DOCUMENT RESUME

ED 454 362		UD 034 293
AUTHOR	Kim, Jason J.; Crasco, Linda M.; Blank, Rolf K.; Smithson, John	
TITLE	Survey Results of Urban School Classroom Practices in Mathematics and Science: 2000 Report. Using the Survey of Enacted Curriculum Conducted during Eight USI Site Visits. How Reform Works: An Evaluative Study of National Science Foundation's Urban Systemic Initiatives. Study Monograph No. 3.	
INSTITUTION	Wisconsin Center for Education Research, Madison.; Council of Chief State School Officers, Washington, DC.; Systemic Research, Inc., Norwood, MA.	
SPONS AGENCY	National Science Foundation, Washington, DC. Directorate for Education and Human Resources.	
ISBN	ISBN-0-9702968-3-5	
PUB DATE	2001-04-00	
NOTE	94p.; Assisted by David J. Leavitt. For the 1999 report, see UD 034 292.	
CONTRACT	REC-9874322	
AVAILABLE FROM	For full text: http://www.systemic.com/publication or http://www.siurbanstudy.org/newspublication.	
PUB TYPE	Numerical/Quantitative Data (110) -- Reports - Evaluative (142)	
EDRS PRICE	MF01/PC04 Plus Postage.	
DESCRIPTORS	Academic Achievement; Active Learning; Classroom Techniques; *Curriculum Development; *Educational Change; Educational Technology; Elementary Secondary Education; Evaluation Methods; Experiential Learning; *Faculty Development; Higher Education; Homework; Mathematics Instruction; Preservice Teacher Education; Program Effectiveness; Program Evaluation; Science Instruction; Small Group Instruction; Student Evaluation; Teaching Methods; Thinking Skills; Time Management; *Urban Schools	
IDENTIFIERS	Content Area Teaching; *Enaction Theory	

ABSTRACT

This report presents results from eight Urban Systemic Initiative (USI) school district surveys conducted during 1999 and 2000. The Survey of Enacted Curriculum is the study component of a National Science Foundation grant on how reform works in USI districts. The study explores the impact of USI programs on student achievement and the learning infrastructure in urban school districts. It will develop an inferential causal model linking USI drivers and other key elements. In addition to classroom practices, the survey collects data on teachers' preservice and inservice education experiences, comparing results from elementary and middle school teachers who received varying amounts of professional development. Some of the findings include: most USI teachers were actively involved in professional development, which focused on content standards, in-depth study of content, curriculum implementation, multiple assessment strategies, and new teaching methods. In science, teachers with high professional development levels reported greater use of multiple assessments than teachers with low professional development levels, particularly elementary teachers. For science and mathematics, state and district frameworks or standards had the greatest positive influence on curriculum, as well as national standards. In this context, differences between teachers with high and low professional development levels were not notable. Appendixes contain content maps, descriptions of instructional activities, descriptive data on teachers participating in the survey, and expectations for students in mathematics and science. (SM)

USI EVALUATIVE STUDY

ED 454 362

Urban Systemic Initiatives

Study Monograph No. 3

How Reform Works: An Evaluative Study of NSF's Urban Systemic Initiatives

Survey Results of Urban School Classroom Practices in Mathematics and Science: 2000 Report

Using the Survey of Enacted Curriculum Conducted during Eight USI Site Visits

Jason J. Kim, Systemic Research, Inc.
Linda M. Crasco, Systemic Research, Inc.
John Smithson, Wisconsin Center for Education Research
Rolf K. Blank, Council of Chief State School Officers

Funded by the National Science Foundation
Directorate for Education and Human Resources
Division of Research, Evaluation and Communication
Division of Educational System Reform

Study Monograph No. 3

How Reform Works:
An Evaluative Study of National Science Foundation's
Urban Systemic Initiatives

Survey Results of Urban School Classroom Practices in Mathematics and Science : 2000 Report

Using the Survey of Enacted Curriculum Conducted during Eight USI Site Visits

Jason J. Kim, Systemic Research, Inc.
Linda M. Crasco, Systemic Research, Inc.
Rolf K. Blank, Council of Chief State School Officers
John Smithson, Wisconsin Center for Education Research

Assisted by:
David J. Leavitt, Systemic Research, Inc.

Eric Hamilton
Bernice Anderson
Division of Research, Evaluation and Communication

Costello Brown
Celestine H. Pea
Division of Educational System Reform

Directorate for Education and Human Resources
National Science Foundation, Arlington, VA

April 2001

Systemic Research, Inc.
Norwood, MA

The preparation of this report was sponsored by the National Science Foundation, Directorate for Education and Human Resources, Division of Research, Evaluation and Communication, under Grant No. REC-9874322: "How Reform Works: An Evaluative Study of NSF's Urban Systemic Initiative."

This report also is available on the World Wide Web:
www.systemic.com/publication or www.siurbanstudy.org/newspublication

ISBN 0-9702968-3-5

ABOUT THE AUTHORS

Jason J. Kim, Ph.D.

Dr. Kim has been involved in educational reform programs for K-12 and post-secondary levels in various capacities since 1993. Currently he is leading two evaluative studies as a PI- Urban Systemic Initiatives (USI) and Comprehensive Partnerships for Mathematics and Science Achievement (CPMSA) programs both granted by the National Science Foundation. He designed, developed, and implemented numerous evaluation and assessment instruments sponsored by federal or state governments for K-12 and college level programs. He has published numerous papers and provided workshops and consultations in the area of educational evaluation and assessment, and information management systems and technologies. Dr. Kim founded Systemic Research, Inc. in 1995 to provide expertise in educational evaluation/ information management systems. Prior to founding Systemic Research, Inc., he was a faculty member for ten years in the College of Engineering of Northeastern University, Boston.

Linda Crasco

Mrs. Crasco is Executive Director of Systemic Research, Inc. She is extensively involved in Systemic Research's Urban Systemic Initiative (USI) and Comprehensive Partnerships for Mathematics and Science Achievement (CPMSA) Evaluative Studies as the Project Director, designing and implementing a quantitative and qualitative data collection template, coordinating various study activities, conducting site visits, contacting site staff, providing technical presentations and writing summary reports. Mrs. Crasco is responsible for the design of USI cross-site summary tables and rubric scoring templates. She is also acting as Project Director for NSF's Model Institutions for Excellence (MIE) program for the Implementation of Conceptual and Operational Framework for Evaluation Design.

Rolf Blank, Ph.D.

Dr. Blank is Director of Education Indicators at the Council of Chief State School Officers. He has been a senior staff member of the State Education Assessment Center of the Council for 14 years. He is responsible for developing, managing, and reporting a system of state-by-state indicators of the condition and quality of science and mathematics education. Over the past three years, he has led a comprehensive study of state curriculum frameworks and standards in mathematics and science. He collaborates with state education leaders, researchers, and professional organizations in carrying out research, reporting and technical assistance about education indicators. He holds a Ph.D. from Florida State University and an M.A. from the University of Wisconsin-Madison.

John Smithson, Ph.D.

Dr. Smithson is a project director at the Wisconsin Center for Education Research, where he has been involved in the development, use and analysis of indicator measures of classroom practice for the past ten years. In recent years, working with the Council of Chief State School Officers (CCSSO), he has developed the use of "content maps" as a graphical tool for presenting data on instructional content, and has assisted in the development of a procedure for calculating a measure of alignment to describe the level of agreement between instruction and assessments. Current work includes extending these tools to encompass content standards and curriculum frameworks in order to measure alignment of instruction to standards as well as assessments. His work also focuses on promoting the use of indicator and alignment data by districts, schools, and teachers as a resource for informing curricular decision-making.

CONTENTS

LIST OF TABLES AND FIGURES

ACKNOWLEDGEMENTS

The original Survey of Enacted Curriculum (SEC) was an instrument designed and developed by a collaborated effort among the Council of Chief State School Officers (CCSSO), National Institute for Science Education (NISE) at the University of Wisconsin-Madison, National Science Foundation (NSF), and participating states. The SEC instrument was tailored to urban school districts within the context of our three year study funded by a grant from the National Science Foundation- "How Reform Works: An Evaluative Study of NSF's Urban Systemic Initiatives." This monograph presents the results of eight USI school district surveys conducted during site visits in 1999 and 2000. Systemic Research, Inc. conducted the survey process with technical assistance from CCSSO and the Wisconsin Center for Education Research. The survey will be continued in the third year of the study to include additional Cohort 95 sites.

Special thanks to the many teachers who participated in the Survey and the Project Directors who assisted with the survey process in the following eight USI sites:

Cohort 93 (survey conducted in 1999)	Baltimore USI	Dr. Jonathan Wilson
	Dallas USI	Ms. Sally Dudley
	Detroit USI	Dr. Juanita Clay-Chambers
	Phoenix USI	Dr. Susan Holt-Maas
Cohort 94 (survey conducted in 2000)	Columbus USI	Dr. Camille Nasbe
	Fresno USI	Ms. Sandra Carsten Dr. Carole Sarkisian-Bonard
	Memphis USI	Dr. Marietta Harris
	Philadelphia USI	Ms. Clara Tolbert

ABSTRACT

Survey Results of Urban School Classroom Practices in Mathematics and Science : 2000 Report

Using the Survey of Enacted Curriculum Conducted during Eight USI Site Visits

The Survey of Enacted Curriculum (SEC) is being conducted as a study component of a three year grant from the National Science Foundation (NSF), entitled "How Reform Works: An Evaluative Study of NSF's Urban Systemic Initiatives (USI)." The evaluative study is exploring the impact of USI programs on student achievement and the learning infrastructure in urban school districts. These results will be used to develop an inferential causal model linking the systemic reform drivers and other key elements.

The purpose of the Survey of Enacted Curriculum is to analyze classroom practices and curriculum, and to assess the impact of USI and other reform efforts. In addition to classroom practices, the survey collects data regarding teachers preservice education and professional development experiences. Survey results from elementary and middle school teachers who received varying amounts of professional development (High PD and Low PD) will be compared.

In brief, some survey findings are as follows:

- About 80 to 90% of USI teachers were actively involved in professional development, which focused on content standards, in-depth study of content, curriculum implementation, multiple strategies for assessment, and new methods of teaching. Teachers report that as a result of professional development they are using and applying new methods and standards in classrooms (average 2.3 on scale of 1 to 3).

- In science, teachers with High PD report greater use of multiple assessments than their counterparts with Low levels of professional development, especially at the elementary level.

- For science and mathematics, state and district frameworks or standards have the greatest positive influence on curriculum, as well as national standards. Differences between High PD and Low PD teachers were not notable.

The first report, *Survey Results of Urban School Classroom Practices in Mathematics and Science: 1999 Report,* presented a summary of the SEC from four USI sites surveyed in 1999; Baltimore, Dallas, Detroit, and Phoenix. In 2000 four additional USI sites were surveyed; Columbus, Fresno, Memphis, and Philadelphia. This report presents a summary of findings of both 1999 and 2000 survey results.

CHAPTER I

INTRODUCTION

I.1 The Survey of Enacted Curriculum and the Evaluative Study of NSF's Urban Systemic Initiatives

The Survey of Enacted Curriculum (SEC) is being conducted as a study component of a three year grant from the National Science Foundation (NSF), entitled "How Reform Works: An Evaluative Study of NSF's Urban Systemic Initiatives (USI)." The purpose of the study is to determine the impact of the USI program on student achievement and the learning infrastructure in urban school districts. The study is focusing on development of an inferential causal model that relates the systemic initiative drivers and other key elements to the outcomes observed.

As part of the study activities, the evaluative study team conducted four site visits each year to interview superintendents, principals, teachers, and USI and district staff members, and to observe classrooms and teacher practices. During two-day site visits to the Baltimore, Dallas, Detroit, and Phoenix school districts in 1999, and Columbus, Fresno, Memphis and Philadelphia in 2000, the study team met with a group of teachers to conduct the survey. This is the second Survey of Enacted Curriculum report summarizing all eight USI site survey data.

Within the context of the USI evaluation study, there are three main objectives for conducting the Survey:

- Collect data from a sample of teachers in selected urban schools to assess classroom practices and curriculum enactment in science and mathematics. This data will be used to confirm and validate changes in practice relevant to USI implementation.
- Analyze enacted classroom curriculum and instruction in relation to expectations for practice as outlined in state/district content standards, science and mathematics reform initiatives, and standard-based assessment.
- Analyze the effects of professional development on teaching practices within the context of USI implementation.

The SEC is a practical research tool for collecting consistent data on mathematics and science instructional practices and curriculum based on teacher reports of what is taught in the classroom. The SEC offers an objective approach to analyzing current classroom practices in relation to state, national, and local content standards and the goals of systemic initiatives. The survey results provide a means of validating described changes in practice in urban systemic sites by analyzing classroom practice data from a sample of schools in selected sites. It also provides a method for analyzing the effects of professional development in actual classroom practice.

I.2 Background of Urban Systemic Initiatives and the Evaluative Study

NSF launched the USI program in 1993, applying lessons learned from its initial State Systemic Initiative (SSI) program to the problems of inner city school systems. The USI program was offered to the 25 cities with the largest number of K-12 students living in poverty. Five cohorts of cities (22 cities in all) signed cooperative agreements with NSF for a five-year concerted system-wide effort to promote standards-based reform in mathematics, science, and technology (MST). The NSF investment was meant to be a catalyst for large-scale educational change affecting standards, curriculum, assessment, professional development, partnerships, and convergence of intellectual and fiscal resources, with the goal of improving student achievement.

Over the course of its systemic initiative programs, NSF has developed a theoretical structure for systemic reform that is based on six "drivers"; four process drivers and two student outcome drivers, as well as a number of cross-cutting issues such as equity, quality, scaling-up, coordination and organization. NSF is committed to measuring impact within its systemic initiatives in the following three areas: 1) the implementation of standards-based curriculum, instruction and assessment, 2) enhanced professional development for teachers of mathematics and science and, 3) increased mathematics and science achievement of all students.

With a focus on the six drivers outlined by NSF, our evaluative study is seeking evidence of program effectiveness that profoundly affects and sustains systemic reform in 22 USI cities. We are seeking to identify interrelationships among the four process drivers (Drivers 1 to 4) and two outcome drivers (Drivers 5 and 6) based on compiled outcome data collected by the Key Indicator Data System (KIDS).

Urban Systemic Initiatives

Our study is focusing on two major hypotheses and one investigative question

Hypothesis I: A well-implemented USI program has significant and sustainable positive impact on the infrastructure that supports student success (opportunity to learn) including curriculum, teacher skills, and resources in urban school districts.

Hypothesis II: A well-implemented USI program leads to significantly improved student outcomes in MST.

Question I: Which SI drivers or cross-cutting variables (equity, quality, scaling-up, etc.), are most critical to achieving sustainable reform and improved student outcomes, and how do these variables interact with each other?

Six Drivers for NSF's Educational System Reform

1. Implementation of comprehensive, standards-based curricula as represented in instructional practice, including student assessment, in every classroom, laboratory, and other learning experiences provided through the system and its partners.

2. Development of a coherent, consistent set of policies that supports: provision of high quality mathematics and science education for each student; excellent preparation, continuing education, and support for each mathematics and science teacher (including all elementary teachers); and administrative support for all persons who work to dramatically improve achievement among all students served by the system.

3. Convergence of the usage of all resources that are designed for or that reasonably could be used to support science and mathematics education--fiscal, intellectual, material, curricular, and extra-curricular--into a focused and unitary program to constantly upgrade, renew, and improve the educational program in mathematics and science for all students.

4. Broad-based support from parents, policymakers, institutions of higher education, business and industry, foundations, and other segments of the community for the goals and collective value of the program, based on rich presentations of the ideas behind the program, the evidence gathered about its successes and its failures, and critical discussions of its efforts.

5. Accumulation of a broad and deep array of evidence that the program is enhancing student achievement, through a set of indices that might include achievement test scores, higher level courses passed, College admission rates, college majors, Advanced Placement Tests taken, portfolio assessment, and ratings from summer employers, and that demonstrate that students are generally achieving at a significantly higher level in science and mathematics.

6. Improvement in the achievement of all students, including those historically underserved.

CHAPTER II

METHODOLOGY AND INSTRUMENTATION

II.1 Background

Under the grant for the USI Evaluative Study, Systemic Research, Inc. contracted with the Council of Chief State School Officers (CCSSO) to adopt the Survey of Enacted Curriculum (SEC) as a study component for a three-year period beginning in Spring 1999. The SEC instruments, analysis, and reporting methods were designed and field-tested by CCSSO in collaboration with researchers at the National Institute for Science Education (NISE) at the University of Wisconsin-Madison. The design and development work began in 1995 as part of a multi-state collaborative project, and the current survey design was completed under support from the National Science Foundation, Education and Human Resources Directorate, Division of Research, Evaluation and Communication.

II.2 Sampling and Data Collection

The SEC collects teachers' response to written survey forms. The survey forms were prepared in four categories: two subjects (mathematics and science) per two grade levels (elementary and middle). In each urban site, science and mathematics teachers were recruited from 20 schools -- 10 elementary (grade 3, 4 or 5) and 10 middle (grade 6, 7 or 8). To form a control group for statistical analysis, a group of teachers were recruited from both high implementation schools (involved in USI implementation for a longer period of time with active participation in professional development) and low implementation schools (schools less actively involved in USI implementation) at each grade level. Two mathematics and two science teachers from each school were selected. The survey forms were distributed to 80 participating teachers: 20 mathematics and 20 science teachers per grade level.

II.3 Survey Procedures

The survey was conducted during site visits in 1999 (Baltimore, Dallas, Detroit, and Phoenix) and 2000 (Columbus, Fresno, Memphis, and Philadelphia). Before each site visit, Systemic Research sent out an initial memorandum explaining the purpose and methodology of the survey. The USI Project Director in each site assisted in selecting the 20 schools, and recruiting the teachers to participate in the survey. In 1999, one teacher from each school was invited to attend a survey orientation session. After a full explanation of the survey, the teacher representatives were asked to return to their schools with four surveys (two each for mathematics and science) to distribute to three other teachers who were asked to complete it. The completed surveys were then returned by mail to the Wisconsin Center for Education Research for data processing and analysis.

Due to the low response (142 surveys returned from the 232 distributed), a different procedure was initiated in 2000. Instead of inviting one representative teacher from each school to explain the survey procedures and complete the survey at each school site, all of the teachers were invited to a central location to complete the survey. This resulted in a better response (248 surveys returned). Appendix C presents a summary of descriptive data on teachers participating in the survey during 1999 and 2000.

A total of 390 teachers participated in the survey process; 142 in 1999 and 248 in 2000. An average of 49 teachers in each of the eight sites participated, with a wide range from 24 in Baltimore to 80 in Philadelphia. The demographic description of teachers is as follows:

- 55% elementary school teachers, 45% middle school teachers
- 49% mathematics teachers, 51% science teachers
- 79% female mathematics teachers, 18% male mathematics teachers, 3% no response
- 77 % female science teachers, 20% male science teachers, 3% no response
- 46% underrepresented minority mathematics teachers
- 36% underrepresented minority science teachers

II.4 Survey Instrument Structure

The survey was conducted using four different instruments to accommodate the two grade levels and two subject matters involved. However, each instrument consists of three sections as shown in Table 1.

Table 1. General Structure of SEC Instrument for Middle School Mathematics

Section	Questions (number of questions & type)
I. General School and Class Descriptions	• School description (2 Q- multiple choice) • Class description (10 Q- multiple choice) • Most recent unit of mathematics instruction & instructional time distribution (10 Q- percentage of time)
II. Subject Content – Expectations for Students in Mathematics	• Number sense/ Properties/ Relationships (17 Q) • Measurement (13 Q) • Data analysis (15 Q) • Algebra concepts (22 Q) • Geometric concepts (18 Q) • Instructional technology (3 Q)
III. Instructional Activities in Mathematics	• Homework (10 Q) • % of mathematics instruction time (12 Q) • % of problem-solving activities (8 Q) • % of pairs or small groups work (6 Q) • % of use of hands-on materials (6 Q) • Use of calculators, computers, etc. (11 Q) • Assessments (8 Q) • Instructional influences (10 Q) • Classroom instructional preparation (18 Q) • Teacher opinions (18 Q) • Professional Development (14 Q) • Formal course preparation (3 Q) • Teacher characteristics (8 Q)
Total	• 242 Questions

Section I collects school and classroom information, along with the teacher's most recent unit of mathematics instruction and instructional time distribution as shown in Figure 1.

Figure 1. Sample Questions in Section

What percent of mathematics instructional time was spent on the following activities?

Enter the percentage of time for each item in the box provided, so that items 9-16 total 100%. Then use the scale to code your response (rounded to the nearest 10%) for each item on the answer sheet.

	%	None	10	20	30	40	50	60	70	80	90+
9 Management or administrative routines, interruptions, and other non-instructional activities		⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
10 Whole class lecture or class discussion		⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
11 Individual student work (e.g. completing exercises, reading textbook)		⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
12 Small group work		⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
13 Field study or out-of-class investigation.		⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
14 Student demonstrations or presentations.		⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
15 Review or work on homework during class.		⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
16 Test or quiz		⓪	①	②	③	④	⑤	⑥	⑦	⑧	⑨
	100%	(Note: Total should sum to 100)									

Section II requests information regarding subject topic coverage and teacher's expectations for students in the target class for the current year. It is not intended to reflect any recommended or prescribed content for the grade level. For middle school mathematics, six topic areas (ex. *Number sense/properties/relationships*) are detailed by multiple sub-topic areas (ex. *Place value*, *Whole numbers*, *Operations*, etc.) as shown in Figure 2.

Figure 2. Sample Questions for Middle School Mathematics – Topic Coverage and Teacher's Expectations for Students

SECTION II								
Time on Topic		*Middle School Math Topics*	*Expectations for Students in Mathematics*					
<none>	1	**Number sense / Properties / Relationships**	Memorize	Understand Concepts	Perform Procedures	Analyze / Reason	Solve Novel Problems	Integrate
⓪ ① ② ③	101	Place value	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③
⓪ ① ② ③	102	Whole numbers	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③
⓪ ① ② ③	103	Operations	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③
⓪ ① ② ③	104	Fractions	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③
⓪ ① ② ③	105	Decimals	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③
⓪ ① ② ③	106	Percents	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③
⓪ ① ② ③	107	Ratio, proportion	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③
⓪ ① ② ③	108	Patterns	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③
⓪ ① ② ③	109	Real numbers	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③
⓪ ① ② ③	110	Exponents, scientific notation	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③
⓪ ① ② ③	111	Factors, multiples, divisibility	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③
⓪ ① ② ③	112	Odds, evens, primes, composites	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③
⓪ ① ② ③	113	Estimation	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③
⓪ ① ② ③	114	Order of operations	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③
⓪ ① ② ③	115	Relationships between operations	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③
⓪ ① ② ③	116	Mathematical properties (e.g. distributive property)	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③	⓪ ① ② ③

To complete this section, the teacher identifies topic/sub-topic areas covered in his/her mathematics class, using "Time on Topic" column (0 = none- not covered, 1 = slight coverage- less than one class/lesson, 2 = moderate coverage- one to five classes/lessons, 3 = sustained coverage- more than five classes/lessons). Then the teacher indicates the relative emphases of each expectation for students for every sub-topic taught using scale bubbles for six categories: *memorize*, *understand concepts*, *perform procedures*, *analyze/reason*, *solve novel problems*, and *integrate*. Appendix D presents detailed explanations of each student expectation category for mathematics and science. Four scale bubbles indicate: 0 = no emphasis, 1 = slight emphasis (accounts for less than 25% of the time), 2 = moderate emphasis (accounts for 25% to 33% of the time), 3 = sustained emphasis (accounts for more than 33% of the time).

Section III asks ten types of questions regarding instructional practices. These topics include:

- Homework
- Instructional Activities in Mathematics
- Use of Calculators, Computers, and Other Equipment
- Assessments
- Instructional Influences
- Classroom Instructional Preparation
- Teacher Opinions
- Professional Development
- Formal Course Preparation
- Teacher Characteristics

Figure 3 illustrates a sample question regarding "Instructional Activities in Mathematics."

Figure 3. Sample Questions about Instructional Activities in Mathematics

INSTRUCTIONAL ACTIVITIES IN MATHEMATICS

Listed below are some questions about what students in target class do in mathematics. For each activity, pick one of the choices (0,1,2,3) to indicate the percentage of instructional time that students are engaged in the activity identified. Please think of an average student in this class, in responding.

What percentage of mathematics instructional time in this target class do students:

NOTE: No more than two '3's, or four '2's should be circled for any given set of items.

		None	Less than 25%	25% to 33%	More than 33%
27	Observe the teacher demonstrate how to do a procedure or solve a problem.	0	1	2	3
28	Read about math-related topics in books, magazines, articles				
29	Collect and/or analyze data.	0	1	2	3
30	Maintain a portfolio of their own work.	0	1	2	3
31	Use hands-on materials/manipulatives (e.g. counting blocks, geometric shapes, algebraic tiles, etc.).	0	1	2	3
32	Engage in mathematical problem solving (e.g. computation, story-problems, and mathematical investigations).	0	1	2	3
33	Students take notes.	0	1	2	3
34	Work in small groups	0	1	2	3
35	Work on an assigned mathematics project at home or away from school.	0	1	2	3
36	Use computers, calculators, and/or other technology to learning mathematics.	0	1	2	3
37	Work individually on assignments.	0	1	2	3
38	Take a quiz or test	0	1	2	3

CHAPTER III

SURVEY RESULTS
SUMMARY AND ANALYSIS

III.1 Overview

State and national standards in mathematics and science provided the foundation for the survey design, item writing, and reporting results. The standards used in design and reporting were selected by the CCSSO/NISE study team with a panel of mathematics and science education leaders from states. Not all topics and standards that provided the structure for the survey questions are reported here. The data analysis reported provides a snapshot of some of the practices and curriculum content in selected urban school districts.

This report presents SEC results based on 191 participating teachers of mathematics and 199 participating teachers of science in eight USI sites: Baltimore, Columbus, Dallas, Detroit, Fresno, Memphis, Philadelphia, and Phoenix. In all eight districts, the elementary school surveys were completed by teachers of grade 4 or 5, and middle school surveys by teachers of grade 7 or 8.

One of the key elements of all of the USI programs across districts was professional development for teachers that focused on increasing teachers' content knowledge in science and mathematics and skills in pedagogy based on state and national standards. Recognizing the emphasis on professional development, our analysis of the Survey data compared teacher responses in two groups: a) those receiving High amounts of professional development (High PD) defined as 16 or more hours of professional development in their teaching subject in the last 12 months, and b) those receiving Low amount of professional development (Low PD) defined as less than 16 hours. These operational definitions are consistent with analysis of data from the NAEP 1996 survey of teachers (Shaughnessy, et al., 1997) and other national surveys such as the Schools and Staffing Survey. The cut point of 16 hours divided the sample of teachers fairly evenly into two strata. We also analyze the data by comparing teachers of middle grades and teachers of elementary grades.

III.2 Selected Item Profiles and Content Maps/Graphs for Mathematics and Science

This section presents selected item profiles of SEC especially relevant to standards-based curriculum, instructions, and assessment. The theme or concept that is being reported and analyzed in each data chart is based on standards for learning in mathematics or science. The charts and data presentations are intended to illustrate some of the findings that were analyzed. The full survey results are attached as an appendix for further comprehensive analysis. Table 2 outlines the 18 data charts presented in this section which focus on:

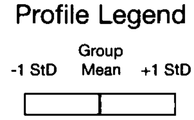
- Active Learning in Science
- Reasoning and Problem Solving in Mathematics
- Science and Mathematics Content Maps and Graphs
- Multiple Assessment Strategies in both Science and Mathematics
- Use of Lab and Technology
- Influences on Curriculum and Practices
- Participation in Professional Development
- Teacher Preparation

Item Profile Legend

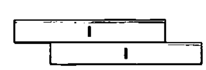
Except the science and mathematics content maps and graphs, item profiles summarize the average of each item response using a bar graph referencing a group mean and standard deviations. Each chart summarizes the item response using a three-column presentation. The first column presents item response summaries by grade level; elementary and middle school. The second and third columns present item response summaries of elementary and middle schools by High PD and Low PD teachers. Each cell presents two bars comparing two groups of data.

The vertical line in the center indicates the item (group) mean and the shaded area (blue or gray) shows the range of responses from -1 to +1 standard deviation (StD) from the mean, which generally includes two-thirds of the survey responses. A bordered bar indicates a statistically significant mean difference between the two groups.

Profile Legend



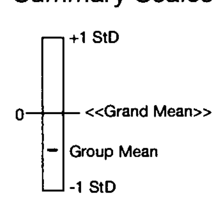
Bordered Bar



Summary Scales

Several charts present Summary Scales that present an average of combined item responses relevant to standards-based curriculum and instruction. The summary scale has been statistically transformed so that the grand mean of all teachers has a value of zero. Two bars present relative group means and standard deviation compared to the grand mean.

Summary Scales



Scale Reliability: .80

Scale Reliability

Scale reliability is a summary measure of internal reliability among the selected profile items. For example, if one item is higher than average, the scale reliability predicts how likely the other items in the scale will also be higher than average. Reliability ranges from 0 to 1. As a rule of thumb, anything in the .8 to .9 range is considered high reliability.

Table 2. Selected Item Profiles and Content Maps/Graphics

Chart	Title
Chart 1	Active Learning in Science
Chart 2	Reasoning and Problem Solving in Mathematics
Chart 3	Science Content Maps
Chart 4	Elementary School Science Content Graphs
Chart 5	Middle School Science Content Graphs
Chart 6	Mathematics Content Maps
Chart 7	Elementary Mathematics Content Graphs
Chart 8	Middle School Mathematics Content Graphs
Chart 9	Multiple Assessment Strategies in Science
Chart 10	Multiple Assessment Strategies in Mathematics
Chart 11	Use of Lab Equipment & Educational Technology in Science
Chart 12	Use of Educational Technology in Mathematics
Chart 13	Influences on Curriculum and Practices in Science
Chart 14	Influences on Curriculum and Practices in Mathematics
Chart 15	Professional Development in Science
Chart 16	Teacher Preparation in Science
Chart 17	Professional Development in Mathematics
Chart 18	Teacher Preparation in Mathematics

Chart 1: Active Learning in Science

Chart 1 displays a summary of item profiles to the survey question "*When students in the target class are engaged in laboratory activities, investigations, or experiments as part of science instruction, what percentage of that lab time do students*". The Item Profiles display the percentage of time spent on classroom activities relevant to active learning in science. Data related to Active Learning in Science are reported in two ways: the eight individual item profiles, and a Summary Scale that combines the four item profiles (as indicated by *) relevant to standards-based curriculum and instruction.

Active learning is one of the central concepts in state and national standards for student learning in science that underlies the Survey. The data in Chart 1 illustrate the extent of active science learning and the kinds of classroom practices being used as reported by science teachers. Differences in active learning strategies employed by teachers across grade levels and High PD vs. Low PD are displayed.

