Background

- Societal Implications of Nanotechnology
- Proposal for Nano & Society teaching at UW
- Undergraduate Course (Spring ‘05)
  - Sci. and Tech. Studies 201, 2 sections, 3 credits
  - 2 Graduate students: Ricky Leung (Sociology) and CT (Physics)

“The National Nanotechnology Initiative sets aside $80 million out of $774 million for education and societal implications ($30m), and environmental studies ($50m) in 2003.”

- M. C. Roco, NSF
Preparation for Class This Spring

- Graduate Seminar last fall
- Introduction to materials - sociological texts/ nanotech readings
- “Clash of civilizations”
- Led by graduate students
- Chance to test active learning/discussion techniques

Examples:
- Think-Pair-Share
- Jigsaw
- Town-meeting format
- Group discussion
- Black-board exercises
- ...

(Organized by G. Zenner, W. Crone, C. Miller, K. Ellison)
My class

STS 201: Nanotechnology and Society, and Freshman (and Sophomores, and Juniors, and …).

Freshman (4)
Sophomores (11)
Juniors (4)
Seniors (4)

Mixed class.

Atmospheric & Oceanic Sciences
Biochemistry (4)
Botany
Business/Marketing (2)
Chemical Engineering
Communicative Disorders
Computer Science/Eng. (5)
Legal Studies
Mathematics
Nuclear Engineering (2)
Pharmacy
Zoology

Undecided
### Pre-assessment

**PRE ASSESSMENT**

**STS 201: Nanotechnology and Society**

*Section 84405*

Please rate your comfort level with the following topics.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Very Comfortable</th>
<th>Comfortable</th>
<th>Slightly Comfortable</th>
<th>Not Comfortable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The science of nanotechnology.</td>
<td>0%</td>
<td>17%</td>
<td>48%</td>
<td>35%</td>
</tr>
<tr>
<td>2. Any science or engineering field.</td>
<td>36%</td>
<td>36%</td>
<td>28%</td>
<td>0%</td>
</tr>
<tr>
<td>3. Science and society issues.</td>
<td>21%</td>
<td>42%</td>
<td>33%</td>
<td>1%</td>
</tr>
<tr>
<td>4. Nanotechnology and society.</td>
<td>0%</td>
<td>22%</td>
<td>43%</td>
<td>35%</td>
</tr>
</tbody>
</table>

Charles Tahan, March Meeting 2005
Where did you first hear the term nanotechnology?

1. News/Internet/TV   5. Sister’s boyfriend
2. This class          Bill Clinton
3. Science fiction    Feynman
4. Pop-sci            A video game

Define nanotechnology.

- Study/tech of small particles/minute/very, very small tech (6)
- Study/design/manufacturing of products/objects at nanoscale (5)
- “…to make our lives easier/better/improve society” (4)
- Technology involving microscopic particles
- “minute scale”
- Technology on nanometer scale
- Modification and altering of nanoparticles or atoms (1)
- Larger than a single atom and smaller than a living cell (1)
- $10^{-9}$ meters (1)
Give three examples of nanotechnology applications.

Really, Really Fast Computers/chips (7)
Carbon nanotube particles
Water resistant fabrics
Stain free pants (3)
Fiber Optics
Biotech (2)
Quantum Dots (2)
CPU lithography
Microchips
LCD screens
Stained glass (8)
Medicine/Medical things (4)
Surgery
Robotics
Synthetic diamonds
Nanobots (2)
Sensors and data acquisition
Agriculture (2)
Military
Sensors
Curriculum

TEXTS:
• **Hand-made course reader** (sociological, science and technology studies, history of science, science policy, nanotechnology reviews)
• **Understanding Nanotechnology** (SciAm Press)

Syllabus
1. Introduction to Nanotechnology and Society
2. Topics in Nanoscience
3. Nanotech in Culture
4. Revolutions and the History of Science and Technology
5. Technology and Society
6. *How Government Drives Technology*
7. Weighing the Risks
8. Policy Reports and Reviews
9. Thinking about the Future

Congressional Mock Hearings/Town Hall Meetings
1. Nanotech Funding: Should the government continue funding of nanotechnology research?
2. Public Participation: Should the public have an active role in the evolution of nanotechnology? How?

Research Project and Presentations
1. Summary report on a key nanotechnology, it’s applications, and it’s implications.
2. 25 students, 25 technologies.
3. Result: Pamphlet on Nanotechnologies for the lay person.
Quantum dot nanocrystals

- Bulk-”Nano” transition
- Optical properties: bandgap, photons
- Atom-like properties
- Bands become energy levels
- “Cool or Hot, Quantum or Not”

Silicon nanocrystal

Mighty Small Dots

... nanoscience and nanotechnology will change the nature of almost every human-made object in the next century.

—The Interagency Working Group on Nanotechnology, January 1999

Howard Lee and his colleagues have synthesized silicon and germanium quantum dots ranging in size from 1 to 8 nanometers. The larger dots emit in the red end of the spectrum; the smallest dots emit blue or ultraviolet.
6. How Government Drives Technology: Military and Tech

Reading:


• Performance, Command, Modern Methods


(Science) Video: Institute for Soldier Nanotechnologies

Working through it:

Debates, Town Hall Meeting, Discussion, Essay

Rumsfeld vs. Langdon Winner

*Charles Tahan, March Meeting 2005*
Research Projects

Nanocrystals as QDs/Medical Imaging on the Body
Nanobiotechnology
Nanoparticles and Drug Delivery
Cancer and Nanotechnology
Diagnostics/Lab on a chip

Many Faces of Carbon
Carbon Fullerenes (Buckyballs)
Carbon Nanotubes (mechanical properties)

Nanoparticles and nanocrystals: Synthesis and Toxicity
Nanofiltration/ Sorting/ Water Desalinization
Nanotech and Agriculture
Nanocrystals as Catalysts

Professional article for a lay audience: science/societal implications.

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Output

• Research Reports
  1. Summary report on a key nanotechnology, it’s applications, and it’s implications.
  2. 25 students, 25 technologies.
  3. Result: Pamphlet on Nanotechnologies for the lay person.

• Curriculum materials / Course portfolio

• Did it work? (assessment)
  • T - 1 month to go
  • Write something up.

Wisconsin Initiative on Nanotechnology and Society
http://www.lafollette.wisc.edu/research/Nano/

http://tahan.com/charlie/