Improving Instruction through Schoolwide Professional Development: Effects of the Data-on-Enacted-Curriculum Model

Rolf K. Blank, John Smithson, Andrew Porter, Diana Nunnaley, and Eric Osthoff

The instructional improvement model Data on Enacted Curriculum was tested with an experimental design using randomized place-based trials. The improvement model is based on using data on instructional practices and achievement to guide professional development and decisions to refocus on instruction. The model was tested in 50 U.S. middle schools in five large urban districts, with half of the schools in each district randomly assigned to receive the two-year treatment. Each school formed an improvement leadership team of five to seven members, including teachers, subject specialists, and at least one administrator. Teams received professional development on data analysis and instructional leadership and then the teams provided training and technical assistance to all math and science teachers in their school. The central premise of the treatment model is to provide teachers with data on their instructional practices and student achievement, to teach them how to use that data to identify weaknesses and gaps in instruction compared with state standards, and to focus school-level professional development on needed curriculum content and classroom practices. After a two-year period of implementing the improvement model, the analysis of change in instruction showed significant effects of the model. The longitudinal analysis of instruction before and after treatment showed math teachers in treatment schools had significant improvement in alignment of instruction with standards compared with teachers in control schools, and the math teachers on the leader teams showed significantly greater gains than all other teachers.

Since the effective schools movement of the 1970s and '80s (Edmonds 1979), initiatives to improve the quality of public schooling in the United States have continued to build on the idea of improving education through schoolwide programs that involve all education staff, including administrators and teachers. Currently, education leaders are being presented with several models for improving the effectiveness of classroom instruction and increasing student achievement that advocate for better use of data to guide decisions about instruction. Schoolwide models for instructional improvement such as those advocated by Marzano (2003), Garmston and Wellman (1999), Schmoker (2002), Love (2001), Black and Wiliam (1998), and Fullan (2002) have several common themes or components to their models: (a) a schoolwide improvement design that involves school leadership and most/all instructional staff; (b) an ongoing process for instructional improvement involving administrators and teachers, including time scheduled for staff to work together and time for teacher development of content knowledge

Rolf K. Blank is director of education indicators at the Council of Chief State School Officers in Washington, D.C.; John Smithson is director of the Measures of Enacted Curriculum project, Wisconsin Center for Education Research, University of Wisconsin-Madison, in Madison, Wis.; Andrew Porter is director of the Learning Sciences Institute and professor of Public Policy and Education at Vanderbilt University in Nashville, Tenn.; Diana Nunnaley is director of implementation and professional development of the Using Data project, TERC, in Cambridge, Mass.; and Eric Osthoff is an associate researcher, Wisconsin Center for Education Research, University of Wisconsin-Madison, in Madison, Wis.

and subject-specific pedagogy; (c) structured activities for training staff to analyze data on student performance and data on the educational environment that explains performance differences; and (d) use of disaggregated data to identify learning problems and gaps between expected and actual performance and frequent use of data as a formative evaluation tool to guide instructional decisions and plans. These characteristics of schoolwide improvement models are also found in the designs for Comprehensive School Reform that were promoted and implemented starting in the 1990s and supported under Title I federal education funding (Desimone 2002; Tushnet, Flaherty, and Smith 2004; Borman et al. 2002; Cross 2004).

Another type of application of data can now be added to the "data-driven" models for instructional improvement. The Data on Enacted Curriculum (DEC) model for improvement uses data on instructional practices and enacted curriculum taught in classrooms to offer educators an additional rich source of information to provide formative evaluation data and direct feedback to teachers. The model also guides leaders in planning and decisions about professional development and instructional improvement initiatives. A key feature of the model is the capacity to analyze gaps and weaknesses of instruction in relation to standards, assessments, and improvement goals.

This paper reports on results from testing this school-based model for teacher professional development and instructional improvement. The DEC model is based on prior research and development of Porter, Smithson, and others (Porter 2002; Porter and Smithson 2001; Porter et al. 1993; Gamoran et al. 1997; Blank, Porter, and Smithson 2001). The Porter-Smithson research focused on methods of quantifying data on classroom instructional practices and instructional content. Subsequent development and wide field testing of survey- and data-reporting instruments have resulted in a set of practical data tools that can be applied in a school-based professional development model (Blank et al. 2004). The DEC model provides leaders and teachers with needed knowledge and skills, as well as the necessary data, to make informed decisions about the content areas of instruction that should be strengthened to improve student learning. The model has a strong research base, is cost effective, and demonstrates results in improving instructional practices in a targeted subject area.

Many of the recent data-driven models for instructional improvement focus on using achievement data. One recent model emphasizing instructional data is the lesson study model adapted from research with Japanese schools (Lewis, Perry, and Murata 2006) and the video-based instructional practices data from the Trends in International Mathematics and Science Study (TIMSS) research of Stigler and Hiebert (1997). The lesson study approach provides in-depth analysis of a small number of teachers and classrooms, along with extensive feedback and guidance to focus improvement of specific teachers' knowledge and practice. By comparison, the DEC model emphasizes the collection of critical indicators of instructional practices and content for a whole year's curriculum and the use of Web-based surveys to analyze instruction across many teachers, schools, and districts. (For a review of other data-based improvement models and Web links, see the Council of Chief State School Officers/Appalachian Educational Laboratory [2001] online tool at http://www.ael.org/dbdm/.)

Components of the DEC Model

The DEC model for improving instruction begins with collecting and reporting data to teachers on their instructional practices and then organizing and delivering an 18-month process of training, technical assistance, and ongoing support to staff for improving instructional effectiveness based on their own school-level analyses. The DEC model is based on five advances in education research and development of data tools:

(a) improved quality and efficiency of survey methods of data collection on instructional practices, both pedagogy and content (and ensuring validity);

(b) research findings documenting the characteristics of effective professional development;

(c) procedures for analyzing the content of curriculum materials, including content standards, assessments, and textbooks that provide the basis for measuring content alignment;

(d) development of collaborative strategies for school staff to work together on raising student achievement; and

(e) computer software programs that allow for analysis of complex instructional data and for graphic portrayals of survey practices data and content alignment data; these software-generated graphics provide a key vehicle for encouraging educator group analysis, reflection, and discussion of instructional improvement.

Based on these advances in research and application of research tools, the Council of Chief State School Officers (CCSSO) was awarded a grant from the National Science Foundation (NSF) in 2000 to conduct an experimental design study that would test the DEC model for instructional improvement (CCSSO 2002). The study design carried out from 2001 to 2004 consisted of place-based randomized trials, with middle schools in large urban districts randomly assigned to the treatment or control condition (Porter et al. 2005). The study team tested the hypothesis that the DEC model would significantly improve instruction in math and science at the middle grades level, with the dependent variable being the measured improvement in degree of alignment between instructional practices being taught and the state content standards for the grade level and subject (Blank et al. 2004). The study addressed two key research questions:

(1) To what extent does the DEC model for professional development improve the alignment of instruction in mathematics and science?

