University of Michigan
Provost's Teaching Innovation Prize

2015 WINNER

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JILL HALPERN
Lecturer IV
Mathematics and Comprehensive Studies Program
College of Literature, Science, and the Arts
jhalpern@umich.edu

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Calculus in the Commons: Bringing Math to Life

Innovation Description

When students can make meaningful connections to abstract material, they learn more. In Jill Halpern's project-based sections of U-M's introductory math sequence, students trek to the Nichols Arboretum to see Fibonacci's sequence at work in nature. Or they explore the meaning of a difficult concept like half-life through the radiometric dating of dinosaurs in the Museum of Natural History. Beyond providing a realistic context for computations, venturing out of the classroom can engage students both intellectually and emotionally by

- increasing understanding, retention, and motivation,
- stimulating curiosity and the appetite for learning,
- transcending cultural and socio-economic boundaries through shared spirit of adventure and joy of learning, and
- cultivating feelings of home and belonging through interactions with campus public goods.

The university's support for reducing class sizes makes it feasible to envision offering "outside-the-box" learning experiences to increase the success of hundreds of students moving from introductory to upper-level courses. Applied to other disciplines, this approach can re-frame discussions of "at risk" students and transform introductory courses from mere prerequisites to inspiring springboards to students' dreams.

Student Comments

"My grades improved, my understanding was stronger, but most importantly my appreciation for the material was strengthened."

"Every student that has benefited from Jill's adventures outside of the classroom has experienced what it means to think, to learn, and to enjoy the experience along the way."

"Being able to witness true applications of the work we committed so much time and effort to learning, like Fibonacci's sequence, perpetuated in me a continued desire not to give up on the material."

"I don't just sit in lecture and try to drill a concept into my head; rather, I seek and look for the bigger picture and appreciate the small details that go into making the puzzle of life that much more beautiful and perplexing."

"I was not excited to learn mathematics because I felt the journey would be painful and may end in me failing miserably. When you feel behind the curve, far behind it, it becomes tempting to crawl into your shell and brace for the injuries to follow. Jill pulled every one of her students out of his or her shell by creating an atmosphere of curiosity and wonder."

Examples of Teaching Innovation

Painting polar pictures at the U-M Museum of Art introduces students to using calculus to find properties (areas, arc lengths, etc.) of shapes defined by polar equations.

Mathematical Models	Applications in the Fallout from Fukushima Project
logarithmic	earthquake Richter scale
sinusoidal	tsunami waves
exponential	radioactive decay
power function	decrease in radioactivity with distance
rational functions	concentration of contaminated water in ocean

Students learn math by modeling several aspects of the March 2011 earthquake and its after effects.

Students compare the limits of normal notions of time for describing things in the far past with the elegance of mathematical expression, in this case, exponential modeling.