

# Studying and Improving Mathematics Teaching

University of Delaware Research  
Activity

CLT Annual Meeting, Feb 7-9, 2005

Washington, DC

# University of Delaware: Research Goals

1. Develop a model for the continuous improvement of teaching
  - To help pre-service elementary and middle school teachers prepare to become, over time, effective teachers
  - To improve our own teaching toward this goal
2. Examine the growth of pre-service teachers' ability to study and improve teaching
3. Examine our own growth as demonstrated by course improvements

# 1. An “Experiment” Model for the Continuous Improvement of Teaching

- Studying and improving teaching in a planned, intentional way
- Treating lessons as opportunities for teachers, not just students, to learn
- Developing competencies needed to study teaching
  - Mathematics knowledge for teaching
  - Skills and dispositions for analyzing teaching
    - Describing learning goals for instructional episodes
    - Collecting evidence about students’ achievement of goals
    - Constructing claims that link learning with teaching
    - Proposing changes that improve teaching

## 2. Growth of Pre-Service Teachers' Ability to Study and Improve Teaching

- Overview of the UD Pre-Service Program
  - 3 content courses and 1 methods course
  - 3 to 7 sections of each course a semester
  - Lesson study groups formed for selected courses each semester (faculty and doctoral fellows)

# Development of Pre-service Teachers' Mathematics Knowledge for Teaching

- Instrument: Written Test
  - 9 questions (23 sub-questions)
  - focus on rational numbers
  - administered beginning of every semester
- Participants
  - All pre-service teachers in program (200+ per cohort)
  - Follow cohorts entering every other year

# Sample Result – Percent Correct

(Cohort One - Test administered before each course)

	Course One (N=307)	Course Two (N=256)	Course Three (N=171)	Liping Ma's U.S. teachers (N=23)
Solve: 1_ ÷ _ = [ ]	68	71	71	43
Write a story for: 1_ ÷ _ = [ ]	14	28	65	4

# Pre-Service Teachers' Ability To Analyze Teaching

- Skills and dispositions for analyzing teaching
  - Describing learning goals for instructional episodes
  - Collecting evidence about students' achievement of goals
  - Constructing claims that link learning with teaching
  - Proposing changes that improve teaching

# Study 1: Under What Conditions Can Pre-Service Teachers' Display Analytic Skills?

- Beginning pre-service teachers viewed videotaped 6<sup>th</sup>-grade lesson on area of triangles
- Asked to form hypotheses about what students learned and to collect supporting evidence
- Two conditions (N=30, 15 per condition)
  - Neutral: “What did students learn? How do you know?”
  - Negative: “Students didn’t learn everything intended. How can you tell?”

Morris, Anne. (2004, April). *An experiment model for analyzing and improving classroom lessons*. Paper presented at the annual meeting of the AERA, San Diego.

# Study 1 – Sample Results

	% of pre-service teachers	
	Neutral	Negative
Hypotheses linked specific teaching activity with student learning (and non-learning)	20	100
Hypotheses assumed students learned what the teacher explained	80	0

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- Pre-service teachers in the negative group more often proposed revisions and these more often aimed to engage students more actively in the lesson.

## Study 2: How Does Planning Affect Pre-Service Teachers' Ability to Analyze Teaching?

- Beginning pre-service teachers studied a lesson plan on understanding decimal fractions
- Asked to plan to collect evidence that would show whether the lesson was effective
- Three conditions (N=30, 15 per condition)
  - Control: No planning
  - Neutral: “What did students learn? How will you know?”
  - Negative: “Students didn’t learn everything intended. How will you tell?”
- Watched the lesson and collected evidence

## Study 2 – Sample Results

- Most of the plans, in both groups, targeted evidence that would not reveal students' achievement of the learning goals.
- But, when analyzing the lesson, a larger percentage of pre-service teachers in the negative group identified at least one piece of evidence that revealed a plausible teaching-learning connection:
  - Control condition: 40%
  - Neutral condition: 40%
  - Negative condition: 87%

### 3. Growth of Teacher Educators' Teaching As Demonstrated by Course Improvements

- Course improvements judged by pre-service teachers' achievement of learning goals
  - Mathematics knowledge for teaching
  - Skills and dispositions to study and improve teaching
- Data available on course improvements related to mathematics knowledge for teaching
- Multiple studies planned for course improvements related to studying teaching

# Sample Result – Percent Correct

Write a story for:  $1\_ \div \_ = [ ]$

	Before Course One	Before Course Two	Before Course Three
Before Course Improvement	13	22	47
Cohort One: After 1 <sup>st</sup> Improvement	14	28	65

# Summary: Developing and Testing a Model for the Continuous Improvement of Teaching

- A core question in the emerging research agenda of the Mid-Atlantic Center is how to prepare teachers with the essential mathematical and pedagogical competencies.
- University of Delaware faculty and doctoral fellows are addressing this question by examining how a range of competencies develop that will allow pre-service teachers to continue learning from their practice.
- The process used to study these questions also provides opportunities for faculty and doctoral fellows to continue learning from their practices.