(2) What are the conditions for implementation of the model that explain positive effects?

Surveys of Enacted Curriculum

A first key step in the model is collecting and reporting baseline data on the instructional practices carried out in classrooms over the prior year. The Surveys of Enacted Curriculum (SEC) for math and science were designed and field tested with NSF support in the 1990s (see Blank, Porter, and Smithson 2001; Porter and Smithson 2001), and these surveys are now used in schools in 16 states. (To review the surveys and a summary of current projects, see CCSSO [2003] online access at http://www.SECsurvey.org.) The surveys, designed for use with math and science teachers, report data on pedagogical practices used in a year-long course, homework, student grouping, classroom assessment strategies, technology use, teachers' opinions and beliefs about teaching, professional development, and the content teachers cover. The items are grouped into a dozen scales for purposes of reporting and analysis.

The SEC uses a two-dimensional grid for collecting information about the subject content taught in classrooms. The first dimension lists topics (in mathematics or science). Mathematics content areas are (a) number sense, (b) measurement, (c) data analysis/probability/statistics, (d) algebraic concepts, (e) geometric concepts, and (f) instructional technology. Each of these general content areas is broken down into a dozen or so specific topics. For example, under geometric concepts are specific topics such as angles, symmetry, and theorem. The second dimension of the grid relates to expectations for students (referred to here as "cognitive demand"). Categories of cognitive demand in mathematics are (a) memorize facts, definitions, formulas; (b) perform procedures; (c) demonstrate understanding of mathematical ideas; (d) conjecture, analyze, prove; and (e) solve non-routine problems/make connections. (For more on the research and development of the surveys, see Porter 2002; Blank, Porter, and Smithson 2001.)

Research on Effective Professional Development

The DEC model is consistent with the common findings of a number of research studies over the past decade that established the characteristics of effective professional development, especially in math and science (Cohen and Hill 2001; Desimone et al. 2002; Weiss et al. 2000; Kennedy 1998; Garet et al. 2001; Loucks-Horsley et al. 1998). From his review of the set of studies addressing math and science professional development, Elmore (2002) concluded there is a "consensus from research" about designing and implementing professional development. The research has shown effective professional development (a) engages participants in active learning, giving them the opportunity to construct their own knowledge; (b) is designed for groups of participants (e.g., a team of teachers or all teachers in a given grade from a school); (c) is coherent (i.e., tailored to the teachers' level of experience and aligned with the content standards, assessments, and other policy instruments of the system within which the teachers teach); (d) focuses on the content of instruction, and especially knowledge of how students learn that content; and (e) is sustained over time (in contrast to one-shot workshops).

The DEC professional development model builds on the findings from these studies by focusing professional development activities on the curriculum taught in the participating schools and classrooms, and the model involves the teachers and staff as colleagues working together on improving their skills and knowledge. The activities focus on the subject content of instruction by reflecting on current content being taught and identifying gaps in content. Finally, the DEC model has a sustained approach by planning with improvement teams to establish school-level workshops and technical assistance to meet the needs identified by their own data analysis.

Content Alignment Analysis

The two-dimensional grid or content matrix of the survey instrument is used to collect data from teachers on the subject content taught in class, and the same matrix is used to analyze and quantify the subject content represented in state tests and standards. A simplified example of the grid is show in figure 1. The degree of consistency, or alignment, between the content reported by teachers and the subject content analyzed in state standards or assessments is reported as an alignment statistic, which can be a dependent variable measuring change in instruction, or the statistic can be an intervening measure that explains effects of instruction on achievement. The horizontal dimension represents time or emphasis on topics and the vertical dimension represents emphasis on cognitive demand. The third dimension produced from the data is the relative time or emphasis placed on topics and cognitive demand.

To produce the standards/assessments content analyses, three or more subject specialists independently judge for each standard benchmark statement or assessment item which cells in the two-dimensional grid represent the content a student is expected to know. The content specialists are trained in the SEC procedures to obtain consistency in definitions and approach. The content analysis score for a given state document is an average of responses across the team.

Software to Analyze Instructional Data and Produce Graphics

The detailed instructional data produced from teacher surveys using the SEC content matrix, with an average of 350 cells, and the data from the expert teams' analysis of content of standards (using the same matrix) are converted into proportions of emphasis for each cell such that the marginal proportions sum to 1. The data are presented in a graphic form using either a topographical mapping program or a tile format (using Excel and Corel presentations). Figures 2.1 and 2.2 illustrate the use of a topographical map to display teacher survey data and content standards in middle grades math from one of the DEC study sites.

