and colleagues (2004) constructed a model of how data are transformed into knowledge, based on a sequence of six steps identified by Ackoff (1989) and Drucker, (1989). These steps include collecting, organizing, summarizing, analyzing, synthesizing, and decision-making. The six steps form a continuum of cognitive complexity. As Light and colleagues note, during the sequential set of steps, raw data are always made meaningful by a process of contextualizing within the situation that produced the data.

The theoretical framework guiding our research is conceptualized as data-driven decision-making in the service of focused inquiry. A focused inquiry guides the processes educators engage in as they move from thinking about relevant data (collecting, organizing), to formulating hypotheses (summarizing, analyzing), to taking actions (synthesizing, deciding).



Methods and Data Sources

We are examining the use of three technology-based applications in terms of data use and the theoretical framework. The first application is handheld technologies used to conduct diagnostic assessments of students' literacy and mathematics learning. Teachers collect classroom data on a handhelds and upload their information from the handhelds to a web-based reporting system, where they can obtain richer details about each student. They can follow each student's progress along a series of metrics, identify when extra support is necessary, and compare each student's performance to the entire class. The second application is the Grow Network (2004), which helps to "transform assessment results into instructional tools for teachers, principals, and parents." Grow is both a print and web-based reporting system that uses standardized testing data to provide clear and comprehensible information to various stakeholders. Grow delivers customized reports to teachers, administrators, and parents and provides overviews of class-wide priorities, groups students according to state performance standards, and enables teachers to focus on the strengths and weaknesses of individual students. The third application is a data-warehouse, a locally grown initiative that enables school improvement teams, administrators, teachers, and parents to gain access to a broad range of data. The district stores a diverse array of information on students enrolled in the school system. The information is available for data mining to an increasingly larger set of stakeholders in a growing number of formats for use in various educational contexts.

We examined the implementation and use of these applications in three sites during the project's first year. Interviews and focus groups were conducted with

teachers, administrators, and students. Classroom observations also were conducted as teachers made use of the applications. The site for the handheld diagnostic tool is the Albuquerque Public Schools; the Grow Network in the New York City Schools; and the data warehouse in the Broward County Public Schools. As the project moves into its second year, we will continue to collect data in these sites, and move to validation sites: Mamaroneck Public Schools for the handhelds, Chicago Public Schools for Grow, and a site to be determined for the data warehouse.

Results

The applications are clearly impacting how practitioners interact with and use data to make educational decisions. The handhelds have closed the feedback loop between assessment and instruction, enabling teachers to obtain immediate information about students' performance on specific cognitive skills and thereby customing remediation accordingly. They can plot and analyze the trajectories of performance over time to make decisions about individual students in terms of differentiated instruction and examine classroom performance more broadly. The use of the handhelds has become a thoroughly integrated tool for many teachers in Albuquerque.

The work on the Grow Network has been linked directly to the theoretical framework by Light and colleagues (2004). The framework illuminates the interrelation between the application and the educator in supporting decision-making. In understanding the role of the Grow Reports, the framework allows us to identify how the tool supports the creation of knowledge by collecting, organizing, and summarizing the data. The ease with which most teachers were able to understand the reports perhaps indicates that the *data* are now at the level of *information*. The transformation process identifies that the last few steps in generating knowledge are analyzing and synthesizing. In order to do this, teachers connect the information about test performance to their prior knowledge of teaching and their students, thereby shaping this connection by their pedagogy, their context and their level of understanding of the test. Decisions being made from Grow were not driven by the data as much as by teachers' pedagogy. As teachers stated, the data helped them develop a clearer picture of their students, but they still had to integrate this data into their broader understanding. In the final stages of the data-knowledge process, teachers rely more on their knowledge of teaching and learning than on their assessment literacy. This is perhaps the crux of the relationship between the application and the educator where Grow effectively transforms the test data so that the educator can use them when making classroom decisions.

The data warehouse and the use of data have fundamental changed how some schools function in Broward County. In one school, the use of data inquiry has permeated all levels from the administration and teachers, to students and parents. Everyone uses data to make informed decisions that are relevant to their particular roles. Administrators create an atmosphere in which data-driven decisions are infused. Teachers conduct item analyses to differentiate instruction. Students take responsibility for setting goals, plotting data, and analyzing their learning strengths and weaknesses. Parents help their children to understand their performance. Area and central administrators rely heavily on the data warehouse to obtain a variety of information. However, not all practitioners readily use the warehouse. Access and time are issues. Facility with technology is a barrier. Often schools must rely on a central person who

makes queries to the warehouse, rather than the practitioners themselves interfacing directilywith the application. These are barriers we will continue to examine.

Scientific Implications

While debate about the merits of using state mandated testing data for diagnostic purposes continues, responding to accountability requirements remains a challenge that schools and districts must address (Pellegrino, Chudowsky, & Glaser, 2001; Stiggins, 2002). Although high-stakes accountability mandates are not new, NCLB places schools under intensified external scrutiny that has real consequences (Fullan, 2000). Not only are failing schools identified, but parents are given the option of removing their children from such schools or using school resources to hire tutors and other forms of educational support. Administrators are struggling to respond to these heightened expectations, which by design call for different thinking about the potential of accountability data to inform improvements in teaching and learning. It is clear that NCLB requires schools to give new weight to accountability information and to develop intervention strategies that can target the children most in need. The growing interest in data-driven decision-making tools is no doubt a direct response to these mounting pressures (Wayman, et al., 2003). Technology-based have the potential to enable practitioners and stakeholders to effectively and efficiently access data and transform them into meaningful information and ultimately to actionable decisions. In the wake of the increasing accountability pressures, the affordances of the technology to provide such transformations of data to information and knowledge can be essential tools for educational practitioners and stakeholders.

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