Mathematics Classes for Elementary Teachers

What matters?

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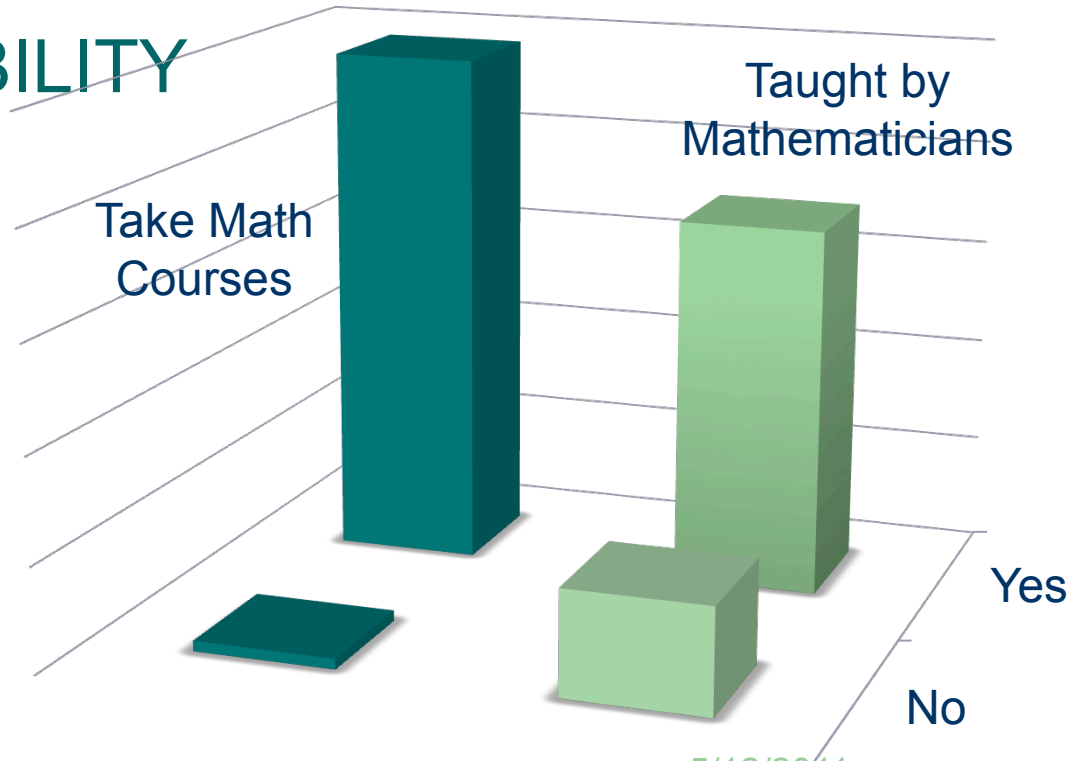
Why is this important?

