Online Ethics Center
FOR ENGINEERING AND SCIENCE

Ethics When Biocomplexity Meets Human Complexity (Role-Play Workshop) and Nanosilver Linings Case

Author(s)

Kathleen Eggleson
Joshua Dempsey

Description

This activity is considered an NAE Exemplar in Engineering Ethics Education and was included in a 2016 report with other exemplary activities.

Body

Exemplary features:

Interactive and creative education approach; consideration of macroethics issues

Why it's exemplary:

The Nanosilver Linings case and the workshop, "Ethics When Biocomplexity Meets Human Complexity," that supports it are exemplary because they are based on best practices in the field (e.g., clear definition of learning objectives, active learning,

interactive learning, case-based learning, role play), provide instructors with refined and assessed (by both student participants and an external faculty expert) materials sufficient for a 3-hour ethics education workshop, and offer students the experience of STEM-relevant role play with richly detailed stakeholder characters in a realistic hypothetical case. The robust supporting materials provide an organized reading list, instructor checklist, time table, slides, and guidelines for role play. This activity is sponsored by the National Science Foundation (Award #1338682), for the Ethics Education in Science and Engineering (EESE) Program. It is a product of the Collaborative Research project Ethics Education in Life Cycle Design, Engineering, and Management.

Program description:

Participants are graduate students in any field of science or engineering. The case and workshop have been piloted and refined through initial offerings to cohorts of STEM graduate students at two universities. In addition, the Nanosilver Linings case has been offered at an academic research institute for both faculty and students, spanning STEM disciplines and STEM-related fields (e.g., science policy), and went smoothly and was well received by participants. Learning objectives underpinned the design of the case and workshop, and their achievement was assessed formally through the instrument administered upon completion of the workshop. Through this workshop, STEM graduate students learn to:

- List ethical dilemmas involved in public communications about science and technology
- Appreciate the human factors, conflicts of interest, struggles, and tradeoffs in a participatory governance scenario pertaining to science and technology
- Identify stakeholders in complex decisions pertaining to science and technology
- Understand how the perspectives of different stakeholders are informed and communicated
- Understand the inherent limits of quantitative, technical methods of assessment in incorporating values
- Operate professionally as a scientist or engineer even in “grey areas” of practice where there is no possibility of a single correct answer

These learning objectives prepare natural and applied scientists for ethical research, practice, and leadership. For example, on the assessment instrument, in response to the question “What event during the workshop changed your thinking? In what way did your thinking change?” one student answered “Discussion of our responsibility as scientists to be ambassadors to the general public. I have a responsibility. I need to do my due diligence as an academic.”

Methods and content: The Nanosilver Linings role play case, delivered through the workshop, provides science and engineering graduate students with an active learning experience on the “wicked problems” of emerging technology macroethics. Participants play one of seven societal stakeholders in a hypothetical scenario involving the possible location of a nanosilver food packaging company in an economically struggling city. Both social and scientific implications are considered around the product life cycle, during the role play and in structured discussion when participants are out of character. The event calls on participants to practice intellectual integration of technical, moral, legal, and societal aspects of a complex science/technology situation as well as spontaneous interpersonal communication—skills that will be useful in myriad aspects of their careers.

To further elucidate methodology, an excerpt of the Instructor Notes for Workshop Leader is included here:

This is a role play workshop designed for ethics education of STEM graduate students. It primarily emphasizes societal-level macroethics related to decision making related to commercial application of emerging nanotechnoloies, as opposed to microethics or responsible conduct of research (RCR). However, students will confront dilemmas at the level of individual contact through perspective-taking in acting as one of seven characters in a hypothetical, but realistic, case. To offer the Nanosilver Linings case in the context of one, three-hour workshop, the basic steps are:

- Register 7 students per group. (The workshop can run with either 6 or 7 students, allowing room for one cancellation or no-show without disrupting the role play case.) Doodle internet polling can be used for this purpose, choosing the (free) option to limit the number of participants.
- Prepare materials (copies of the Nanosilver Linings case, character folders including readings and private information, nametags, certificates, assessment

forms).
- One week in advance, send out the set of readings intended for all participants.
- Adapt workshop slides with photos of your registered participants.
- Water/coffee and baked goods may be served during the event.

Requirements

- Groups of 6 or 7 participants are required for this exercise. It is recommended that, for a free-standing workshop, 7 participants be scheduled in advance; that way if there is a cancellation or no-show on the day of the event, the workshop can take place without need for recruiting a substitute on short notice.

