Online Curriculum and Dialog Design for Ethics Skills for Science and Engineering Students

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Paper “extended version” at www.umass.edu/sts/ethics
Project Scope: Curriculum Devel.

Science/Technology & Society

Ethics

Graduate Science/Engineering majors

International / Global contexts

Lecture / In-class

On-Line

— Curriculum Development and Instructional Pedagogy Guidelines —
Traditional Ethics Instructional Goals

- Conformance
  - Rules: regulations, laws, policies, norms, work practices, duties
  - Bodies: national & regional regulatory; professional orgs., NGOs, unions; corporate
  - Monitoring & enforcement

- Policy & regulation development, advocacy

- Standard ethical issues:
  - conflicts of interest, gifts, intellectual property, confidentiality & privacy, whistle blowing, public service, publication, data fabrication, perjury…

- International & multi-cultural contexts
Ethical “Dilemmas”

- Grey Areas (vs. black & white; good guys & bad guys)
- Context and rule interpretation
- Conflicting interests/values/priorities
- Risk analysis (and cost-benefit analy.)
- Conflicting & uncertain info. sources
- Conflicting roles and allegiances
  - Professional, citizen, employee, supervisor, supervisee, friend, family member…
Generic Ethical Problem Solving Capacities

- **Moral imagination** (anticipate the potential consequences)
- **Cognitive empathy** (put oneself in another's shoes)
- **Recognizing ethical issues** (realizing *that* a situation has ethical implications)
- **Analytical skills** (critical thinking, synthesizing information…)
- **Sense of responsibility** (caring and moral obligation)
- **Tolerating disagreement, uncertainty, and ambiguity** (harder for technologists!)
- **Dialog**, deliberation, and mediation skills

(from Harris 2000, key objectives for ethics instruction in higher education)
Ethical Skills for Science/Technology & Society

- Evaluate potential **impacts** of a technology or implementation
- Interactions & **tradeoffs**: time, cost, quality, resource use, safety, affordability, sustainability, satisfaction & quality of life
- **Stakeholders**: coworkers, citizens, politicians & officials, technical experts, clients, regulatory representatives...
- Multiple **perspectives**, roles, interests...
- Nature and pace of **change**/innovation
Ethical Analysis

(from Harris 2000)

- **Clarifying factual issues**
  - What is known and needs to be known?
  - How do we evaluate the certainty and sources of each "fact"?

- **Conceptual Issues**
  - An analysis of how words and concepts are used by various parties.

- **Framing the ethical/moral issues**
  - What are the key moral/ethical issues or dilemmas in the case?
International Issues & Concepts

- Transnational conduct
- Workplace ethics in transnational contexts
- Responsible participation
- International accountability
- Variation in international regulatory processes
- Transnational diffusion of ideas and practices
- The emergence of international consensus and norms
Realistic (!) educational goals

- Hard to get ethics in the curriculum
- Courses-length vs class-length treatments
- Modular curriculum
  - Re-usable, adaptive, customizable
  - HTML files
  - Cases with many “driving questions”
- Familiarity
- Issue and opportunity recognition
- Practice reflection and dialog (not mastery)
Pedagogical Considerations

- Higher order skills for authentic contexts
- Open-ended, ill-defined problems
- Case-based method
- Student-driven, self-directed
- Dialog & discussion based
Case Components

- Case description
- List of interviewees
  - 8-15, with bios
- Q&A (2-6 per interv.)
- Hyperlinked Resources
- Online Forum
- Instructor Guidelines
Current Cases

- The "Dhopal" Chemical Disaster
  - Based on Union Carbide, Bhopla, India, 1984

- The SARS Virus Outbreak Reporting Controversy
  - (China & WHO, 1992)

- The Global Debate on Genetically Modified Organisms
  - GMO policy in EU vs US, ongoing

- Citizen Privacy and Government-Mandated Cyber-Censoring
  - Chinese Green Dam Youth Escort 2009
Dhopal Case Description

