LEADING CHANGE
Disrupting the Dominant Narrative

Suzanne L. Weekes

Department of Mathematical Sciences
Worcester Polytechnic Institute
Theory and Practice
The WPI Plan

Projects are central to the WPI Plan

Undergraduates must complete:

• Humanities and Arts Requirement
• Interactive Qualifying Project (IQP)
  Interaction between science, technology, and society
• Major Qualifying Project (MQP)
  Original research in major area
GOALS:

- formulate a problem, develop a solution and implement it competently and professionally,
- demonstrate application of the skills, methods, and knowledge of the discipline,
- work in teams and communicate well, both orally and in writing.

All WPI undergrads must do original research in their major area.
Not that we care about rankings...
My first MQP student  WPI ‘02

Look where I found a video of my first MQP student!  
http://meetings.aaas.org/posters/
PhD, Computational Linguistics, UMD
Industrial Math at WPI

Center for Industrial Mathematics & Statistics

- Make partnerships with industry that benefit the sponsors, and our mathematical sciences community
- Real-world research projects that come directly from industry, government and finance

Visit http://www.wpi.edu/+CIMS
CIMS Partners

130+ projects 75+ companies

GenomeQuest

SATMAP™

John Hancock

SRI International

Advanced Sports Logic

Chitika

AdHarmonics

Sun Life Financial

BOSE®
Possible Challenges

• Company interested but too busy
• Mathematical content - too high/ Too low
• Alignment of company & academic timetables
• Getting the right students
• Competition with internships
• Financial support
• Industrial project topic does not line up with faculty’s interest
• Climates in industry change
WPI REU Program in Industrial Math and Statistics

1998 – 2015

18 summers
56 projects
28 companies
198 students
141 colleges

Visit http://www.wpi.edu/+CIMS/REU
PIC Math Program Goals

• Increase awareness among math and statistics faculty and undergraduates about non-academic career options
• Provide research experience working on real-world problems from business, industry and government
• Prepare students for industrial careers.

- PIC Math Faculty Summer Workshop
- Spring Semester Research Course
- Summer Research Competition

with Michael Dorff, BYU

http://www.maa.org/pic-math

NSF

DMS 1345499

PIC Math

MAA 100 CELEBRATING A CENTURY OF ADVANCING MATHEMATICS

SIAM

MATH METRICA
Industrial Case Studies Videos

We produced four **2-video sequences** highlighting some research problems that mathematicians and statisticians encounter outside of academia.

Go to **Industrial Math Case Studies**

at [http://www.maa.org/picmath](http://www.maa.org/picmath)
Industrial Case Studies Videos

The first video features a professional mathematical scientist talking about their career and some of their research.

The second video features a faculty member presenting an approach, with technical details, that one may use to make progress on the industrial research problem.
Improving Marketing Strategies

Use text analytics to help an online company distinguish between its business customers and its private consumers from messages on gift cards.

Dr. Jonathan Adler  Prof. Talithia Williams, Harvey Mudd College

Creating More Realistic Animation for Movies

Use mathematics to make realistic, art-directable animations to simulate phenomena such as water, fire, smoke, wind in the movie and gaming industries.

Dr. Alex McAdams, Disney Animation Studios  Prof. Joseph Teran, UCLA
The Videos

**Building a Better Filter**

Use mathematics and statistics to help understand waste capture mechanisms and to optimize microstructures to create better filtration devices.

**Dr. Sumanth Swaminathan**, W. L. Gore & Assoc.  
**Prof. Louis Rossi**, U. of Delaware

**Finding the Safest Place to Store Nuclear Waste**

Use mathematics and statistics to study the feasibility and safety of prospective subsurface nuclear waste storage sites using limited geologic data.

**Dr. Genetha Gray**, Intel  
**Prof. Gwen Spencer**, Smith College
Toyota-RIT Math Initiative

For high school mathematics teachers interested in exploring:

• how the math and statistics taught in high school is used by professionals,
• what career paths are open to students well-trained in math,
• how high school math forms the foundation for college success.

Rochester Institute of Technology, Univ. of Delaware, Univ. of Minnesota
MIST

Applied and Industrial Mathematics Institute for Secondary Teachers

4 days     33 teachers     10 industry speakers

8 faculty speakers     1 robot     3 REU talks

+ homework
Industrial Math Projects for High School Students

https://www.wpi.edu/+CIMS/IMPHSS/

- Developed with Research Experience for Teachers supplement to REU
- Directed by **Prof. Art Heinricher**
- 20+ industrial mathematics projects for high school students drawn from a variety of real-world situations.
- **Industry projects for every level of high school mathematics, from Algebra to Calculus and Statistics**
- Project database contains downloadable versions of each of the projects, ready to be assigned to students.
Network Analysis

The Problem
Amtrak has been shown to be a company that does a service to the country, but does not make a profit. Executives at Amtrak have suggested that some of the rail lines, stations and/or trains should be eliminated to allow the company to minimize its losses. A team of consultants has been hired to analyze the rail services that are available in any region and decide where Amtrak needs to concentrate its money and services to best meet the needs of its customers. As a team of consultants you will need to make recommendations in your area of expertise as to what Amtrak should do.

Areas of Application
The Problem
Modern production lines have to be designed to be as fast as possible with almost no error. When producing millions of products a day how does a company keep track of it all? The project describes how salt water taffy is made. The process starts with mixing raw materials, which are then baked in ovens and subsequently cooled. The taffy ingredients are pulled, folded and twisted on special pulling machines. Finally, the mixture is put into an extruding and cutting machine which produces pieces of wrapped taffy. In this project students become design engineers. They will need to decide how many of each machine the company needs, how long it will take to make taffy, and how much raw material is needed each day.
SIAM and COMAP - Modeling

GAIMME - Guidelines for Assessment and Instruction in Mathematical Modeling Education

- What is Mathematical Modeling?
- Early Grades (K–8)
- High School (9–12)
- Undergraduate

Writing team:
Karen Bliss
Kathleen Fowler
Ben Galluzzo
Sol Garfunkel
Frank Giordano
Landy Godbold
Heather Gould
Rachel Levy

Jessica Libertini
Mike Long
Joe Malkevitch
Michelle Montgomery
Henry Pollak
Dan Teague
Henk van der Kooij
Rose Zbiek
THANK YOU FOR YOUR ATTENTION