- **Summary Scale:** The summary scale in active learning in science is comprised of the following four standards-based item profiles: *use science equipment or measuring tools*, *change something in an experiment to see what will happen*, *design ways to solve a problem*, and *make prediction, guesses or hypotheses.*

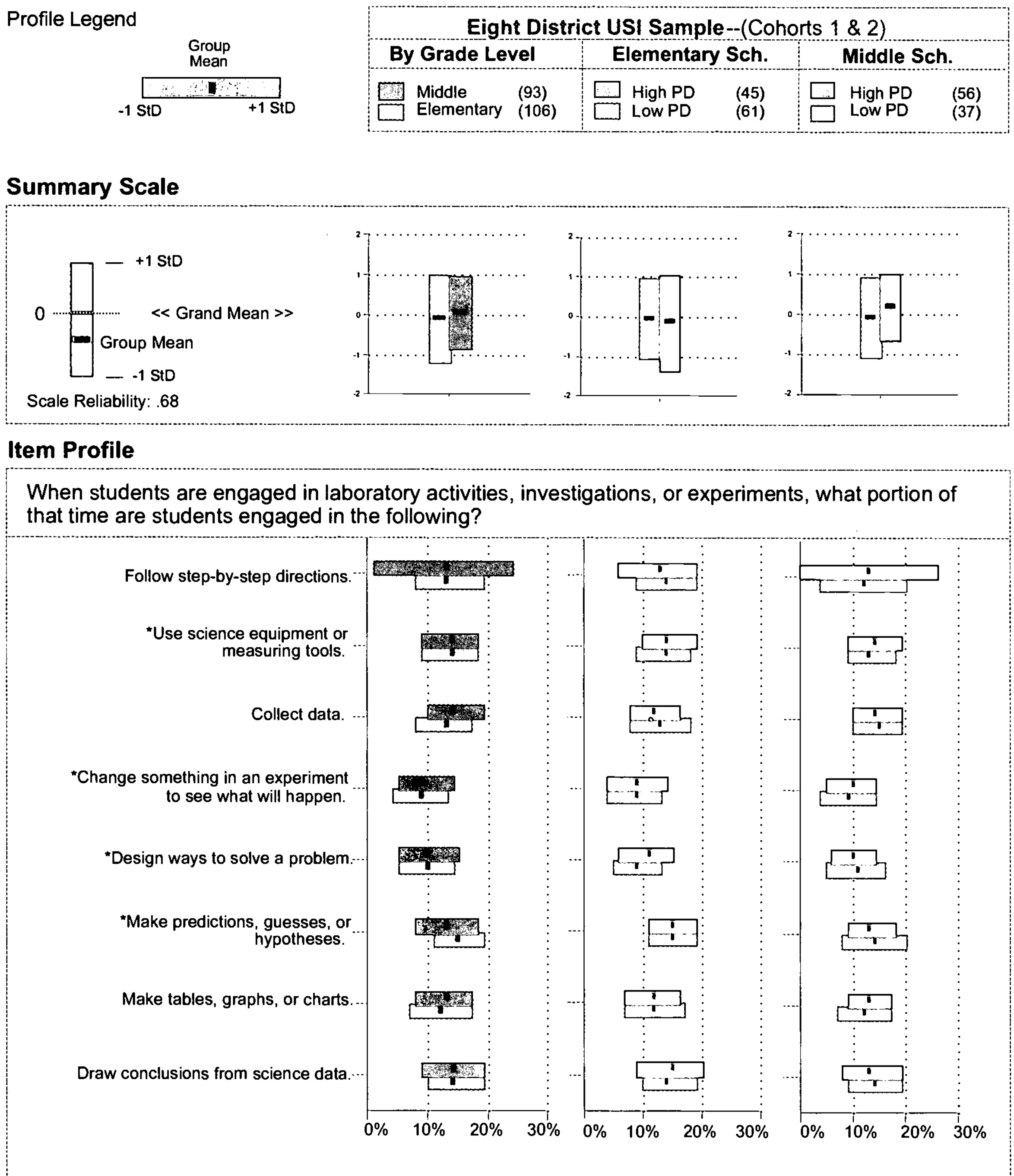
  The results of the survey indicate that there is no difference in the amount of time spent on the above referenced items by any group of teachers. Middle school teachers with High PD report slightly more, although not statistically significant, emphasis on standards-based instruction.

- **Experiments/Investigations:** The Item Profiles display the percent of time classes spend on specific activities during active learning in science, particularly during experiments or investigations. Another set of questions in the survey asked about how class time is typically allocated (see Appendix Chart B.7. Use of Class Time During Most Recent Unit of Instruction in Science.) In total, classes used 27% of science class time doing hands-on or laboratory activities in science. In a typical classroom experiment or investigation, students would be expected to be engaged in a number of these activities in combination or sequence. Thus, it is useful to examine groups of activities with similar time frames. In Chart 1, we see that in general the four items associated with standards-based instruction are practiced nearly 50% of the time during active learning. No one activity dominated time spent– all activities were reported between almost 10% to 15% of time. In our survey the amount of professional development a teacher received did not have an impact on the time spent on any particular activity.

Summary: The data on active learning in science show that all teachers are utilizing standards-based instructional methods nearly half of the time. There is not much variation in time spent on any of the eight items listed.

Chart 1

Active Learning in Science



* Item included in Summary Scale

Chart 2: Reasoning and Problem Solving in Mathematics

Both reasoning and problem solving are curriculum standards for K-12 mathematics education set out in the NCTM Mathematics Standards (1989), and this learning goal is found in most state content standards for mathematics (Blank, et al., 1997). Key questions concerning classroom practices and instruction related to the standard are: *"How much instructional time do teachers spend on this goal?" "What do teachers mean when they use the term 'problem solving'?"* The results in Chart 2 illustrate how results from the Survey that can answer these questions.

- **Summary Scale:** The scale on reasoning and problem solving is comprised of four survey items that, taken together, provide a reliable index of the degree to which teachers are focusing mathematics instruction on improving students' reasoning and problem solving skills and knowledge using standards-based methods. These four items are *solve novel mathematical problems, apply mathematical concepts to real or simulated "real-world" problems, make estimates, predictions, guesses, or hypothesis* or *analyze data to make inferences or draw conclusions.* The scale results show that middle school classes experience more problem solving activities than elementary school classes. The data also show that mathematics classes of elementary school High PD teachers spend more time on mathematics reasoning and problem solving than the classes of Low PD teachers. The results of middle school teachers show the opposite effect; that Low PD teachers spend more time on reasoning and problem solving skills than High PD teachers. However, this data is not statistically significant.

- **Problem-solving Activities:** When analyzing the results from questions on mathematical reasoning and problem solving, it is important to know how teachers interpret the term *"problem solving."* For example, do they mean completing exercises in a text or solving novel problems (those for which students have no ready procedure)? The item profile section of the chart identifies these distinctions. For example: about 15% of time in elementary and middle grades mathematics in problem solving activities is spent on both *computational exercises from a text or worksheet* and *solve word problems from a textbook or worksheet.* There is wide variation in time on these activities, from less than 10% to over 25%, as indicated by the range of responses for one standard deviation from the mean. In general the mathematics classes of High PD teachers spend less time on these activities compared to Low PD teachers.

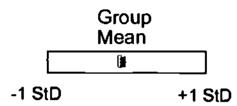
  All teachers report the majority of time spent on problem solving and reasoning skills involve standards-based methods. In general, middle school teachers spend significantly more time than elementary school teachers on problem solving, but interestingly, PD has a more marked effect on elementary school teachers; those with High PD spend much more time on standards-based problem solving than their Low PD counterparts.

Summary: The findings on Mathematics Problem solving and Reasoning indicate that teachers with more professional development in mathematics content and teaching report a greater instructional emphasis on standards-based instruction, such as *applying mathematical concepts to real world problems* and *making predictions* and less on drill and practice exercises.

Chart 2

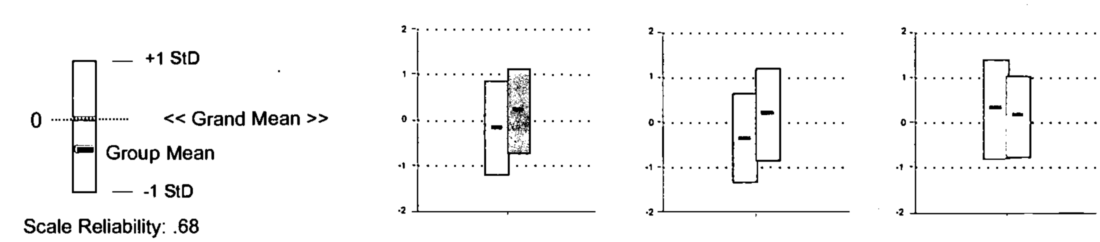
Reasoning and Problem Solving in Mathematics

Profile Legend



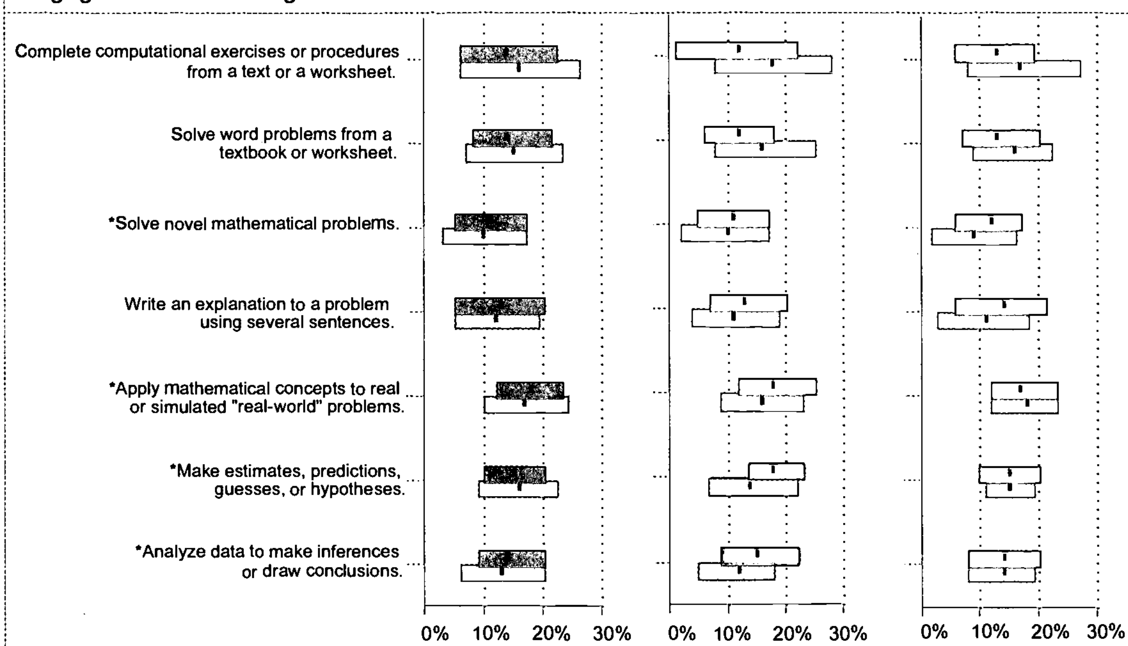
Eight District USI Sample – (Cohorts 1 & 2)		
By Grade Level	**Elementary Sch.**	**Middle Sch.**
Middle (84) Elementary (107)	High PD (36) Low PD (71)	High PD (56) Low PD (28)

Summary Scale



Item Profile

When students are engaged in problem-solving activities, what portion of that time are students engaged in the following?



* Item included in Summary Scale

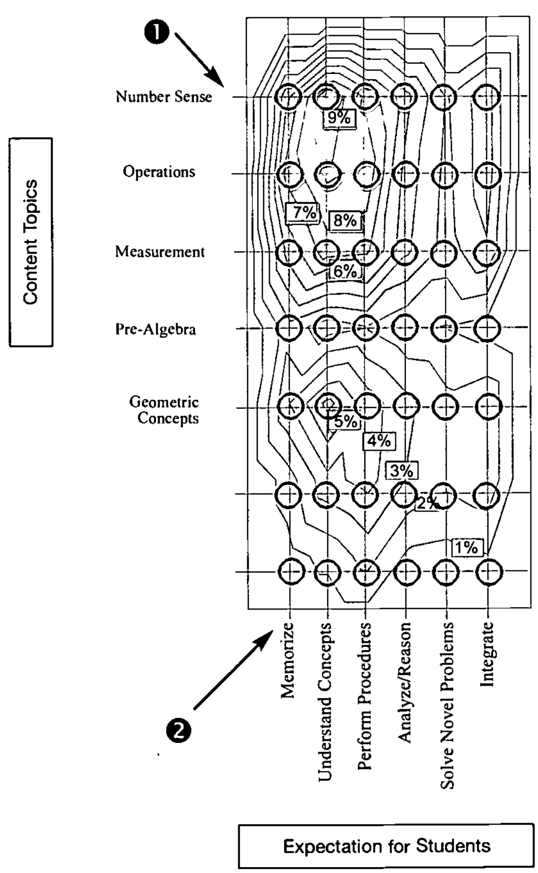
Bordered bar indicates statistically significant mean difference.

Charts 3, 4, & 5: Science Content Maps and Content Graphs

The Survey of Enacted Curriculum incorporates an innovative approach to data collection on subject content taught in class. Teachers are asked to report the amount of time spent on content in mathematics or science using a “subject content matrix.” The two dimensions of the matrix are content topics and expectations for students. Teachers first identify the major mathematics or science standards covered in class and amount of time spent teaching specific topics, and then report the expectations they had for student learning (e.g., memorize, understand concepts, perform procedures, analyze information). Teachers are asked to identify subject content taught in one class over one school year. (See Appendix A for a detailed explanation of content matrix.)

Data on the mathematics and science content taught in class have been compiled and visualized using “content maps,” and “content graphs.” A content map, as shown in Figure 4, provides a two-dimensional representation of instructional content using a surface area chart, which results in a graphic very similar to topographical maps. The grid overlaying each map identifies a list of topics areas (indicated by horizontal grid lines- ➊) and six categories of cognitive expectations for students (indicated by vertical grid lines- ➋). The intersection of each topic area and category of cognitive expectation represents a measurement node. A Content Map is an excellent instrument for reporting a general overview using a 3-dimensional perspective.

Figure 4. A Sample Mathematics Content Map



For more detailed node-by-node comparison, a Content Graph is presented in a matrix format combining multiple bar graphs on each node with scales (see sample Chart 4). Each bar graph compares High PD and Low PD teachers. Each row total shows a mean value and a range of one standard deviation for each topic area. Likewise, each Column Total shows a mean and standard deviation for six categories of cognitive expectations for students.

Content maps and content graphics are both generated from teacher responses across all eight USI school sites. The teacher responses are aggregated and reported by grade level (elementary and middle) and High PD vs. Low PD teachers

The main advantages of content matrix design for data collection on content taught is its consistency with standards-based learning, as described in national professional standards – National Council of Teachers of Mathematics (NCTM), 1989; American Association for the Advancement of Science (AAAS), 1993; National Research Council (NRC), 1995 – and most state standards. With this approach, curriculum is viewed as a combination of the mathematics or science disciplinary knowledge to be learned (e.g., geometry) and the skills and capacities that students are expected to gain through instruction (e.g., solve real-world problems).

Chart 3 presents four science content maps for both middle and elementary science teachers by High PD and Low PD. Charts 4 and 5 present content graphs comparing High PD and Low PD in bar graph format.

- **Elementary School Science.** The areas of *Life Science* were reported by teachers as being taught from 20 to 22% of the time, with High PD teachers spending slightly less time. *Physical Science* and *Earth Science* were reported at about 14 to 19% of time. *Measurement and Calculation* in science averaged 14% of time. The aggregate category *Nature of Science* averaged nearly 20% of time. This category includes teaching scientific method, history of science, science and technology, and science-health-environment. The most striking aspect of the data on science topics is the wide variation in time on topics spent by teachers, particularly in *Nature of Science* with time spent varying from 0 to over 30% of time.

  All six expectations for science learning were reported as over 10% of time; *understand concepts, conduct experiments*, *analyze information* and *apply concepts* were all reported as 20% or more of time. Memorize was reported as the least expected kind of learning, which includes learning facts, definitions, terms, and formulas. High PD teachers reported slightly more time on expectations for *analyze information*, but other expectations were very similar between the two groups.

- **Middle School Science.** Teachers reported spending the most amount of time on *Life Science* (27%) followed closely by *Physical Science* (22%). Less than 5% of time was spent on *Measurement and Calculation in Science.* There were wide variations among teachers in amount of time spent on most topics, particularly the 10% to 40% time variation on *Life Science.*

  Teachers' expectations for student learning were fairly balanced among the six expectations. More time was spent on *understand concepts* and the least amount of time on the traditional practice of *memorize.*

Summary: Elementary teachers who participated in the survey reported fairly balanced content among the areas of *Life*, *Physical*, and *Earth Science*, and almost the same amount of time in instruction on *Nature of Science*. Only small differences were found between High PD and Low PD teachers. There was very little difference among Middle school High PD and Low PD teachers in both content and expectations.

Chart 3

Science Content Map

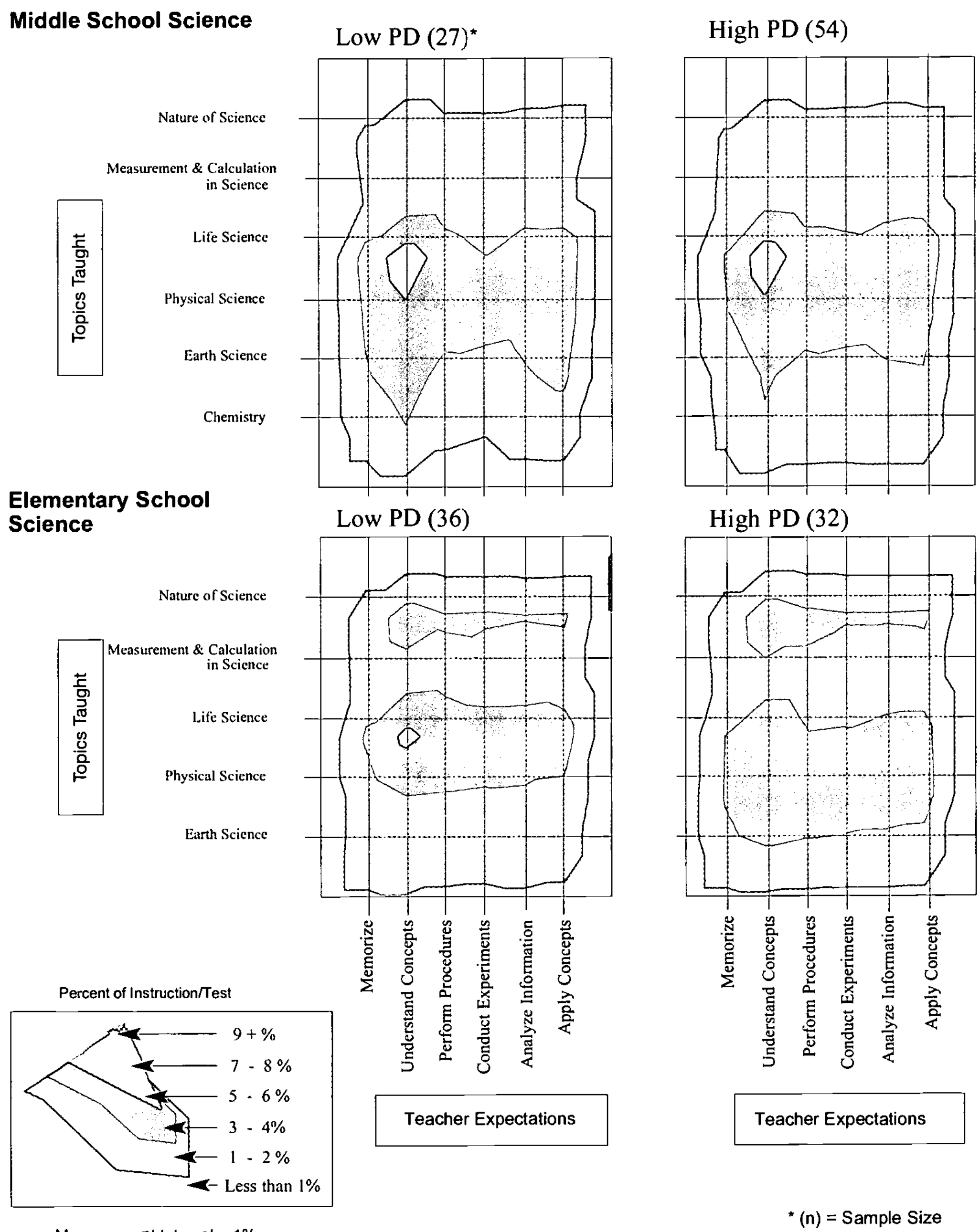
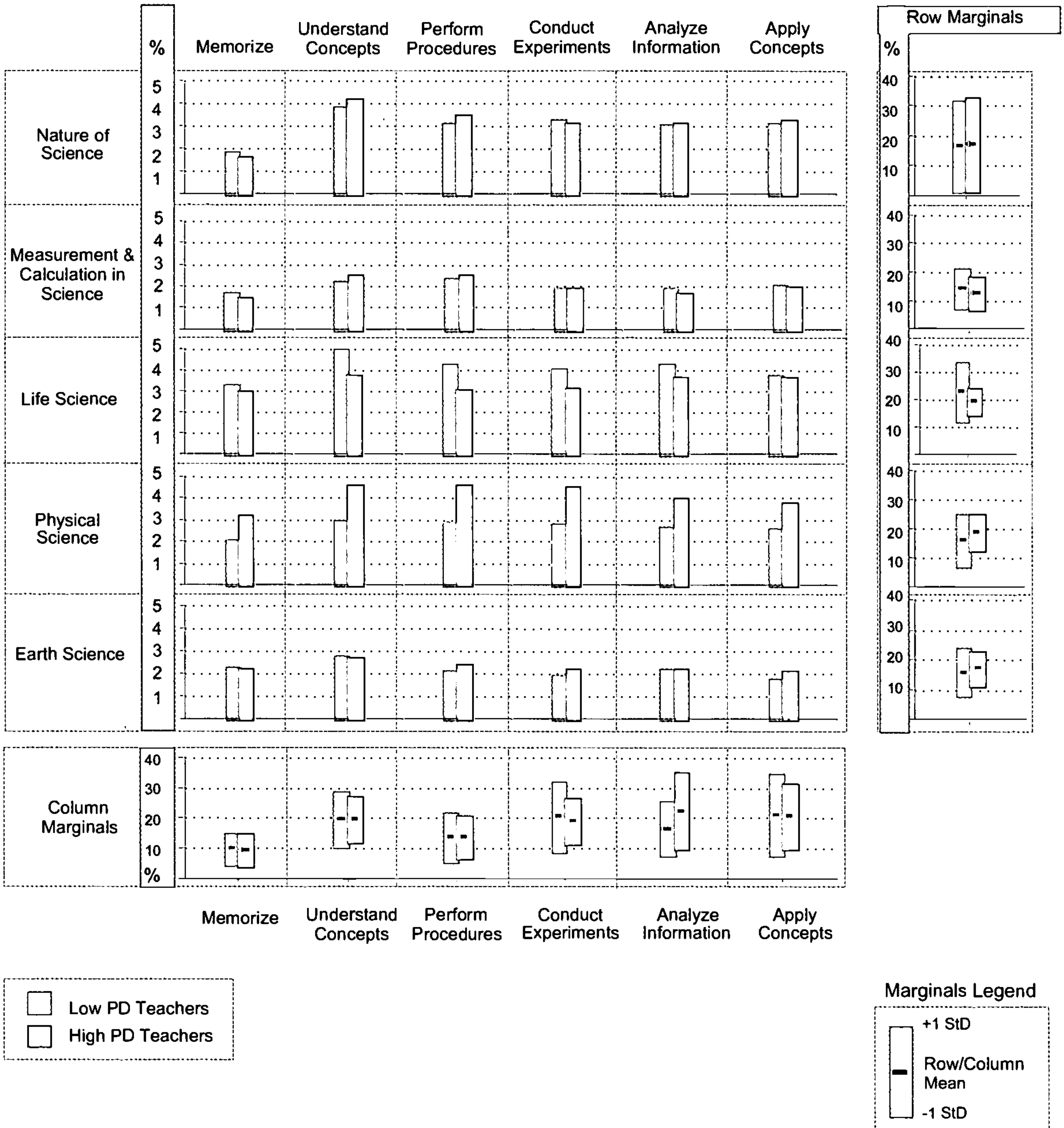


Chart 4

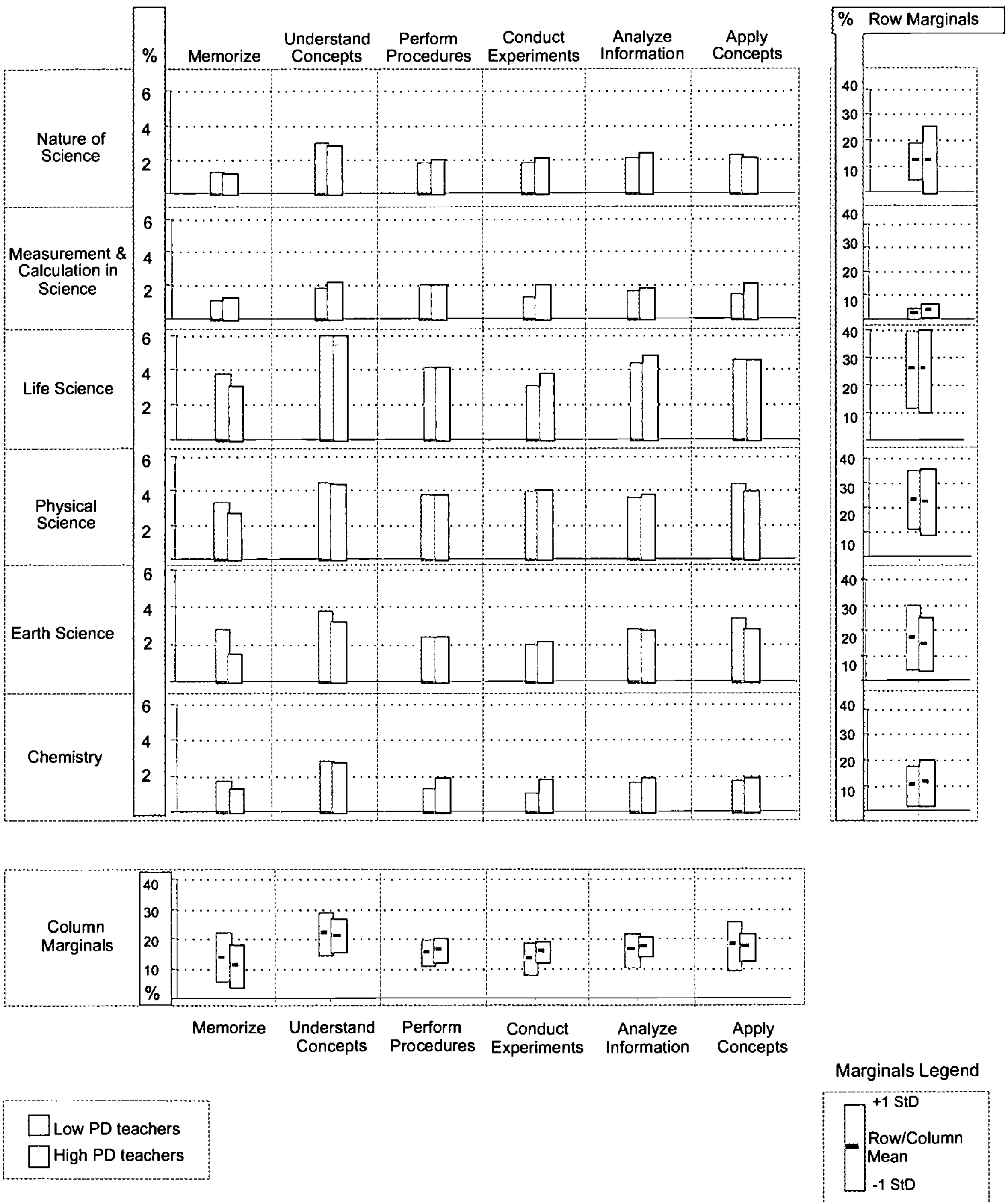
Elementary School Science Content Graph
Eight District Sample (Cohort 1 & 2): Low PD (36), High PD (32)



Marginals = The sum across rows or columns.

Chart 5

Middle School Science Content Graph
Eight District Sample (Cohort 1 & 2): Low PD (27), High PD (54)



Marginals = The sum across rows or columns.

Charts 6, 7 & 8: Mathematics Content Maps, and Graphs

Chart 6 presents four mathematics content maps for middle school by High PD and Low PD. Charts 7 and 8 present content graphs for the same data. In our survey the majority (82%) of middle level mathematics teachers were teaching grade 8. The content maps reflect patterns of responses from teachers with High PD in mathematics in the past year vs. Low PD in mathematics. In the content graphs (Charts 7 & 8), each cell has bars representing average percent time for High PD vs. Low PD teachers, and the row and column marginals indicate the mean and range of responses for each topic area (e.g., number sense) and type of expectation (e.g., memorize).

Understand Concepts refers to students' ability to represent a concept, apply it to a problem, or explain its use. *Perform procedures* means using numbers for counting or ordering, doing computation, or solving equations. *Solve novel problems* indicates doing non-routine problems or those for which the student has no routine strategy or algorithm.

- **Elementary School Mathematics:** Teachers reported spending about 20% of time on *number sense*, *operations* and *geometric concepts*. They spent about 18% of time on *measurement*. Teacher expectations for students were highest for *understand concepts*, and *perform procedures* and lowest for *solve novel problems.*

- **Middle School Mathematics:** Teachers reported spending the most instructional time on *number sense* (average 20 to 24% time), *geometric concepts* (22%), and *data analysis* (20%). Algebraic concepts were reported at about 18% of time. Further analysis of the content matrix data (not shown) indicate that the specific topics reported most often under number sense were fractions, decimals, percent, and ratio and proportions, and topics covered most often in Algebra were use of variables and multi-step equations.

  Teaching of Algebra and Geometry is highly varied among teachers/classes, especially for High PD teachers. High PD teachers spent slightly more time teaching Algebra on average. Time reported on teaching Algebraic Concepts varied from less than 8% to more than 30% of time across classes of High PD teachers. Time on Geometry varied from 12 to over 30% of time in both groups of classes. High PD teachers had more variation in time spent on Number Sense.

  Expectations for learning as reported by teachers focused most on understand concepts and perform procedures (about 20%). Teachers with High PD had large variations in expectation for memorizing facts and terms in mathematics class, but surprisingly, in general reported higher expectations than Low PD teachers.

Summary: There were no significant differences between High PD and Low PD teachers. All teachers reported spending the most amount of time on number sense, operations and geometric concepts. Most emphasis was put on understand concepts and perform procedures expectations. Elementary school teachers reported the most amount of time spent on the content areas of *number sense*, *operations*, and *geometric concepts*. Middle school teachers reported spending class time on all five major content areas with the least amount on *measurement.* Differences among middle High PD and Low PD teachers were mainly in the greater degree of variation in teacher responses among High PD teachers in four of the five content areas. The average amount of time spent teaching each topic area are similar.

