CBMS FORUM 2019
panel

HIGHER EDUCATION LANDSCAPE

FRANCIS SU (HARVEY MUDD COLLEGE)
JULIE PHELPS (VALENCIA COLLEGE)
GARY MARTIN (AUBURN UNIVERSITY)
MICHAEL PEARSON (MAA)
CHANGING VIEWS ABOUT THE PURPOSES OF MATHEMATICS

FRANCIS SU (HARVEY MUDD COLLEGE)

@MATHYAWP
WHY LEARN MATHEMATICS?

• “To be college and career-ready”
• “You’ll use it later”
• Neither are sufficient answers
Make Your Daughter Practice Math. She’ll Thank You Later.

The way we teach math in America hurts all students, but it may be hurting girls the most.

By Barbara Oakley

Ms. Oakley is an engineering professor and the author of a book on learning.
• How about teaching math in ways that students will thank us NOW?
• analogy: music
MORE PURPOSES FOR MATHEMATICS

- Catalyzing Change (NCTM)
- Expand Professional Opportunities [later]
- Understand and Critique the World [now]
- Experience Wonder, Joy, Beauty [now]
WE CAN HELP STUDENTS SEE THE VALUE OF MATH NOW

• Understand and Critique the World:
  Power to understand how things work, to actively critique and create

• Experience Wonder, Joy, Beauty:
  See triumphs of human ingenuity, beauty of reasoning & thrill of understanding, unexpected enchantments found in well-designed problems and in nature
BEYOND CONTENT: BUILDING IDENTITY & AGENCY

• **Mathematical identity:** beliefs students have about their ability to participate in and do mathematics (e.g., seeing themselves as capable and empowered)

• **Mathematical agency:** the extent to which students express and engage their mathematical identities (e.g., taking risks, engaging in productive struggle, etc.)

- Expand Professional Opportunities [later]
- Understand and Critique the World [now]
- Experience Wonder, Joy, Beauty [now]
GOOD THINGS HAPPENING
(COLLEGE LEVEL)

• Active learning, IBL uptake

• Emphasis on modeling projects, statistics, more pathways

• Professional societies on board, spreading awareness, professional development, e.g.,
  MAA Project NExT,
  AMS inclusion/exclusion blog

• Greater engagement in equity issues by newer, more diverse set of professors
LET’S EQUIP PROFESSORS TO:

• Incorporate active learning (*MAA IP guide*)

• Learn language, research, pedagogical practices around equity

• Understand the need to train in inclusive pedagogy, building identity & agency

• Appreciate multiple pathways to/through math
Communicating mathematics well is an important part of doing mathematics. When writing homework solutions, keep these things in mind:

- **Write in sentences.** Complete thoughts are sentences that end in periods. Instead of listing equations by displaying them, but even displaying them, use paragraphs to separate important ideas.
- **Use helpful connective phrases.** Use phrases like “If”, “then”, “so”, “therefore”, “we see that”, “recall that”, etc.

### Mathematical Practice

- **P1. (Affection)** Students should appreciate the beauty, fun, and power of mathematics, and be able to articulate what mathematics is about and what mathematicians do.

- **P2. (Application)** Students should be able to link applications and theory, and be able to apply mathematics in a variety of settings.

- **P3. (Inquiry)** Students should develop mathematical independence and experience open-ended inquiry, so they have the competence and confidence to build on their knowledge base.

- **P4. (Communication)** Students should develop effective thinking and communication skills.

- **P5. (Technology)** Students should be able to use technological tools appropriately and effectively.

- **P6. (Society)** Students should strive to be good citizens who understand of the impact of their work on society.

- **P7. (Teamwork)** Students should be able to function well as part of a team and have honed their leadership skills.

- **P8. (Diversity)** Students should be able to work and communicate with diverse groups of people of varying abilities who come from a variety of cultures.

### Mathematical Content

- **C1. (Breadth)** Students should be competent in a broad range of mathematical skills and topics.

- **C2. (Perspective)** Students should demonstrate that they can see key mathematical ideas and concepts from a variety of perspectives, including the view from other disciplines, historical perspectives, and the contributions of diverse cultures.

- **C3. (Duality)** Math majors should demonstrate that they can see key ideas from complementary points of view: continuous and discrete; algebraic and geometric; deterministic and stochastic; exact and approximate.

- **C4. (Proofs)** Math majors should learn to reason mathematically and read, understand, analyze, and produce proofs.

- **C5. (Tools)** Math majors should learn concepts and methods from data analysis, computing, and mathematical modeling.

- **C6. (Depth)** Math majors should see at least one mathematical area in depth in a sequence of upper-level courses.

- **C7. (Projects)** Math majors should work, independently or in a small group, on a substantial mathematical project that involves techniques and concepts beyond the typical content of a single course.

- **C8. (Careers)** Math majors should be aware of careers in mathematics.
LET’S EQUIP TEACHERS TO:

• Focus on process of doing math (elevating student thinking, making strategic choices, enabling sense making) — this better aligns with college instruction

• Broaden assessment to value more ways of expressing mathematical growth — aligns with college efforts to broaden math training
A PERSONAL VIEW

• People will build math identities if they see math as deeply tied to what it means to be human: to think well, reason effectively, to care for others, to experience joy & wonder, to build communities.

• Policies should promote human-centered thinking about math education.