



MATH PARTNERSHIP PROJECT EVALUATION: ANNUAL EVALUATION REPORT – YEAR 5

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MATH PARTNERSHIP PROJECT EVALUATION YEAR 5

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Executive Summary

Observations of teachers participating in the Math Partnership Project were conducted to determine how teaching techniques changed over the school year. Staff from the Delaware Education Research and Development Center conducted 35 observations of math lessons during fall 2008 and 35 observations during spring 2009. Thirty of the teachers observed in spring were also observed in fall.

The observations conducted included three main components: The design and implementation of the lesson, mathematics content, and elements of classroom culture. The data gathered indicate a positive change towards better teaching techniques; in all three components.

Introduction

This evaluation report, prepared by the Delaware Education Research and Development Center, includes a description of the performance of a group of mathematics teachers who participated in the Secondary Mathematics Partnership Project in the school year 2008-2009 in the state of Delaware. This is the fifth year of evaluation.

This report includes four sections. The first section briefly describes the project and gives an overview of its main domains. The second section includes the methodology of the evaluation. The third section includes the results of the fall and spring observations. Finally, a summary is presented in the fourth section.

Delaware Secondary Mathematics Partnership Project

The Delaware Secondary Math Partnership Project targets at-risk math students in grades six to ten. High-school and middle-school teachers videotape one another as they instruct their classes and then they watch and critique their own and others' techniques. The main goal of the Delaware Secondary Math Partnership is to help teachers through observation, consider which kind of instruction is reaching their students and which is not. The three main components of the projects are:

1. The *Design and Implementation of the Lesson* which encompasses a range of factors including communication of purpose, effective allocation of time to critical lesson components, and effective questioning and formative assessment technique;
2. *Mathematics Content* which addresses both rigor and appropriateness of the mathematics, assessing level of challenge *and* accessibility. Elements of mathematical abstraction, connections within mathematics and between mathematics and the phenomena it represents are elements of interest;
3. Elements of *Classroom Culture* which include factors that are believed to enhance effective mathematics discourse including high expectations for all students and a privileging of mathematical argumentation.

Methodology

An observation protocol was developed by University educators from the Mathematics & Science Education Resource Center in conjunction with researchers from the Delaware Education Research and Development Center. The observation protocol called “Determining the Quality of Mathematics Instruction” was adopted as the main measure of teaching quality. The protocol consists of the three main components in which the Secondary Mathematics Partnership Project is interested: The design and implementation of the lesson, mathematics content, and classroom culture. The items or questions for each of the components are as follows:

The design and implementation of the lesson:

1. Teacher clearly defines and communicates a purpose of the lesson.
2. Teacher effectively engages students with important ideas.
3. Teacher provides adequate time and structure for investigation and exploration.
4. Teacher provides adequate time and structure for "wrap-up."
5. Teacher achieves a collaborative approach to learning.
6. Teacher enhances the development of student understanding.
7. Teacher assesses the students' level of understanding.
8. Teacher plans and/or adjusts instruction based on students' level of understanding.

Mathematics content:

1. The content is balanced between conceptual understanding and procedural fluency.
2. The content is challenging and accessible to the students.
3. Teacher provides content information that is accurate.
4. Elements of mathematical abstraction are included when appropriate to do so.
5. Appropriate connections are made to other mathematics and/or to real world content.

Classroom culture:

1. Active participation of ALL is expected and valued.
2. There is a climate of respect for students' ideas, questions, and contributions.
3. Teacher's classroom management style/strategies enhance productivity.
4. The classroom climate is encouraging to students
5. Intellectual rigor and/or the constructive challenge of ideas are evident.

Using the “Determining the Quality of Mathematics Instruction” protocol a group of observers was trained until they achieved an adequate inter-rater reliability. During observations, questions were answered using three principal descriptors, “close to ideal,”

“getting there,” and “not even close.” While these concepts are illustrated through examples within the context of each of the separate indicators, it is possible to characterize them in more general terms. An indicator is rated as “close to ideal” if there is a good bit of strong supporting and little or no contradictory evidence. “Getting there” suggests a convergence on exemplary practice but also an incomplete realization thereof. Practices that are clearly at odds with the ideal within an indicator may still be present but no longer represent the norm. Teaching that is rated as “not even close,” however, is consistently impoverished with little indication of progress toward the exemplary.

