INTEGRATION OF PRE-SERVICE TEACHER KNOWLEDGE AND *CCSSM*: MODELING IN ALGEBRA

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Introduction

Purpose of the *PTA* Project

- To provide information about how teacher education programs that graduate secondary school mathematics teachers prepare their students to teach algebra to diverse student populations.
- This part of the project aims to answer the question:

What are the opportunities for secondary mathematics pre-service teachers (PSTs) to learn about modeling and how to teach modeling in algebra?

Theoretical Perspective

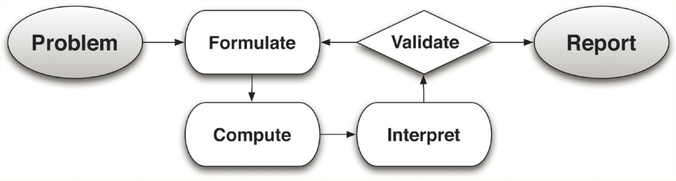
Algebra

- Algebra has been considered as a gatekeeper for entrance to college course work (Kilpatrick and Izsák, 2008).
- The high failure rate for students taking algebra courses raises concerns about how teachers are prepared to teach algebra (Loveless, 2008).

Contexts and Modeling

- *Common Core State Standards for Mathematics (CCSSM)* includes a modeling strand for high school mathematics and "Model with Mathematics" is one of the standards for mathematical practices (National Governor's Association Center for Best Practices & Council of Chief State School Officers, 2010).

Figure 1
Modeling in *CCSSM*



- **Identifying and selecting variables**
- **Formulating a model by creating and selecting appropriate representations**
- **Analyzing and performing operations to draw conclusions**
- **Interpreting the results of the mathematics**
- **Validating the conclusions, possibly improving the model**
- **Reporting on the conclusions and the reasoning behind them**

Methods

Data sources

29 instructor interviews

	Beta University	Gamma University	Kappa University
M	5	4	6
MfT	1	2	0
ME	3	5	3

M: Mathematics Content Courses MfT: Mathematics Courses for Teachers ME: Mathematics Education Courses

Interview Questions

a) Are you familiar with the Common Core State Standards?
b) To what extent does your course emphasize modeling?
c) Which aspects of modeling are studied in this course?
d) Which specific problems or activities do you use to teach these aspects of modeling?
e) How does the modeling in this course compare with the modeling process described on the handout? [Given a handout containing Figure 1]

Data Analysis

- Responses to the familiarity-with-*CCSSM* question were placed into one of the following categories: (a) Not at all; (b) Not very; (c) Some; and (d) Very familiar, corresponding to 0 through 3 respectively.
- Responses to the how-does-your-modeling-compare question were similarly assigned values 0 through 2, according to whether the instructor gave opportunities in zero steps, some steps, or all steps of the *CCSSM* modeling process (Figure 1).

Findings

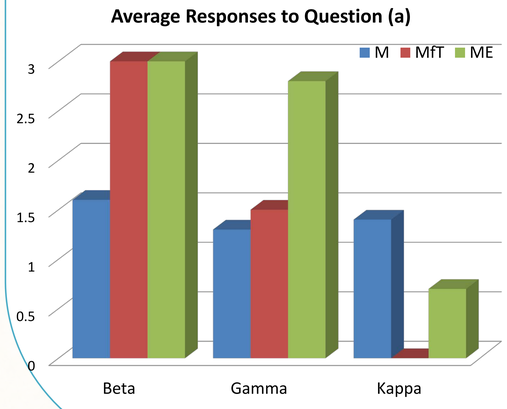


Figure 2

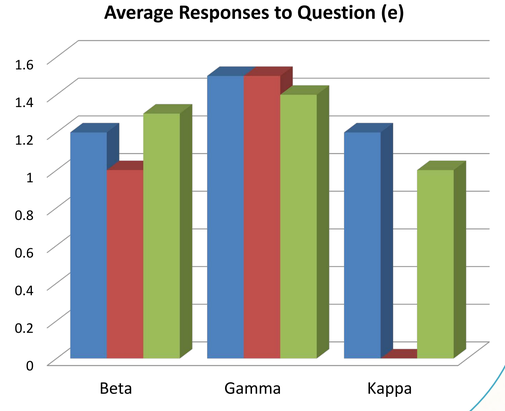


Figure 3

Findings

Opportunities to Teach Modeling

Teaching Content Knowledge
"My hope is, at least, that in seeing some of the ways that we do it in there, that they can take that into the classroom when they are doing some of their own work with their own students." *[Math instructor from Beta]*

Lesson Planning
"They come up with an engaging lesson but it's like ok, where did they take a real world problem and go through this with it?" [*Math Ed Instructor from Gamma]*

PSTs' Understanding of Student Learning
"[I] have students grapple with real-life data and try to make sense of it. So when they see what's difficult for students, what's beneficial for students and that, they learn how to adjust in terms of how much support they're providing for their students. " *[Math Instructor from Beta]*

Discussion
"We teach the mathematics through modeling as much as possible and we talk about the difference between learning the math and applying it versus learning the math in the context of modeling and how there's so much more power in learning it in the context of modeling" *[Math Ed Instructor from Gamma]*

Discussion

- Mathematics content course instructors have lower awareness of *CCSSM*.
- A commitment to modeling can come at the program level, as opposed to being limited to certain course types, something seen at Gamma University (see Figure 3).
- Although less than half of the courses reported opportunities for PSTs to teach modeling, we saw diverse opportunities across various course types.

References

Kilpatrik, J, & Izsák, A. (2008) A history of algebra in the school curriculum. In C.E. Greenes and R. Rubenstein (Eds.), Algebra and algebraic thinking in school mathematics. (pp. 1-18). Reston, VA: National Council of Teachers of Mathematics.

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Preparing to Teach Algebra (*PTA*)

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