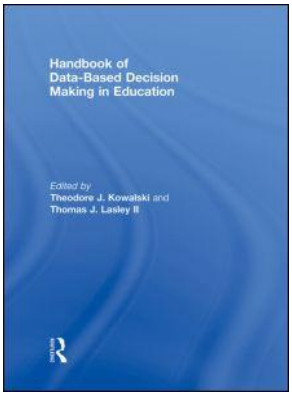

Handbook of Data-Based Decision Making in Education

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Research on Teachers Using Data to Make Decisions

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Research on Teachers Using Data to Make Decisions[1]

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What is Data-Driven Decision Making?

Upon undertaking this review of research on teachers' use of data-driven decision making, we first endeavored to define data-driven decision making. We began this process by determining what would *not* constitute data-driven decision making.

This is a challenging exercise, in that it is difficult to imagine any professional not responsive to some kind of feedback. Here is an apparently clear-cut non-example of the concept, "data-driven decision making."

> *A teacher who is guided by a syllabus and teaches Topic A on September 12, and Topic P on November 22, just as the syllabus directs.*

One might, for argument's sake, take the position that the syllabus is evidence or it was created based on data of some sort, but this position does not reflect what the advocates of data-based decision making mean by teachers using "data." Our sense of the process, reinforced by our reading countless pages of literature, is that teachers who take frequent measures of how well their students are progressing in the acquisition of instructional goals, and in response to what the evidence tells them, adjust their instruction and are engaged in "data-driven decision making." It is important to note, as note 1 explains, that evidence can be collected at the school level or the district level for purposes of implementing changes in policies or practices. Our focus is on teachers using data relevant to their own teaching, their own classrooms, and their own students.

To engage in data-driven decision making, there is no need that the data be relevant to standardized tests. We found an example of a teacher using data described in the *Milwaukee Sentinel* (Hetzner, 2007) and this account surely represents data-based decision making even though the evidence is not concerned with scores on a standardized test.

> A teacher observed a student in her class who refused to do her school work. The teacher paired the student with another student who would make the reluctant student feel safe and observed the results. As a result of these observations, including a close study of body language, the teacher adjusted her plan to help the student's performances.

Why is Data-Driven Decision Making Receiving so much Attention Recently?

Several articles noted that NCLB-mandated accountability serves as a driver for data-driven decision making (Bernhardt, 2004; Bloomfield & Cooper, 2003; Johnson, 2004; Trimble, 2003; Wayman, 2005). School leaders in most districts are under pressure to have their schools do well on high stakes annual assessments. The consequences of failing to have sufficient numbers of students passing the state tests can be job threatening. Teachers are advised, under this high stakes regimen, to attend to evidence of student learning to optimize the chances that sufficient numbers of students will pass the state tests. Again, this process is seen as "evidence-based teaching" (see Fuchs et al., 1999, p. 610).

What are Some Examples of Research on the Effectiveness of Data-Driven Decision Making?

It seems odd to ask whether those who advocate that teachers engage in data-driven decision making have evidence to support their recommended approaches to teaching. As Wayman (2005) put it, "few would argue that creating more information for educators to use is a negative" (p. 236).

A useful summary of research into data-driven decision making would probably not compare scientific procedures with random, intuitive, commonsense approaches to teaching. On the other hand, teachers who use data-driven decision making, or at least a grounded, idiosyncratic version of it, to work with pupils who are facing a high stakes accountability test, might believe that any successes they saw—reflected in rising test scores—were attributable to the fact that the evidence-based procedures were being used. Assume for a moment that these teachers had no control groups, or any other way of sorting out rival explanations for the rise in test scores. With such problems notwithstanding, a case study of their experiences with data-driven decision making could be written. The case study would report pre-scores and post-scores and assert or imply that the observed gains were due to the teaching processes described as data-driven decision making. We found quite a few studies in this genre. Samples of these case studies are summarized here.