- SCALE
- RESPONSIBILITY



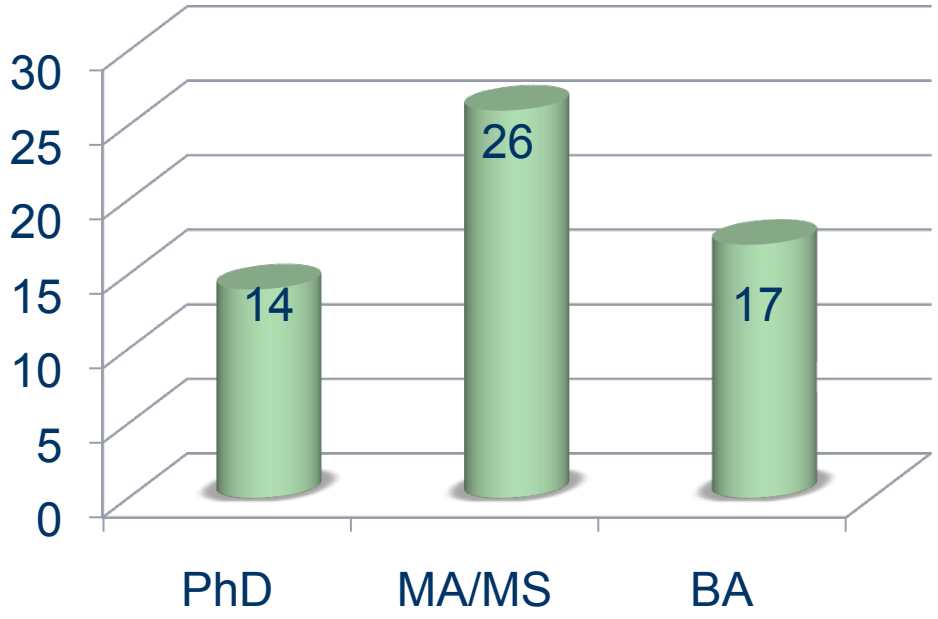
Goals for This Talk

- Describe the courses
- Explain our model of students' (PreService Teachers)* achievement
- GOOD NEWS: These classes "work" and they matter

*In this talk, student = elementary preservice teacher

Our Sample

- 57 schools (81% of eligible) in three sites (MI, NYCity and SC)
- Size of cohort:
  - <50 to >150
- Selectivity
- Public/private



Required Courses

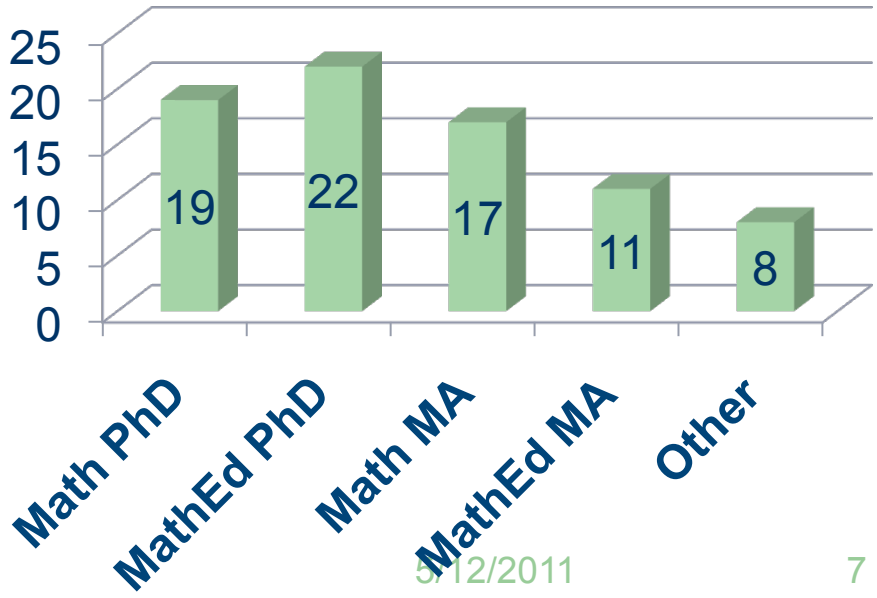
- 2 courses is the mean for elementary certification
- 7 courses is the mean for “specialization” WHEN THAT OPTION EXISTS
- Varies by type, size and selectivity of institution

Organization

- Mathematics courses FOR elementary teachers: 80%
- Number and operations primary focus: 50%
- Textbooks written for such courses: 60%
  - No “Standards” for textbooks or courses – many of them include EVERYTHING; others take a point of view; one is based on a particular elementary curriculum

Instructors

- N= 77
- In mathematics departments: 100%
- Tenure stream: 57%
- Highest degree:



Instructors

- K-12 teaching experience: 64%
- TAUGHT calculus: 69%
- TOOK calculus: 94%
- Experience teaching this course: Median of 2 times
- Interest in teaching: LOW, 1.25 on a scale of 0-3

