Integrating Ethics and Societal Impacts into Engineering Courses: Opportunity to Develop Actionable Ideas

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Abstract: This active engagement session in the collegiate track will focus on the integration of ethics and societal impacts (termed ESI) in engineering education. Ethical reasoning and an understanding of the social and environmental implications of engineering and technology are important skills for future professionals. The acceleration of technology development and interconnectivity of globalization necessitate engineers having these technical and professional competencies. Despite this motivation, engineering faculty face challenges in infusing ESI into their courses such as a lack of training and expertise and limited time in a dense curriculum. This session will help educators address these challenges and realize the potential of teaching ESI in their own courses. The facilitators will introduce participants to results from an ongoing National Science Foundation (NSF) project on ESI education that is synthesizing perspectives from faculty, students, and alumni and conducting in-depth explorations of integration practices in engineering courses across the Unites States. ESI is inclusive of a broad range of topics that are relevant to all engineering disciplines and subjects and can be taught and assessed with a variety of methods. The active engagement session will provide the opportunity for participants to think of topics, learning objectives, teaching approaches, and assessment techniques that they can include in their courses. In the introductory part of the session, participants will be asked about the courses they teach in which they are considering integrating ESI. The facilitators will then leverage those interests and address those needs. The interactive session aims to provide actionable ways for participants to integrate ESI while collaborating with each other and the facilitators to generate ideas and strategies.

FOCUS

The focus of this session is the integration of ethics and societal impacts (termed ESI) in engineering education. ESI is inclusive of microethics, the day-to-day decisions of individual engineers, and macroethics, the responsibilities of the engineering profession to society [1]. An understanding of ethical responsibility and an awareness of the broader context are important outcomes for engineering graduates [2]. Undergraduate education is the primary, if not only, formalized training that future engineers receive to develop these skills. Engineering educators play a key role in developing their students' professional and societal responsibility. This session is designed to help educators realize the potential of integrating ESI into their own instructional settings. ESI covers a broader range of topics that are relevant to all engineering disciplines and subjects and can be taught in various courses and co-curricular activities. The focus of this session is creating actionable ways to teach ESI so that students can have greater exposure to these topics across the curriculum.

LEARNING OBJECTIVES

By the end of the session, participants should be able to:

1. Understand the distinction between microethics and macroethics and be able to provide examples of both
2. Understand and identify the different settings into which ESI can be integrated (including courses and co-curricular activities)
3. Develop specific ideas for how to write learning objectives related to their instructional setting
4. Develop specific ideas for effective methods to teach ESI that are mapped to their learning objectives
5. Develop ideas for how to assess student learning related to their ESI education objectives

INSTRUCTIONAL STRATIGIES

We will employ a variety of instructional strategies during the session. The session will begin with a brief presentation to provide background information on microethics and macroethics. The presentation will also include an overview of the three-year, multi-institution, National Science Foundation funded project that the facilitators are conducting. The project is exploring ESI education including a broad-level view of how it is taught in the United States, challenges confronting ESI educators, and examples of effective approaches.

We will use think-pair-share so the participants can brainstorm learning objectives, pedagogies, and assessment strategies that they can use to teach ESI. The participants will discuss ideas with each other and report out to the group. Large group discussion will be used to exchange and develop ideas while encouraging conversation between the participants and with the facilitators.

OUTLINE

The total duration of our active engagement session is 90 minutes and is guided by the following outline:

- Facilitator introductions: 5 min
- Participant introductions: 5 min
    - Name, university
    - Your interest, context
    - Problems/needs related ethics education or what you hope to learn in the session
- Overview: 5 min
- Learning objectives (20 min total)
    - Mini-presentation: 5 min
    - Brainstorm individually: 5 min
    - Share with partner or small group: 5 min
    - Report out and discuss as large group: 5 min
- Pedagogy (20 min total)
    - Mini-presentation: 5 min
    - Brainstorm individually: 5 min
    - Share with partner or small group: 5 min
    - Report out and discuss as large group: 5 min
- Assessment (20 min total)
    - Mini-presentation: 5 min
    - Brainstorm individually: 5 min
    - Share with partner or small group: 5 min
    - Report out and discuss as large group: 5 min
- Wrap-up: 5 min
    - Questions
    - Resources

The focus of the session will be the sections on learning objectives, pedagogy, and assessment. Each of these sections with follow the same format beginning with a brief overview of the topic including relevant examples and results from the NSF study. The facilitators will then give the participants time to think through and discuss how the topic applies to their instructional setting and how it can be implemented in their ESI teaching. Based on the participant introductions at the beginning of the session, the facilitators will tailor the content to the needs and interests of the participants. If we are not able to have 90 minutes, the time for these blocks can be trimmed.

RMS ASEE TARGET AUDIENCE

All engineering educators will have the opportunity to benefit from the session. RMS ASEE attendees who already teach ethics, professional issues, or societal impacts of technology will learn more about approaches to integrating these topics. They will also be able to collaborate with the research team and other participants to generate actionable ideas to modify or update their instruction. Educators at RMS ASEE who teach core technical courses are also welcome. The session will demonstrate the opportunities to integrate ESI into engineering science and design. All educators regardless of if they personally teach, or have taught, ESI can learn about how to increase students' exposure to this important topic.

PRESENTER CREDENTIALS

Angela Bielefeldt

- Professor in Civil, Environmental, and Architectural Engineering
- Principal investigator on NSF-funded "Collaborative Research: Efficacy of Macroethics Education in Engineering"
- ABET assessment coordinator
- Member of the American Society of Civil Engineers (ASCE) Body of Knowledge 3 Task Committee
- Member of American Association for the Advancement of Science (AAAS) Committee on Scientific Freedom and Responsibility
- Extensive experience in engineering education research and Scholarship of Teaching and Learning
- Teaches ESI in Introduction to Civil Engineering, Professional Issues in Civil Engineering, and Environmental Engineering Capstone Design

Madeline Polmear

- PhD candidate in Civil, Environmental, and Architectural Engineering
- Graduate research assistant on NSF-funded "Collaborative Research: Efficacy of Macroethics Education in Engineering"
- Dissertation topic (defending in May 2019): the internal and environmental influences on engineering faculty members' practices and perspectives related to ESI education

REQUIREMENTS

We will bring handouts of example rubrics for assessment of ESI student outcomes.
The participants do not need to bring anything.
The ideal participant count is 10-20 and there is no maximum.

REFERENCES

[1] J. Herkert, "Future directions in engineering ethics research: Microethics, macroethics and the role of professional societies", *Science and Engineering Ethics*, vol. 7, no. 3, pp. 403-414, 2001.

[2] ABET, "Revisions to the criteria for accrediting engineering programs", Engineering Accreditation Commission, Baltimore, MD, 2017.