Tufts University Noyce Project
Urban Math/Science Teacher Collaborative

- 8 Teaching Fellows interning at Fenway High School, Boston Arts Academy, Mission Hill & Somerville High School (6 math; 2 physics)
- 3 Master Teacher Fellows to mentor them for 4 years
- Full year internship; CAST/UDL partnership
- Graduate level content courses that integrate content and pedagogical content knowledge taught on site in an MTF's classroom.

The Math Behind the Math You Teach

From the syllabus: a graduate level math course

- We will learn mathematical reasoning and beautiful mathematics that shows the richness of the real numbers. This math is behind what you will teach your secondary school students, and we hope to make this connection clear.
- This course will help you develop an orientation towards secondary mathematics in which you ask yourself, “What does this mathematical concept mean?” and “How can I help my students learn this mathematical concept?” as opposed to “How can I get my students to give the right answer?” This orientation views mathematical activity as a process of developing insight into relationships and structures rather than just getting answers to questions.

The Math Behind the Math You Teach

Professor Todd Quinto shares his experience of teaching this course.

- I taught by having them discover the ideas. For example, when they learned about spherical geometry, they played finding lines on balls and figuring out their properties.
- We had extended discussions about what the mathematical ideas mean and how they relate.
- We had in class problems and students coming to the board and a generally more relaxed atmosphere than in my typical math classes.
- We talked about how I was teaching and how I could teach better.
- Teaching in one of our partner schools helped me focus on the goal of the course: to help our TFs teach mathematics to middle- and high-school aged students.

The Math Behind the Math You Teach

What we will improve next year

- Integrate the MTFs more into the course. I would like them to show example class projects such as projects involving social justice.
- Integrate math and education even more.
- More conceptual discussions about the math: what it means, why is it defined this way…
- More learning through the discovery of ideas.

The Science and Pedagogy of Thermodynamics

Hugh Gallagher & Judah Schwartz

From the syllabus:

- Conservation Laws
- Model building, role of idealization
- Microscopic / Macroscopic connections
- Parallel with our study of the science of energy and entropy, we will focus on the challenges of teaching and learning these concepts and on the pedagogy of helping students learn to formulate abstract measures and relate them to one another in models

The Science and Pedagogy of Thermodynamics

Hugh Gallagher & Judah Schwartz

- A deep understanding of the key content related to thermodynamics:
  Distinctions between temperature, heat, work and energy.
  Entropy and the statistical nature of the second law.
  Efficiencies – ideal and real world.
  Applying thermodynamics to novel contexts and real-world situations.

The Science and Pedagogy of Thermodynamics

Hugh Gallagher & Judah Schwartz

- *Pedagogy:*
  - common conceptual challenges for learners
  - historical development of key ideas
  - discussion of research literature in science education
  - critiques of common classroom activities at the middle and high school level
  - appropriate activities for exploration of the 1st and 2nd laws
  - use of simulations (particularly for 2nd law)
  - discussions with educators about their experiences and challenges teaching
  - energy at various grade levels

Science and Pedagogy of Thermodynamics

Hugh Gallagher & Judah Schwartz

- Prepare research on an important milestone in the intellectual development of thermal and statistical physics, when a key idea became widely accepted by the scientific community. (Some examples might include the atomic hypothesis, energy conservation, entropy, the second law, or the understanding

  of work and heat as forms of energy transfer.)
- Design a new simulation that you think would be useful in the teaching your topic.