Chart 6

Mathematics Content Maps

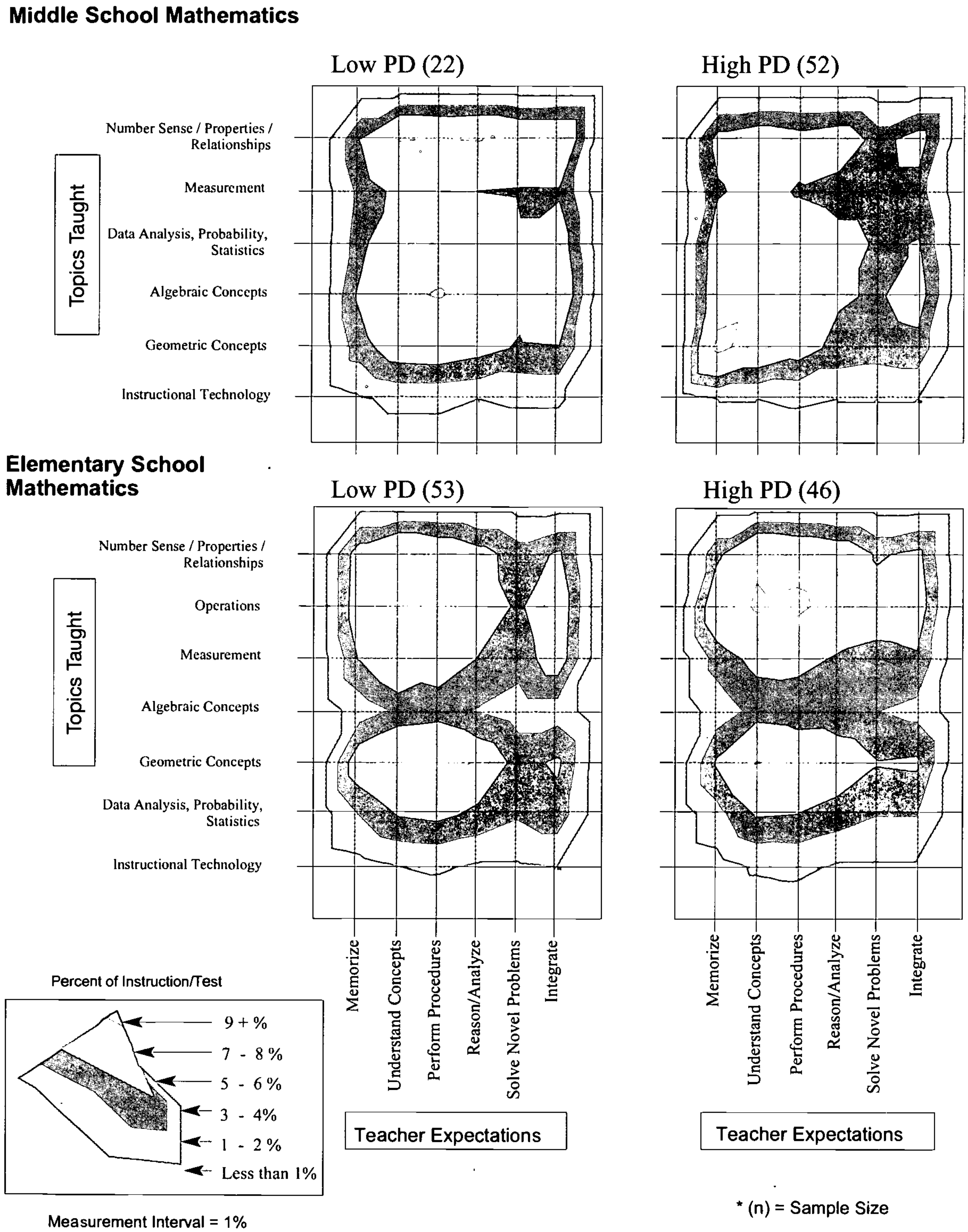
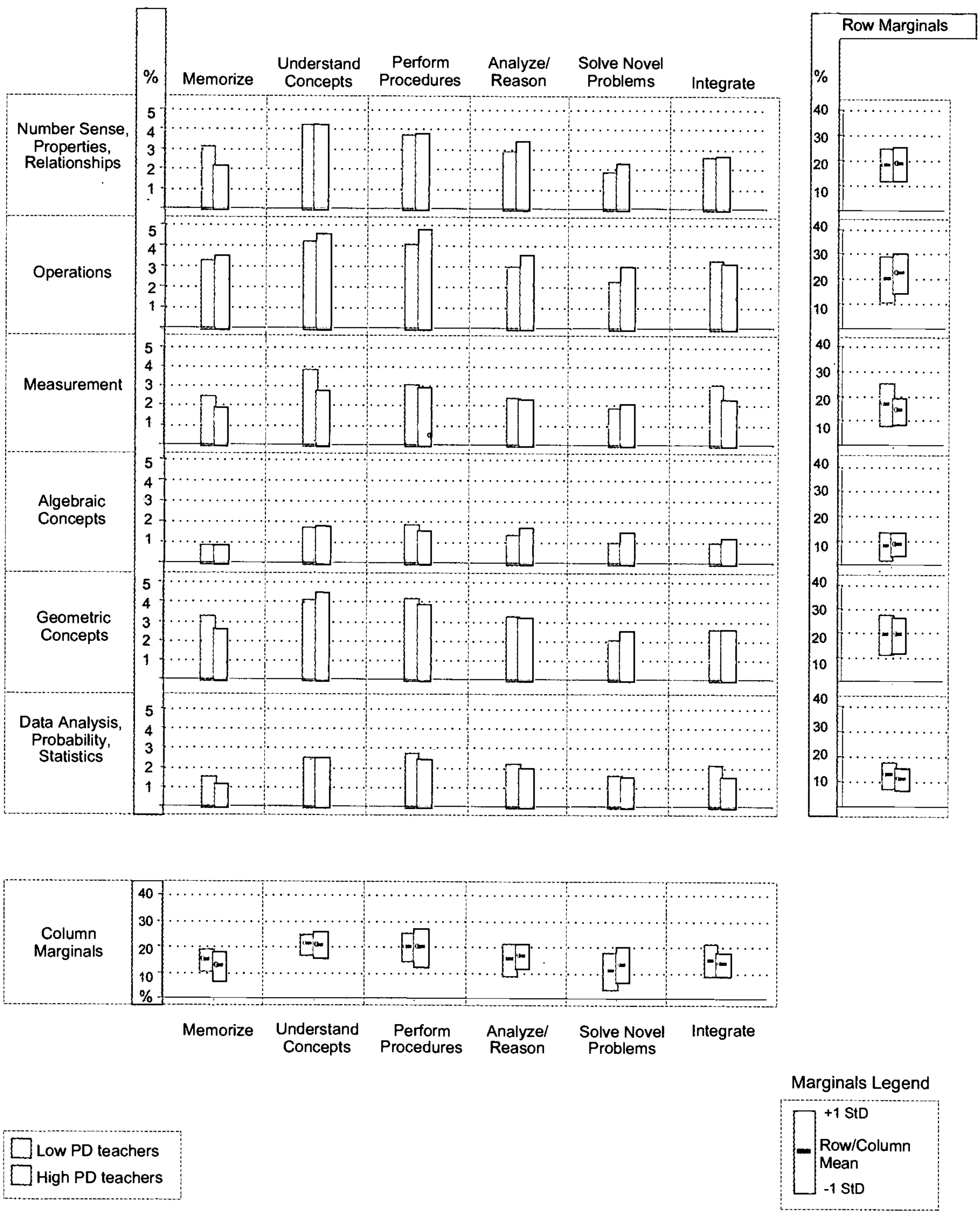


Chart 7

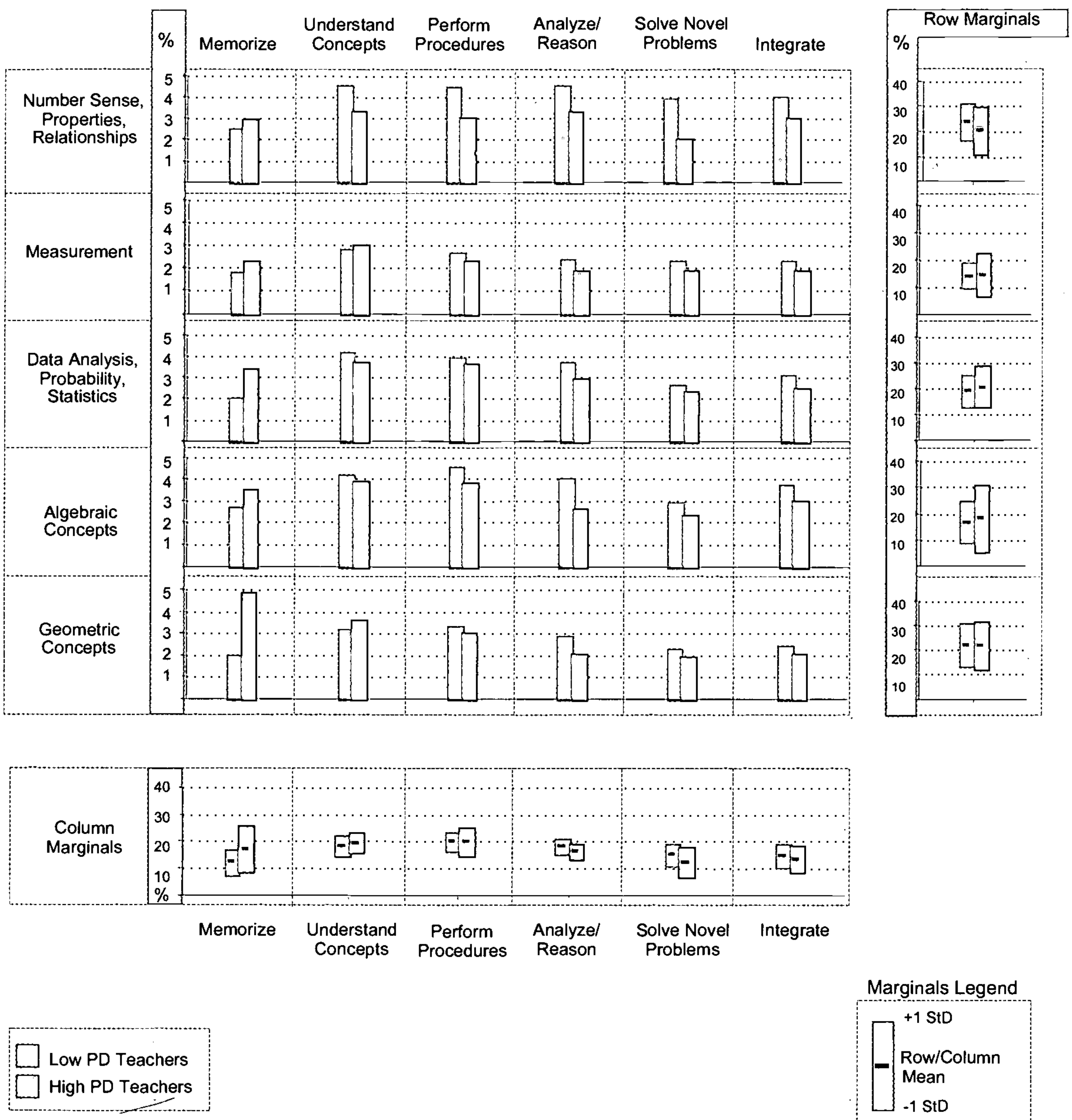
Elementary School Mathematics Content Graph
Eight District Sample (Cohort 1 & 2): Low PD (53), High PD (46)



Marginals = The sum across rows or columns.

Chart 8

Middle School Mathematics Content Graph
Eight District Sample (Cohort 1 & 2): Low PD (22), High PD (52)



Marginals = The sum across rows or columns.

Charts 9 & 10: Multiple Assessment Strategies in Science and Mathematics

In standards-based reform initiatives, including USI, mathematics and science teachers are encouraged and prepared to make use of a variety of assessment strategies rather than relying on a single type of assessment, such as paper-and-pencil tests comprised of objective items or routine procedural problems. The purpose of varied assessment strategies is, in part, to increase the validity of the inferences that teachers can make about student learning. Using multiple sources of evidence allows the strengths in one type of assessment to compensate for weaknesses in another. But to what extent are mathematics and science teachers moving beyond a reliance on a single type of assessment, and what strategies are they using? The results depicted in Charts 9 and 10 illustrate how SEC resources provide data on these questions.

Science: The Summary Scale on Multiple Assessment Strategies in Science (Chart 9) is based on several Survey items: *extended response items for which student must explain or justify answers, performance task or events*, *individual or group demonstration or presentation*, *science projects* or *portfolios*. Together these items provide a reliable index of the degree to which science teachers are using less traditional multiple assessment strategies in the classroom. The results show wide variation in use of multiple assessment strategies. However, at both elementary and middle levels, the teachers with High PD report greater use of multiple assessments than their counterparts with Low levels of PD. There is a statistically significant difference among High PD and Low PD elementary school teachers.

- **Science Item Profiles:** The responses from elementary school science teachers on specific items concerning assessment strategies show distinct differences between High PD and Low PD teachers in the following four areas: *extended response*, *performance tasks*, *portfolios*, and *systemic observation of students*. High PD teachers are more likely to use these strategies than Low PD teachers. Only one of the strategies, *systemic observation*, is considered to be a traditional method of assessment. We also note wide variation in the use of these strategies; from never, up to three times a week.

  Middle school teachers also report wide variations in the use of multiple assessments, but no real difference was reported between High PD and Low PD teachers. The teachers in our survey use the traditional practice of *systemic observation* of students most often. Use of this method, along with *portfolios*, show the widest variation of use.

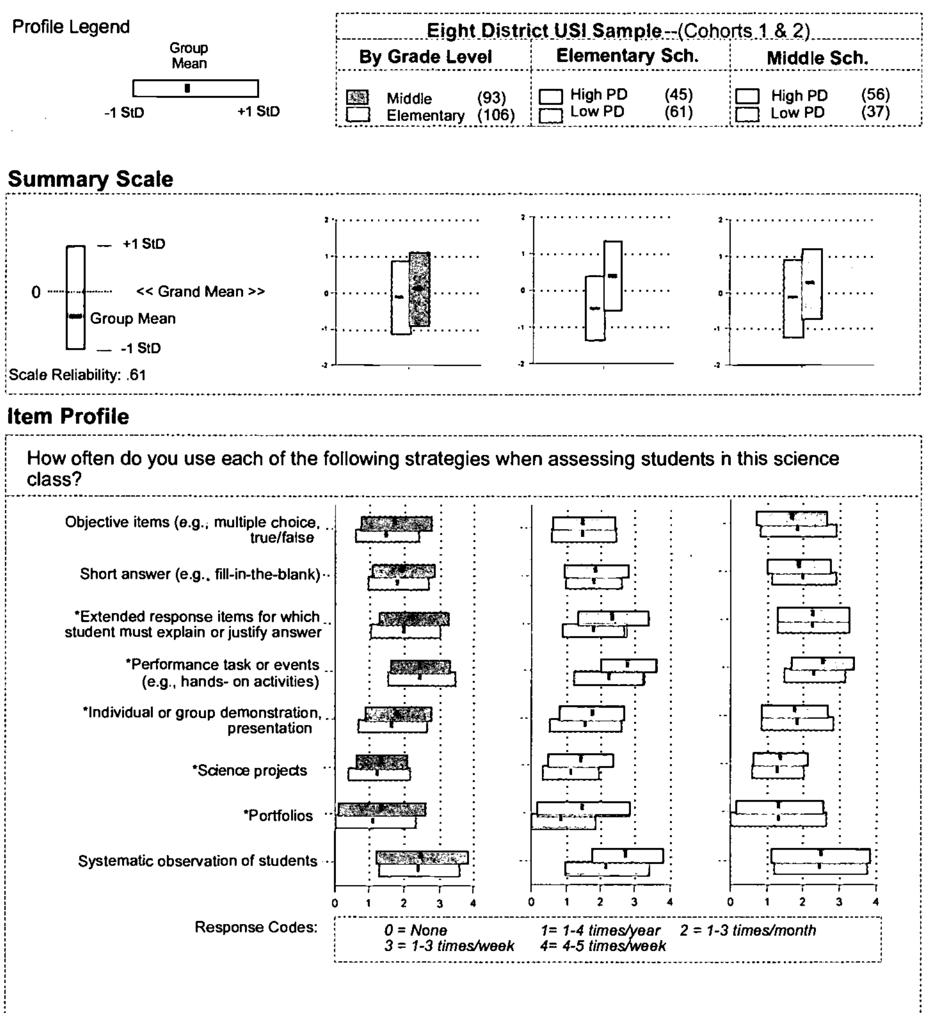
Mathematics: The Summary Scale on Multiple Assessment Strategies in Mathematics (Chart 10) is based on several Survey items: *extended response items for which students must explain or justify answer*, *performance task or events*, *individual or group demonstration or presentation*, and *mathematics projects*. Together these items provide a reliable index of the degree to which mathematics teachers are using multiple assessment strategies in the classroom. The results show that middle school teachers are much more likely to employ nontraditional assessment strategies. There is a slight, not significant, more likelihood of High PD teachers than Low PD teachers to use these methods.

- **Mathematics Item Profiles:** The responses from mathematics teachers on several of the assessment questions are displayed in the second section of the chart. For each type of assessment strategy there is wide variation in use among teachers from never to several times per week. It is also notable that the average teacher uses several methods of assessing student knowledge and skills in mathematics.

Elementary school teachers *use performance tasks or events* more than middle school teachers but there is no significant difference between High PD and Low PD teachers. While middle school teachers are less likely to use these methods of assessment, high PD teachers use *performance tasks* much more often than Low PD teachers (an average of 1 - 4 times per year vs. more than 3 times a month.) Other notable difference is the use of multiple assessments between High PD and Low PD middle school teachers are in the areas of *extended response*, and *mathematics projects*. High PD teachers are more likely to use these strategies.

All teachers report using multiple assessment strategies, with wide variations of use among all groups. The traditional practice of systemic observation is the method utilized most often; somewhat surprising is the relatively small level of use of *multiple choice items* (average 1- 4 times per year to 1 - 3 times per month.)

Chart 9
Multiple Assessment Strategies in Science



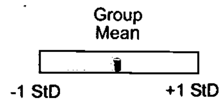
* Item included in Summary Scale

Bordered bar indicates statistically significant mean difference.

Chart 10

Multiple Assessment Strategies in Mathematics

Profile Legend



Eight District USI Sample – (Cohorts 1 & 2)		
By Grade Level	**Elementary Sch.**	**Middle Sch.**
Middle (84)	High PD (36)	High PD (56)
Elementary (107)	Low PD (71)	Low PD (28)

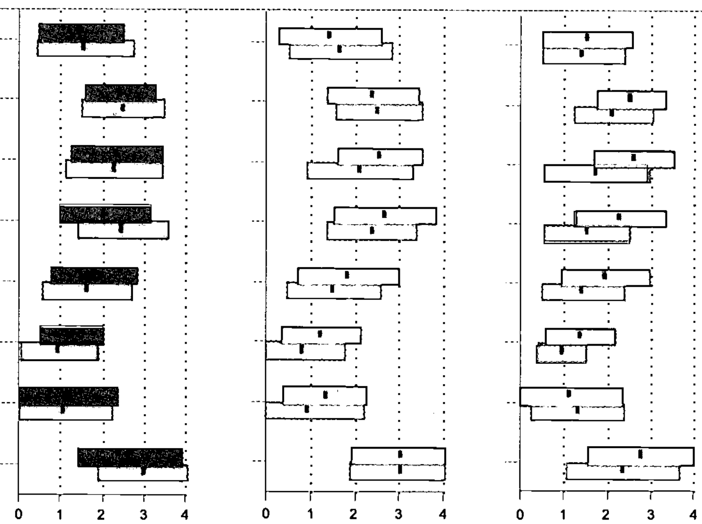
Summary Scale

Scale Reliability: .72

Item Profile

How often do you use each of the following strategies when assessing students in this mathematics class?

- Objective items (e.g., multiple choice, true/false)
- Short answer (e.g., fill-in-the-blank)
- *Extended response items for which student must explain or justify answer
- *Performance task or events (e.g., hands-on activities)
- *Individual or group demonstration, presentation
- *Mathematics projects
- Portfolios
- Systematic observation of students



Response Codes: *0 = None* *1= 1-4 times/year* *2 = 1-3 times/month* *3 = 1-3 times/week* *4= 4-5 times/week*

* Item included in Summary Scale

Bordered bar indicates statistically significant mean difference.

Charts 11 & 12: Use of Lab Equipment & Educational Technology in Science and Mathematics

An important indicator of active, inquiry-based methods of teaching science and mathematics, as well as school system capacity for supporting this approach, is the availability and use of educational technology and laboratory equipment. Science and mathematics standards advocate learning to apply knowledge to real problems and to gain skills that will be used outside of school. Science and mathematics applications in careers now involve computers, calculators, and a variety of simple and complex lab equipment. Thus, a key component of the Survey of Enacted Curriculum concerns the use of equipment and technology in teaching science and mathematics. Charts 11 and 12 illustrate how the survey data can be analyzed to examine several kinds of questions concerning availability and instructional uses of educational technology and lab equipment.

Science: Two items on teacher reports of use of science equipment in classrooms illustrate differences highlighted in Chart 11:

- **Use of Equipment:** Middle school teachers are significantly more likely to use lab equipment, but there is wide variation-- from never to weekly. High PD teachers report slightly more use. *Running water* (a traditional indicator of lab capacity) is not available at all in about one-third of elementary classes (the bar shows middle two-thirds of responses), and in the average class running water is rarely used. The average middle grade science class uses running water less than monthly, and rates vary from rarely to weekly.

  Recently, "high-tech" approaches to experimentation in classrooms involve *computer-lab interfacing devices*, often called computer-based labs (CBLs). The sample data in the study indicate that one-third of classes did not have CBLs available, while the average class had access but rarely used them. Use at the middle grades level is highly varied—from not available to monthly or greater rates of use.

- **Educational Technology in Science:** Chart 11 illustrates the extent of calculator, computer, and other educational technology use in science classes and how they are applied in instruction. The scale shows wide variation among science classrooms. The only significant difference between elementary and middle school teachers is that middle school teachers require students to *display and analyze data* more often than elementary school students.

  In science classes, calculators and computers are most often used to *learn facts or practice procedures and displaying and analyze data*. However, these uses vary widely, from 0% to 42% of time, showing that teachers make very different use of educational technology.

Mathematics: The Summary Scale in Chart 12 includes three items that ask teachers to report the extent of calculator and computer use in class and how they are applied in instruction: *use sensors or probes*, *collect data or information*, and *display and analyze data*. The scale shows wide variation among mathematics classrooms. The amount off professional development a teacher received had a significant effect at the middle school level– High PD teachers use more technology.

- **Calculator use:** Teacher reports on student use of calculators indicate that middle grades consistently use them at least monthly, while elementary classes less than seven times per year. Graphing calculators are used much less often than traditional calculators. Few elementary schools have them available, and middle school use varies widely from not available to monthly.

- **Item Profiles:** The Survey data show that educational technology's most frequent use in mathematics instruction are *learning facts or practicing procedures* (average 25%). Other frequent uses are *display and analyze data*, *take a quiz or test*, and *use individualized instruction or tutorial software.* Less than one third of instructional time is spent on the standards-based methods of *use sensors or probes, collect data or information*, and *display and analyze data.*

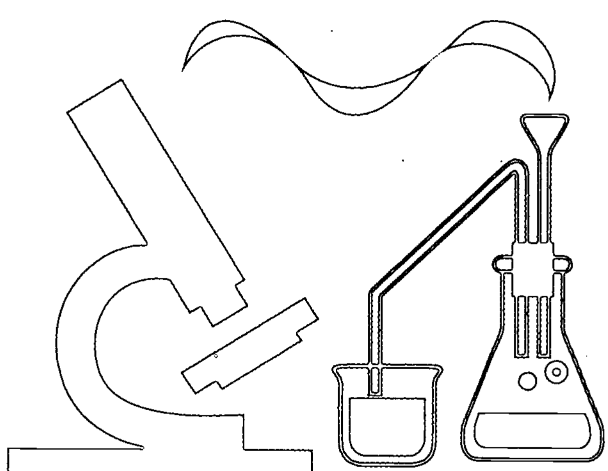
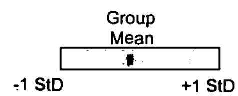


Chart 11

Use of Lab Equipment & Educational Technology in Science

Profile Legend

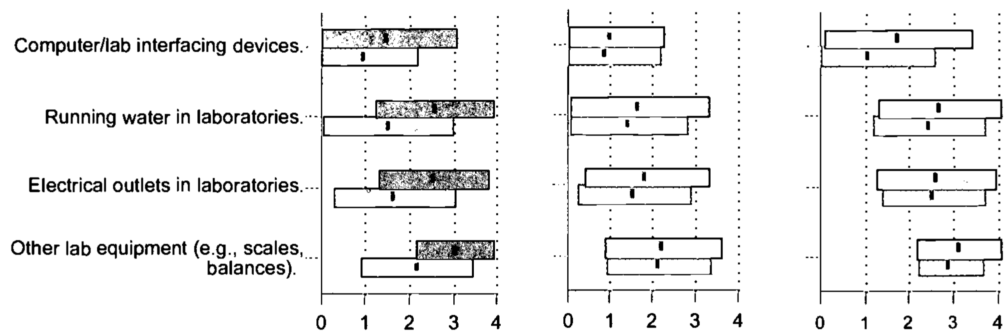


Eight District USI Sample--(Cohorts 1 & 2)

By Grade Level		Elementary Sch.		Middle Sch.	
Middle	(93)	High PD	(45)	High PD	(56)
Elementary	(106)	Low PD	(61)	Low PD	(37)

Use of Lab Equipment

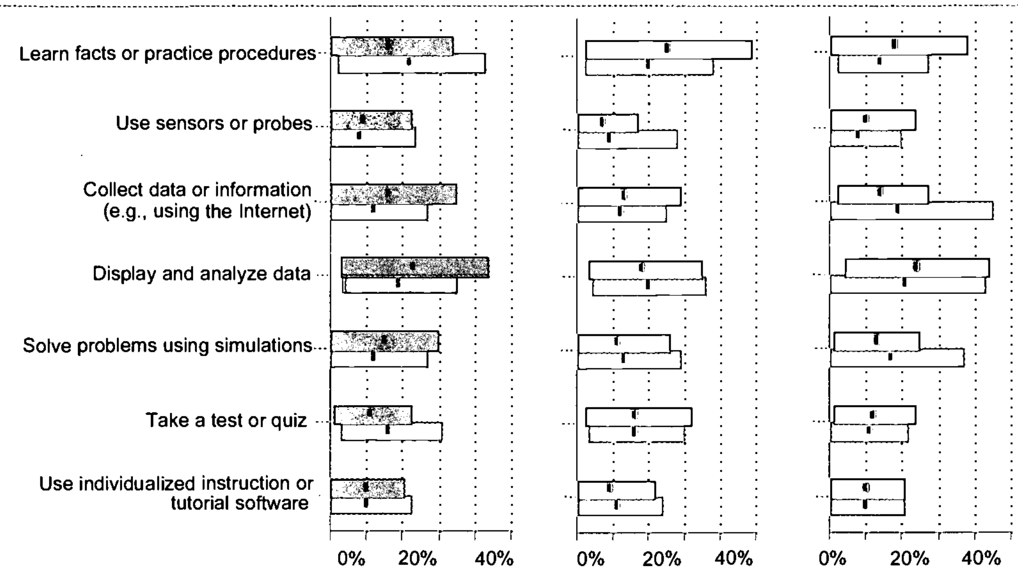
Indicate how often the average student uses each of the following types of equipment in this science class:



Response Codes: *0 = Not Available 1 = Available, but rarely used 2 = Used < 7 times/yr. 3 = 7- 36 times per/yr. 4 = Used weekly*

Educational Technology in Science

When students are engaged in activities that involve the use of calculators, computers, or other educational technology as part of science instruction, what percentage of that time do students:



Bordered bar indicates statistically significant mean difference.

Chart 12

Use of Lab Educational Technology in Mathematics

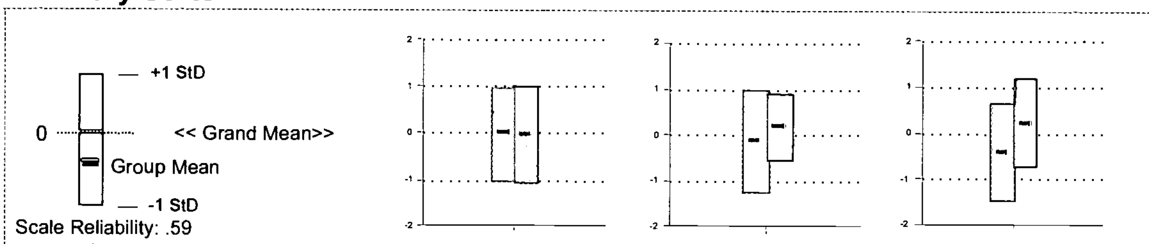
Profile Legend

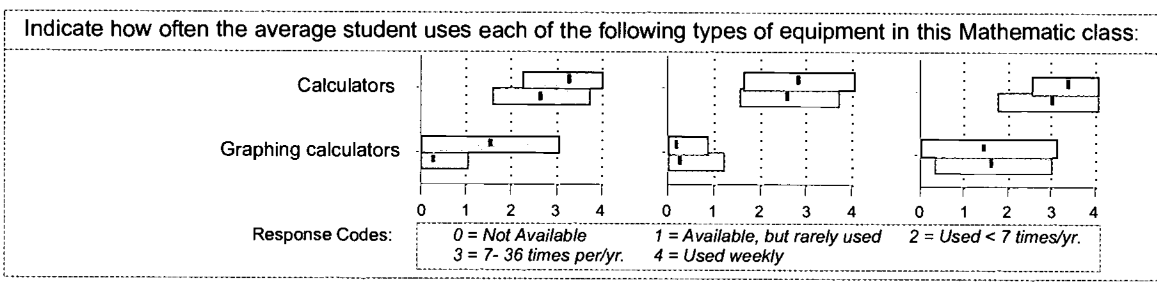
Group Mean

-1 StD +1 StD

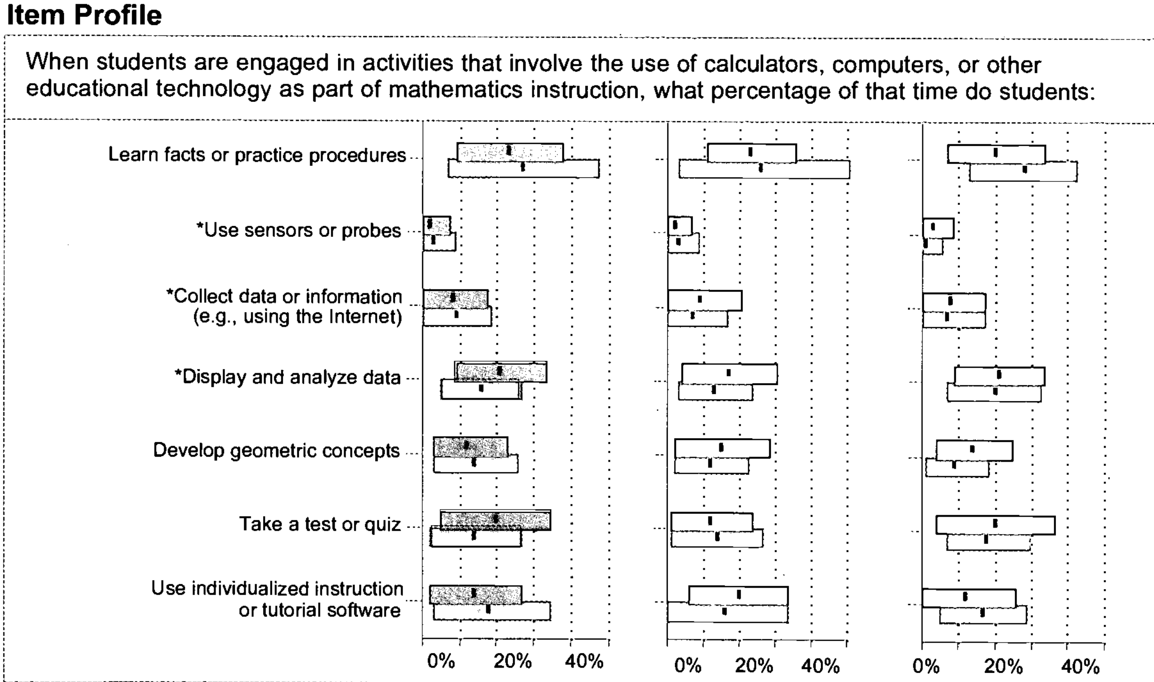
Eight District USI Sample – (Cohorts 1 & 2)		
By Grade Level	**Elementary Sch.**	**Middle Sch.**
Middle (84)	High PD (36)	High PD (56)
Elementary (107)	Low PD (71)	Low PD (28)

Summary Scale





Item Profile



* Item included in Summary Scale

Bordered bar indicates statistically significant mean difference.