Hansen, Gentry, and Dalley (2003) described a case involving Dixon Middle School in Provo, Utah. Teachers and administrators used state assessment data to identify areas of deficiency, and they used data about the school context to determine how to address these deficiencies, using a collaborative model that built on their experience with quality circles. Hansen et al. noted that the teachers and administrators concluded that:

> measurement and data-utilization were effective because they helped educators determine the effectiveness of activities, tasks, and programs; generated possible solutions to problems and issues within the school; encouraged the charting of future directions and decisions; and provided feedback and progress checks as a strategic planning source to monitor, adjust, redirect, and readjust things that occur.
>
> (p. 40)

Ramnarine (2004) illustrated features of a district-wide database system in St. Paul, Minnesota, through which teachers could access standardized test scores as they became available, and create pre-defined as well as user-defined reports about the scores with the ability to analyze the data according to a number of descriptors. Teachers and other school personnel responded very positively to the timeliness of and easy access to the data, and the district identified a number of results they attributed to the use of this system, including culture changes in the expectations about having access to timely and accurate test score data and using data to plan instruction.

Decker (2003) documented the improvement plan for Lead Mine Elementary School in Raleigh, North Carolina, which centered upon the state end-of-grade tests: the curriculum was aligned to the test; teachers and other school personnel mapped out the curriculum sequence over the course of the school year; benchmark tests measured students' understanding of the curriculum four times a year; and students used course system software several times each week to provide differentiated development of curricular goals. Decker credited this improvement plan with the school's citation by the state for exemplary growth two years in a row.

Often data-driven decision making is described as a collaborative process. We found articles that cited research about the effectiveness of the collaborative process, then used this research as support for data-driven decision making, although these two constructs were not satisfactorily decoupled (Hansen et al., 2003; Trimble, 2003).

What Are Some Potential Research Studies in the Area of Data-Driven Decision Making?

Wayman (2005, p. 237) asserted that the research base associated with data use "lacks rigor and many oft-cited references are short studies or opinion pieces." Our recent search of the literature supported his judgment in this matter. What would research look like that informed the field about data-driven decision making? At this point we are suggesting seven generic sorts of research efforts that could be undertaken in this area.

Research on Teacher Skills in Using Evidence

One might assume that data-driven decision making requires certain skills or understandings on the part of teachers—and that some teachers, because of their enhanced levels of skill, make use of evidence more effectively than do other teachers. We have not found a study which investigates the existence of variance in skills associated with using evidence to guide teaching decisions. If we had, it might look like this: A sample of teachers could be given some evidence of student learning for a group of students and asked to plan a lesson responsive to the evidence. A finding of the study might be that some teachers are more effective in interpreting evidence of student learning than other teachers.

Research on Teacher Uses of Evidence

If it were observed that some teachers consistently produced better plans based on evidence than others, researchers might inquire into the factors that account for the observed difference. Are the better planners brighter, more experienced, or do they hold more sophisticated understandings of evidence? This line of research could generate important ideas for training teachers in the process of evidence-based decision making. We did not find research studies that addressed this problem.

Research on Teacher Training in the Uses of Evidence

Another approach would be to train teachers to use evidence in making instructional plans. One group of teachers could receive the training and another group, perhaps those waiting for a chance to receive training, could be a control group. Teachers in both groups could be presented with evidence for a group of students and asked to suggest "next steps." The findings might show that trained teachers produce plans that are likely to be more effective than those who were untrained. Researchers of course could look beyond planning decisions, and focus instead on the performances of students who studied with trained teachers and untrained teachers. We did find several studies of this nature, which are summarized in a later section.

