Longitudinal Study to Measure Effects of MSP Professional Development on Improving Math and Science Instruction

# MSP-RETA Project (2002 - 05)



A collaborative study conducted by: Council of Chief State School Officers (CCSSO) American Institutes for Research (AIR) Wisconsin Center for Educational Research (WCER)







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### Goals for This Workshop

- Demonstrate Online, Web-based Tools
  - Surveys of Enacted Curriculum (SEC)
  - Professional Development Activity Log (PDAL)
- Describe Initial Data and Findings with sample of MSPs

Provide information and access

### **Study Questions / Objectives**

• Effects of MSP vs. Other PD on Improving Instruction ?

 Use of Hi Quality Survey tools to Evaluate PD Quality?

Disseminate to MSPs, Other users

### MSP PD Study Sites

- Brockport/Rochester SUNY
- Cleveland Municipal SD
- Corpus Christi AIMS TX A&M
- El Paso UTEP
- Also: NJ MSP -- 12 districts Rutgers NC MSP 17 districts – UNC SW PA MSP SCALE – Los Angeles

### **Project Staff Leadership**

• Pl

- Rolf Blank, CCSSO
- Co-PIs
  - Bea Birman & Mike Garet (AIR)
  - Andy Porter, Vanderbilt University
  - John Smithson (WCER)

• PD

– Kwang Suk Yoon (AIR)

For more info ...

### Logic Model



### **Research Questions**

- To what extent is the quality of the professional development supported by MSP activities consistent with research-based definitions of quality (e.g., content focus, active learning, coherence, collective participation, and sustained efforts)?
- What effects do teachers' professional development experiences have on instructional practices and content taught in math and science classes? Are high-quality professional development activities more likely than lower-quality activities to increase the alignment of instructional content with state standards and assessments?

# Participants

- Four MSP projects were selected for the study. In each project, we are collecting data with teachers in middle schools or middle grades about their professional development in mathematics and science education (Total teacher N=474).
- Our study model, instruments, data and reports will benefit each of the four participating sites, and we hope that all of the MSP projects will be able to incorporate some aspects of this evaluation model.

### **Data** Collection

- Using the Surveys of Enacted Curriculum (SEC), measure the subject content and instructional practices teachers are employing in math and science instruction, prior to MSP implementation in Year 1 (Spring 2003);
- Using the Professional Development Activity Log (PDAL), identify the characteristics of professional development activities in which teachers participated through MSP-supported or other programs to improve math and science instruction, over 15 months through Year 2 (Fall 2004); and
- Repeating the SEC, measure the subject content and instructional practices again in Year 3 (Spring 2005), to determine change in practices after participation in the broad range of MSP-supported professional development activities.

# **Rationale for SEC**



Key Question -- SEC Tools Research into Practice

> How can Educators obtain reliable, valid data to determine Alignment of instruction with required standards and assessments?

# Applications

- Alignment analysis --instruction, standards, assessments
- Instructional improvement in schools
- Needs assessment/ Evaluation
- Indicators monitoring change over time



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 You could use data on instructional quality and content to guide professional development?

•You could have consistency across grade levels?

•You could know how well aligned your state standards were to the state assessment?

### And

 You could compare how you teach content compared to how others across the nation teach?

 You could use anonymous teacher data to start a powerful school discussion about what the teacher needs are?

## Key Question—PDAL Tool Research Into Practice

 How can educators obtain reliable, valid data to determine the quality of professional development activities?

# Applications

- Analysis of PD Quality —research based criteria
- Examine how PD relates to teachers' instruction
- Track teachers' PD over time
- Identify Teachers' PD needs
- Target PD to improve instruction

### What if....

- You could have data on the content and quality of PD for district, school, teacher?
- You could examine teachers' PD and aligned instruction, as measured by SEC?
- You had data about teachers' actual PD experiences when addressing their needs?

### Steps in PDAL Development

Evaluation of Eisenhower Program
 Identified features of quality

 Evolution of survey instrumentation

 From individual to aggregate profile/portfolio
 Use of cognitive labs for refinement

# Surveys of Enacted Curriculum







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		Categories of Cognitive Demand							
Тор	ics	Memorize	Perform Procedures	Communicate Understanding	Solve Non- Routine Problems	Conjecture Generalize Prove			
Mult Ste Equat	iple p ions								
Inequa	lities								
Lite Equat	ral ions								
Line Slope Inter	es / and cept					-			
Opera or Polyno	tions n mials								
Quad Equat	ratic ions								