Options and Flexibility Personnel

- The character Carlson, concerned parent, may be included or excluded, allowing a ±1 extent of flexibility in number of participants per group.
- Participants may be engaged in the study of any STEM or STEM-related field (e.g., philosophy of science, science policy).
- Participants may be from the same or different fields.
- Participants may be at different levels of study; this experience was designed with STEM graduate students at any level or year of study in mind, but may also be appropriate for advanced undergraduates.
- Participants may know one another well, or not at all, prior to the workshop.
- Characters' assignments may be determined by random draw, by the workshop leader, or by the participants.

Time

- Running time may be adjusted through time allotted for reading, accordingly adjusting the amount and difficulty of readings selected or assigning readings in advance.
- Electronic highlighting can be applied to readings before printout to draw out the most pertinent passages, thus reducing reading time and volume while maintaining the original document context.
- Time allotted for discussion is flexible, and can be used to adjust total running time.
- The length and nature of the break is flexible.

Content

- Selection of readings by the workshop leader allows flexibility with regard to (a) level of difficulty and (b) subject matter emphasis.

Materials Checklist

- Informed consent form, if applicable
- Identical initial packets for each participant, with case plus selected readings
- Slides with character identities and student photos (prepared while participants are in common learning phase); template provided in Power Point file
- Character nametags
- Character-specific packets, with character information and selected readings
- Discussion questions/slides (Power Point file)
- Assessment forms

Assessment information:

(1) Quantitative and (2) written responses on assessment instrument, (3) external evaluator Michael Loui (formative and summative involvement), and (4) focus group. (1) On a 5-point Likert scale, where 5 is strongly agree and 4 is agree, graduate student participants across four cohorts (n=26) agreed with the following statements: I would recommend this experience to other STEM graduate students (4.69), This experience makes me more aware of my own values as they pertain to science and engineering applications (4.62), This experience was a good use of my time (4.58), and This experience makes me more aware of the values of other people as they pertain to science and engineering applications (4.5). Where 5 is highly satisfied and 4 is satisfied, students were satisfied with the realism of the hypothetical case (4.69) and the appropriateness of readings for character (4.42). (2) In answer to the question: What was the most surprising thing you learned from the workshop?, one student said “Most of the characters had a bias/motivation to be biased to benefit themselves in the situation. I think this highlights the need for ethical, unbiased work to represent truth/underrepresented populations.” Some of the insights shared in response to this question were fundamental: “Grey things can be ‘made’ completely black or completely white depending on how you want to use the information”; “Making decisions in the ‘real world’ is not as black and white as I

had initially thought. Much more goes into everyone's decisions." For the question, What event during the workshop changed your thinking? In what way did your thinking change?, one student replied "When we were speaking about the responsibilities of the small community to make decisions that impacted the future of the community/larger scope society with limited representation. It is hard to understand/think about this, since in a way, it makes us all responsible for each other, even though we don't act like it." Other responses to this question included: "Thinking about stakeholders not represented in the workshop then discussing who they were/possible pros and cons that could impact them. Usually this isn't discussed, and thinking about it is important!" and "Discussion of our responsibility as scientists to be ambassadors to the general public. I have a responsibility. I need to do my due diligence as an academic." (3) Excerpts from the external evaluator's report: "The positive comments from the focus group indicate that the current version of the workshop is engaging and appropriately challenging." "Overall, I believe you have designed an intellectually challenging, emotionally engaging, and likely enjoyable experience that teaches students to consider the variety of stakeholder viewpoints in making ethically difficult decisions about technology and society." (4) Feedback from focus group participants, as reported by the external evaluator: "Students strongly agreed that this workshop format was far superior to the one-day all-campus RCR training because the content was more useful, practical, and directly relevant to science and engineering, and because the workshop required active participation: it required more thinking about the challenging ethical issues."

Additional resources:

1. Ethics when Biocomplexity meets Human Complexity Role Play Workshop and Nanosilver Linings Case: https://nationalethicscenter.org/resources/7811
2. J. Dempsey, J. Stamets, and K. Eggleson. Stakeholder Views of Nanosilver Linings: Macroethics Education and Automated Text Analysis through Participatory Governance Role Play in a Workshop Format, *Science and Engineering Ethics* 2016. (accepted and in press).

Rights

Resource Type

Educational Activity Description

Parent Collection

NAE Exemplars in Engineering Ethics Education
Dark Clouds, NanoSilver Linings: Ethics When Biocomplexity Meets Human Complexity (A Role-Play Workshop)

Topics

Emerging Technologies
Lab and Workplace Safety
Responsible Innovation
Safety

Discipline(s)

Computer, Math, and Physical Sciences
Engineering
Life and Environmental Sciences
Nanoscience and Nanotechnology
Teaching Ethics in STEM