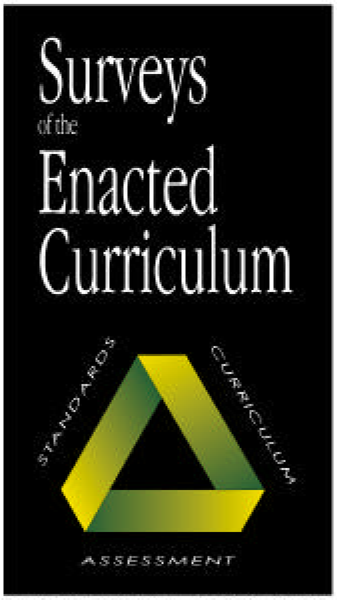

State Collaborative on Assessment and Student Standards

Data on Enacted Curriculum Study: Summary of Findings

Experimental Design Study of Effectiveness of DEC Professional Development Model in Urban Middle Schools

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Council of Chief State School Officers

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Experimental Design Study of Effectiveness of DEC Professional Development Model in Urban Middle Schools

Rolf K. Blank

DEC Project Team

2004

The research reported in the paper is based on results from a three-year longitudinal study supported by a grant from the National Science Foundation, Research on Learning in Education program, “Experimental Design for Improving Effectiveness of Instruction in Mathematics and Science through Use of Data on Enacted Curriculum” (REC #0087562). See www.SECsurvey.org/projects for design information.

The DEC Project Team included: Diana Nunnaley and Mark Kaufman, TERC; Andrew Porter, Vanderbilt University; John Smithson, Eric Osthoff, and Alissa Minor, Wisconsin Center for Education Research.

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ISBN 1-884037-94-1

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Introduction

Schools across the nation are working to adapt and improve curricula and teaching practices to meet the standards for learning established by states and school districts. In mathematics and science education, "standards-based reform" typically means that teachers must plan and implement their curriculum and teaching in relation to challenging content standards with high expectations for student knowledge and capacities. A major question for education decision makers is how best to assist teachers in improving their curriculum content and teaching practices, with the ultimate goal of improving student achievement.

The Council of Chief State School Officers (CCSSO) was awarded a three-year NSF grant in 2000 under the Research on Learning in Education Program (ROLE) to conduct an experimental design study to determine the effectiveness of a new model for professional development aimed toward improving the quality of instruction in math and science education. Wisconsin Center for Education Research (WCER) and TERC Regional Alliance for Science and Math partnered with CCSSO to provide study staff to carry out the project. The professional development model focused on developing teachers' skills to analyze and use in-depth data on the enacted curriculum (curriculum actually taught in classrooms), to identify weaknesses or gaps in their instruction in relation to state standards, and to revise teaching strategies and curriculum to meet the problems identified by the data. Data for a school's enacted curriculum in a specific subject is obtained through a comprehensive survey of all teachers assigned to teach math or science.

The purpose of the three-year CCSSO study was to design, implement, and test the effectiveness of the Data on Enacted Curriculum (DEC) model for improving math and science instruction. The model was tested by measuring its effects with a randomly selected sample of "treatment" schools at the middle grades level as compared to a control group of schools at the same level. The study focused on teachers of middle grades math and science in 5 urban districts with a total of 40 middle schools comprising the pool for random selection to groups. The enacted curriculum model drew on prior development of a Surveys of Enacted Curriculum (SEC) data collection instrument and method of analyzing and reporting data on instructional content and practices (Blank, Porter, & Smithson, 2001; Porter, Kirst, Osthoff, Smithson, & Schneider, 1993; Porter, 2002). Recent research studies on effective professional development in math and science informed the development of the DEC model (Loucks-Horsley, Hewson, Love, & Stiles, 1998; Cohen & Ball, 1999; Love, 2000; Garet, Birman, Porter, Desimone, & Herman, 1999). The intervention model used in this experimental design study was built upon four characteristics of effective professional development indicated by the research: (a) development activities focus on subject content and active learning strategies; (b) activities are coherent with the curriculum teachers use; (c) data are used to track continuous improvement and define follow-up steps; and (d) teacher development involves school-based collaboration and teacher networking aimed toward sharing improvement ideas, practices, and strategies.

Summary of Findings:
What Has Been Learned from the Experimental Design Study of the DEC Professional Development Model

The study findings summarized in this paper will inform education leaders and educators about the effectiveness of the DEC data-based model for evaluating and improving instruction. Readers can consider the use of the DEC model to help to focus and direct their professional development programs, especially the initiatives aimed toward improving quality of instruction in science and math. The study results also inform education researchers about the degree to which the effects of the model did have significant results on instruction as evaluated through the experimental design. The following findings from the study are described in this paper:

- How the enacted curriculum data-driven model for professional development was designed and implemented.
- Methods of effective collection and reporting of enacted curriculum data for use by educators.
- How enacted curriculum data on alignment of content of instruction are used to improve instruction.
- How school-level data on instructional practices in a subject are reported and used.
- How data on teacher preparation and teacher opinions/attitudes are used to initiate improvement activities.
- Effects of the DEC model on improving instruction over time.
- What was learned about local support and organization for implementing the DEC model.
- Lessons learned about conducting an experimental design study using randomized school-level trials.

The first portion of the paper outlines the study rationale, prior research, and study design. The main body of the paper provides a description of key study findings and highlights key data charts and tables of data demonstrating use of the DEC professional development model.

Study Rationale, Prior Research, and Design

A prominent theme of current approaches toward improving instruction is to train educators to analyze quantified data on their students' achievement, as measured by standardized assessments, and then to apply these data along with other measures toward improving instruction and student learning. Assuming that teachers do effectively use these data to identify problems in achievement for their students, how do they then move to analyzing their instruction in relation to the data on student achievement? This is the question driving the improvement model tested in this study.

Comparable, reliable data on the curriculum actually taught in classrooms (enacted curriculum) allows teachers to analyze their own instruction in relation to standards and in comparison to instruction among teachers within a school and in comparison to other schools. These kinds of analyses allow teachers to identify where the links between instruction and achievement can be strengthened.

Research Questions

The CCSSO project involved development, testing, and analysis of the effects of a new data-based professional development model designed to improve instruction through applying lessons from data analyses. The study tested the model across a range of schools at the same grade level serving comparable students. The following three research questions led to the study design initiated in 2000:

- What are the effects of the Data on Enacted Curriculum (DEC) model for professional development for teachers on improving the quality of instruction in middle grades math and science?
- What is the extent of variation in the content of classroom instruction and variation in instructional practices in middle grades math and science, based on teacher survey data?
- How is the DEC professional development model effectively implemented in large urban districts at the school level?

This paper describes the main findings of the study and summarizes what has been learned about how the DEC model for professional development can be implemented in schools and can assist educators in improving instruction in science and math. Lessons about the use of an experimental design with random assignment of treatment at the school level are discussed. Several other papers analyzing the research questions have been produced from this project and are referenced in this paper.

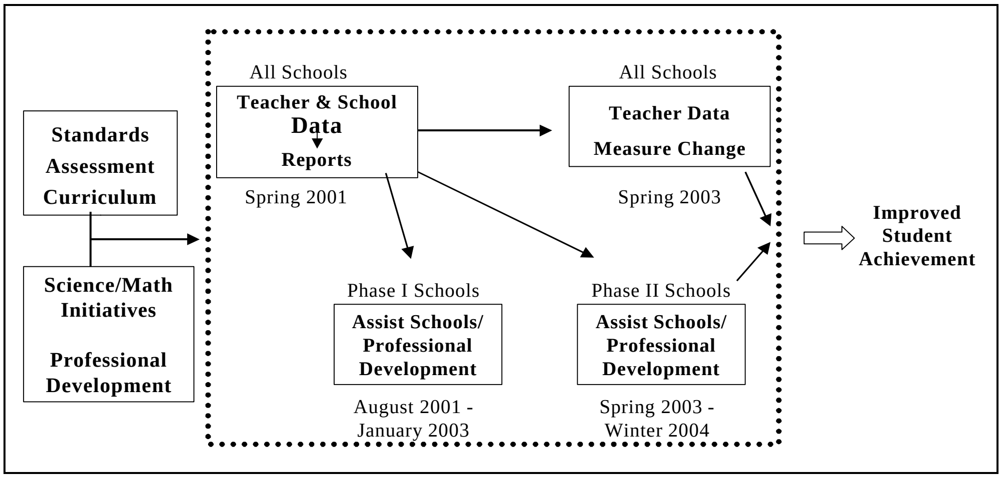
Design for the Study

CCSSO organized a study team which included professional development experts to lead the implementation of the DEC professional development model and outstanding education researchers to lead the evaluation of implementation and effects of the model in schools. The DEC model for improving instruction was implemented in five large urban districts: Charlotte-Mecklenburg, Chicago, Miami-Dade, Philadelphia, and Winston-Salem/Forsyth County. The study sample comprised 40 middle schools located in these districts. All of the math and science teachers in treatment middle schools were the target groups for the surveys and professional development model. An experimental design was used to measure the effects of the program model through comparing the degree of change in instruction in treatment schools to the change in control schools. The study design contained the following major steps:

- Select urban school districts and middle schools for the project, and orient district and school leaders to the project objectives and design.
- Collect baseline data (year 1) on instruction in math and science through in-depth surveys with all math and science teachers in study schools.
- Randomly select 10 schools per participating district into 2 groups for conducting the place-based experimental design: (a) treatment schools (schools/teachers receive DEC model technical assistance and professional development); and (b) control schools (comparable schools with no assistance).
- Provide professional development workshops and technical assistance to leadership teams and teachers in treatment schools on how to use enacted curriculum data (18 months).
- Conduct implementation research in study sites and validate self-report survey data.
- Carry out follow-up surveys (year 3) with science/math teachers in all schools.
- Analyze change in teaching practices and determine effects of model.
- Provide technical assistance and professional development to control schools.

The following flow chart illustrates the timing of key steps in the DEC project. The dotted line captures the key steps in the three-year time period of the study.

Chart 1
Flow Chart of Study Design



The project team was led by Rolf K. Blank, director of education indicators at CCSSO. The research and data analysis component of the study was led by Andrew Porter, Vanderbilt University, and John Smithson, Wisconsin Center for Education Research (WCER) at University of Wisconsin-Madison. The implementation of the DEC professional development model was led by Diana Nunnaley and Mark Kaufman of the Regional Alliance for Mathematics and Science Education at TERC.

Prior Research and Development: Three categories of studies support the design and testing of the study model

Surveys of Enacted Curriculum. The teacher survey instruments used in the study of the DEC model to analyze math and science instruction were previously developed and field-tested by CCSSO and WCER through a collaborative project with 11 states and 300 schools across the states. The instruments were designed by a committee of subject specialists and researchers. A portion of the survey items were based on previous studies—including Reform Up Close (Porter, et al., 1993), National Survey of Science and Math Education (Weiss, Banilower, McMahon, & Smith, 2001), TIMSS teacher questionnaire (NCES, 1996), NAEP background surveys, and state and national standards in science and math education.

The surveys are inclusive of content standards and curriculum currently in place across states, but the intent and design of the surveys aim toward collecting objective, reliable data on instructional practices and subject content regardless of the intended standards or curriculum for a school and its classrooms. That is, the survey items are designed to be neutral and comprehensive in order to gain an accurate picture of current instruction as reported by teachers. (For survey development process, see Blank, et al., 2001; Porter, 2002.) Surveys are administered anonymously and respondents are guaranteed the data will not be used for teacher or school accountability.

Survey topics. As a result of several stages of design, testing, and survey development work, the resulting Surveys of Enacted Curriculum (SEC) for mathematics and science were ready for application in the present study to provide reliable, comparable data based on teacher responses concerning instructional content and practices in math and science instruction. Additionally, the survey items on teacher background, class characteristics, and schools conditions provide the capacity for multivariate analyses to explain differences in instruction. The SEC instruments produce the following categories of data:

- Subject content of instruction (topic by expectations by time)
- Classroom instructional practices (general and specific practices by time)
- Teacher course preparation, recent professional development, demographics
- Teacher beliefs and opinions regarding teaching and school conditions
- Class characteristics

With the survey data, any specific set of state standards or assessments, or local curriculum, can be analyzed in relation to the enacted curriculum as reported by teachers. The survey tool serves as an independent, common reference point for analyzing data across schools, districts, and states. (See www.SECsurvey.org for further description of survey development.)

The teacher survey instruments for middle grades math and science were used in year 1 of the DEC study to establish baseline data on teaching practices and instruction in the 40 schools selected for the study. These schools were randomly selected for treatment and control groups after initial data collection. Enacted curriculum data were reported to the treatment group schools in year 1, and school teams used these data as the basis for professional development based on analysis of instruction across classrooms and schools (see DEC professional development model, following). In year 3 of the study, surveys were repeated with teachers in treatment and control schools in order to measure the extent of change in instruction.

Research on effective models for professional development. Educational standards and systemic approaches to reform have emerged in the past decade as favored policy tools for promoting "world-class" public education for all students. In mathematics and science education, *standards-based reform* typically means teachers must plan and implement their curriculum and teaching practices in accordance with state or district content standards (Leonard, Penick, & Douglas, 2002). A primary reason for the importance of professional development with current veteran teachers is that standards-based education requires teachers to have abilities to both communicate basic knowledge as well as develop advanced thinking and problem-solving skills among all students (Loucks-Horsley, et al., 1998; Birman, Desimone, Garet, & Porter, 2000). Standards-based instruction expands the expected behaviors and methods of teaching that are needed (National Research Council, 1995).

A professional consensus has emerged suggesting that particular characteristics of professional development can make it "high quality" or effective in improving teaching and increasing student achievement (Garet, et al., 1999; Hiebert, 1999; Loucks-Horsley, et al., 1998; Kennedy, 1998; Desimone, Porter, Garet, Yoon, & Birman, 2002; Corcoran & Foley, 2003; Supovitz, 2002). The research-based characteristics include the following program design elements:

- Active learning opportunities for teachers, responsive to how teachers learn and take leadership roles.
- Extended duration, sustained over time.
- Focus on content, high standards, and how students learn the content.
- Collective participation of groups of teachers from the same school or department.

A key step in the process of moving toward standards-based instruction is evaluating the quality of science and math instruction across classrooms to determine what changes and improvements need to be made. To provide effective formative evaluation designed to improve quality of curriculum and instruction requires reliable, comparable data that allows educators to determine the degree of consistency in the curriculum being taught, and then to identify the sources of variation in the enacted curriculum, the subject content, and classroom practices (Blank, 2002; Porter, 2002).

The DEC professional development model is designed to assist school leadership teams and teachers to use quantified survey data to identify the subject areas which have a high degree of variation in instruction and low student achievement, and then to implement a process of using data to focus discussions of leaders and teachers specifically on what is needed to improve instruction in these areas (CCSSO, 2002a). The DEC data-driven approach to designing professional development is based on research documenting the characteristics of schools and learning communities which use effective strategies for improving student achievement (Schmocker, 2002; Fullan, 2000; Love, 2000; Wellman & Garmston, 1999). The Standards for Student Evaluation emphasize the important purpose for student assessment data of providing appropriate and timely feedback to teachers for improving teaching and learning (Joint Committee, 2003). The general approach underlying the DEC professional development model is for teachers to gain knowledge through use of data:

> …To support those leading mathematics and science education reform at the school or district level so that teachers can become inquirers into how to best improve student learning. (Love, 2000)

Enacted Curriculum Data in the Professional Development Model

Underlying the efforts to develop an effective, reliable method of collecting, reporting, and using data on the enacted curriculum is the proposition that useful analysis of student achievement results—the usual target of data-driven improvement—needs also to incorporate education inputs and processes (Porter & Smithson, 2001; Martin, Blank, & Smithson, 1996; Blank, 2002).

Education outputs (i.e., assessed measures of student achievement) are mediated and influenced by a variety of inputs to and processes in the delivery of instruction. Any useful analysis of the performance of our schools requires information pertaining to all three factors—inputs, processes, and outputs.

Education inputs cover factors such as teacher characteristics (e.g., educational background, preparation in teaching field, years of experience); student characteristics (e.g., prior achievement, attitudes toward school); classroom resources and equipment; school characteristics (e.g., school climate and safety, instructional leadership); and parental involvement. Other input variables include student racial/ethnic heritage, socioeconomic background, and geographic location (urban vs. suburban vs. rural).

The ***education processes*** and activities which actually occur in the classroom (i.e., the enacted curriculum) have the most immediate impact on student achievement. Indicators of these processes provide a description of the enacted curriculum and are central to any analysis of the opportunity to learn. Data on enacted curriculum provide information on what influences the curriculum taught by teachers, the instructional practices and cognitive activities in which students engage, materials and equipment used in classrooms, classroom organization and roles of students, subject content of assignments students receive, and methods of assessment used to measure learning.

Given these assumptions about the role that data can have in assisting educators, the DEC model for professional development focuses on three applications of the data on enacted curriculum:

1. Description of current curriculum and classroom practices.
2. Analysis of differences within and across schools.
3. Diagnosis of reasons for variation and gaps in subject content and practices.

Descriptions of the enacted curriculum make it possible to assess the effects of policy on practice and provide an opportunity for school-based conversations about curricular goals and practices. Knowing the degree to which goals are or are not being met, and having some theories as to why, makes fine-tuning and corrective measures possible.

Summary Findings from the Study

The findings from the experimental design study of the DEC model are summarized in *eight main points.* The summaries are intended to inform education leaders and researchers about the effectiveness of the model for evaluating and improving instruction.

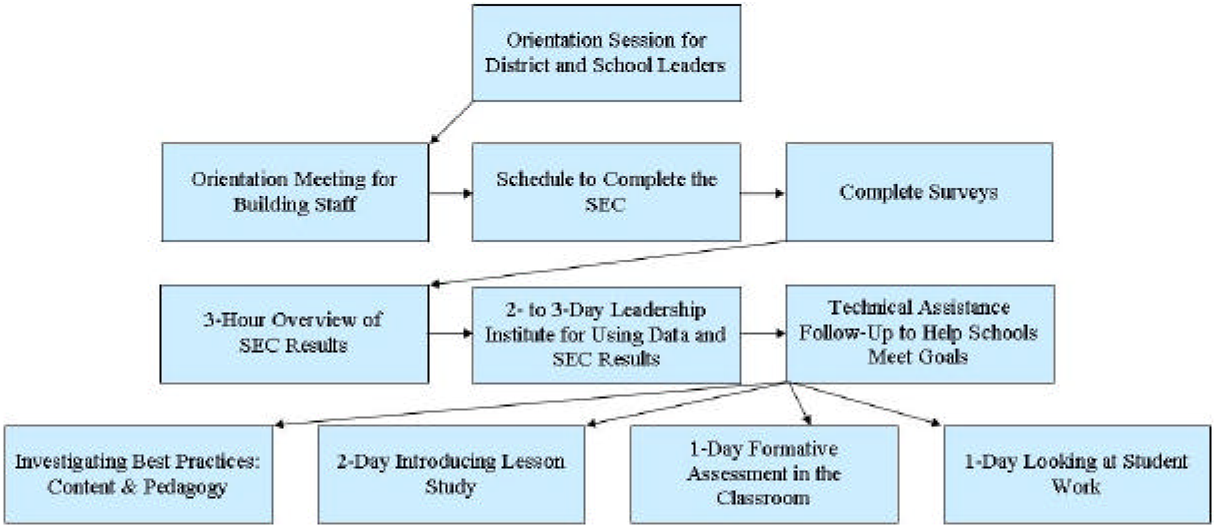
Finding 1: Development and Implementation of the Enacted Curriculum Model for Professional Development

In year 1 of the study, CCSSO project staff undertook three major steps to begin the study. First, following district and school introductory orientation to the project, baseline surveys were conducted with math and science teachers and school administrators in middle schools within the target districts.

Second, the project staff provided details about the organization and design of the DEC model for using quantified school-level curriculum data to improve instruction by use of an inquiry-based approach to learning and improvement.

Third, the project staff began implementing the model by working with school leadership teams through centrally located workshop sessions and school-based, on-site technical assistance.

Chart 2
DEC Professional Development Model to Help Schools to Reach Improvement Goals



Developing Data Skills of Educators in Year 1. The DEC project plan for implementation of professional development and technical assistance in the target middle schools recognized that few teachers, or administrators, had been involved in a professional development process for analyzing data. The project sought to introduce key ideas and train staff in applying strategies for working collaboratively within a group of professionals and to begin to ask tough questions about which students were or were not learning, what content was being learned, and why some students were not learning. Second, and of equal importance, professional development workshops modeled best practices in teaching and provided resources and support which enabled participants to engage their own colleagues. The DEC model was presented to the district staff and school teams in five participating districts and set forth three specific goals for the work with math and science leadership teams and subsequent development with teachers:

- Learn to use rich, in-depth data to inform decisions about curriculum practice, assessment, organization, and materials.
- Gain skills in collecting, analyzing, and displaying data, working collaboratively, and organizing data-driven dialogue.
- Learn how to set measurable student learning goals, develop data-driven local improvement plans, and sustain process.

In other data-driven school improvement initiatives, such as the Charlotte-Mecklenburg district approach to analyzing North Carolina “end of grade” test scores, school groups have undertaken the challenge of learning skills for working with student achievement data. However, the DEC approach to using instructional and curriculum data is new, and few schools or districts had the advantage of previously adding to their analyses the kinds of data generated when an entire mathematics or science department completes the Surveys of Enacted Curriculum.

District and School Responsibilities and Commitments

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

- Regularly scheduled meeting times for school leadership teams, and time commitment for teachers to work on applying the model.
- Decision-making support for next steps in schools.
- Inclusion of DEC model into school and district professional development.
- Access to school data including state assessment results.
- Focus on measurable results.

Table 1
DEC Professional Development Model Time-Activity Outline

Year 1:	Mar–Apr 2001	Orientation of district and school leaders; teachers complete baseline SEC
	Aug–Sep 2001	Introductory PD workshop for leader teams (two days); develop data skills and begin data inquiry
	Oct–Nov 2001	Technical assistance in schools to introduce model to teachers (leader half-day session each school)
Year 2:	Jan–Feb 2002	PD workshop #2 (one day): Use of content data and instructional practices data
	Feb–Apr 2002	Technical assistance in schools to set school targets for improvement based on data analysis
	May 2002	PD workshop #3 (one day): Analyzing student work and comparing instructional strategies
	Sep–Oct 2002	Technical assistance in schools; work with teachers to apply data to instruction
	Nov–Dec 2002	Evaluate progress toward improvement objectives; re-focus efforts within schools
Year 3:	Jan–Mar 2003	Teachers continue work in teams and application of data lessons
	Apr 2003	Complete follow-up surveys with teachers

Each school selected and organized a leadership team for the DEC model with five to seven members representing the following kinds of school staff: principals/assistant principals, math/science team leaders or department heads, math/science teachers, data specialists (school staff working with data).

Initial workshop training was geared for the leadership teams and focused on developing data skills and inquiry approaches with data. The training provided leaders with a design and sequence of activities for working with teachers to bring the model into schools. (For full explanation and detail on the DEC model design, see Nunnaley, *Using Data on Enacted Curriculum,* 2003.)

What Was Learned about Developing and Implementing the DEC Model—District Level

In this study, the DEC model was implemented and tested in five large urban districts. The study design included research on the implementation process based on data from observations, interviews, staff feedback, and administrator surveys. The results of the implementation analysis across the five districts produced several central findings regarding effective implementation of the DEC model—particularly how the district level actions affected model effectiveness. (The findings are described in detail in CCSSO, Year 2 Progress Report, 2002b.)

1) District Leadership and Support for the DEC Model

All five districts indicated strong interest in the DEC model at the district leadership level. CCSSO provided information about the newly funded study to states and large districts. The five selected districts were similar in expressing commitment to standards-based improvement of math and science education as well as to the use of data with schools and teachers to lead improvement. Four of the five districts had received Urban Systemic Program grants from NSF.

Written information and materials were provided by CCSSO outlining the study design, model for assisting schools, district responsibilities, selection of schools, and role of project staff in working with schools. The same on-site presentations were made by the CCSSO project staff to district administrators and school principals at the outset of the project. CCSSO project staff worked to maintain a consistent approach to soliciting district leadership and requesting support for the DEC model, especially in gaining school-level commitment to the model. Two main factors varied in district-level leadership related to the DEC model: communication of support to target schools, and change in district priorities for programs.

Districts varied in giving clear support for the project to target schools. In each district, a district contact person was assigned to serve as liaison between the DEC model and the target schools. In one district, strong support for the model from top leadership provided a consistent message to selected schools that the DEC model was a priority for math and science improvement, and the district administrators provided consistent leadership. For example, district staff provided early and regular communications to principals in the target schools encouraging use of professional development time, scheduling sessions with CCSSO project staff, and advocating broad teacher involvement. Conversely, in another district, district contacts for the project did not have authority to contact schools directly, and communications of support and facilitating arrangements were indirect. In a third district, the primary district administrator for math and science went on leave in year 2, and, as a result, initial positive contacts with schools were not sustained and district-level leadership and support for the model declined.

District leadership change resulted in new program priorities. In two districts, top-level leadership change in the district resulted in declining interest and time for the DEC professional development model. In one district, a state takeover of district governance prevented math and science staff from having a direct role in communicating with schools and providing support for the model with schools. In another district, change in superintendents in year 2 and district-wide change to a choice model for student assignment severely reduced the district role in supporting the model.

When district leadership and support for CCSSO project staff was less clear, interactions and involvement from school leaders were more problematic—that is, more time was required by CCSSO project staff for arranging technical assistance and professional development workshops, and less school-wide support was given to the model.

2) Integration of DEC Model with District Program for Professional Development

In two of the project districts, the data-driven DEC model for improving math and science was highly consistent and coordinated with the districts' own math-science improvement initiatives and their organization structures for assisting schools and teachers. For example, in Miami, the math and science district-level staff were funded and organized to work directly with middle schools. The DEC model became integrated into the district's own school-based approach to assisting middle schools and emphasis on improving skills of all teachers. In Winston-Salem, the DEC model was strongly advocated by district specialists also responsible for an NSF grant, because the model provided important data for formative evaluation and analysis of instruction with standards; in this case, the role of the district staff greatly facilitated the work of the CCSSO staff with school leadership and promoted teacher participation in activities.

In a third district, professional development was largely controlled by principals, and the district math/science specialists did not operate through a school-based model or have direct contact with school leadership. This structure did not facilitate scheduling and interaction with schools for the DEC project staff. In a fourth district, in year 2, a program priority was set for all schools to improve student performance in reading, resulting in schools devoting more professional development time on this subject and decreasing focus on use of the DEC model.

3) Improving Planning and Implementation in Partnership with Districts

From the results of the study, CCSSO identified several steps for improving implementation of the DEC model at the district level. One step is to plan with the district leaders for how the DEC professional development can be integrated into existing professional development. Although this goal was verbally presented to districts and schools, CCSSO staff leaders have identified several actions which could have been taken to improve the integration process.

For example, staff observed that each district had a planned set of school- or district-level activities for analyzing and applying results from state or district achievement tests. This kind of activity could provide an opportunity for demonstrating links between enacted curriculum data and student achievement data. Then, both sets of data could be enriched by comparisons and implications for instruction.

In each district, the DEC professional development model plan and 18-month schedule should be delivered to district and school leaders at the outset of the project, and a formal agreement should be signed affirming that the plan will be followed. To help to ensure consistent implementation of the plan, a local DEC advisory panel should be selected and used.

DEC is built on a school-based approach to improving instruction, which includes formative evaluation of practice through data, developing common instructional practices, analyzing data, and building a learning community among staff. The time requirements are organized differently from traditional professional development workshops or activities. These differences and assumptions behind the model should be clarified and presented to district leaders at the outset and refreshed during the project.

A trained district-level team responsible for DEC model follow-up and assistance to schools would greatly increase the probability of integration of the model with local professional development programs and schedules. In planning with district leaders, staff time and involvement should be planned as to provide a small district team to work at least part time in carrying out the model—meeting with school teams to analyze curriculum data, convening follow-up sessions in the schools, helping to identify additional resources or training, and providing in-school technical assistance. The result would be improved integration of the project. CCSSO project staff would provide training to the district team as the work with schools is initiated and would provide continuing support thereafter.

Finding 2: How SEC Data Were Collected and Reported to Target Schools

In spring of year 1 of the study, CCSSO project staff conducted orientation visits to each school where they outlined the rationale for the study, presented a schedule for key steps in the project, and reviewed the procedures for administration of the Surveys of Enacted Curriculum (SEC). Orientation focused on ensuring confidentiality and use for school improvement (not for individual accountability), how to organize group administration in the school to increase response rates and decrease turnaround time, and how data will be presented and used to assist schools.

Survey data collection for the baseline teacher SEC was conducted in spring 2001 (4 districts, 40 schools). Due to attrition of schools from the study in year 1, 10 additional schools joined the study in fall 2002, and additional teacher surveys were administered.

Response rates. The overall survey response rate in the baseline teacher SEC in year 1 was more than 75 percent. The rate did vary widely by school across the 40 sample schools from more than 90 percent down to 50 percent. A total of 604 teacher surveys were completed for the baseline survey.

At the end of the treatment phase of the project, the follow-up SEC was conducted in all study schools (treatment and control), and a total of 439 surveys were completed by teachers, yielding a response rate for the year 3 follow-up survey of 55 percent. (See appendix A for Descriptive Data on the survey sample.)

Table 2
Teacher Surveys of Enacted Curriculum Completed, District by Subject

District	**Year 1**			**Year 3**		
	Math	Sci	Total	Math	Sci	Total
Charlotte-Mecklenburg	50	49	99	50	19	69
Chicago	28	27	55	17	11	28
Miami-Dade	114	105	219	83	88	171
Philadelphia	34	31	65	24	17	41
Winston-Salem / Forsyth County	71	65	136	69	61	130
Total	319	285	604	243	196	439

Steps to increase survey responses. The SEC instruments are extensive and require significant effort for completion by teachers. Typically teachers require 60 to 90 minutes to complete the entire survey. Given the complexity of the survey tools, the response rates for this study are quite good, but they require effort to achieve. The following specific methods of increasing response rates were developed in the DEC project:

- Administrator and teacher orientation to explain the purpose of the surveys.

- Group administration led by principals or district staff.
- Cash or gift certificates for teacher survey completion participation.
- Professional development credits.
- Dinner or lunch provided at the survey administration site (e.g., hotel).
- Follow-up reminders or scheduling through local district or school coordinators.

For DEC project staff, encouraging the district coordinator to play a strong role was a key step. In the fifth district, Winston-Salem, which was added to the study in 2002, the district coordinator and his math/science staff went to each target middle school to administer the survey. The district staff allocated time on the school staff schedule—typically after school—and obtained full survey participation in each school.

Preparing data charts. All completed teacher survey data were entered into a central database for producing pre-designed data graphs and charts to be used in professional development workshops with the schools in the treatment sample. The complete SEC dataset from teacher responses in year 1 (treatment and control schools) formed the baseline data for evaluation of effects of the model on improving instruction. Each treatment school received a customized school-based report within three months after initial administration of the teacher surveys. The reports contain more than 150 pages of school-specific data organized into charts covering 20 categories of survey results, including instructional practices, content of instruction, class characteristics, teacher preparation, teacher attitudes, and school conditions. (Appendix B includes a list of charts used with target schools, and description of summary scales). To view a set of charts for a school, go to www.SECsurvey.org/tools.) Each category of charts was disaggregated with grouping variables:

1. Grade level
2. Class achievement level
3. Class size
4. Percent minority
5. Percent female
6. Percent limited English
7. Teacher professional development

Interpreting Data Charts

The SEC survey results are reported and analyzed using three formats: item profiles, summary scales, and content maps and graphs.

Item Profiles present data from individual survey questions, grouped by topic and item format (see chart 4-1). The data are shown in horizontal bar graphs. The mean is indicated by a solid vertical line, and the shaded bar represents responses that are one standard deviation above the mean and one standard deviation below the mean. Generally, the responses at the mean and within the bar represent about two-thirds of all responses to a question. The number of teacher responses per group (e.g., middle, elementary) is reported in parentheses.

Summary Scale is an average score for a group of five to eight questions in the survey centered on a specific concept underlying curriculum or instruction, e.g., active learning in science (see chart 4-2). Scales are formed by purposeful selection of items and statistical analysis of responses to determine scale reliability (e.g., .81 for communicating math understanding). The selected scale items typically cut across different sections of the survey, and items may have different kinds of responses. The scale measures are "standardized scores," meaning the average score for the scale for the whole group of teachers is set equal to 0, and the standard deviation (a measure of variation in responses) for the whole group is 1. Scale score differences would mean that subgroups of teachers (e.g., middle, elementary) differ on the concept being measured.

***Content Maps and Graphs*.** Teachers report time spent on subject content during the year using a content matrix covering topics and expectations for learning. Responses of teachers are aggregated by grade level and reported with either (a) a content mapping program (available in MSExcel), which gives a three-dimensional picture of variation in time across the whole curriculum (see chart 3-1 and appendix C, Interpreting a Content Map); or (b) a bar graph format, which shows average percent of time by topic and expectation (see chart 3-6).

The core reporting topics for SEC data charts and decisions on disaggregation categories were completed in the survey development project in 2001 (Blank, et al., 2001). The data are reported to schools in three types of charts—item profiles, summary scales, and content maps and graphs.

Scales and item profiles are used to report on instructional practices and teacher characteristics and attitudes. Content maps and graphs are used to report data on content of instruction as well as degree of alignment between instruction and standards and assessment. (See appendix C for a description of SEC alignment procedures; see appendix D for a guide to interpreting content maps.)

While the full set of school data results tended to provide more information than schools required for their individual needs, the broad range of data collected ensured that all schools were able to find relevant data within their school report which addressed particular areas of concern or interest. The training provided to school leadership teams made use of these data as a starting point for conversations and activities by the teams during workshops and technical assistance visits.

