# MATH PARTNERSHIP PROJECT EVALUATION
# YEAR 2

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## Executive Summary

Observations of teachers participating in the Math Partnership Project were conducted in order to determine the impact that the project is having on teaching techniques. Staff of Delaware Education Research and Development Center conducted 47 observations of math lessons during fall 2005 and 37 observations during spring 2005. All 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 Classroom Culture. The data gathered indicate a positive change towards better teaching techniques; especially in the components of design and implementation of the lesson and classroom culture. In the component of mathematics content there is still room for improvement.

## 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 2005-2006 in the state of Delaware. This is the second year of evaluation.

This report includes four sections. The first section describes briefly 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 10. 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 School Math Partnership is to help students through observation and considering which kind of instruction is reaching them and which is not. The three main components of the project 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. The teacher provides adequate time and structure for investigation and exploration.
4. Teacher provides adequate time and structure for "wrap-up."
5. The teacher achieves a collaborative approach to learning.
6. The teacher enhances the development of student understanding.
7. The 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. 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.

Using the "Determining the Quality of Mathematics Instruction" protocol a group of observers was trained until they achieved an adequate inter-rater reliability. In October of

2005 and May of 2006, as part of the second year of the Secondary Mathematics Partnership Project evaluation, observers were sent into math classrooms to gather data about math instruction across the state. Forty-seven math lessons were observed in October and seven months later 37 out of the 47 teachers were visited again.

The lessons observed occurred in sixth to tenth grade classrooms. The lessons observed ranged from 40 to 120 minutes in length. The observers looked for specific evidence regarding three main components. They were instructed to categorize the concepts 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.

## Results

The results of the fall and spring observations are presented in this section. Percentages of teacher 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 of the three components. It is desirable that the category "close to ideal" increases from the first to the second observation. In the same manner, the category "not even close" would decrease from the first to the second observation in the best case scenario.

*The design and implementation of the lesson*

The first domain pertaining to the design and implementation of the lesson is represented in Figure 1 for fall and spring. In almost all of the questions an improvement was observed from fall to spring. When defining and communicating the mathematical purpose of the lesson, all the teachers observed were right on target or "getting there" (Question 1) by spring. Only one- fifth of the teachers remained unsuccessful when engaging students with important ideas related to the focus of the lesson (Question 2). Two-thirds of the teachers stimulate investigation and exploration by proving an adequate structure and enough time (Question 3). Similarly, two-thirds of the teachers achieved a collaborative approach to learning. Interaction among students was observed often as a group dynamic (Question 5). Also, most of the teachers assessed students' level of understanding to accommodate their teaching by taking into consideration prior experiences, how prepared the students were, and how they adjusted to different students learning styles (Question 7). In addition, almost three-fourths of the teachers were "close to ideal" or "getting there" regarding adjusting their lessons to the students' level of understanding (Question 8). This is the only item where the performance of teachers remained alike from fall to spring.

The most room for improvement was observed in the area of "wrapping up" the lesson and questioning strategies. The evidence showed that only half of the teachers were "close to ideal" or "getting there" for both. Although a slightly higher percentage of teachers performed "close to ideal," only half of them set class ready in time and structure for a summing up of the lesson (Question 4). This could be problematic since this is the phase of the lesson during which conceptual closure may be achieved for the majority of the students. "Summing it up" represents an opportunity for the teacher to orchestrate the presentation of student ideas that have resulted from the exploration phase and, in so doing,

to draw out the important mathematical ideas from the lesson. This is where mathematical connections are often made and may be a final opportunity for the teacher to assess the impact of the day's lesson.