Learning in These Courses

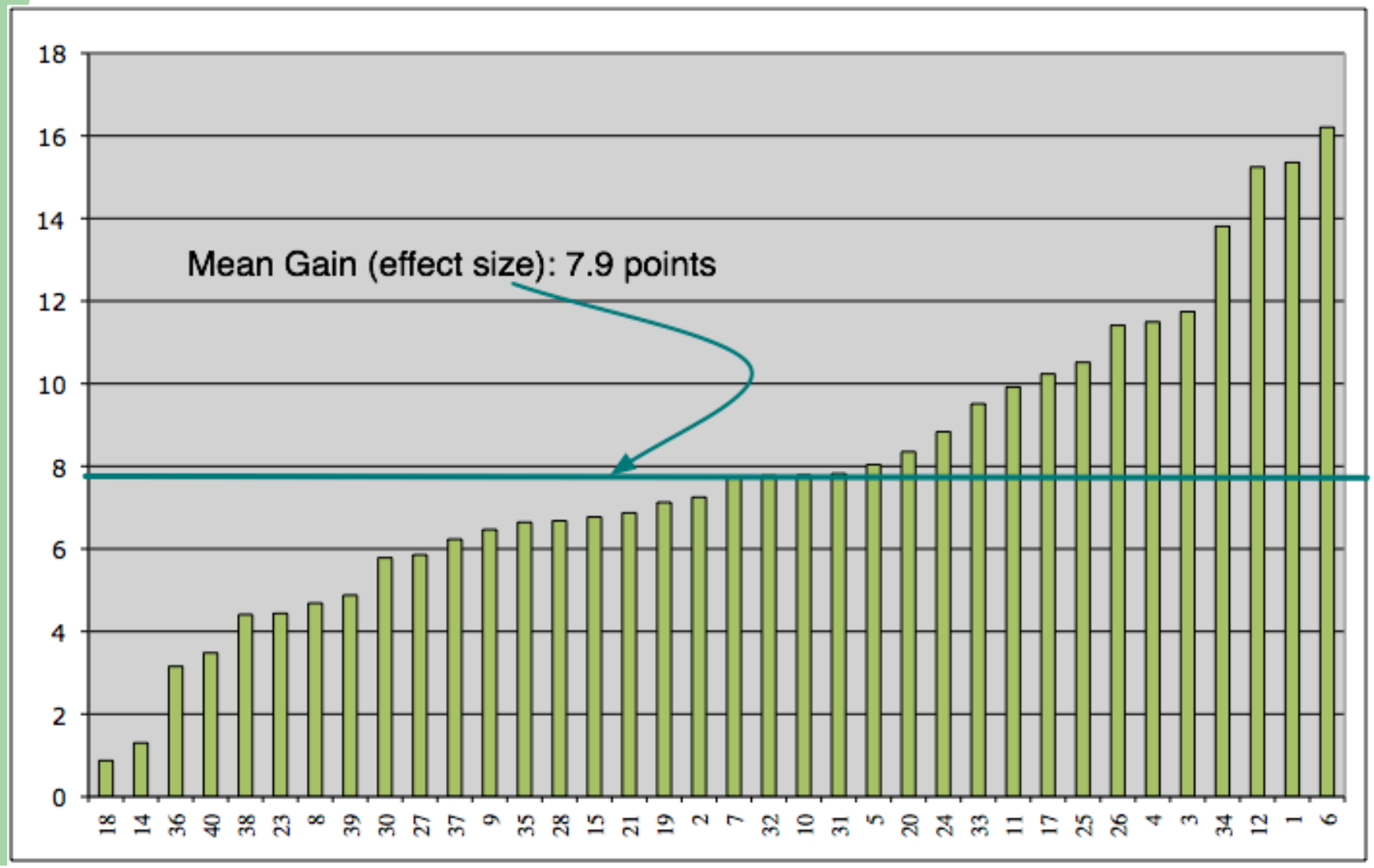
- What do these undergraduate students learn in the mathematics courses required for certification?

