Poster Submission

Growing a Backbone: Building an 'Ethics Spine' into a 4-year Biomedical Engineering Curriculum

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Abstract

The undergraduate biomedical engineering program at Arizona State University offers a 4-year B.S.E. degree. Approximately 850 students are currently enrolled in this program, which is taught by about 30 faculty. Here we report on first steps in the development of an 'ethics spine' that runs through the undergraduate curriculum. The core objective of this initiative is to ensure more systematic integration of ethics into the curriculum, and to develop student capacity and confidence to grapple with a range of ethics-related issues.

Since 2012, our BME students have been required to take a 1-credit course on Biomedical and Bioengineering Ethics. This course focuses primarily on research ethics (including human subjects and animal research), core principles of biomedical ethics, and codes of engineering ethics. An informal survey of BME teaching faculty reveals that our students additionally receive some exposure to professional integrity and workplace ethics, as well as safety and quality control of biomedical devices. There is relatively little attention in the curriculum devoted to macro-ethical issues, sociotechnical systems thinking, or discussions of the broader societal and environmental impacts of engineering.

In the self-evaluation performed by all 143 students in the 2015 graduating class, 35 (24%) evaluated themselves as 'not meeting' ABET Criterion 3(j) (contemporary issues), and 15 (10%) felt they did not meet Criterion 3(f) (professional and ethical responsibility). Together with Criterion 3(i) (lifelong learning), these were the three domains in which our students felt least confident in their abilities. We propose that some integration of macro-ethics into the curriculum – with at least some focus on contemporary debates in biomedical engineering – may be one approach to improving reported self-efficacy for all three criteria.

Recognizing that the addition of further, compulsory credit hours to the BME curriculum is unrealistic, we are experimenting with constructive ways to integrate ethics teaching into our existing program – for example, as discrete modules within courses, or written into technical problem sets. Drawing on published literature, online ethics resources, and training offered by the NAE, we have begun to identify and curate a variety of approaches and tools for embedding BME-relevant ethical content into the curriculum. We are also mapping courses that could lend themselves to different ethical topics and questions, so as to develop pathways through the

undergraduate program that will expose students to principles and practices of deliberation across several ethical domains.

Starting in Fall 2017, we will target the existing BME ‘design spine’ for integration of ethics exercises, and will work with individual faculty interested in formalizing some ethics content within their courses. The variety in BME courses currently taught by our research team (including design spine courses, lower-division and advanced technical courses, and the core bioethics course) will enable us to experiment with different models of ethics integration, and positions us to have an immediate impact on students in the BME program.