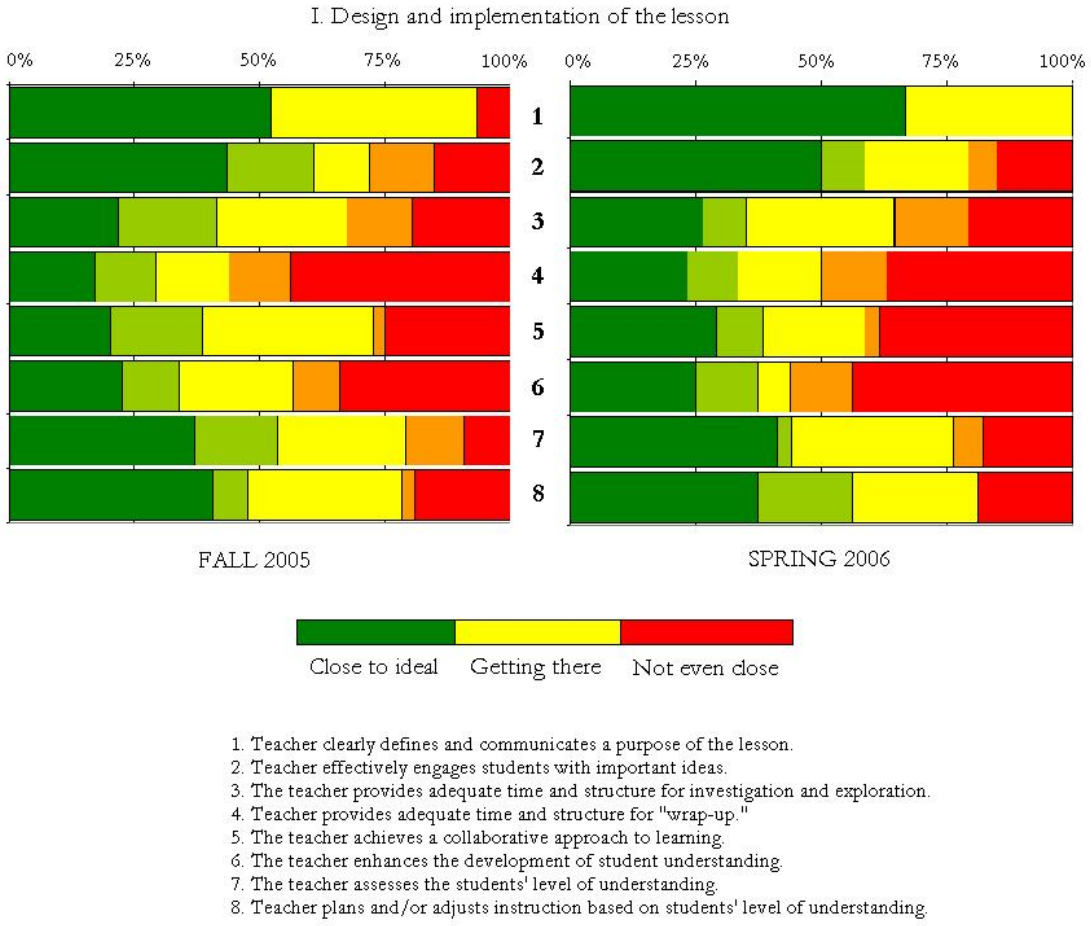


FIGURE 1. Design and implementation of the lesson FALL and SPRING

Also, while half of the teachers emphasized higher order questions or identified prior misconceptions, half did not (Question 6). This issue refers to the frequency of teachers framing higher order questions and moving beyond asking students simply to respond with factual answers. By using prior experience, higher order questions offer opportunities to learn and think about the mathematical ideas in many different ways. In standards-based

mathematics instruction, it is desirable that the design of the lessons promotes an inquiry-based framework.

From fall to spring we observed a polarization in behaviors for some of the items. In other words, the percentages of the "close to ideal" and "not even close" classifications both increased. Questions 5, 6, and 7 are in this group. These questions deal with assessment and enhancement of students' understanding and a collaborative approach to learning.

