

# CREATIVITY IN MATH AND SCIENCE (CMS) FACULTY WORKSHOP

June 20, 2017

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DISCUSS WITH YOUR GROUP (WITHOUT  
LOOKING IT UP, OF COURSE!):

- What is the area of the Pacific Ocean?
- Which state in the United States is flown over the most?

WHAT WERE YOUR APPROACHES, AND HOW  
ARE THEY RELATED TO SOME FEATURES OF  
CREATIVITY?

- Connect ideas
- Be flexible
- Have aesthetic taste
- Be unorthodox
- Be motivated—not be afraid of failure
- Question norms
- Be inquisitive
- See similarities and differences

## GOALS FOR TODAY

- Have you experience creativity as a learner
- Give a brief overview of our project
- Have you participate in an exercise that connects disciplines and creativity
- Have you consider how you might incorporate creativity into a course you will be teaching in the fall
- Convince you to participate in this project long-term

# CREATIVITY IN MATH AND SCIENCE OVERVIEW

- Funded by the National Science Foundation
- 3-year program (September, 2016-August, 2019), Track I pilot program
- Components
  - Course revision
  - Scholarship program
  - Research
- Involves
  - Instructors of undergraduate mathematics and science
  - K12 teachers
  - Bergen Community College partners

## CMS PROJECT OBJECTIVES

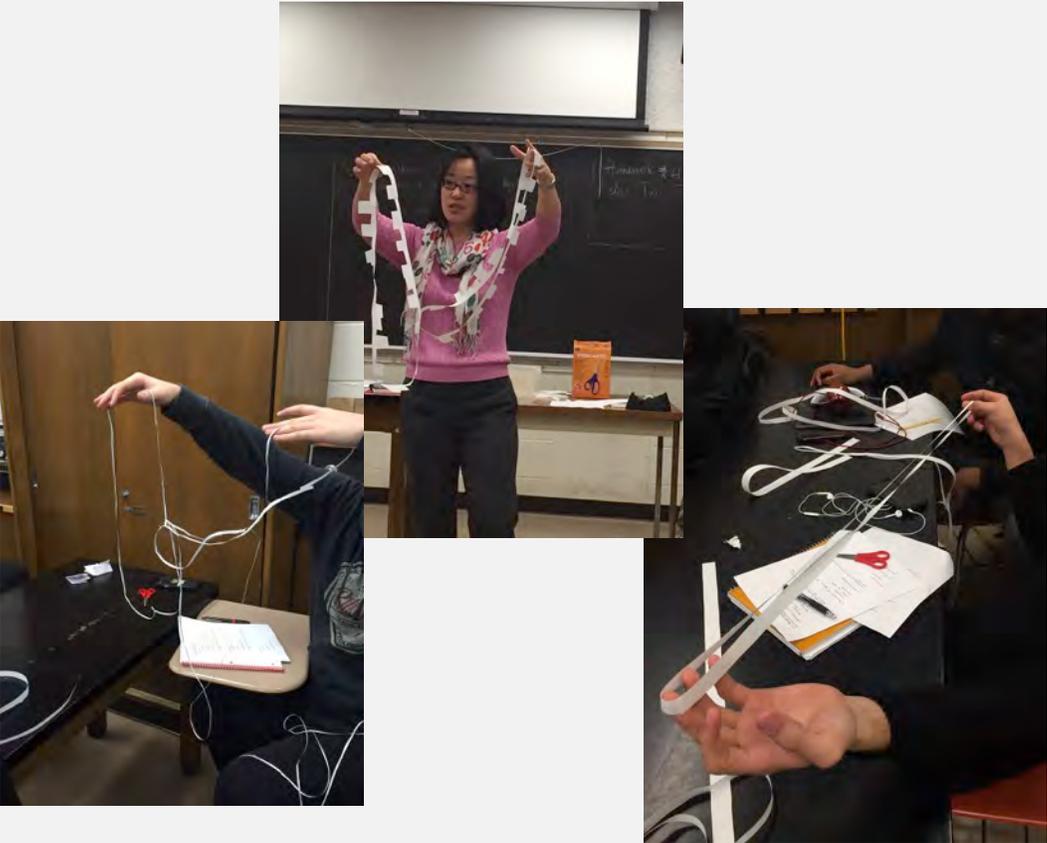
- Design, pilot, and refine learning materials and instructional innovations to engage students in creative thinking in STEM. Sustain these efforts at MSU.
- Evaluate and report on the project with respect to effective instructional strategies and students' perceptions of STEM learning, retention of STEM majors, success in subsequent courses, and preparedness for the STEM workforce
- Build bridges with partner institutions to coordinate sustainable change in undergraduate STEM education