The Fuchs et al. study (1999) mirrored the last paragraph above fairly precisely. Thirty-two teachers from a southeastern urban school district were randomly assigned either to a performance assessment treatment group or to a control group. The control group continued to teach in their usual manner; the performance assessment group (PA) learned about performance assessment, met to assess performance assessments, and discussed among themselves what some next steps were for students based on the assessments. The PA treatment group worked together for several months prior to a summative assessment. Overall, the PA treatment was more effective than the control treatment in terms of signs of increased levels of problem solving—the goal of both the intervention and the control groups. The effect sizes ranged from .76 to 1.15. The intervention was more successful with the students who were at or above grade level, than for the students who were initially below grade level. Effect sizes for these students ranged from .09 to .50.

Research on Teachers' Decision-making Styles

There may be many ways of responding to data. Some writers who seek to study less analytic approaches to interpreting data speak of "naturalistic decision making" (Clemen, 2001, p. 359). This approach to interpreting data models itself on studies of "experts" who decide on courses of action with great effect. It would be possible to compare the products of planning decisions and/or the impacts on students of implementing the plans put forward by "naturalistic decision makers" and those who are more "analytic" in their approaches. The merits of such a study would depend on

the definitions, both connotative and operational, that guided its procedures. We were not able to locate such a study in our literature search.

Research on the Transfer of Teacher Skills

As teachers develop dispositions to use evidence to make decisions about their instructional practices, researchers might ask if their dispositions transfer to other situations, namely to interpret data *other* than test scores of youngsters in the context of a high stakes accountability program. For example, schools could collect attendance data, evidence of absenteeism, ratings of student satisfactions with schools, records of truancy, or the dollar cost of damages inflicted on school property by vandals. As these figures vary, teachers might offer recommendations for school policies and practices. The research question would ask: Are teachers who are efficient using evidence of student learning on tests also effective using other kinds of data? We did not find a study similar to this one.

Research on the Forms of Data

Surely, there are data and there are data. A researcher can ask, "In what forms and in what amounts can teachers make use of the evidence available to them?" "Do teachers find item analyses helpful?" "Are means and standard deviations sufficient for making decisions?" "Do the data need to be disaggregated in some way to be useful to teachers?" Researchers could randomly assign teachers to various data forms and ask them to interpret the evidence and to plan instructional changes. This line of research could help isolate the characteristics of evidence that are optimally helpful for teachers. We did not find a study that investigated the nature of the evidence made available to teachers.

Research on the Role of Decision Making in the Teaching Process

Researchers have long been aware of the role decision making plays in teaching. Jackson (1968) estimated that teachers may make as many as 1,000 decisions each day in planning and implementing lessons in the classroom. Shavelson (1973) called decision making "the basic teaching skill." The complexity of decision making can be reduced by identifying and applying "rules." An example of a rule would be the following: "In selecting words for use in a vocabulary study, choose words that are critical to the text and not solely on the basis that the students do not know the words" (Downes, 2004). Researchers could seek out rules that could guide teachers' decisions in planning for instruction. We did not find examples of research studies into rules that influenced or guided teachers' decisions related to instruction.

Wayman's (2005) introduction to a special issue of the *Journal of Education for Students Placed at Risk* identified an even dozen questions that he judged merited

study. Many of his questions focus on the school as the unit of analysis and not the teacher, but they are certainly important and worthwhile questions.

What are Some Flaws in the Research Focused on Data-Driven Decision Making?

Our search of the literature yielded a number of studies that used the school building or the district as the unit of analysis rather than the classroom. As such, these studies were outside of our chapter's focus. However, the studies were instructive to researchers interested in addressing questions about teachers' use of evidence. We observed the following general flaws in those studies.

Many if not most of the studies used "teacher self-report" to describe the processes utilized in the decision-making process or in estimating the impact of the process on student learning. It is important in studies of teacher decision making to make use of assessments independent of the teachers' perceptions or at least in conjunction with them.

Most studies we read suffered from a problem identified in the research literature as "multiple treatment interference." Rarely was the independent variable solely data-driven decision making. Instead, the treatment included data, collaboration, training, and consultant help. When gains were observed in the study, it was difficult to isolate what factor contributed to the gains.