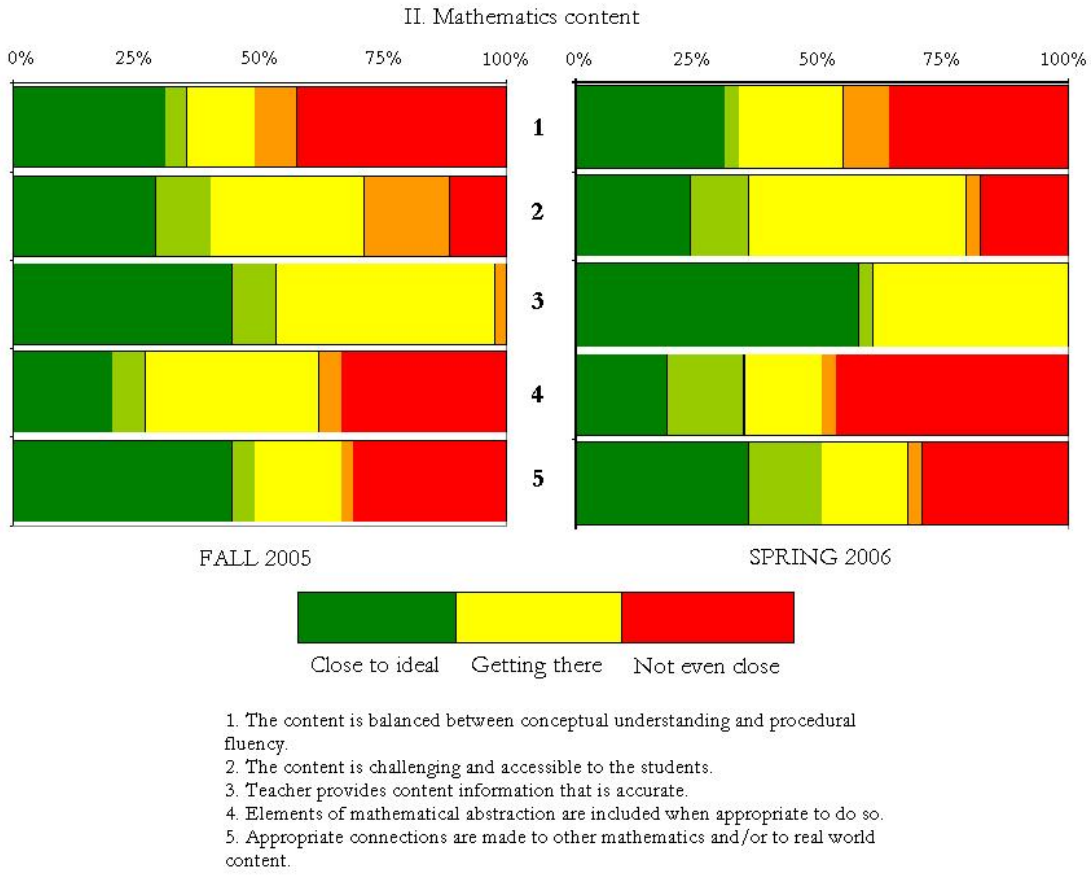


FIGURE 2. Mathematics content FALL and SPRING

*Mathematics content*

Items regarding mathematics content of the lesson are represented in Figure 2. There was not a big change from fall to spring. The pattern of performances remained similar. On the question regarding how challenging and accessible the content was to

students, four out of five teachers were "close to ideal" or "getting there" (Question 2). Furthermore, teachers did not demonstrate any conceptual errors during the lessons observed (Question 3). Finally, two-thirds of the teachers made appropriate connections to other mathematics and/or real world content (Question 5); however, the percentage of teachers at the "close to ideal" classification went down from fall to spring.

Conversely, red flags were raised when looking for balanced content between concepts and fluency (Question 1). Even a poorer performance was observed when 50% of the teachers failed to include elements of mathematical abstraction when appropriate (Question 4).

*Classroom culture*

The classroom culture section revealed encouraging results for most of the questions (see Figure 3). Almost all the teachers promoted the production of ideas and questions from students as they solved problems (Question 4). Also, in three-fourths of the classrooms a climate of respect for students' ideas, questions and contributions were observed when the teacher acted as a facilitator, although in some cases the problem solving was scaffolded (Question 2). Even a higher percent of teachers showed that their classroom management style and strategies enhanced productivity. For instance, expectations for student behavior were consistently enforced and classroom procedures were clearly defined (Question 3).

However, two areas in classroom culture could be improved. First, it is apparent that active participation of all students is not always expected or valued; less than one fourth of the teachers were rated "close to ideal" on this statement. Teachers did not always succeed in focusing all students (Question 1). Second, intellectual rigor or constructive challenge of ideas were evident 24% of the time. In other words, less than one fourth of the time the students' conjectures were explored and students were held to the standard of

justification and proof. A little less than half of the teachers were somewhere in the middle on the issue by at least expecting students to explain their reasoning (Question 5).