Finding 3: How Data on Alignment of Curriculum Content Are Used to Improve Practice

A school receives its SEC data report several weeks after the surveys are completed by teachers. The complete report for instruction in math, or science, consists of 25 selected topics from the survey sections on instructional practices in the subject, content of instruction, and teacher preparation and attitudes. The data for each topic are disaggregated by selected student, class, and teacher characteristics, and school level data are reported together with district level data.

With the alignment content maps and statistics, educators can examine critical differences in content of instruction within a school or across schools in a district. Especially pertinent to No Child Left Behind and the requirement for identifying "schools in need of improvement," the alignment model provides a method for identifying discrepancies between curriculum being taught and the content in standards and assessments used by a state. The curriculum and instructional analysis can also be linked to analysis of student achievement results to help teachers begin to identify explanations for low performance based on the curriculum. The data do not analyze quality of instruction but do clearly demonstrate differences across schools, class and student characteristics, and teacher background and preparation. The analysis also helps educators to identify areas of the standards which are not being taught, or are taught with only limited time or emphasis, and which expectations for learning expressed in standards or assessments are not being included in the curriculum.

The alignment maps, graphs, and other data reporting charts were designed by the CCSSO and WCER study team to provide the same variables for disaggregation across all charts and to provide comparison of instruction in a school with district and state standards. The series of decisions which led to a common reporting format and initial set of topics and methods for reporting and disaggregating data were made through advice of a survey development and reporting committee (during the 1998–2001 development process). In reporting data, each district selected the specific types of data disaggregations and comparisons that were desired to match the local plans for using data. (See appendix D for illustrative alignment content maps displaying state standards for each DEC study district in comparison with district-level teacher survey data results for content of instruction in math and science.)

Reporting Math Instruction Aligned with Math Standards

Instructional data in the SEC content charts are reported using a matrix format based on a two-dimensional view of content—i.e., content topics and expectations for student learning. (To review the survey instruments, go to www.SECsurvey.org/tools.)

- ***Main topics in middle grades math:*** Number/operations, measurement, algebraic concepts, geometry, data/statistics/probability
- ***Expectations for learning:*** Memorize/recall, perform procedures, demonstrate understanding, conjecture/proof, solve non-routine problems

In the SEC data collection phase, all teachers reported on the percent of time the target class spent on instruction over the course of an academic year. Chart 3-1, for example, displays the amount of time grades 6 through 8 teachers in Miami study schools spent teaching math by topic and, for those topics taught, the degree of emphasis on different expectations for learning. The contour map allows educators to quickly learn which topics and expectations were emphasized in instruction, and the degree to which the instruction varied by main topics (number, measurement, algebra, geometry, etc.).

In addition, teachers can compare their instruction in the district with the standards defined by the state, both by topic and by expectations for learning. This level of "alignment analysis" using visual comparison of content of instruction does not require statistical analysis, which is very conducive for use by a variety of audiences and users. However, the alignment analysis process includes an overall statistic of degree of alignment, or "alignment index," which varies from 0 to 1 (Porter & Smithson, 2002). For example, the following is based on the year 1 survey results and coding of the Florida state standards:

> *Alignment index for grade 6 math (treatment schools):*
> Degree of alignment between instruction and Florida state standards, grade 6 = .19 (scale from 0 to 1).

Professional development for educators with the DEC model began with training in data skills including how to analyze and apply the enacted curriculum data charts and how to interpret differences in the color contour maps and bar graphs signifying high and low emphases of instruction across a school or district. The school team began the analysis process with one chart, using their experience of completing the survey and their existing knowledge of instruction in the school.

Three-step process. Educators were asked to go through a three-step process—*predict, observe/analyze, and interpret*. Teachers were asked first to predict what they will see in the degree of consistency, or alignment, between math instruction and district and state standards (for example Florida middle math standards). In step two, educators looked at the charts for math instruction and standards for their district and state. Educators worked together in teams to share what they saw—which topics and expectations had high emphases of time and how consistent they were with the standards. For example, chart 3-1 shows real data from Miami study schools. Miami math educators could see that instruction in grades 6 through 8 strongly emphasized number sense (where the green chart colors represent higher time commitments), while the Florida standards emphasized number sense, measurement, and data analysis for grade 6 instruction.

School level. In step three, educators refered to a chart which analyzed the content in their school, such as charts 3-2.1 and 3-2.2, which compare math instruction in two schools, Richmond and Homestead, grades 6 through 8, with further comparison to Florida standards. Teachers compared and contrasted instructional content in their school with another school and the average for the district in comparison with standards. Thus, teachers could begin to analyze their school's instruction as compared to the overall district average instruction and compared to state standards, which provide broad goals for learning. Teachers also could compare instructional content from the survey to content in a district curriculum guide, if available. In the Homestead-Richmond example, the results show that Homestead teachers placed greater emphasis on all five expectations for student learning than did Richmond teachers.

Drill down by topic. Another approach to using the data is to "drill down" to look at instruction on specific topics in the curriculum. Chart 3-3 displays Miami middle grades math instruction on number sense. This topic typically receives a high degree of emphasis in the early elementary grades, and given the demand on time for the middle grades math curriculum, a useful analysis can be made on the question of how much time is spent in grades 6 through 8 on number sense. (Critiques of U.S. math curriculum focus on excessive repetition of topics across the grades.)

In chart 3-3, the specific instructional topics are disaggregated in detail at the subtopic level, which is the level at which teachers reported the data. Subtopics are useful for educator team analysis because they likely correspond to the organization of the teacher's lesson plans and course outlines. The results show that Miami teachers emphasized numbers related to operations in all three of the middle grades, while the Florida standards placed emphasis on patterns, exponents, factors, and estimation.

Grade by grade. A next step school teams took in using the enacted curriculum alignment data was to consider the *vertical alignment* of instruction by grade, sometimes called *curriculum articulation*. For example, in the Homestead school data example from year 1, shown in charts 3-4.1 and 3-4.2, the teachers looked at the degree to which time spent on instruction in grade 6 is then repeated in the same pattern across topics in grades 7 and 8. Note that grade 8 instruction continued to have a high percent of time on number sense and little time on algebra or geometry. Teachers and administrators can use these data to dig deeper by comparing instruction for specific classes and by asking their school instructional staff several questions:

- Is the vertical alignment pattern from grade to grade present with only certain classes, or is it a problem across a school or district?
- What are reasons for topics being repeated from one year to the next? For example, are teachers responding to poor student performance? Or, are they responding to a large number of students entering from other schools (who are not well prepared)?
- Are books and materials vertically aligned?
- Is the instruction by grade consistent with state standards by grade?

Instructional content data in relation to assessments. Another way to view the survey data reported by schools is to compare data on instruction with the content being tested in state assessments. Charts 3-5.1 and 3-5.2 display data for two Miami middle schools in comparison to the content on the Florida Comprehensive Assessment Test (FCAT) in mathematics for grade 8.

The FCAT was content-coded using the SEC coding procedures. (See Appendix C for procedures; Porter & Smithson, 2002.) Three points can be highlighted:

- The instructional content maps for both schools show high consistency in topics taught in middle grades math with the topics on FCAT, grade 8. As discussed above for chart 3-1, time on instruction is concentrated heavily on number sense/properties, with much less time allocated to topics of measurement, algebra, geometry, and data/analysis.
- The expectations for math instruction by Miami teachers are inclusive of all five types of expectations, while the FCAT assessments focus almost solely on the expectation of perform procedures.
- The correlation of alignment of grade 8 math instruction and the FCAT math assessment = .22 (school average; 0 to 1 scale).

Educators in the Miami schools in the DEC project used these findings to improve their instructional strategies and curriculum design and cited the data in planning professional development.

Histogram method of reporting. Charts 3-6.1 and 3-6.2 present a second method of displaying and reporting the SEC instructional content data for two schools through a more traditional histogram. As opposed to the three-dimensional contour map format, the histogram display of data provides further details about the differences in instruction across topics and expectations. One advantage of the histogram is the capacity for comparing the row or column percentages at the margins, such as total percent of class time on number sense (row one), or percent of time on perform procedures (column two). These sums allow educators to compare the total allocation of time by topic. By comparison, the contour maps display the whole picture of the curriculum, particularly the intersection of topics and expectations for learning.

Schools Chose a Target Content Area or Expectation to Improve

A key step in the DEC model for improving instruction is selection of a specific set of priorities for improving instruction based on initial analysis of the data. The school leadership teams selected targets for focusing on content areas needing improvement, generally during the first or second DEC professional development workshop. In the DEC project, 18 of the 20 treatment middle schools did identify one or two specific areas of math or science content or instruction to be the focus of a school, department, or grade-level team. Schools identifying content topics typically also identified a subgroup of students (e.g., African American females, students below proficiency). Content targets also were associated with goals focused on expectations for learning (i.e., higher-level thinking skills, problem solving, applications).

Table 3
Example Improvement Targets (Defined Year 1):
Three Treatment Schools, Miami-Dade

School	Target for Improvement
School #87	▪ Measurement, algebraic thinking ▪ Nature of science ▪ Analyzing information ▪ Hands-on learning / active learning
School #810	▪ Measurement, geometry, measurement in science ▪ Analyzing curriculum alignment to FL state assessment for skills needed and coherence across the grades ▪ What is taught compared to what is learned ▪ Student-centered learning goals; student understanding of student scores; students working cooperatively
School #85	▪ Seek three-percent improvement in bottom quartile students ▪ Improve student achievement ▪ Scientific thinking ▪ Measurement, graphing ▪ Spatial sense

Case Study: How DEC Model Was Used to Improve Math Instruction

Diana Nunnaley, professional development director for the DEC project, has written a more detailed description of how one school in the Miami-Dade school district used the DEC professional development model as the core strategy for improving instruction in mathematics. This case example shows how the DEC process of using curriculum data worked well to intersect with the district and school priorities for building a learning community and focusing on data as a vehicle for change. (See "Test Scores: What Can They Tell Us?" from *Hands-0n,* TERC, June 2004, at http://www.ccsso.org/projects/Surveys_of_Enacted_Curriculum/Products/.)

Case Study: Use of Data to Improve Science Instruction in Winston-Salem Schools

A second case description of how schools used SEC data to analyze science instruction was provided in a recent article in *Science Teacher*. The article presents a summary of how schools in one district applied their science instructional content data. (See Blank & Hill, January 2004, at http://www.SECsurvey.org/products.)

Chart 3-1
Mathematics Curriculum Content
Miami - Dade Public Schools
Instruction / Assessment

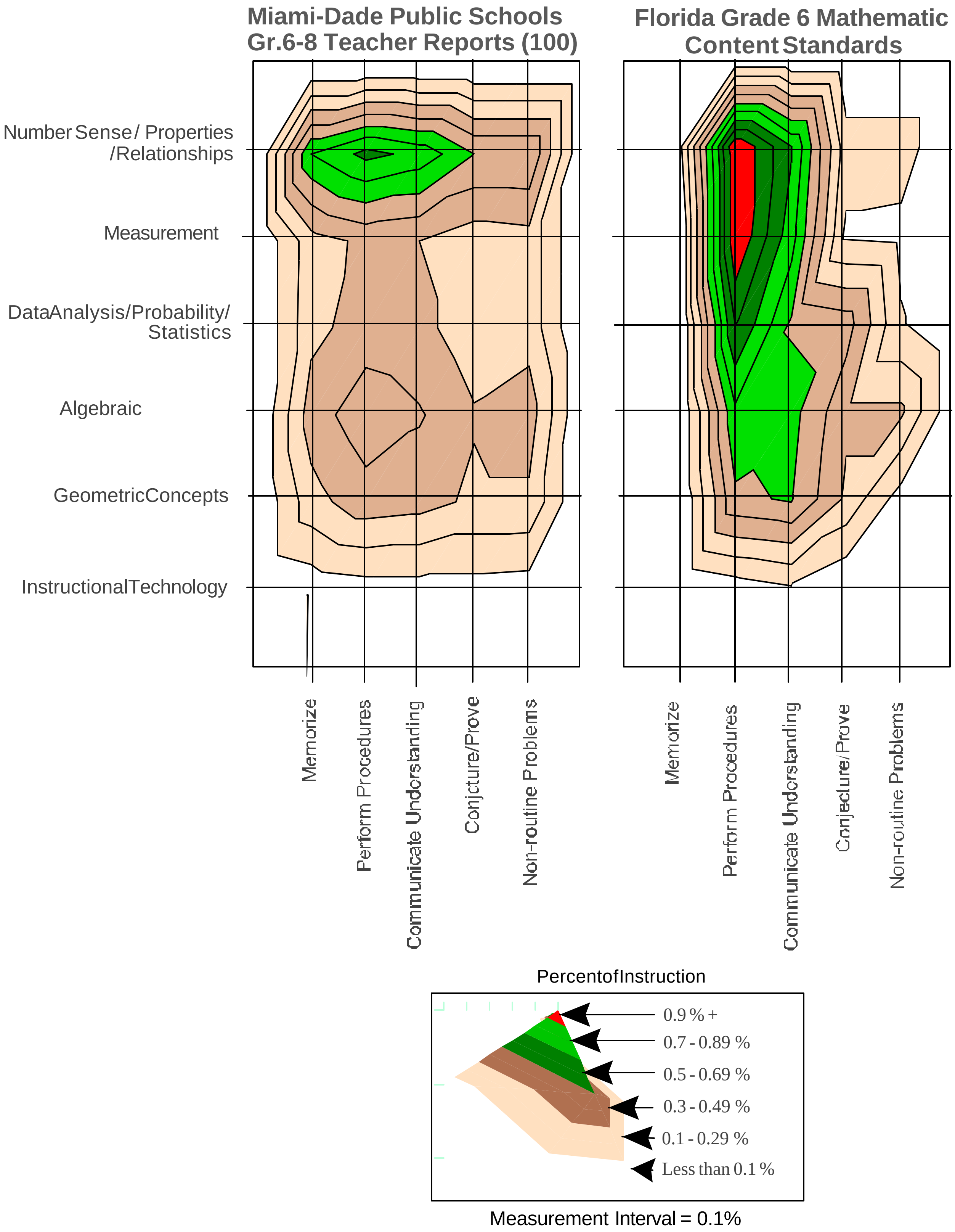


Chart 3-2.1

Mathematics Curriculum Content
Miami-Dade Public Schools
Instruction / Standards

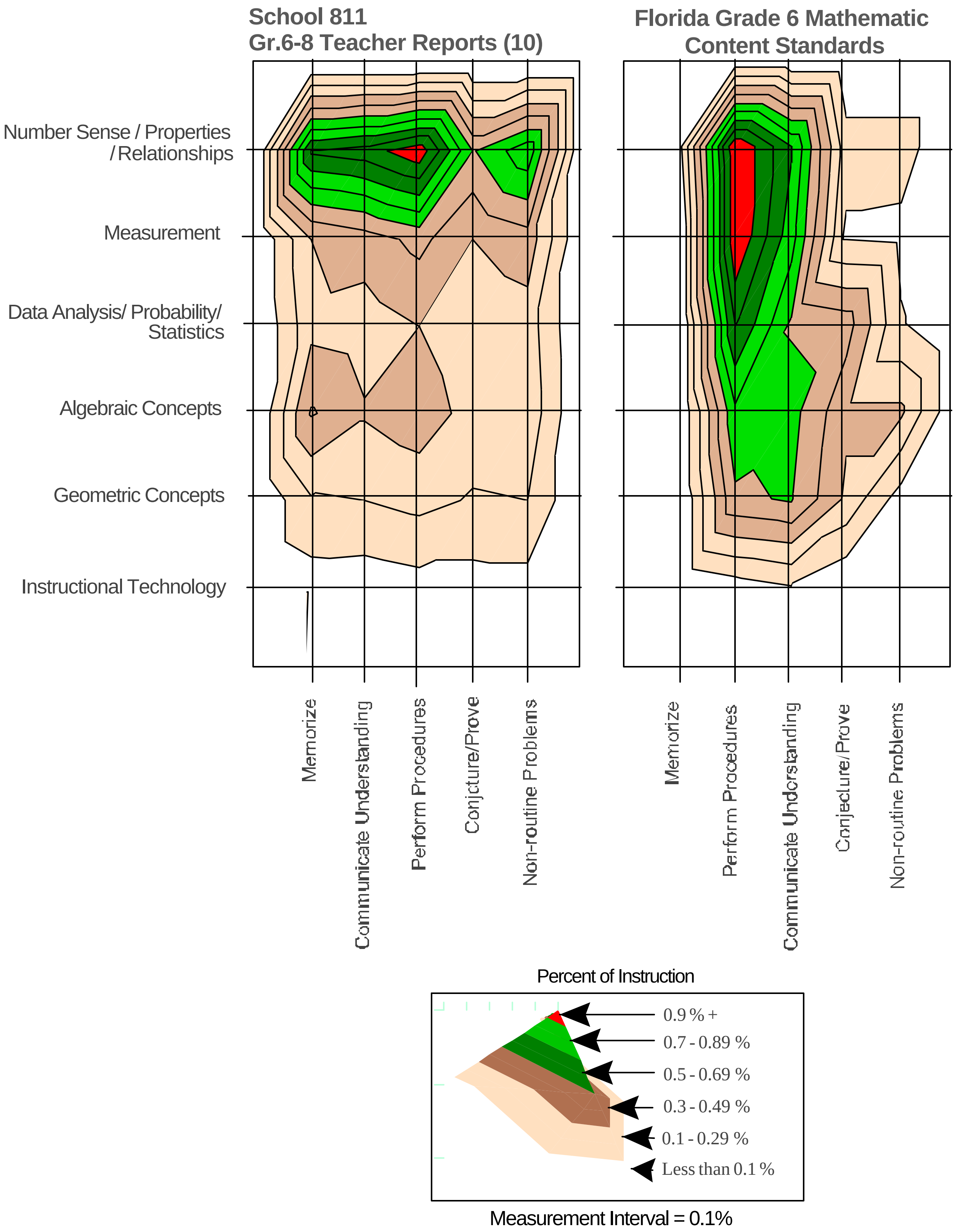


Chart 3-2.2
Mathematics Curriculum Content
Miami-Dade Public Schools
Instruction / Standards

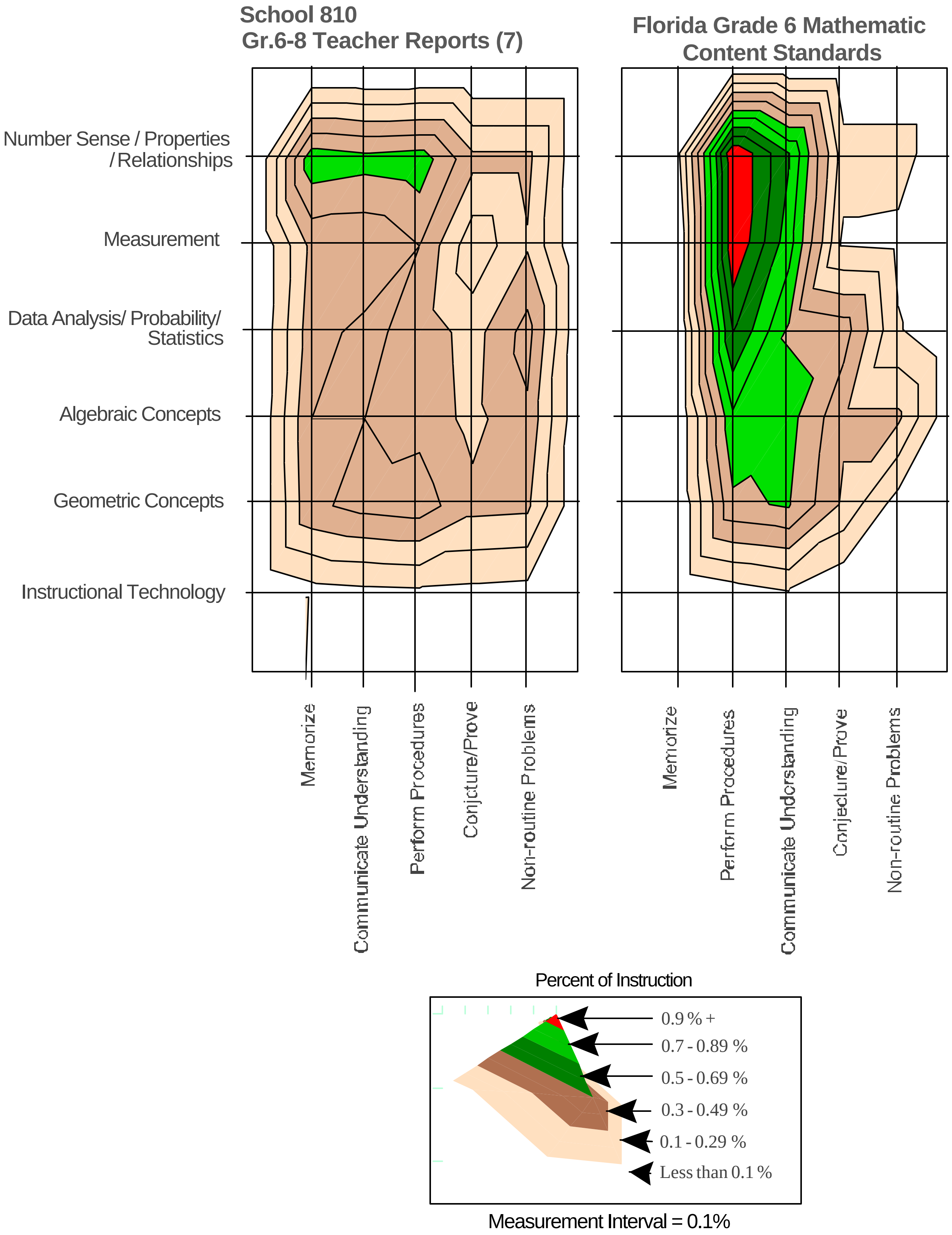
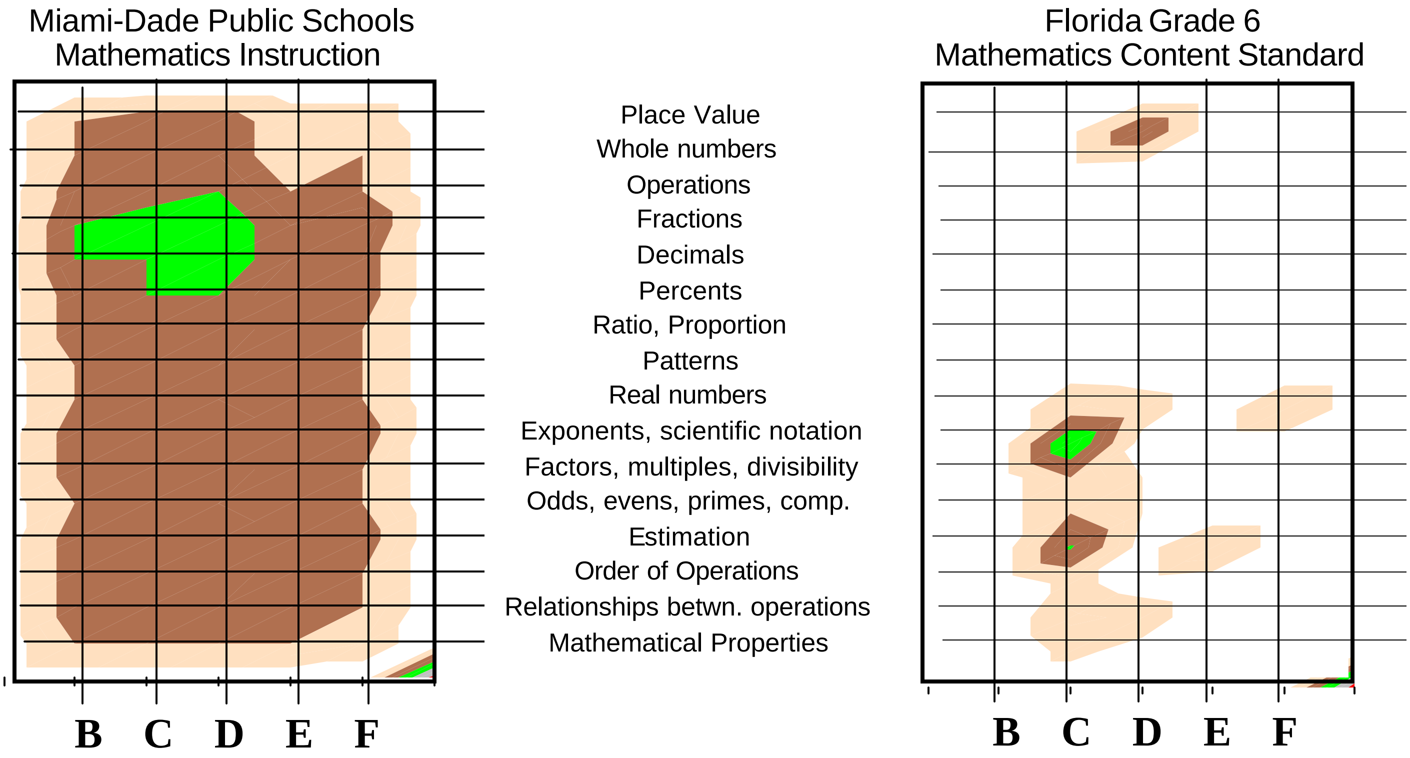
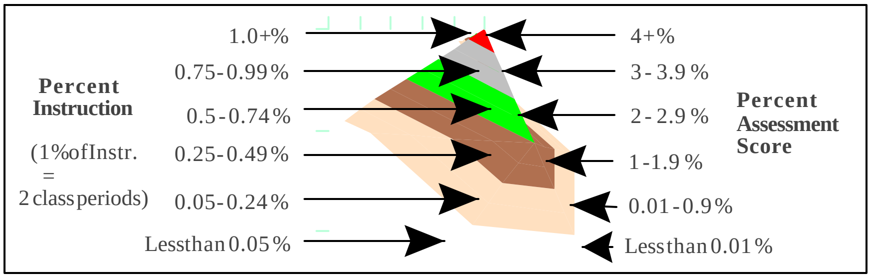


Chart 3-3
Mathematics Content Map AAI
Number Sense/Properties/Relationships





B Memorize
C Communicate Understanding
D Perform Procedures
E Conjecture/Prove
F Non-routine/Novel Problems

Chart 3-4.1

Mathemaitcs Content Map AAI

Miami-Dade Public Schools
Number Sense / Properties / Relationships

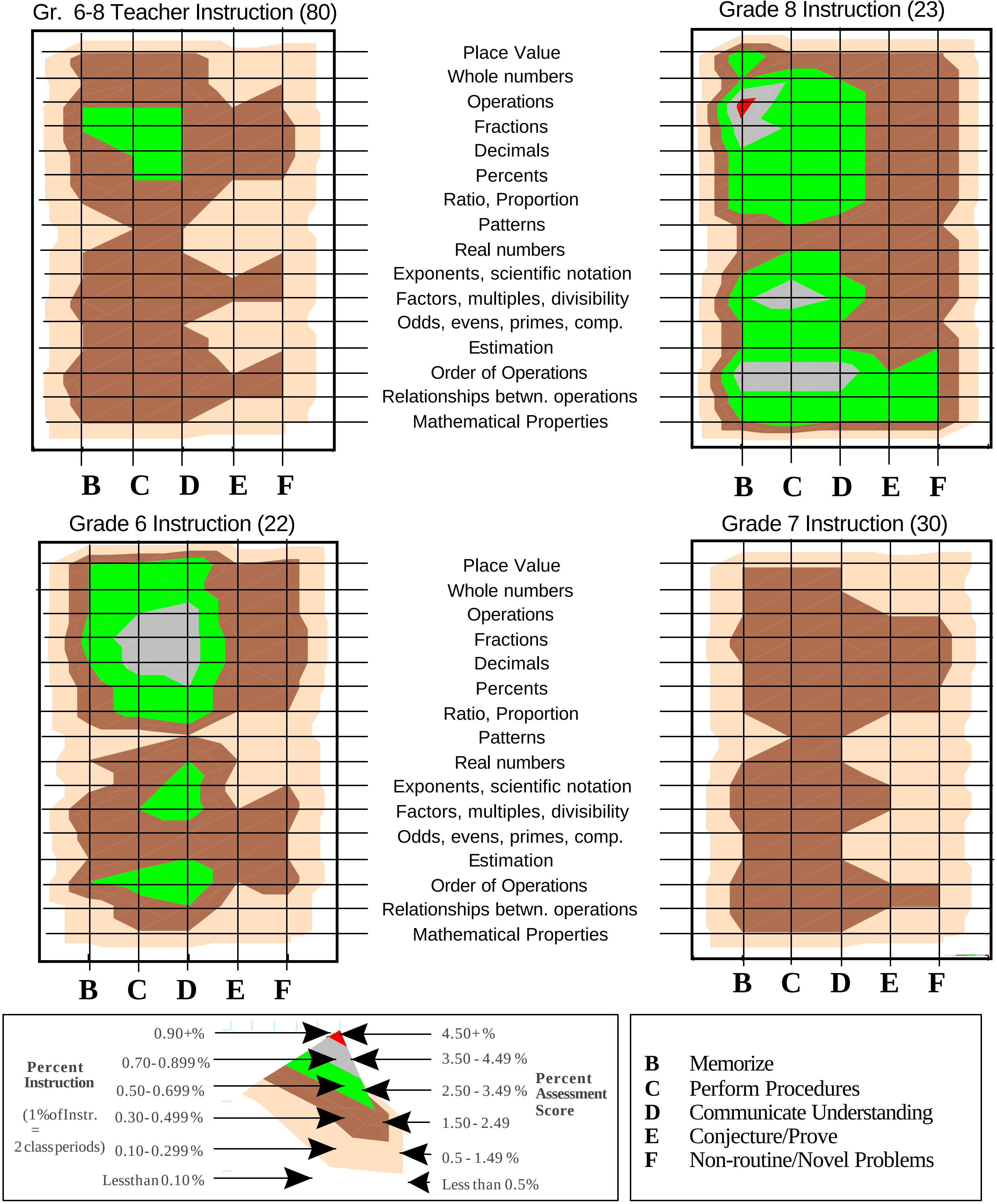
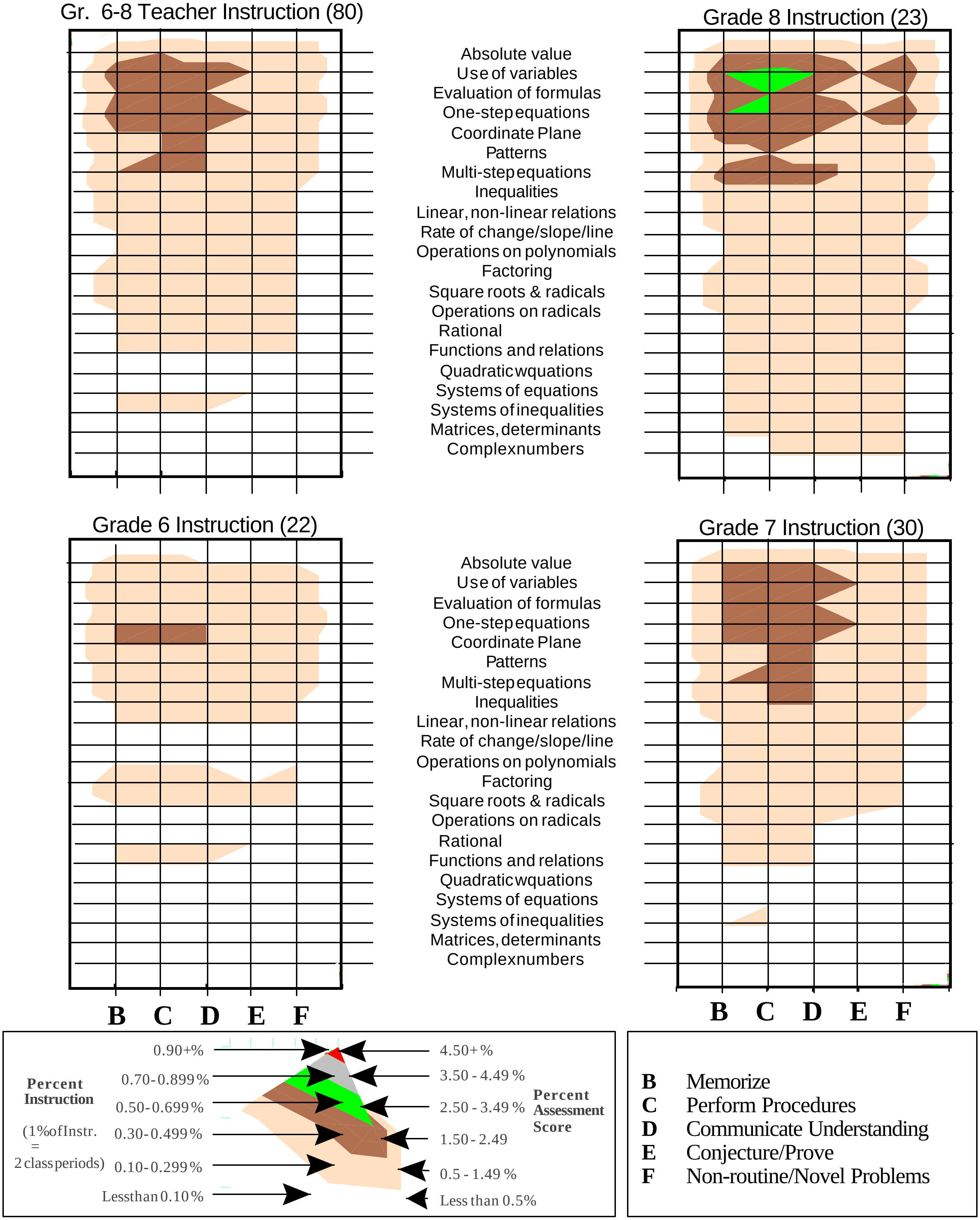


Chart 3-4.2
Mathematics Content Map AA4
Miami-Dade Public Schools
Algebraic



B	Memorize
C	Perform Procedures
D	Communicate Understanding
E	Conjecture/Prove
F	Non-routine/Novel Problems

Chart 3-5.1
Mathematics Curriculum Content
Miami-Dade Middle School
Instruction / Assessment

