A new course on societal dimensions of nanotechnology that is taught interactively, both to first and second year students at UVA and to members of a community betting on emerging technologies to revive their economy. The course emphasizes the development of “interactional expertise” relevant to nanotechnology, which means that students learn enough about technical aspects of nano to understand potential social impacts.

The course culminates with **Nanosim**, a role-playing simulation of the National Nanotechnology Initiative, that allows students to vicariously experience adaptive management and anticipatory governance, making decisions about how society’s substantial investment in nanotechnology ought to be made, and managing these investments over time.

### Educational Goals and Learning Outcomes

The primary goal of the course is to develop students’ capabilities to shape the future of nanotechnology. They will be able to participate in multidisciplinary, multi-stakeholder trading zones exemplified by the PIs, who span psychology, sociology, ethics, materials science and electrical engineering. The development of interactional expertise is encouraged by presenting and synthesizing an array of core technological, social, business and environmental concepts that contextualize nanotechnology.

### Nanosim

This course culminates in a role-playing simulation of the National Nanotechnology Initiative (Gorman & Groves, 2007) that allows students to vicariously experience adaptive management and anticipatory governance, making decisions about how society’s substantial investment in nanotechnology ought to be made, and managing these investments over time. “Nanosim” has been piloted twice in a course for first-year engineering honors students at UVA. Most recently, groups corresponded to:

- The House Committee on Science (given the power to authorize and spend money)
- NSF
- DARPA
- A NASA research facility focused on zero and space applications of nanotechnology (e.g., the space elevator)
- A biotech-research facility at a University, focusing on nanotechnologies that benefit the environment and human health (Rice’s CBEN is a good analogy)
- A security research facility at another University (MIT’s Institute for Soldier Nanotechnologies is a good example)
- A research facility at a major IT company focusing on nanotechnology applications to a wide range of IT services (IBM is a good analogy)
- A start-up company making a decision about what area of nanotechnology to go into
- The Project on Emerging Nanotechnologies at the Woodrow Wilson Center
- ETC, an NGO that has proposed a moratorium on nanotechnology
- The science pages of a newspaper (Washington Post) which covers politics and technology.

### Expected Outcomes

The end-result will be a distance-education course taught to UVA undergraduates at the main campus, in Danville, and in other Virginia locations. The course syllabus and materials will be available on-line to others who wish to use them.

**Evaluation:**

This course will be assessed according to ABET EC 2000 outcomes criteria, which stipulate that students should:

1. Demonstrate an understanding of the impact of engineering solutions in a global and social context.
2. Recognize and analyze the role that technology and engineering play in contemporary issues and put contemporary issues in perspective.
3. Demonstrate an appreciation for differing perspectives and integrate their views with those of others.

A portfolio of the students’ work will be used to assess the extent to which each student has achieved these criteria, on a one to five scale, where one is no competences and 5 is outstanding competence (Olds, 1997). The portfolio will include the students’ case-study, her/his paper on Nanosim, and her/his final exam.

### Broader Impact

The course will provide training opportunities to enable the following broader impacts:

- Enabling scientifically informed trading zones by producing engineering students who can interact with multiple stakeholder groups, including, regulators (EPA, FDA, NIOSH), businesses and policy-makers.
- Educational Case Studies led by teams of undergraduate students available on the course website and aimed for eventual publication in journals and conferences.
- An interactive simulation of the NNI that can be adapted for use elsewhere.

This course will contribute to a nanotechnology concentration within UVA’s Engineering Science degree that is available across Virginia via a new desktop-to-desktop undergraduate distance learning program – Engineers PRODUCED in Virginia.

This course development is based upon work supported by the National Science Foundation under Grant #0836648.
Societal dimensions of nanotechnology course

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Regulatory

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Academic Lab

NASA Lab

Academic Lab

NSF

Industry Lab

Startup company

NGO

NanoPost

Arrows reflect the flow of money in the simulation