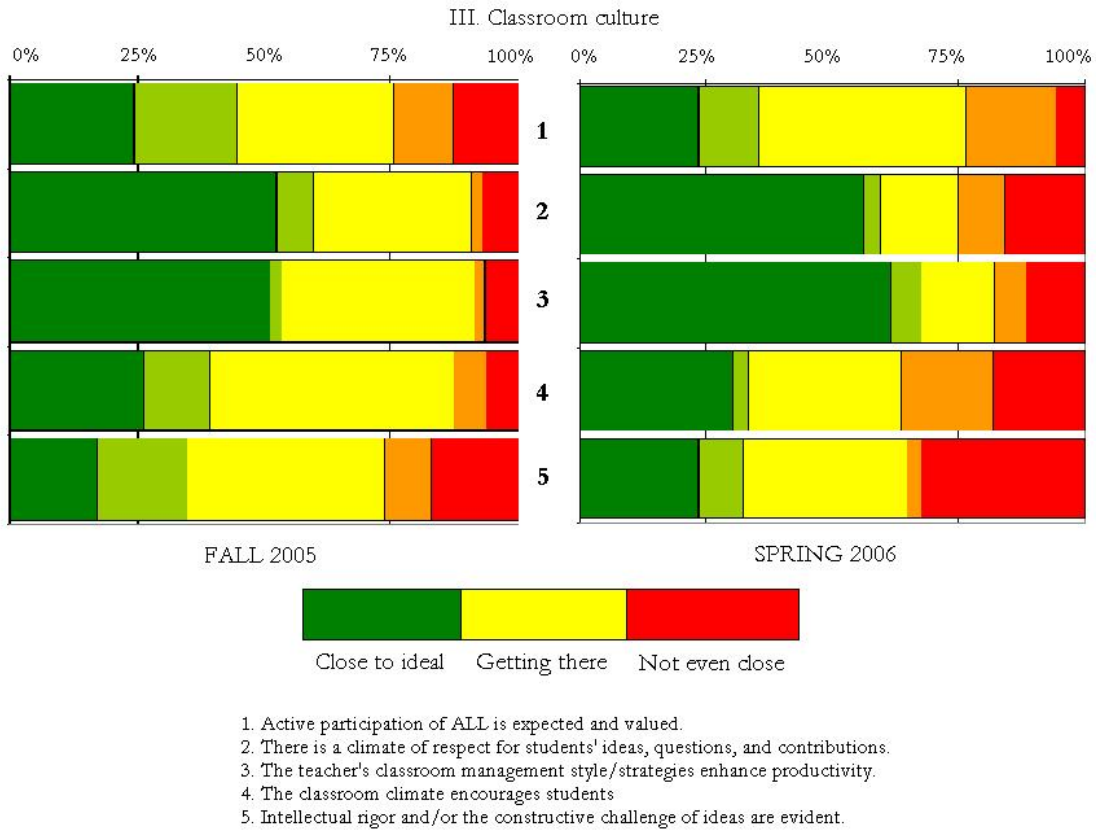


FIGURE 3. Classroom culture FALL and SPRING

From October to May, the percentages of teachers in the "getting there" classifications decreased. In this case, in Questions 2, 3, 4, and 5 polarization was evident. These items deal with most of the aspects of classroom climate.

**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
- assessed students' level of understanding to accommodate their teaching

- took into consideration prior experiences, how prepared the students were, and they adjusted to different students learning styles
- adjusting their lessons to the students' level of understanding
- engaged students with important ideas related to the focus of the lesson
- attempted or achieved to make the introduction to the lesson task clear
- facilitated a collaborative approach to learning

Two areas for improvement were also noted from the observations, time management and structure. Specifically, more time for students to engage in problem solving activities and providing a summary or wrap-up of the lesson is needed.

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

- made the content challenging and accessible to students
- balanced the content between conceptual understanding and procedural fluency
- made appropriate connections to other mathematics and/or real world content
- provided accurate content information during the observed lessons

The main area for improvement regarding mathematical content was elements related to mathematical abstraction.

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

- promoted the production of ideas and questions from students as they solved problems
- facilitated respect for students' ideas, questions and contributions
- enhanced productivity

Two areas of improvement were also noted on the subject of classroom culture. Teachers should work to expect and value active participation of all students.

An apparent issue of polarity emerged. In two of the three main domains of the project, the percentage of teachers at the extremes of the scale increased from fall to spring. Regarding the design and implementation of the lesson, polarization was observed in the areas of assessment and enhancement of students' understanding and a collaborative approach to learning. On the topic of classroom culture polarization was observed in the areas of climate of respect, teachers' management style, encouraging climate, and intellectual rigor. The scenario of teachers rated at the middle ground was more evident in October; explanation for this could be the following. At the time of the first observations, teachers were motivated and were trying to create adequate climate for learning, which is the reason behind the higher percentage in the classification of "getting there." However by the end of the school year, the teacher either achieved the adequate climate or stopped trying, which increased the percentages at the ends of the scale.

Closing comments

The data gathered indicate a positive change towards better teaching techniques; especially in the components of design and implementation of the lesson and classroom culture. However, not much change was observed for the component of mathematics content. There is still room for improvement in this area. We need to consider that this is the second year of the Secondary Mathematics Partnership Project. So far, it appears to be easier for teacher to adjust the design and implementation of their lessons and to enhance the classroom climate towards a more positive learning environment than to improve the rigor and appropriateness of the mathematical content.