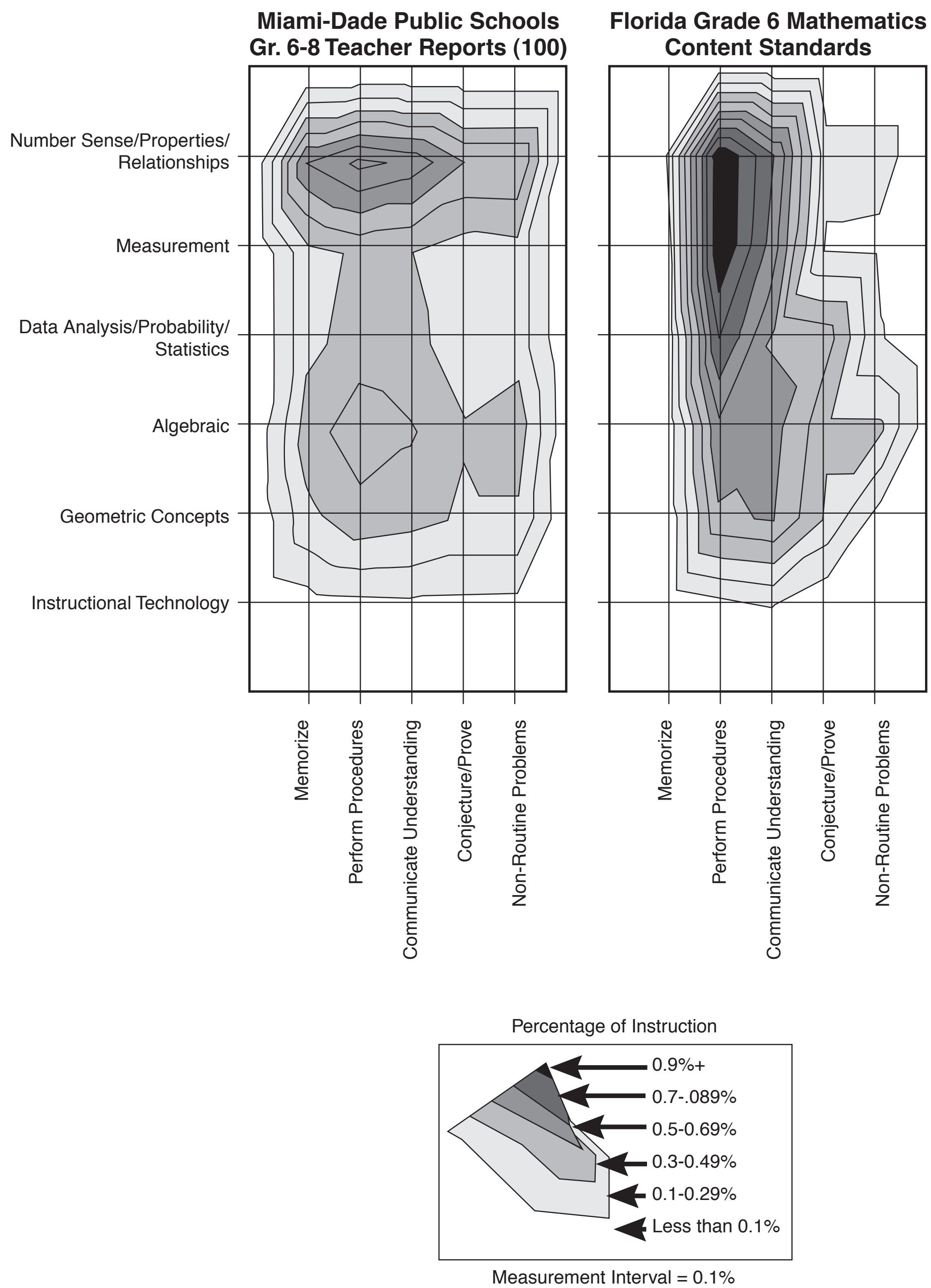
Collaborative Improvement Strategies with Schools Using Data

The DEC model is based on several areas of research and development on instructional improvement strategies with teachers. The work of Schmoker (2001) and Fullan (2002) on effective strategies for improving student achievement was used to inform the group training process with teams and then teachers. The processes for working with educators through hands-on activities, school leader teams,

Figure 1—SEC Content Matrix

	Categories of Cognitive Demand				
Math Content Topics	Memorize	Perform Procedures	Communicate Understanding	Solve Non-Routine Problems	Conjecture, Generalize, Prove
Number Sense/ Properties/Relationships					
Measurement					
Data Analysis/Probability/ Statistics					
Algebraic Concepts					
Geometric Concepts					
Instructional Technology					

Figure 2.1



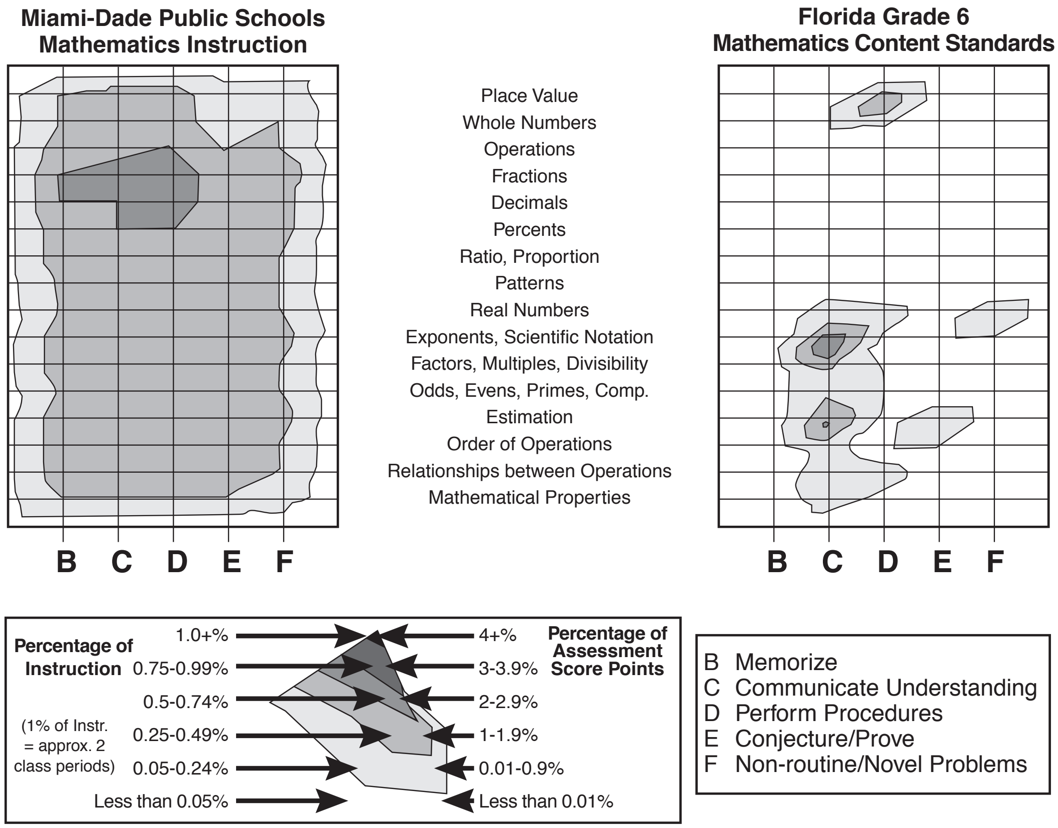
simulations, and direct engagement with instructional and curriculum data have been adapted from Love (2001) and Garmston and Wellman (1999). Further guidance for the DEC professional development design has come from the work of Loucks-Horsley et al. (1998) on effective professional development in science and math and the important leading studies of professional development strategies of Cohen and Hill (2001) and Garet et al. (2001).

Finally, we drew from the work of several scholars on data-based decision making for raising student achievement (Creighton 2001; Smith and Freeman 2002; Streifer 2001; Yeagley 2001) and the growing literature on using data from classroom and large-scale assessments to guide instrument improvement (Wiggins and McTighe 1998; Guskey 2003; Commission on Instructionally Supportive Assessment 2001; Gandal and McGiffert 2003).