Study Design

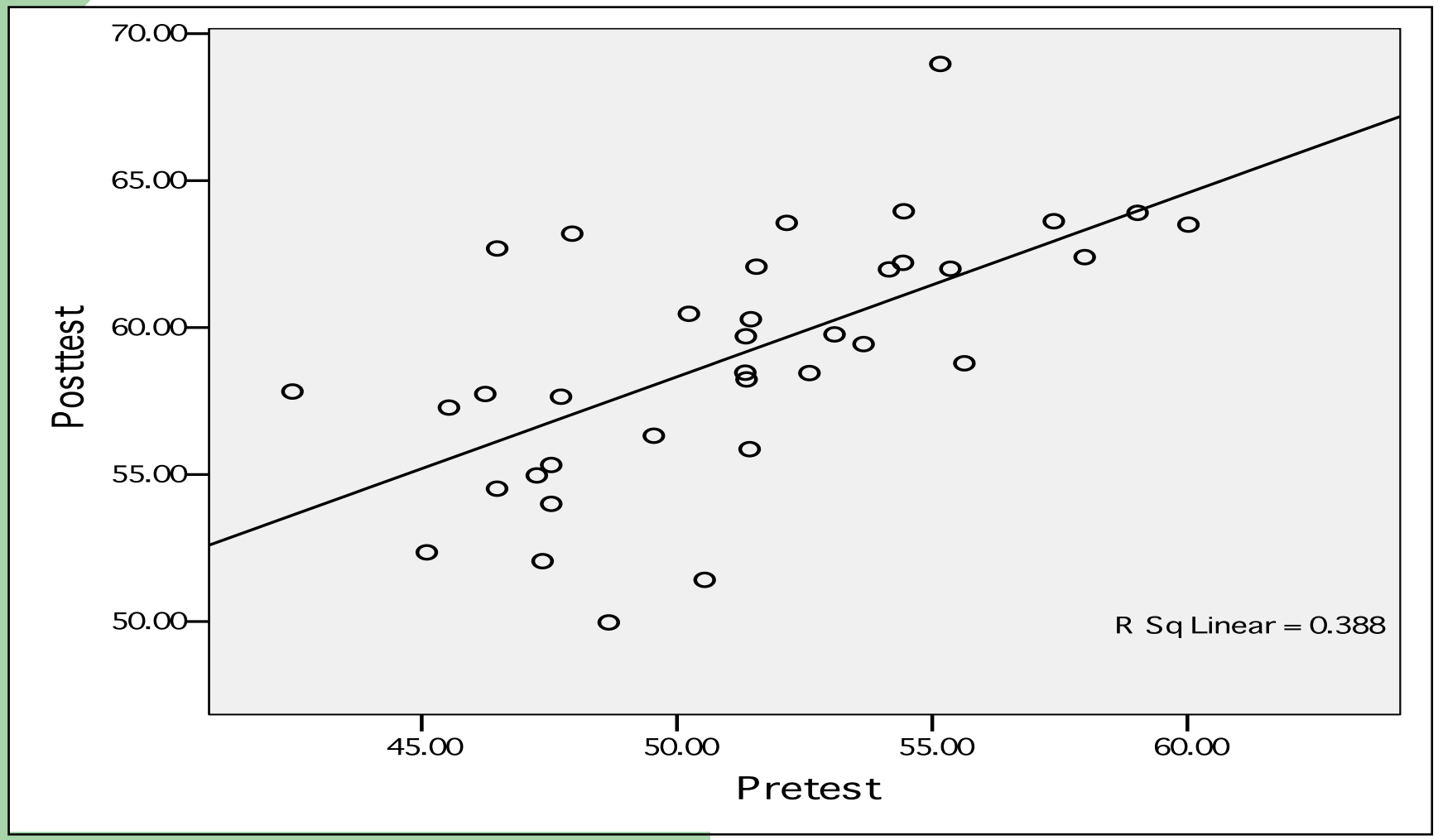
Mean 50; Standard Deviation 10

N= 1026 Matched pre/post tests from 40 instructors

Gain Score Variation Across Instructors



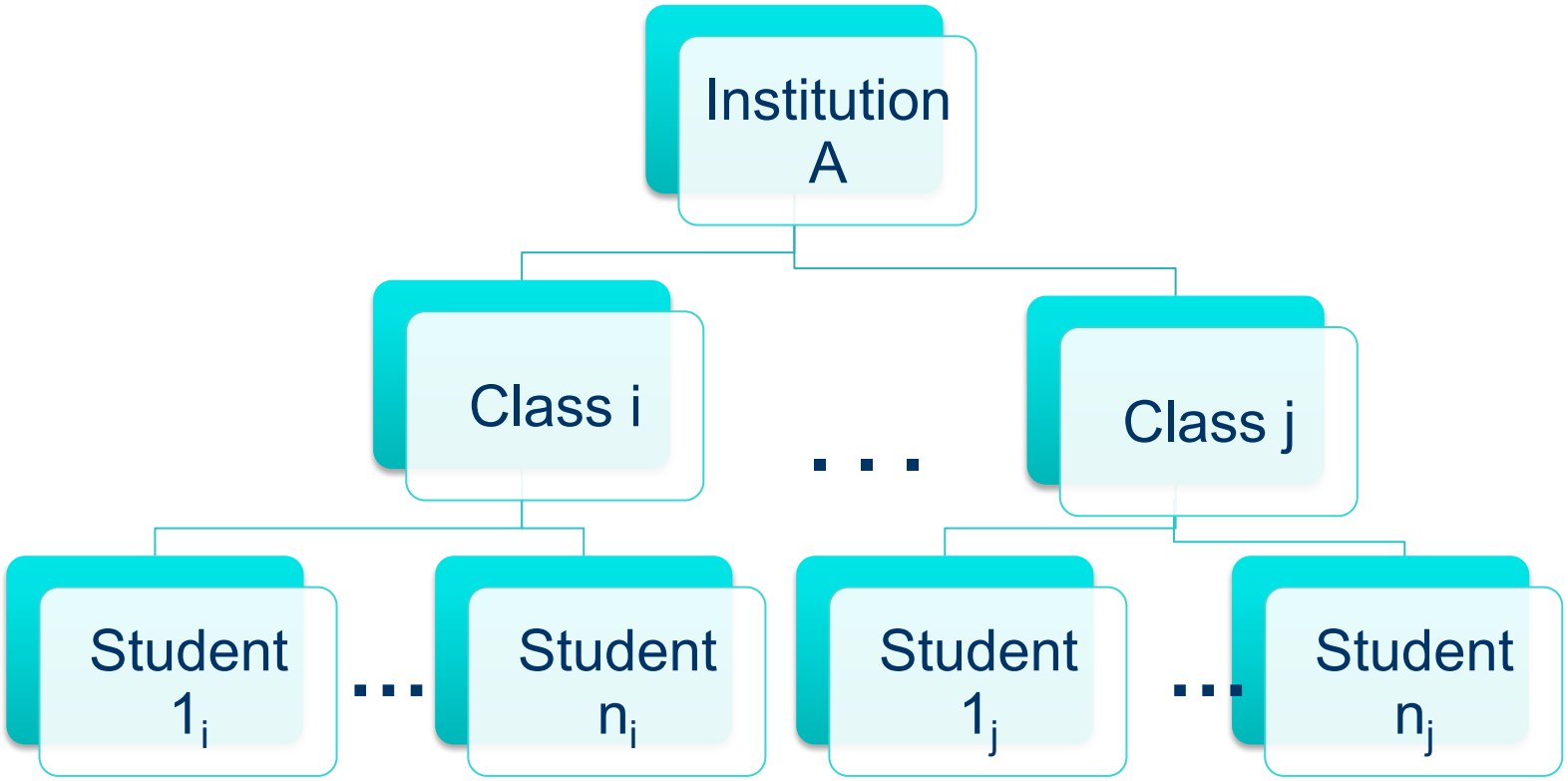
Variation, Another View



Our question

- Can we explain differences in student achievement across instructors based on characteristics of students, instructors, and classroom context?