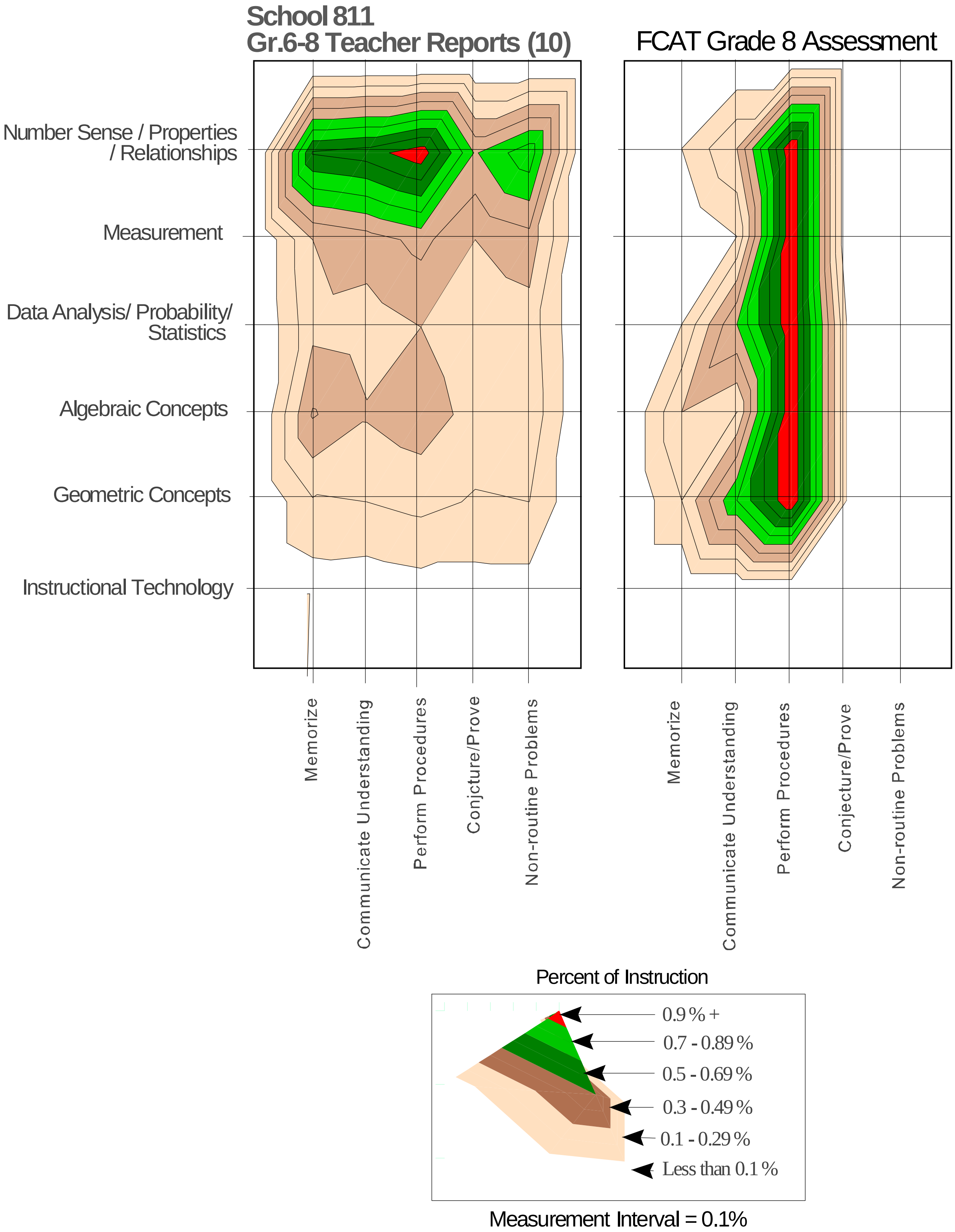


Chart 3-5.2
Mathematics Curriculum Content
Miami-Dade Middle School
Instruction / Assessment

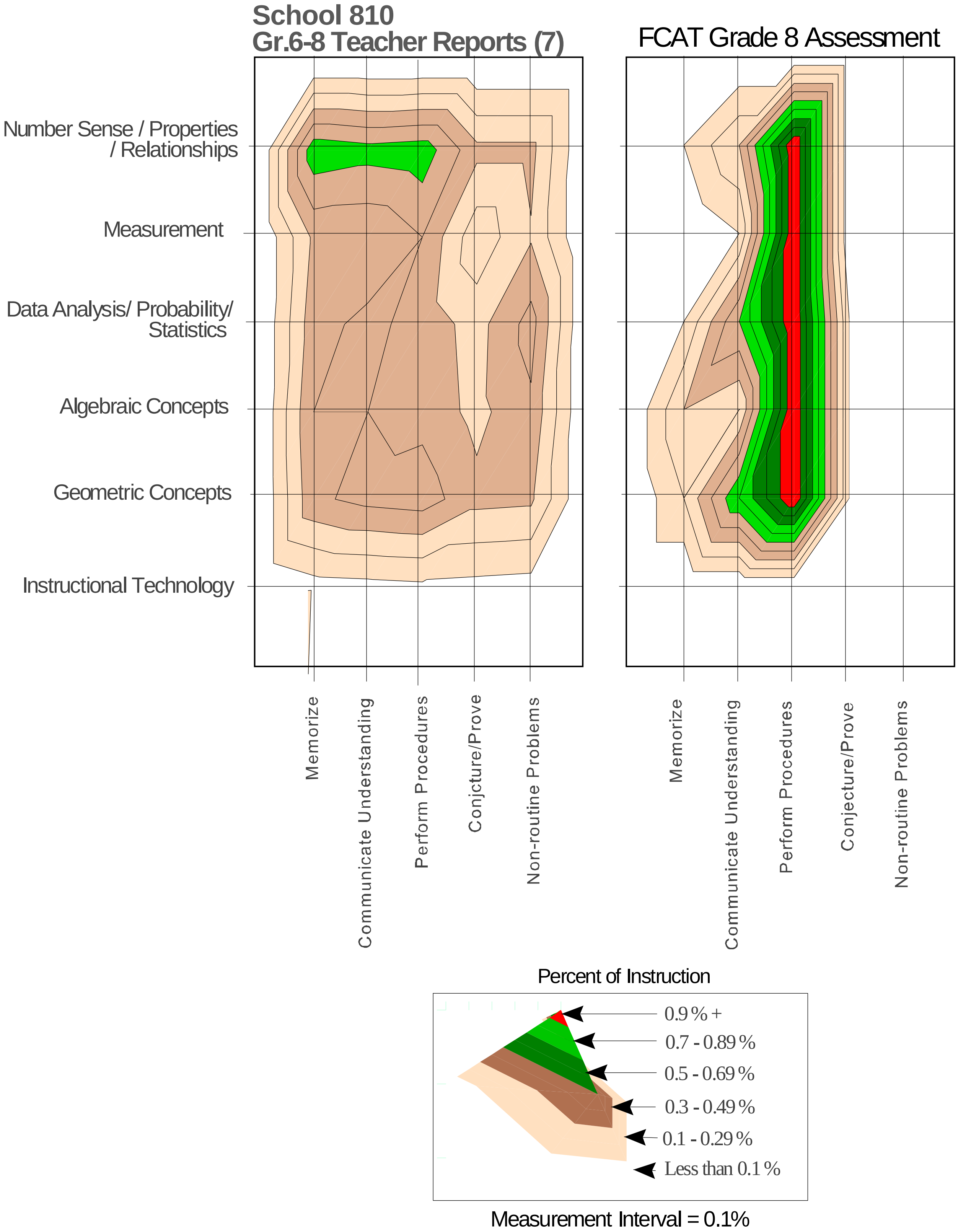


Chart 3-6.1
Mathematics Curriculum Content
School 811
Instruction / Assessment

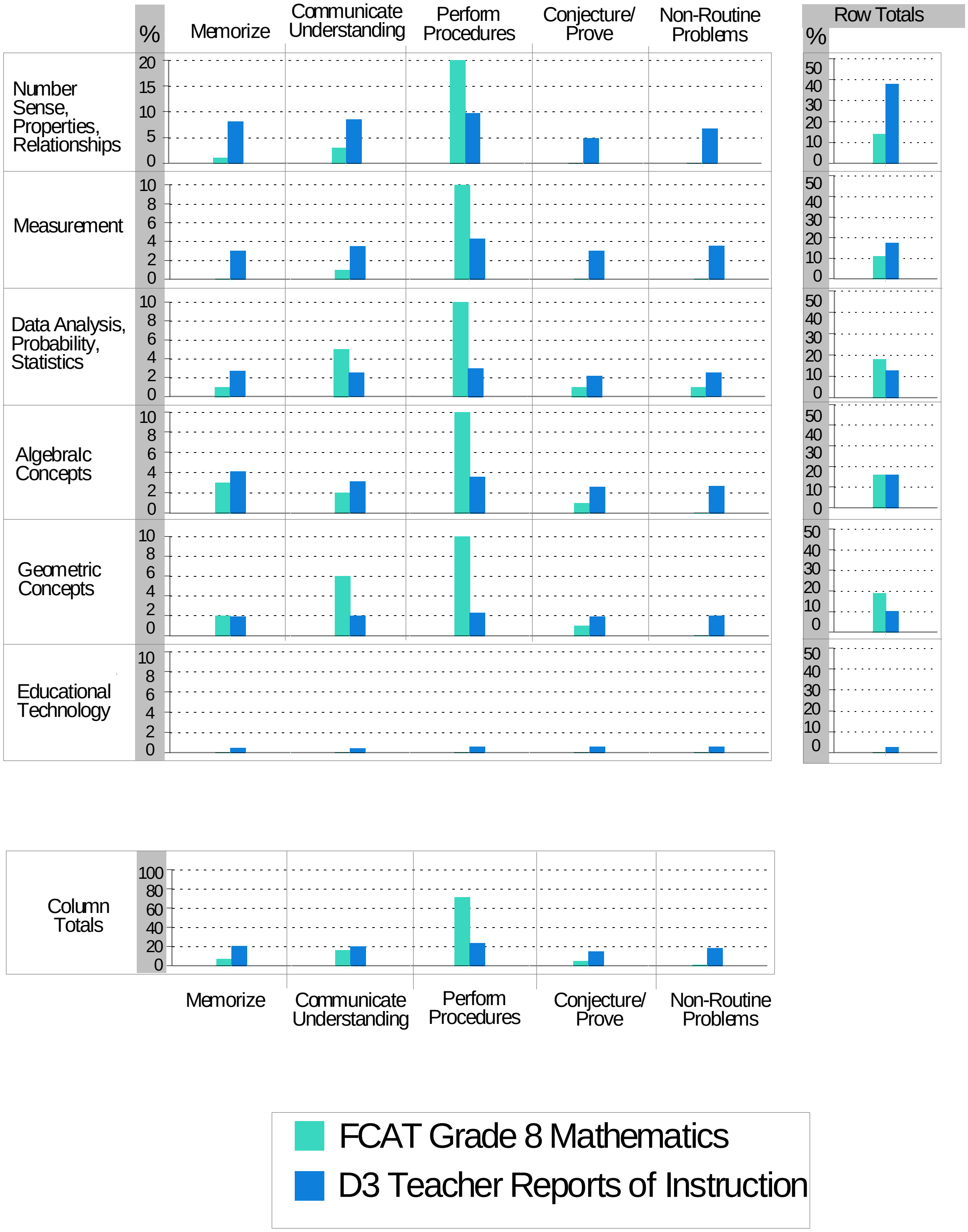
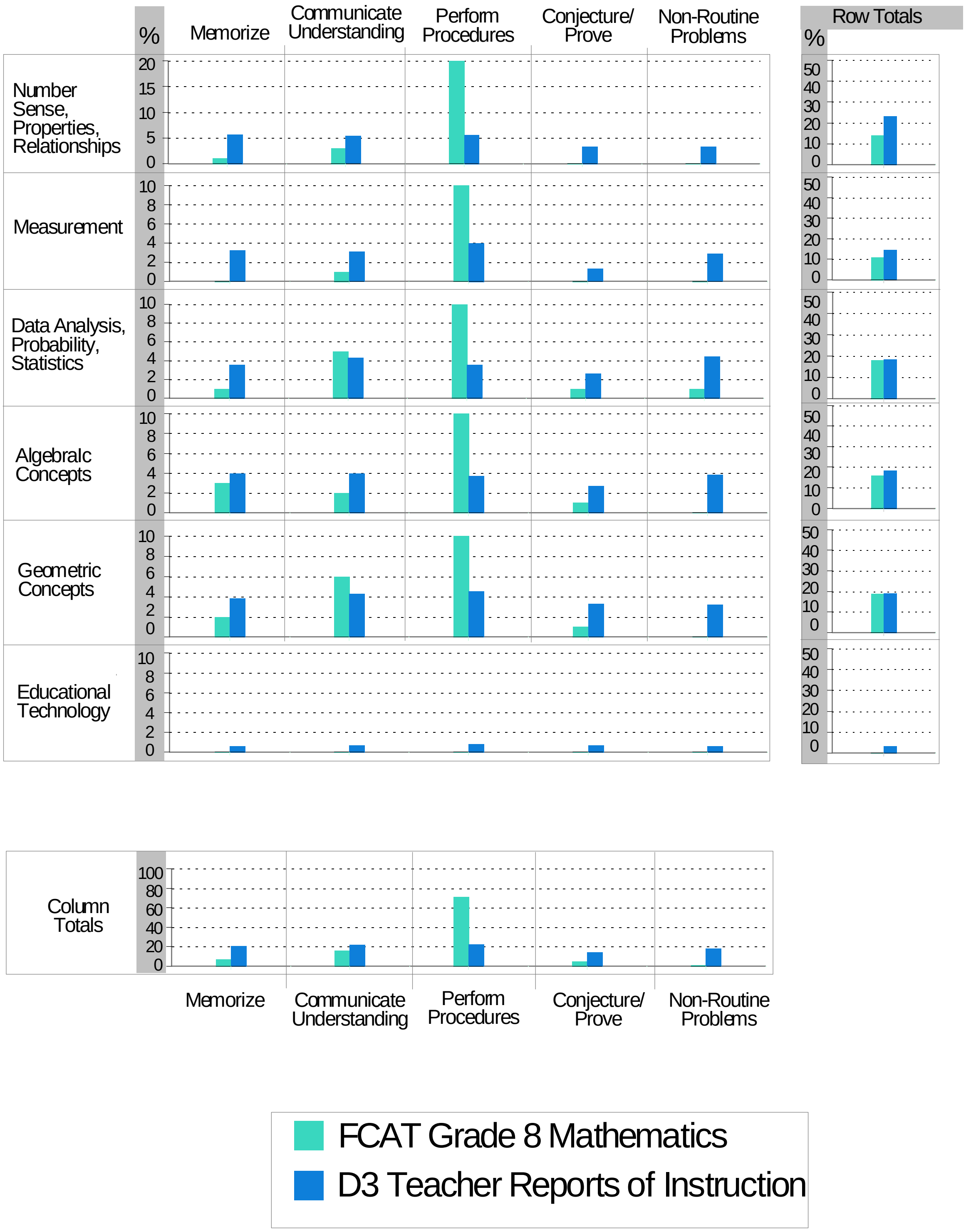


Chart 3-6.2
Mathematics Curriculum Content
School 810
Instruction / Assessment



Finding 4: How Data on Variation in Instructional Practices Are Used to Improve Instruction

In the DEC study, schools and districts used the data on classroom and school differences in instructional practices in two ways:

- To gain a broad view of types of practices being used in a school or district, or
- To analyze in-depth an issue or problem identified through curriculum content analysis (as described in finding #3).

In the SEC instrument, teachers reported on the percent of total class time in which each of 15 to 20 possible instructional practices for the subject were used during a school year. Teachers reported on instruction for the same class and period of time as reported on for subject content of instruction.

Chart 4-1.1 shows data from the survey results for the main types of instructional practices in science. The item-level results show the percent of time reported by practice with data aggregated across teachers by district and school. The statistics in chart 4-1.1, using the *floating bar* approach, display the mean percentage and the distribution of reported practices one standard deviation above and below the mean. This graphic approach to reporting data allows the teacher or administrator to quickly see the degree to which multiple practices are present and vary among teachers and classrooms. For example, in Winston-Salem middle schools, science teachers averaged 20 percent of time on lab activities and 12 percent of time on collecting information about science. The average science teacher devoted only 6 percent of time for learning activities outside the classroom or lab. These categories of instructional practices are very broad, and they are primarily useful for gaining a general overview of how science is taught in a school or district. The extent of variation in practices provides key information which educators can use to determine how instruction is organized and delivered across classrooms, and then to develop ideas about how instruction can be focused and improved to attain standards-based goals for learning.

A second way that the instructional practice data are used by schools is through relating practices to content alignment and student assessment results. Chart 4-1.2 displays science instructional practices by district and school level with data disaggregated by student achievement level. This display of data allowed Winston-Salem educators to ask the question, *Does instruction in science differ for students with lower prior achievement as compared to students with higher achievement?* The surveys include a section of items on class description, including the teacher's report of the achievement level of the class. Thus, one strategy for improving instruction for all students is to use this kind of chart to launch a discussion among teachers around the following kinds of questions:

- What instructional activities were used with higher-achieving students vs. lower-achieving students? What assumptions can be made about each practice?
- How effective are these practices?

- Are some of these practices worthy of consideration for raising the performance of lower-achieving students? And if so, what is needed?

The instructional practices data can also be compared with recent student assessment results (e.g., prior end-of-year tests, end-of-quarter tests), which are reported by class or grade. The DEC schools typically examined state assessment results for their schools in relation to the alignment of instruction with specific content topics (as described in finding #3). However, differences in instructional practices across classrooms can also be viewed from the perspective of student assessment results, as in the following example:

Are students with higher test scores found in classes . . .

- With more hands-on, active learning or with more teacher-led activities?
- With more frequent in-class testing and/or multiple methods of testing?
- With more participation in small group work or with more individual work?
- With greater use of educational technology during instruction?

Scales Summarize Instructional Practices in Relation to Standards and Policy Goals

Chart 4.2 provides a display of six scale scores (i.e., average for a set of items from the survey), which focus analysis on core concepts of instructional improvement found in state and national standards. (See Appendix A for a list of items by scale.) For example, the results for Winston-Salem science at the district level show that on average science classes spent more than 60 percent of instructional time on active methods of learning (e.g., lab activities, collecting information, working in small groups, and *not* sitting and listening to the teacher).

At the same time, another scale score on scientific thinking shows science classes in the district and school spent relatively little time on student scientific thinking (i.e., activities in which students design investigations or experiments or draw their own conclusions). There are several possible reasons for a low score, and further analysis may reveal that the group of items ask about activities which were not expected in the local curriculum or may have been conducted in many classes but did not require large amounts of class time. The instructional activities being surveyed do not all require equal amounts of time.

Two of the scales in chart 4.2—use of multiple assessments and use of educational technology—indicate that teachers demonstrated a high degree of variation in practices at both the district and school level. The scales provide a summary view of the methods of improving instruction. However, the degree of variation leads to closer examination of responses across the items in the scale and comparison of approaches to assessment and technology among teachers:

- Are differences among teachers causing wide variation?
- Are teachers using different types of assessments in their classes?
- Are teachers using technology differently in instruction?

Chart 4-3 provides more detailed analysis of practices during lab activities/experiments. The data in this chart display item results concerning teacher reports about what students were doing in a lab activity. This specific chart for Winston-Salem science shows data for all schools surveyed (elementary, middle, and high), and the data are broken out by grade level. Teachers completed these items after they had reported the total amount of time spent on lab activities in science instruction. Several of these items are included in the scale of active learning and several in the scientific thinking scale. The data in chart 4-3 show several major differences in how lab activities operated in middle schools, with differences by grade. For example, grade 8 teachers reported widely varied use of step-by-step directions in conducting lab activities and wide variation in students making predictions or hypotheses.

Chart 4-4 gives more details about the use of educational technology, including lab equipment in science instruction. In charts 4-1.1 and 4-1.2, data from the “large-grain items” on use of time showed that educational technology was used in science classes an average of 20 percent of time, across teachers. The survey focused further on specific types of technology through a representative sample of technology used in science teaching, as displayed in chart 4-4.

All of the science technology use varied widely at the district and school level. Running water and other equipment in science classes varied from rarely used to weekly use. Computer lab interfacing and electrical outlets varied in use from rarely to bi-weekly (7 to 36 times). In addition, nearly one-third of teachers, particularly at grade 6, reported some of the technology was not available.

Chart 4-1.1
Instructional Activities in Science
By Grade Level

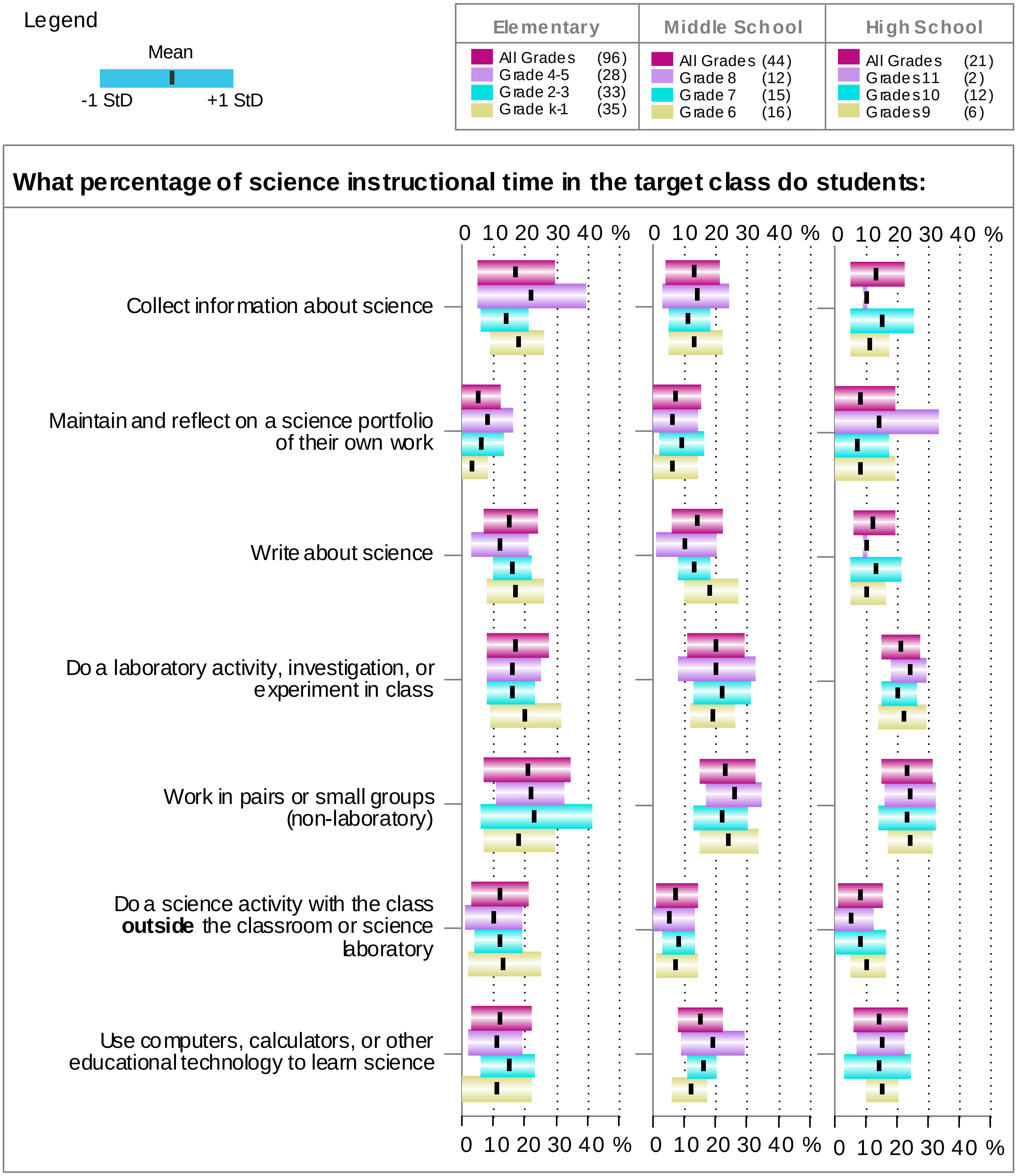
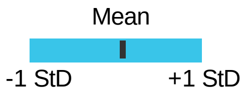


Chart 4-1.2
Instructional Activities in Science
By Level of Student Achievement

Legend



Elementary		Middle School		High School	
Mixed	(35)	Mixed	(16)	Mixed	(8)
Low	(20)	Low	(11)	Low	(3)
Average	(33)	Average	(16)	Average	(5)
High	(7)	High	(1)	High	(5)

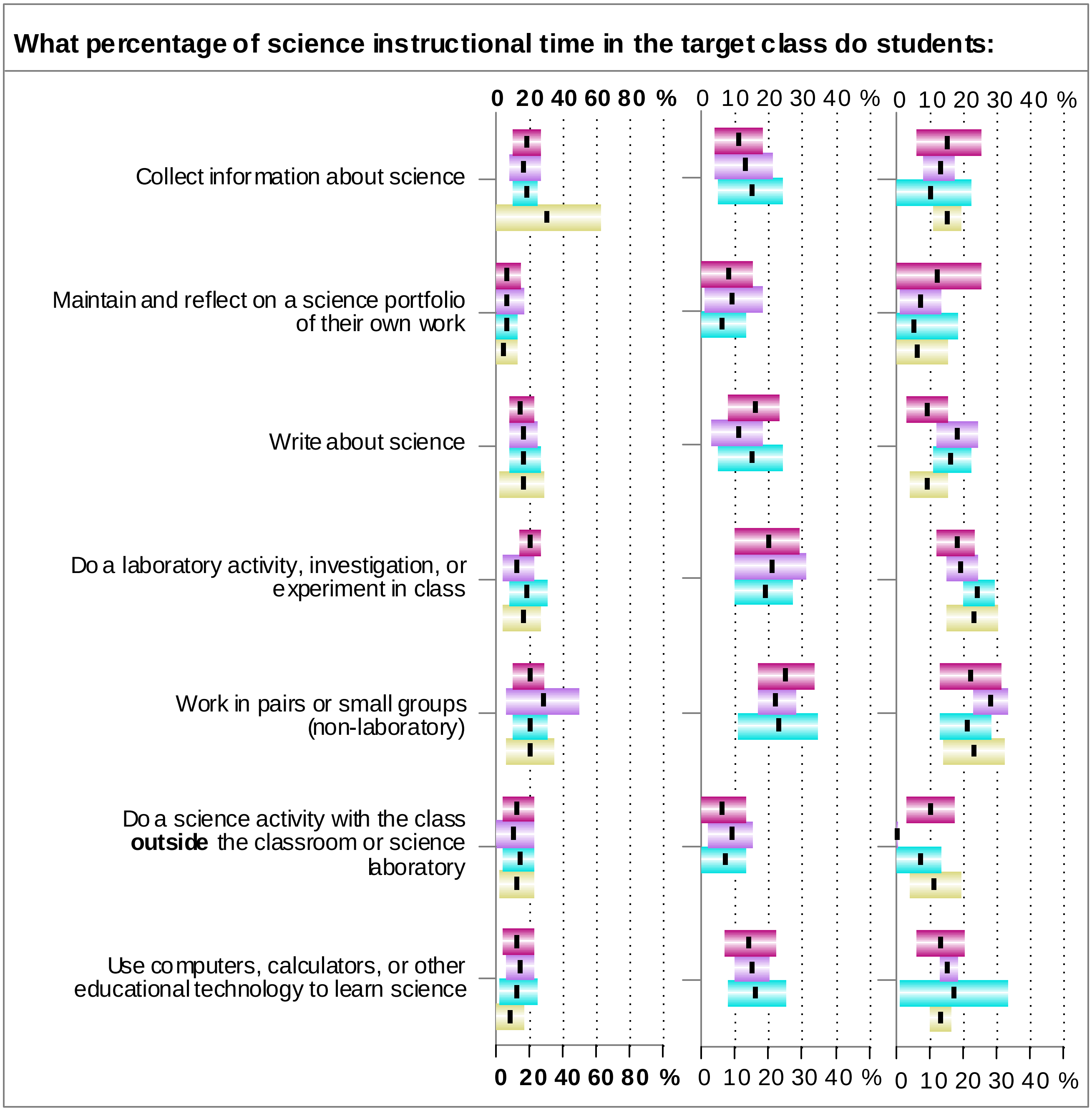


Chart 4-2
Science
Scale Measures of Instructional Practices
By Grade Level

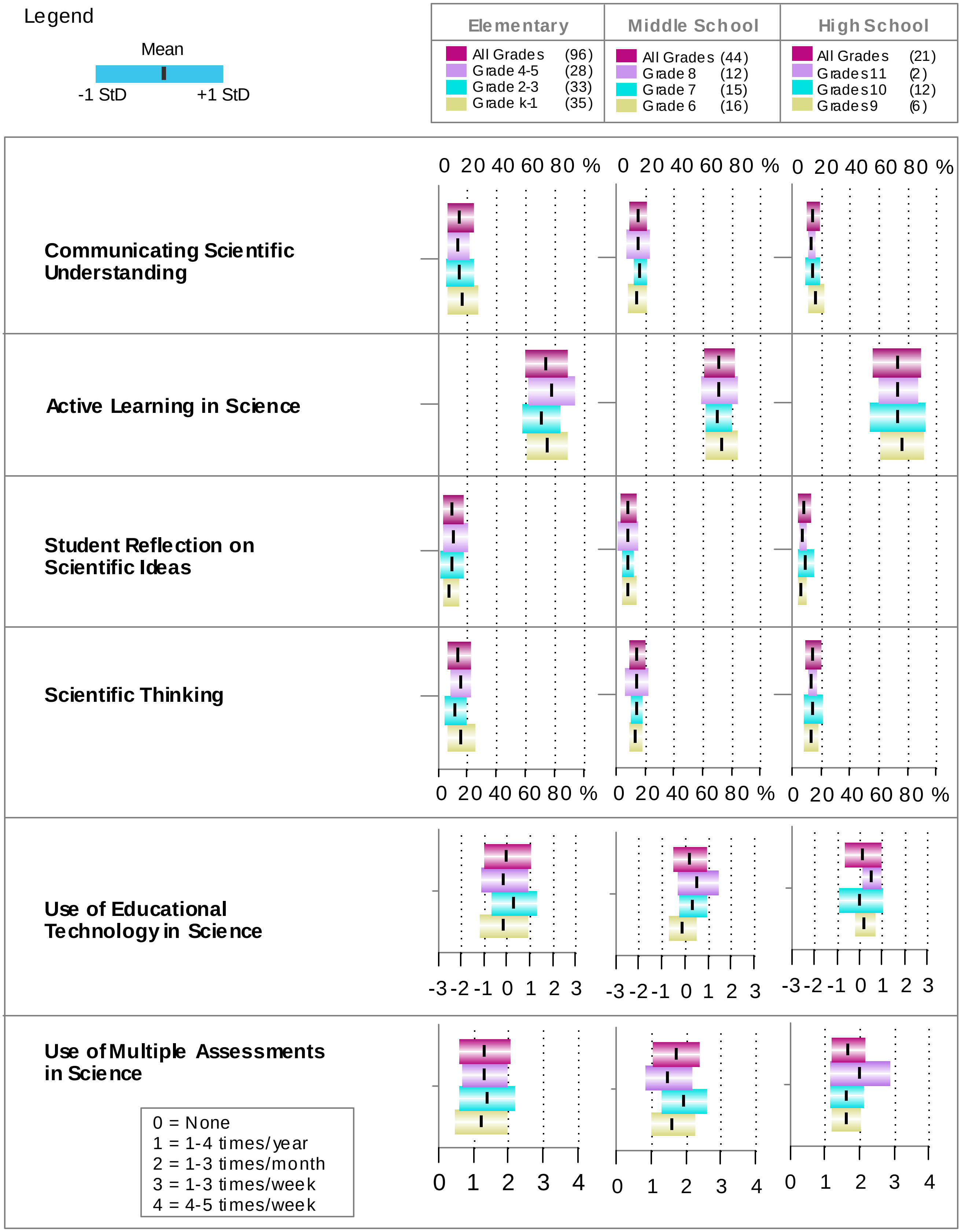
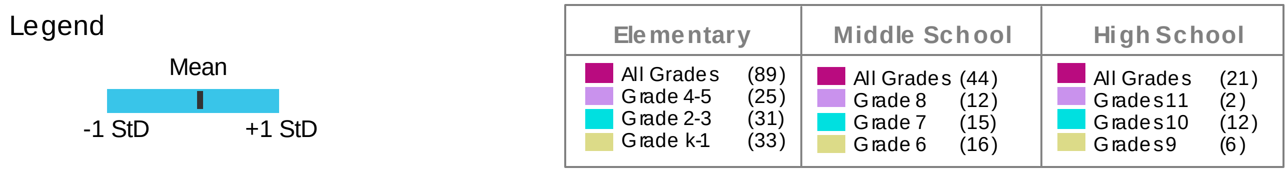


Chart 4-3
Laboratory Activities During Science Instruction
By Grade Level



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:

