CONVERGING CURRICULUM PROJECT
YEAR 2

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HEIDI SWEETMAN, PHD., EDUCATIONAL RESEARCHER

WITH ASSISTANCE FROM

XIMENA URIBE-ZARAIN, EDUCATIONAL RESEARCHER

Delaware Education
R&D
Research & Development
CENTER

Executive Summary

Observations of teachers participating in the Converging Mathematics Project were conducted in order to determine the impact that the project is having on teaching techniques. Staff of the Delaware Education Research and Development Center conducted 20 observations of math lessons during fall 2007 and 20 observations during spring 2008. Nine of the teachers observed were also in the cohort that was observed for the Converging Curriculum evaluation for the 2006-2007 school year. All 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 some improvement across all three domains. However, all three domains were also marked by a polarization trend where teachers who scored in the middle of the continuum in the fall, migrated to extreme ends of the continuum in the spring.

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 Converging Mathematics Project in the school year 2007-2008 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.

The Converging Mathematics Project

The main goal of the Converging Mathematics Project intervention program is to increase mathematics competency of at-risk and special education students and their teachers. For its second year of implementation, the project targeted a larger cohort of teachers in grades five through nine. The project provides recommendations for materials and methods for extended math time interventions for at-risk students that are carefully aligned to the existing mathematics program. The Converging Mathematics Partnership is expected to accomplish the following:

1. strengthen the knowledge of teachers of at-risk students, and in particular special education teachers, by providing curricular content training and the use of the identified instructional approaches
2. provide teachers with tools they will not only use, but also understand
3. enable teachers to become more adept in the diagnosis of student thinking through a continuous loop of formative assessment, student feedback, and refined instruction
4. increase teacher content knowledge and instructional effectiveness
5. facilitate the provision of better quality programs that meet the needs of the students who have fallen through the cracks
6. improve student achievement
7. establish a strong community of learners with a belief that all students can succeed in learning challenging mathematics

Classroom observations were conducted in fall 2007 and spring 2008 to address these goals as they related to classroom instruction. Results should be interpreted with some caution, as the total of teachers observed is relatively small (a 5% change indicates the movement of one teacher) and many other factors at work in schools could greatly impact the classroom observation results.

Methodology

In 2005, 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 for use with the Math Partnership evaluation. The observation protocol called "Determining the Quality of Mathematics Instruction" was adopted as the main measure of teaching quality for the Converging Mathematics Project as well. The protocol consists of the three main components in which the Converging Mathematics Project is interested: the design and implementation of the lesson, mathematics content, and classroom culture.

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;

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.

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.

Because only one researcher, previously trained with this protocol, completed all of the observations, it was not necessary to assess inter-rater reliability. In October of 2007 and May of 2008 as part of the second year of the Converging Mathematics Project evaluation, one observer was sent into math classrooms to gather data about math instruction across the state. In the pilot year of the study, at least two teachers from each of the six school districts involved in the pilot year of the Converging Mathematic Project were randomly selected for observation. Of these 13 teachers, 10 remained with the project for the second year. Nine of the 10 teachers were included in the Year 2 observations. One teacher from the original observation cohort was excluded because of an

extended medical leave. In addition to the original nine teachers, 11 additional teachers were randomly selected for observation, with a minimum of two teachers from each school district represented in Year 2 of the project. Thus, twenty mathematics teachers were observed in October and seven months later, in May, all of the teachers were observed a second time.