Nested Model



Characteristics of Students

- Possible predictors of achievement
  - Pretest score
  - SAT/ACT
  - Attitude toward math
  - Socio-economic status
  - College mathematics classes
  - Year in college

Characteristics of Instructors

- Possible variables
  - Experience
  - Rank
  - Highest degree
  - Instructional methods
  - Attitude toward teaching the course
  - Knowledge of math ed policy and standards documents

Characteristics of the Context

- Instructional materials
  - What textbook is used (if any)
- Class size
- School quality
  - Average SAT/ACT overall
  - Average SAT/ACT reported by the class

Measuring Instructional Methods

- In your mathematics course, how often do **your students engage** in each of the following activities? Please check the box that best describes what happens in your course. The scale of responses ranges from 1, “Never or almost never”, to 4, “Every lesson”

How often do YOUR STUDENTS engage in these activities:

- Explain the reasoning behind an idea
- Work on problems for which there is no immediate method of solution
- ***Listen to you explain terms, definitions, or mathematical ideas***
- ***Listen to you explain computational procedures or methods***
- Analyze similarities and differences among several representations, solutions, or methods

Model Explanation

- Level 1- Students

  $POSTTEST = B_0 + B_1(PRETEST) + B_2(CACT) + r$

- Level 2 – Instructors

  $B_0 = G_0+G_{01}(TEXT)+G_{02}(METHOD)+G_{03}(MEANPRE) +u_0$

  $B_1 = G_{10}$

  $B_2 = G_{20}$

- .

Model Results

Explains 62% of the ***between instructor*** variance.