Charts 13 & 14: Influences on Curriculum and Practices in Science and Mathematics

The Survey includes questions for teachers aimed at the main influences on their classroom curriculum. In some schools, textbooks and materials that are selected by districts, states, or schools may be a major influence on what is taught. Many states and districts have established standards for student learning in mathematics and science, and these standards have been guided or influenced by national standards developed and published by professional organizations. Even where widely disseminated and used by teachers, standards do not provide curricula for teaching in classrooms. Teachers may rely on district curriculum, their own knowledge and experience, their colleagues, or mandated assessment programs to determine what is taught. The question of influences on curriculum is important for analyzing commonalities in curriculum and for determining how change and improvements can be made in science and mathematics education.

Charts 13 and 14 provide Cross-Site results for science and mathematics reported by teachers in the eight USI sites concerning major influences on their curriculum and teaching practices.

- **Influences on Science:** The summary scale shows that state and national standards have more of an influence on High PD teachers than Low PD teachers especially in elementary schools.

  The item profiles for science teachers indicate that *state and district frameworks or standards* had the greatest positive influence, as well as *national standards* and *preservice preparation* for science. *Textbooks/instructional materials* and *state tests* had little influence on science curriculum reported by teachers. *District tests* were reported as having a negative influence. At both levels, PD made little difference in most responses concerning curriculum influences.

- **Influences on Mathematics:** Summary scale results for *state and national standards*' influences on mathematics indicate little difference among all groups of teachers.

  The item profiles indicate that the most consistent positive influences reported by teachers were *state and district frameworks or standards*. *District tests* had the least, but unlike in science, a positive influence on curriculum. Differences between High and Low PD teachers were not notable.

Chart 13

Influences on Curriculum and Practices in Science

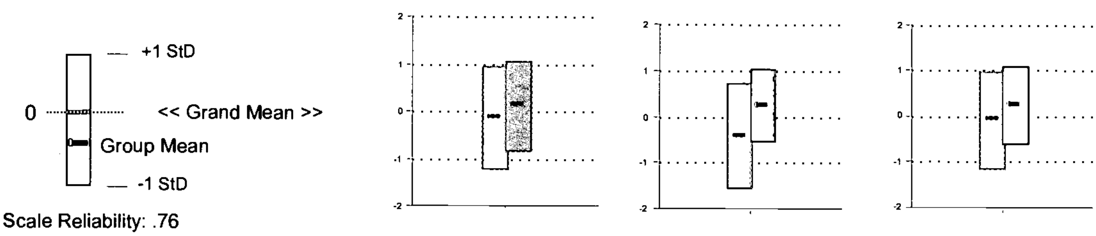
Profile Legend

Group Mean

-1 StD   +1 StD

Eight District USI Sample--(Cohorts 1 & 2)		
By Grade Level	**Elementary Sch.**	**Middle Sch.**
Middle (93)	High PD (45)	High PD (56)
Elementary (106)	Low PD (61)	Low PD (37)

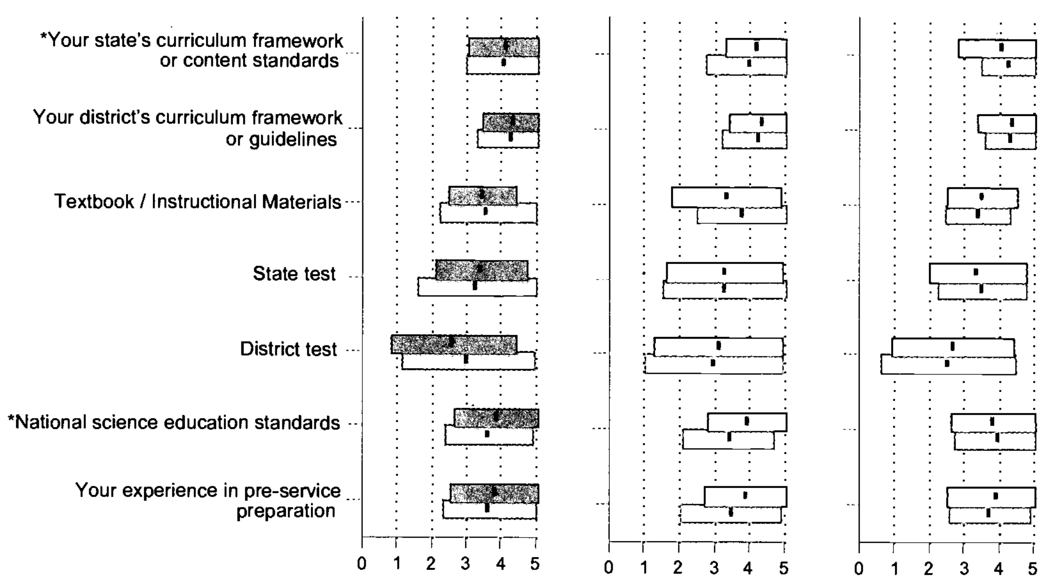
Summary Scale



Scale Reliability: .76

Item Profile

Indicate the degree to which each of the following influences what you teach in this science class:



Response Codes:

0 = Not Applicable
1 = Strong Negative Influence
2 = Somewhat Negative Influence
3 = Little or No Influence
4 = Somewhat Positive Influence
5 = Strong Positive Influence

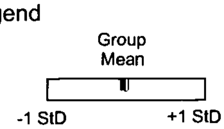
* Item included in Summary Scale

Bordered bar indicates statistically significant mean difference.

Chart 14

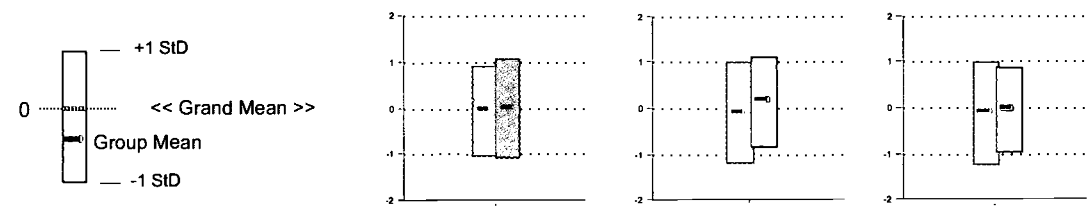
Influences on Curriculum and Practices in Mathematics

Profile Legend



Eight District USI Sample -- (Cohorts 1 & 2)		
By Grade Level	**Elementary Sch.**	**Middle Sch.**
Middle (84)	High PD (36)	High PD (56)
Elementary (107)	Low PD (71)	Low PD (28)

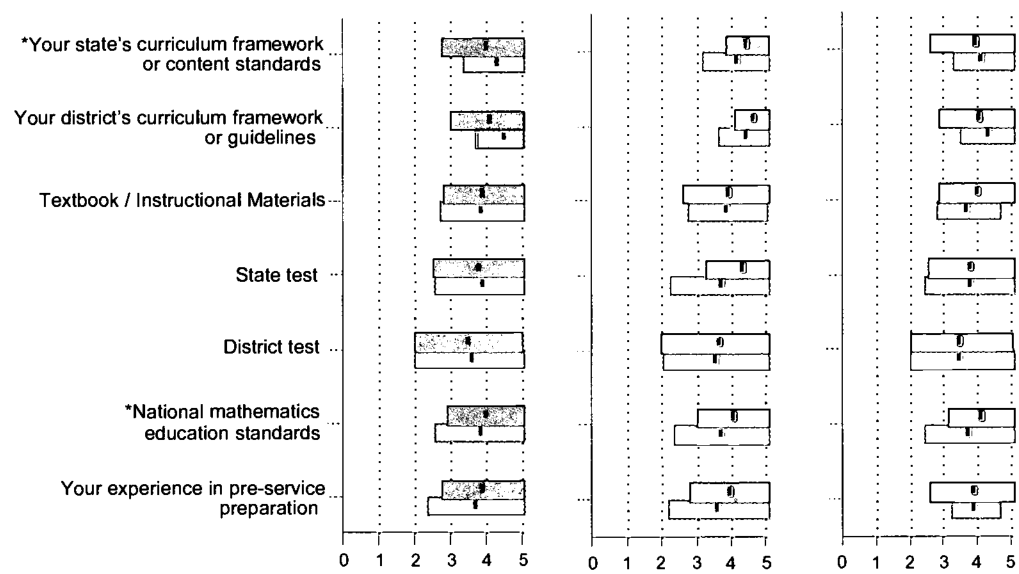
Summary Scale



Scale Reliability: .57

Item Profile

Indicate the degree to which each of the following influences what you teach in the mathematics class:



Response Codes:

0 = Not Applicable
1 = Strong Negative Influence
2 = Somewhat Negative Influence
3 = Little or No Influence
4 = Somewhat Positive Influence
5 = Strong Positive Influence

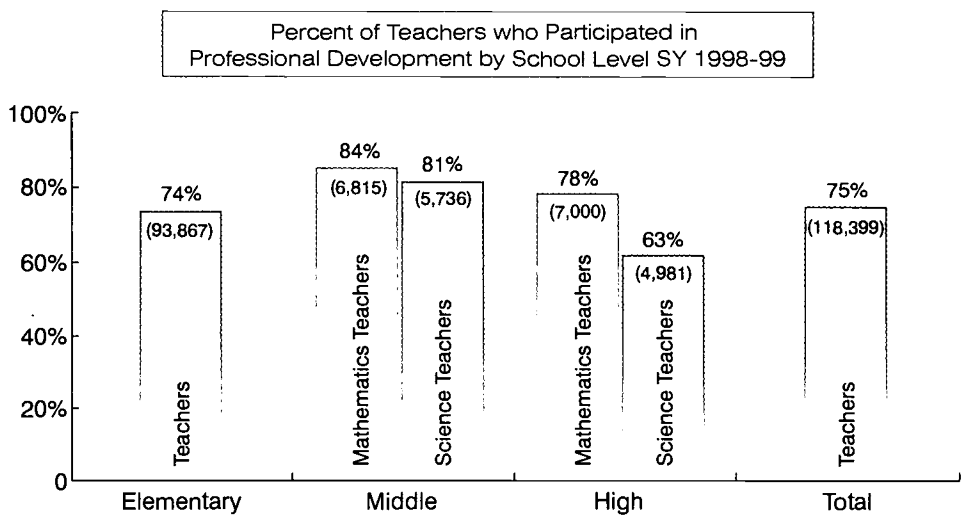
* Item included in Summary Scale

Bordered bar indicates statistically significant mean difference.

Charts 15, 16, 17, & 18: Professional Development and Teacher Preparation

In every USI site, professional development has been recognized as a major driver of school reform reaching to the classroom level and directly impacting student outcomes. The prime purpose of professional development is to improve teachers' content knowledge, pedagogy skills, including inquiry-based teaching, and methods of assessing student learning. According to the *Urban School Key Indicators of Science and Mathematics Education* (September 2000, Systemic Research, Inc.), 75% (118,399) of teachers working in USI schools attended some form of professional development during the 1998-99 school year. Middle school mathematics and science teachers had the highest rates of participation in professional development activities as shown in Figure 5. A major portion of USI funds (average 48%) was spent on Professional Development activities across all of the USI sites.

Figure 5



(#) Number of Teachers who Participated in Professional Development
Source: KIDS-1999

A key section of the Survey of Enacted Curriculum requests individual teacher's information regarding professional development activities, such as the amount of professional development activities (clock hours) by categories (content, curriculum materials, assessment, etc.) in the past year, and the impact on their actual teaching practices. The questions also ask about their formal course preparation in terms of the number of quarters or semesters of subject specific courses taken at the undergraduate and graduate level.

Another section of the survey, Classroom Instructional Preparation, asks for teacher views on how well prepared they consider themselves for using a variety of teaching strategies and for teaching with various groups of students. The cross-site survey results for science teachers are shown in Charts 15 and 16, and for mathematics teachers in Charts 17 and 18.

Chart 15: Professional Development in Science

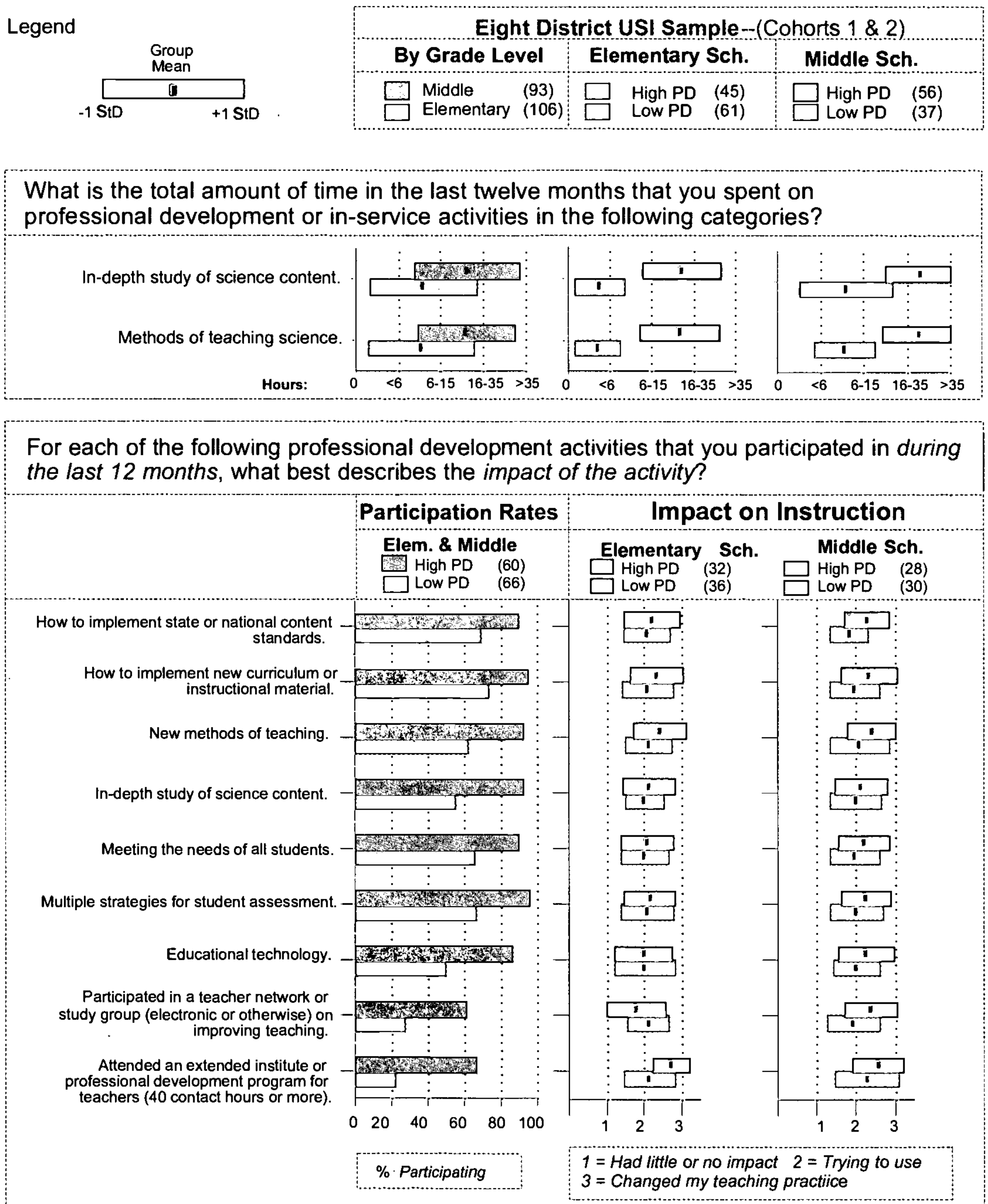
- **Professional Development Participation:** As shown in the first section of Chart 15, middle school science teachers received close to 16-35 hours of professional development both in *in-depth study of science content* and *methods of teaching* science. Middle school science teachers' PD participation was significantly greater than elementary teachers who averaged six hours less.
- **Professional Development Categories:** As shown in Chart 15, 80 to 90% of High PD teachers participated in professional development on *content standards*, *in-depth study of science content*, *implementing curriculum*, *multiple strategies for assessment*, *new methods of teaching*, and *educational technology*. About 60% of Low PD teachers attended these types of activities. In addition, over 60% of High PD teachers attended an *extended institute of 40 hours or more* and *teacher network or study group*.
- **Impact on Instruction:** Teachers reported that professional development activities had impact on their teaching practices. The majority of elementary and middle school science teacher reported the impact of PD activities they participated in as between *trying to use* and *changed teaching practice*, especially among High PD teachers. In general, those teachers who participated in an *extended institute* reported the higher rate of changes in their teaching practices.

Chart 16: Teacher Preparation in Science

- **Teacher Major and Preservice Course Taking:** The average elementary teacher in the survey had less than one courses in *biology/life science*, *physics/chemistry/physical science*, and *geology/astronomy/earth sciences*, and three to four *science education courses*. The average middle school teacher had one to four *science content courses* and seven to eight *science education courses*. Almost 40% of middle school science teachers graduated with a degree in science or science education compared to less than 5% of elementary teachers. In all instances, High PD teachers reported having more science courses than Low PD teachers suggesting their higher level of interest in science.
- **Science Teaching Preparedness:** Teachers reported on their preparedness to teach science in various ways. For most of the teaching strategies, teachers responded from somewhat prepared to very well prepared. Middle school teachers are more prepared than elementary school teachers to use *cooperative learning*. Overall, High PD teachers feel much more confident in their preparedness compared to Low PD teachers especially in *provide science instruction that meets science standards*, *manage a class of students using hands-on or laboratory equipment,* and *use a variety of assessment strategies*. All three items show statistically significant mean differences between High PD and Low PD teachers as indicated by the bordered bars.

Chart 15

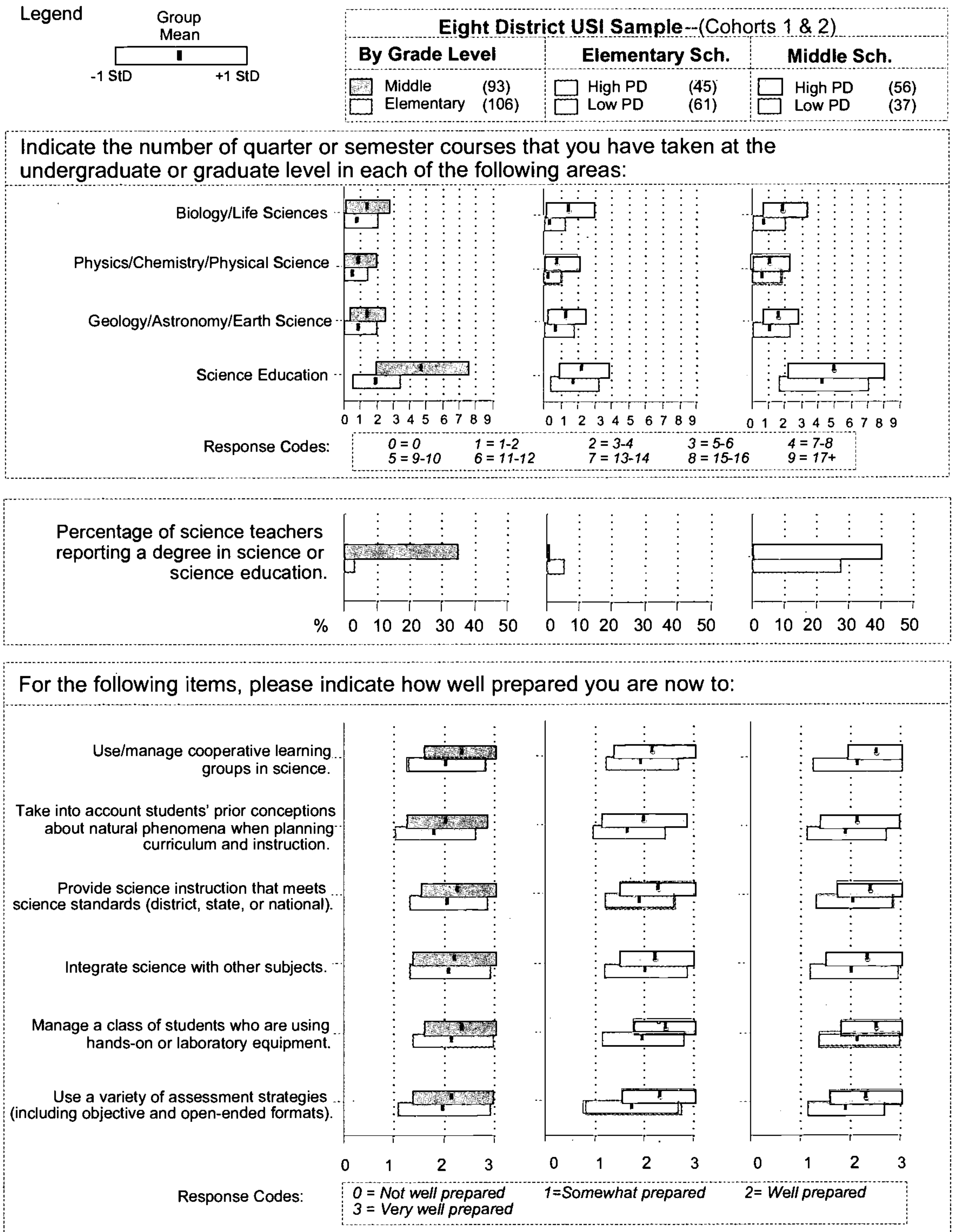
Professional Development in Science



Bordered bar Indicates statistically significant mean difference.

Chart 16

Teacher preparation in Science



Bordered bar indicates statistically significant mean difference.

Chart 17: Professional Development in Mathematics

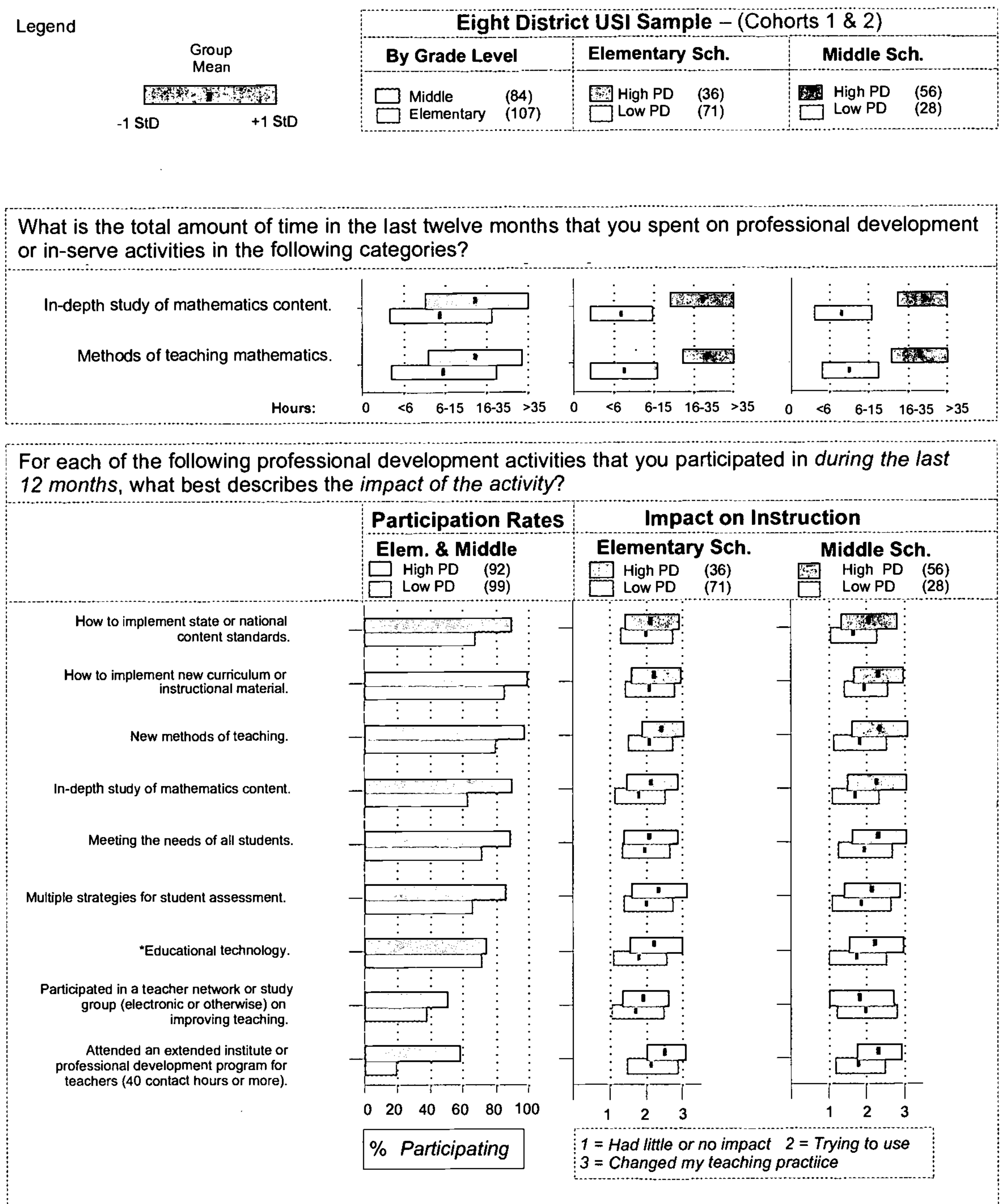
- **Professional Development Participation:** Middle school mathematics teachers received an average of 16-35 hours of professional development on in-depth study of math content and methods of teaching math during the last twelve months. Elementary teachers averaged less than 6-15 hours in each area.
- **Professional Development Categories:** As shown in Chart 17, 80 to 90% of High PD teachers participated in professional development on *content standards*, *implementation of new curriculums*, *new methods of teaching*, *in-depth study of math content, meeting the needs of students*, and *multiple strategies for assessment.* This participation pattern is similar to those of science teachers, except for slightly lower participation rates in *educational technology*. About 60% of Low PD teachers attended these type of activities. About 55 to 60% of High PD teachers reported participating in an *extended institute-style PD of 40 hours or more* and *teacher network or study group*.
- **Impact on Instruction:** Mathematics teachers reported that professional development activities had impact on their teaching practices. Almost all of the High PD teachers reported that PD activities resulted in them trying to use or changed teaching practice. The impact of professional development on instruction was clearly stronger among the High PD teachers than their Low PD peers.

Chart 18: Teacher Preparation in Mathematics

- **Teacher Major Preservice Course Taking:** As shown in Chart 18, approximately 20% of middle school mathematics teachers reported having a major in *mathematics* or *mathematics education* compared with less than 1% of elementary school teachers. High PD teachers in middle school have significantly more intensive backgrounds in mathematics than low PD teachers, which may indicate a voluntary selection of PD among better prepared teachers of mathematics. Both High PD and Low PD middle school teachers reported taking three to four *refresher math courses*, *one to two advanced math courses*, and three to six *math education* courses at the undergraduate and graduate level. In elementary school, Low PD teachers took slightly less numbers of courses compared to High PD teachers. Overall, middle school math teachers took more mathematics courses as undergraduate and graduate students.
- **Mathematics Teaching Preparedness:** Teachers reported that they were well prepared to teach mathematics using various strategies. There were significant differences between High PD and Low PD middle school teachers in six categories including use *cooperative learning*, *integrate mathematics with other subjects*, *use a variety of assessment strategies*, *teach estimation strategies*, *teach problem solving strategies*, *select instructional materials*, and *teach with manipulative materials*. Clearly, intensive professional development has a positive impact on teachers' preparedness.

Chart 17

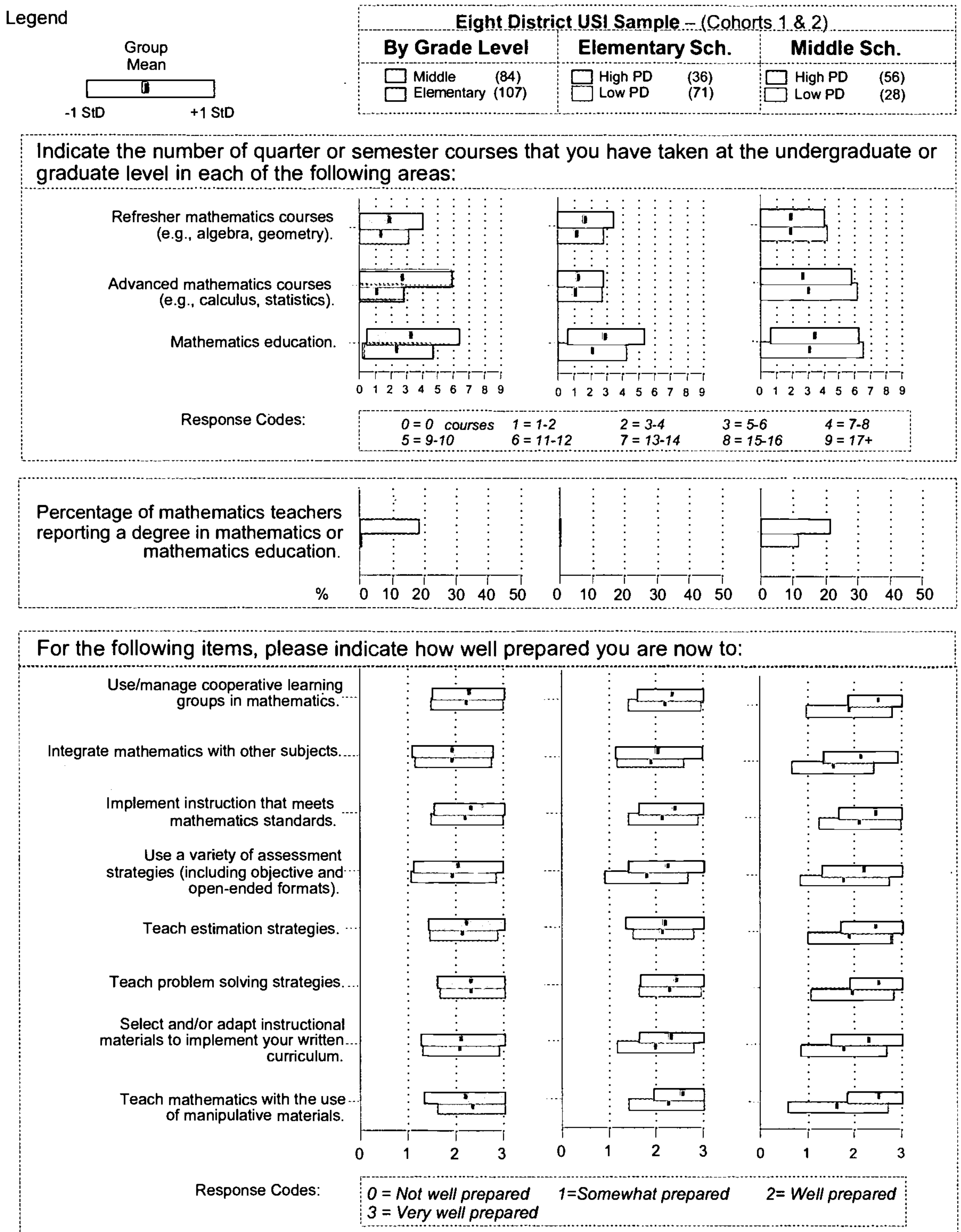
Professional Development in Mathematics



Bordered bar indicates statistically significant mean difference.

Chart 18

Teacher Preparation in Mathematics



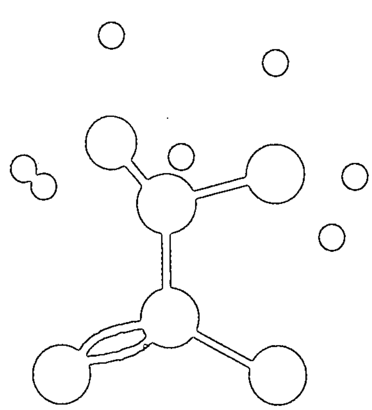
Bordered bar indicates statistically significant mean difference.