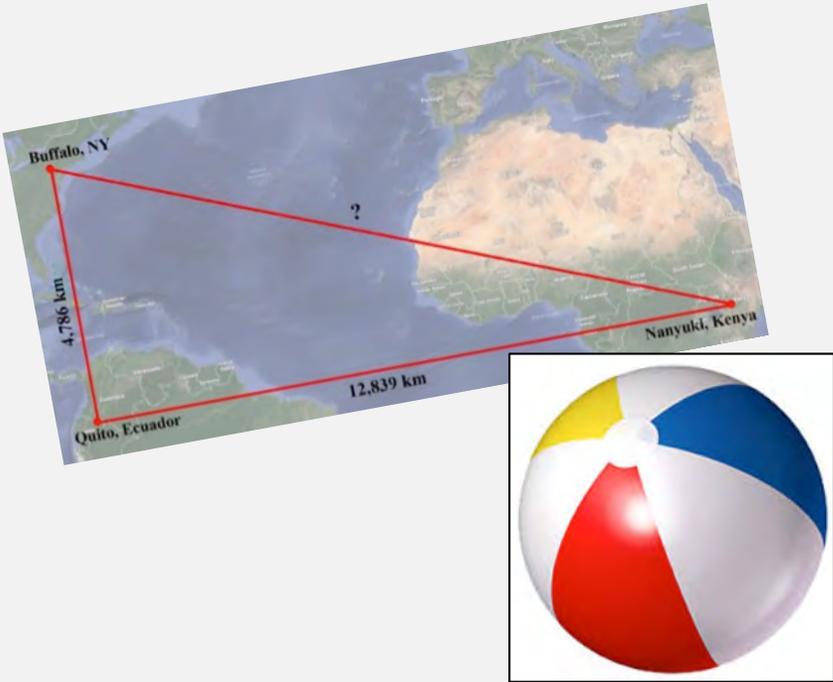
Module 1: Space and time	<ul style="list-style-type: none"><li>• Non Euclidean Geometry on Globes</li><li>• Mobius Strips</li><li>• Explorations of time</li></ul>
Module 2: Data	<ul style="list-style-type: none"><li>• Data visualization</li><li>• Order of Magnitude problems</li><li>• Understanding data—making connections between population and climate data</li></ul>
Module 3: Probability	<ul style="list-style-type: none"><li>• Monte Carlo simulations</li><li>• In 2 dimensions</li><li>• In 3 dimensions</li></ul>
Module 4: Symmetry and design	<ul style="list-style-type: none"><li>• Fractals</li><li>• Number patterns</li><li>• Symmetry groups and transformations</li><li>• Math and architecture</li></ul>
Assessments	<ul style="list-style-type: none"><li>• Midterm</li><li>• Final</li><li>• Book review assignment</li><li>• Journal</li></ul>