Instructor & Context related

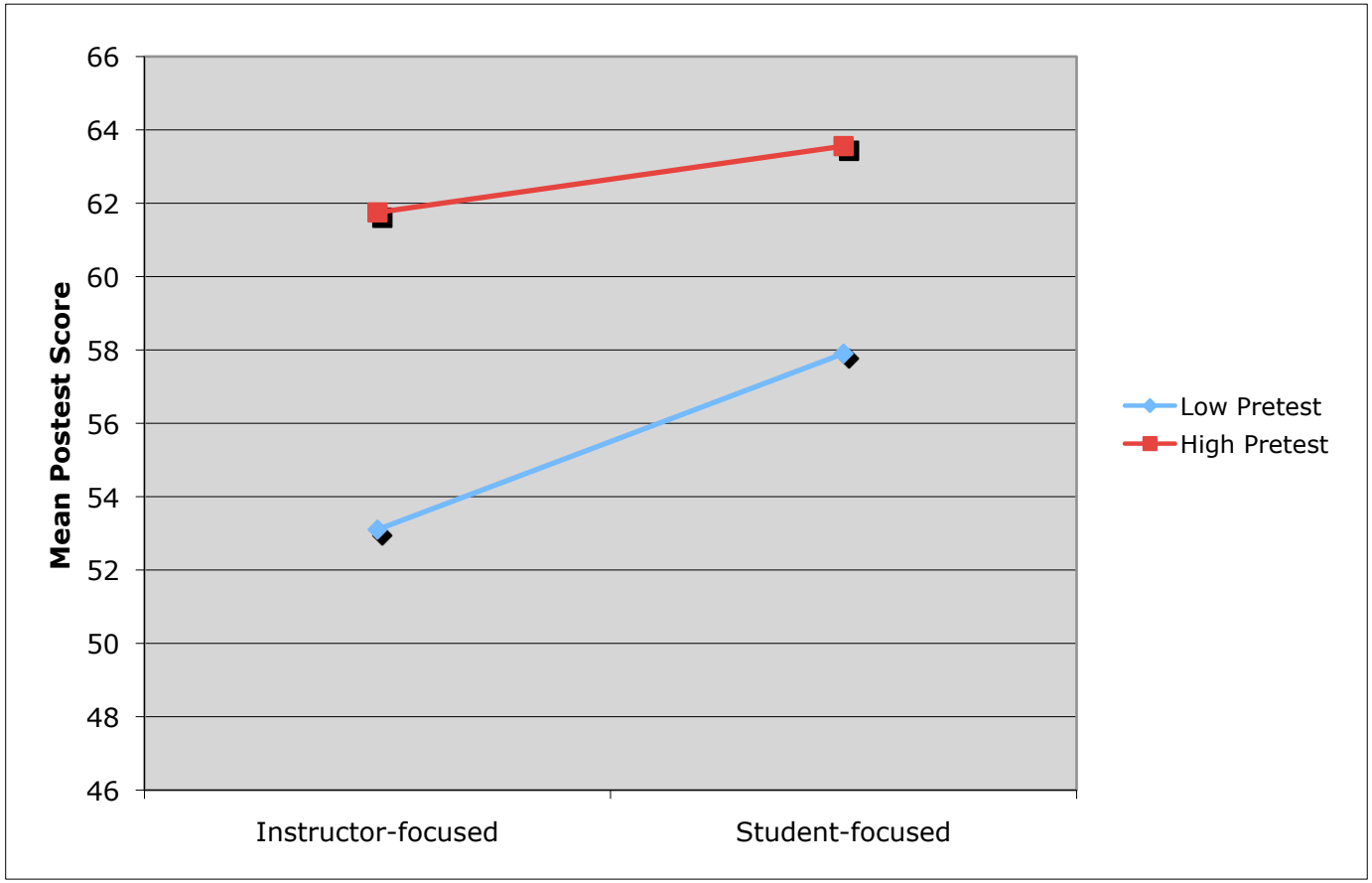
POSTTEST = 56.22 + 5.83(TEXT) + 3.26(METHOD) + 0.26(MEAN PRE)
+ 0.31(PRETEST) + 0.38(CACT)