III.3 Other Item Profiles

The remaining part of the SEC data not covered in the previous section has been compiled in 28 charts attached in Appendix B as follows:

Chart B.1:	Scale Measures of Instructional Practice – Science
Chart B.2:	Scale Measures of Instructional Practice – Mathematics
Chart B.3:	Scale Measures of Teacher and School Characteristics – Science
Chart B.4:	Scale Measures of Teacher and School Characteristics – Mathematics
Chart B.5:	Class Description – Science
Chart B.6:	Class Description – Mathematics
Chart B.7:	Use of Class Time During Most Recent Unit of Instruction in Science
Chart B.8:	Use of Class Time During Most Recent Unit of Instruction in Mathematics
Chart B.9:	Use of Homework in Science
Chart B.10:	Use of Homework in Mathematics
Chart B.11:	Instructional Activities in Science
Chart B.12:	Instructional Activities in Mathematics
Chart B.13:	Small Group Work in Science
Chart B.14:	Small Group Work in Mathematics
Chart B.15:	Student Reflection on Scientific Ideas
Chart B.16:	Use of Hands-on Materials in Mathematics
Chart B.17:	Teacher Readiness – Science
Chart B.18:	Teacher Readiness – Mathematics
Chart B.19:	Teacher Opinions – Science a) Beliefs About Student Learning, b) Professional Collegiality
Chart B.20:	Teacher Opinions – Mathematics a) Beliefs About Student Learning, b) Professional Collegiality

Chart B.21:	Grade 4 Science – Cohort 1 Content Maps
Chart B.22:	Grade 4 Science – Cohort 2 Content Maps
Chart B.23:	Grade 4 Mathematics – Cohort 1 Content Maps
Chart B.24:	Grade 4 Mathematics – Cohort 2 Content Maps
Chart B.25:	Grade 8 Science – Cohort 1 Content Maps
Chart B.26:	Grade 8 Science – Cohort 2 Content Maps
Chart B.27:	Grade 8 Mathematics – Cohort 1 Content Maps
Chart B.28:	Grade 8 Mathematics – Cohort 2 Content Maps



CHAPTER IV

CONCLUSIONS

IV.1 Summary of Findings

The findings of the Year 2000 Survey of Enacted Curriculum analysis can be summarized in three areas; teaching practices, curriculum and subject content, and teacher professional development and preparation.

Teaching Practices

The data on *Active Learning in Science* show that all teachers are utilizing standards-based instructional methods nearly half of the time. Survey results indicated that the amount of professional development a teacher received did not have an impact on the time spent on any particular activity.

The findings on *Mathematics Problem Solving and Reasoning* indicate that teachers with more professional development in *mathematics content and pedagogy* report greater instructional time on standards-based instruction, such as *applying mathematical concepts to real world problems* and *making predictions* and less time on drill and practice exercises. In general, middle school teachers spend significantly more time than elementary school teachers, but professional development has a more marked effect on elementary school teachers; those with High PD spend much more time on standards-based problem solving than their Low PD counterparts.

Scale results show wide variation in use of *Multiple Assessment Strategies* in science and mathematics. In science at both the elementary and middle levels the teachers with High PD report greater use of multiple assessments than their counterparts with Low levels of PD, especially at the elementary level. For mathematics, the results show that middle school teachers are much more likely to employ nontraditional assessment strategies. High PD teachers are more likely than Low PD teachers to use these methods.

Curriculum and Subject Content

For science, *state and district frameworks or standards* have the greatest positive influence on curriculum, as well as *national standards* and *preservice preparation*. Teachers reported little influence of *textbooks/materials, professional development*, and *state tests*. *District tests* were reported as having a negative influence.

In mathematics, the most consistent positive influences reported by teachers were *state and district frameworks or standards*. *District tests* had the least, but unlike in science, a positive influence on curriculum. Differences between High and Low PD teachers were not notable.

Teacher Professional Development and Preparation

Science: Survey results indicate that professional development received by teachers, and emphasized by USI, is largely being used and applied in classrooms. The middle school teachers who participated in this survey reported an average amount of 16-35 hours of professional development while elementary school teachers reported an average of 6-15 hours. Over 80% of High PD teachers participated in professional development on *content standards*, *implementing curriculum*, *multiple strategies for assessment*, *new methods of teaching*, and *educational technology*. About 60% of Low PD teachers reported receiving professional development in similar areas. The professional development activities were reported by teachers as having an impact on their teaching practices. The majority of teachers indicated that they were trying to use the new knowledge or it had changed their practice.

In general, middle school teachers were much more likely to have had a science major in preservice education than elementary school teachers- 40% versus less than 5%. Also, middle school teachers reported taking an average of eight to 12 *science* and *science education* courses compared to the average three to four similar courses for elementary school teachers.

Most of the teachers responded that they felt *somewhat* to *very well prepared* to teach science. Overall, High PD teachers felt more confident in their preparedness than Low PD teachers.

Mathematics: Mathematics teachers' professional development participation rates are the same as those in science- ranges of 16-35 hours for middle school and 6-15 hours for elementary school teachers. More than 80% of High PD teachers received professional development in *content standards*, *implementation of new curriculum*, *new methods of teaching*, *in-depth study of math content*, *meeting the needs of students*, and *multiple strategies for assessment*. About 60% of Low PD teachers attended similar types of activities. Mathematics teachers reported that professional development had an impact on their classroom practices. Almost all of the High PD teachers reported that the activities resulted in them *trying to use new strategies* or they had *changed their teaching practices*.

Approximately 20% of middle school mathematics teachers reported having a major in mathematics or mathematics education compared with less than 1% of elementary school teachers. Middle school teachers averaged seven to 12 *mathematics* or *mathematics education* courses in college. Elementary school teachers took slightly less number of similar mathematics courses.

Teachers reported being well prepared to teach mathematics at both the elementary and middle school levels. High PD teachers were significantly more likely to report that they were well prepared in several categories especially those related to inquiry-based learning.

IV.2 Uses and Misuses of Data

Data on enacted curriculum cannot itself provide a vision of quality education, but it can inform that vision by providing indicator measures to serve as guideposts and measuring sticks to determine where things are and where they need to go in order to move closer to the goals selected. By providing a broad selection of measures pertaining to content, pedagogy, climate, and background, survey data allows concerned individuals and groups to construct their own individualized set of indicators for determining how local practice compares to their and others' visions of quality practice.

The survey data also allows schools to determine estimates of time spent engaged in various types of activities, and descriptive information about how these activities are provided. Together this data forms both an operational definition of desired practice and a description of current practice. While data from these surveys provide a wealth of valuable information about what goes on in classrooms, care must be taken not to over-interpret or even misinterpret the information provided from the surveys.

Curriculum Content Data

The content matrix portion of the Survey of Enacted Curriculum represents the most thorough and detailed approach to measuring classroom subject content that has been developed and tested using a teacher self-report methodology. The method is the first to effectively incorporate both content topics and expectations for learning in teacher reporting on what is taught in class. This matrix approach is critical to analyzing mathematics and science curriculum and teaching in order to relate classroom content to state and national standards developed in the 1990s. Leading educators have long known that curriculum is not simply a listing of topics but rather includes what students are expected to learn about the topics and what skills and knowledge they must master.

There are issues in obtaining valid, reliable data using the content matrix method. Teachers have to report their curriculum in terms of a common set of categories and time scales. The survey requires concentration and time to complete. As the surveys have been field tested, the design has been changed and simplified. The analysis of data from the USI surveys in 1999 and other teacher surveys recently conducted indicate that the content matrix methodology does work. We have found that a comprehensive picture of classroom curriculum across schools and districts can be obtained using this approach.

Specific Classes

The survey data represents teacher perceptions of classroom practice targeted to a particular class and group of students. It should be kept in mind when interpreting such data that teacher reports for a particular class may not represent that teacher's practice across all classes and students.

Socially Desired Responses

In considering the limitations of the survey data, it should be noted that the accuracy of the data depends upon the accuracy of teachers' perceptions and estimates. Accuracy can also be affected by perceptions of socially desirable responses, particularly if sanctions or rewards are commensurate with certain practices.

Misuse of Data

The primary misuse of data on the enacted curriculum or teaching practices is the use of such data for accountability purposes. To be a useful tool for school improvement, this type of indicator data should stand aside from the accountability mechanisms developed by schools, districts, or states. In large part, this is due to the possibility that the diagnostic potential of such data would be compromised if used for accountability purposes because of the increased likelihood of teachers providing socially desirable responses to the survey questions. Further, the indicators that such measures provide should not be rigidly imposed as a definition of quality practice. Survey data on curriculum must be combined with local contextual information in order to provide a sufficient basis for making decisions about changing, rewarding, or sanctioning individual practice. For these reasons this indicator data is best conceived of as a diagnostic and not an accountability tool.

How Reform Works:
An Evaluative Study of NSF's Urban Systemic Initiatives

Study Funded by a Grant from the National Science Foundation (REC-9874322)

Evaluative Study Publications:

- *What Matters in Urban School Reform*, Study Monograph No. 1, by M. Ware, L. Richardson, and J. Kim, Systemic Research, Inc., March 2000.
- *Survey Results of Urban School Classroom Practices in Mathematics and Science: 1999 Report – Using the Survey of Enacted Curriculum Conducted during Four USI Site Visits*, Study Monograph No. 2, by R. Blank, J. Kim, and J. Smithson, Systemic Research, Inc., June 2000.
- *Urban School Key Indicators of Science and Mathematics Education: Based on Key Indicator Data System (KIDS-1999), Volume I, II, III, IV, and Appendix*, by J. Kim, H. Lee, L. Crasco, D. Lee, A. Karantonis, and D. Leavitt, Systemic Research, Inc., September 2000.
- *Academic Excellence for All Students – Their Accomplishment in Science and Mathematics*, by J. Kim, L. Crasco, R. Smith, G. Johnson, A. Karantonis, and D. Leavitt, Systemic Research, Inc., April 2001.

This report is also available on the World Wide Web:
www.systemic.com/usi
www.siurbanstudy.org/newspublication

REFERENCES

CCSSO/SCASS Science Project. (1993, revised 1997). *Consensus Guidelines for Science Assessment*. Washington DC: CCSSO.

CCSSO/SCASS Science Project. (1995). *Collaborative Development of Science Assessments SCASS Experience*. Washington, DC: CCSSO.

CCSSO/SCASS Science MEC Team. (1998). *How is Science Taught in Kentucky Schools? An initial Report to Schools, Districts, and State Participating in the 1997 Survey of Enacted Curriculum in Kentucky*. Washington, DC: CCSSO.

CCSSO/WCER/State Collaborative on SEC. (2000). *Using Data on Enacted Curriculum in Mathematics and Science: Sample Results from a Study of Classroom Practices and Content*. Washington, DC: CCSSO.

Martin, M,. Blank, R. & Smithson, J. (1996). *Guide for Educators on Use of Surveys and Data on Enacted Curriculum*. Washington, DC: CCSSO.

Porter, A., Kirst, M., Oshshoff, E., Smithson, J. & Schneider, S. (1994). *Reform Up Close: A Classroom Analysis. Madison*, WI: Wisconsin Center for Educational Research.

Shaughnessy, C.A., Nelson, J.E., . & Norris, N.A. (1997). *NAEP 1996 Mathematics Cross-State Data Compendium for the Grade 4 and Grade 8 Assessment. Findings from the State Assessment in Mathematics of the National Assessment of Educational Progress.* Washington, DC: U.S. Department of Education, National Center for Education Statistics.

Smithson, J., Porter, A. & Blank, R. (1995). *Describing the Enacted Curriculum: Development and Dissemination of Opportunity to Learn Indicators in Science Education.* Washington, DC: CCSSO.

APPENDIX A:

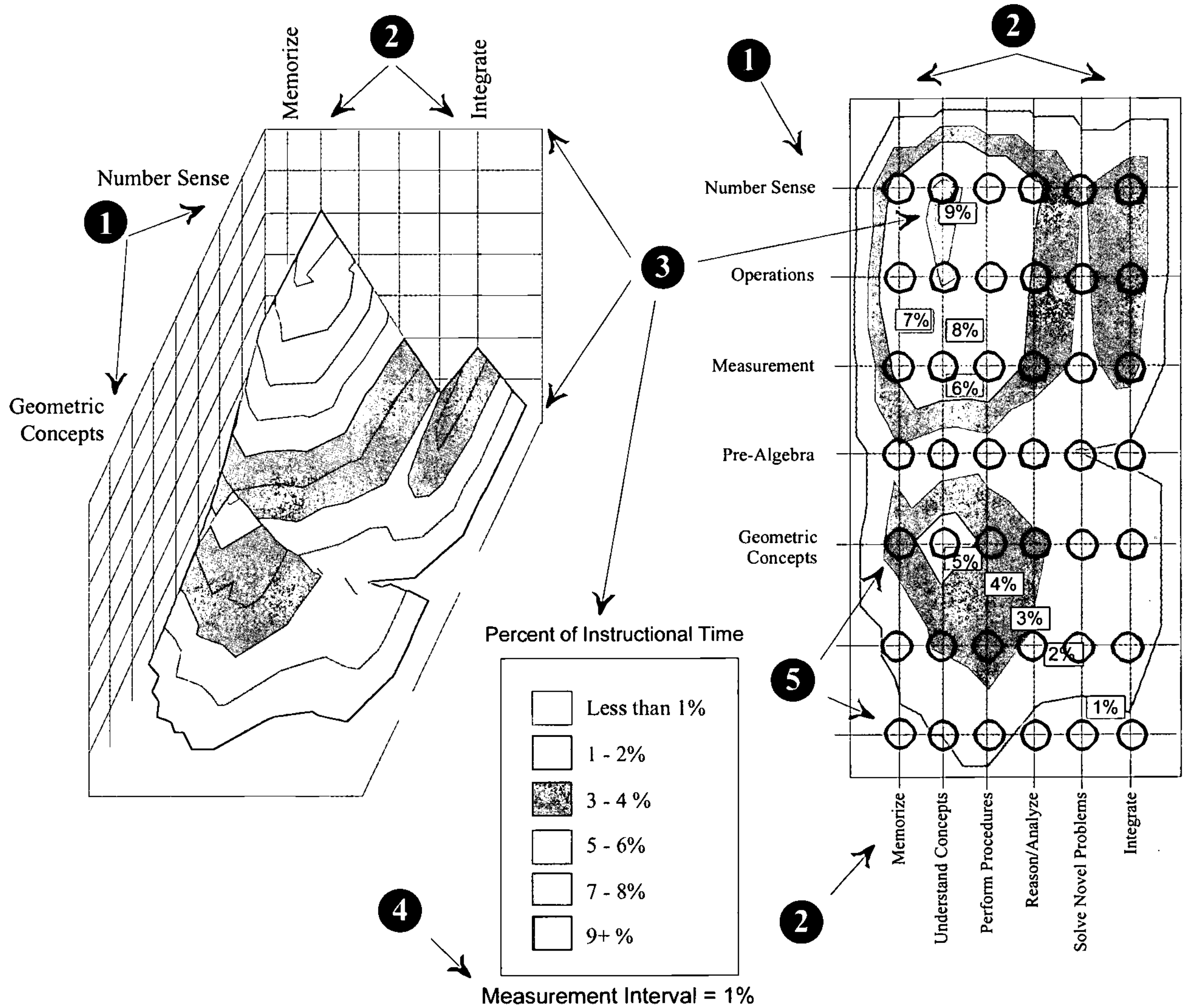
INTERPRETING CONTENT MAPS

Content maps provide a three-dimensional representation of instructional content using a surface area chart which results in a graphic very similar to topographical maps. The grid overlaying each map identifies a list of topics areas (indicated by horizontal grid lines; see ❶ in Exhibit I) and six categories of cognitive expectations for students (indicated by vertical lines; see ❷). The intersection of each topic area and category of cognitive expectation represents a measurement node (see ❺). Each measurement node indicates a measure of instructional time for a given topic area and category of cognitive expectation based upon teacher reports. The resulting map is based upon the values at each of these measurement nodes. It should be noted that the spaces between each measurement node, that is the surface of the map, are abstractions and are not based upon real data, the image of the map is simply a computer generated graphic based upon the values for each intersecting measurement node. The map display is utilized to portray the third dimension (percent of instructional time; see ❸) onto this grid utilizing shading and contour lines to indicate the percent of instructional time spent (on average across teachers) for each topic by cognitive expectation intersection.

The increase (or decrease) in instructional time represented by each shaded band is referred to as the measurement interval (see ❹). To determine the amount of instructional time for a given measurement node, count the number of contour lines between the nearest border and the node, and multiply by the measurement interval.

The graphic at left below displays the three dimensional counterpart of the image represented by the content map displayed on the right. Both graphs indicate that Understanding Concepts related to Number Sense and Operations occupies the majority of time spent on grade four mathematics instruction (9% or more of instructional time over the course of a school year).

Exhibit I



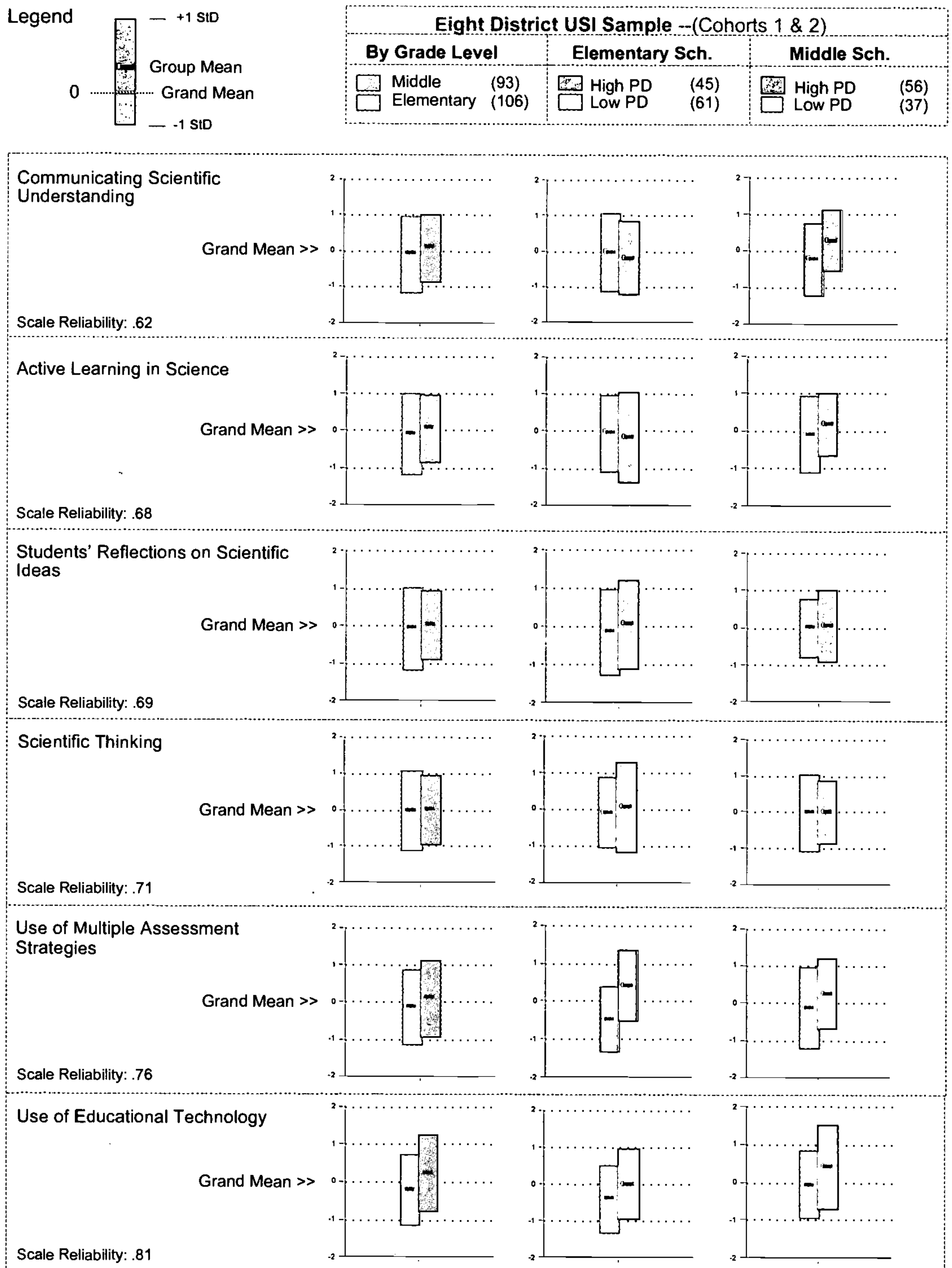
Memorize
Integrate
Number Sense
Geometric Concepts
Operations
Measurement
Pre-Algebra
9%
7%
8%
6%
5%
4%
3%
2%
1%
Percent of Instructional Time
Less than 1%
1 - 2%
3 - 4 %
5 - 6%
7 - 8%
9+ %
Measurement Interval = 1%
Memorize
Understand Concepts
Perform Procedures
Reason/Analyze
Solve Novel Problems
Integrate

APPENDIX B:

ADDITIONAL ITEM PROFILES AND CONTENT MAPS

Chart B.1

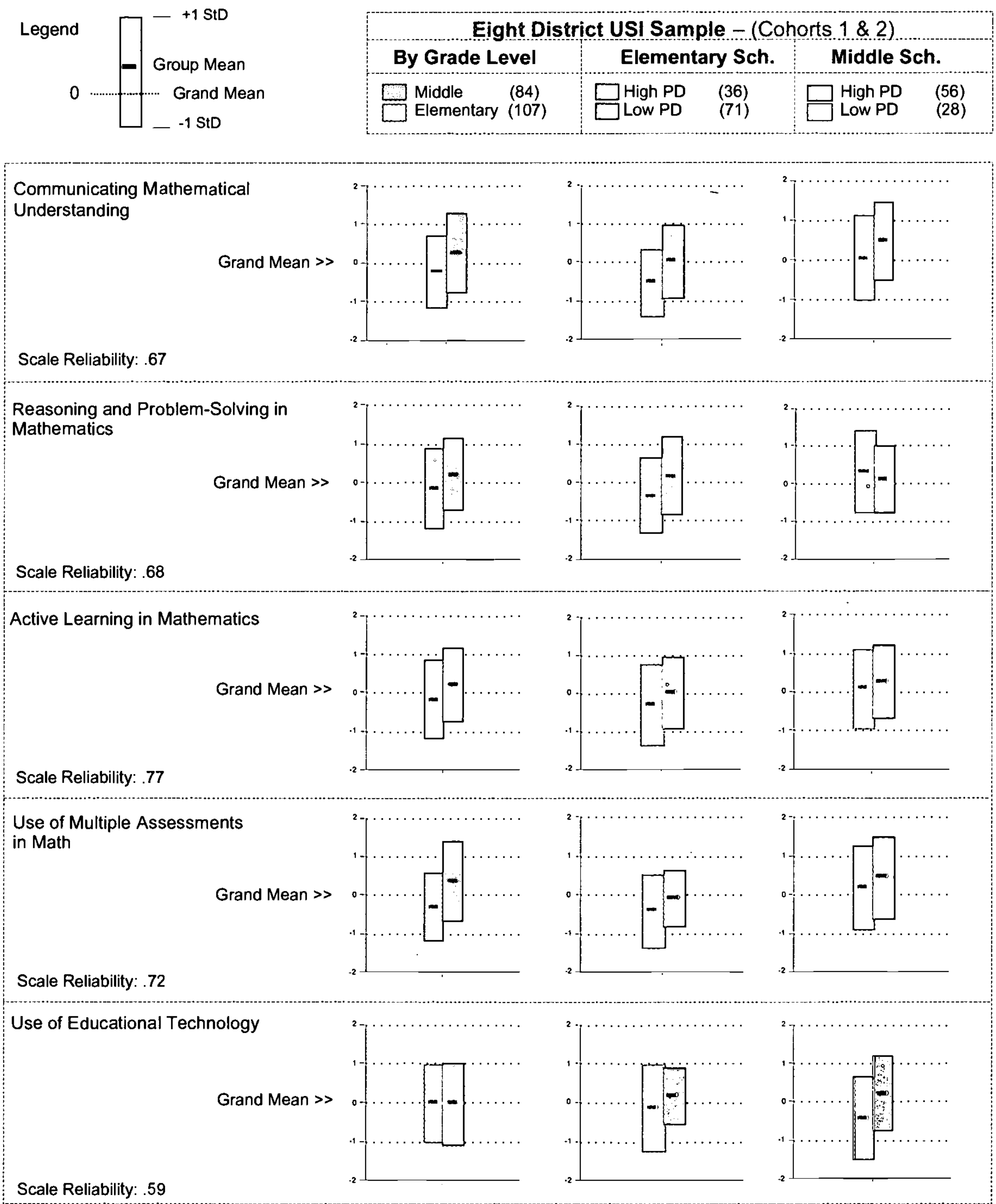
Scale Measures of Instructional Practice – Science



Bordered bar Indicates statistically significant mean difference.

Chart B.2

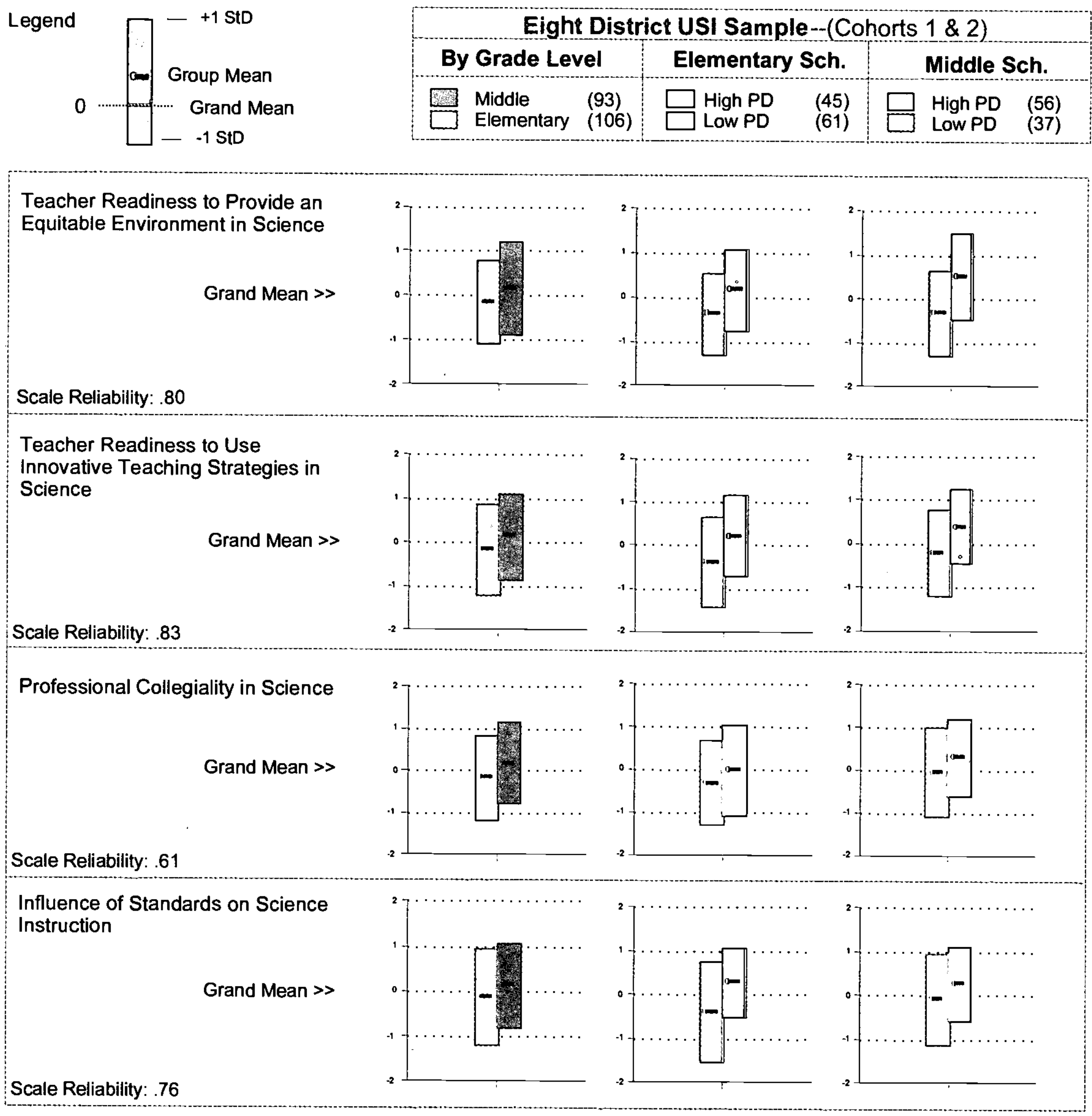
Scale Measures of Instructional Practice – Mathematics



Bordered bar Indicates statistically significant mean difference.

Chart B.3

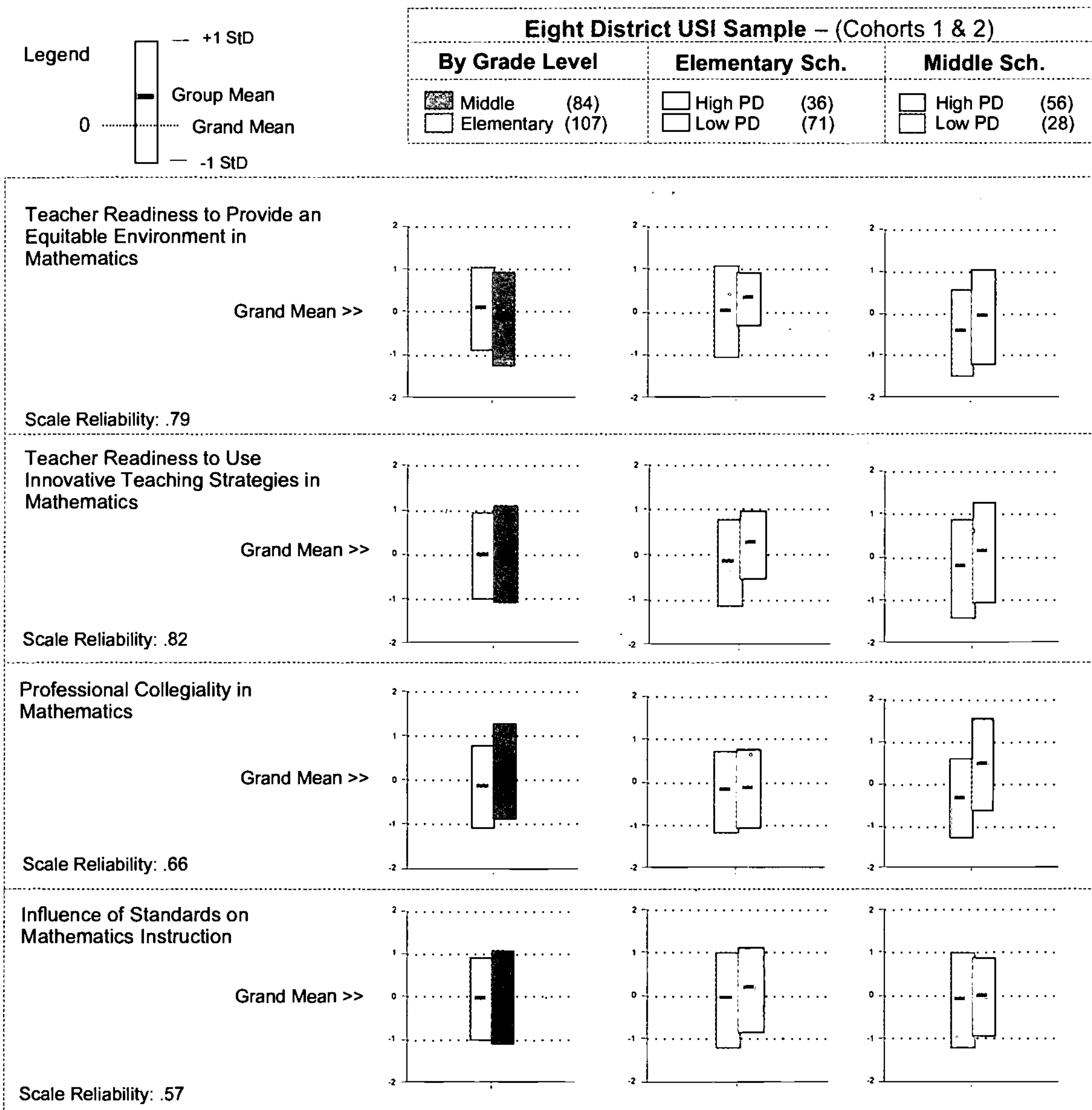
Scale Measures of Teacher and School Characteristics – Science



Bordered bar indicates statistically significant mean difference.