Almost always, interventions that were called data-based decision making were instituted when a school was in some sort of crisis as a result of low scores on a high stakes examination. This nexus between weak performances and the adoption of something new and promising is understandable. However, the connection raises a threat to the findings of any study that eschews using a control group, namely regression. When initial scores are low, any intervention is likely to be associated with increased scores, whether it is effective or not. It is important in many of the designs we reviewed to introduce control groups.

Finally, there is the notion of "reactive arrangements," also known as the Hawthorne Effect. Almost all the case studies we read about using data to improve instruction and student learning included a great deal of enthusiasm on the part of the main participants. Such enthusiasm may be hard to transplant to other sites or even to other times at the target site. Again, control groups can help discredit this research design problem.

What are Some Optimum Conditions for Using Data-Driven Decision Making?

As we read through the case studies, the few experiments, and the advocacy statements by people championing the current high stakes accountability movement in the United States, we learned that there was a great deal of consensus concerning the optimum conditions for using evidence to guide teaching toward state tests. We identify these optimum conditions and describe them, citing the sources from which they were gleaned. It is clear that the specific, individual conditions are not

independent. That is, the condition that teachers have sufficient time to examine data is related to the condition of teachers collaborating with colleagues. Time is a common factor. However, we thought it important to summarize the themes we identified in the literature. The various themes are linked to specific references in the narrative that follows and in Table 13.1.

School climate must "honor" the uses of evidence in making teaching decisions (Ellingsen, 2007; Lachat & Smith, 2005; Murnane & Sharkey, 2004; Wayman & Stringfield, 2006; Young, 2006)

Many of the identified optimum conditions are interwoven but our sources acknowledged several characteristics which epitomize school climate conducive to supporting teachers in analyzing, interpreting, and most importantly using data to benefit student learning.

Young (2006) used the term "agenda setting" to describe the school leadership role in communicating teachers' use of data by establishing a rationale, expectations, time, and learning opportunities. Young (2006, p. 544) concluded that school leaders "need to embed teaching and learning and their improvement in the heart of data-related activities . . . or risk data analyses as compliance activity divorced from teachers'

Table 13.1 Display of support for selected optimum conditions.

	School climate	*Sensitive measures*	*Timely access to evidence*	*Buy-in by teachers*	*Teacher skills*	*Conceptual interpretation of evidence*	*Time for teachers in school day*	*Team work*
1						*		
2		*						
3	*					*	*	
4					*			
5								*
6				*	*		*	*
7		*	*	*	*		*	
8	*		*		*		*	*
9		*				*		
10	*	*	*			*	*	
11								*
12		*						
13			*	*	*		*	
14						*		
15			*				*	
16				*			*	
17	*		*	*	*		*	
18	*					*	*	*

Note: Numbers in the first column refer to citations numbered in the bibliography. The column headings represent the eight "optimum conditions" we identified in the literature. School climate, alignment of evidence with teaching objectives, timeliness of evidence, teacher buy-in to the process, teacher skills, conceptual approaches to interpreting data, time for teachers to work with data, and teaming (collaboration).

classroom actions." In addition, strong school leadership should model data usage in meaningful and manageable ways. Lachat and Smith (2005) found that the commitment to data use for continuous improvement needs to be championed by school leaders. Successful instructional leaders know that they cannot mandate an environment that values data usage (Ellingsen, 2007). School leaders have a responsibility to develop and nurture a culture of data-driven inquiry and co-responsibility among their faculty. Murnane and Sharkey (2004, p. 4) found that a school cultural condition necessary for success is adopting "the idea that the achievement of all students is the responsibility of the whole teaching staff and that success depends on continued learning." It is extremely important to remember that district administrative support and commitment are keys to success (Murnane & Sharkey, 2004).