The lessons observed occurred in fifth to eighth grade classrooms and ranged in length from 30 to 90 minutes. The observer looked for specific evidence regarding the three main components. The concepts were categorized 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 was rated as "close to ideal" if there was a substantial amount of strong supporting and, little or no contradictory evidence. "Getting there" suggested a convergence on exemplary practice but also an incomplete realization thereof. Practices that were clearly at odds with the ideal within an indicator could still be present but no longer represented the norm. Teaching that was rated as "not even close," however, was 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. Given the rating system, improvement across time was judged to occur in one of two ways for any given item: either the category "close to ideal" increased from the fall 2007 to the spring 2008 observations or the category "not even close" decreased from the fall 2007 to spring 2008 observations.
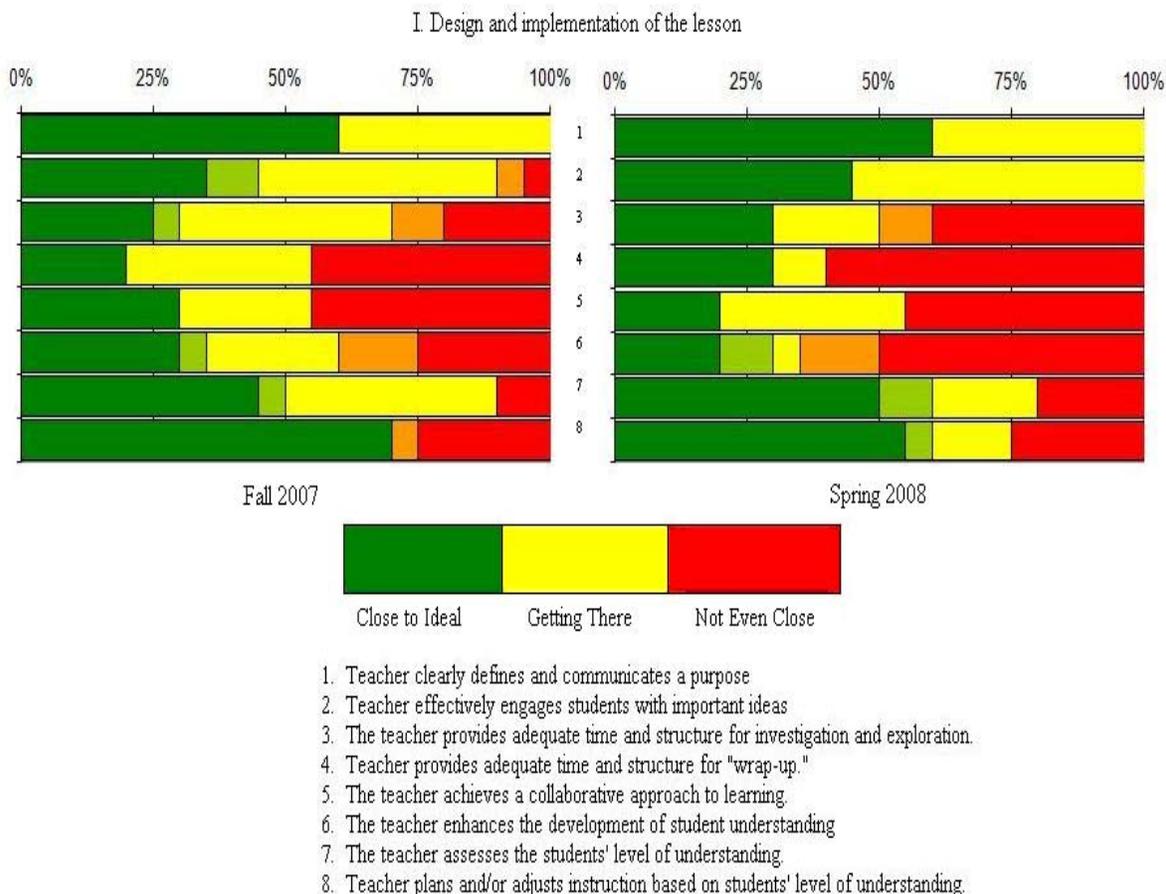
FIGURE 1. Design and implementation of the lesson FALL and SPRING

The first domain, design and implementation of the lesson, is represented in Figure 1 for fall and spring. As previously mentioned, one way to view improvement is through assessing the change from fall to spring in the percent of teachers who obtained a rating of "close to ideal" (represented by dark green in Figure 1) for each of the teaching practices observed. From this perspective, initially four of the eight items appeared to evidence improvement, as indicated by an increase in the percent of teachers rated as "close to ideal". However, three of these four items evidenced not only increases in the percent of teachers rated as "close to ideal", but also an increase in the percent of teachers rated "not even close" (represented by red in Figure 1). This pattern of change seems to be

the result of a polarization of lessons ranked in the middle of the continuum in the fall (represented by light green, yellow and orange in Figure 1), to the far ends of the continuum in the spring (represented by dark green and red in Figure 1).

Item 2, "the teacher effectively engages students with important ideas" was the only item that evidenced clear improvement across the continuum, with a 10% increase from fall to spring in the percent of teaching practices judged as "close to ideal" and a 10% decrease from fall to spring in teaching practices rated at the bottom of the continuum. Because of this shift, by spring of 2008, for this item, all of the teachers were rated as "getting there" or "close to ideal." In lessons rated as "close to ideal", the task was presented as a mathematical challenge, the teachers provided an introduction to the task that was effective in guiding students into exploration and, the students began the tasks immediately.