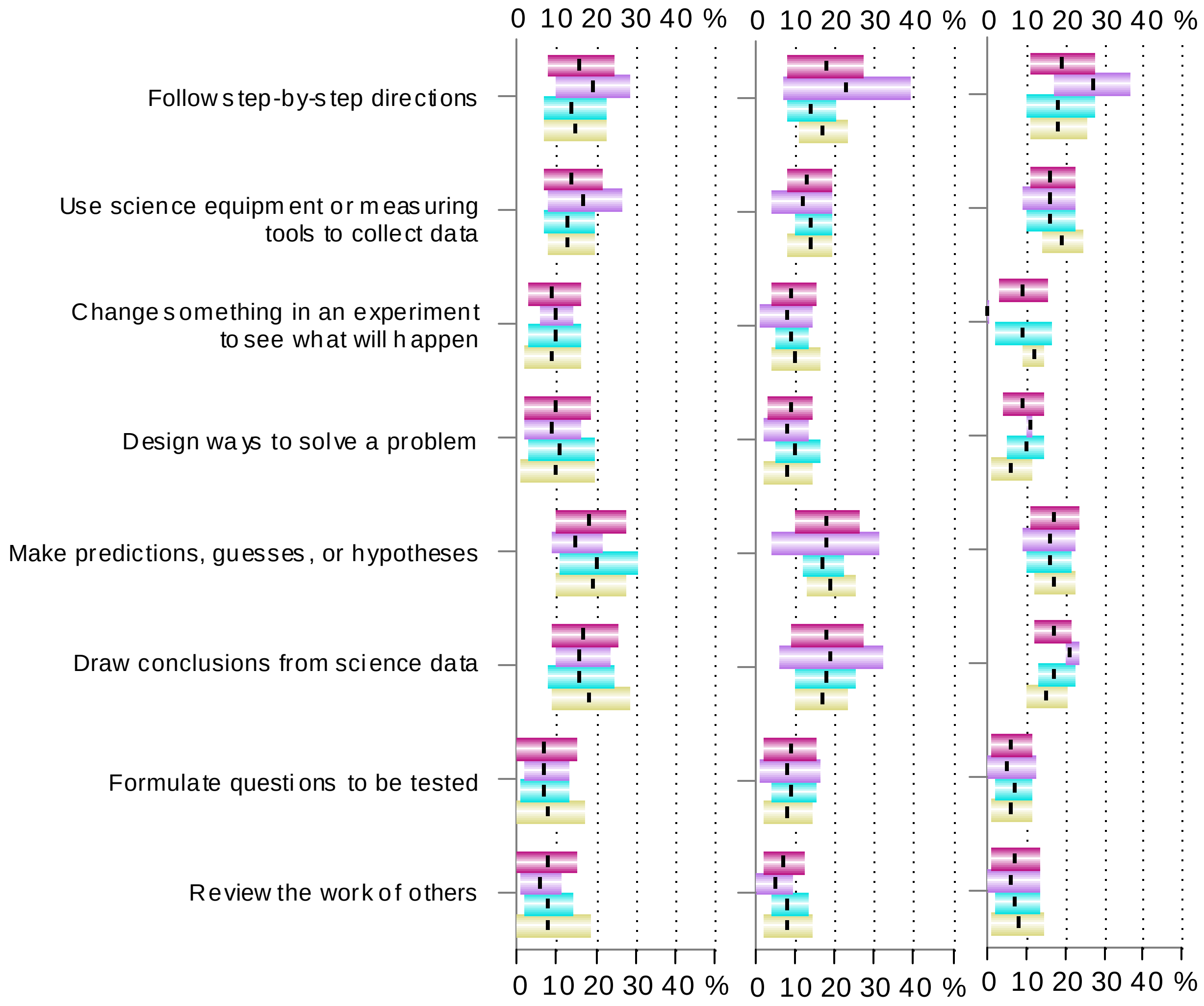
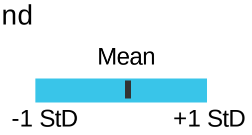


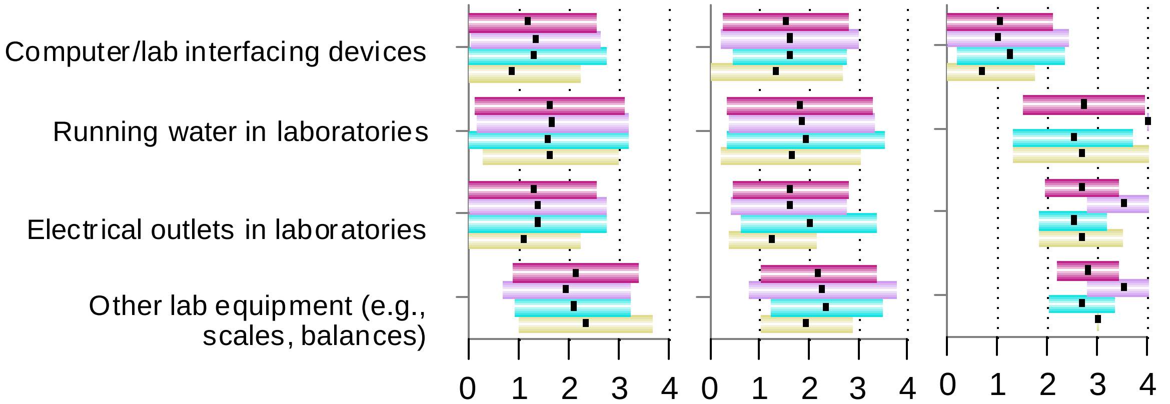
Chart 4-4
Use of Calculators, Computers & Educational Technology in Science
By Grade Level

Legend



Elementary		Middle School		High School	
🟥 All Grades	(96)	🟥 All Grades	(44)	🟥 All Grades	(21)
🟪 Grade 4-5	(28)	🟪 Grade 8	(12)	🟪 Grades 11	(2)
🟦 Grade 2-3	(33)	🟦 Grade 7	(15)	🟦 Grades 10	(12)
🟨 Grade k-1	(35)	🟨 Grade 6	(16)	🟨 Grades 9	(6)

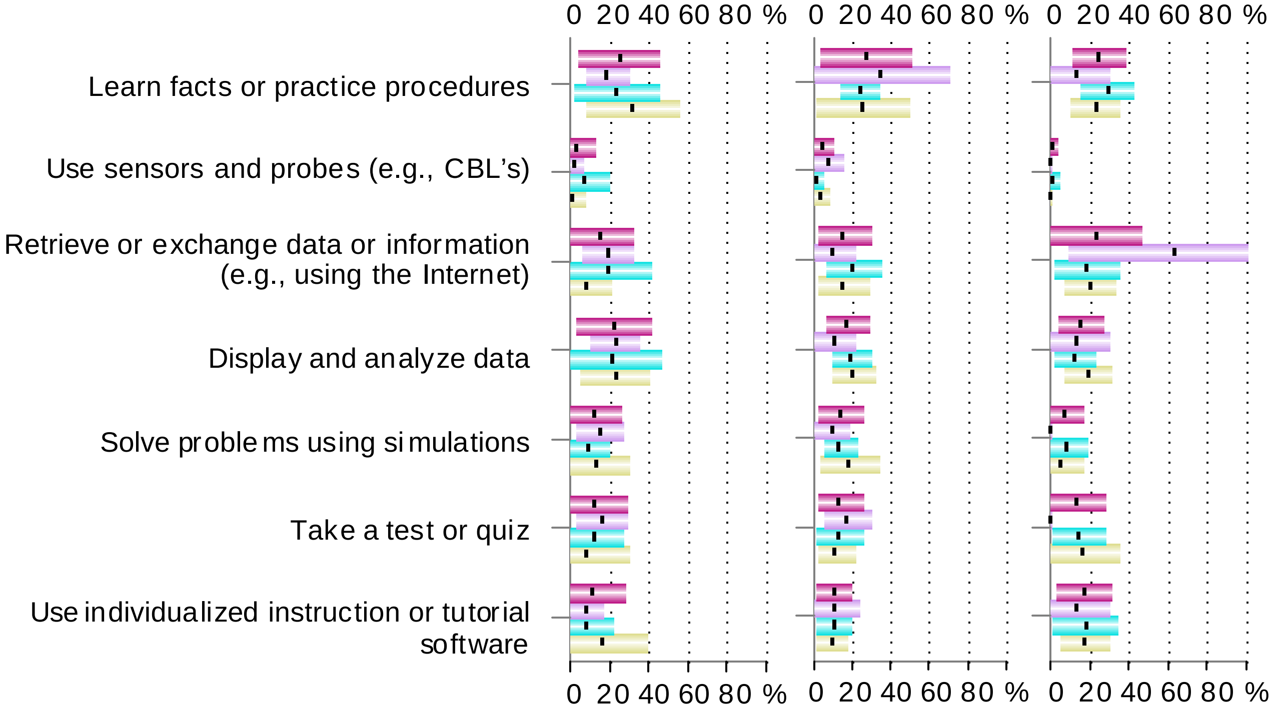
Indicate how often the average student uses each of the following types of equipment in this science class:



Response Codes:

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

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:



Finding 5: How Data on Teacher Preparation and Teacher Attitudes Are Used with Schools and Teachers

The SEC results provide comprehensive data for analyzing teacher preparation, both quantitative course data and qualitative data on teacher views on their conditions for teaching and their own need for improvement. The study identifies three areas in which these data are used to assist schools and districts in focusing instruction and curriculum improvement efforts:

1. Quality of current professional development,
2. Prior course preparation of teachers in their teaching fields,
3. Teacher beliefs about teaching and views about teaching conditions.

Analyzing Quality of Professional Development Provided to Teachers

In the DEC project, teachers reported baseline data in year 1 on the amount of professional development they received in the prior 12 months in their assigned teaching fields (math or science), the focus or emphasis of the professional development activities, and characteristics of the activities as compared to the four criteria of quality: coherence, active learning, content focused, and collegial participation.

Charts 5-1.1 and 5-1.2 provide a summary analysis of the professional development activities of science teachers in the study. Chart 5-1.1 shows that more than two-thirds of middle grades science teachers in the study schools received professional development on teaching to standards or implementing the curriculum for their district, and a majority of teachers participated in the study of science content. In addition, the data show that more than 80 percent of the teachers who participated in activities focused on standards or new curriculum reported that the activities positively met the four criteria of quality.

Chart 5-1.2 provides a trend analysis of change in the amount of time on professional development of science teachers, by type of activity, over the two-year period of the DEC study. The trend analysis shows that science teachers had substantial increases in professional development in four areas: standards, implementing curriculum, in-depth study of content, and networking with colleagues.

Charts 5-2.1 and 5-2.2 provide summary data on the professional development of mathematics teachers in the study. Chart 5-2.1 provides data on activities by teacher response to the quality criteria. More than 80 percent of the mathematics teachers participating in these activities responded positively that the activities met the four criteria of quality. Chart 5-2.2 graphs the extent of change in the professional development of math teachers over the two-year study. Math teachers had substantial increases in three areas: assessment strategies, standards, and in-depth study of math content.

Charts 5-3 and 5-4 display trends in teacher professional development from year 1 to year 3 of the study for Miami-Dade. Chart 5-3 shows change in the percent of middle grades science teachers in school 51 who participated in professional development. The data are reported by type of activity and by grade level of teachers. In this school, professional development increased substantially for teachers in grade 7 in the area of implementing standards and increased in implementing new curriculum and new teaching methods for grade 8 teachers. Overall, professional development regarding the needs of all students and in-depth study of science content declined for teachers in school 51.

Chart 5-4 identifies through bar graphs the trends at the district level in types of professional development activities experienced by middle grades math teachers. Users report the bar graphs provide ease in viewing trends over time for percentages of teachers at each level of activity, while floating horizontal bars in chart 5-3 facilitate viewing the variation in responses.

These data are useful for district leaders in analyzing the degree to which initiatives aimed toward improving teacher knowledge and skills are working. For example, chart 5-4 shows that in year 3 of the study almost 20 percent of math teachers received more than 35 hours of professional development on implementing standards in math instruction, which was an increase of 5 percentage points from year 1. The percent of math teachers receiving 16 to 35 hours of professional development on standards also increased about 5 points. The percent of teachers participating in professional development on multiple assessment strategies and using teacher networks increased substantially from year 1 to year 3.

Data on Teacher Course Preparation Used to Identify Teacher Needs

An important function of SEC data for decision makers and professional development providers is to analyze specific content background weaknesses or strengths of teachers. For example, analysis of current alignment of instruction to standards may show that teachers are not spending sufficient time in classrooms on geometry or statistics/probability. Information on the course preparation of math teachers can show whether they are well prepared in these math subject areas. Analysis of these data might also show that teachers have a strong math background but little preparation for how to teach the content to their assigned grade levels.

Chart 5-5 displays the preparation of Miami middle grades teachers in math based on the number of college courses completed in the subject. The district summary shows that the average math teacher in grades 6 through 8 in the Miami schools sample had taken three to four “refresher” math courses, one or two advanced college math courses, and about five math education courses. Of interest to district leaders was, first, the high variation in teacher preparation among grades 6, 7, and 8, with grade 8 teachers holding about twice as much course preparation in math as other teachers. Second, the teachers in the sample reported wide variation in level of preparation (as indicated by the width of the colored bar, which represents two-thirds of responses). The colored bar shows that more than one-third of teachers in the schools had less than two courses of preparation in math or math education. The column on the right shows that the average math teacher at school 811 (a DEC treatment school) had less preparation than an average teacher in the district sample.

Chart 5-6 displays data on the science course preparation of Miami science teachers. The district summary shows that the average Miami middle grades science teacher in preparation had taken seven to eight life science courses, five to six courses in physical science, three to four Earth science courses, and three to four science education courses. The colored bar is wide at each grade level for both the district total and the target school indicating a high degree of variation in science preparation across both the district and the school. Some teachers had a strong background in science while others with the same subject assignment had a poor science background. The level of preparation for science teaching is about the same at each grade 6 through 8.

The data can be extremely informative for district and school leaders in focusing and planning teacher professional development to target development in specific content areas based on specific needs. In addition, the data on course background can be combined with the data on teacher-reported instructional practices to guide improvement for teachers whose instruction does not match standards and whose course preparation has been minimal.

Teacher Attitude Data to Examine Beliefs about Teaching and Views on Teaching Conditions

Charts 5-7 and 5-8 report data for one district on teacher beliefs about teaching math/science and teacher opinions about conditions for teaching. The DEC project has demonstrated that data from the more subjective teacher attitude and opinion items of the survey are extremely important for analyzing differences in approaches to instruction in math and science. The DEC professional development model advances the idea of building a learning community among teachers and administrators within a school. Staff regularly communicate about their instructional strategies, content, issues, and needs. The analysis of data from SEC results for a school and district are an excellent vehicle for pursuing the learning community objectives. The data on teacher attitudes and opinions are particularly valuable as a way to begin conversations concerning ideas about teaching their subjects, views about how students learn, and reactions to conditions for teaching.

The first six items in chart 5-7 illustrate the use of the data on teacher beliefs. The chart is presented to teachers in a school data analysis session, often prior to examining other charts on instructional practices or subject content of instruction. The data results show divergent views on several instructional strategies, including order of learning, use of calculators, basic skills, and challenging math content. Recognizing the divergent views of teachers within a school provides an excellent opportunity for discussion about how views on these topics relate to math instruction, use of different teaching strategies, and teaching approaches for students with different backgrounds.

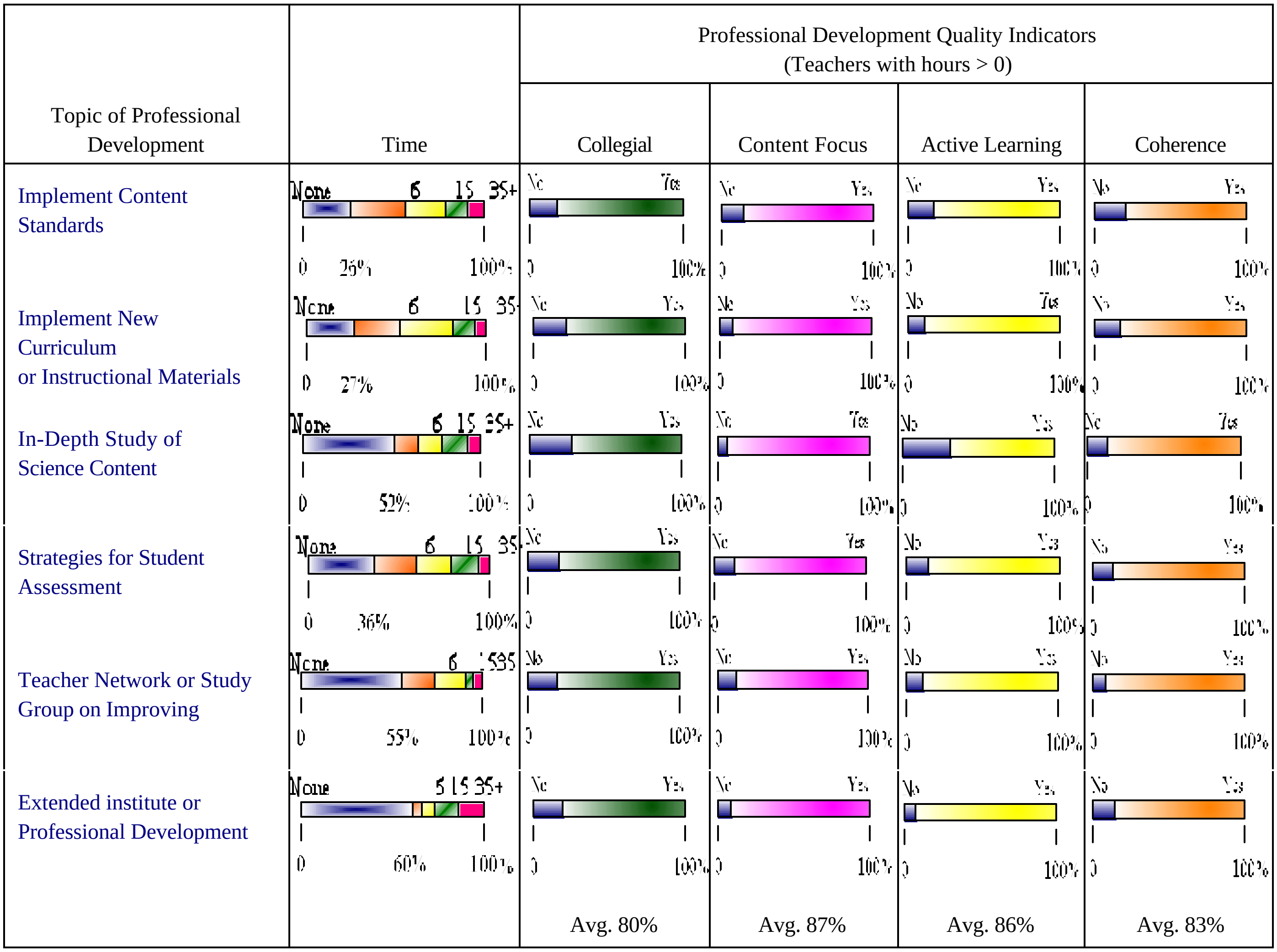
The data in chart 5-8 address issues of teaching conditions and collegiality—that is, how teachers see their roles as faculty of the school. The items report teacher views on working with peers, involvement in decisions, rules of the school, and access to materials. The results for this district show widely differing views, from positive to negative about conditions for teaching. The results in these charts were used by districts to begin data-focused analysis of instruction with teachers.

> …One urban district program director stated that his district found the DEC model provided a “three-legged stool of data” that was essential for improving instruction based on (a) differences in current instruction, (b) degree of alignment with standards, and (c) teacher attitudes about teaching their subjects (S. Hill, Winston-Salem, 2004).

A major advantage of a data-focused discussion among teachers is that the data can serve as the common target for discussion, thereby avoiding situations in which individual teachers have to argue and defend their views in front of colleagues. The data clearly show there are differences in views and assumptions about teaching a subject and about children learning. Comparing differences through group data can lead to further detailed examination of reasons behind the data, and discussion of how the views that were expressed affect instruction and efforts to improve learning. The goal of using the teacher attitude data is for teachers to learn more about underlying issues which might contribute or detract from building a learning community and might inhibit frank and open discussion of the reported data about instruction.

Chart 5-1.1

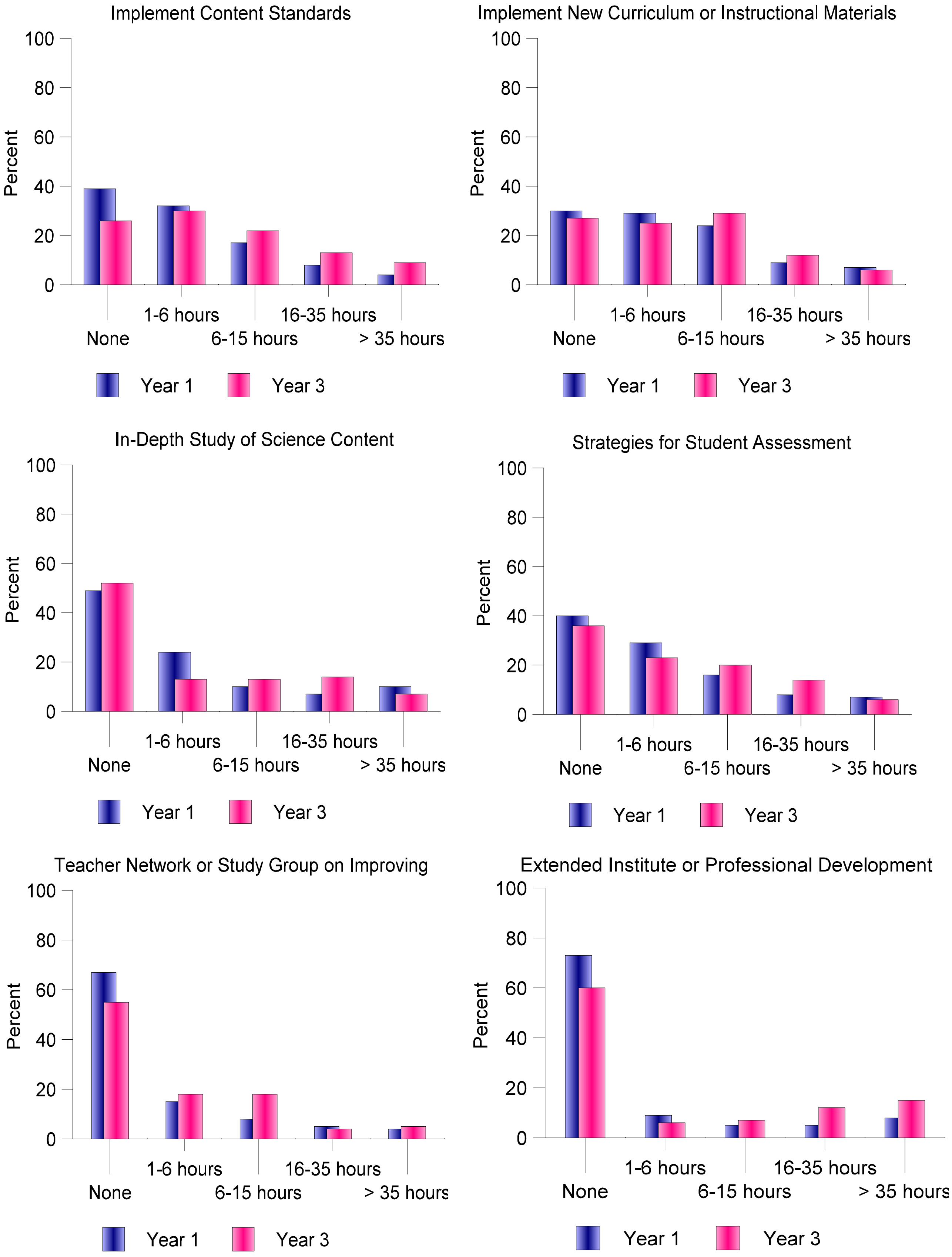
Professional Development of Middle Grades Science Teachers (4 urban districts): Topic by Time by Quality Indicators, 2003 (N=127)



Legend:
Time: Clock hours teachers reported spending on specific topic of professional development in prior year.
Quality Indicators: Four teacher-reported measures of the quality of the professional development activity (teachers reporting some time).
Collegial Participation: Attended with a group of teachers from their school or district.
Content Focus: The professional development activity had a focus on content knowledge.
Active Learning: The professional development activity engaged teachers in active forms of learning.
Coherence: The activity was associated, integrated or coordinated with other professional development offerings.

Source: CCSSO, Data on enacted Curriculum Project, 2003

Chart 5-1.2
Professional Development of Middle Grades Science Teachers (4 urban districts):
Topic by Time, N=185, Year 1 (2001) and N=127, Year 3 (2003)


Implement Content Standards

Implement New Curriculum or Instructional Materials

In-Depth Study of Science Content

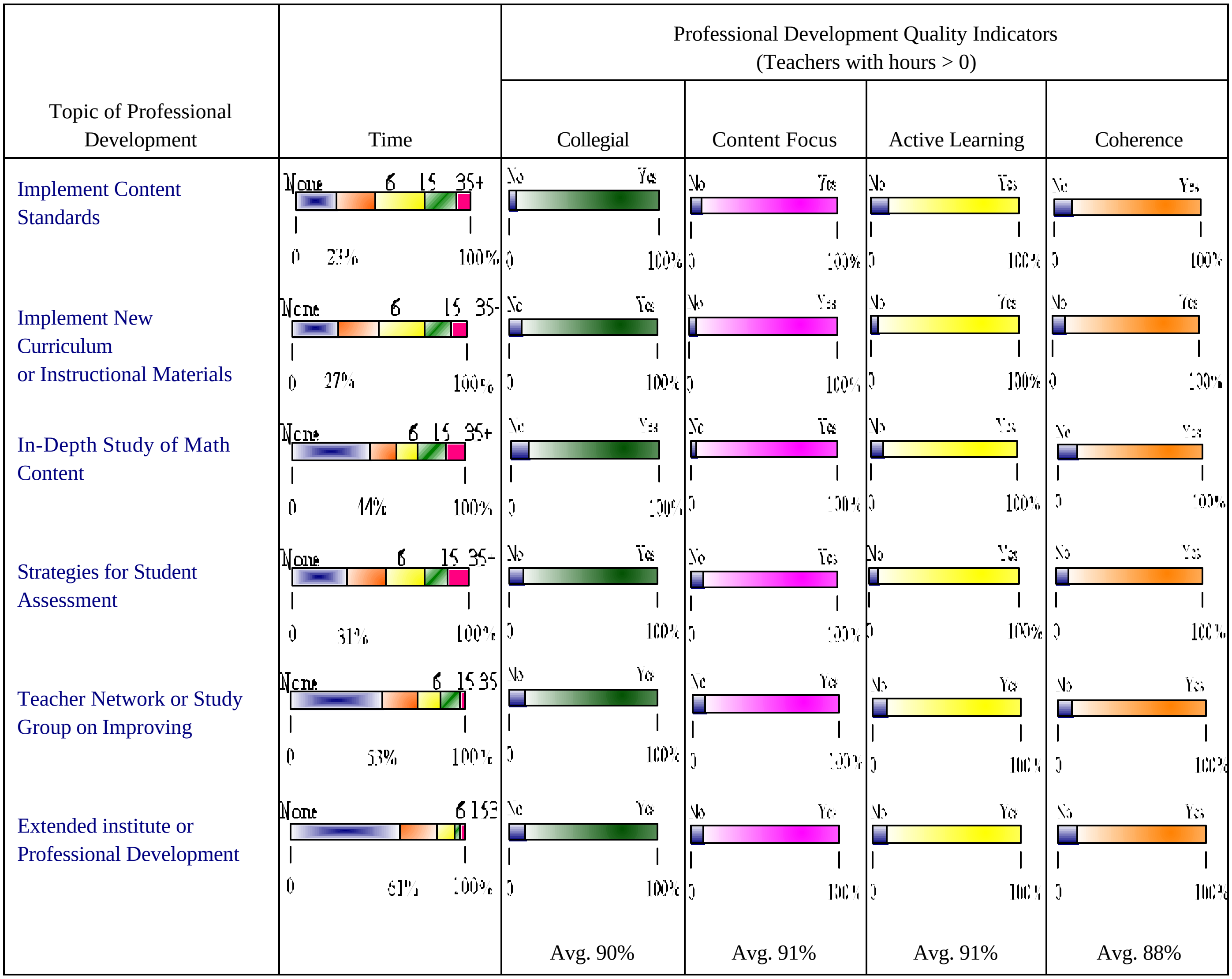
Strategies for Student Assessment

Teacher Network or Study Group on Improving

Extended Institute or Professional Development

Chart 5-2.1

Professional Development of Middle Grades Math Teachers (4 urban districts): Topic by Time by Quality Indicators, 2003 (N=197)



Legend:

Time: Clock hours teachers reported spending on specific topic of professional development in prior year.

Quality Indicators: Four teacher-reported measures of the quality of the professional development activity (teachers reporting some time).

Collegial Participation: Attended with a group of teachers from their school or district.

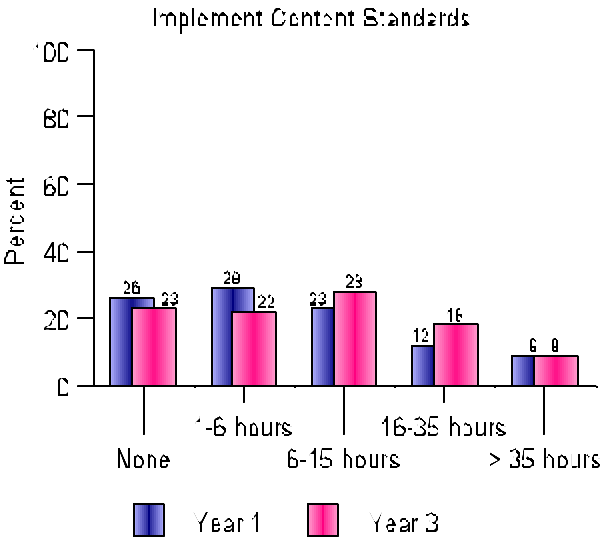
Content Focus: The professional development activity had a focus on content knowledge.

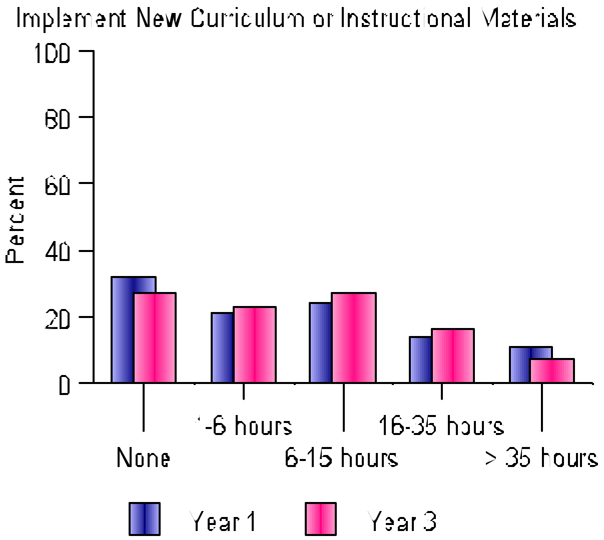
Active Learning: The professional development activity engaged teachers in active forms of learning.

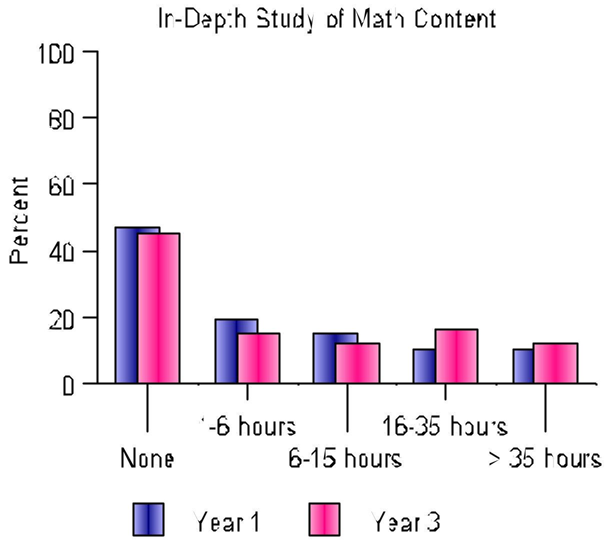
Coherence: The activity was associated, integrated or coordinated with other professional development offerings.