The Dhopal Disaster

Description: The names, locations, and events in this case are fictitious, but based loosely on a real occurrence. At midnight on November 14, 1990, an explosion rocked the Barrow Inc. manufacturing plant in Dhopal, Calpora. A pipe connecting two pressurized tankers holding sulfuric chloride used in the processing of Barrow’s industrial paint thinner Diflosticyne burst, releasing three tons of toxic gas into the atmosphere. The gas drifted into residential areas surrounding the factory, mainly comprised of ramshackle squabbles and huts, killing more than 2500 and injuring 200,000. The volume of the injured overwhelmed local medical staff, and many who sustained injuries from the gas leak were not attended to by a doctor for several days. The extent of the injuries ranged from minor skin and lung irritations to blindness and severe and permanent respiratory problems.

The Dhopal plant had been involved in the manufacturing of Diflosticyne for eight years, though declining sales had slowed the plant’s production for the last five fiscal quarters, and there were rumors that the plant would be sold or closed outright in the near future. On the night of November 14, the plant was operating at only 30% capacity and had only 6 workers and 1 supervisor on duty, instead of the 12 workers and 3 supervisors recommended in the company’s guidelines at this capacity. An inspection of the plant five months earlier had uncovered problems in the plant’s equipment and safety measures as well as the lack of a contingency plan in the event of a leak. These problems were reported as fixed in July 1990.
Dhopal Interviewee List

Interviewees:

**Jitendra Vanedra**: Head Engineer, Chemical Unit, Dhopal Plant

Bio: Jitendra Vanedra grew up in the Calporan capital of Kichari and received his Bachelor's degree in Chemistry from Kichari University. He earned his Master's degree in Chemical Engineering from Calpora University in 1984 and began working at the Dhopal plant later that year. He has served as Head Engineer of the Chemical Unit since 1989.

**Chinmay Arihant**: Team Leader, Chemical Unit, Dhopal Plant

Bio: Chinmay Arihant grew up in Dhopal and began working at the Dhopal plant in 1984, ten months after the plant began operations. He was promoted to Team Leader in November 1988.

**Nida Hemadi**: Shift Supervisor, Dhopal Plant

Bio: Naresh Hemadi grew up in a Dhopal suburb and has worked at the Barrow plant since 1985. He was promoted to Shift Supervisor in 1989, responsible for a team of 8 workers.

**Sara Richards**: Reporter, London Times

Bio: Sara Richards grew up in the Archway section of London and earned her BA in Journalism from the University of Westminster. She has worked at the London Times for 14...
Jitendra Vanedra: Head Engineer, Chemical Unit, Dhopal Plant

Bio: Jitendra Vanedra grew up in the Calporan capital of Kichari and received his Bachelor's degree in Chemistry from Kichari University. He earned his Master's degree in Chemical Engineering from Calpora University in 1984 and began working at the Dhopal plant later that year. He has served as Head Engineer of the Chemical Unit since 1989.

Questions:

Can you describe the chemical processes used in the formation of Diflosticyne?

Related resources:
U.S. Policy on Information about Chemical Plant Hazards

How did you feel about working at the Dhopal plant?

Related resources:
Dhopal Chronology

How long had you worked at the Dhopal plant when the accident occurred?

Related resources:
Dhopal Chronology

What do you know about the night of the accident?

Related resources:
Question: How long did you work at the Dhopal plant?

Response:

I worked at the Dhopal plant for 9 years, from 1982 until it closed in 1991. I was a team leader my last two years there, since by that time I was one of the more senior members of the chemical unit. I stayed on even after the accident and helped get the plant ready to close.
02. Evaluating perspectives.

Read several more stakeholder interviews. Pick three stakeholders you have read and Reply to this topic to answer the following questions. Make sure at least one of these stakeholders is in an engineering or technical job.

1) How do their perspectives differ? What values, interests, biases, world views, responsibilities probably motivate each one? What are the main interests and concerns? (Consider time, money, safety, quality, relationships, integrity, reputation and power, loyalties, well-being, sustainability, etc.)