Figure 2.2

Mathematics Content Map

Number Sense / Properties / Relationships



Longitudinal Study Design with Urban Middle Schools

The study design to test the DEC instructional improvement model consisted of place-based randomized trials, with middle schools in large urban districts randomly assigned to the treatment or control condition. The sample consisted of 50 middle schools located in five urban districts: Charlotte-Mecklenburg, Chicago, Miami-Dade, Philadelphia, and Winston-Salem. The study team collected baseline survey data using group administration in spring 2001. Surveys were completed by 604 middle grades math and science teachers, representing just over 75 percent of all math and science teachers in those schools. Seventy percent of the teachers were female, 40 percent White, 33 percent African American, and 20 percent Hispanic. The majority of teachers were generalists, with just 9 percent having mathematics education as their major and 6 percent with science education as their major. Twenty-seven percent of the teachers reported they had received more than 100 hours of professional development in the preceding two years. Twenty-three percent reported having received less than 30 hours, and 8 percent reported having received no professional development in the preceding two years (Porter et al. 2005).

The independent variable—the DEC instructional improvement model—introduced from 2001 to 2003 was the treatment condition (provided in half the randomly selected schools) versus the control condition (model not provided in the other half of schools). The control condition could not be absolute. The control schoolteachers continued to participate in other professional development, and the teachers in the treatment schools participated in professional development other than the DEC model. The study, however, did examine these differences by collecting data not only on the quality of the treatment implementation, but also on the other professional development experiences of both the treatment and control schoolteachers.

The treatment does not prescribe what is to happen in each participating teacher's classroom. Rather, it specifies professional development in which leadership teams initially participate and receive training on data-driven improvement strategies. The team members, in turn, provide professional development to their colleagues in their schools. The professional development is aimed at helping teachers reflect on their individual and collective practices, and from that reflection they are to decide how their instruction might be strengthened, such as by changing or decreasing variation in practices across classrooms or by providing intensive subject preparation for teachers.

After two years of the treatment versus control condition, the research team collected 439 follow-up teacher surveys in the same set of schools surveyed in study year 1. Several schools had dropped out of the study due to leadership change and district political issues, and many teachers had moved out of the study schools (Blank et al. 2004) and as a result, longitudinal survey data were obtained from 72 percent of the initial sample of teachers.

A key dependent variable in the study is the degree of change in alignment between the content of each teacher's instruction and the content of the state standards and state- or districtwide assessments used for accountability purposes. We hypothesized that the greater the effect of the treatment, the greater the alignment of teachers' content practices with the standards and assessments used with their students. Each treatment school selected a specific focus target of improvement based on analysis of their baseline data and the target was related to a content area or learning expectations, and these target standards served as a dependent variable measuring the effects of the DEC model.

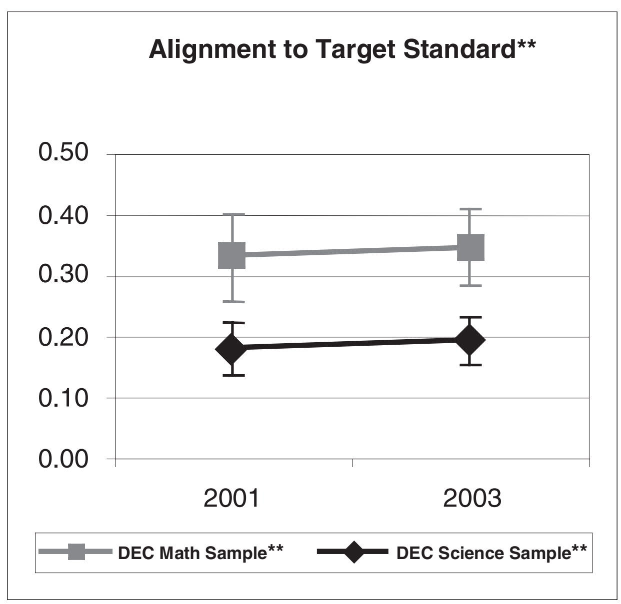
Measuring Effects of the Model on Instruction

This study reports the effects of the DEC model using summary statistics of the amount of change and significance of differences from year 1 (2001 baseline) to year 3 (2003 follow-up survey). A paper describing analysis of the DEC model treatment effects has been published by Porter et al. (2006). In the present paper, we highlight some of the key findings for educators and decision makers who are interested in replicating or adapting the model. Figure 3 shows the change in alignment between instruction and target standards for the math teachers and the science teachers. These results show that across the whole sample of teachers—math and science, including treatment and control groups—instruction increased in consistency with standards. On a scale of 0 to 1, science instructional alignment increased from .18 to .20, while math instruction increased from .32 to .36 (both significant changes). This finding likely shows that standards-focused change of various kinds in these districts was having some impact on teaching in math and science.

Figure 4 highlights the degree of improvement in alignment of instruction in three teacher groups—treatment, leader, and control. The change results in figure 4 clearly show positive effects of the DEC model. First, math teachers in the treatment schools gained in alignment of instruction to target math standards compared with teachers in control schools (in year 3, treatment group alignment = .31 versus control = .29). This shows the DEC model had effects on improving mathematics instruction for teachers in treatment schools compared with teachers in schools that did not experience the DEC professional development.

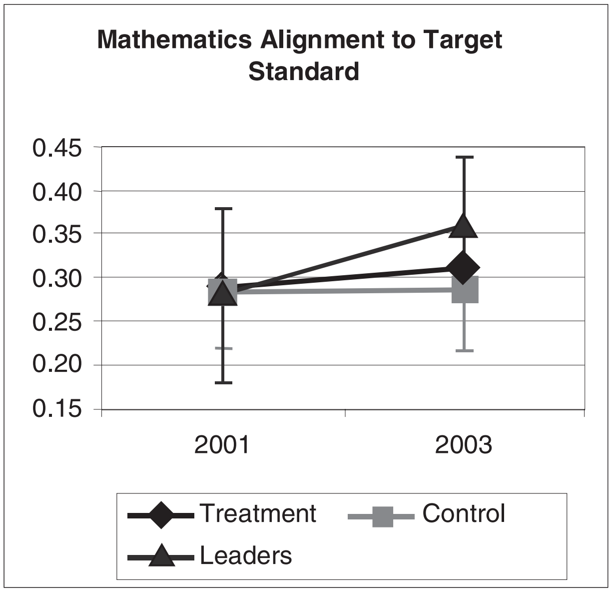
Another key finding is that the math teachers serving on leader teams in the treatment schools had a significantly greater gain in alignment of instruction than either group (i.e., change in alignment of instruction from year 1 to year 3). The analysis of

Figure 3



** Significant mean difference $p < 0.01$

Figure 4



2003: Treatment vs. Control group, significant mean difference $p < 0.05$; Leader vs. Control group, significant mean difference $p < 0.01$