# Content Maps





# **Survey Sections**

- School & Class Description
- Instructional Activities
  - General
  - Problem Solving Activities
    - Pairs & Small Group Work
  - Use of Hands-on Materials
  - Use of Calculators/Computers & other Ed. Tech.
- Assessment Use
- Instructional Influences

- Instructional Readiness
- Teacher Opinions
- Professional Development
  - Types
  - Content Focus
  - Active Learning
  - Collegial Participation
  - Coherence
  - *Time* Span
- Teacher Characteristics
- Instructional Content

# Survey of Enacted Curriculum (SEC)

- Description about target class
- Instructional practice (e.g., instructional time in target class, classroom instructional preparation)
- Content alignment: time on topic and expectation for students (e.g., memorize facts, perform procedure, or solve non-routine problems)
- Professional development experiences
- Teacher opinions about school culture (e.g., trust)
- Teacher characteristics

# SEC Content Topics Math, Science, ELA

The SEC provides a neutral, researchbased language to describe content of English language arts, mathematics, and science.

NCLB anyone?

Time on Topic			То	Dic	Elementary Mathematics Topics
<none> 1</none>		1	Number sense / Properties / Relationships		
۰		2	3	101	Place value
	1	2	3	102	Patterns
0	Ο	0	3	103	Decimals
0	1	۲	3	104	Percent
0	1	0	0	105	Real numbers
0	1	0	۲	106	Exponents, scientific notation
0	۲	0	3	107	Factors, multiples, divisibility
0	1	0	3	108	Odds, evens, primes, composites
0	1	2	۲	109	Estimation
0	٢	0	3	110	Order of operations
0	۲	0	3	111	Relationships between operations
<	<no< th=""><th>ne&gt;</th><th>&gt;</th><th>2</th><th>Operations</th></no<>	ne>	>	2	Operations
0	1	2	3	201	Add, subtract whole numbers
0	1	2	3	202	Multiplication whole numbers
0	1	0	3	203	Division whole numbers

#### **Expectations for Students in Mathematics**

#### Memorize Facts/ Definitions/

#### Formulas

Recite basic mathematics facts Recall mathematics terms & definitions Recall formulas and computational procedures

#### **Perform Procedures**

Use numbers to count, order, denote Do computational procedures or algorithms

Follow procedures/instructions Solve equations/formulas/routine word problems

Organize or display data Read or produce graphs and tables Execute geometric constructions

#### Demonstrate Understanding of Mathematical Ideas

Communicate mathematical ideas Use representations to model mathematical ideas

Explain findings and results from data analysis strategies

Develop/explain relationships between concepts

Show or explain relationships between models, diagrams, and/or other representations

#### Conjecture/ Generalize/ Prove

Determine the truth of a mathematical pattern or proposition

Write formal or informal proofs

Recognize, generate or create patterns Find a mathematical rule to generate a pattern or number sequence

Make and investigate mathematical conjectures

Identify faulty arguments or misrepresentations of data

Reason inductively or deductively

#### Solve Non-routine Problems/ Make Connections

Apply and adapt a variety of appropriate strategies to solve non-routine problems

Apply mathematics in contexts outside of mathematics

Analyze data, recognize patterns Synthesize content and ideas from several sources

Happyville Public Schools Chart I-1 Year 1 Year 3 **Collecting Information in Science** (97) (29) (30) All Grades (86) (25) (29) (31) All Grades Grades 8 Grades 8 **By Grade Level** Grades 7 Grades 7 1331 Grades 6 Grades 6

Survey results are also reported for individual survey items, and disaggregated by seven distinct categories: grade level, level of student achievement, amount of teacher professional development, percent minority, percent female, percent LEP and class size.



When students in the target class collect information about science from books, magazines, computers or other sources, what percentage of that time do students:

Hov stu	w much of the total mathematics instructional time do dents in the target class:	None	10% or<	11-25%	26-50%	51-75%	>75%
25	Watch the teacher demonstrate how to do a procedure or solve a problem.	0	1	2	3	4	5
26	Read about mathematics in books, magazines, or articles ( <b>not</b> textbooks).	0	1	0	3	4	5
27	Take notes from lectures or the textbook.	0	1	$\bigcirc$	3	4	(5)
28	Complete <i>computational exercises or procedures</i> from a textbook or a worksheet.	0	1	2	3	4	5
29	Present or demonstrates solutions to a math problem to the whole class.	0	1	2	3	4	5
30	Use manipulatives (for example, geometric shapes or algebraic tiles), measurement instruments (for example, rulers or protractors), and data collection devices (for example, surveys or probes).	0	1	2	3	4	5
31	Work <i>individually</i> on mathematics exercises, problems, investigations, or tasks.	0	1	2	3	4	5
32	Work <i>in pairs or small groups</i> on math exercises, problems, investigations, or tasks.	0	1	2	3	4	5
33	Do a mathematics activity with the class outside the	0	1	2	3	4	(5)
34	Use computers, calculators, or other technology to learn mathematics.	0	1	2	3	4	5
35	Maintain and reflect on a mathematics portfolio of their own work.	0	1	2	3	4	5
36	Take a quiz or test.	0	1	2	3	4	(5)