Items 3, 4 and 7 evidenced the polarization trend discussed above. Specifically, regarding item 7, "the teacher assesses the students' level of understanding", there was a 10% increase in the percent of teaching practices scored at the top of the continuum and 10% increase in the percent of teaching practices judged at the bottom of the continuum. For item 4, "the teacher provides adequate time and structure for 'wrap-up'" there was a 10% increase in teaching practices rated as "close to ideal" and a 15% increase in teaching practices deemed "not even close". The polarization was slightly more negatively skewed for item 3. Regarding item 3, "the teacher provides adequate time and structure for investigation and exploration" there was only a 5% increase in teaching practices deemed as "close to ideal" while there was a 20% increase from fall to spring in teaching practices rated as "not even close".

If an increase in the percent of teachers rated as "close to ideal" could be regarded as indicative of improvement, then a decrease in the percent of teachers judged as "close to ideal" could be viewed as evidence of a lack of improvement. Two items, items 5 and 6 evidenced such a

trend. Specifically, for item 5, "the teacher achieves a collaborative approach to learning" there was 10% decrease in the percent of teaching practices marked as "close to ideal". Similarly, item 6, "the teacher enhances the development of student understanding", evidenced not only a 10% decrease in the percent of teaching practices scored as "close to ideal" but also a 25% increase in the percent of teaching practices rated as "not even close."

Finally, item 1, "teacher clearly defines and communicates a purpose" did not exhibit a change in the ratings of teaching practices from fall to spring. It is notable however, that for item 1, all teachers were rated as "getting a good start" or "close to ideal", with the majority of teachers (60%) rated as "close to ideal." Teachers in classrooms rated as "close to ideal" understood and communicated the purpose of their lesson to their students.
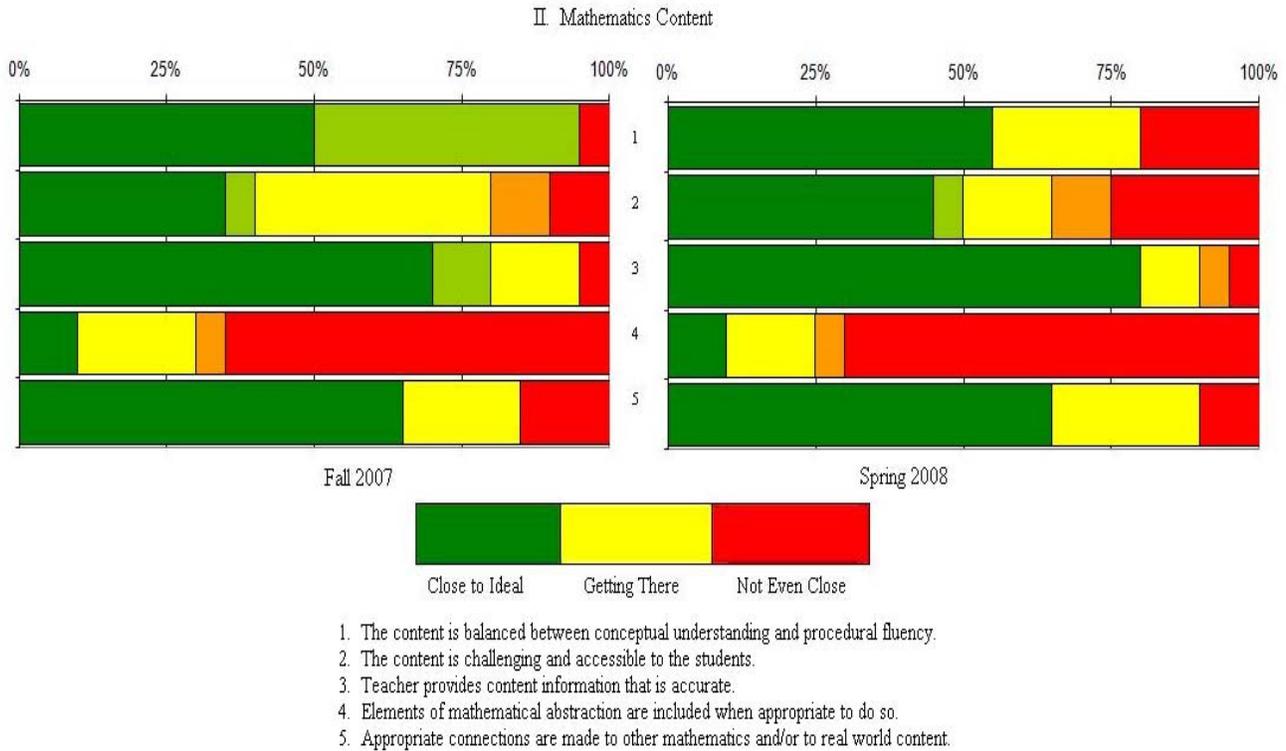
II. Mathematics Content