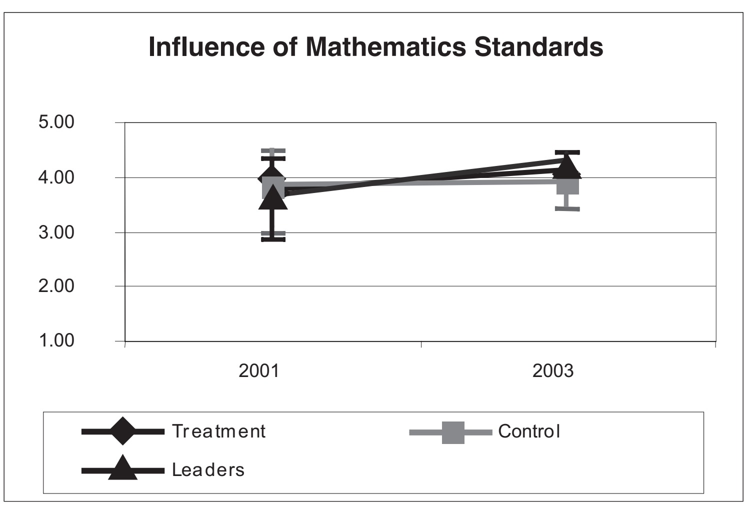
the treatment effects data by Porter et al. (2006) showed the effect size of the change in instructional alignment for the leader group of teachers is equal to .36 (or 36 percent gain), which represents a moderate but certainly meaningful level of change. The finding is significant in relation to the DEC model because these teachers received the most intensive and consistent training in analysis and use of data to identify ways to improve instruction. We did not, however, find a comparable level of change in instructional alignment of leader teachers in science. One explanation is that most schools chose focused targets for improvement related to math content.

Measures of Model Implementation

Our analysis of variables that may have produced DEC model results included measures of change in teacher preparation, school conditions, and professional development activities. We highlight three measures of professional development as reported by teachers in the study that help explain the effects of the DEC model. Figure 5 displays change in teachers' reporting on what influences their instruction, specifically the degree to which state content standards affect what they teach. In year 1, there was significant variation in influence of standards, but all three groups averaged between 3 and 4 (none to positive). In year 3 after the DEC treatment, however, the math leader teachers reported significant increases in the influence of math standards on their instruction, with average after two years above 4 (positive influence).

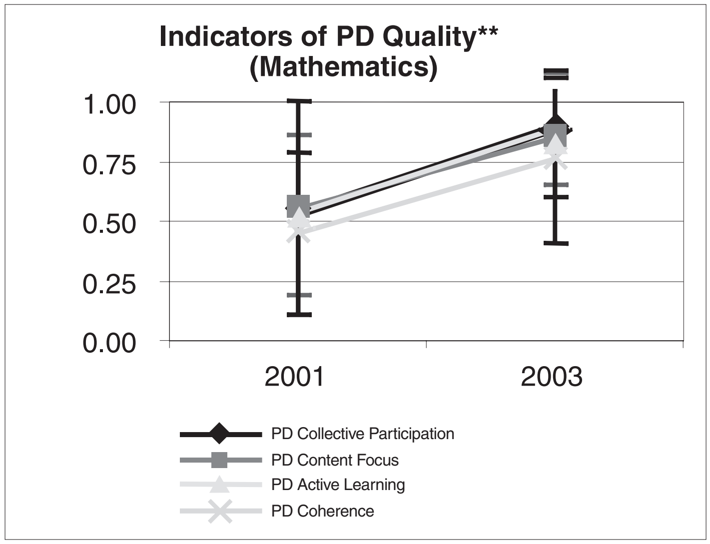
A second measure of DEC model implementation is change in indicators of the quality of professional development activities reported by sample teachers. The teachers were asked to report on the presence and/or absence of a range of activity types, including college content courses, inservice workshops, and within-school work with colleagues and professional practice networks. (See SEC survey instrument for full listing of the items on professional development activities at http://www.SECsurvey.org.) Survey item responses were analyzed using four scales of quality of professional development received by teachers.

Figure 5



Scale: 1 = strong negative influence on instruction, 3 = no influence, 5 = strong positive influence

Figure 6



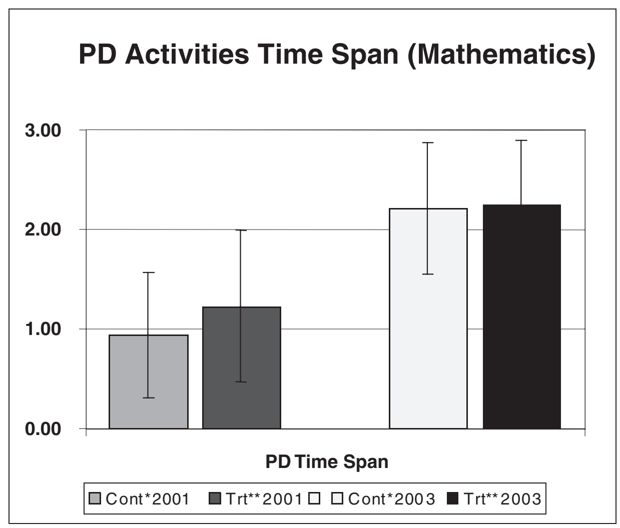
** All four measures: significant mean difference p < 0.01
Scale: 0.25 = 1/4 of professional development quality items received "yes" response, 0.50 = 1/2 of items received "yes," 0.75 = 3/4 of items received "yes", 1.0 = all items received "yes"

These items and scales are designed to analyze the range of professional development activities and opportunities received by teachers during the prior 12 months; thus, they include the activities as part of the DEC treatment as well as other forms of professional development received by teachers.

The analysis of change in professional development quality scales from year 1 to year 3 of the study showed significant improvement in quality reported by mathematics teachers. (See figure 6.) The four scales are based on the results of research on characteristics of effective professional development (e.g., Garet et al. 2001). The scales vary from 0 to 1, with 1 meaning all professional development quality items received a "yes" response. In year 1, all four scales (collective participation, content focus, active learning, coherence) were very close to .5—which means half of the teachers' professional development experiences were not consistent with quality measures. After the introduction and experience with the DEC treatment model, in year 3, the same teachers reported an average quality of all professional development in four scales above .75, which represents a 50 percent increase in reported quality of professional development received by math teachers. Also noteworthy is the significant decrease in the extent of variation in responses (indicated by the whisker plots for 1 standard deviation above/below the means).