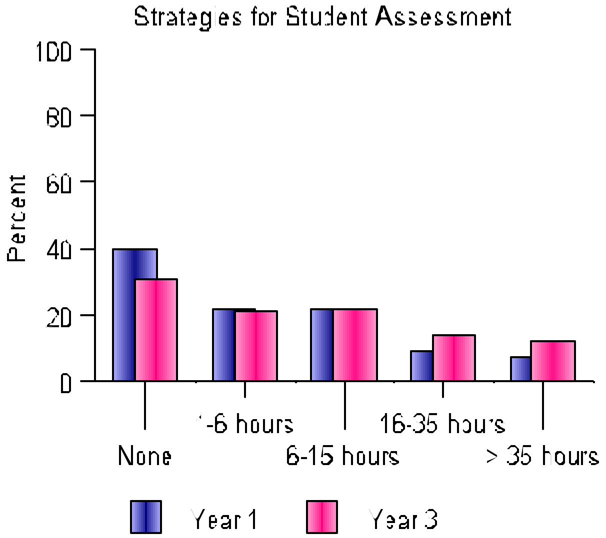
Source: CCSSO, Data on Enacted Curriculum Project, 2003

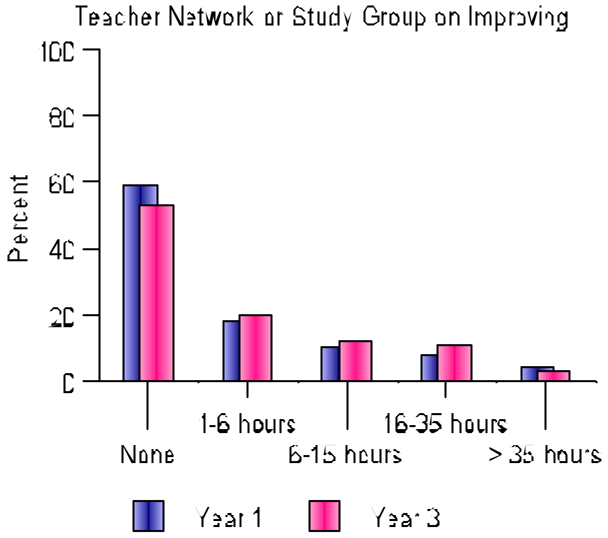
Chart 5-2.2
Professional Development of Middle Grades Math Teachers (4 urban districts):
Topic by Time, N=219, Year 1 (2001) and N=167, Year 3 (2003)











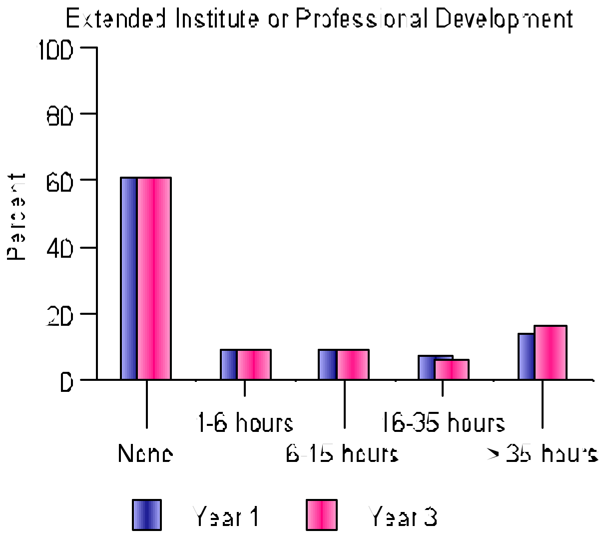
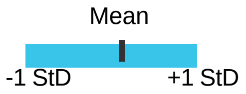


Chart 5-3
Professional Development in Mathematics
By Grade Level

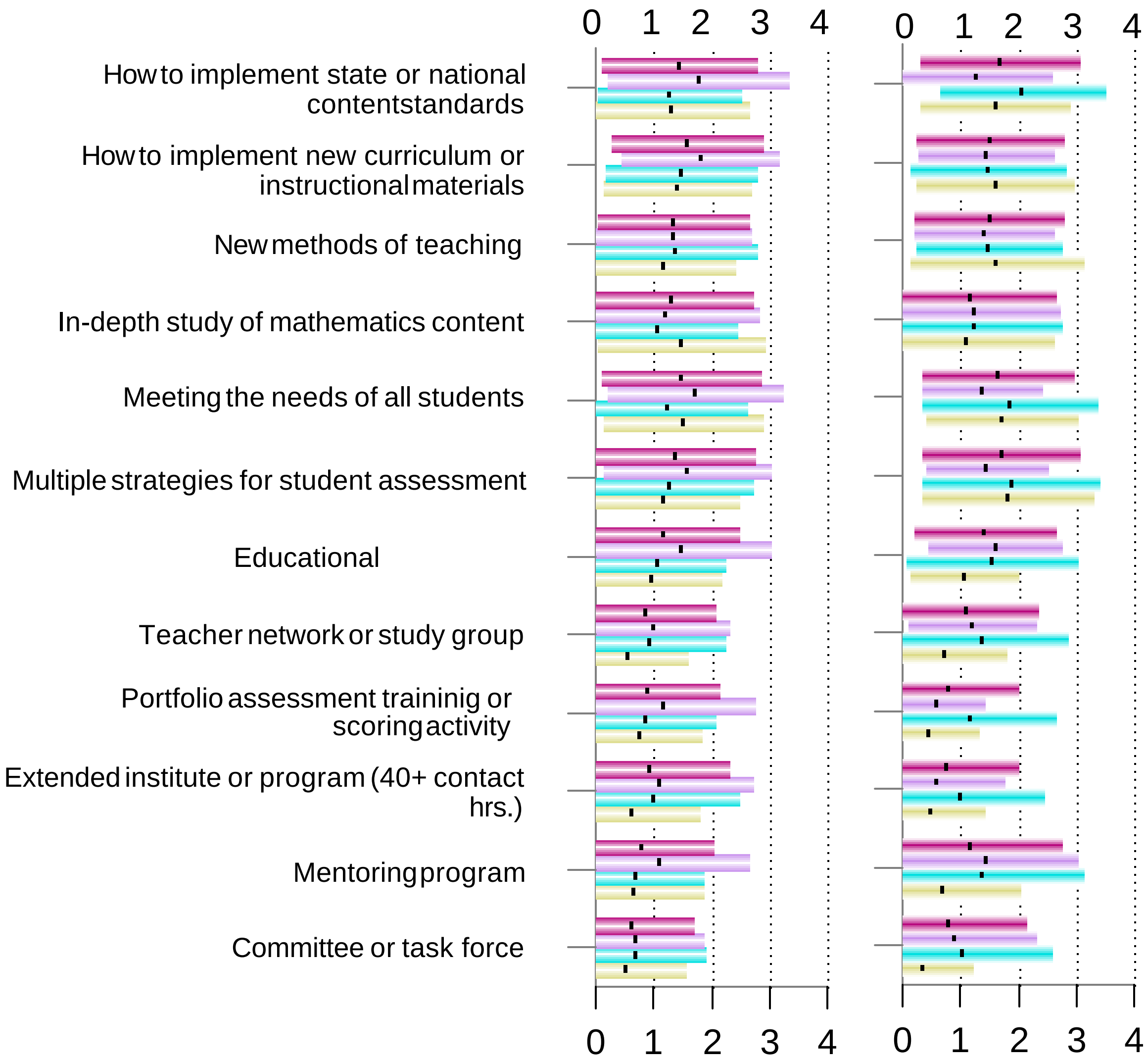
Legend



Miami-Dade Public Schools

Year 1			Year 3		
🟥	All Grades	(111)	🟥	All Grades	(80)
🟪	Grades 8	(32)	🟪	Grades 8	(24)
🟦	Grades 7	(34)	🟦	Grades 7	(31)
🟨	Grades 6	(32)	🟨	Grades 6	(22)

Indicate the amount of time, in the last 24 months, you particpated in each mathematicsactivitylistedbelow:



Response

0 = Did not participate
1 = Less than 6 hours
2 = 6 - 15 hours
3 = 16 - 35 hours
4 = More than 35 hours

Chart 5-4

Professional Development of Miami Middle Grades Math Teachers: Topic by Time, N=110, Year 1 (2001) and N=81, Year 3 (2003)

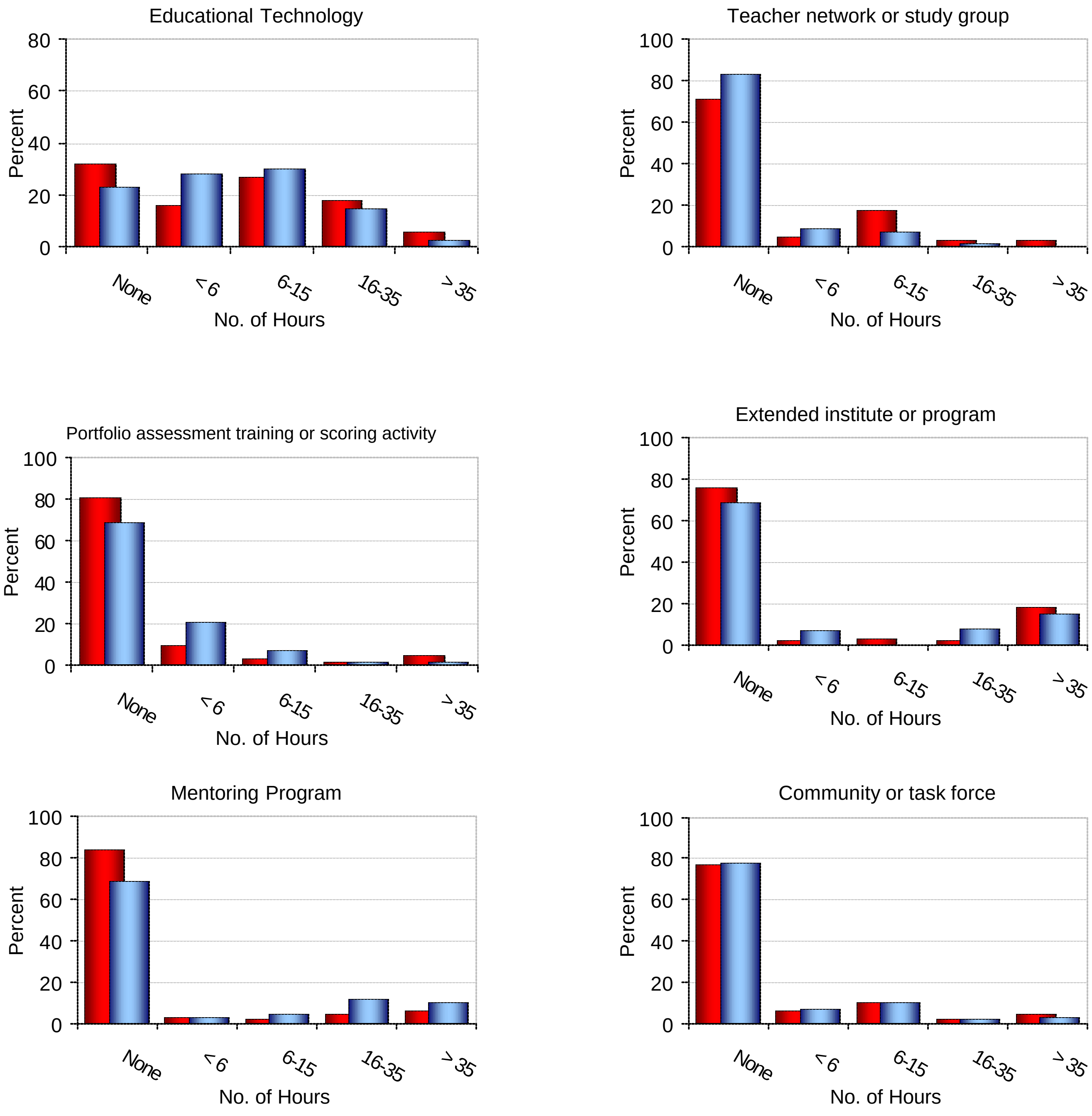


Chart 5-4, continued

Professional Development of Miami Middle Grades Math Teachers:
Topic by Time, N=110, Year 1 (2001) and N=81, Year 3 (2003)

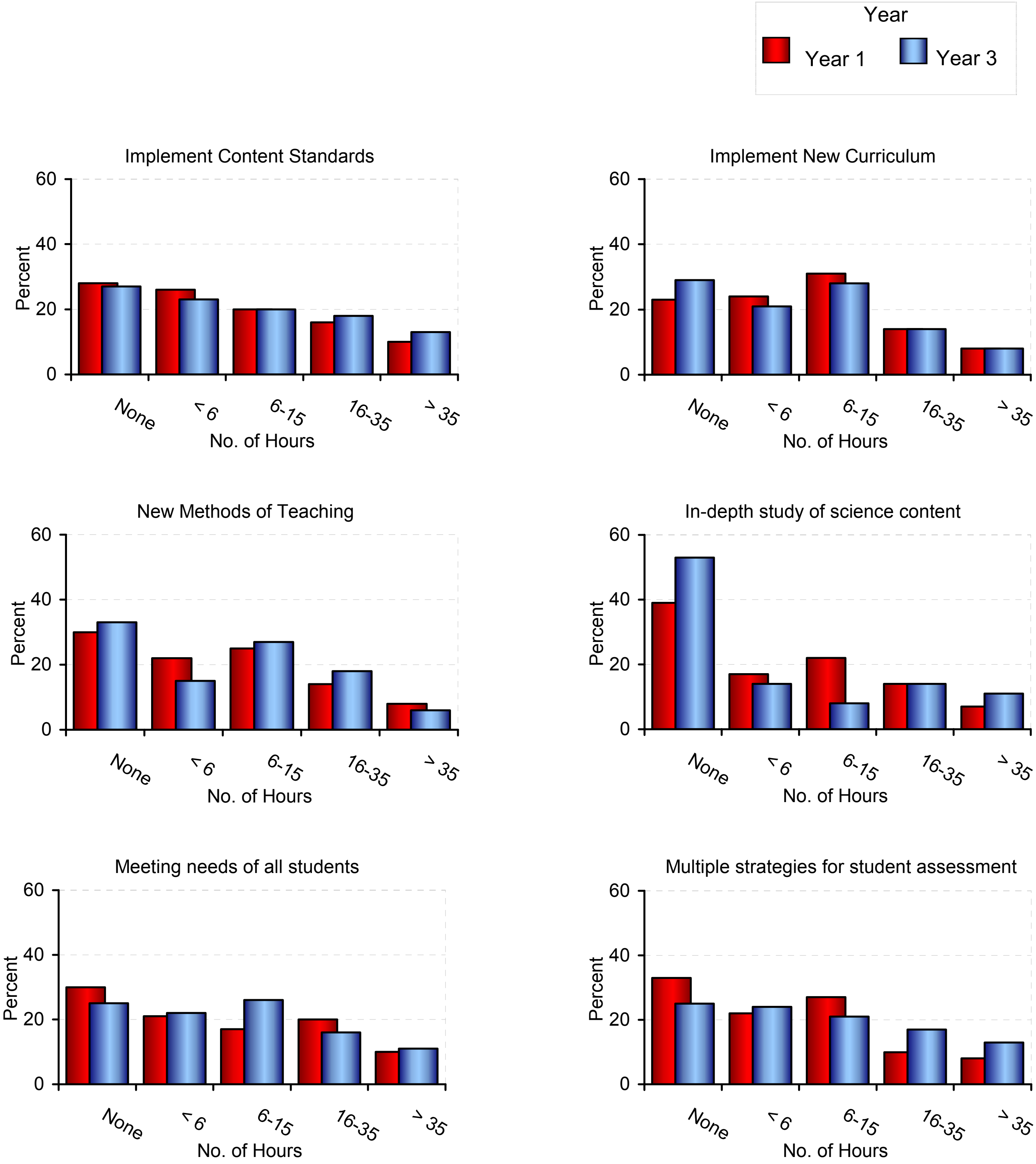
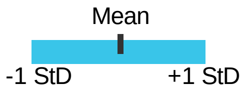


Chart 5-5
Teacher Course-Taking in Mathematics and Mathematics Education
By Grade Level

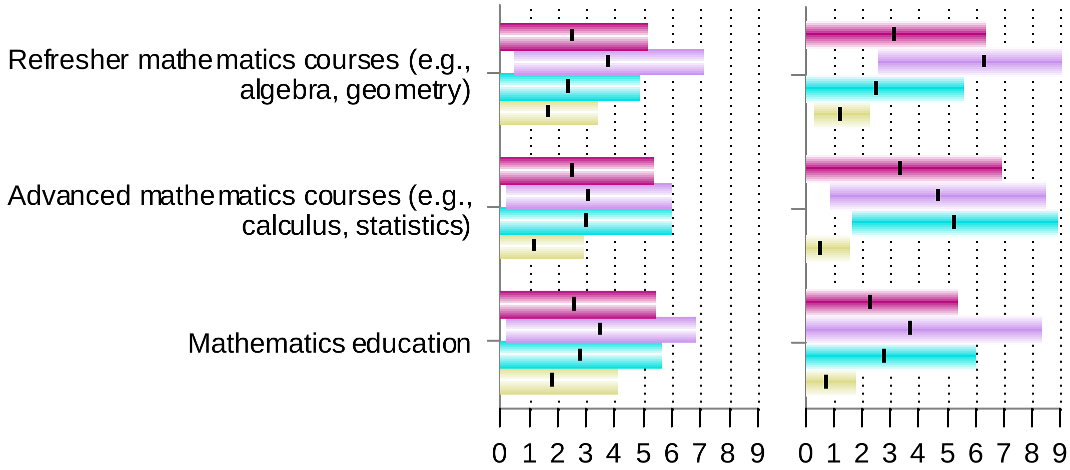
Legend



School 811

Your District (n)		Your School (n)	
🟪 All Grades	(110)	🟪 All Grades	(11)
🟪 Grade 8	(32)	🟪 Grade 8	(3)
🟦 Grade 7	(34)	🟦 Grade 7	(4)
🟨 Grade 6	(31)	🟨 Grade 6	(4)

Indicate the number of quarter or semester courses that you have taken at the undergradute or graduate level in each of the following areas:

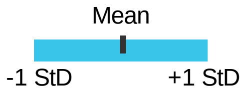


Response Codes:

0 = 0 courses *1= 1 - 2* *2 = 3 - 4* *3 = 5 - 6* *4 = 7 - 8*
5= 9 - 10 *6 = 11 - 12* *7 = 13 - 14* *8 = 15 - 16* *9 = 17+*

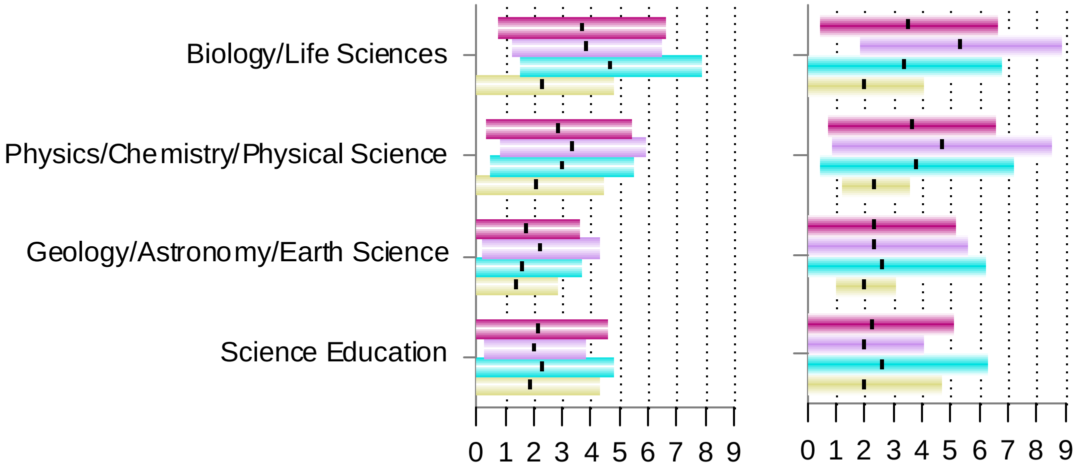
Chart 5-6
Teacher Course-Taking in Science and Science Education
By Grade Level

Legend



School 811			
Your District (n)		**Your School** (n)	
🟥 All Grades	(99)	🟥 All Grades	(11)
🟪 Grade 8	(30)	🟪 Grade 8	(3)
🟦 Grade 7	(32)	🟦 Grade 7	(5)
🟨 Grade 6	(33)	🟨 Grade 6	(3)

Indicate the number of quarter or semester courses that you have taken at the undergradute or graduate level in each of the following areas:

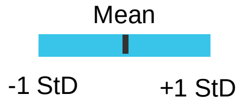


Response Codes:

0 = 0 courses	*1= 1 - 2*	*2 = 3 - 4*	*3 = 5 - 6*	*4 = 7 - 8*
5= 9 - 10	*6 = 11 - 12*	*7 = 13 - 14*	*8 = 15 -16*	*9 = 17+*

Chart 5-7
Mathematics
Teacher Opinions (Part 1):
Beliefs About Student Learning and Professional Collegiality
By Grade Level

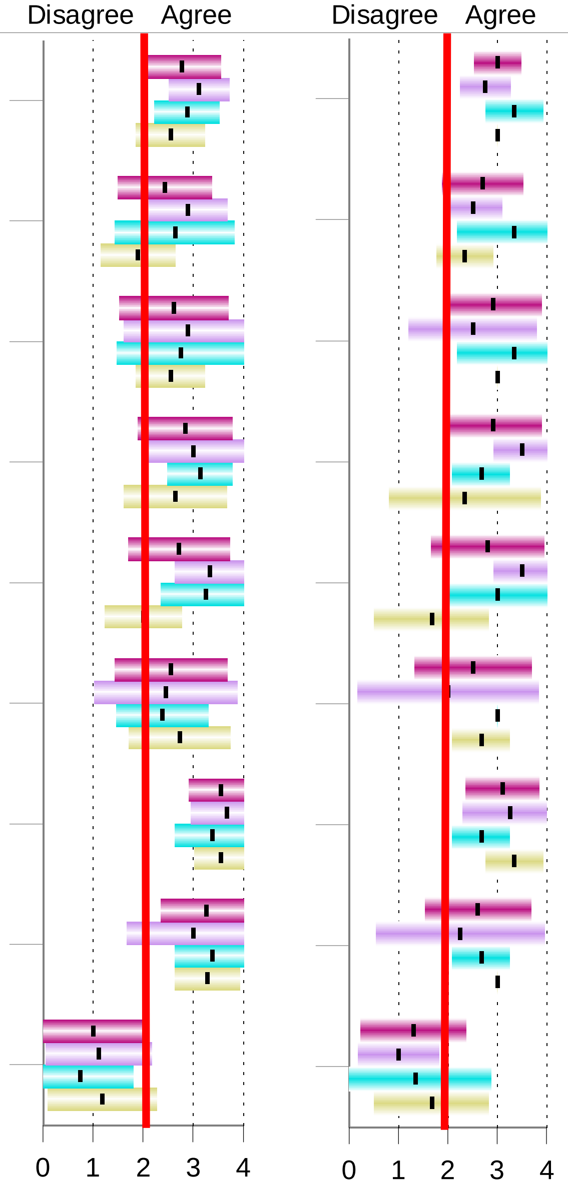
Legend



School 72

Your District (n)		**Your School** (n)	
■ All Grades	(30)	■ All Grades	(10)
■ Grade 8	(9)	■ Grade 8	(4)
■ Grade 7	(7)	■ Grade 7	(3)
■ Grade 6	(11)	■ Grade 6	(3)

Please indicate your opinion about each of the statements below:



Students learn mathematics best when they ask a lot of questions

Students master and retain mathematical algorithms more efficiently through repeated practice than through the use of applicaitons and simulations

Calculator use should be incorporated only after the mastery of basic arithmetic facts

All students can learn challenging mathematics content

Students learn mathematics best in classes with students of similar abilities

It is important for students to learn basic mathematics skills before solving problems

I really enjoy teaching mathematics

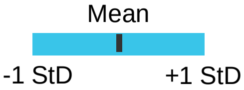
I am supported by colleagues to try out new ideas in teaching mathematics

I receive little support from the school administration for teaching mathematics

Response Codes: *0 = Strongly disagree* *1 = Disagree* *2 = Neutral / Undecided*
3 = Agree *4 = Strongly agree*

Chart 5-8
Science
Teacher Opinions (Part 2):
Beliefs About Student Learning and Professional Collegiality
By Grade Level

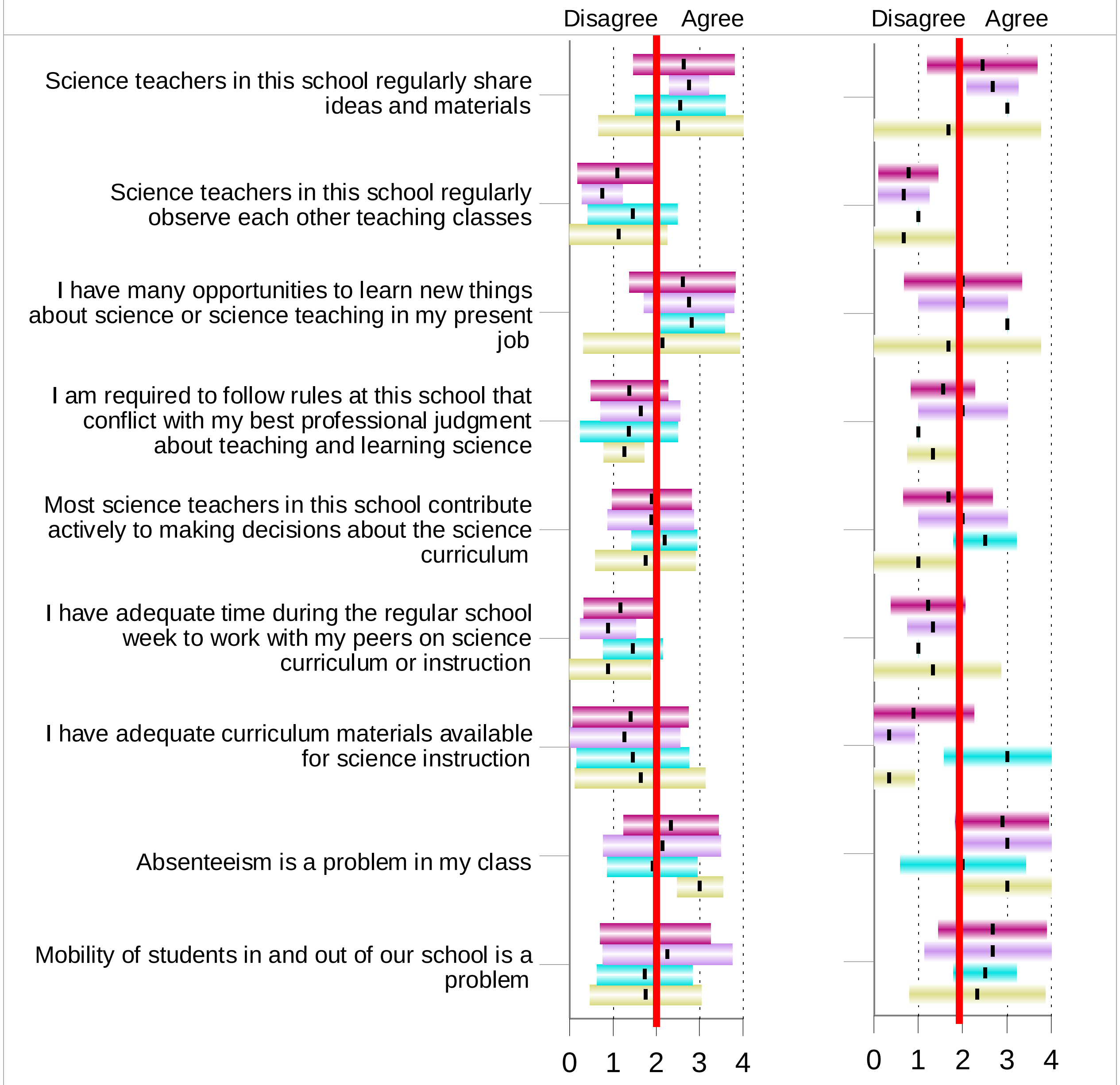
Legend



School 72

Your District (n)			Your School (n)		
🟥	All Grades	(30)	🟥	All Grades	(9)
🟪	Grade 8	(8)	🟪	Grade 8	(3)
🟦	Grade 7	(11)	🟦	Grade 7	(2)
🟨	Grade 6	(8)	🟨	Grade 6	(3)

Please indicate your opinion about each of the statements below:



Response Codes:

0 = Strongly disagree	*1 = Disagree*	*2 = Neutral / Undecided*
3 = Agree	*4 = Strongly agree*	

Finding 6: Measuring Change in Math and Science Instruction over Time

A primary research goal of the DEC study was to measure the change in math and science instruction over time and, specifically, to determine the effects of the DEC professional development model on improving alignment of instruction with standards. A main advantage of a longitudinal study which collects data in the same schools at two points in time is the ability to measure the effects of specific improvement initiatives. The DEC study has the additional advantage of comparing this change in two groups of schools randomly placed into treatment and control groups.

Key Findings on Effects of DEC Model on Improving Instruction

Results from analysis of the effects of the DEC model on improving instruction of math and science teachers in the treatment schools are reported in a separate research paper (Porter & Smithson, November 2004, forthcoming). The main points of the effects analysis can be summarized as follows:

- The DEC model did improve quality of instruction, as measured by increasing alignment with state standards, when comparing instruction in treatment schools to control schools; however, the effects are contingent on the level and effectiveness of implementation within the treatment schools.
- Schools with a high level of participation in DEC activities showed greater increases in alignment of instructional content with state standards than did other schools.
- Teachers who served on leader teams for their schools and had high stability in participation with the DEC model had greater gains in alignment of instruction than did other teachers in the treatment schools.
- Due to high teacher mobility in the study middle schools and other leadership and organizational changes in schools and districts from year 1 to year 3 of the DEC study, only one-fourth of the teachers in the study who completed the baseline teacher survey in year 1 also completed the follow-up SEC in year 3. This high attrition factor reduced the rigor and statistical significance of the trends analysis for DEC model effects.
- The DEC data analysis produced an index of alignment between state assessments and state standards for each of the study sites, as well as index of alignment for instruction. The alignment statistics and content maps for state assessment and standards are an important analysis product of the DEC study. (See Porter, 2004, and Smithson, 2004, alignment analysis presentations. For a complete listing of alignment analyses by state, see www.SECsurvey/ collaborative.)

Illustrations of Use of SEC Data to Analyze Change in Instruction

The following examples illustrate how schools use SEC data charts as indicators of change in instruction across a set of schools.

Change in instructional practices in math. Charts 6-1 and 6-2 provide data for tracking change in instruction in two schools in the same district. Data results for school 87 (treatment school) are shown in chart 6-1, and data for school 83 (control school) are shown in chart 6-2. For both schools, two years of survey results are displayed, the following examples of which indicate change in mathematics instruction:

- *Instructional time on problem solving and use of manipulatives:* One area of change from year 1 to year 3 was time on problem solving in math—school 87 math classes increased time on problem solving activities (18 to 20 percent on average), while school 83 decreased time (24 to 20 percent). Teachers in school 87 also reported increased time in use of manipulatives to teach math (10 to 15 percent of total class time).
- *Activities in small groups:* Treatment school 87 teachers reported less time on activities in small groups from year 1 to year 3. At the same time in control school 83, use of small groups increased from 12 to 20 percent of time.
- *Degree of variation by classroom in math instruction practices:* Both schools reported less variation in instructional practices in year 3 than in year 1 of the study. The variation in instructional time (shown by length of the bar) for school 87 teachers decreased in collecting data, use of portfolios, use of manipulatives, problem solving, and use of small groups. School 83 showed a similar pattern of decreased differences in instructional practices among the teachers.

Change in science instructional practices. Charts 6-3 and 6-4 provide data reported by teachers on science instruction in school 51 (treatment school) and school 53 (control school).

- *Portfolios and small groups increase:* From year 1 to year 3, school 51 showed more time devoted to use of portfolios in assessing science learning and greater use of small group activities.
- *Greater variation in instruction:* In school 53, teachers reported a higher degree of variation among classes in time spent on lab activities and investigations in year 3 than in year 1, while they reported less time in use of small group activities in year 3.

Change in alignment of math instruction with standards. Charts 6-5 and 6-6 illustrate content of math instruction in two Miami-Dade schools in year 1 and year 3. The instructional data are displayed in comparison to the FCAT state math assessment for grade 8. (Note: Instruction can also be compared to state standards, as shown in charts 3-1 through 3-5.)

The FCAT state math assessment emphasized all five main math topics: number sense, measurement, data analysis, algebraic concepts, and geometric concepts. The expectations dimension places high emphasis on perform procedures, with some emphasis on memorize and communicate understanding.

- *Focus on specific topics:* Data in charts 6-5 and 6-6 show that math instruction in year 1 in grades 6 through 8 in both schools 87 and 83 strongly emphasized number sense (i.e., green colors show higher average time reported) and some emphasis on the four other topics. Expectations for learning in number sense emphasized all five expectations.

- *Differences between schools:* In both years of the survey, school 87 teachers reported more instructional time on algebra and geometry than did teachers in school 83.
- *Change over two years in math content:* In year 3, school 87 teachers reported an increase in expectations for conjecture/prove across several topics, slightly less time on data analysis/statistics, and continued emphasis on algebra and geometry. School 83 teachers reported more instructional time on geometry in year 3.

These aggregated charts for schools by year are intended to demonstrate how trends can be analyzed. As shown in the charts in finding #3, the alignment data can be further analyzed by looking at the content maps for specific topic areas (number sense, algebra, etc.). The overall patterns for a school can be examined more carefully by looking at the detailed data for each topic.

Change in alignment of science instruction with standards. Differences in science instruction content between year 1 and year 3 are displayed in charts 6-7 and 6-8. School 51 (treatment school) and school 53 (control school) are both in the Winston-Salem district. The science instructional data can be analyzed in relation to the SAT 9 science assessment used in the district.

The SAT 9 science assessment for grade 8 focuses heavily on content in the topics of life, physical, and Earth sciences and nature of science. The expectations dimension focuses heavily on students learning to perform procedures and analyze information. The following are highlights of charts 6-7 and 6-8:

- Teachers in both schools 51 and 53 reported more emphasis on life science in year 1, and distribution of emphasis across all content areas except nature of science in year 3. Teachers in year 3 reported slightly more emphasis on measurement in science (possibly reflecting the emphasis on analysis of information in the expectations for the SAT 9).
- Teachers in both schools reported relatively equal levels of emphasis on all five expectations for science content learning; whereas, the SAT 9 places emphasis on expectations for memorize and analyze information.

The content maps allow teachers and leaders to analyze content taught by main topic and subtopic by expectations in relation to assessment or standards. (Charts 6-7 and 6-8 show main topics by assessment.) Schools receive a report of their instruction at the main topic and subtopic level, as well as charts for the average across all surveyed teachers in the district at the same grade and subject. Individual teachers can request a report of their own data. Teachers and leaders can review how they reported content topics by expectations and discuss their responses with other teachers—both to check interpretation of the survey items and terms, and then to further identify instructional content differences.