FIGURE 2. Mathematics content FALL and SPRING

The mathematics domain is represented by Figure 2 and was marked with items that evidenced improvement and items that demonstrated the polarization trend previously discussed. Two items, item 3 and item 5, indicated improvement. Item 3, "teacher provides content information that is accurate" demonstrated a 10% increase in the percent of teaching practices rated as "close to ideal" with no corresponding increase in teaching practices rated as "not even close". Teachers rated as "close to ideal" on this item demonstrated accurate content knowledge and appropriately addressed students' conceptual errors. Item 5, "appropriate connections are made to other mathematics and/or to real world content" evidenced a 5% decrease in the percent of teaching practices deemed "not even close".

Two of the five items in this section, items 1 and 2, demonstrated the polarization trend described above. Item 2, "the content is challenging and accessible to the students" evidenced a 10% increase in the percent of teaching practices rated as "close to ideal" and a 15% increase in the percent of teaching practices rated as "not even close". With a slightly more negative trend, item 1, "the content is balanced between conceptual understanding and procedural fluency" showed only a 5% increase in the percent of teaching practices deemed "close to ideal", but a 15% increase in the percent of teaching practices rated as "not even close"

Finally, as previously discussed, if a decrease in the percent of teachers rated as "not even close" could be regarded as indicative of improvement, then an increase in the percent of teachers judged as "not even close" could be viewed as a lack of improvement. One item, item 4, "elements of mathematical abstraction are included when appropriate to do so" exhibited a minor, 5% increase in the percent of teachers rated as "not even close".
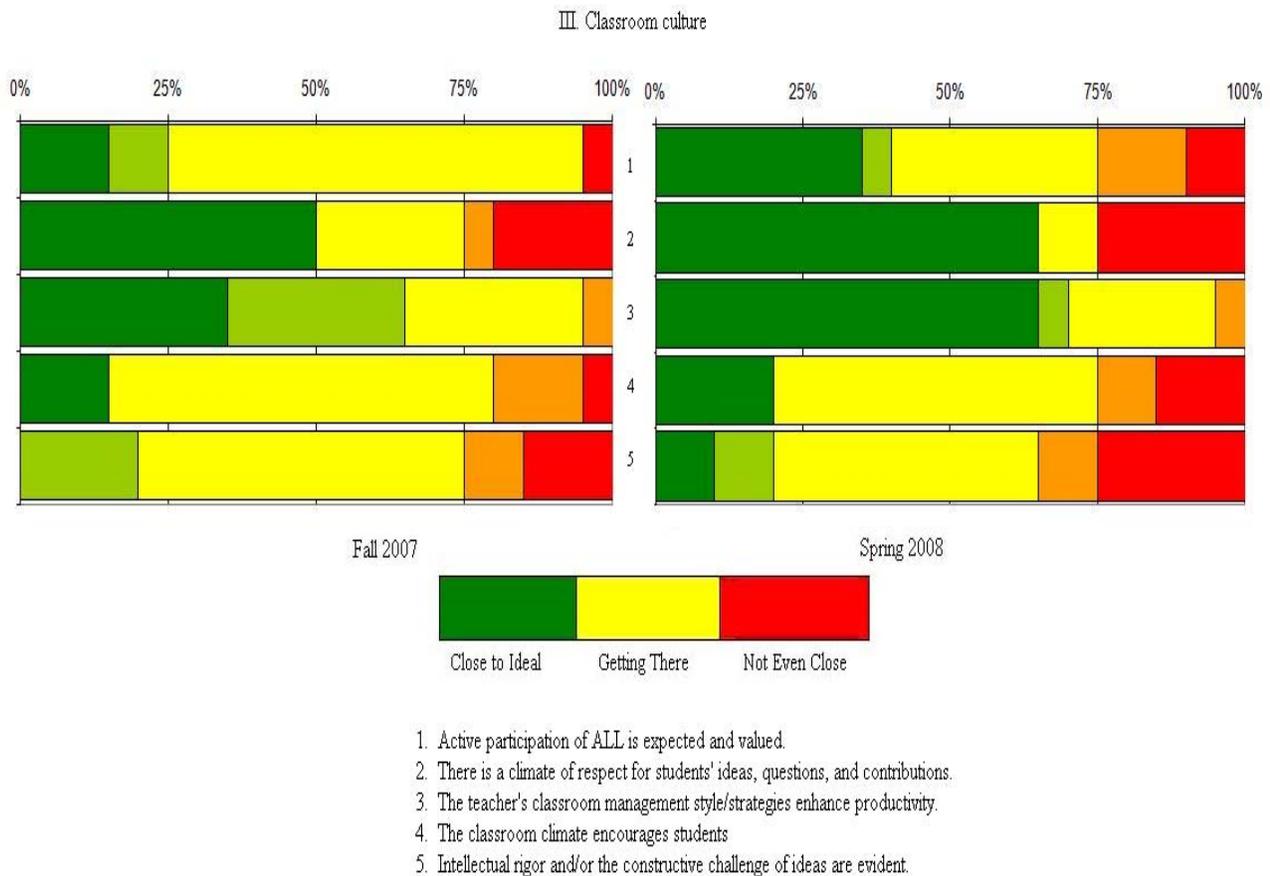
III. Classroom culture