### Steps in SEC Development

- Early '90s—Curriculum R/D, TIMSS, NAEP, NSF
- OTL interest of States, Science Assessment
- 11 State collaborative –'98-'01 (NSF) Surveys, Reports, Alignment, USI/USP
- Develop/test PD Model on Use of SEC data (DEC :'01-04)
- Evaluation: MSP RETA PD Study ('02 05, NSF)
- English/ Language Arts survey ('03 04)
- Current: 15 States, 4 Districts, 7 NSF-MSPs, 5 State MSPs
- SEC Collaborative thru CCSSO

### Standards-based Alignment among Instruction, Assessment, and Professional Development



### **Professional Development Activity Log** (PDAL)

- Help teachers create an ongoing monthly log of any professional learning activity in which they participate
- Longitudinal data collected over 15 months
- Web-based, self-administered log
- Aligned with SEC (e.g., content coverage)
- Inclusive approach to professional development
  - Includes MSP-sponsored and non-MSP-sponsored activities
  - Documents one-time and recurring activities
  - Captures both formal and informal activities

### **PDAL Entries**

- Name of activity
- Number of hours spent on each activity and its duration
- Whether the activity is a one-time event or a continuous one (i.e., recurring over a number of months)
- Type of activity (e.g., workshop, summer institute, study group)
- Purpose of activity (e.g., strengthening subject matter knowledge)
- Content focus (e.g., algebraic concepts: absolute values, use of variables, etc.)
- Instructional practice instructional topics covered in each activity (e.g., use of calculators, computers, or other educational technology)
- PD quality features (e.g., active learning, coherence, collective participation)
- Materials used during each activity
- Comments

#### January, 2004 log entry for: new jan

#### MENU Instructions Activity Profile Math Content Covered Instructional Topics CA when Students Work Individually CA when Students Work in Pairs or Small Groups Hands-on Materials Use of Calculators, Computers, or Other Ed Tech Assessments Characteristics of PD Activity Materials Additional Comments

THANK YOU!!!

**View Status** 

**CA when Students Work Individually** 

Did the professional development focus on any of the following instructional strategies for use in your classroom (when students work individually)?:

	res	NO.			
Solve word problems from a textbook or worksheet	0	0			
Solve non-routine mathematical problems (for example, problems that require novel or non-formulaic thinking)	0	0			
Explain their reasoning or thinking in solving a problem, using several sentences orally or in writing	0	0			
Apply mathematical concepts to real-world problems	0	0			
Make estimates, predictions or hypotheses	0	0			
Analyze data to make inferences or draw conclusions	0	0			
Work on a problem that takes at least 45 minutes to solve	0	0			
Complete or conduct proofs or demonstrations of their mathematical reasoning	0	0			
[clear					



### **Advantages of PDAL**

- Gathers accurate, time-sensitive information; Minimizes recall problem with retrospective reports
- Collects disaggregate information about specific PD activities – Reduces bias introduced by gross data aggregation
- Generates context sensitive questions
- Alleviates teachers' response burden
- Minimizes data entry errors
- Be able to tailor technical assistance to teachers based on their response patterns
- Allows teachers to review their own logs Teachers can reflect on their own PD experiences

### **Analysis of PDAL Data**

- Examine the viability of PDAL as alternative PD data collection instrument (Implementation analysis)
  - Sample attrition; response rates; extent of missing data; TA needs; other PDAL development and implementation issues
- Produce rich description & correlates of PD activities (Descriptive analysis)
  - Patterns of responses to monthly logs
  - Patterns of teachers' PD experiences
  - Latent classes of teachers based on their PD experiences
  - Correlates of high-quality PD activities
- Assess the impact of PD on math & science instruction (Impact analysis)

### For More Information & Services

CCSSO

 RolfB@ccsso.org;
 Carliseg@ccsso.org
 www.SECsurvey.org

TA/PD Workshops—Use of Data TERC—Diana N (DEC model), Others Learning Point Assoc /NCREL

# For SEC Access, Alignment, Research

WCER

 johns@education.wisc.edu
 aminor@wisc.edu

www.SEConline.org

### For PDAL Information

AIR
bbirman@air.org
ksyoon@air.org
mgaret@air.org
rjacobson@air.org