Evidence should be "curriculum sensitive" and should align with the teacher's instructional objectives
(Coburn & Talbert, 2006; Kerr, Marsh, Marsh, Ikemoto, & Barney, 2006; Marzano, 2003, Murnane & Sharkey, 2004; Popham, 2007)

Teachers find more validity in assessment results if they are closely aligned to their classroom teaching. Marzano (2003, p. 56) reported that "using measures of student learning that are not sensitive to the actual learning occurring in the classrooms is the first mistake." Teachers find more validity in assessment results if they are closely aligned to their classroom teaching (Coburn & Talbert, 2006). Even though high stakes assessments are aligned with the standards and we assume that teachers are planning instruction around the standards, many teachers view the data as old news (Kerr et al., 2006). Lessons learned by research encourage districts and states to utilize benchmark or interim assessments that are closely aligned to the standards (Murnane & Sharkey, 2004). Popham (2007) alerted the field to the pitfalls of using tests that are insensitive to the quality of instruction. In his view, insensitive tests undermine the fundamental assumptions of accountability. His article proposed ways of assessing tests for their instructional sensitivity.

Teachers need to have access to evidence close to the time it is collected
(Kerr et al., 2006; Lachat & Smith, 2005; Murnane & Sharkey, 2004; Reeves & Burt, 2006; Supovitz & Klein, 2003; Wayman & Stringfield, 2006)

Once teachers are provided time to work with data, they want data that are meaningful to them. Yet, the high stakes testing schedule of assessing students in late winter or at best early spring frustrates classroom teachers. They find the state data not as useful as current classroom data in trying to make instructional decisions. School administrators also find the inability to receive data in a timely fashion to be a barrier to effective use (Reeves & Burt, 2006). In most instances, once the data are received from the state, the school year is ending or has ended. The teachers find these data less relevant (Kerr et al., 2006). Research indicates that teachers want assessment results returned quickly and in a user-friendly format (Murnane & Sharkey, 2004;

Supovitz & Klein, 2003; Wayman & Stringfield, 2006). A recommendation advanced by Kerr et al. (2006, p. 515) is for districts to implement "assessment and data analysis strategies that include multiple types of data collected at regular intervals to allow for a timely, balanced, and meaningful review of data." For example, Lachat and Smith (2005) found that data were used effectively when teachers received the data in a timely fashion which allowed them to plan immediate intervention strategies.

Teachers need to "buy-in" and have faith that the process is worthwhile, and that data will not be used punitively
(Ingram, Louis, & Schroeder, 2004; Kerr et al., 2006; Reeves & Burt, 2006; Trimble, 2003; Wayman & Stringfield, 2006)

As part of the school culture, school leaders need to help teachers develop confidence in the data and the process by which decisions will be made. Teachers will respond in varying degrees depending upon their perceptions of data use (Ingram et al., 2004). These perceptions can be addressed by allowing teachers to vent negative feelings, and by assuring them that tests are diagnostic and results will not be used punitively (Trimble, 2003). Engaging in evidence-based decision making can be a positive process in which teachers feel supported by the data (Wayman & Stringfield, 2006). For example, Kerr et al. (2006) found that principals and teachers viewed data in a constructive manner when they were consistently engaged in making evidence-based instructional decisions. In this case teachers were supported in a positive school culture that promoted the use of data. Wayman and Stringfield (2006) referred to "non threatening triangulation of data" in which multiple measures are utilized in a positive manner to inform instruction.

Often, stakeholders are at odds as to which data are meaningful (Coburn & Talbert, 2006; Ingram et al., 2004; Kerr et al., 2006; Reeves & Burt, 2006). Variations of conceptions of valid evidence seem to be based on individual roles within the school system. "Individuals with different work roles have substantively different data needs" (Coburn & Talbert, 2006, p. 491). Recognition of the diverse perceptions is a much needed step to build a collaborative culture and buy-in.