FIGURE 3. Classroom culture FALL and SPRING

The classroom culture domain could also be characterized by the polarization trend described in the previous two sections. Four of the five items, items 1, 2, 4 and 5, showed an increase in both the percent of teaching practices rated as "close to ideal", as well as, the percent of teaching practices rated as "not even close". Item 1, "active participation of ALL is expected and valued" and item 2, "there is a climate of respect for students' ideas, questions, and contributions" evidenced a 20% and 15% increase, respectively, in the percent of teaching practices judged as "close to ideal" and a 5% increase in the percent of teaching practices rated as "not even close."

Item 4, "the classroom climate encourages students" and item 5, "intellectual rigor and/or the constructive challenge of ideas are evident" demonstrated a 5% and 10% increase, respectively, in the percent of teaching practices rated as "close to ideal" and a 10% increase in the percent of teaching practices rated as "not even close".

Only one item, item 3, "the teacher's classroom management style/strategies enhance productivity" evidenced a 30% increase in the percent of teaching practices rated as "close to ideal" with no corresponding increase in the percent of teachers rated as "not even close". Regarding this item, teachers in classrooms rated as "close to ideal" exhibited classroom expectations for student behavior that were consistently enforced and clearly defined classroom procedure as evidenced by a smooth flow of the lesson.

Summary

There were two strengths observed regarding design and implementation of lessons. By spring, the majority of teachers observed:

- Understood and communicated the purpose of the lesson to the students
- Were getting a good start on effectively engaging students with important ideas related to the focus of the lesson
- Planned and/or adjusted instruction based on students' level of understanding.

While some teachers did evidence growth in the following areas, the spring observations indicated that continued improvement may be needed in the following areas: providing adequate time and structure for investigation and exploration, providing adequate time and structure for wrap-up, achieving a collaborative approach to learning, utilizing questioning strategies that enhance the development of students' conceptual understanding or sense-making and, assessing the students' level of understanding.

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

- Achieved a content balanced between conceptual understanding and fluency

- Provided content information that was accurate

- Made appropriate connections to other mathematics and/or to real world content.

The main areas for improvement regarding mathematical content were providing a content that is challenging and accessible to the students and elements related to mathematical abstraction.

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

- Facilitated respect for students' ideas, questions and contributions

- Enhanced productivity

Three areas of improvement were also noted on the subject of classroom culture. Teachers should work to provide a climates where active participation by all students is expected and valued, that encourages students to generate ideas, questions and/or conjectures as they problem solve and that evidences intellectual rigor.

Closing comments

These observations mark the progress of the second year of the Converging Curriculum project. While the observations indicate improvement across all three domains, there is room for improvement across all three domains as well. These results should be viewed with some caution given the small sample size and the myriad of other factors aside from the Converging Curriculum project that may be impacting teacher teaching practices. Anecdotally, teachers during spring observations noted that factors such as classroom structure (multi-grade verses single grade structure), their perceptions of the efficacy of the techniques with their student population and class

scheduling issues impacted their teaching practices Given the polarization trend demonstrated across all three domains, subsequent evaluations may benefit from interviews to better explore how the previously mentioned factors, as well as, teacher "buy in" to the project and history with the project influenced whether teachers scoring in the middle of the continuum in the fall migrated to the upper or lower end of the continuum in the spring.