In October of 2008 and May of 2009, as part of the fifth and last year of the Secondary Mathematics Partnership Project evaluation, observers were sent into math classrooms to gather data about math instruction across the state. We gathered data from 35 teachers in October and 35 teachers in May. Thirty teachers were observed both times. The lessons observed occurred in sixth to tenth grade classrooms, and ranged from 30 to 100 minutes in length (average = 72 minutes). There were between six and 34 students in each classroom with an average of about 22 students. Observers looked for specific evidence regarding the three main components: lesson design and implementation, math content, and classroom culture.

Results

The results of the fall and spring observations are presented in this section. Percentages of teachers rated in each category: “close to ideal,” “getting there,” and “not even close” as well as instances where teachers rated in the middle of the categories (e.g. in between “close to ideal” and “getting there”) are represented in graphs throughout this section. The graphs portray fall and spring observations side by side for the three components. It is desirable that the category “close to ideal” increases from the first to the

second observation. In the same manner, progress is evidenced by a decrease in the category “not even close” from the first to the second observation.

To compare the distribution of responses from fall to spring, a chi-square test was calculated for each item. A table with the chi-square results is presented after each frequency chart. We only considered three categories instead of five. We combined teachers who were rated as “close to ideal” with teachers who fell in between “close to ideal” and “getting there.” In other words, for the chi-square analyses, the category “close to ideal” compiles the two highest categories in the rating system. Teachers who were rated as “getting there” remained in a category by themselves. Finally we combined teachers who were rated as “not even close” with teachers who fell in between “getting there” and “not even close.” In other words, for the chi-square analyses, the category “not even close” compiles the two lowest categories in the rating system. All three categories were necessary to estimate the chi-square. For an accurate chi-square calculation, the expected frequency in each cell should be at least five. We did encounter some expected frequencies that were less than five. The results are displayed in the tables; however, caution should be exercised when interpreting these results.

The design and implementation of the lesson

The first component pertaining to the design and implementation of the lesson is represented in Figure 1 for fall and spring. In most of the questions an improvement was observed from fall to spring. Almost all of the teachers observed were right on target by spring when defining and communicating the mathematical purpose of the lesson (Item 1) and regarding adjusting their lessons to the students’ level of understanding (Item 8). More than half of the teachers were rated “close to ideal” at successfully engaging students with important ideas related to the focus of the lesson (Item 2), providing an adequate structure

and enough time to stimulate investigation and exploration (Item 3), and assessing students' level of understanding to accommodate their teaching (Item 7).

However, even when a large proportion of teachers are “getting there” regarding providing adequate time and structure for “wrap-up” (Item 4), the achievement of a collaborative approach to learning in their classrooms (Item 5), and teachers' questioning strategies to enhance students' understanding (Item 6), only a third of them were rated as “close to ideal.” In this component, these are the three areas that need improvement.