Teachers need to acquire new skills and improved understandings about evidence and/or understandings about assessment and how to respond to assessment results
(Guskey, 2003; Ingram et al., 2004; Kerr et al., 2006; Lachat & Smith, 2005; Reeves & Burt, 2006; Wayman & Stringfield, 2006)

Ingram et al. (2004) found that teachers are not "data-phobic" but rather lack the experience of working with data. Some teachers are unprepared or unfamiliar with data practices to fully utilize evidence available to them (Wayman & Stringfield, 2006). Guskey (2003) noted that teachers receive little training in assessment design or analysis, and that fewer than half the states require competence in assessment for licensure. Consequently, many teachers regard assessment only as a tool for assigning

grades at the end of a unit, rather than as a means of improving instruction and student learning.

The problem is not only with teachers. District officials may also lack the skills needed to analyze data (Kerr et al., 2006; Reeves & Burt, 2006). It is difficult to create a school culture rich in inquiry when the basic skills or knowledge is lacking. It seems to be crucial that all stakeholders develop data-analysis skills. Professional development for principals and teachers must be sustained, job-embedded, focused on understanding data, and using data to inform practice (Reeves & Burt, 2006).

Kerr et al. (2006) recommended administrative support for teachers "in analyzing and interpreting data, as well as identifying strategies to address diagnosed problems" (p. 515). In a case study, Lachat and Smith (2005) found success with data coaches. The data coaches supported the administration and teachers in their quest to analyze data, interpret data, question data, and arrive at informed decisions. The data coaches assisted principals and teachers in developing the needed skills to effectively utilize data.

Teachers should utilize a conceptual approach to interpret the data
(Clemen, 2001; Ellingsen, 2007; Marzano, 2003; Murnane & Sharkey, 2004; Schmoker & Wilson, 1995; Young, 2006)

Data do not speak for themselves in spite of the common notion that they do. Teachers need tools for interpreting data. Researchers working in the field of decision analysis attempt to provide models to guide practitioners' decision making (Clemen, 2001). Data are only useful if they can be used to arrive at credible explanations of observed variations (Marzano, 2003). With newly developed skills and a better understanding of analyzing and interpreting data, teachers need to process their thinking about data in a conceptual manner. Once the data are aggregated or disaggregated, the initial step is to look for patterns. The next critical step is for educators to brainstorm possible explanations and develop strategies for identifying the most plausible explanation (Murnane & Sharkey, 2004). The explanatory process is the most neglected and in need of educators' time (Ellingsen, 2007; Murnane & Sharkey, 2004), and the tendency is to jump from data patterns to quick fixes (Ellingsen, 2007; Schmoker & Wilson, 1995) without examining possible causes. A school or district needs a systemic and conceptual plan for first interpreting data and using the data. The teachers then need to be supported within this system through agenda setting and school norms (Young, 2006).

Teachers need time in the school day to interpret evidence and to plan instruction based on the evidence
(Ellingsen, 2007; Ingram et al., 2004; Kerr et al., 2006; Lachat & Smith, 2005; Murnane & Sharkey, 2004; Reeves & Burt, 2006; Supovitz & Klein, 2003; Trimble, 2003; Wayman & Stringfield, 2006; Young, 2006)

An obstacle cited in much of the research is the lack of time provided for teachers to

effectively use data to drive instruction. Ellingsen (2007) reminded the field that the greatest gift school leaders can provide to their faculty is time. The challenges of No Child Left Behind have spurred the evolution of educators' roles and responsibilities. Educational reformists and school administrators need to rethink the teachers' role, set time priorities for data examination, and structure collaborative activities (Ingram et al., 2004; Young, 2006). Murnane and Sharkey (2004) recommended that time should be provided within the school day. Reeves and Burt (2006, p. 70) also concurred that the teachers' "workday and responsibilities need restructuring" if we expect effective utilization of data to improve instruction. Lachat and Smith (2005) stressed the expectation within the school culture for teachers to regularly engage in collaborative examination of student data. Though the research is limited on suggesting ways to restructure the roles and responsibilities, many researchers describe methods in which school leaders have provided time to their faculty: Ellingsen (2007) observed modified school days as the most prevalent method in providing teachers time to work with data; Young (2006) described teacher collaboration time during full-day grade-level meetings throughout the year and/or frequent team meetings; and Trimble (2003) noted that collaboration can take place during daily common planning periods. Principals try to work creatively within the system to utilize planning time, faculty meetings, grade-level meetings, as well as professional development days (Kerr et al., 2006; Wayman & Stringfield, 2006). Supovitz and Klein (2003, p. 37) identified "more time" as a factor for "schools that seek to use data more effectively."