Chart 6-1
Instructional Activities in Mathematics
Treatment School, Year 1 and 3

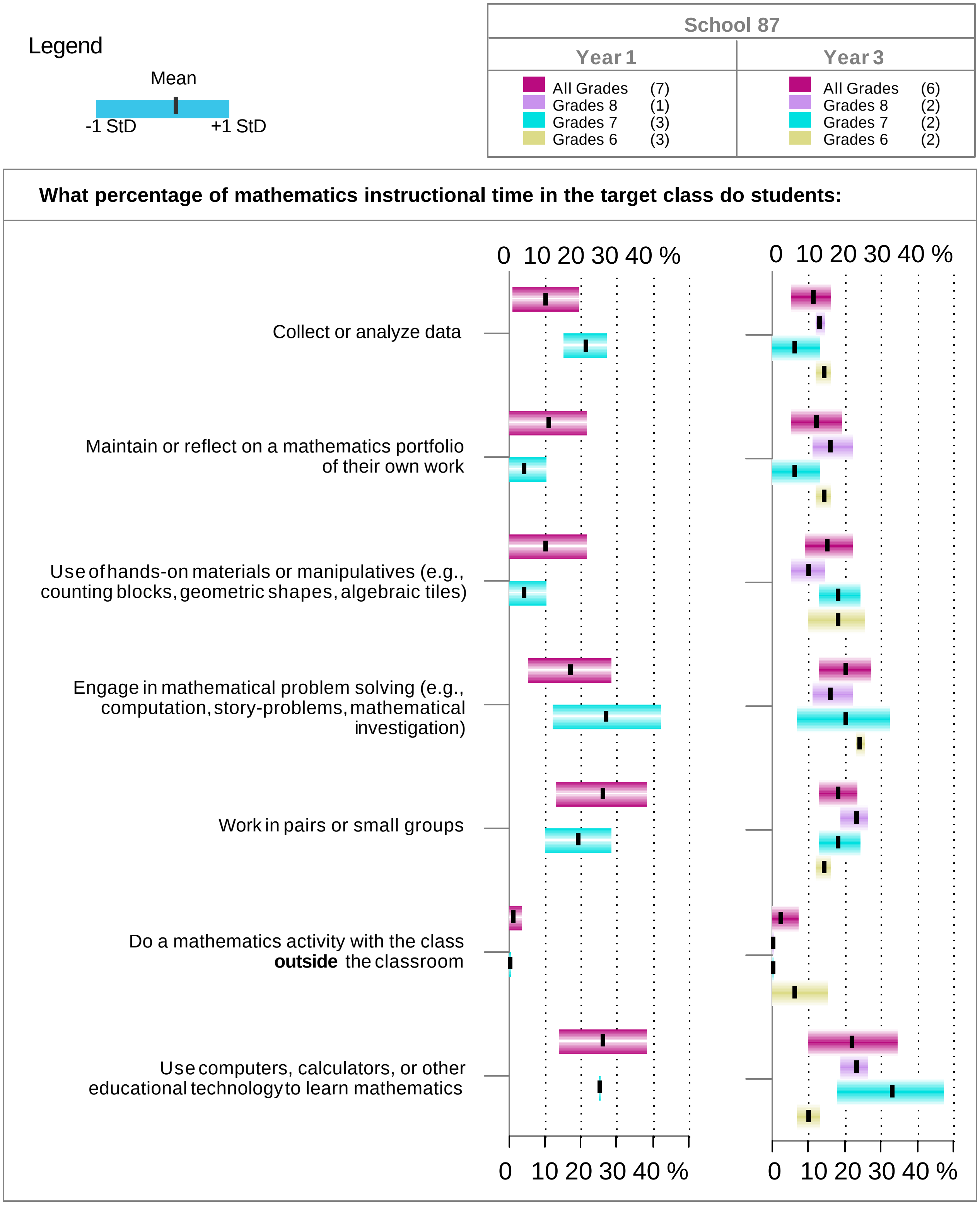


Chart 6-2
Instructional Activities in Mathematics
Control School, Year 1 and 3

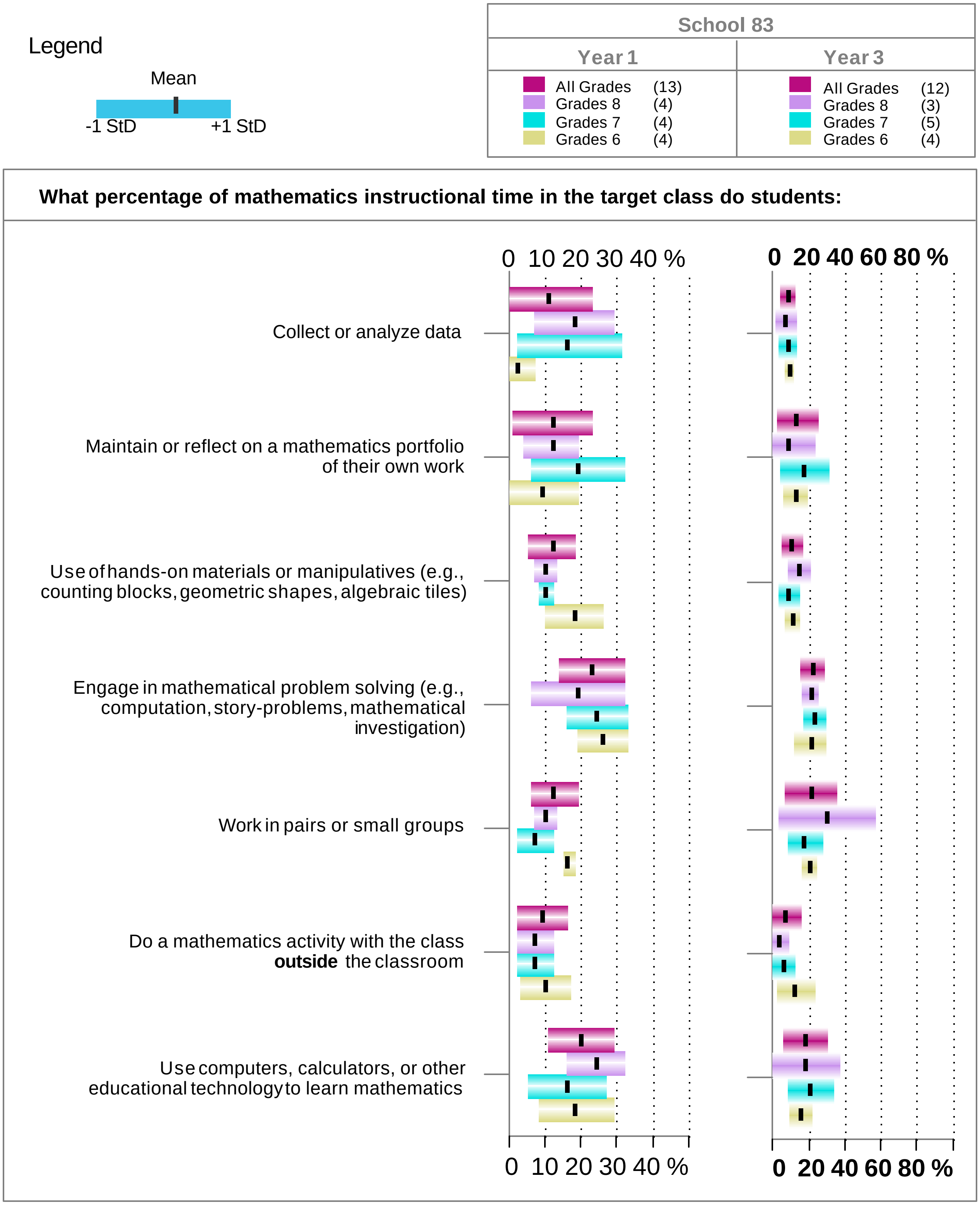


Chart 6-3
Instructional Activities in Science
Treatment School, Year 1 and 3

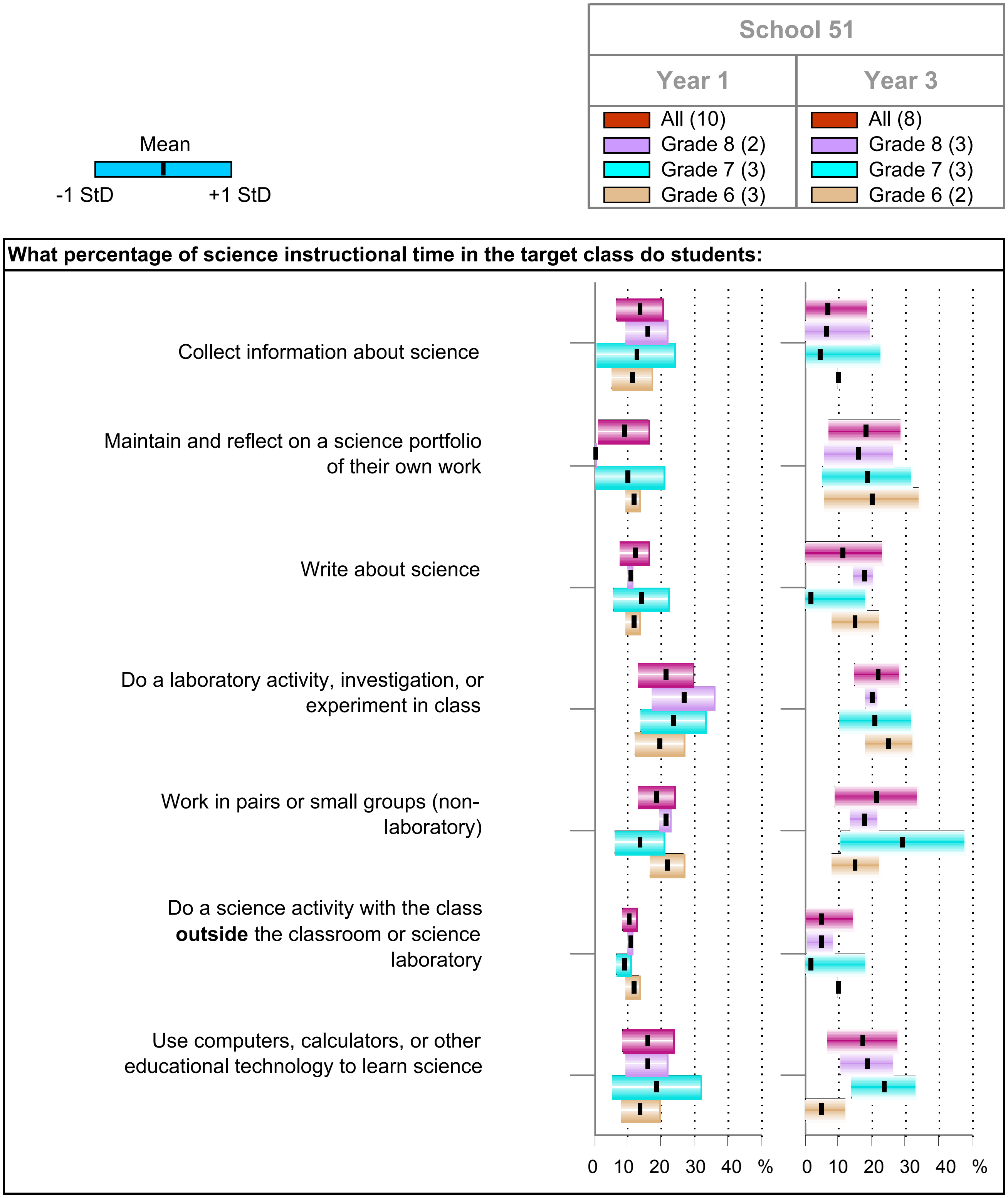


Chart 6-4
Instructional Activities in Science
Control School, Year 1 and 3

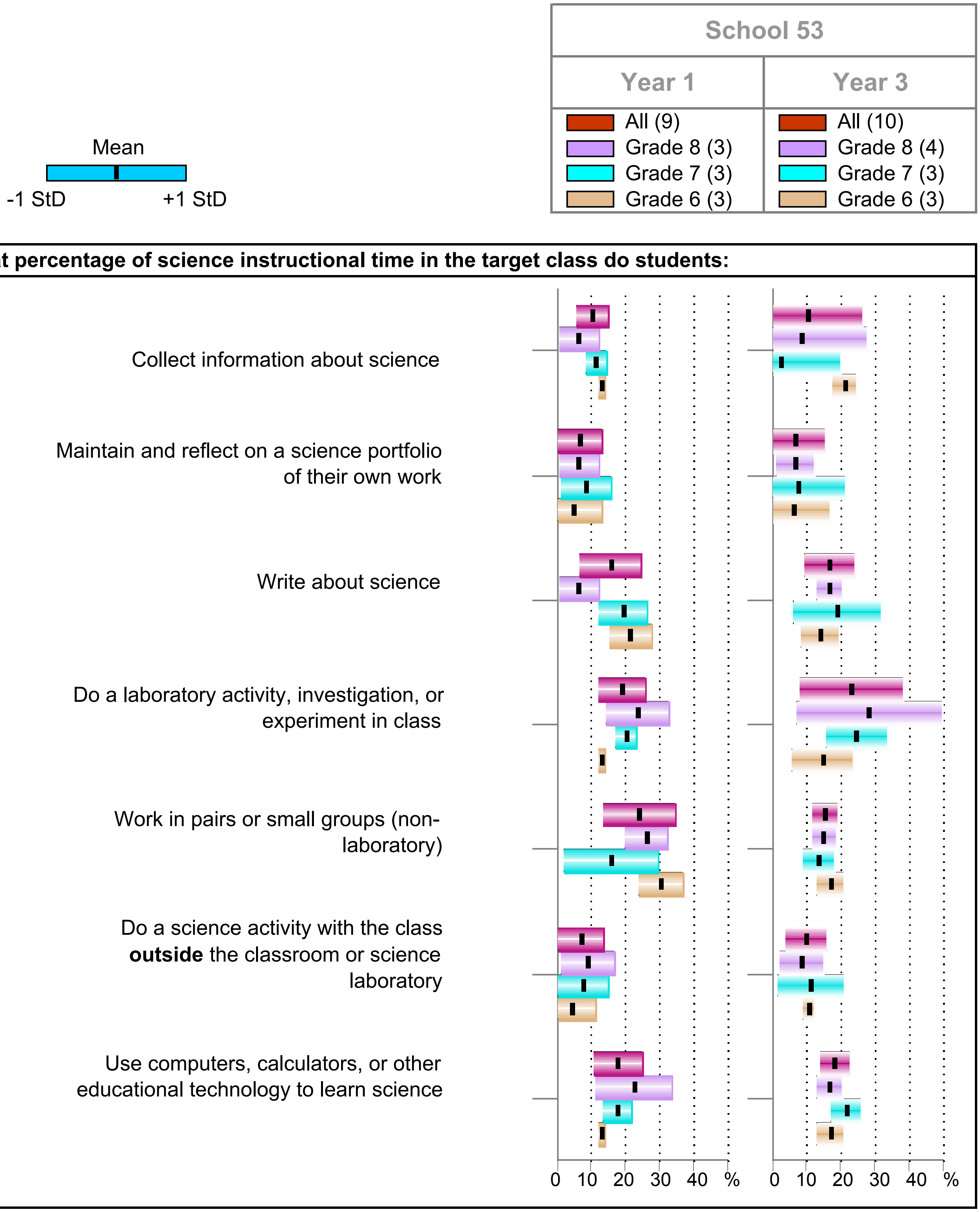


Chart 6-5
Mathematics Curriculum Content
Treatment School, Year 1 and 3
Instruction / Assessment

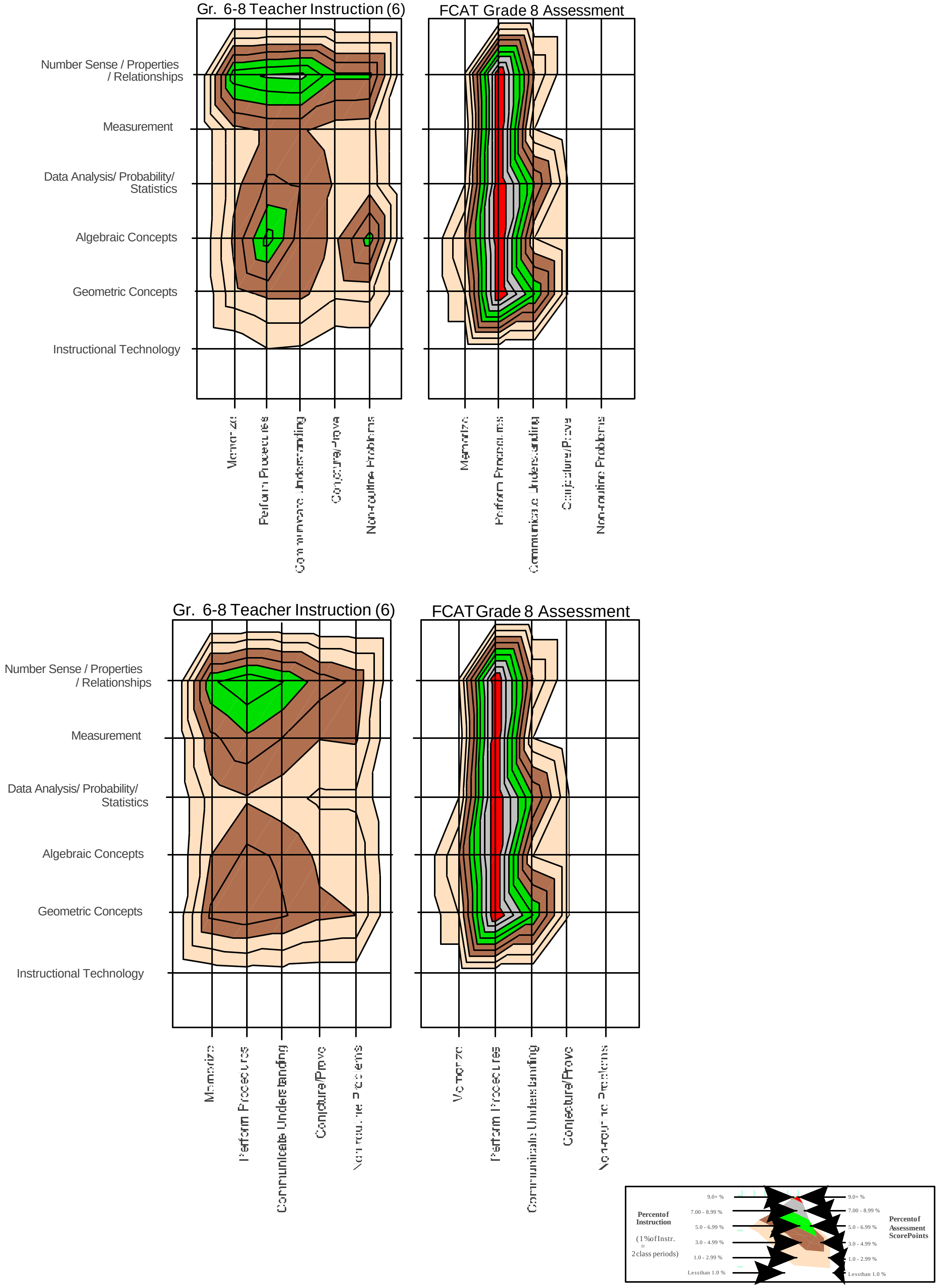


Chart 6-6
Mathematics Curriculum Content
Control School, Year 1 and 3
Instruction / Assessment

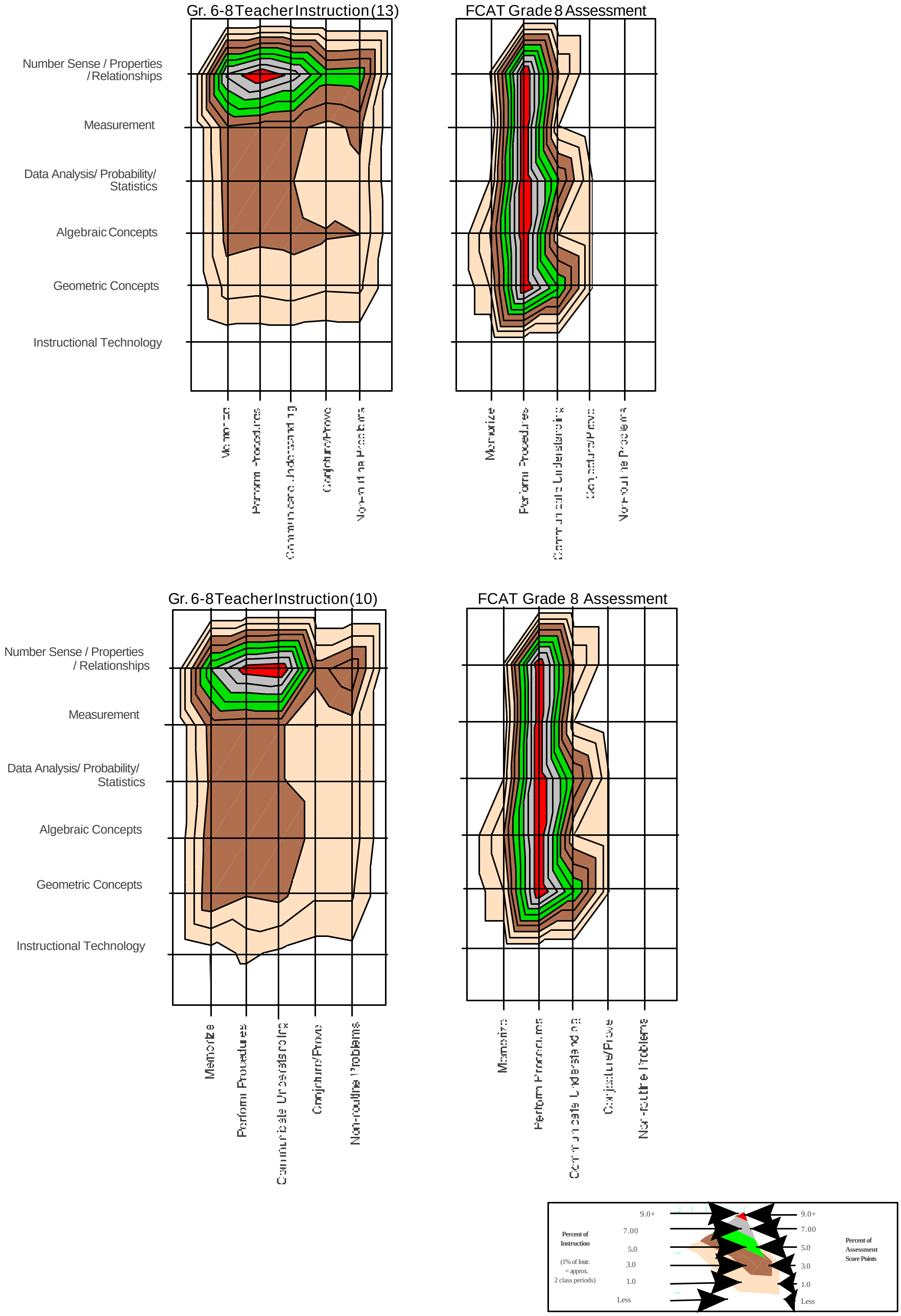
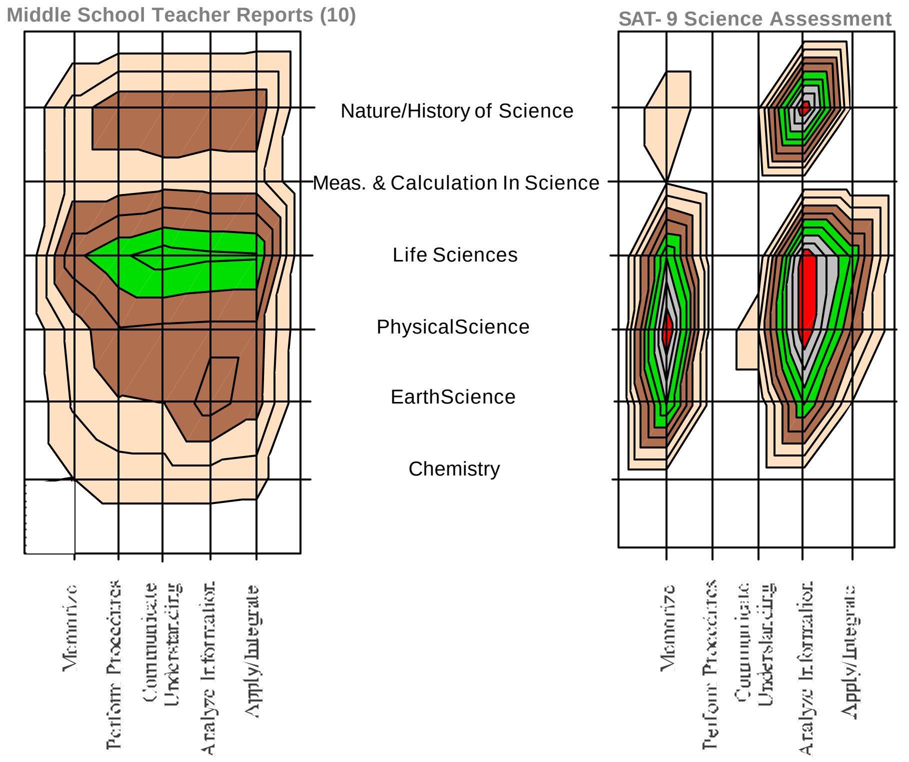
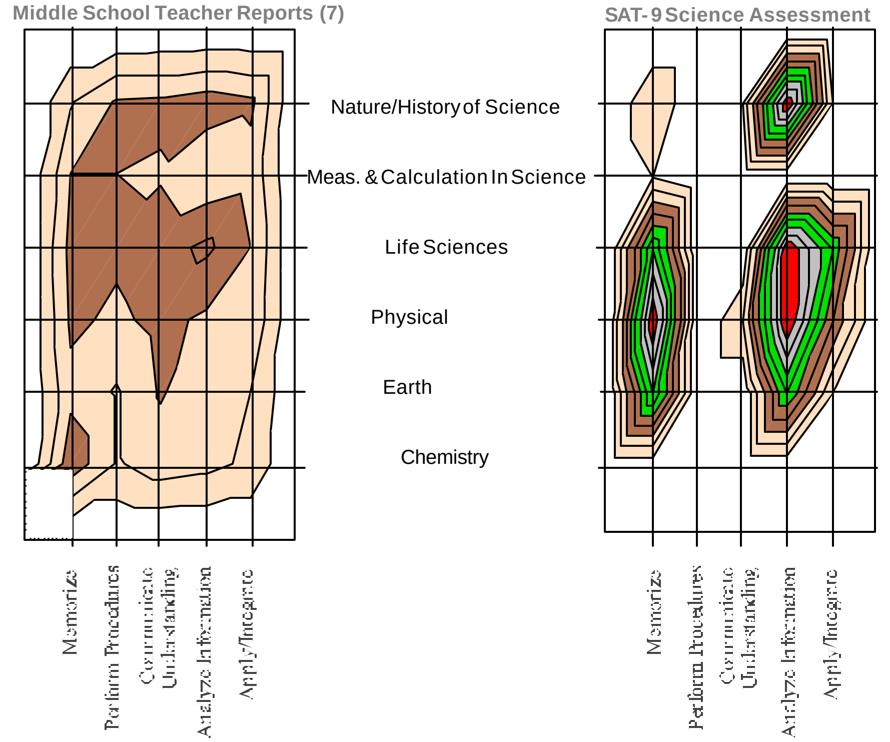


Chart 6-7
Science Curriculum Content
Treatment School, Year 1 and 3
Instruction / Assessment





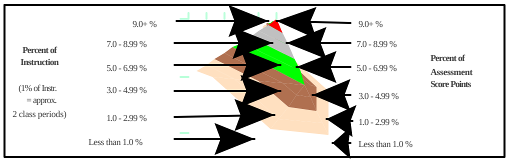
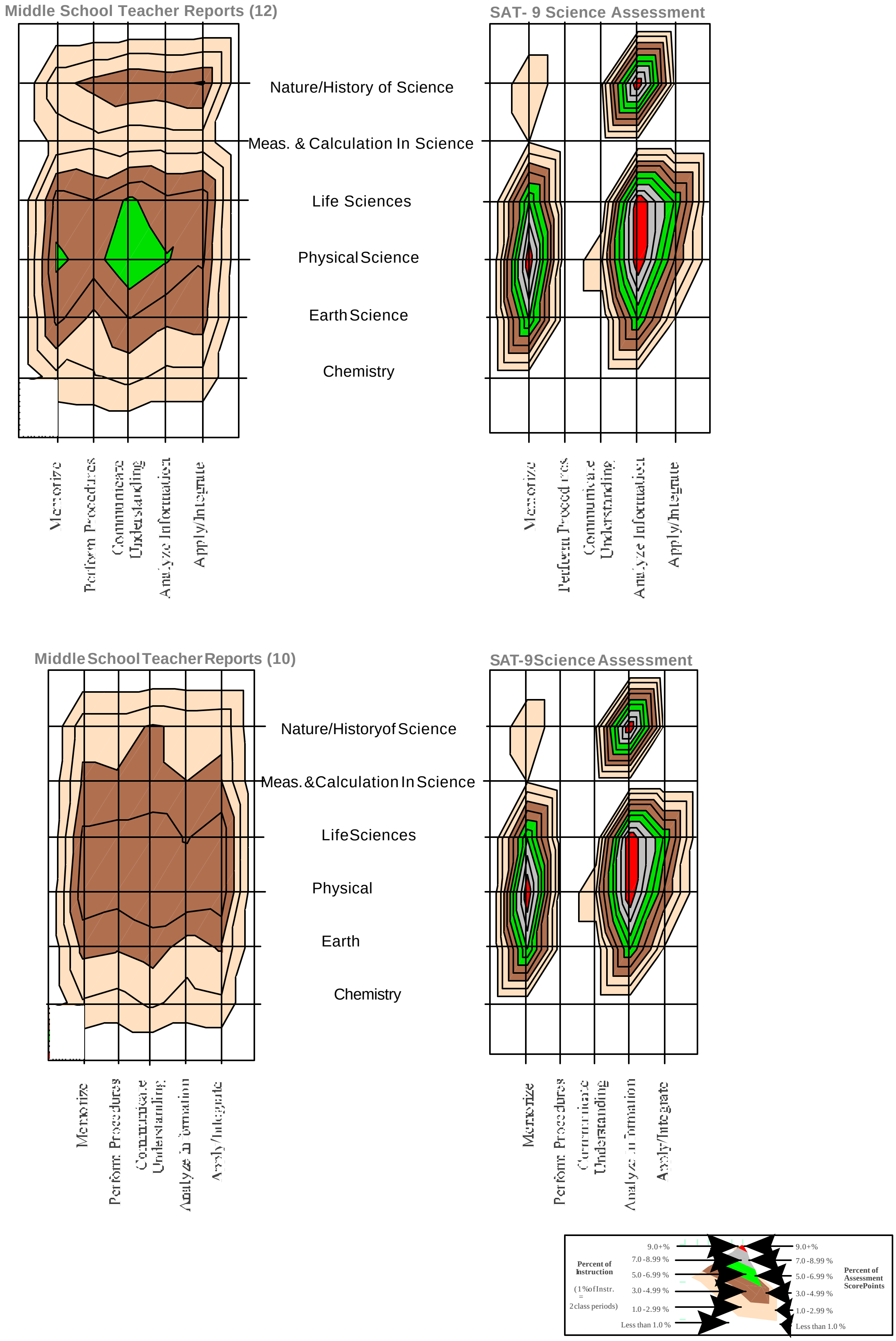


Chart 6-8
Science Curriculum Content
Control School, Year 1 and 3
Instruction / Assessment



Finding 7: What Was Learned about Implementing The DEC Model in Middle Schools

Findings from the study address how the DEC model was implemented in the target schools and demonstrate lessons learned from effective implementation. Multiple sources of data were used to analyze implementation of the DEC model, including surveys with teachers and administrators, interviews with local leaders and participants, observations by study research staff, and discussions with professional development staff.

Gaining Teacher and Administrator Buy-In

The first step in the DEC model which requires full participation by the target group of school staff is completion of the teacher SEC instrument. Finding #2 presents what was learned about effective steps toward survey administration to produce a high response rate and increase the quality of responses. Districts and schools demonstrated different levels of commitment and support for the project, especially in encouraging full and willing teacher completion of the survey. Essentially, school leaders need to be convinced that the survey completion step will produce data that will be useful and relevant to an important improvement goal or program initiative in the school. Whereas district leadership and support is an important ingredient for success, the survey and data production step is critical for schools to buy in to the DEC model. It was learned that schools need clear, timely information on how the DEC model and data will assist the schools directly, and why the initial baseline survey is critical to begin the process (and, in year 3, how the follow-up survey will measure improvement progress). Teacher support is an essential ingredient for school-based data-driven models to succeed.

Low numbers of responses from the initial baseline survey with teachers produced a severe handicap on the subsequent steps in the DEC professional development process, because the school leadership team and DEC leadership staff did not have the demonstrated buy-in from teachers and had relatively little data to turn around for use in the process. At the end of the initial baseline survey administration, four schools were dropped from the study by CCSSO due to low response rates (less than 20 percent of teachers completed surveys), and three additional schools decided not to continue at the end of the initial professional development workshop in year 1. (For details on school status, see Year 2 Progress Report (2002).) Thus, by the end of study year 1, almost 20 percent of the original sample of schools did not continue due to teacher buy-in issues.

Extent of Participation in Professional Development Activities

The DEC model relied heavily on a *turn-key* or *training-of-trainers* approach. With the turn-key model, each school selected a school leadership team whose members were expected to attend all professional development sessions (both multi-school sessions and in-school technical assistance). The leadership teams then lead other school staff through similar data-driven instructional improvement learning experiences. The participation of school leadership teams in the 18-month DEC professional development process is summarized in table 4.

Table 4
School Level Participation in DEC Professional Development and Technical Assistance Sessions

District	School ID	Total Sessions Attended	Average Staff Per Session	Percent Sessions Attended by Admin.	Participation Index
Charlotte	62	4	4.0	75%	44.4%
	66	5	4.8	60	32.0
	68	4	3.8	75	41.7
	610	3	7.0	100	41.2
	611	3	4.7	100	93.4
District Average	NA	3.4	4.7*	79%*	44.0%*
Chicago	91	6	5. 7	83	56.7
	92	5	2.2	60	73.3
	93	4	3.3	100	54.2
	97	4	3.3	75	46.4
District Average	NA	4.8	3.7*	79%*	55.3%*
Miami	80	6	4.8	66	48.0
	85	5	3.4	80	68.0
	87	6	4.0	33	44.4
	88	4	2.8	75	55.0
	810	5	4.4	100	55.0
	811	6	5.0	100	41.7
District Average	NA	5.3	4.2*	75%*	49.7%*
Philadelphia	70	5	6.4	100	58.2
	72	5	4.2	100	38.2
	76	5	2.6	60	65.0
District Average	NA	5.0	4.4*	87%*	50.8%*
Winst.-Salem	50	7	3.3	0	65.7
	51	6	3.2	83	52.8
	52	6	3.3	33	66.7
	56	7	2.4	100	60.8
District Average	NA	6.5	2.2*	54%*	59.5%*
Overall Average	**NA**	**4.95**	**3.95***	**73%***	**50.2%***

*Overall average weighted to reflect number of sessions attended by schools.