Chart B.4

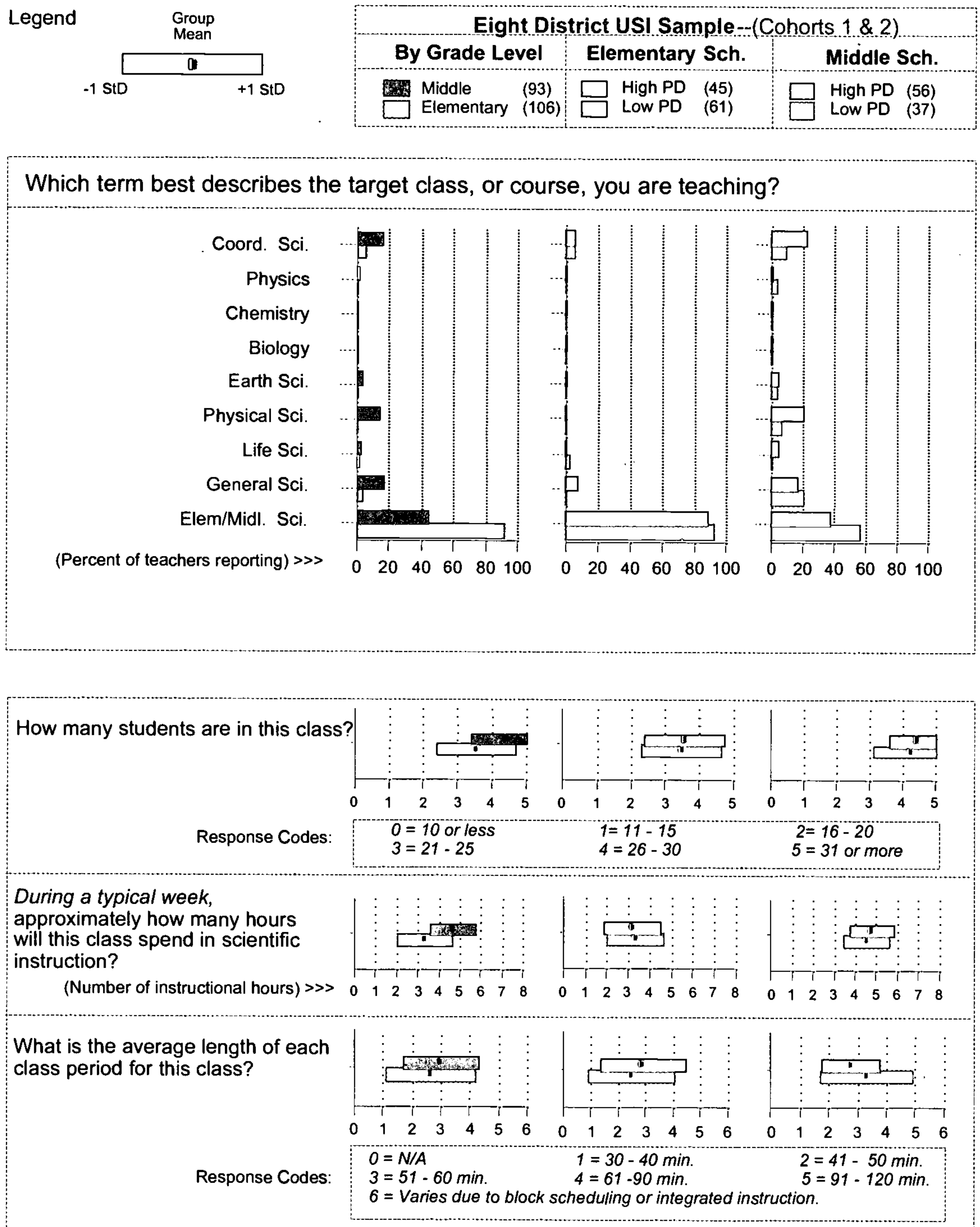
Scale Measures of Teacher and School Characteristics – Mathematics



Bordered bar Indicates statistically significant mean difference.

Chart B.5

Class Description – Science



Bordered bar Indicates statistically significant mean difference.

Chart B.6

Class Description – Mathematics

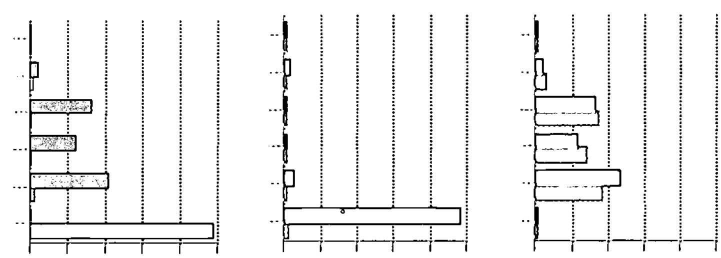
Legend

Eight District USI Sample – (Cohorts 1 & 2)		
By Grade Level	**Elementary Sch.**	**Middle Sch.**
Middle (84) Elementary (107)	High PD (36) Low PD (71)	High PD (56) Low PD (28)

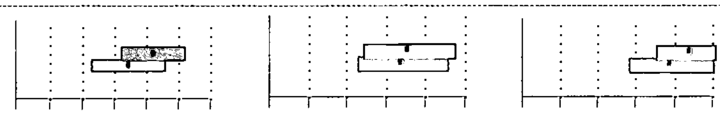
Which term best describes the target class, or course, you are teaching?

Geometry
Integrated Math
Algebra
Pre-Algebra
Middle Sch. Math
Elementary Math

(Percent of teachers reporting) >>>



How many students are in this class?

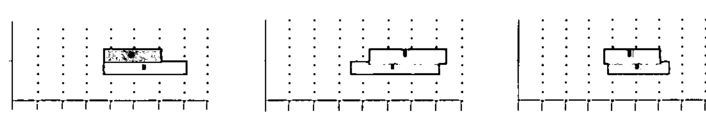


Response Codes:

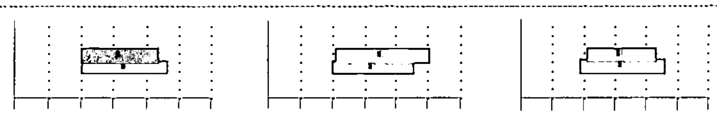
0 = 10 or less	*1= 11 - 15*	*2= 16 - 20*
3 = 21 - 25	*4 = 26 - 30*	*5 = 31 or more*

During a typical week, approximately how many hours will this class spend in mathematics instruction?

(Number of instructional hours) >>>



What is the average length of each class period for this class?



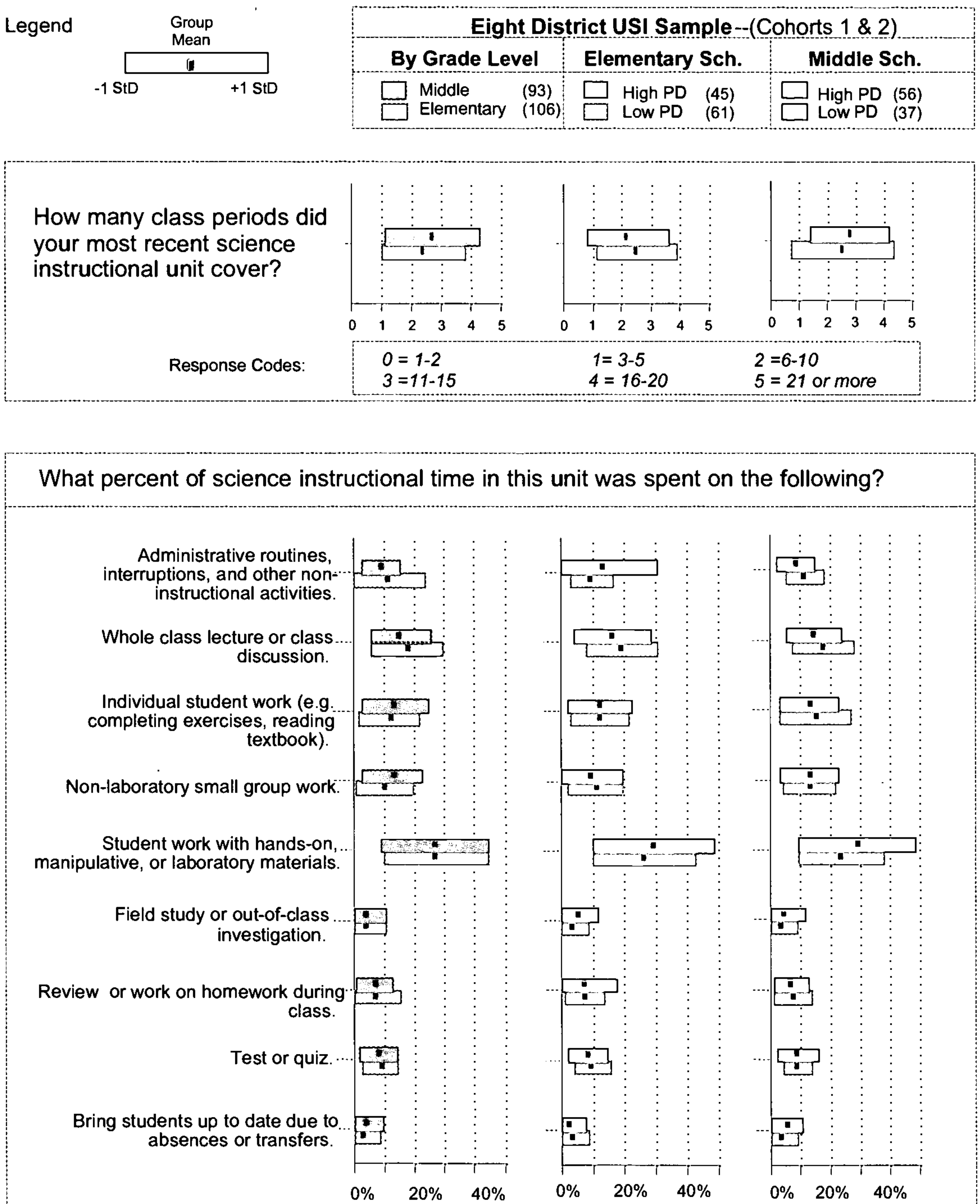
Response Codes:

0 = N/A	*1= 30 - 40 min.*	*2 = 41 - 50 min.*
3 = 51 - 60 min.	*4 = 61 - 90 min.*	*5 = 91 - 120 min.*
6 = Varies due to block scheduling or integrated instruction.		

Bordered bar Indicates statistically significant mean difference.

Chart B.7

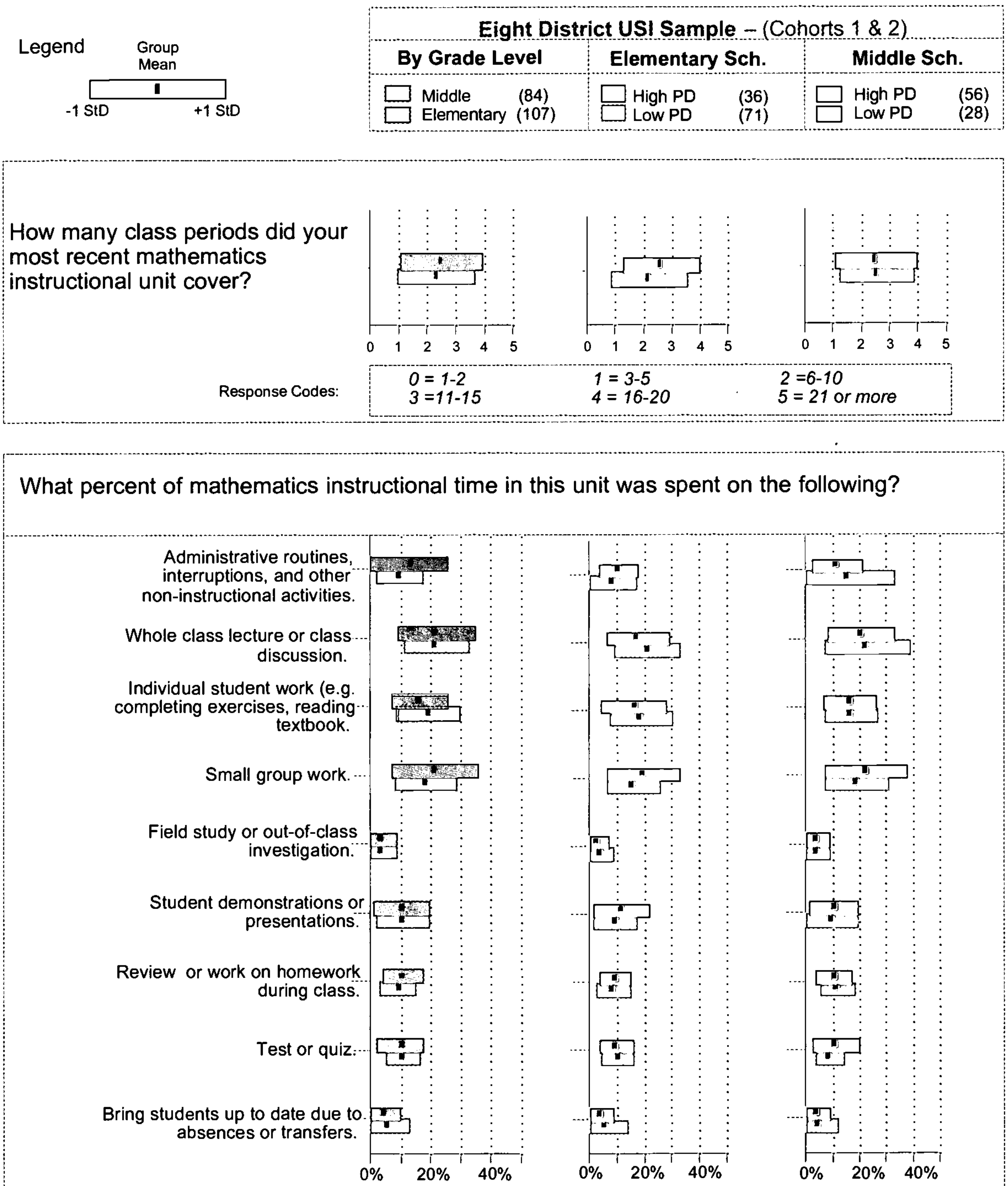
Use of Class Time During Most Recent Unit of Instruction in Science



Bordered bar Indicates statistically significant mean difference.

Chart B.8

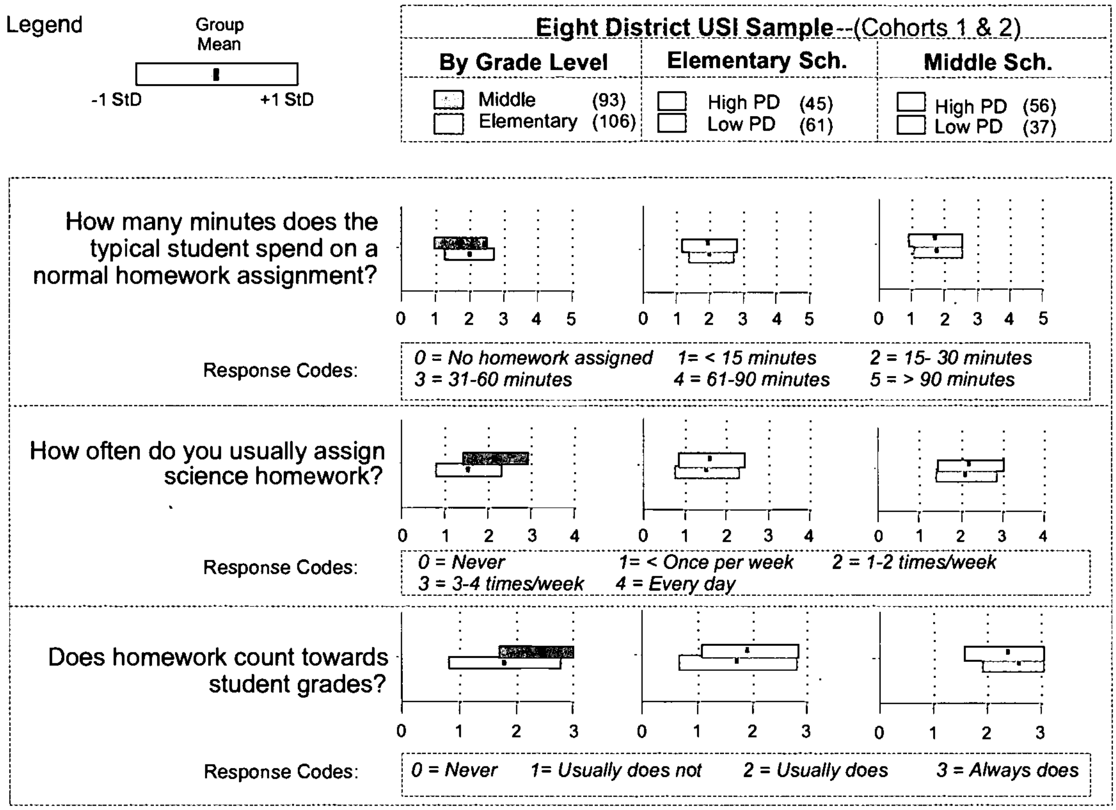
Use of Class Time During Most Recent Unit of Instruction in Mathematics

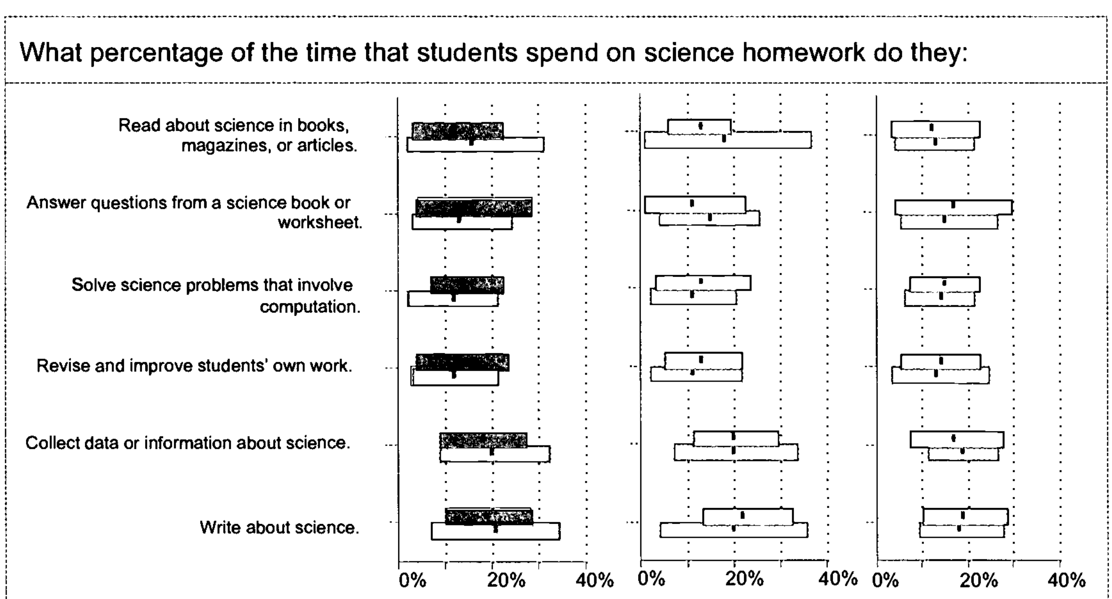


Bordered bar Indicates statistically significant mean difference.

Chart B.9

Use of Homework in Science

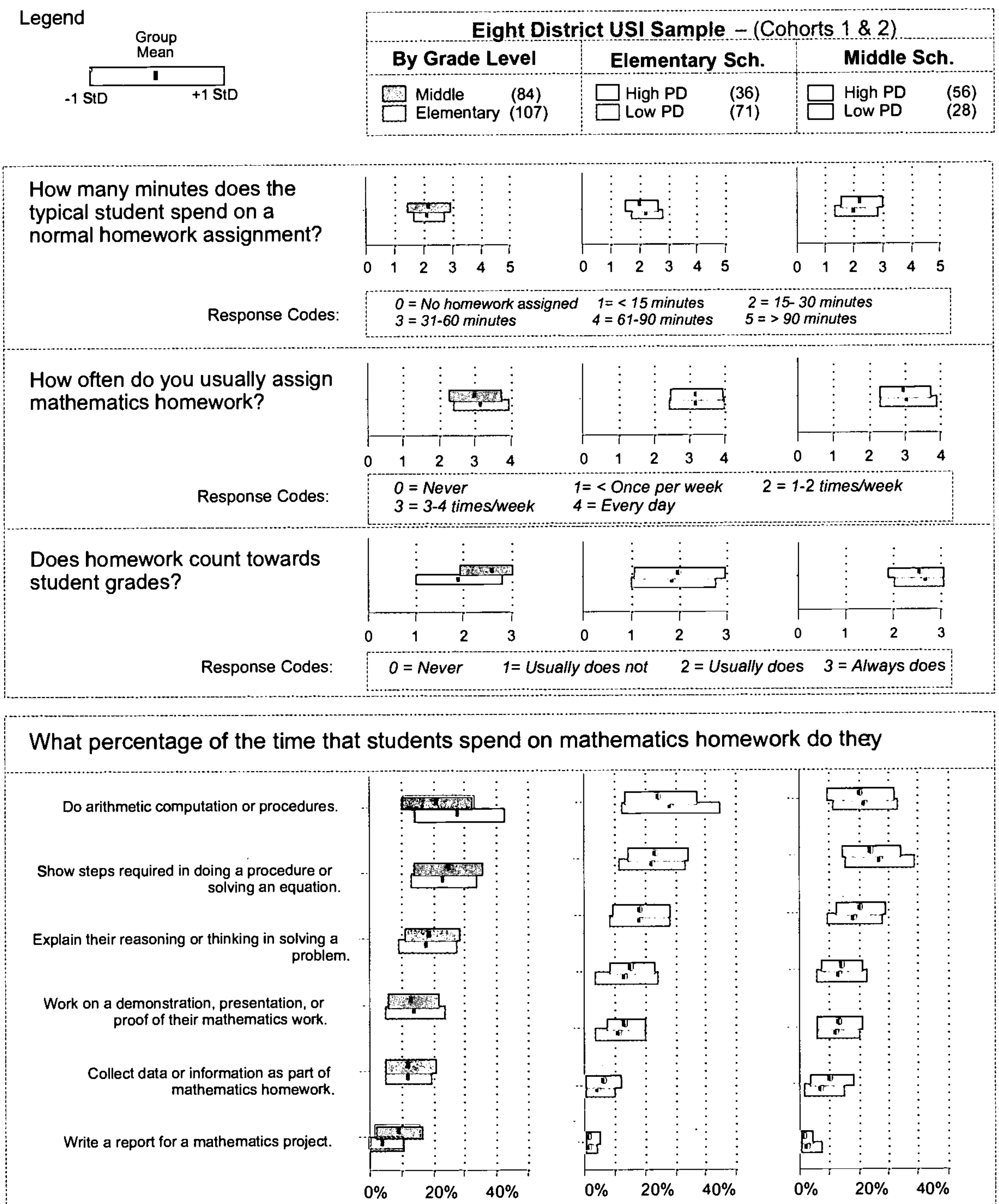




Bordered bar Indicates statistically significant mean difference.

Chart B.10

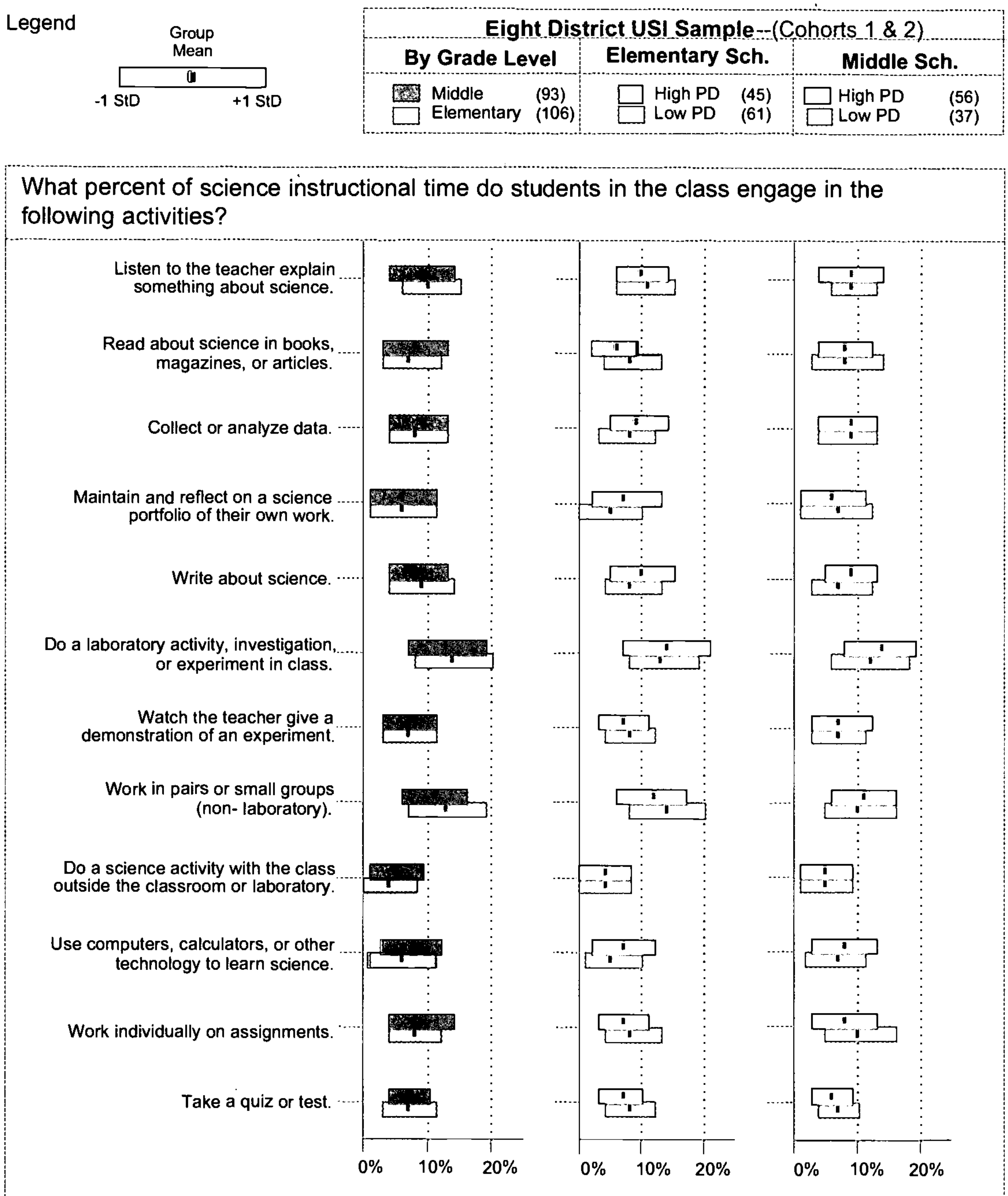
Use of Homework in Mathematics



Bordered bar Indicates statistically significant mean difference.

Chart B.11

Instructional Activities in Science



Bordered bar Indicates statistically significant mean difference.

Chart B.12

Instructional Activities in Mathematics

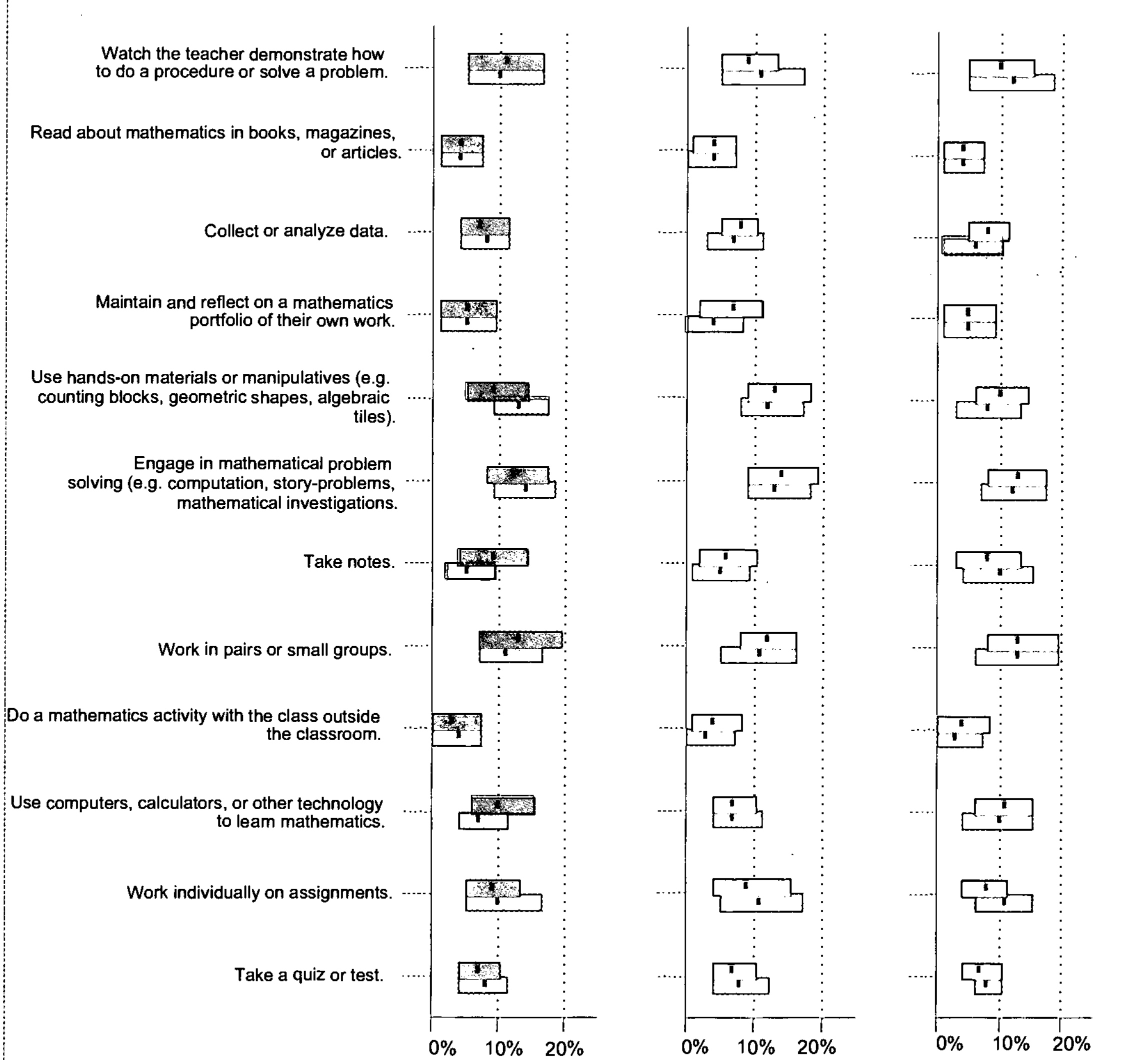
Legend

Group Mean

-1 StD +1 StD

Eight District USI Sample – (Cohorts 1 & 2)		
By Grade Level	**Elementary Sch.**	**Middle Sch.**
Middle (84)	High PD (36)	High PD (56)
Elementary (107)	Low PD (71)	Low PD (28)

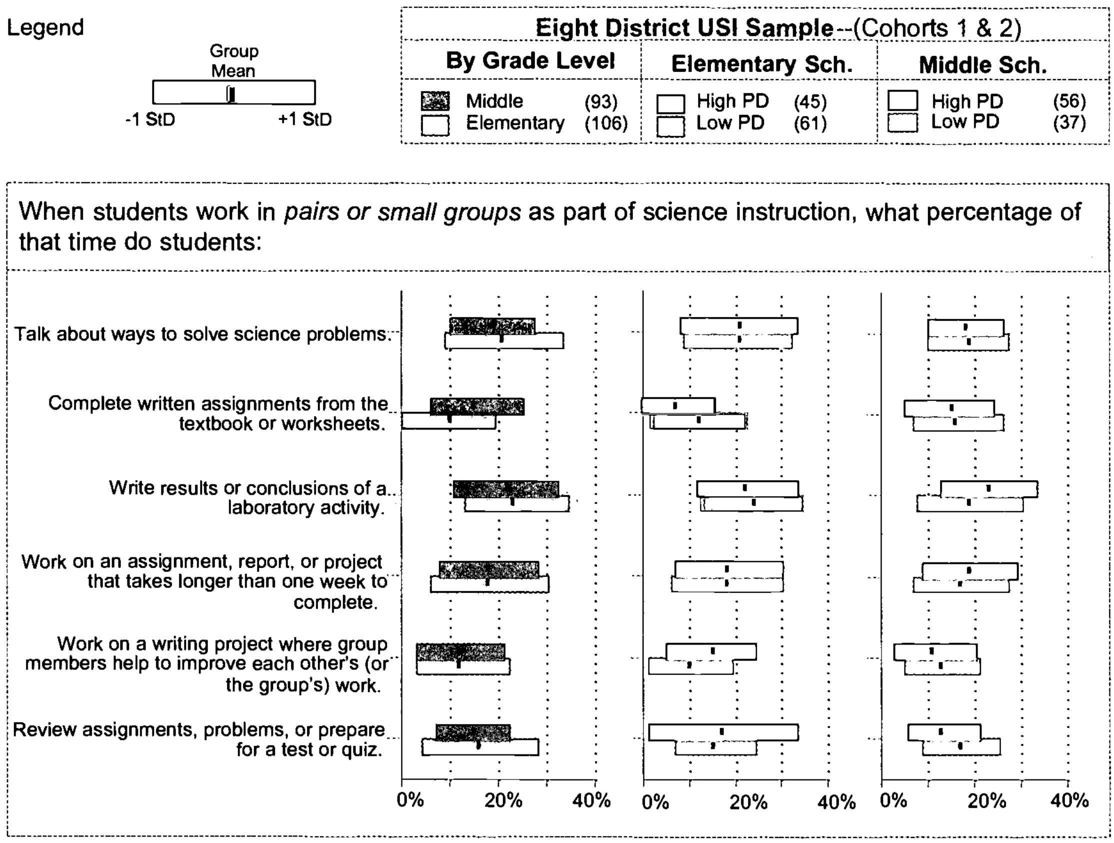
What percent of mathematics instructional time do students in the class engage in the following activities?