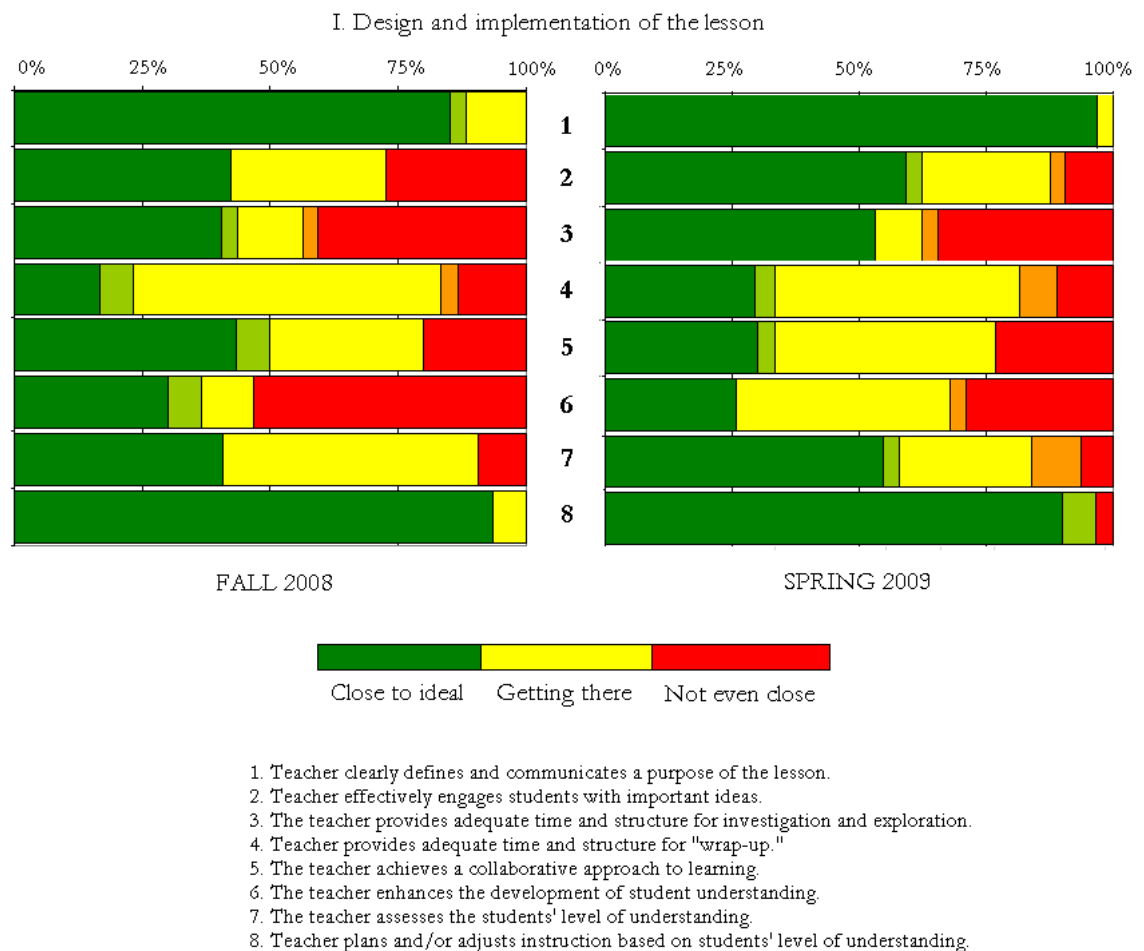


FIGURE 1. Design and implementation of the lesson FALL and SPRING

It is likely that Items 6 and 7 would have been significant if not for the small sample size. There was an apparent difference between the fall and spring distributions of categories regarding teachers' questioning strategies to enhance students' conceptual understanding or

sense making (Item 6). There appeared to be a considerable decrease of teachers rated as “not even close” from fall to spring. There was also an apparent difference between the fall and spring distributions of categories regarding teachers’ assessing of students’ understanding (Item 7). There appeared to be a considerable increase of teachers rated as “close to ideal” from fall to spring.

	χ^2	df	sig	Test is valid
1. Teacher clearly defines and communicates a purpose of the lesson.	NA	NA	NA	
2. Teacher effectively engages students with important ideas.	5.913	2	ns	yes
3. Teacher provides adequate time and structure for investigation and exploration.	1.176	2	ns	no
4. Teacher provides adequate time and structure for "wrap-up."	1.852	2	ns	no
5. Teacher achieves a collaborative approach to learning.	3.611	2	ns	yes
6. Teacher enhances the development of student understanding.	35.194	2	***	no
7. Teacher assesses the students' level of understanding.	7.451	2	*	no
8. Teacher plans and/or adjusts instruction based on students' level of understanding.	NA	NA	NA	

TABLE 1. Chi-square for the design and implementation of the lesson FALL and SPRING

Mathematics content

The second component pertaining to the mathematics content of the lesson is represented in Figure 2 for fall and spring. In almost every question improvement was observed from fall to spring. Seventy percent or more of teachers were rated “close to ideal” on four items: teachers balanced content between conceptual understanding and procedural fluency (Item 1), the content is challenging and accessible to students (Item 2), teachers demonstrated conceptual accuracy when teaching their lessons (Item 3), and teachers made

appropriate connections to other mathematics and/or real world content (Item 5). Still, teachers have a long way to go regarding elements of mathematical abstraction. A poor performance was observed when a third of the teachers failed to include elements of mathematical abstraction when appropriate (Question 4). The chi-square analyses for the items in this component were not valid due to the small sample size, however in four out of five items, the percentage of teachers in the “not even close” category was reduced and the percentage of teachers in the “close to ideal” category was increased.