Evidence should be interpreted collaboratively and instructional decisions should be arrived at in conjunction with colleagues
(Hansen, Gentry, & Dalley, 2003; Ingram et al., 2004; Lachat & Smith, 2005; Murname, Sharkey, & Boudett, 2005; Wayman & Stringfield, 2006; Young, 2006)

In the spirit of creating a school culture that nurtures data-driven inquiry and decision making, research finds success in collaboration. Teachers are more likely to engage in data analysis as a group (Ingram et al., 2004). Lachat and Smith (2005) found that the modeling of collaborative data inquiry by school leaders was a positive influence on schoolwide data utilization, while Wayman and Stringfield (2006) reported that teachers noted an increase in professional interactions when working with data; teachers began to feel a sense of "common language" in professional discussions. Young (2006) recommended that time should be provided for joint analysis of data, but also heeds warning that collaboration is only a single piece of the larger picture—several other optimum factors contribute to effective data use by teachers such as school/district capacity and agenda setting. Hansen et al. (2003) cautioned that the norms of the group must support learning—members must be willing to share and cooperate with each other, ask questions of one another, and challenge the status quo at times.

How can Teachers be Prepared to Use Data-Driven Decision Making?

Hiebert, Morris, Berk, and Jansen (2007) proposed a framework for teachers to learn from evidence about their own instruction, built on the following four skills:

1. Specify the learning goal(s) for the instructional episode: What are students supposed to learn?
2. Conduct empirical observations of teaching and learning: What did students learn?
3. Construct hypotheses about the effects of teaching on students' learning: How did teaching help [or not] students learn?
4. Use analysis to propose improvements in teaching: How could teaching more effectively help students learn?

This framework is supported in part by studies documenting the success of schoolwide efforts to use analysis of teachers' instruction to improve student learning. The effectiveness of this framework, of course, depends on the skills of the teachers implementing it. Several researchers have begun to examine ways of developing these skills.

Van Es and Sherin (2002) noted that teacher training tends to focus on helping teachers learn to *act*, but not to *interpret*. They studied the effects of using a software package known as Video Analysis Support Tool (VAST) designed to scaffold teachers' analysis of student thinking, the teacher's role, and classroom discourse in the context of their own videotaped lessons. The authors compared teachers who used VAST to those who did not. They found that lesson analysis essays written by VAST users were organized increasingly around noteworthy teaching events rather than chronology, that they included more evidence to support their analyses, and that they incorporated more interpretations about student thinking, the teacher's role, and classroom discourse. Control group participants gained in these areas as well, but at lesser rates and levels of growth.

Santagata, Zannoni, and Stigler (in press) also used a video software package, LessonLab's Visibility software, this time to train preservice teachers with videotaped lessons from the TIMSS project. Masters-level teacher education students in Italy participated in a course which featured guided analysis of the lessons, focusing on parts of the lesson and learning goals, students' thinking and learning, and alternative teaching strategies. As in the Van Es and Sherin study, participants moved from simple descriptions in the pre-test to cause-and-effect analyses in the post-test.