# QUESTIONING NORMS, BE INQUISITIVE, ASK QUESTIONS

## Mobius Strips

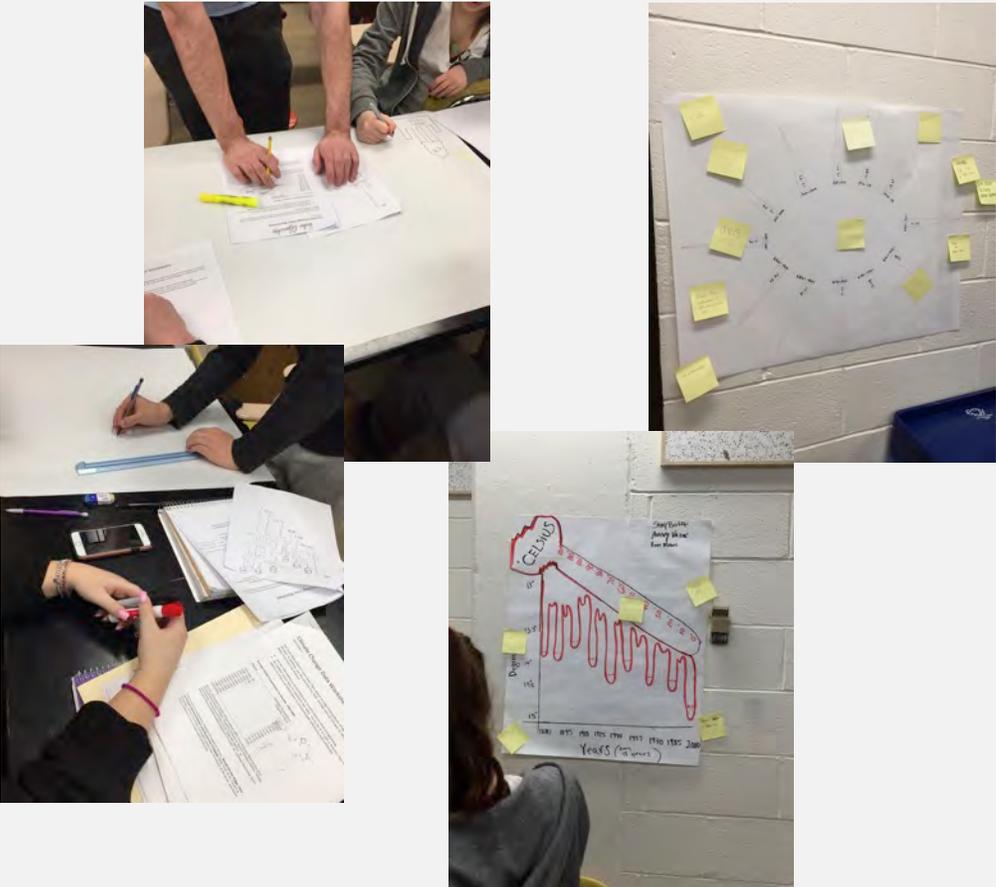


## Geometry

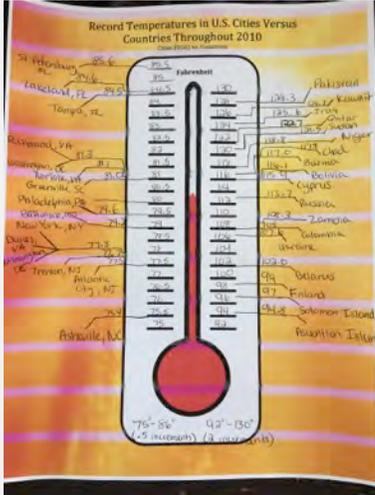
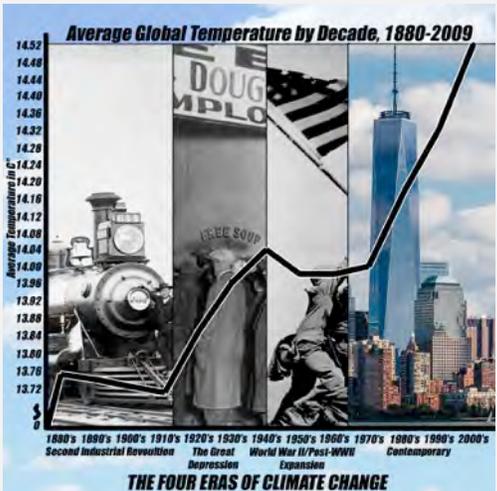
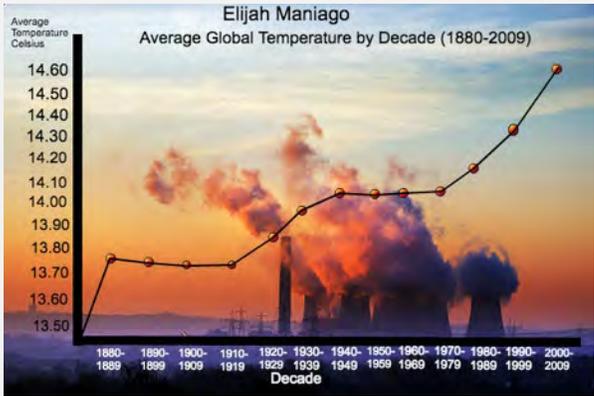