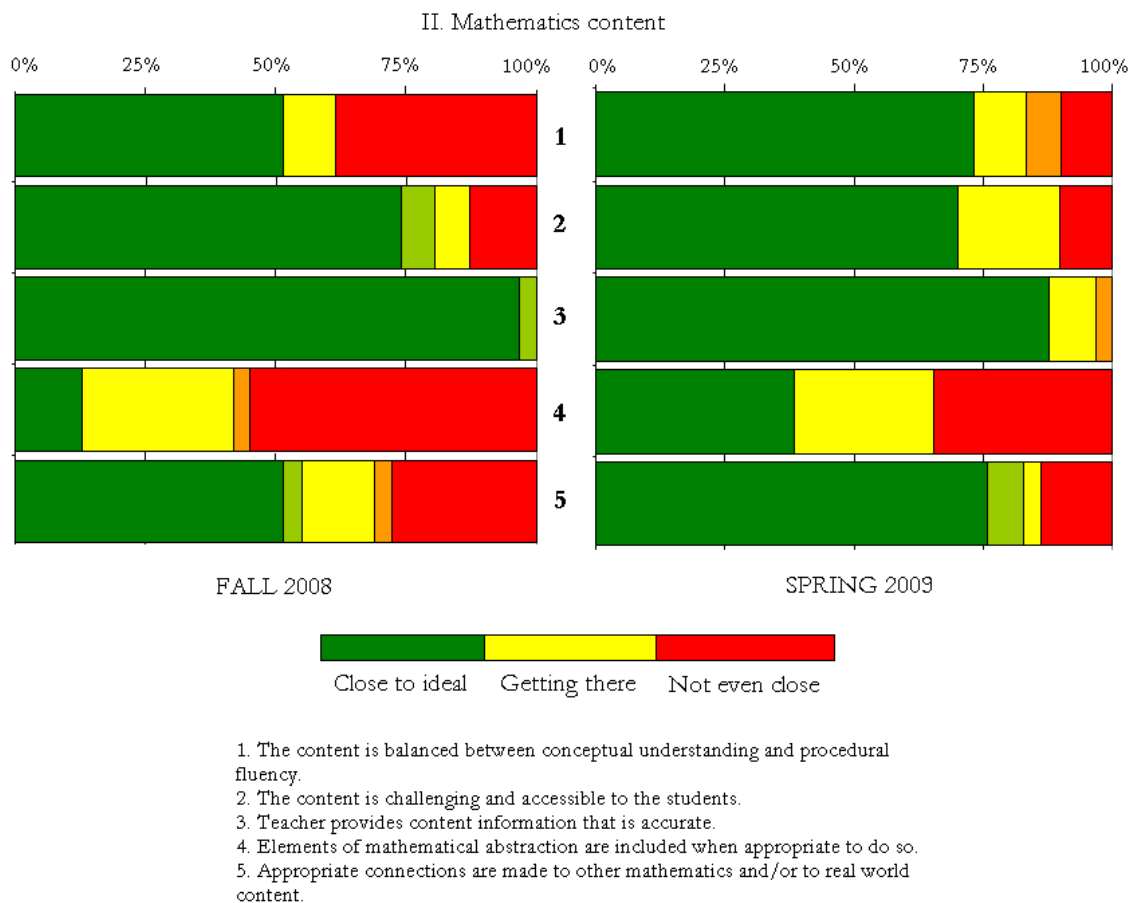


FIGURE 2. Mathematics content FALL and SPRING

	χ^2	df	sig	Test is valid
1. The content is balanced between conceptual understanding and procedural fluency.	6.512	2	*	no
2. The content is challenging and accessible to the students.	9.025	2	*	no
3. Teacher provides content information that is	NA	NA	NA	

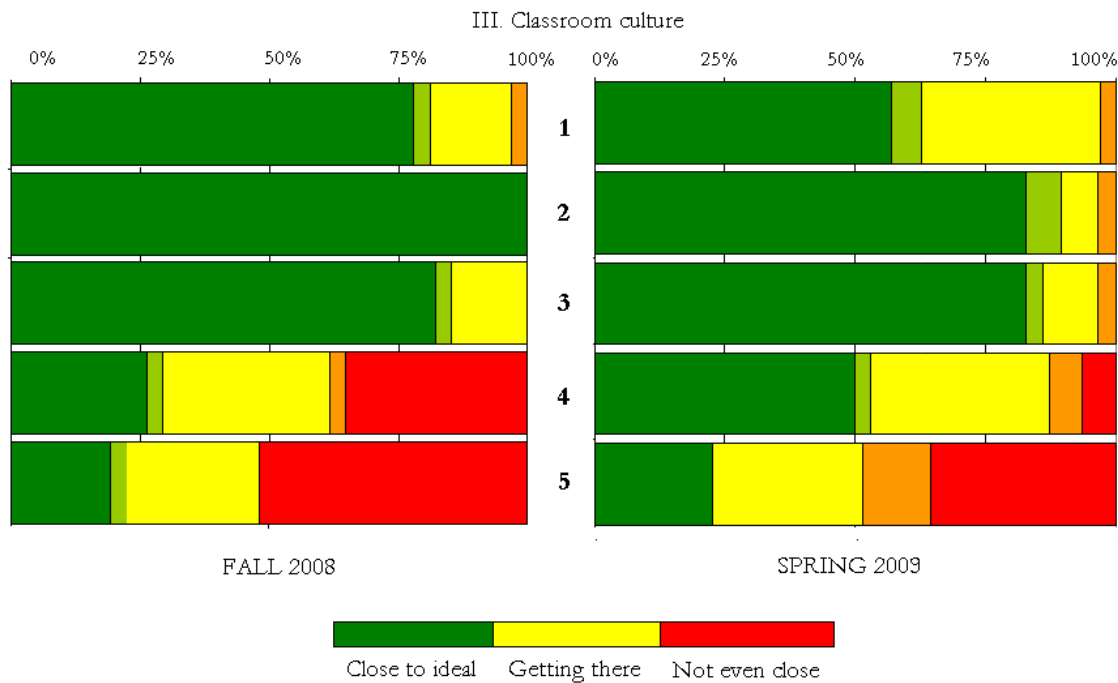
accurate.