A third measure of effects of the DEC model is change in time and effort of teachers on professional development. Figure 7 data show the average time span of professional development activities reported by math teachers in 2001 (study year 1) compared with 2003 (study year 3). For both treatment and control groups, the average time span in year 1 was a single workshop, and within one standard deviation a significant portion of teachers experienced a single workshop with follow-up activities. In year 3 of the study, the average math teachers in both

Figure 7



Response Codes: 1 = single workshop, 2 = single workshop with follow-up, 3 = multiple workshops
*Control group, ** Treatment group

treatment and control groups received a single workshop with follow-up, and a significant portion of teachers experienced multiple workshops.

Summary of Findings from Longitudinal Analysis

Our review of findings from the DEC experimental design study have focused on several of the significant results regarding change over time for schools and teachers in the treatment group compared with those in the control group. A basic pattern across all the schools in the study (treatment and control) is greater alignment of instruction with standards from inception to year 3. This pattern held in both math and science. In mathematics, the analysis showed group teachers, and especially leader team members, had significantly greater improvement in aligned instruction than the control group, indicating the DEC model's approach to instructional improvement was effective in math, but showed less effects in science. It should be noted that improvement of instruction was measured in relation to the specific standards selected by schools.

Finally, the longitudinal findings show change in the types of professional activities, shifting from single workshops to multiple session activities, and mathematics teachers reported significantly greater quality of professional development activities at the end of the DEC treatment compared with the baseline data on their professional development.

How the DEC Model Works

The basic findings outlined from the three-year longitudinal study provide support for the premise that the DEC model for instructional improvement can have positive effects in many schools and districts. More detailed analysis and description of study findings have been provided in other papers (Porter 2002; Blank et al. 2004). But, how does the model actually work? How do the professional development activities through the implemented DEC model work to influence change in teaching practices? What are the key steps in the model for educating teachers? The DEC professional development model for improving instruction is based on three primary goals:

1. focus on developing skills of educators and continuous improvement of classroom practices using data and formative evaluation;
2. standards-based improvement of instruction and use of data on alignment with standards to identify weaknesses and gaps in instruction; and
3. school-based collaboration, technical assistance, and networking among teachers to foster the sharing of teaching ideas, models, and strategies for improvement.

The five large urban districts that volunteered to participate in the study were similar in expressing commitment to standards-based improvement of math and science, and support for the concepts in the DEC model. The DEC treatment schools were asked to form a five- to seven-member mathematics and science school leader team at the outset of the project. The teams included at least one administrator—the principal or the assistant principal for curriculum—mathematics and science department chairs, lead or master mathematics and science teachers, and other math and science teachers such that a range of grades and subjects were represented. The teams participated in all project professional development workshops and meetings throughout the treatment. For further details on the DEC model organization and activities, see Nunnaley (2003).

In addition to the school leadership teams, the DEC treatment calls for each district contact person to involve district-level instructional specialists by inviting them to participate in all the workshops. Districts have the option of scheduling separate workshops for entire district groups in supporting mathematics and science instruction in the schools. The rationale for involving a larger support network is to ensure everyone working in the schools has knowledge of the processes, techniques, and goals of the DEC work.

Developing Knowledge and Skills of Educators in Using Data

The DEC professional development model recognizes that few teachers, or administrators, have previously been involved in a professional development process to teach them how to analyze and use data on curriculum or student achievement. The DEC trainer staff introduces to school leader teams the skills for leading collaborative work with a group of professionals, how to provide training on data analysis, and how to ask tough questions about which students are/are not learning, what content is being learned, and why some students are not learning. The leader team workshops model best practices in data analysis and in teaching specific subject-area topics, and provide support and strategies for how to engage colleagues.

Table 1—Schedule for DEC Professional Development (PD) Model

Year 1:	Spring	Orientation of district and school leaders; teachers complete baseline SEC
	Summer-Early Fall	Introductory PD workshop for leader teams (two days); develop data skills and begin data inquiry training
	Late Fall	Technical assistance in schools to introduce model to teachers (leader half-day session each school)
Year 2:	Winter	PD workshop #2: Use of content data and instructional practices data (one to two days)
	Spring Year 2	Technical assistance in schools to set school targets for improvement based on data analysis; integrate model with other PD in subject area
	Spring	PD workshop #3: Analyzing student work and comparing instructional strategies (one day)
	Summer to Fall	Technical assistance in school teams; work with teachers to apply data to instruction; identify additional PD needs
	Fall Year 2	Evaluate progress toward improvement objectives; re-focus efforts within schools; continue team interaction
Year 3:	Winter	Teachers continue work in teams and apply data lessons to improved teaching strategies; continue team interaction
	Spring Year 3	Complete follow-up surveys with teachers to assess change at end of second year of PD model

District and School Responsibilities

Table 1 provides a summary outline of the schedule and scope of main activities in the DEC professional development model as it was presented to the participating districts. In year 1 at the orientation stage of the DEC model, the CCSSO team outlined the key responsibilities of the districts and schools for effective implementation:

- regularly scheduled meeting times for school leadership teams and time commitment for teachers to work on applying the model;
- decision-making support for next steps in schools;
- inclusion of the DEC model in school and district professional development;
- access to school data including state assessment results; and
- focus on measurable results.

After the orientation, each school selected and organized a school leader team for implementing the DEC model. Initial workshop training was geared toward the leadership teams and focused on developing data skills and inquiry approaches with data. The training provided leaders with a design and sequence of activities for working with teachers to bring the model into schools. (For a full explanation and detail on the DEC model design, see Nunnaley 2003.) School leader teams were provided skills in leading workshops with teachers. In addition, school teams identified ways to integrate the DEC model for using curriculum data with other professional development activities and strategies within the school. It is critical for teams to develop a coherent approach to subject-area professional development and instructional improvement with the school. Leader teams also work to develop a long-term plan for using the data-driven model with teachers.

Standards-Based Improvement of Instruction Using Analysis of Alignment

The DEC model is grounded with research-based tools (Surveys of Enacted Curriculum) that provide the capacity for describing instructional practices at the school level (both pedagogy and content) based on responses from all teachers of a given subject and grade, as well as tools for describing the content of the intended curriculum (e.g., expressed in content standards and assessments) through measures of the nature and degree of alignment between instructional practices and curriculum materials (Porter 2002). The treatment model can be understood in part by the nature of the data provided to school leadership teams and other teachers in the treatment schools.