Bordered bar Indicates statistically significant mean difference.

Chart B.13

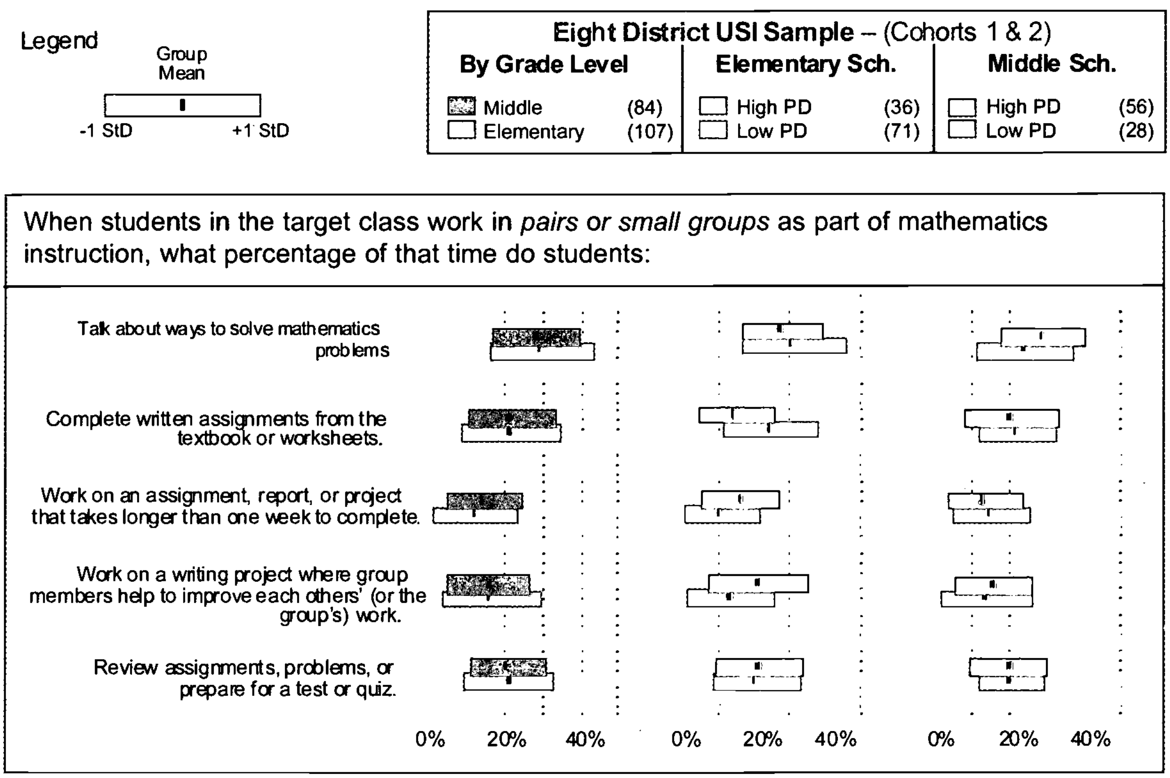
Small Group Work in Science



Bordered bar Indicates statistically significant mean difference.

Chart B.14

Small Group Work in Mathematics



Bordered bar Indicates statistically significant mean difference.

Chart B.15

Student Reflection on Scientific Ideas

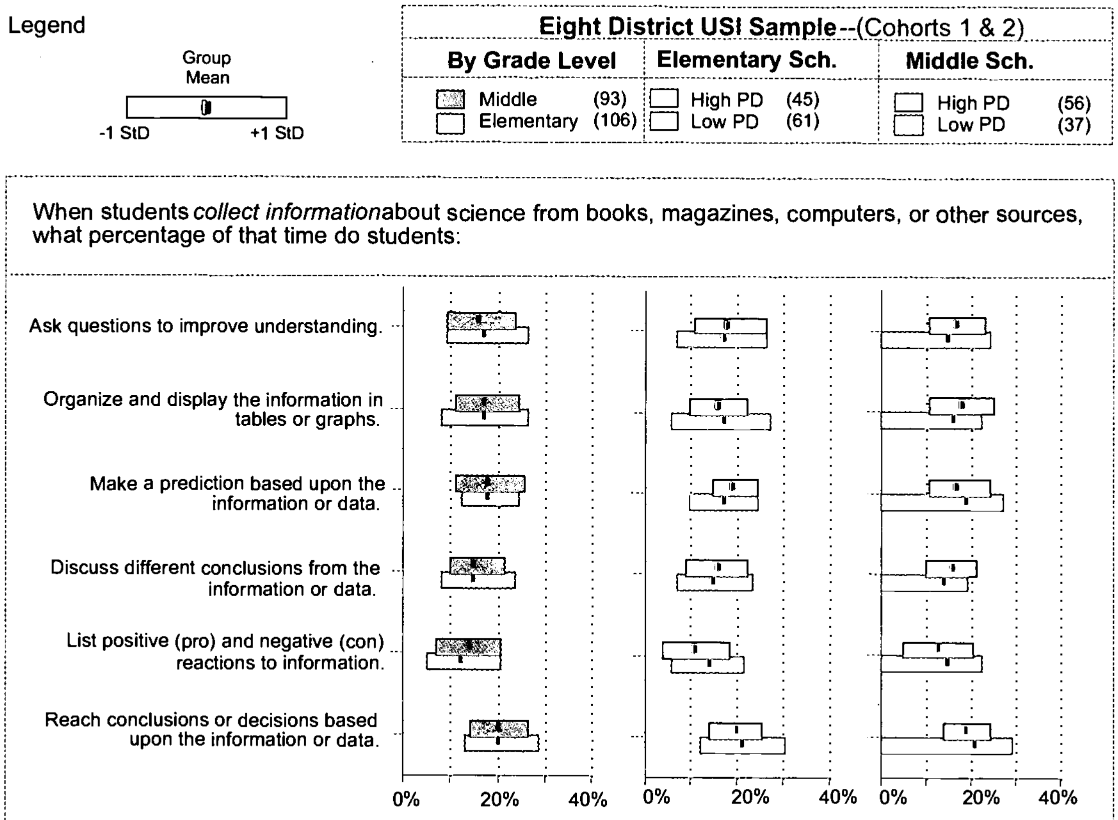
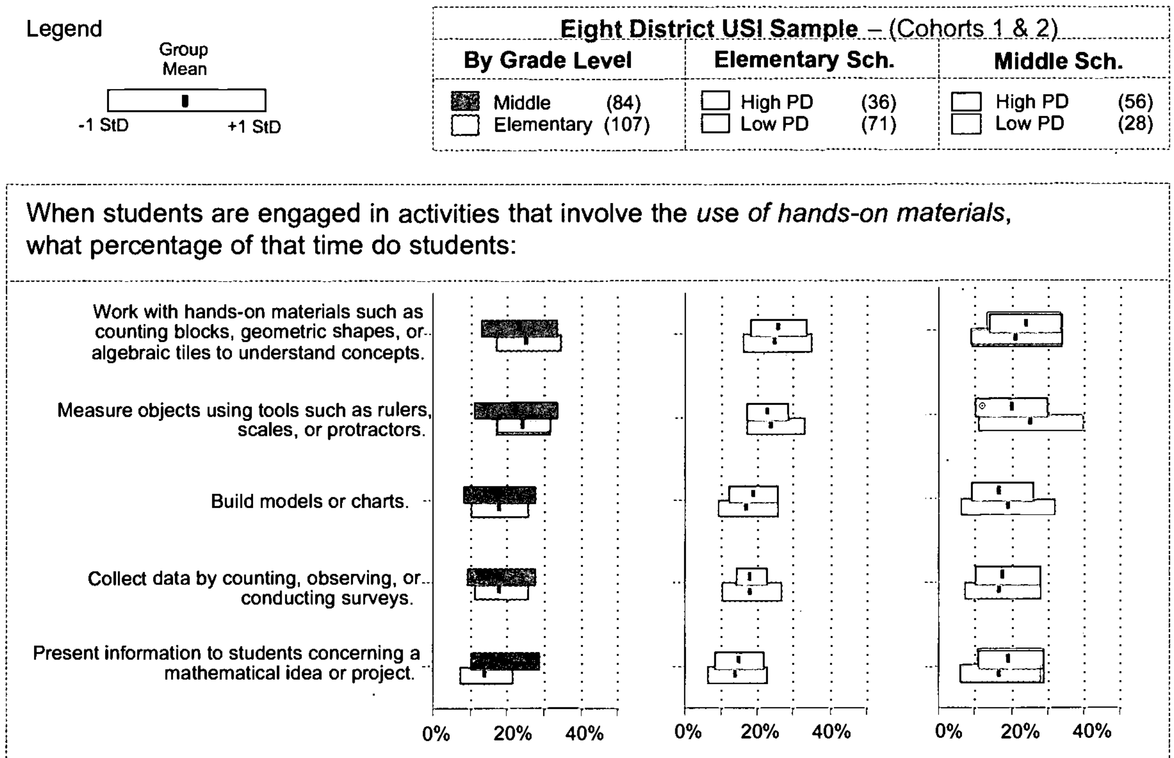


Chart B.16

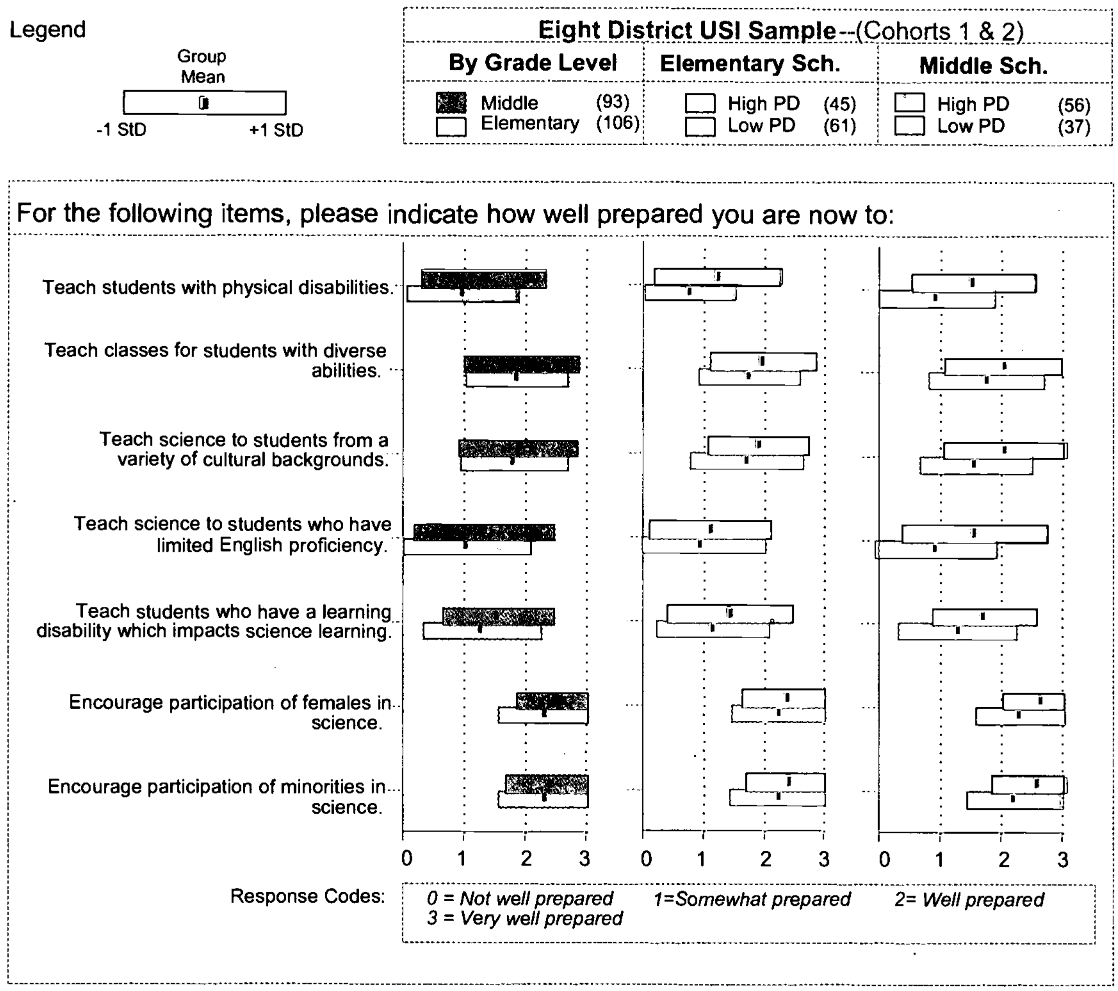
Use of Hands-on Materials in Mathematics



Bordered bar Indicates statistically significant mean difference.

Chart B.17

Teacher Readiness – Science



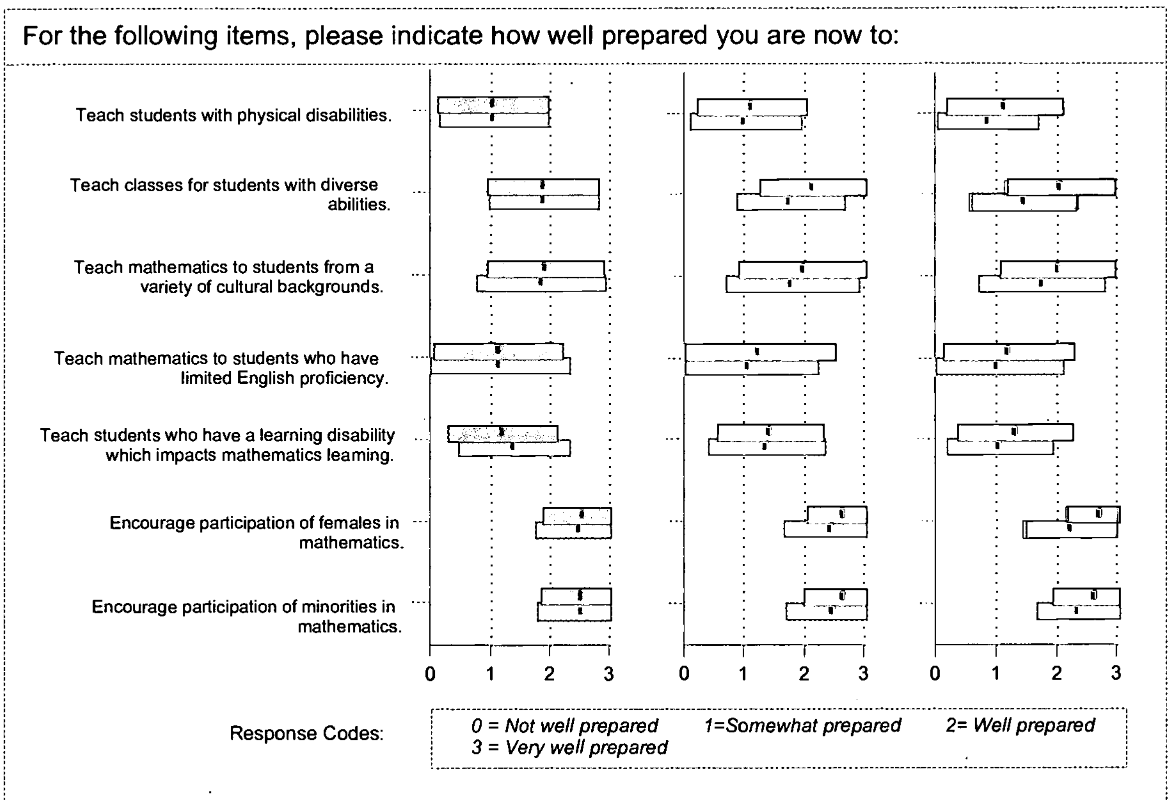
Bordered bar Indicates statistically significant mean difference.

Chart B.18

Teacher Readiness – Mathematics

Legend: Group Mean; -1 StD; +1 StD

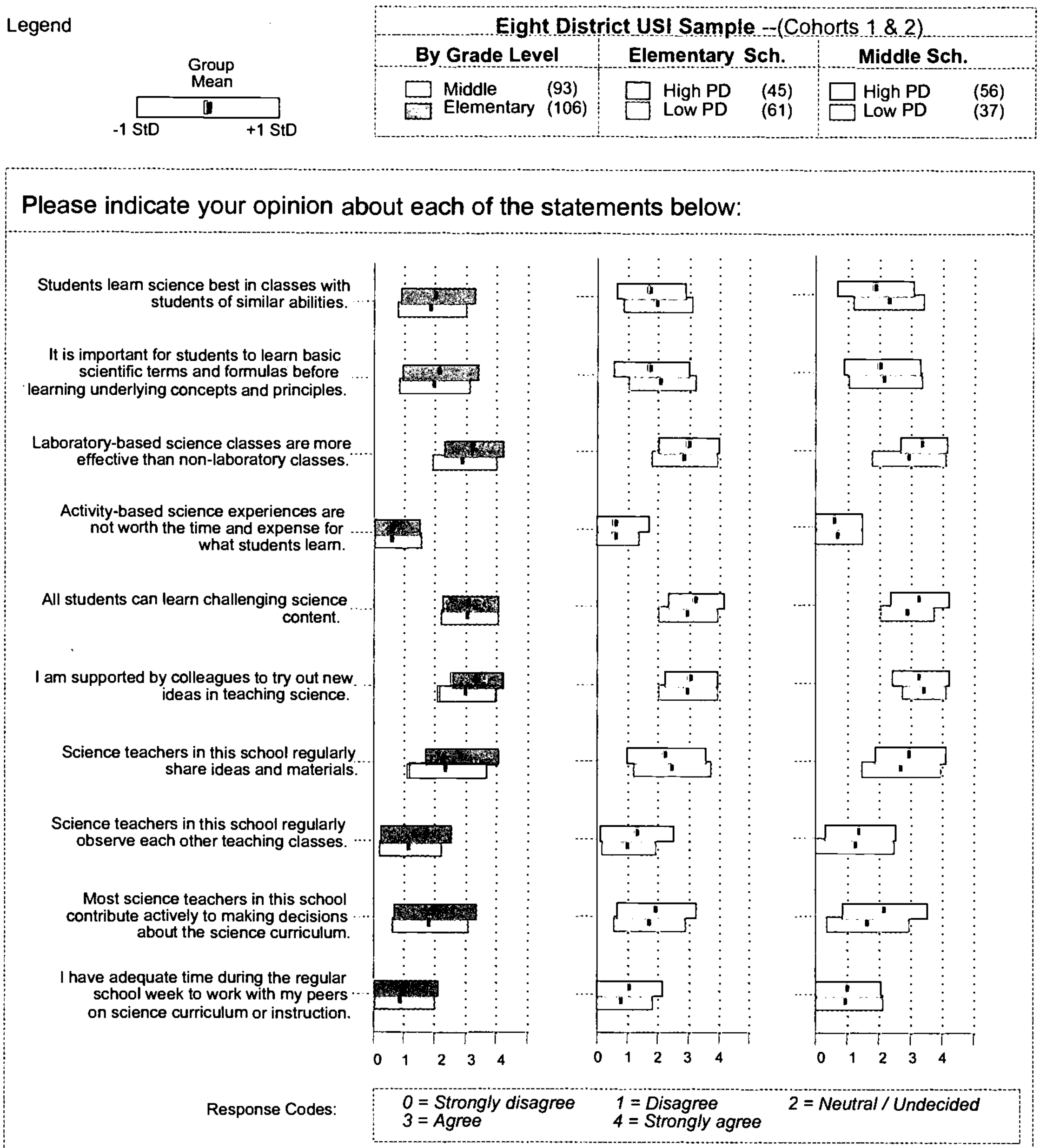
Eight District USI Sample – (Cohorts 1 & 2)		
By Grade Level	**Elementary Sch.**	**Middle Sch.**
Middle (84)	High PD (36)	High PD (56)
Elementary (107)	Low PD (71)	Low PD (28)



Bordered bar Indicates statistically significant mean difference.

Chart B.19

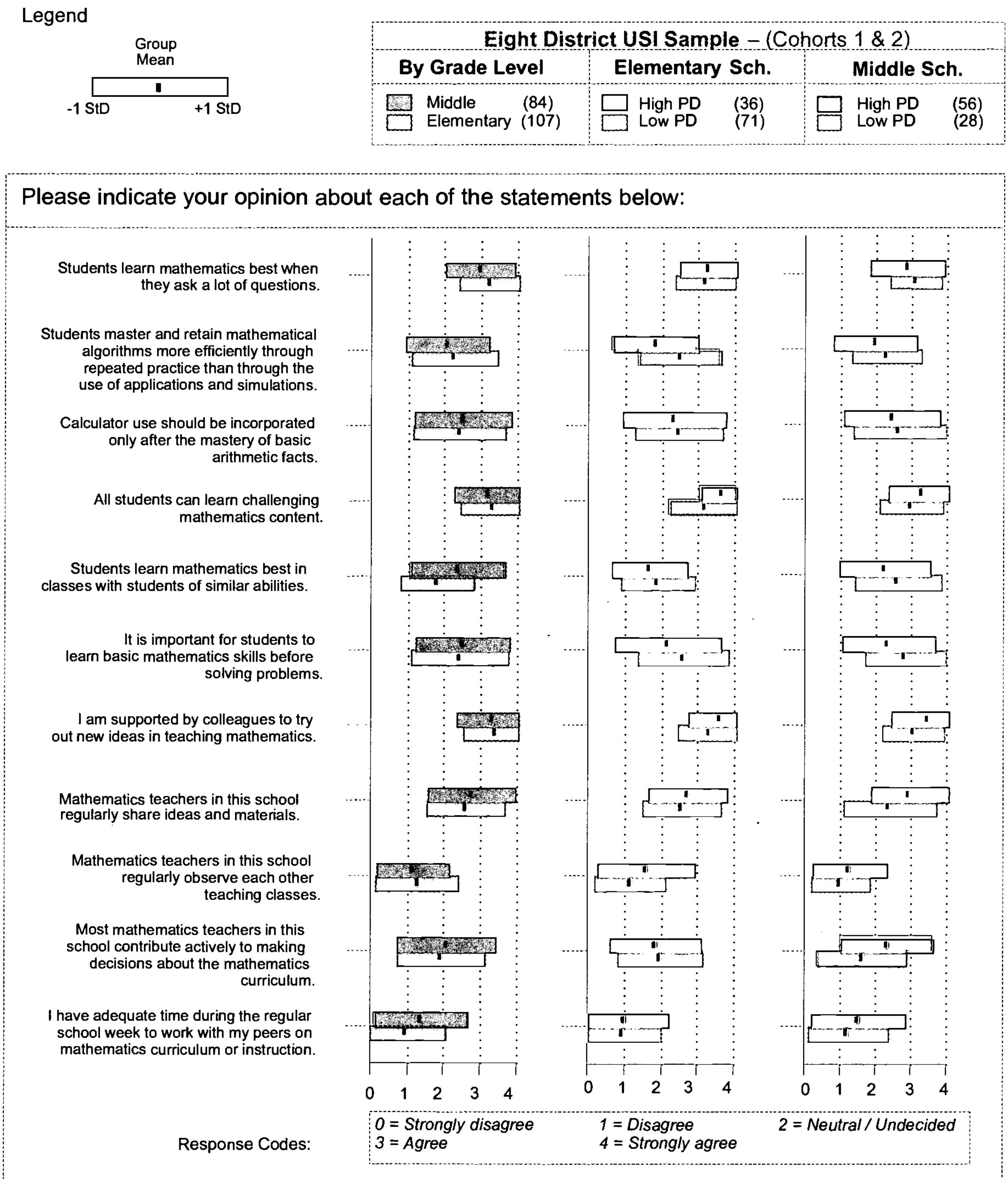
Teacher Opinions – Science
a) Beliefs About Student Learning, b) Professional Collegiality



Bordered bar Indicates statistically significant mean difference.

Chart B.20

Teacher Opinions – Mathematics
a) Beliefs About Student Learning, b) Professional Collegiality



Bordered bar Indicates statistically significant mean difference.

Chart B.21

Grade 4 Science – Cohort 1 Content Maps

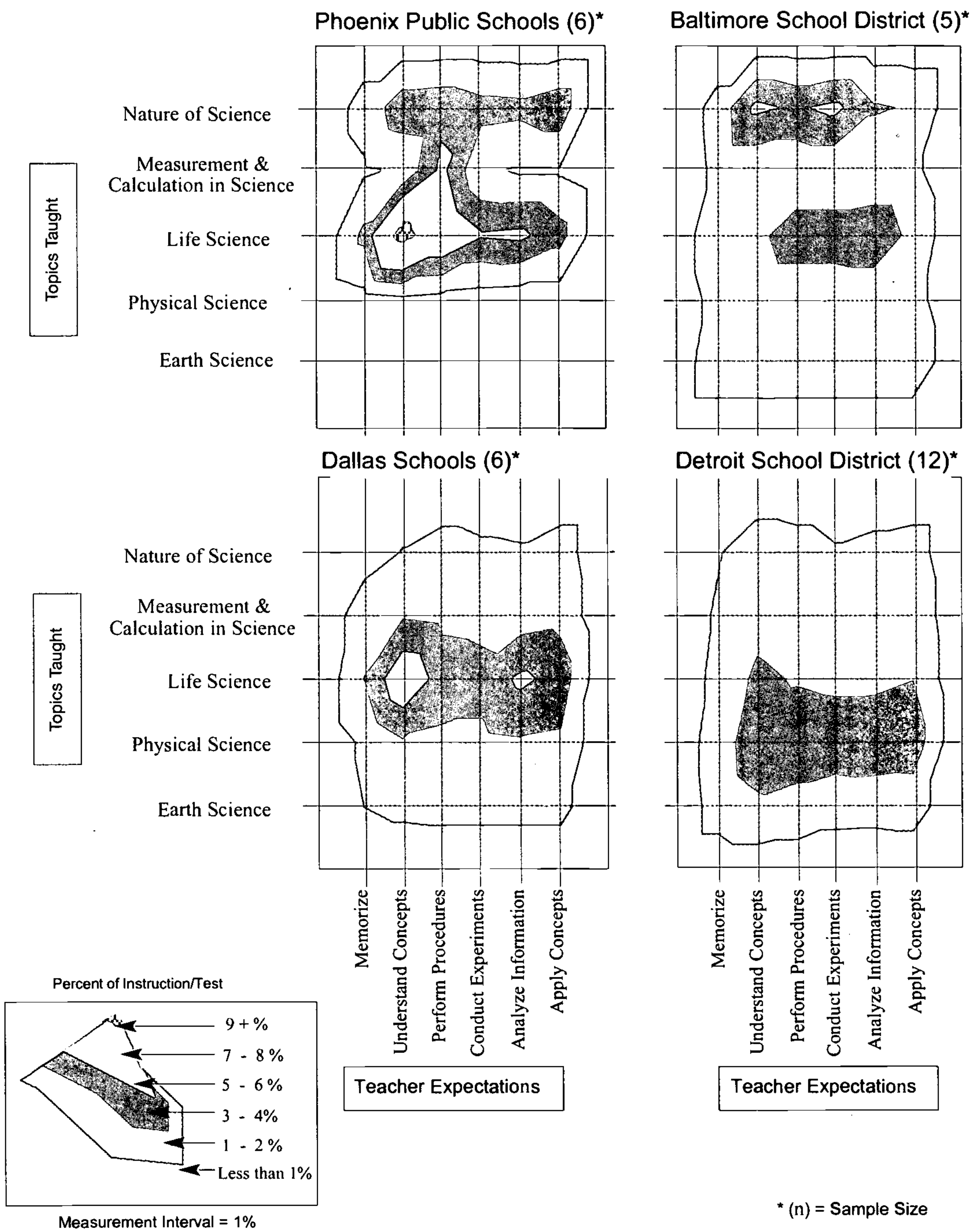
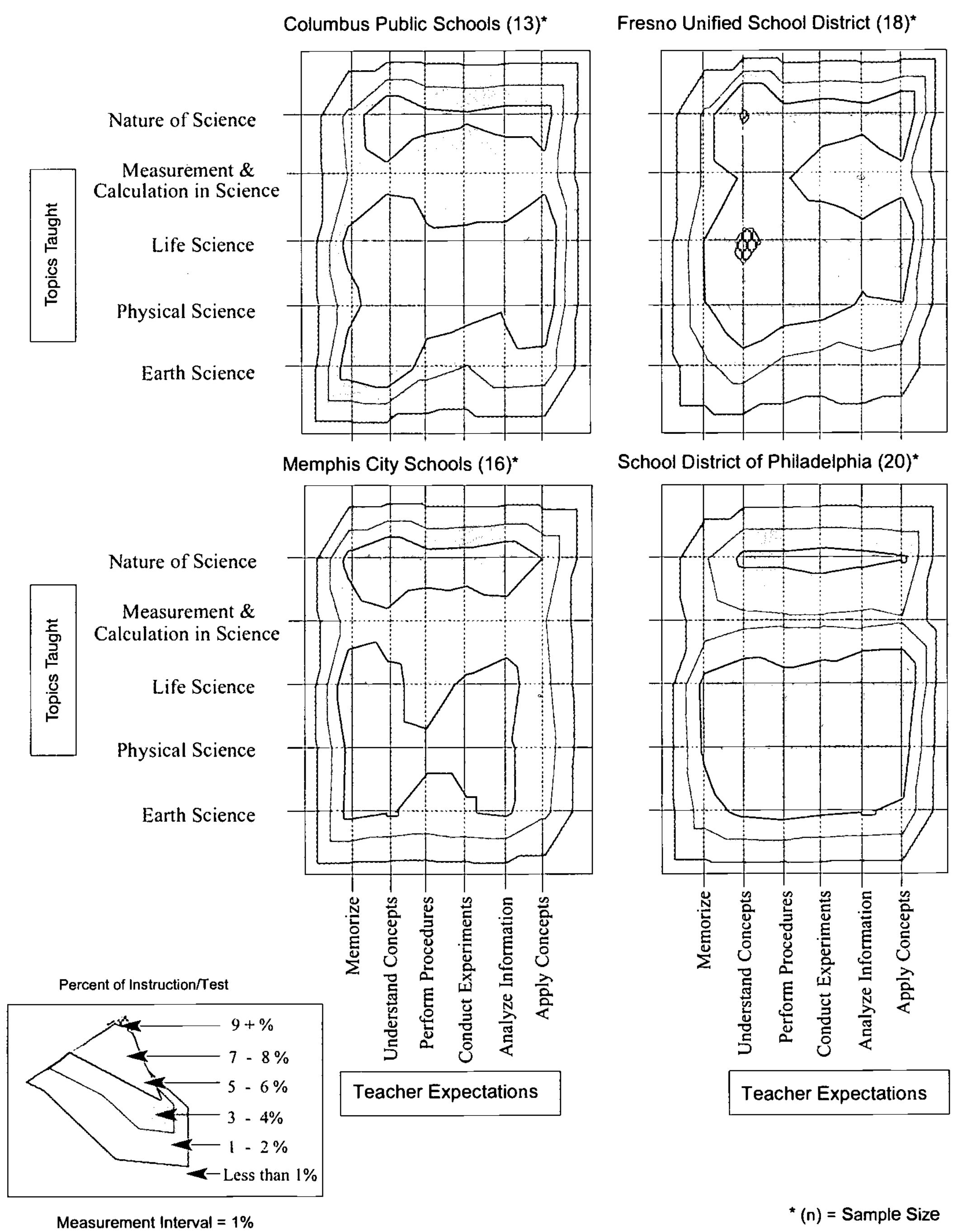