4. Elements of mathematical abstraction are included when appropriate to do so.	15.676	2	***	no
5. Appropriate connections are made to other mathematics and/or to real world content.	9.012	2	*	no

TABLE 2. Chi-square for the mathematics content FALL and SPRING

Classroom culture

The classroom culture component revealed encouraging results for most of the items (see Figure 3). First, it is apparent that active participation of all students is almost always expected or valued (Item 1). Furthermore, most lessons showed a climate of respect for students' ideas, questions and contributions (Item 2). Classroom management style (Item 3) stayed almost the same from one fall to spring. Only one area in the *classroom culture* section needs improvement. Intellectual rigor or constructive challenge of ideas was not evident half of the time. In other words, students' conjectures were explored and students were held to the standard of justification and proof in only half of the lessons (Item 5).



1. Active participation of ALL is expected and valued.
2. There is a climate of respect for students' ideas, questions, and contributions.
3. The teacher's classroom management style/strategies enhance productivity.
4. The classroom climate encourages students
5. Intellectual rigor and/or the constructive challenge of ideas are evident.

FIGURE 3. Classroom culture FALL and SPRING

Also, many more teachers supported generating ideas and questions from students as they solved problems (Item 4) in the spring than in the fall (see Table 3). The percentage of teachers in each category regarding whether or not classroom climate is encouraging to students differed from fall to spring, $\chi^2(2, N = 33) = 11.70, p < .01$. From fall to spring, we found a significant increase in teachers rated as “close to ideal” and a significant decrease in teachers rated as “not even close.”

	χ^2	df	sig	Test is valid
1. Active participation of ALL is expected and valued.	9.305	2	*	no
2. There is a climate of respect for students' ideas, questions, and contributions.	NA	NA	NA	

3. Teacher's classroom management style/strategies enhance productivity.	NA	NA	NA	
4. The classroom climate is encouraging to students	11.698	2	**	yes
5. Intellectual rigor and/or the constructive challenge of ideas are evident.	0.188	2	ns	yes

TABLE 3. Chi-square for classroom culture FALL and SPRING

Summary

There were several strengths observed regarding design and implementation of lessons. The majority of teachers:

- defined and communicated the mathematical purpose of the lesson,
- attempted or achieved making the introduction to the lesson task clear,
- provided adequate time for students to engage in problem solving activities,
- assessed students' level of understanding to accommodate their teaching, and
- took into consideration prior experiences, how prepared the students were, and how teachers adjusted to different students learning styles.

Three areas for improvement were also noted from the observations. Teachers could do a better job:

- facilitating a collaborative approach to learning,
- eliciting students' understanding, using higher order questions, and providing structure, and
- providing a summary or wrap-up of the lesson.

Concerning mathematical content, several strengths were observed. The majority of teachers:

- balanced between conceptual understanding and procedural fluency,
- provided accurate content information during the observed lessons,

- made the content challenging and accessible to students, and
- made appropriate connections to other mathematics and/or real world content.

The main area for improvement regarding mathematical content was that elements related to mathematical abstraction were not included when it was appropriate to do so.

Several strengths regarding classroom culture were observed. Specifically the majority of teachers fostered a classroom climate that:

- expected and value active participation of all students,
- showed respect for ideas, questions, and contributions,
- promoted the production of ideas and questions from students as they solved problems, and
- enhanced productivity through classroom procedures.

One area of improvement was also noted on the subject of classroom culture.

Teachers should work on modeling mathematical rigor.