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Coupled Ethical-Epistemic Analysis in Teaching Ethics: Critical reflection on value choices

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Description

Ethics is an important component of STEM education as illustrated by the fact that ABET accreditation requires proof of training in ethics for engineering fields. But what range of knowledge and skills are required for integrity? Covering codes of ethics does not teach ethical sensibility or the ethical reasoning skills required for research and professional integrity.¹⁰ So what should be included in ethics education for engineers?

Body

Engineers like to “get it right,” and engineering education should focus on knowledge and skills to ensure that engineering work meets the highest standards of empirical and theoretical adequacy. This is what Mason⁵ refers to as a “covenant with reality.” But this does not ensure the best interests of the broader community and the environment are served. “Getting it right” requires understanding what is epistemically *and* ethically salient to the issues being addressed, communicating

information and sharing technologies in ways users can understand, and supporting responsible application.

Integrity in engineering research and practice depends on values. This is especially important in the responsible conduct of research. “Computer experts,” Deborah Johnson reminds us, “aren’t just building and manipulating hardware, software, and code, they are building *systems that help to achieve important social functions, systems that constitute social arrangements, relationships, institutions, and values.*” Johnson claims computer experts can “facilitate and constrain behavior, and materialize social values.”⁴ Social media pages, for instance, can be designed to track Internet browsing histories—even after the user logs off—to tailor advertisements or software or enable companies to engage in workplace surveillance. Is this OK and why? An important but often overlooked component of ethics education is the ability to identify values and appreciate the ethical dimensions of the broader impacts from actions computing professionals might take. Coupled ethical-epistemic analysis is an important lens for critical reflection on value choices. This column explains why and how.

Values serve as a guide to action and knowledge. They are relevant to all aspects of scientific and engineering practice, including discovery, analysis, and application. Cognitive scientists have found values to be inextricable components of STEM research. Paul Thagard explains, “the decisions that scientists and others need to make about what projects to pursue, what theories to accept, and what applications to enact will unavoidably have an emotional, value-laden aspect,” and concludes, “the best course is not to eliminate values and emotions, but to try *to ensure that the best values are used in the most effective ways.*”⁹ Decisions about whether there is robust evidence for a claim (an epistemic value) can for example be influenced by possible effects on human well-being (an ethical value).

To use the best values effectively, I advocate ethics education in STEM fields be based on analysis of values in four dimensions of research and practice. Various types of values can be involved in each domain including ethical values (the good of society, equity, sustainability), aesthetic values (simplicity, elegance, complexity), or epistemic values (predictive power, reliability, coherence, scope).

- What is a good basis for the selection of research topics?
- What counts as evidence and what constitutes robust evidentiary support?

- What is the likelihood that a model, hypothesis, or theoretical explanation will provide convincing explanation?
- Are epistemic and ethical values relevant to applying results to other research problems or to social problems (for example, via decision-support)?

Coupled ethical-epistemic analysis will help answer these questions (see the



accompanying figure).

Values transparency and analysis is central to the National Science Foundation's Sustainability Research Network on Sustainable Climate Risk Management (SCRiM, <http://scrimhub.org>). Coupled ethical-epistemic analysis has helped identify new and refined research topics, and informed modeling for multi-objective, robust decision making.⁸ An example is the debate over ice sheet data in modeling sea level rise. Whether ice sheet melt data is sufficiently robust for sea level rise projection models was debated by Intergovernmental Panel on Climate Change (IPCC) scientists. They had to balance evidential robustness and predictive power (epistemic values), a decision that remains controversial despite improvements in scientific understanding and modeling of ice sheet dynamics (for example, Chang et al.²).

Balancing these epistemic values has ethical implications: a decision to not include ice sheet data might result in underreporting future sea level rise.⁷ Does the value assigned to evidential robustness outweigh the impact on predictive power? Also at stake is whether ice sheet data helps the wider community understand the impact of climate change mitigation and adaptation decisions. Epistemic and ethical values are coupled.

Mason⁵ urges that modelers adopt a covenant with reality and a covenant with values to make models faithful not only with relevant facts, but also with the values of intended model users. Fleischmann and Wallace³ augment Mason's work with a third covenant, values transparency in modeling, which "not only allows the client to assess whether the model conforms to the first two covenants, it allows the client to assess when the model is misbehaving or malfunctioning." They suggest that transparency can allow clients to avoid, "circumstances where the model errors might lead to negative consequences for those affected by the model."³

I applaud and support these positions, and add a further step. Users (and modelers) are not always aware of relevant values. Ethics education designed to promote values identification and analysis is a key element of this ability, but values analysis requires techniques to identify values. An example is values-informed mental models (ViMM).¹ ViMM is an empirically grounded method for gathering information about individuals' beliefs and inferences about an issue, and elicits values in addition to beliefs and inferences. It is designed to provide the transparency regarding users' and modelers' values in a decision situation.

Epistemic and ethical value decisions have important social implications. This fact is reflected in the National Science Foundation broader impacts criterion and its view of the role and purpose of ethics education: "Ethics education is particularly critical to the science and engineering community as it faces an increasingly competitive funding environment; rising collaboration with international colleagues who may follow different guidelines; and growing recognition of the relevance of science and engineering to social, economic, and ethical issues of wide public and political interest."⁶

A twofold approach should be used in training for coupled ethical-epistemic analysis. This requires some changes in ethics education for engineers, philosophers, and social scientists. Engineers must become more aware of the ethical and epistemic values embedded in all components of their work as well as their salience and role in

research and practice through training for values transparency and coupled ethical-epistemic analysis skills. This better prepares engineers to understand and take responsibility for the epistemic and/or ethical import of the values embedded in their work, so values of the users and those impacted by use become essential elements in that work.

Parallel training of philosophers and social scientists is needed so they can assist with coupled ethical-epistemic analysis. Techniques such as ViMM assist in identifying the range of relevant values, and serve as a basis for careful analysis of the implications of value choices. This approach works best when trained philosophers and social scientists are embedded in research teams, collaborating with engineers and scientists. The SCRiM network illustrates the benefits of this transdisciplinary approach to coupled ethical-epistemic analysis.

Engineering ethics training involving coupled ethical-epistemic analysis helps with “getting it right” in all senses.

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Notes

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