Student related

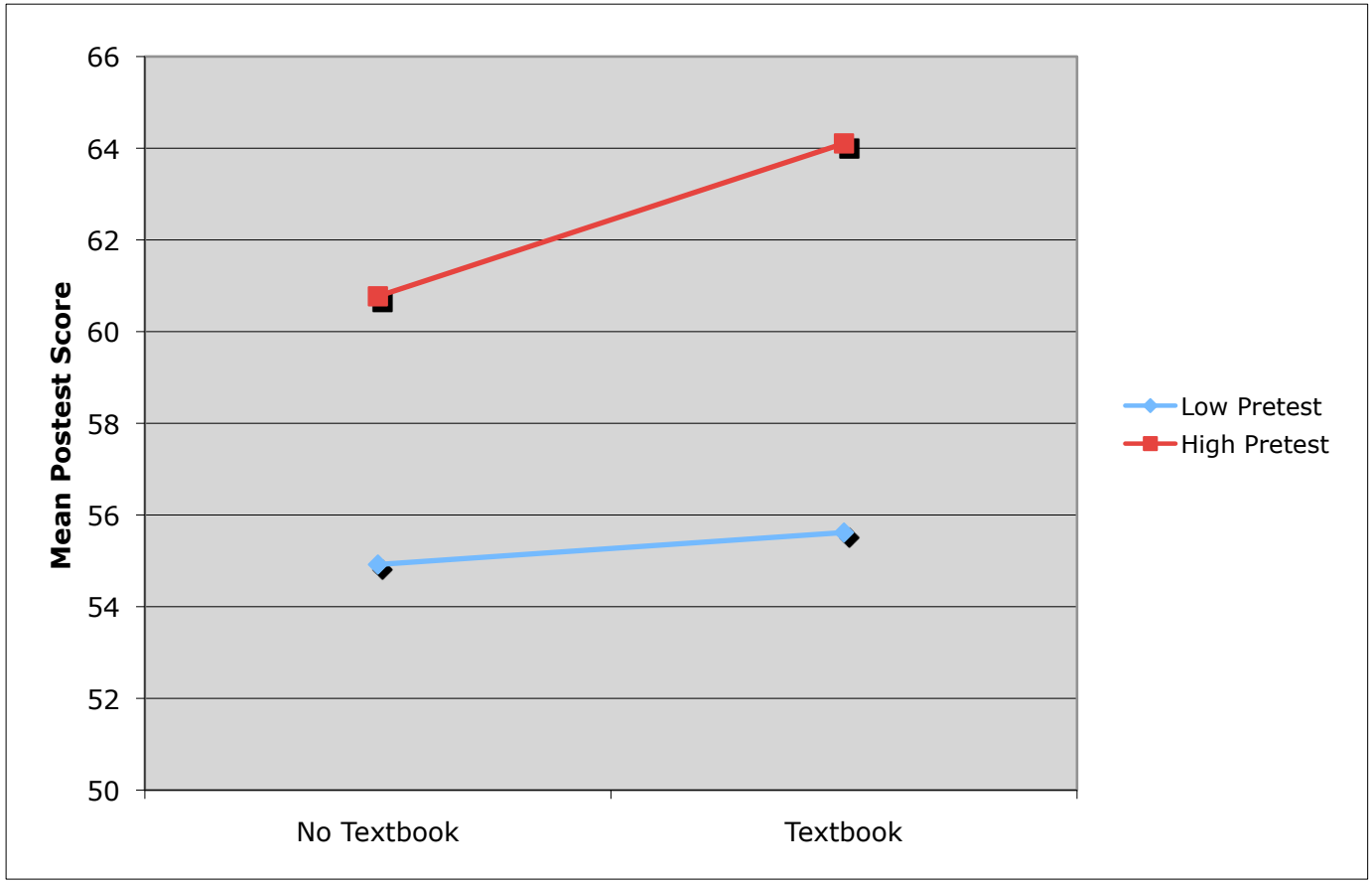
Model Results

- **Student prior knowledge** matters
  - More knowledge, more gain and higher posttest
- **Use of a textbook** designed for such a course matters
  - Using one of the 13 predicts higher gain
- **Method** matters
  - Less instructor-focused predicts higher gain

Posttest Score by Method



Posttest Score by Textbook



TEXT and METHOD

- Using a more student-focused method has a greater impact on low-scoring students (Pretest <50)
- Using one of the 13 textbooks has a greater impact on high-scoring students (Pretest>50)

Lessons: What Matters?

- Textbook
- Students' prior knowledge
- Class average prior knowledge
- Teaching methods
  - But method and textbook use matter differentially

Lessons: The Courses

- In mathematics departments
- Taught by mathematics faculty
- Mean of 2 courses
- Some of the “obvious” instructor and contextual factors do not predict outcomes

What else have we learned?

- These courses have an impact on future teachers' mathematical knowledge.
- The impact can be BIG.
- Factors that matter are ones we can influence.

Important Observation

- Most schools do not require enough mathematics to give future elementary teachers a chance to learn what they need to know.

What else have we learned?

- In other parts of the project
  - Comparing textbooks
  - Analyzing lessons
- No reflection of standards or standardization
  - Instructors doing their own thing
  - Diversity of methods
  - Diversity of content

My Personal Conclusions

- Need to focus these courses on SOMETHING PARTICULAR
  - Starting points for knowing elementary mathematics and for learning to learn mathematics
- Use K-6 curriculum
  - A standard curriculum would help
- Use children's common misunderstandings

Thank You!

And thanks to the many graduate and undergraduate students and faculty who have worked on this project, and to the instructors who shared their teaching with us.

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