CCSSO DEC Professional Development Study, 2004

Professional development sessions. The first dimension of participation is the total number of sessions attended by one or more members of a school's leadership team. The total number of sessions attended by schools ranged from 3 to 7, with an average of 4.95 sessions attended per school. As outlined in Table 1, sessions included project overview, professional development session #1 (multi-school), technical assistance session #1 (in-school), professional development session #2, technical assistance session #2 (in-school), and professional development session #3.

Variation between schools indicates differences in implementation at the school level. As few as three sessions were held by a few schools in Charlotte and Philadelphia, one of which started the process late due to the school's decision to wait until new state testing was implemented before beginning any data-driven improvement activities. The data also reveal uneven school participation in Chicago and Miami schools. For example, school 93—probably the most engaged and committed DEC school in Chicago—did not attend professional development session #3 because it conflicted with other end-of-year school-wide activities. Although Miami school 87 participated in six professional development/technical assistance sessions and was one of the higher rated implementing schools, two of the sessions were short (half-day) repeat sessions conducted with a newly constituted leadership team. Restarting the initiative at school 87 became necessary when administration and staff turnover resulted in near total attrition of the original school leadership team.

Average staff participation per session. The second dimension of participation is the average number of persons attending DEC professional development sessions as part of a school's leadership team. The average attendance indicates the degree to which a school has full involvement from teachers, administrators, specialists, and department heads, as defined by the DEC model. School averages ranged from 2.2 to 7 persons, with an overall weighted sample average of 3.95 persons. The districts varied in average staff participation per school: Charlotte 4.7 persons, Chicago 3.7, Philadelphia 4.2, Miami 4.4, and Winston-Salem 2.2.

Principal participation. The third dimension of participation is the percent of DEC sessions in which school leadership teams included the principal or assistant principal. This measure indicates the degree of leadership knowledge about the operation of the model and how it can assist math and science teachers in curriculum improvement. Charlotte (70%) stands out for having a high rate of consistency of administrators present at DEC professional development workshops and meetings. Other districts varied widely in school leader participation: Miami averaged 75 percent; Philadelphia 87 percent; Chicago 79 percent, and Winston-Salem 54 percent. One Miami school that changed principals several times during the 2001–02 school year had a school leader present for only one of six DEC professional development/technical assistance sessions; two other Miami schools had leader representation at all of their sessions.

Stability of participation. The fourth dimension of school participation in DEC implementation is captured in the *participation index.* The index reflects the average rate of consistency of participation among the individuals in the school who attended one or more professional development sessions, with 100 percent being the maximum and 20 percent being very low. The index (overall average 50.2%) provides a summary measure of the degree to which schools send staff to the sessions who can build their skills from one session to the next, and thus have greater commitment to the model and capacity for passing on the approach to other teachers.

School Conditions for Effective Implementation

In table 4, the data on level of participation by schools across the five district sites shows that school-level implementation of the DEC model was extremely varied. Winston-Salem and Miami had high numbers of school-level sessions and teacher participation, and more formal sessions organized at district and school levels than other districts. Treatment schools in these districts had a higher degree of involvement with professional development, and thus had a higher probability of teachers using the data skills and analysis results for improving performance (for further data on analysis of implementation process, see CCSSO, Year 2 Progress Report, 2002b).

Analysis across the districts using the range of information available showed that three factors are crucial for a high degree of participation by schools and effective implementation of the model.

1. *Allocation of sufficient time for professional development activities in math/science, and time allotted specifically for the DEC model.*

   Schools with higher rates of participation and depth of implementation also had more time allocated by administrators for professional development or had organized teachers for special sessions devoted to the DEC data-based approach to improving instruction. Several schools devoted after-school time to informing staff, organized special Saturday sessions when time was tight, and in a few cases established a whole day for DEC data analysis and implementation sessions.

2. *School-level leadership that linked the DEC model to other professional development activities.*

   One of the outstanding features of schools with more effective use of the DEC model was active leadership by the principal and other school leaders to ensure continuity among school leadership teams. One of the goals for the teams with higher stability and leadership involvement was to move the learning from the DEC model into other instructional improvement activities with teachers. Effective schools with this model did not view the work through DEC activities as separate, isolated events required by an order from the district level. They tended to recognize the important relationship between data analysis skills concerning curriculum and instruction and other efforts to analyze strengths and weaknesses revealed in student achievement data. They also were able to link the DEC data analysis to other curriculum improvement activities, such as improving staff understanding of state standards for their subjects and grades or selecting new instructional materials and providing staff training for use of new materials.

3. *Identifying and communicating targets for improvement from DEC analysis.*

   The goal of the DEC model is to have all teachers in a school gain skills in curriculum analysis and increase their capacity for making decisions about instructional improvement based on shared information with colleagues. An important step in the process is moving the training of school leadership teams on to the remaining math and science teachers. In the current project, this step was largely in the hands of the schools. One strategy that could help in communication of the DEC analysis is to focus on specific content targets as a starting point for work with all teachers. The analysis of model effects over time showed that target areas identified by the school were typically the content areas that did experience change in instruction. Also, DEC project staff found that it was important that the teachers begin learning the data analysis skills with a small number of curriculum data charts—that is, to start with some identifiable differences in a specific instructional area.

   Another strategy for improving communication of the DEC analysis process to all staff is to identify areas of high differentiation in the curriculum. Using data to identify clear gaps between teachers in how instruction is delivered causes discussion about reasons for these gaps. First, staff can analyze how they responded to the surveys as they did, and then they can move on to identifying the relationship between survey responses and real differences in how instruction is organized in the school. In the course of these discussions, teachers will begin to recognize how ongoing use of these data could be useful for their own decisions about curriculum improvement.

Finding 8: Lessons Learned on Conducting Randomized Experimental Design Studies at the School Level

The DEC study design used random assignment of schools to treatment and control groups for the purpose of determining effects of the model with a scientifically rigorous design. In a prior paper, Andrew Porter presented some of the initial study design decisions and effects of local district context on the experimental design (2003). At the end of the three-year process, the CCSSO study team has identified four major factors that *negatively* affected the chance for effective implementation of the experimental design as initially planned.

Change in district leadership and control. During this study, two districts experienced significant policy changes which had two effects: (a) change in program priorities, which reduced the schools' need to participate in the DEC professional development model; and (b) change in the chain of command so that program offices could not directly work with individual school principals and staff.

Teacher mobility. High rates of teacher mobility in the 40 sample middle schools had a strong impact on the study design and implementation. From year 1 to year 3 of the study, one-half of the teachers of math and science in the sample changed schools (i.e. over a period of two school years). ***Of 660 math and science teachers (treatment and control) in study schools in year 1, only 49 percent were in the same school and subject assignment in year 3 (based on teacher assignment rosters collected from five school districts).*** The high rate of teacher mobility had several significant effects on the study design and implementation. First teacher mobility decreased the continuity of professional development from one session to the next and from one year to the next. Staff had to spend more time devoted to beginning orientation and training a new group of teachers, or teachers who were not present at the outset never became involved. Second, the measurement of change from year 1 to year 3 proved to be very problematic. Teachers in year 3 (many of them new since the baseline survey in year 1) either chose not to take the survey, or baseline data were missing for purposes of trends analysis.

Participation rates of teachers. In several districts in year 1 of the study, the lack of support from district or school leadership or poor communication to faculty resulted in low baseline survey response rates in 20 percent of the sample schools. Due to low rates of teacher buy-in, several treatment and control schools were dropped from the study. Project staff did recruit replacement schools within the first year of the study; however, increased expense and time for the study were required to maintain the expected number of schools. In light of these challenges, the rigor of the experimental design could be questioned.

Problem of treatment vs. no treatment design. Random selection at the school level into two groups—one where the treatment model is delivered and a second (control) where no treatment is provided—was extremely difficult to communicate and to sell to school systems and made it difficult to sustain support for the model. School leaders expressed significant concerns with the treatment/control design (which is the common approach to experiments at the individual student or teacher level). The solution this study provided was to offer delayed delivery of treatment to control schools after the initial two-year period of the study—however this approach required project staff to convince assigned control schools to participate in data collection with no reward or gain from the project for two years. In addition to hampering good relations with some districts and schools, the solution strained project resources.

In future applications of a school-level random selection design, use of one of the following two designs is strongly recommended: (a) assign schools to one of two or more alternate treatments, such as different professional development models, with effects of the different models measured and compared over time; or (b) design a study in which the control group is “blind” and analysis of dependent variables are conducted with data centrally collected from all schools.

Conclusions

Teachers, administrators, and policymakers across the United States continue to base efforts toward educational reform on content standards, a movement in public K-12 education which has continued for a decade. At national, state, and local levels, educators are now working to identify methods of aligning curriculum and instruction with standards. School leaders seek models for professional development which focus on upgrading teacher knowledge and skills to teach toward standards. The Data on Enacted Curriculum (DEC) project led by CCSSO has addressed a central question in the push for standards-based instructional improvement: *How do we fairly and accurately determine the status of current instruction across classrooms and schools, and measure progress of improvement using reliable data? And, then, how can the data be used to inform efforts to guide instructional improvement toward greater alignment with standards?*

The study tested the DEC model for collecting, analyzing, and using data to guide instructional improvement in math and science education. The model was tested in a sample of 40 middle schools in 5 urban districts. The study findings show the model can be effectively used by school teams to lead instructional improvement. The findings further show that when the DEC model was effectively implemented in schools, school leaders and teachers used the enacted curriculum data as a tool for focusing instruction on content contained in state standards.

The study also showed that several local conditions are crucial for the DEC model to be effective locally. First, a large proportion of math and science teachers in a school must complete the baseline and follow-up surveys, so that data analysis and applications of the results have strong buy-in from the staff, ensuring the data are fully representative of instructional practices across a school. Teachers and leaders need to see an important connection between curriculum data, analyses of student achievement, and other professional development in math and science.

Second, the instructional data need to be presented in displays and graphs which facilitate use of the data by teachers and other professionals to compare instructional content and practices with standards and assessments. Data workshops need to be scheduled to allow educators sufficient time to work together to gain skills in data interpretation and application to their own efforts in improvement.

Third, school and district leaders need to advocate for data-driven strategies for improvement and purposely schedule time when teachers can work together to review their instructional data; where they can jointly identify gaps in relation to standards and wide variation in content of instruction—both topics and expectations for students; and where they can then collaborate on strategies for moving instruction toward content contained in state standards and assessments.

Fourth, professional development initiatives need to be aligned, coherent, and coordinated, so that available time is used wisely and so that educators work toward a common improvement goal. Follow-up efforts need to build from prior experience and data should be used to track the degree of change. Leadership from district and school levels is key for maintaining a coherent and consistent model. The DEC sites with consistent local leadership and support for the model showed evidence of strongest gains on aligned instruction.

The findings of the three-year experimental design study demonstrate that the DEC model has strong potential for further application and effective use in schools. The results also show that much has been learned about planning, organization, and support, which are key ingredients for the model to be effective, and these findings can be used by program developers to improve the model and gain positive outcomes. The study results also inform the work of researchers and program evaluators who are planning applications of the Surveys of Enacted Curriculum design and procedures for analyzing effects of professional development initiatives on improving alignment of instruction with standards and assessments.

Appendix A - Descriptive Data on Schools, Teachers, and Classes Participating

Numbers of Districts	**5**

Teachers Responding to Survey	**Mathematics**		**Science**	
(whole or in part)	Year 1	Year 3	Year 1	Year 3
	289	239	261	194

Class reported by Teacher		**Mathematics**		**Science**	
		Year 1	Year 3	Year 1	Year 3
	Grade 2-5	20	12	11	4
	6	91	80	87	69
	7	89	77	77	60
	8	85	66	82	61
	Total	**285**	**237**	**257**	**194**

Teaching Time		**Mathematics %**		**Science %**	
(hours/week)		Year 1	Year 3	Year 1	Year 3
	Less than 4	10.7	9.6	15.7	35.1
	4 - 4.9	22.1	15.9	25.3	43.8
	5 or more	67.1	73.6	57.5	20.1

Achievement Level of Students		**Mathematics %**		**Science %**	
		Year 1	Year 3	Year 1	Year 3
	High	13.8	15.1	9.2	13.9
	Average	31.8	31.8	31.0	24.7
	Low	35.3	29.7	25.3	24.7
	Mixed	17.3	22.6	33.3	36.6

Teacher Characteristics		**Mathematics %**		**Science %**	
Experience: Yrs in Subject		Year 1	Year 3	Year 1	Year 3
	0--2	28.0	28.0	29.9	24.2
	3--5	17.3	16.3	16.9	23.7
	6--11	22.1	23.4	21.1	20.1
	12 or more	32.5	32.2	29.9	29.4
Experience: Yrs at School		Year 1	Year 3	Year 1	Year 3
	0--2	37.4	36.0	36.4	29.9
	3--5	31.1	29.7	27.2	31.4
	6--11	18.0	21.3	16.5	21.1
	12 or more	13.1	13.0	17.2	14.4

Appendix A - Descriptive Data on Schools, Teachers, and Classes Participating

Teacher Characteristics	**Mathematics %**		**Science %**	
Highest Degree	Year 1	Year 3	Year 1	Year 3
BA/BS	59.8	57.7	54.0	54.1
MA/MS or higher	40.1	41.0	41.4	41.2
Other	0.3	1.3	0.8	2.1
Major: Bachelors	Year 1	Year 3	Year 1	Year 3
Elementary Ed.	34.6	31.4	28.0	31.4
Middle Ed.	10.6	10.9	7.3	10.9
Math Ed. or Science Ed.	9.3	7.9	5.4	7.9
Mathematics/Science field	10.1	12.6	25.7	12.6
Combined Education and M/S field	6.6	3.3	4.6	3.3
Other field	28.8	35.1	22.2	35.1
Major: Highest Degree	Year 1	Year 3	Year 1	Year 3
Elementary Ed.	57.1	20.1	22.2	23.7
Middle Ed.	5.9	7.9	7.3	13.9
Math Ed. or Science Ed.	7.3	10.0	8.4	9.8
Mathematics/Science field	4.2	4.2	11.1	28.9
Combined Education and M/S field	4.2	5.4	5.4	6.2
Other field	20.1	19.7	15.7	19.6

Teacher Demographics	**Mathematics %**		**Science %**	
	Year 1	Year 3	Year 1	Year 3
Female	76.8	75.7	66.3	70.1
Male	23.2	22.6	31.0	26.8
White	48.4	53.6	53.6	50.5
Minority	52.6	46.4	37.9	45.8

Appendix B

SEC Reporting: List of pre-formatted charts for reporting data collected by Surveys of Enacted Curriculum (online or paper versions)

Mathematics Charts
A: Scale Measures of Instructional Practices
B: Scale Measures of Teacher and School Characteristics
C: Class Description
D: Use of Class Time during Most Recent Unit of Instruction in Mathematics
E: Use of Homework in Mathematics
F: Instructional Activities in Mathematics
G: Problem Solving Activities during Mathematics Instruction
H: Small Group Work in Mathematics
I: Use of Hands-On Materials in Mathematics
J: Assessment Strategies in Mathematics
K: Use of Calculators, Computers, & Educational Technology in Mathematics
L: Professional Development in Mathematics
M: Influences on Instructional Practice in Mathematics
N: Teacher Course-Taking in Mathematics and Mathematics Education
O: Teacher Readiness (Part 1)
P: Teacher Readiness (Part 2)
Q: Teacher Opinions: Beliefs about Student Learning
R: Teacher Opinions: Beliefs about Professional Collegiality
S: Teacher Demographic Characteristics
T: Content Maps of Instruction & Assessment/Standards
U: Content Graphs of Instruction & Assessment/Standards
AA: Fine Grain Content Maps

Science Charts
A: Scale Measures of Instructional Practices
B: Scale Measures of Teacher and School Characteristics
C: Class Description
D: Use of Class Time during Most Recent Unit of Instruction in Science
E: Use of Homework in Science
F: Instructional Activities in Science
G: Laboratory Activities during Science Instruction
H: Small Group Work in Science
I: Collecting Information in Science
J: Assessment Strategies in Science
K: Use of Calculators, Computers, & Educational Technology in Science
L: Professional Development in Science
M: Influences on Instructional Practice in Science
N: Teacher Course-Taking in Science and Science Education
O: Teacher Readiness (Part 1)
P: Teacher Readiness (Part 2)
Q: Teacher Opinions: Beliefs about Student Learning
R: Teacher Opinions: Beliefs about Professional Collegiality
S: Teacher Demographic Characteristics
T: Content Maps of Instruction & Assessment/Standards
U: Content Graphs of Instruction & Assessment/Standards
AA: Fine Grain Content Maps

	Science Year3 Scale Items **Science Scales**		**Reliability Coefficient** *(reliability if item dropped)*	**Scale Mean** (item mean)
Communicating Scientific Understanding		**CSU**	**0.761**	**1.69**
Q36	Write about Science		*0.751*	1.57
Q47	Complete written assignments from the textbook or workbook.		*0.731*	1.30
Q49	Talk about ways to solve science problems.		*0.729*	1.77
Q51	Write results or conclusions of a laboratory activity.		*0.706*	2.02
Q56	Organize and display the information in tables or graphs.		*0.716*	1.76
Q64	Display and analyze data.		*0.722*	1.68
Active Learning in Science		**AcLS**	**0.715**	**1.62**
Q31	Collect data or information as part of science (as part of science homework).		*0.679*	1.63
Q34	Collect information about science.		*0.694*	1.50
Q37	Do a laboratory activity, investigation, or experiment in class.		*0.674*	2.13
Q38	Work in pairs or small groups.		*0.695*	2.02
Q39	Do a science activity with the class outside the classroom or science laboratory.		*0.693*	0.88
Q42	Use science equipment or measuring tools		*0.678*	1.92
Q43	Change something in an experiment to see what will happen.		*0.689*	1.40
Q52	Work on an assignment, report, or project that takes longer than one week to complete.		*0.694*	1.47
Student Reflection on Scientific Ideas		**RPS**	**0.686**	**1.39**
Q35	Maintain and reflect on a science portfolio of their own work.		*0.637*	1.04
Q53	Work on a writing project or portfolios where group members help to improve each other's (or the group's) work.		*0.604*	1.06
Q55	Ask questions to improve understanding.		*0.671*	1.82
Q58	Discuss different conclusions from the information or data.		*0.614*	1.69
Q59	List positive (pro) and negative (con) reactions to the information.		*0.649*	1.32
Scientific Thinking		**SciThi**	**0.733**	**1.93**
Q44	Design ways to solve a problem.		*0.733*	1.52
Q45	Make guesses, predictions, or hypotheses.		*0.634*	2.15
Q46	Draw conclusions from science data.		*0.686*	2.11
Q57	Make prediction based on the information or data.		*0.678*	1.76
Q60	Reach conclusions or decisions based upon the information or data.		*0.695*	2.07
Teacher Preparedness for Providing an Equitable Environment		**TPEQ**	**0.811**	**1.96**
Q98	Teach students with physical disabilities.		*0.781*	1.40
Q100	Teach classes for students with diverse abilities.		*0.749*	2.08
Q102	Teach science to students from a variety of cultural backgrounds.		*0.810*	1.54
Q103	Teach science to students who have limited English proficiency.		*0.754*	1.66
Q104	Encourage participation of females in Science.		*0.799*	2.54
Q105	Encourage participation of minorities in Science.		*0.789*	2.52

Teacher Preparedness for Using Innovative Teaching Strategies		**TPIN**	**0.829**	**2.29**
Q91	Use/manage cooperative learning groups in Science.		*0.778*	2.35
Q92	Integrate Science with other subjects.		*0.802*	2.30
Q94	Use of a variety of assessment strategies (including objective and open-ended formats).		*0.793*	2.35
Q96	Teach problem solving strategies.		*0.792*	2.35
Q97	Take into account students' prior conceptions about natural phenomena when planning curriculum and instruction		*0.807*	2.10
Professional Collegiality		**PC**	**0.599**	**2.04**
Q114	I am supported by colleagues to try out new ideas in teaching science.		*0.582*	2.97
Q116	Science teachers in this school regularly share ideas and materials.		*0.534*	2.67
Q117	Science teachers in this school regularly observe each other teaching classes.		*0.547*	1.10
Q120	Most Science teachers in this school contribute actively to make decisions about the science curriculum.		*0.540*	1.99
Q121	I have adequate time during the regular school week to work with my peers on science curriculum instruction.		*0.513*	1.45
Use of Multiple Assessment Strategies		**MAS**	**0.597**	**1.89**
Q74	Extended response item for which students must explain or justify solution.		*0.520*	2.38
Q75	Performance tasks or events (e.g., hands-on activities		*0.487*	2.43
Q77	Science projects		*0.554*	1.22
Q78	Portfolios		*0.536*	1.02
Q79	Systemic observations of students		*0.615*	2.40
Standards		**STND**	**0.579**	**4.12**
Q80	Your state's curriculum framework or content standards		*0.300*	4.43
Q81	Your district's curriculum frame work or guidelines		*0.401*	4.07
Q85	National science education standards		*0.694*	3.84
Use of Educational Technology		**EDTE**	**0.552**	**1.25**
Q40	Use computers, calculators, or other technology to learn Science.		*0.496*	1.49
Q62	Use sensors and probes.		*0.548*	0.41
Q63	Collect data or information (e.g., using the internet).		*0.382*	1.51
Q68	Computer/lab interfacing devices included		*0.459*	1.53

Appendix C

Methodology for Alignment Analysis of Instruction with Standards or Assessments as a Measure of Change in Instruction

Central to the design of the experimental study underlying the Data on Enacted Curriculum (DEC) project are a series of alignment analyses designed to determine if instruction in phase 1 (treatment) schools moves toward closer alignment with state standards and/or assessments than does instruction in phase 2 (control) schools. To conduct these analyses, two types of data are produced and analyzed using the Survey of Enacted Curriculum (SEC) two-dimensional content matrix (topic by expectations for learning). Teacher survey reports on content of instruction are compared with coded data on content of state standards and assessments. The data produce a common metric for quantitative analyses.

The cells comprising the SEC content matrix (specific to math and to science) are used to code the content included in standards and assessments. Teachers use the same matrix to report on the content taught in class with their curriculum, making it possible to compute an objective measure of alignment. (A copy of the survey instrument is available at the CCSSO website, www.SECsurvey.org.) Data on the subject content of standards and assessments are coded by teams of four subject experts using SEC content framework based on established procedural rules and training techniques (Porter & Smithson, 2002). The alignment coding method has been found to have a high degree of inter-rater reliability among subject area specialist teams when applied to state assessments and standards (Porter, 2002).

Other standards or assessment alignment procedures often have compared only topics of instruction. The primary reason for using a two-dimensional approach is that analyzing the intersection of both topics and expectations provides a powerful predictor of how well students learn, as demonstrated in research (Gamoran, Porter, Smithson, & White, 1997).

Procedures in DEC project. The project included both content coding of state standards and assessments and surveys of teachers on instructional content. The description of instructional content was collected from teacher surveys, which were completed by 75 percent of the mathematics and science teachers in the DEC schools. Descriptions of state, local, and other assessments were collected as part of a content analysis workshop held in the fall of 2001 for DEC districts.

The alignment statistic for each school or district is computed by comparing content data from two content descriptions (e.g., instruction and assessment). These data are reduced to a single index running from 0 to 1, with 1 representing perfect agreement (or alignment) between the two descriptions and 0 indicating no agreement whatsoever.

In considering alignment measures it is important to note the “target” used for aligning instruction. Typically, instruction will be aligned to content standards or to assessments. Which target to select will largely depend upon the purpose for which the measures will be used. Content standards (if they are sufficiently detailed) are useful for providing a general description of desired instruction, as content standards cover a larger domain than is possible with assessment instruments. However, if the alignment measure is intended to be used as a tool for determining the effects of instruction on student achievement gains, then the assessment serves as a better target. Content standards also vary significantly by state, and some are likely to be more conducive to content analyses than others. For the DEC project thus far, only assessments have been content analyzed, in part because participating schools and districts tend to be more focused on assessments, upon which their accountability is based.

Key role of alignment. Recently, federal and state policies in public education have required educators at all levels to focus their efforts in curriculum development and instructional improvement toward state standards in core subjects. The No Child Left Behind Act of 2001 requires states to establish accountability systems that are based on statewide assessments which in turn are aligned with state standards, with a defined purpose of accountability as to ensure that schools focus improvement efforts on students with low performance.

Currently educators and leaders at all levels are trying to improve alignment of policies as well as alignment of classroom instruction. The concept of alignment in education policy comes from the movement toward standards-based, system-wide education reform (Smith & O'Day, 1991; Porter & Smithson, 2001; National Research Council, 1995; National Council of Teachers of Mathematics, 2000). To improve education quality systemwide, policies governing K-12 education, including curriculum, assessment, graduation, and teacher preparation, must be coherent and consistent—that is, aligned.

A focus on alignment analysis is not just applicable to state policymakers; it is a powerful tool for local curriculum specialists, department heads, or classroom teachers. If poor and minority children are to receive a high quality, standards-based education—ultimately to reduce the achievement gap—then the instruction they receive must be aligned with the state content standards. Hence, a key element in understanding the impact of standards-based reform on student achievement is a measure of the alignment between the curricular content to which students are exposed and the content standards the state and district hope to implement. (For a summary of models, go to http://www.ccsso.org/projects/Alignment_Analysis.)

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 1 below) and six categories of cognitive expectations for students (indicated by vertical lines; see 2 below). The intersection of each topic area and category of cognitive expectation represents a measurement node (see 5 below). 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 3 below) 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 4 below). 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).

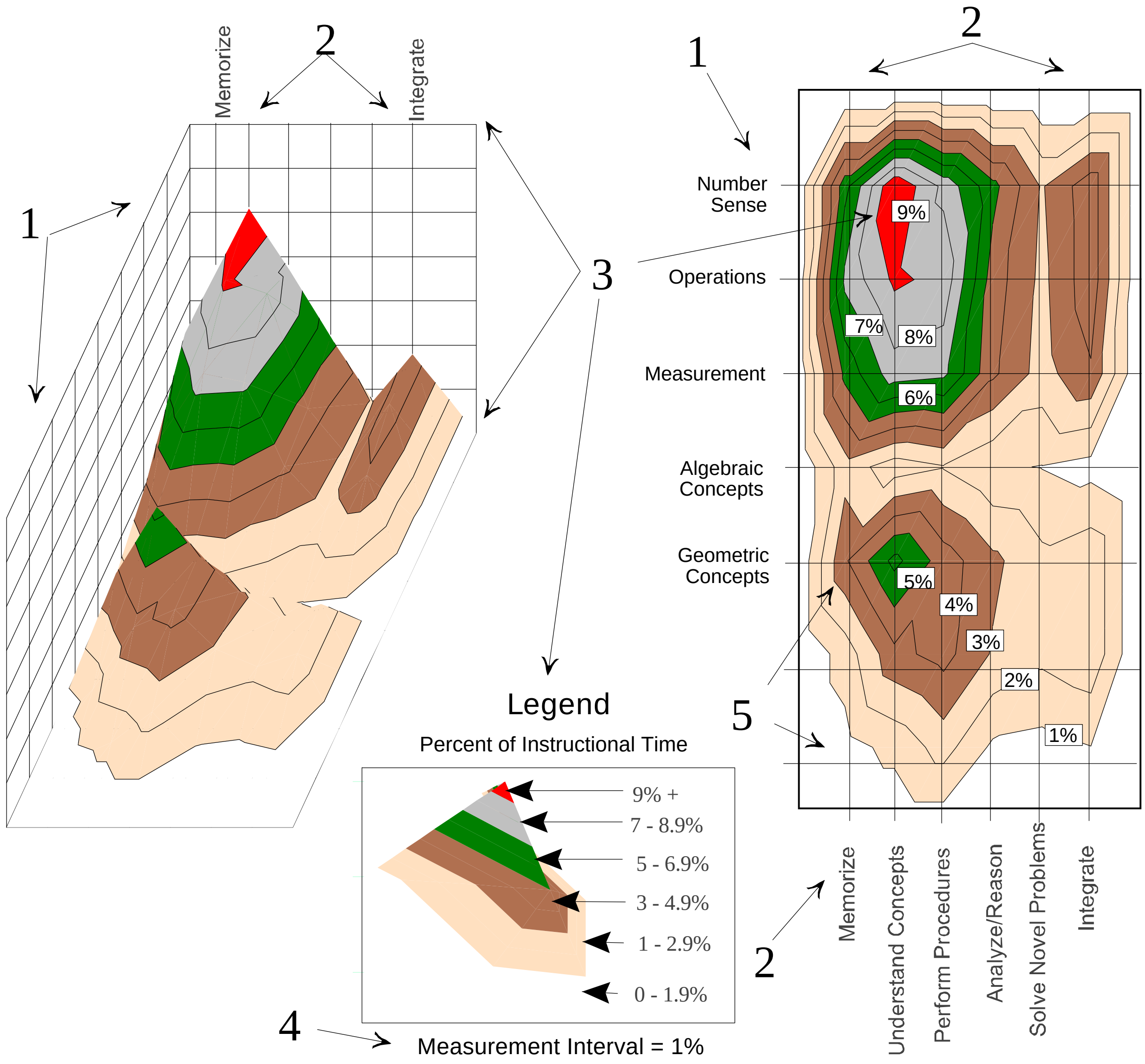
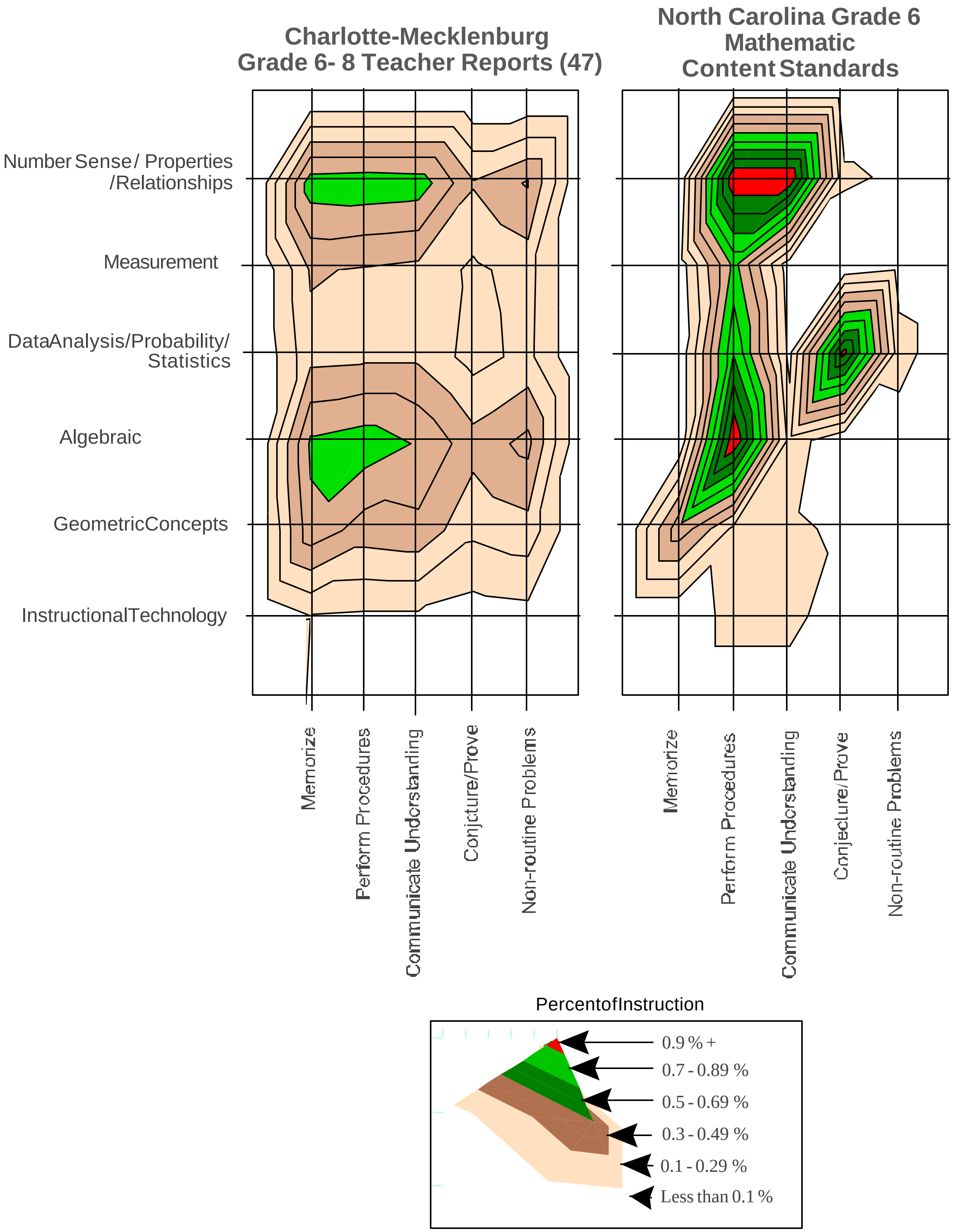


Chart D-1
Mathematics Curriculum Content
Charlotte-Mecklenburg Schools
Instruction / Assessment



Measurement Interval = 0.1%

Chart D-2
Mathematics Curriculum Content
School District of Philadelphia
Instruction / Assessment