2) For each of the three, comment on the multiple roles that each person has, and on how these roles create diverse and sometimes conflicting demands or needs within the person. Example roles

- An employee (has a duty to help with the profit and goals of his company)
- A supervisee, and co-worker (is motivated to keep her/his boss happy, and her/his coworkers happy)
- A citizen (is concerned about the success and security of his country, and the wellbeing of his countrymen)
Case Design Issues

- Real vs. fictitious cases
- Audio vs. video
- Stakeholder perspectives, motives
  - Citizen, victim, engineer, manager, govt. official, journalist, family member, inspector, political theorist…
- Diverse/conflicting opinions & facts
- Dialog refs other dialogs & resources
Alternatives for Activity Design

- **Group interaction modes:**
  - Jigsaw, roles, dialog,…

- **Driving question types**
  - Impacts of technology, ethical dilemmas, valuating perspectives, epistemological questions, international and cultural issues

- **Online Activity Types**
Driving Question Types (35)

- General questions (7):
  - What would you do if you were in [the situation of a particular character in the case?]
  - Who do you think is at fault? What could have been done to avoid the problem?

- Impacts of technology (5):
  - What are the core technical or scientific aspects or innovations for the case?
  - What were (or might be) the unforeseen impacts or consequences of the technologies of the case?

- Ethical Dilemmas (5):
  - For each stakeholder, how would they be affected by the possible decisions? What might they have to say about it (pros and cons)?
  - Put yourself in the shoes of the person making the decision. Evaluate the pros and cons of the possible decisions from each of these roles.
Driving Question Types (cont.)

- Evaluating Perspectives (5):
  - Evaluate the options available to key decision makers in the case in terms of the tradeoffs they faced? Did the responsibilities/obligations conflict for any single individuals?
  - Did any characters in the case show conflicting needs or concerns based on having multiple roles (e.g., as a government official who is also a parent; or as a friend who was also a supervisor)?

- Epistemological questions (6):
  - What facts of the case seem to be generally agreed upon? What facts seem controversial? What information seems unknown by all (or most) parties?
  - Are there some facts or issues that will likely never be agreed upon, known, or "solved"? (Why?)

- International and cultural issues (7):
  - What regulatory, professional, or government organizations or bodies have jurisdiction or relevance to this case? From them, what key rules, laws, guidelines, or procedures are applicable?
Online Activity Types

- Online tools that structure debate and deliberation
- Peer-generated questions and topics
- Online surveys and polls
- Peer review
- Structured forms ("fill in the blanks" along pre-defined dimensions)
- Concept maps (mind-maps)
- Motivational video
- Role playing (students could take the role of a particular character or stakeholder type)
- Design your manager (if they pass the buck)
- Brainstorming (possible positive and negative impacts/consequences)
- Parlor games (encourage creative thought and diving deeper into difficult questions; word-associations, guessing how another would answer a question, etc.)
Sample Q’s

• You work for Microsoft Inc. on a top secret project
• 1) Concerns about how your module could be abused, could it be a cyber-censor?...boss says “don’t worry about it”
• 2) Activist colleague confides that he introduced a back door in the code…
(pros and cons of action options)
Online Forum Design Principles

- Online “rules of the road” (netiquette)
- Structured dialog (given questions)
- Identity and community formation
  - Who are you, why are you here, biases?
- Student-created questions/topics
- Meta-dialog
  - How is the dialog & activity going? Suggestions?
  - Self-reflection: changes, learning, biases, reactions, appreciations, surprises
- Tangents: Announcements, Fun, Peer help
Pilot Testing

- Dhopal pilot (n=5): Survey questions:
  - Materials: usefulness, interest: √
  - Online dialog: not enough time, liked question structure
  - Think about engineering/science ethics more deeply or in new ways: split decision
  - Did your opinions change: split results

- Cyber-Censor case
Database-driven HTML Authoring
Next: Rashi – import into inquiry & argumentation system