Morris (2006) compared two different cuing conditions on preservice teachers' ability to collect evidence about students' learning and to use that evidence to analyze and revise instruction. Participants were asked to view a fifth-grade mathematics lesson and to form hypotheses about variations in the children's learning, and finally to cite evidence that supported their hypotheses. One group of participants, identified as CL (Children's Learning), were not cued one way or the other as to whether the lesson was successful, while the other group, identified as SP (Sources of Problems), were cued with the information that several children had difficulty with the homework following the lesson. Once the participants had made and supported

their hypotheses, they were asked how they would change the lesson, and to give reasons for their changes. Morris found that although both groups of preservice teachers had very elementary skills in identifying evidence about student learning, with many describing teacher statements as "evidence" of what students had learned (e.g., "The children understand that the height and base are not always in the same places on a triangle because the teacher said that a triangle's height must always form a right angle with the base," Morris, 2006, p. 487), the SP participants were much more likely to cite evidence that referred to students learning than were their CL counterparts. Furthermore, SP participants were more likely to suggest improvements to the lesson that provided opportunities for students to develop their understanding of the mathematical concepts and relationships covered in the lesson.

Fuchs et al. (1999) studied the effects of training teachers to use the results of performance assessments by comparing two groups of eight randomly assigned mathematics teachers each. One group (PA condition) attended an initial training workshop, administered three performance assessments over several months, and met with colleagues after giving each performance assessment to score the assessments and share ideas for providing students with feedback and instruction, with instructional support from the researchers. The other group (no-PA condition) did none of these things. Outcomes for both teachers and students were measured. Following the intervention, PA teachers were able to construct performance assessments in which they incorporated more appropriate features, were able to cite more instructional strategies in response to performance assessment results, and planned instruction more closely aligned with reform goals, as compared to their no-PA colleagues. In addition, above-grade-level students and grade-level students in the PA classrooms made significant gains (with above-grade-level students making gains across more problem types), while their no-PA counterparts made no similar gains.

What are Some Limitations of Data-Driven Decision Making in Education?

The literature highlights a number of limitations associated with the data-driven decision-making process. As Marzano (2003) pointed out, the data collected may identify concepts, topics, or skills that need reteaching, but the evidence does not speak to how the reteaching should be done. Some state accountability processes include suggestions to teachers as to what interventions are called for, but those suggestions are hardly "data-based" or the results of scientific inquiry. Marzano (2003) characterized this problem as "having no explanatory model to interpret the data" (p. 57). He chose to illustrate his point with his own findings about "what works in schools," but his suggestions for a model almost surely do not give direction to teachers who find that a significant number of students in his class do not know how to subtract fractions or read Roman numerals or translate Centigrade readings into Fahrenheit readings. As Biesta (2007) commented, "research cannot supply us with rules for action but only with hypotheses for intelligent problem solving" (p. 20).

When teachers find, after studying the evidence, that some students need help in a particular area, there are *not* a lot of research-based interventions available to them

(Duffy & Roehler, 1982). Teachers can group students for instruction—with those who are having difficulty with skill A in one group, and those having trouble with skill B in another group. There is little direction as to what to do next. Reteaching is not a highly studied process. In a recent meta-analysis on teacher research, grouping had an effect size of .10, while differentiation/adaptive instruction had an effect size of .22. The latter is larger, but still in the low end of the scale as interventions go (Siedel & Shavelson, 2007). The advocates of data-driven decision making rarely address this issue in their writings.

Another limitation to the process is related to the acceptance of the state content standards as important goals for students in our schools. Biesta (2007) cautioned that data cannot tell us whether our ends are desirable. Meanwhile, teachers and administrators are urged to accept, without inquiry, the state curriculum mandates as the gold standard, and to work to pass assessments that measure progress toward the state standards. How important are the standards to students in our schools? How well do the assessments measure students' grasp of the content? No one seems to know or even to pose the question.

The model of data-driven decision making does not account for the mutual efforts of teacher and student in the education process, but instead treats education as if it occurs solely through causal professional action. It is as though the advocates of evidence-based decision making understand that teachers "learn" their students.

Note

1. Our review was limited in scope to classroom teachers using evidence to shape their decisions.

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