Chart B.22

Grade 4 Science – Cohort 2 Content Maps



* (n) = Sample Size

Chart B.23

Grade 4 Mathematics – Cohort 1 Content Maps

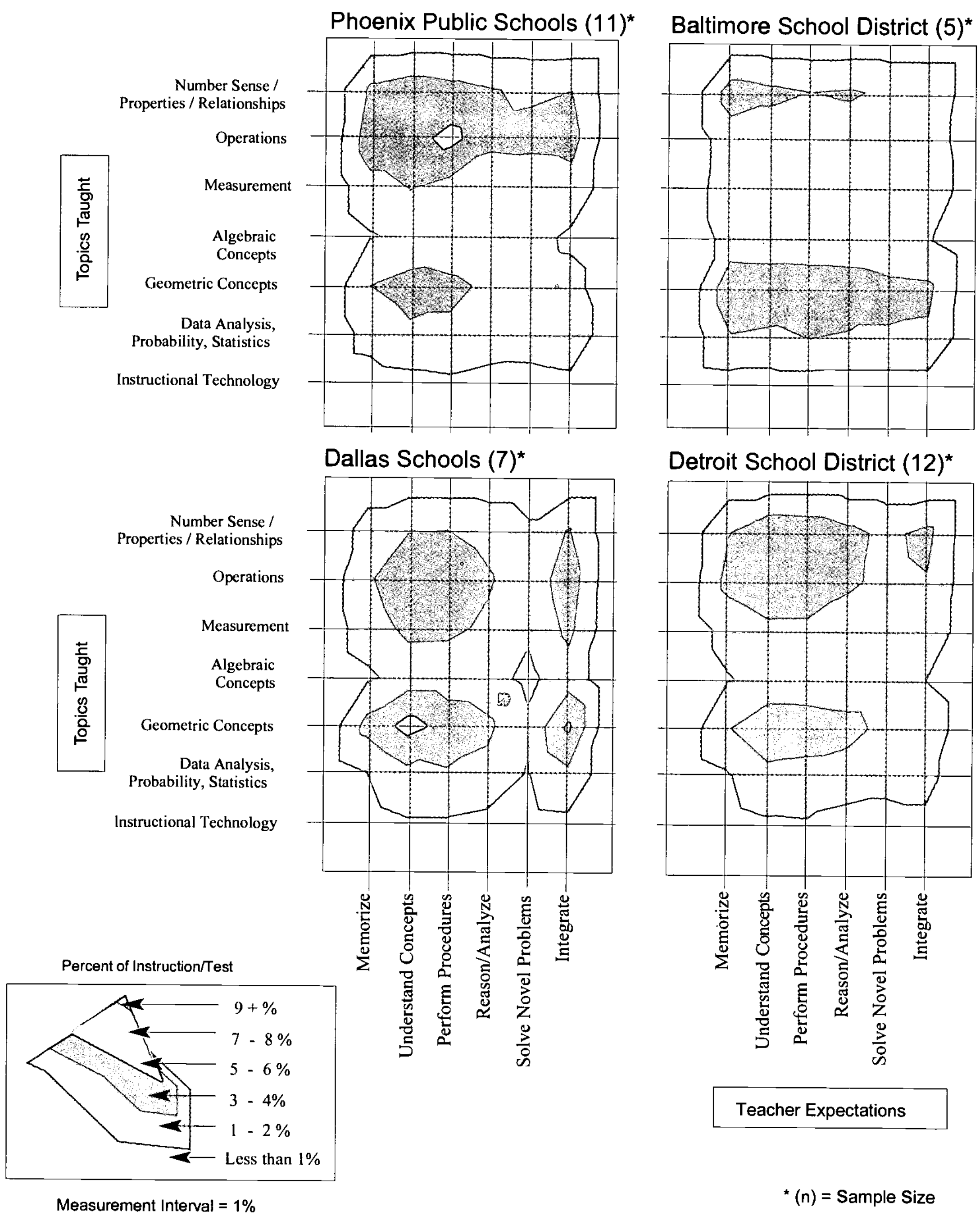
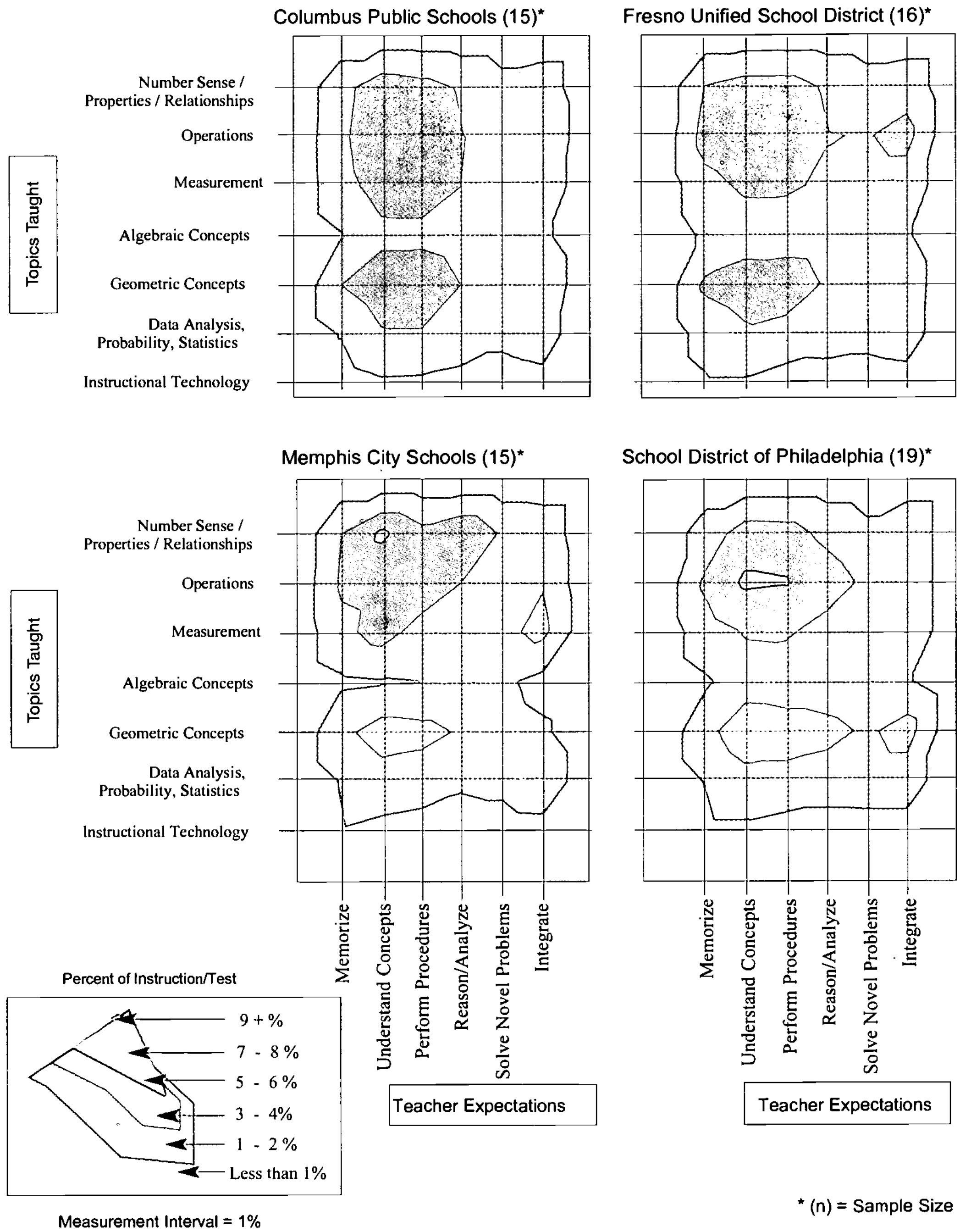


Chart B.24

Grade 4 Mathematics – Cohort 2 Content Maps



* (n) = Sample Size

Chart B.25

Grade 8 Science – Cohort 1 Content Maps

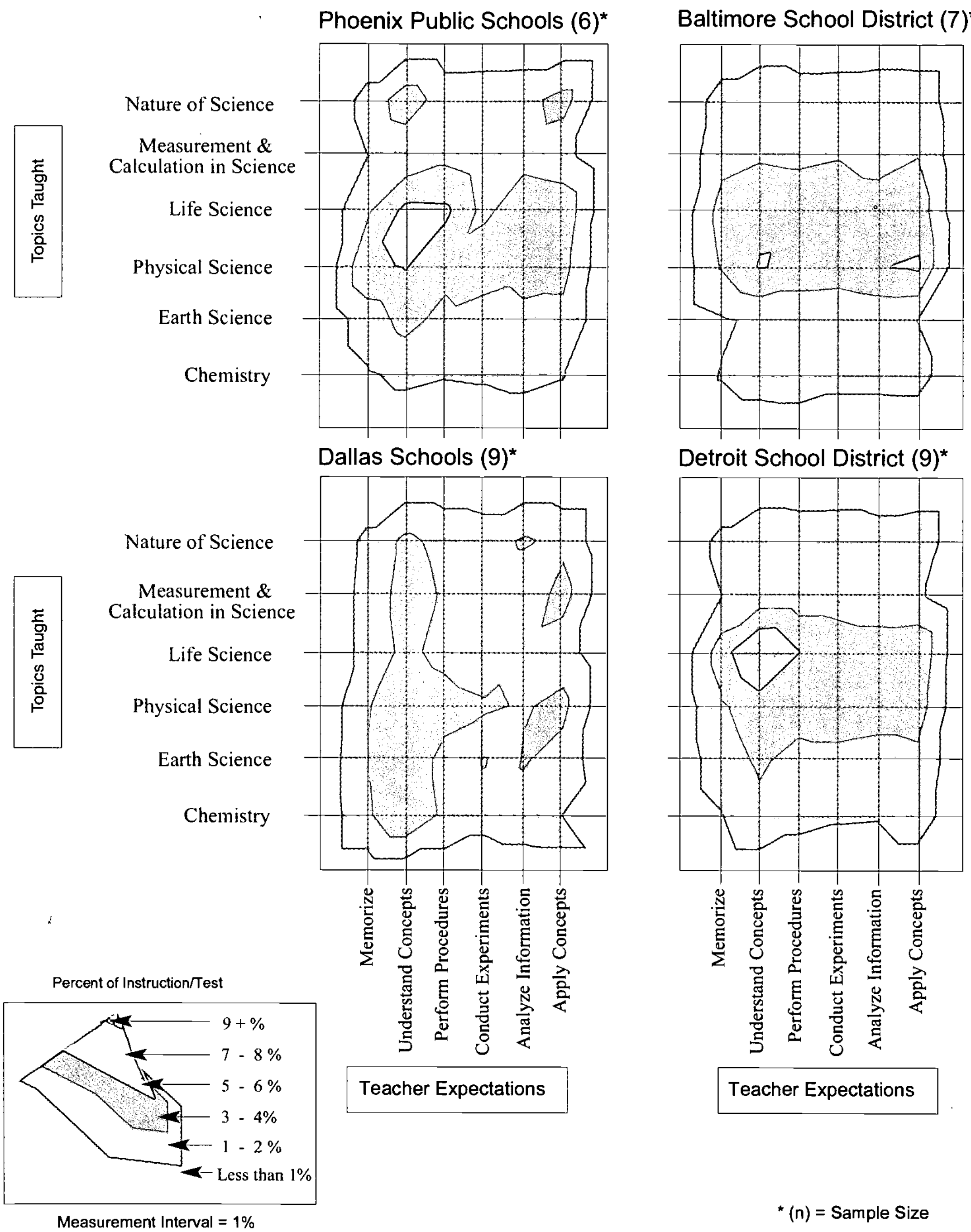
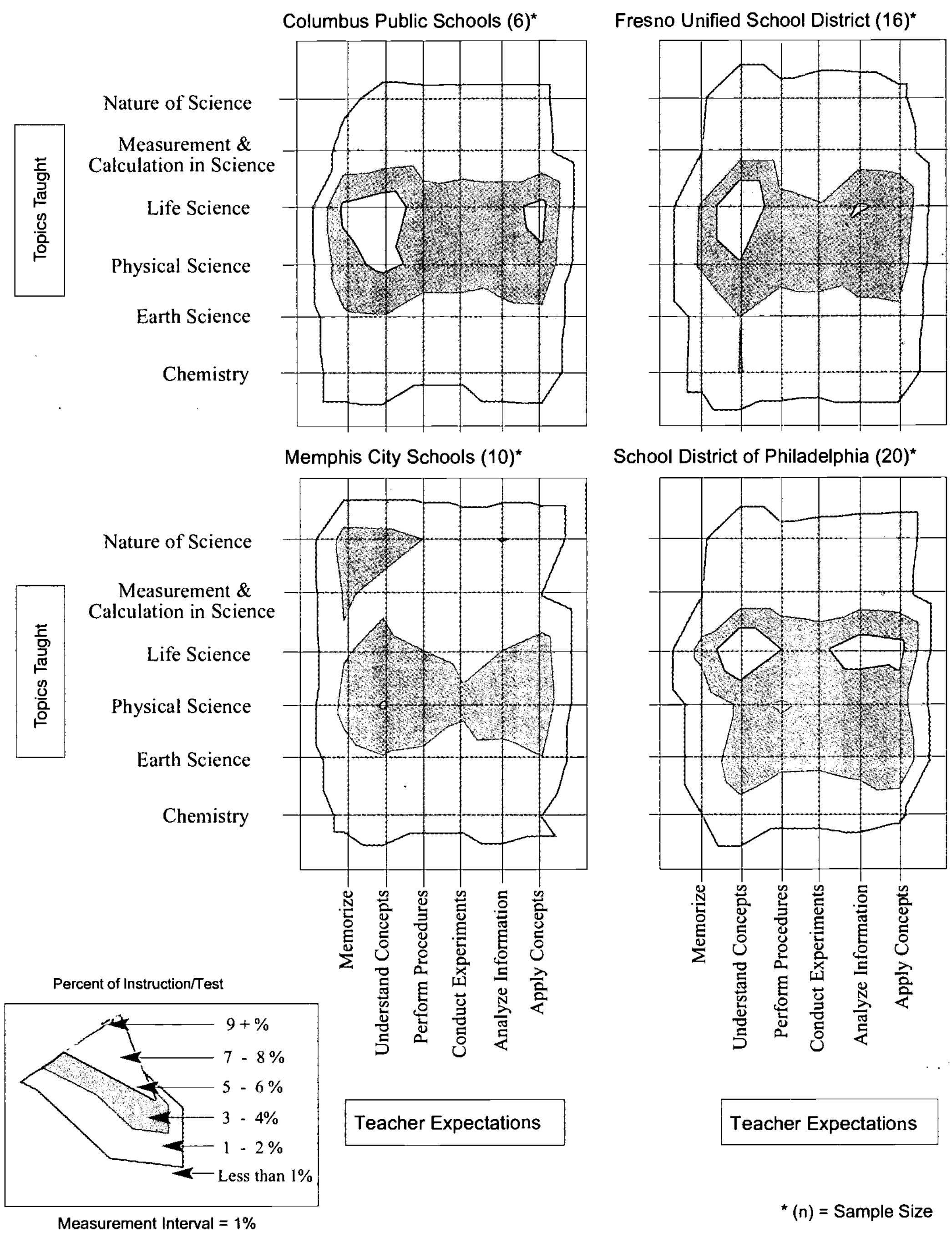


Chart B.26

Grade 8 Science – Cohort 2 Content Maps



* (n) = Sample Size

Chart B.27

Grade 8 Mathematics – Cohort 1 Content Maps

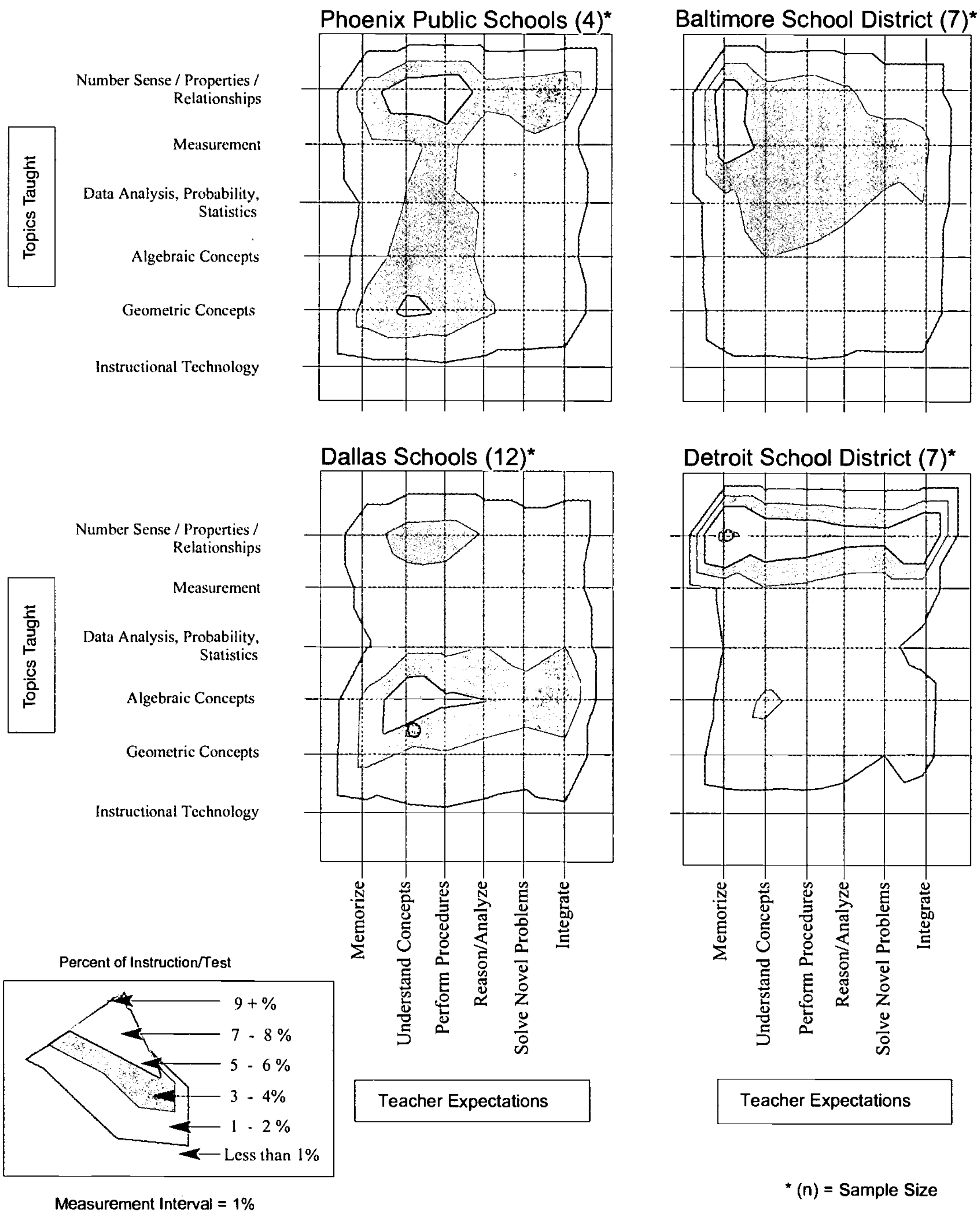
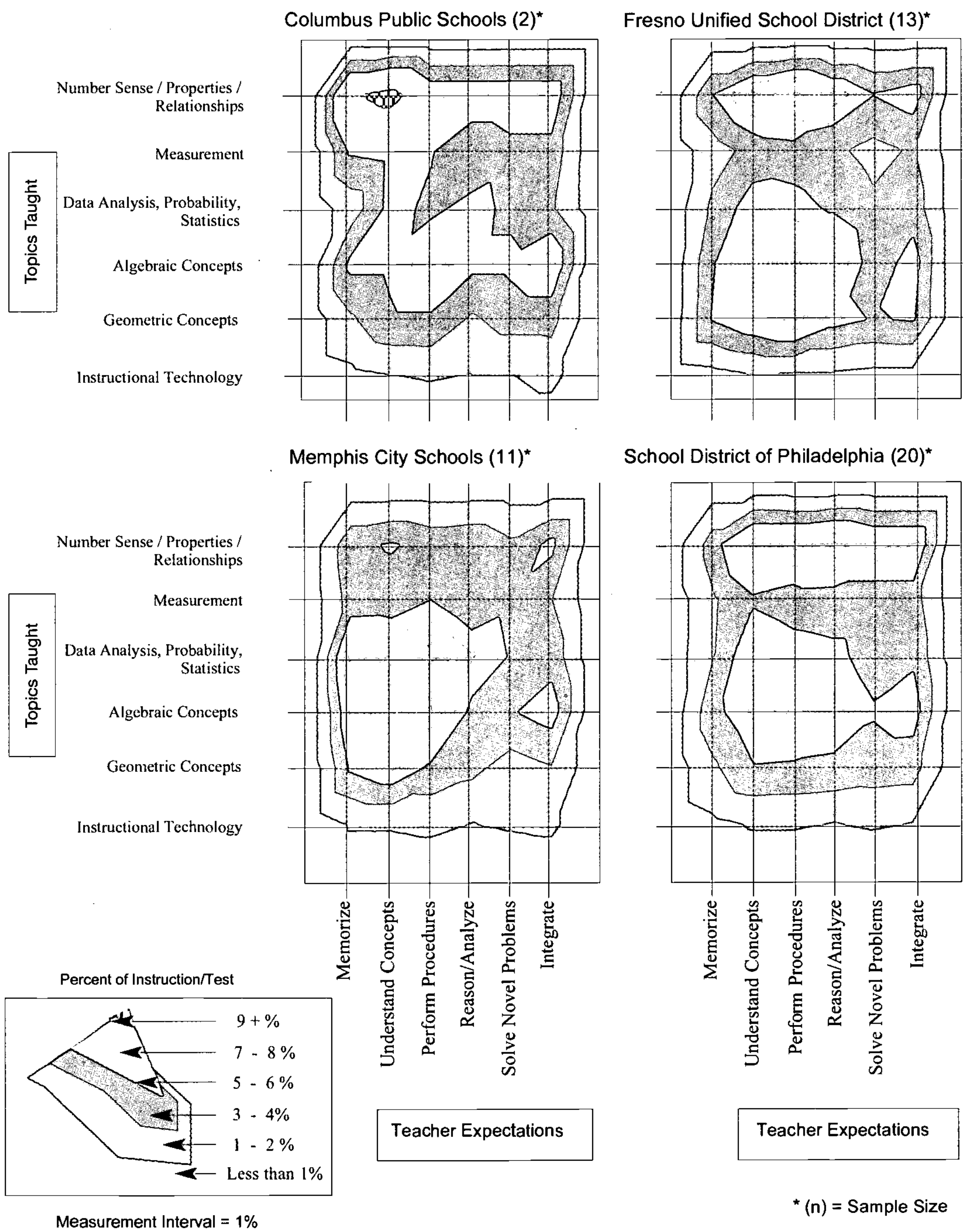


Chart B.28

Grade 8 Mathematics – Cohort 2 Content Maps



APPENDIX C:

DESCRIPTIVE DATA ON TEACHERS PARTICIPATING IN THE SURVEY OF ENACTED CURRICULUM

Survey of USI Sites	1999	2000	TOTAL
	Baltimore, Dallas, Detroit, & Phoenix	Columbus, Fresno, Memphis, & Phila.	8 USI Sites

Teachers Responding to Survey (whole or in part)	1999		2000		TOTAL	
Number of Teachers	Math	Science	Math	Science	Math	Science
Elementary	37	38	70	68	107	106
Middle	32	35	52	58	84	93
Total	69	73	122	126	191	199
Grand Total	142		248		390	

Teacher Demographics	1999		2000		TOTAL	
	Math %	Science %	Math %	Science %	Math %	Science %
Female	76.8	72.6	80.3	80.2	79.1	77.4
Male	18.8	21.9	18.0	18.3	18.3	19.6
White	39.1	56.2	51.6	62.7	45.4	60.3
Minority	47.7	38.3	44.3	34.9	46.0	35.7

Class Reported by Teacher (1 class per teacher)	1999		2000		TOTAL	
Number of Teachers	Math	Science	Math	Science	Math	Science
Grade 2	3	2	0	3	3	5
3	3	7	7	9	10	16
4	26	6	56	51	82	57
5 or 6	7	25	7	7	14	32
7	13	6	6	8	19	14
8 or higher	16	24	45	47	61	71

Teaching Time	1999		2000		TOTAL	
	Math %	Science %	Math %	Science %	Math %	Science %
Elementary (hours/week)						
Less than 4	4.3	30.1	4.9	27.8	4.6	28.7
4 - 4.9	2.9	9.6	5.7	20.6	4.7	16.6
5 or more	43.4	11.0	46.7	5.6	45.5	7.5
Middle (hours/week)						
Less than 4	4.3	5.5	3.3	3.2	3.6	4.0
4 - 4.9	15.9	15.1	6.6	12.7	9.9	13.6
5 or more	26.0	27.4	31.9	27.8	32.8	27.6

Teacher Characteristics		1999		2000		TOTAL	
		Math %	Science %	Math %	Science %	Math %	Science %
Experience:Years in Subject							
	0 to 2	20.2	26.0	15.5	13.5	17.3	18.1
	3 to 5	14.5	17.8	24.6	19.8	20.9	19.1
	6 to 11	14.5	24.6	24.6	33.3	21.0	30.2
	12 or more	46.4	27.4	34.4	31.7	38.8	30.2
Highest Degree							
	BA/BS	49.3	42.5	54.9	48.4	52.9	46.2
	MA/MS or higher	43.4	53.5	44.2	49.2	44.0	50.7
Major: Bachelors or Highest							
	Elementary Ed	44.9	27.4	59.0	41.2	54.0	36.2
	Middle Ed	4.3	4.1	5.8	1.6	4.3	2.5
	Math Ed	13.0		2.5		6.3	
	Science Ed		12.3		6.3		8.5
	Mathematics	4.3		5.0		4.7	
	Science Field		16.4		8.8		11.5
	Math Ed & Mathematics	5.7		1.6		3.1	
	Science Ed & Science Field		5.5		4.8		5.0
	Other	20.2	28.8	23.8	32.6	22.5	32.1

Teacher Professional Development		1999		2000		TOTAL	
		Math %	Science %	Math %	Science %	Math %	Science %
Content study in field							
(hours in last year)	Less than 6	33.3	37.0	29.5	38.1	30.9	37.7
	6 - 15 hours	27.5	30.1	23.0	22.2	24.6	25.1
	16 or more	34.8	30.1	47.5	38.9	42.9	35.7
Methods of teaching in field							
(hours in last year)	Less than 6	27.5	42.5	27.1	37.3	27.3	39.2
	6 - 15 hours	29.0	24.7	25.4	25.4	26.7	25.1
	16 or more	37.7	28.7	47.6	35.7	43.9	33.2

APPENDIX D:

EXPECTATIONS FOR STUDENTS IN MATHEMATICS AND SCIENCE

1. Mathematics

Memorize	• Facts • Definitions, Terms • Formulas, procedures
Understand Concepts	• Explain, define or represent concepts • Apply concepts in procedures and problems • Explain procedures, algorithms, solutions, strategies • Develop/explain relationships between concepts • Show or explain relationships between models, diagrams, or other representations
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
Analyze/Reason	• Analyze or interpret data • Write formal or informal proofs • Recognize, generate or create patterns • Make generalizations or predictions • Identify faulty arguments or misrepresentations of data • Reason inductively or deductively
Solve Novel Problems	• Solve non-routine problems for which students do not have a routine strategy or algorithm • Design a statistical experiment to study a problem
Integrate	• Apply mathematics in real-world situations or to other disciplines • Generate, extend, or restate problems • Synthesize content and ideas from several sources

Response Codes for Expectations for Students

0=No emphasis (Not a performance goal for this topic)
1=Slight emphasis (less than 25% of time on this topic)
2=Moderate emphasis (25%-33% of time on this topic)
3=Sustained emphasis (more than 33% of time on this topic)

2. Science

Memorize	• Facts • Definitions, Terms • Formulas
Understand Concepts	• Explain concepts • Observe and explain teacher demonstrations • Explain procedures and methods of science and inquiry
Perform Procedures	• Make observations • Collect and record data • Use appropriate tools • Make measurements, do computations • Execute procedure
Conduct Experiments & Investigations	• Generate questions, make predictions • Plan and design experiments • Test effects of different variables • Draw conclusions • Communicate investigations & explanations
Analyze Information	• Classify and compare data • Analyze data, recognize patterns • Infer from data, draw conclusions
Apply Concepts and Make Connections	• Use and integrate concepts • Apply to real-world situations • Build or revise theory • Make generalizations

Response Codes for Expectations for Students

0=No emphasis (Not a performance goal for this topic)
1=Slight emphasis (less than 25% of time on this topic)
2=Moderate emphasis (25%-33% of time on this topic)
3=Sustained emphasis (more than 33% of time on this topic)

Systemic Research, Inc.
150 Kerry Place
Norwood, MA 02062
systemic.com

NOTICE

REPRODUCTION BASIS

☐ This document is covered by a signed "Reproduction Release (Blanket) form (on file within the ERIC system), encompassing all or classes of documents from its source organization and, therefore, does not require a "Specific Document" Release form.

☑ This document is Federally-funded, or carries its own permission to reproduce, or is otherwise in the public domain and, therefore, may be reproduced by ERIC without a signed Reproduction Release form (either "Specific Document" or "Blanket").