# INFOGRAPHICS: MAKE CONNECTIONS, BE UNORTHODOX, HAVE AESTHETIC TASTE

## At home assignment



## In Class Activity

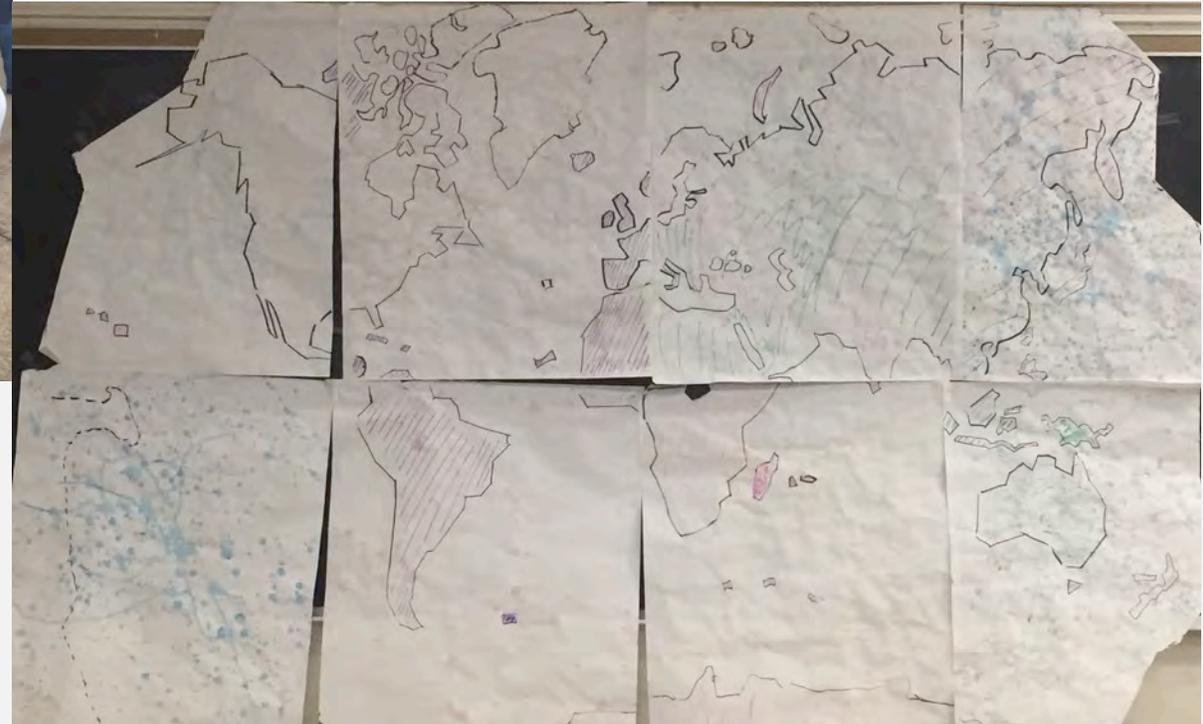


# MONTE CARLO SIMULATION: MAKE CONNECTIONS, SEE SIMILARITIES

## Small Group Activity



## Whole Group Discussion



MIDTERM TEST--PROBABILITY USING BEACH BALL: MAKE CONNECTIONS, CONJECTURE ABOUT DIFFERENCES





# RESEARCH

- Participants: Students in Math 106 – General Education requirement for non-mathematics majors
- Spring 2017 class meetings twice per week
- Weekly assignments
- Surveys
  - Torrance Test of Creativity
  - Guilford Alternate Use Assessment
  - Student Attitude Survey - Conceptions of Science
- Student journals
- Interviews
  - Instructor interviews
  - Student focus group interviews

## STUDENT REACTIONS

- “**it’s really different** from a lot of courses I’ve taken...**they don’t teach in a conventional way**...in every other math course I’ve ever taken they give you examples, and then you do homework, and then you take a test.”
- “[it] makes math less stressful because like it’s okay to be wrong because you’re more learning like **why you’re doing the math, not just how to do the math.**”
- “...It’s the first class I’ve taken that tells you that **math can be creative instead of just logical.**”

## STUDENT REACTIONS

- "...it really **broadens your thinking** to not only math but what each subject really is and how they **overlap** with each other"
- "there's other things that make it like more of a combination where like in high school...it was like never a combination of **science and math**...whereas here it's like **they go together** and here's **why they go together.**"
- "...try to come up, you know with ways to solve it by different means...so, what I noticed is **everybody uses a different source** so it's really uh, I think **it uses everyone's creativity.**"

## WHERE ARE WE GOING FROM HERE?

- By the end the summer, post revised lessons on our website (please check back then!)
- MATH 102—New Student Experience for math majors
- Bergen Community College
- CMS Scholars Program
- Scale up

# THAT'S MATHEMATICS!

- [Our homemade video](#)

## YOUR TURN

- Think of a lesson in your discipline that can be taught using Q-tips. (How is this creative for the teacher? For the learner?)
- You can do this either individually or with group members.
- Choose one to share with the whole group



## PLANNING A COURSE

- Please pick a course that you're teaching next semester and complete the worksheet
- We will collect these, collating the responses, then sending them back to the whole group

## SUMMER HOMEWORK

- Over the summer, revise a syllabus with our discussion in mind
- Please develop lesson plans that deliberately incorporate creativity and email them to us at [vaidyaa@montclair.edu](mailto:vaidyaa@montclair.edu). We will send a reminder before the school year

## EXIT SURVEY

- Consent forms
- Survey
- We welcome further feedback. Please feel free to email us at any time!
  
- Thank you for attending!