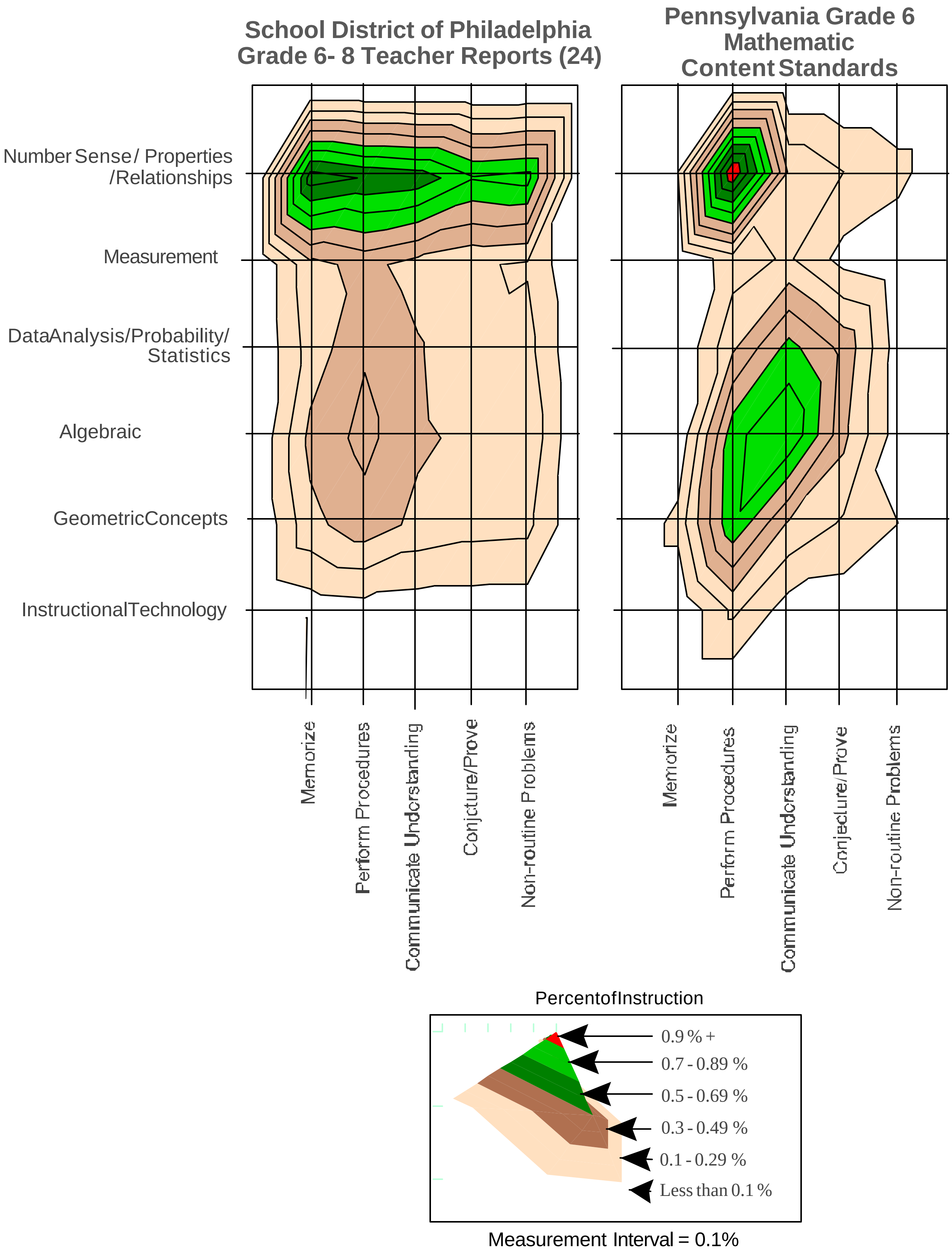


Chart D-3
Mathematics Curriculum Content
Chicago Public Schools
Instruction / Assessment

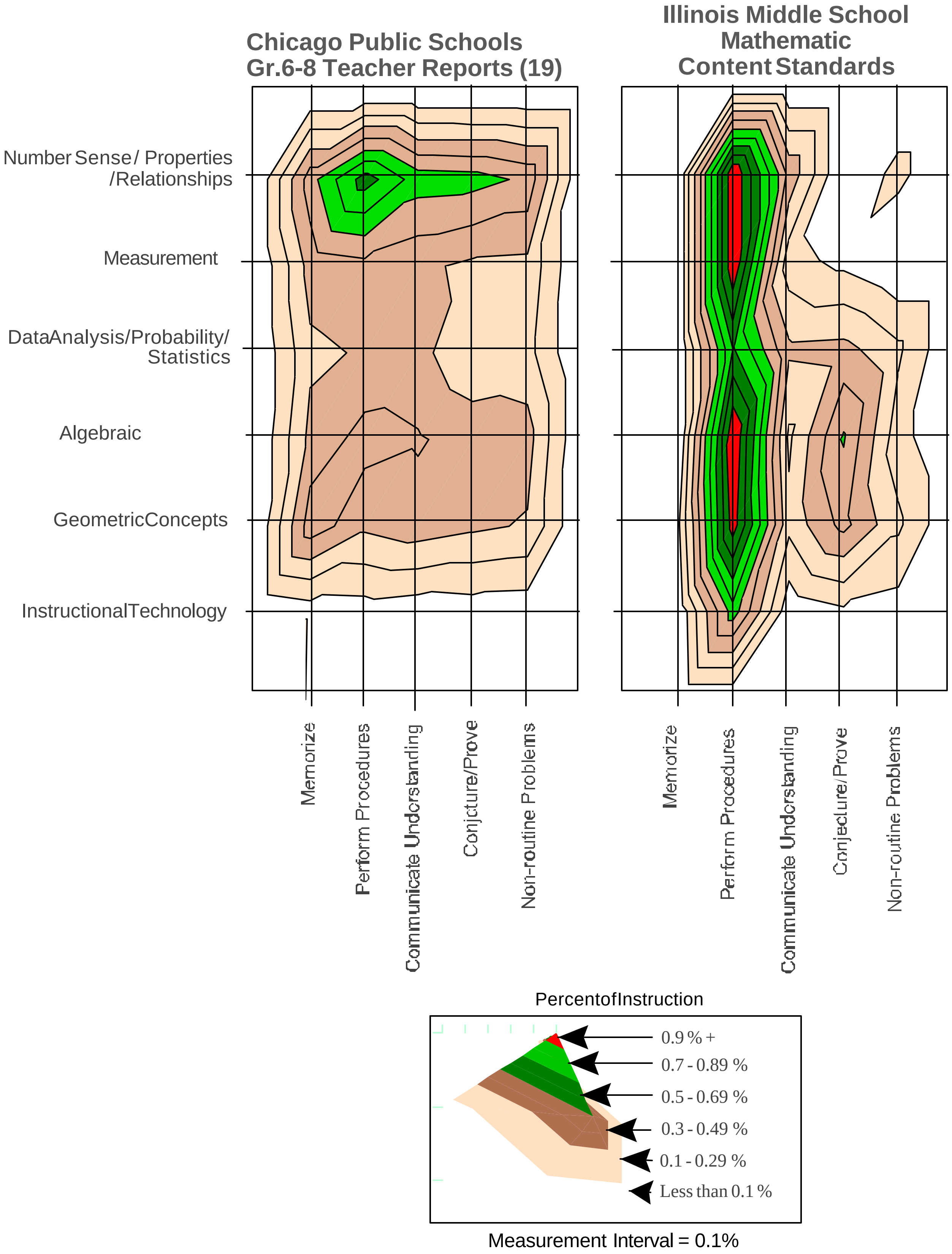


Chart D-4
Mathematics Curriculum Content
Winston-Salem/Forsyth County Schools
Instruction / Assessment

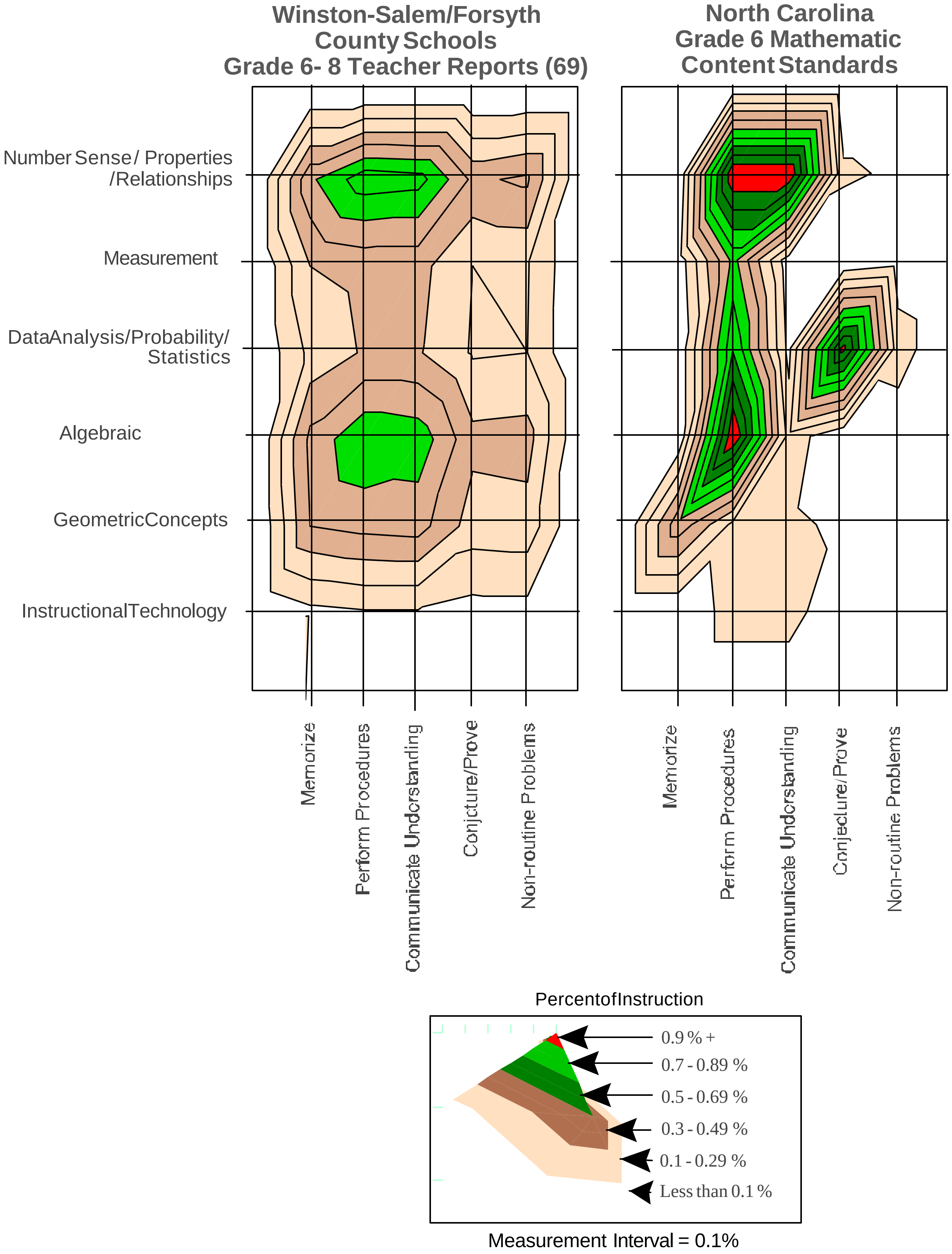


Chart D-5
Science Curriculum Content
Miami-Dade County Public Schools
Instruction / Standards

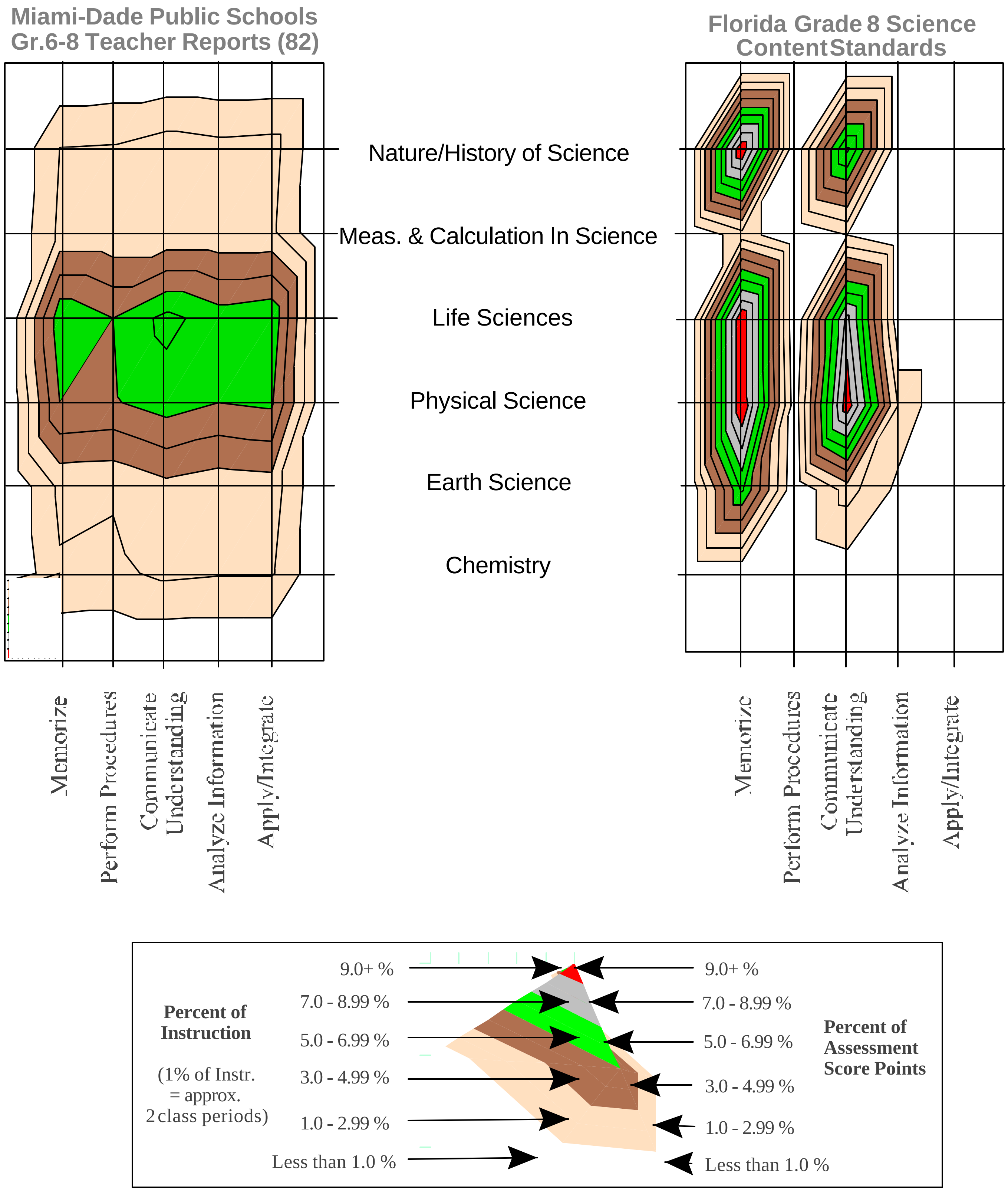
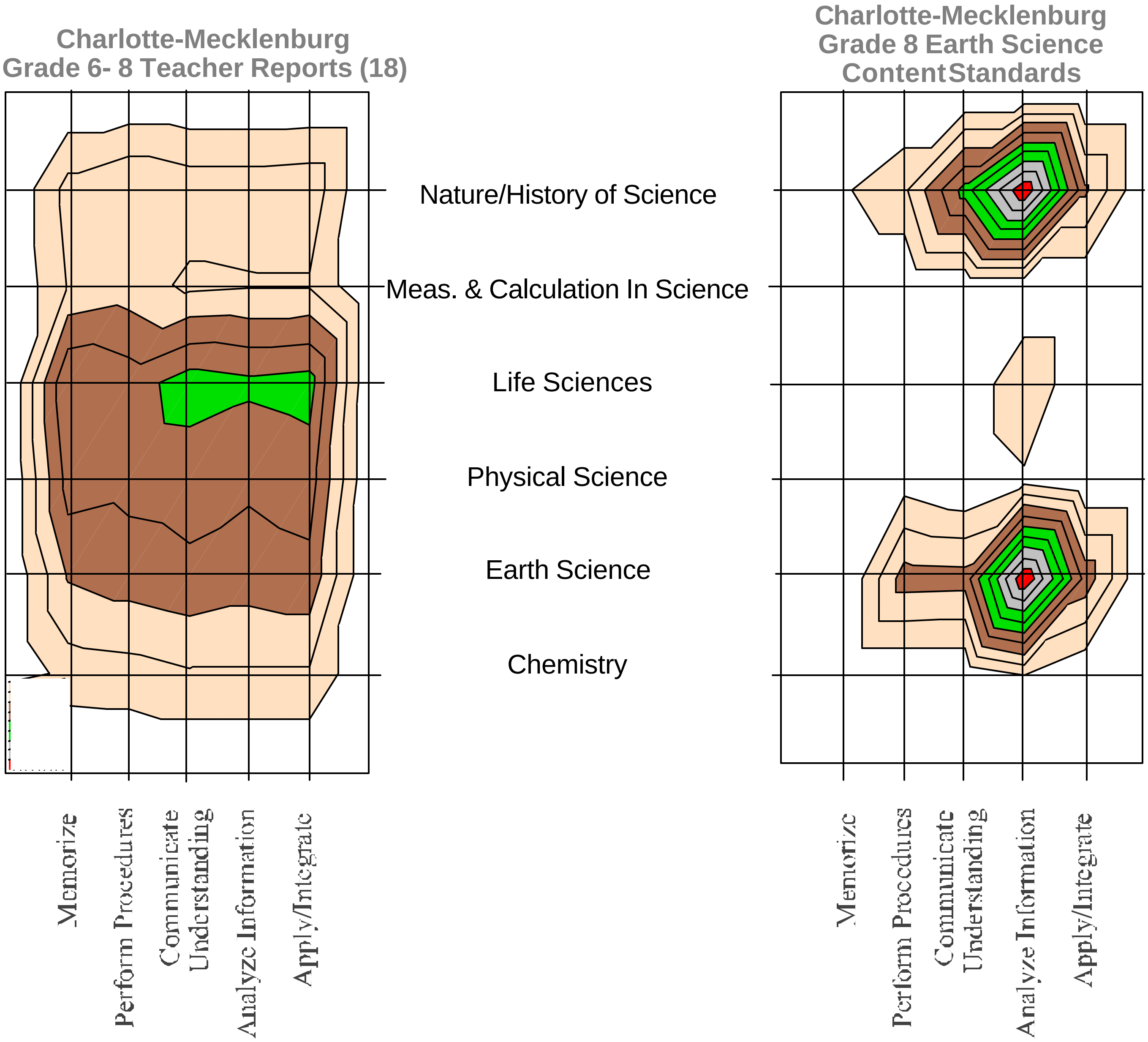


Chart D-6
Science Curriculum Content
Charlotte-Mecklenburg Schools
Instruction / Standards



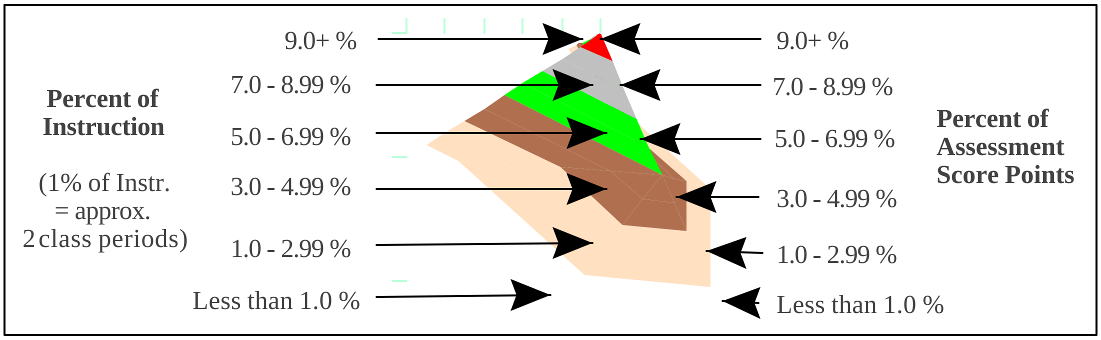
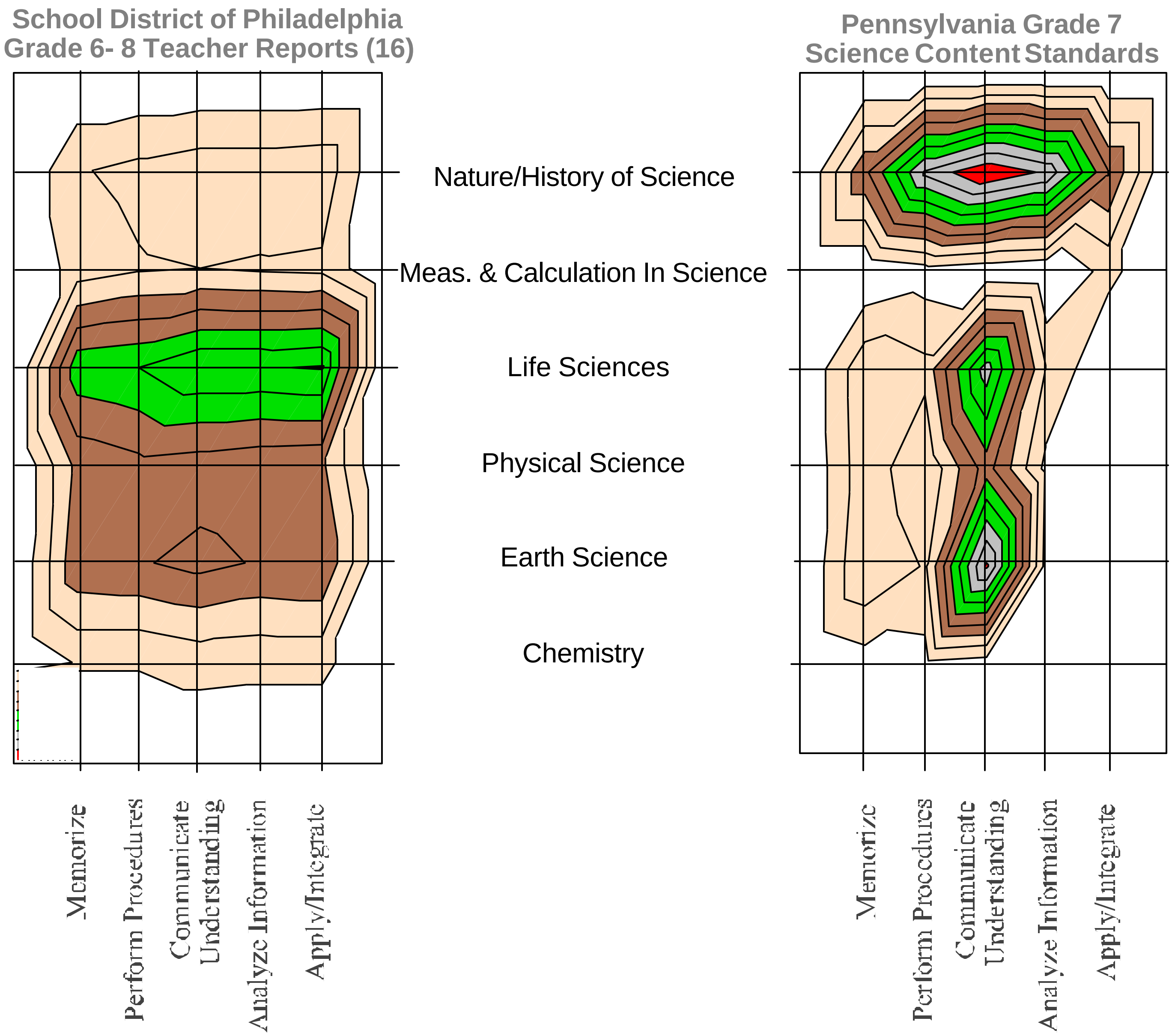


Chart D-7
Science Curriculum Content
School District of Philadelphia
Instruction / Standards



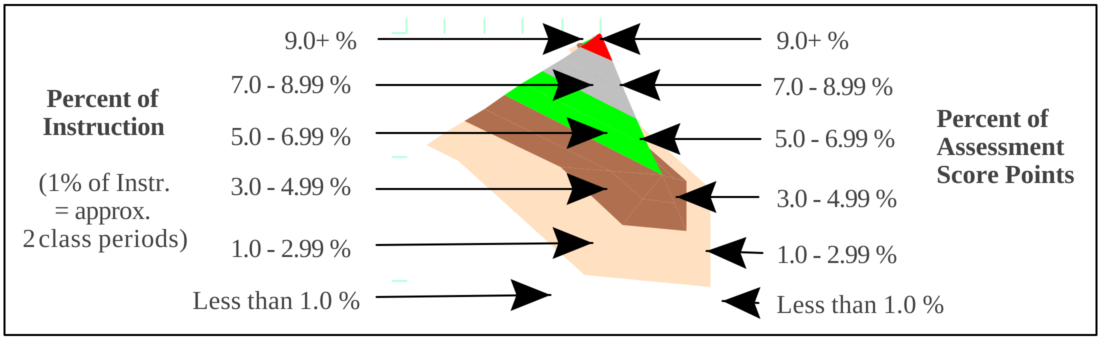


Chart D-8
Science Curriculum Content
Chicago Public Schools
Instruction / Standards

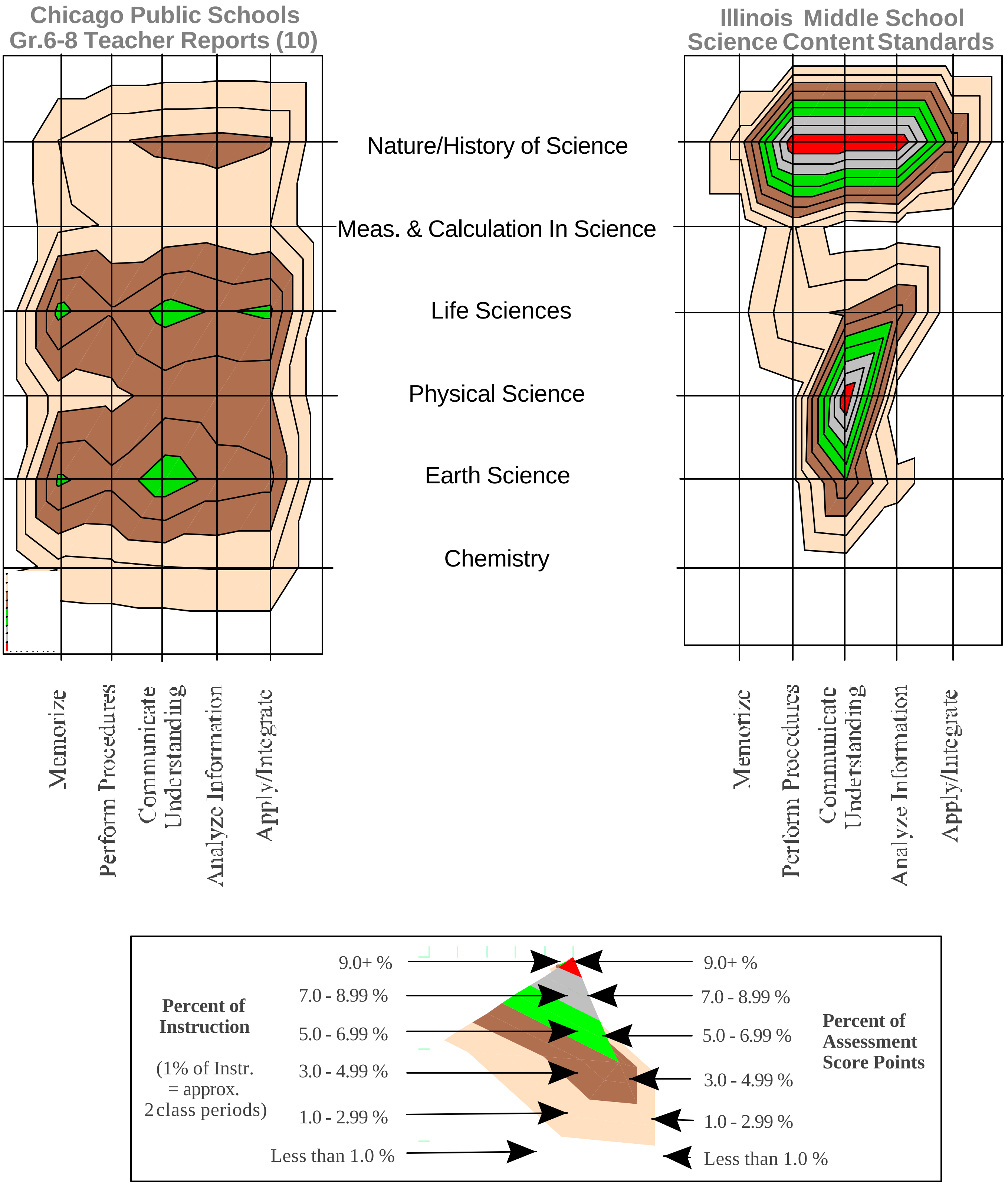
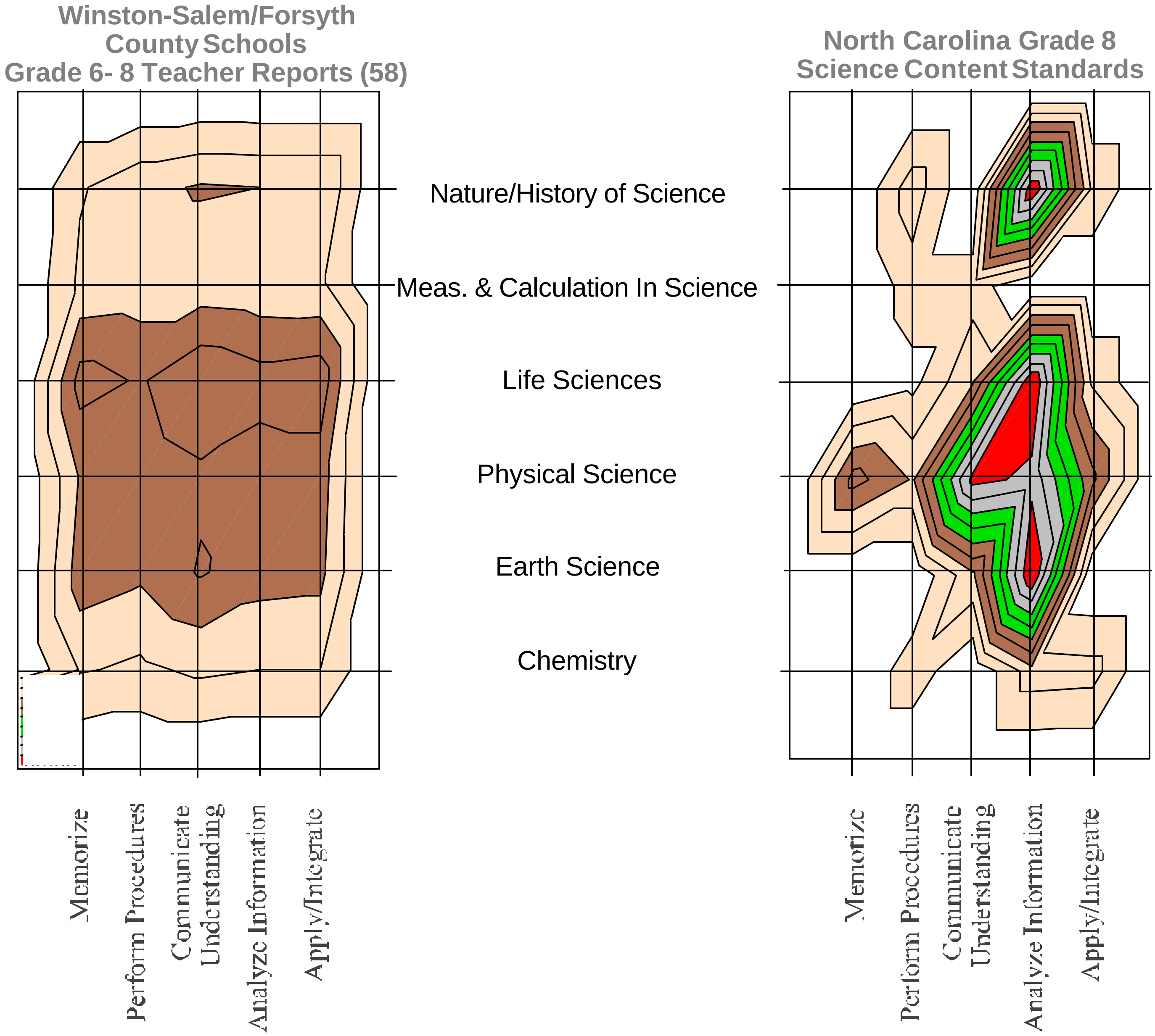
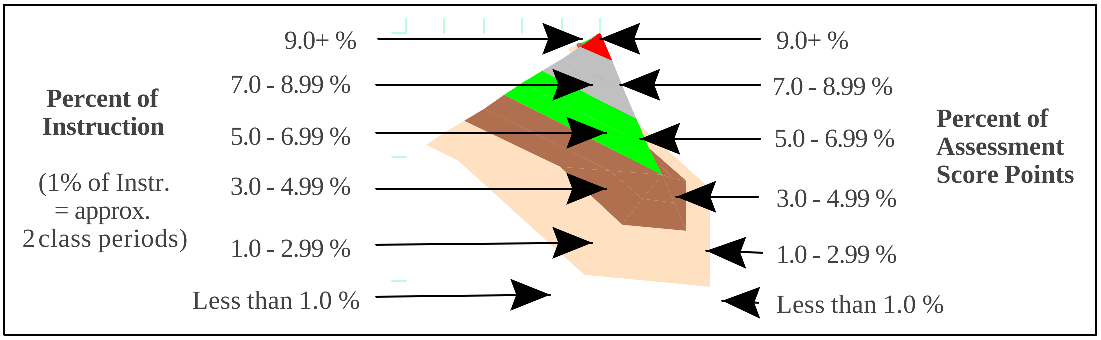


Chart D-9
Science Curriculum Content
Winston-Salem/Forsyth County Schools
Instruction / Standards





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