All teachers in a target school report on their instructional subject content and teaching practices for the prior school year. The content of instruction is reported using a two-dimensional grid. (See the two dimensions—content by expectations—in figure 1; for complete survey instrument and grid, see http://www.SEConline.org.) Data reporting entails three steps:

1. The teacher works through the list of specific topics (e.g., for math: number sense, operations, measurement, algebraic concepts, geometric concepts, etc.), reporting on which of the topics were taught.
2. For the specific topics taught, the teacher describes degree of content coverage on a five-point scale for each specific subtopic (e.g., for numbers: place value, whole numbers, fractions, ratio, etc.), indicating whether the coverage represented (a) less than one class/lesson, (b) one to five classes/lessons, or (c) more than five classes/lessons.
3. For each subtopic covered, the teacher indicates which of the five categories of cognitive demand were taught (i.e., memorize, perform procedures, demonstrate understanding, prove, make connections), and for those that were taught, the degree of emphasis. The three-point emphasis scale distinguishes (a) slight emphasis (less than 25 percent of the time spent on the topic), (b) moderate emphasis (25-33 percent of the time spent on the topic), and (c) sustained emphasis (more than 33 percent of the time spent on the topic).

With the complete data report for each teacher's course/class, a content map is constructed showing the proportion of emphasis on topics by expectations/cognitive demand. Then, data are aggregated by school, and content maps can be compared across schools and classrooms. The first major step in technical assistance is to produce content maps for each school with data disaggregated by grade and class characteristics (e.g., achievement level or percentage of limited English speakers).

State standards and assessments are content coded by expert subject specialists using the same SEC content matrix (often in multi-state workshops). With the coding results, schools and teachers can compare their instruction with the standards defined by the state, both by topic and by expectations for learning. One type of "alignment analysis" used in schools involves visual comparison of content of instruction, which does not require statistical analysis or interpretation. But, the alignment data analysis does produce a statistic of degree of alignment, or "alignment index," which varies from 0 (no consistency) to 1 (perfect consistency) (Porter and Smithson 2002). For example, in the DEC study (figure 2.1), the alignment index for Miami grade 6 math instruction (treatment schools) with Florida state standards was 0.19. (See Porter and Smithson [2001] for further explanation of alignment analysis procedures.)

School-Based Collaboration among Educators

Professional development for all educators with the DEC model begins with training in data skills, including how to analyze and apply the enacted curriculum data charts and how to interpret differences in the contour maps and bar graphs signifying high and low emphases of instruction across a school or district. The school team gains skills in the collaborative analysis method starting with one data chart (e.g., one subject topic area). Educators analyze their own school instructional data building from their experience of completing the survey, their knowledge of instruction in the school, and their team interaction about data variation they observe and discussion about sources of differences in instruction.

Three-Step Process

DEC leader teams work with teachers by subject area through a three-step process—predict, observe/analyze, and interpret. Teachers are asked first to predict what they will see in the degree of consistency, or alignment, between math instruction and district and state standards (e.g., Florida middle math standards). In step two, educators look at the charts for math instruction and standards for their district and state. Educators work together in teams to share what they see—which topics and expectations have high emphases of time and how consistent they are with the standards. For example, figures 2.1 and 2.2 show data from Miami study schools by middle grades math content area. Miami math educators could see instruction in grades 6 through 8 strongly emphasized number sense, while the Florida standards emphasized number sense, measurement, and data analysis for grade 6 instruction.

In step three, educators refer to a chart that analyzes the content of instruction in their school, with charts such as those in figure 2.2 reported by school.

Data results can be compared from school to school, and then with state standards. Teachers compare and contrast instructional content (topic by expectations) in their classroom and school with other classrooms and across schools in their district, and teachers also can compare their instructional differences with classroom and school assessment results by topic area. Teachers can obtain a chart of their own instructional content and compare it with the average instruction for teachers in the school. Thus, teachers identify the differences between their instruction and instruction of others in their schools as well as in the overall district. Teachers engage in discussions about the differences in instruction they observe, how and why differences in instruction develop, and what effects these differences may mean for students.

Drill Down by Topic

Another approach to using the data is to "drill down" to look at instruction on specific topics in the curriculum. For example, the Miami middle grades math instruction map shown in figure 2.1 can be broken out for each content topic (number sense, measurement, algebra, etc.), and figure 2.2 shows such a map for the number sense topic. Then, in analyzing instruction in middle grades math, the topic of number sense, for example, which typically receives a high degree of emphasis in the early elementary grades, can be analyzed in more detail to see what subtopics under number sense should (or should not) be receiving instructional time at middle grades. Critiques of the U.S. math curriculum focus on excessive repetition of topics across the grades, and the instructional maps allow schools to address appropriate versus excessive repetition of content topics. Subtopics are useful for educator team analysis because they likely correspond to the organization of the teacher's lesson plans and course outlines. The analysis showed Miami teachers emphasized numbers related to operations in all three of the middle grades, while the Florida standards placed emphasis on patterns, exponents, factors, and estimation.

Analysis and Technical Assistance Process in Schools

The evidence from the DEC longitudinal study shows that when school teams fully implement the model, the data analysis process becomes an important lever for change. A key role of leader teams, including administrators, is scheduling regular training and technical assistance sessions to ensure follow-up, continued data analyses within schools, and increased depth of analysis. Teachers share ideas and strategies for focusing their instructional strategies and practices to increase alignment. Leaders have a key role in identifying needs, based on school-level analysis, for further content-specific professional development that may need to be provided from specialists. The goal is to build a professional learning community based on continued, ongoing use of data to identify learning gaps and issues, focus improvement efforts, evaluate progress, and then repeat the process of data use. ❏

References

Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education, 5*(1), 7-74.

Blank, R.K., Nunnaley, D., Kaufman, M., Porter, A.C., Smithson, J., Osthoff, E., et al. (2004). *Data on enacted curriculum study: Summary of findings. Experimental design study of effectiveness of DEC professional development model in urban middle schools.* Washington, DC: Council of Chief State School Officers. Retrieved April 29, 2005, from http://www.ccsso.org/content/pdfs/DECStudy.pdf

Blank, R.K., Porter, A.C., & Smithson, J. (2001). *New tools for analyzing teaching, curriculum and standards: Results from the surveys of enacted curriculum project*. Washington, DC: Council of Chief State School Officers.

Borman, G.D., Hewes, G.M., Overman, L.T., & Brown, S. (2002). *Comprehensive school reform and student achievement: A meta-analysis.* Baltimore, MD: Center for Research on the Education of Students Placed at Risk.

Cohen, D.K., & Hill, H.C. (2001). *Learning policy: When state education reform works.* New Haven, CT: Yale University Press.

Commission on Instructionally Supportive Assessment. (2001). *Building tests that support instruction and accountability: A guide for policymakers.* Washington, DC: Author. Retrieved May 30, 2006, from http://www.testaccountability.org/

Council of Chief State School Officers. (2002). *Experimental design to measure effects of assisting teachers in using data on enacted curriculum to improve effectiveness of instruction in mathematics and science education: Year 2 progress report*. Washington, DC: Author.

Council of Chief State School Officers. (2003). *Surveys of enacted curriculum: Surveys of classroom practices and instructional content in mathematics, science, & English language arts.* Surveys developed by CCSSO with Wisconsin Center for Education Research, SEC Collaborative, and Learning Point Associates. Washington, DC: Author. Retrieved from http://www.SECsurvey.org

Council of Chief State School Officers, & Appalachian Educational Laboratory. (2001). *Data-based decision making: Resources for educators*. Washington, DC: Author. [Online Tool]. Retrieved from http://www.ael.org/dbdm/

Creighton, T.B. (2001, May/June). Data analysis and the principalship. *Principal Leadership, 1*(9), 52-57.

Cross, C.T. (Ed.). (2004). *Putting the pieces together: Lessons from comprehensive school reform research.* Washington, DC: National Clearinghouse for Comprehensive School Reform. Retrieved May 18, 2006, from http://www.centerforcsri.org/PDF/PTPTLessonsfromCSRResearch.pdf

Desimone, L. (2002, Fall). How can comprehensive school reform models be successfully implemented? *Review of Educational Research, 72*(3), 433-479.

Desimone, L.M., Porter, A.C., Garet, M.S., Yoon, K.S., & Birman, B.F. (2002). Effects of professional development on teachers' instruction: Results from a three-year longitudinal study. *Educational Evaluation and Policy Analysis, 24*(2), 81-112.

Edmonds, R. (1979, October). Effective schools for the urban poor. *Educational Leadership*, 37, 15-24.

Elmore, R. (2002). *Bridging the gap between standards and achievement: Report on the imperative for professional development in education.* Washington, DC: The Albert Shanker Institute. Retrieved May 30, 2005, from http://www.shankerinstitute.org/Downloads/Bridging_Gap.pdf

Fullan, M. (2002, May). The change leader. *Educational Leadership, 59*(8), 16-20.

Gamoran, A., Porter, A.C., Smithson, J., & White, P.A. (1997, Winter). Upgrading high school mathematics instruction: Improving learning opportunities for low-achieving, low-income youth. *Educational Evaluation and Policy Analysis, 19*(4), 325-338.

Gandal, M., & McGiffert, L. (2003, February). The power of testing. *Educational Leadership, 60*(5), 39-42.

Garet, M.S., Porter, A.C., Desimone, L., Birman, B.F., & Yoon, K.S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38*(4), 915-945.

Garmston, R., & Wellman, B. (1999). *The adaptive school: A sourcebook for developing collaborative groups.* Norwood, MA: Christopher-Gordon Publishers, Inc.

Guskey, T.R. (2003, February). How classroom assessments improve learning. *Educational Leadership, 60*(5), 6-12.

Kennedy, M.M. (1998, April). *Form and substance in inservice teacher education.* Paper presented at the annual meeting of the American Educational Research Association, San Diego, CA.

Lewis, C., Perry, R., & Murata, A. (2006). How should research contribute to instructional improvement? The case of lesson study. *Educational Researcher, 35*(3), 3-14.

Loucks-Horsley, S., Hewson, P., Love, N., & Stiles, K.E. (1998). *Designing professional development for teachers of science and mathematics.* Thousand Oaks, CA: Corwin Press, Inc.

Love, N. (2001). *Using data-getting results: A practical guide to school improvement in mathematics and science.* Norwood, MA: Christopher-Gordon Publishers, Inc.

Marzano, R.J. (2003). *What works in schools: Translating research into action.* Alexandria, VA: Association for Supervision and Curriculum Development.

Nunnaley, D. (2003). *Using data on enacted curriculum.* Cambridge, MA: TERC. [PowerPoint presentation]. Retrieved May 30, 2006, from http://www.ccsso.org/content/pdfs/DianaNunalUseofSECNov25.ppt

Porter, A.C. (2002). Measuring the content of instruction: Uses in research and practice. *Educational Researcher, 31*(7), 3-14.

Porter, A.C., Blank, R.K., Smithson, J., & Osthoff, E. (2005, May). Place-based randomized trials to test the effects on instructional practices of a mathematics/science professional development program for teachers. *The Annals of the American Academy of Political and Social Science, 599*(1), 147-175.

Porter, A.C., Kirst, M.W., Osthoff, E.J., Smithson, J.L., & Schneider, S.A. (1993). *Reform up close: An analysis of high school mathematics and science classrooms.* (Final report to the National Science Foundation). Madison, WI: Wisconsin Center for Education Research.

Porter, A.C., & Smithson, J. (2001). Are content standards being implemented in the classroom? A methodology and some tentative answers. In S.H. Fuhrman (Ed.), *From the capitol to the classroom: Standards-based reform in the states* (pp. 60-80). Chicago: National Society for the Study of Education.

Porter, A.C., & Smithson, J. (2002). Alignment of assessments, standards, and instruction using curriculum indicator data. Presentation at the National Council on Measurement in Education annual meeting, New Orleans, LA.

Porter, A.C., Smithson, J.L., Blank, R., & Zeidner, T. (2006, December). Alignment as a teacher variable. *Applied Measurement in Education, 20*(1) (forthcoming).

Schmoker, M. (2001). *The results field-book: Practical strategies from dramatically improved schools.* Alexandria, VA: Association for Supervision and Curriculum Development.

Schmoker, M. (2002, Spring). Up and away. *Journal of Staff Development Council, 23*(2), 12-13.

Smith, C.L., & Freeman, R.L. (2002, Summer). Using continuous system level assessment to build school capacity. *American Journal of Evaluation, 23*(3), 317-319.

Stigler, J.W., & Hiebert, J. (1997). Understanding and improving classroom mathematics instruction: An overview of the TIMSS video study. *Phi Delta Kappan, 79*(1), 14-21.

Streifer, P.A. (2001, April). The "drill down" process. *School Administrator, 58*(4), 16-19.

Tushnet, N.C., Flaherty, J., & Smith, A. (2004). *Longitudinal assessment of comprehensive school reform program implementation and outcomes: First-year report*. Washington, DC: U.S. Department of Education, Policy and Program Studies Service. Retrieved May 18, 2006, from http://www.ed.gov/rschstat/eval/other/lacio/lacio-final.pdf

Weiss, I.R., Arnold, E.E., Banilower, E.R., & Soar, E.H. (2000). *Local systemic change through teacher enhancement: Year five cross-site report.* Chapel Hill, NC: Horizon Research, Inc.

Wiggins, G., & McTighe, J. (1998). *Understanding by design.* Alexandria, VA: Association for Supervision and Curriculum Development.

Yeagley, R. (2001, April). Data in your hands. *School Administrator, 58*(4), 12-15.