Design and Implementation of an Engineering for Social Justice Curriculum

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Camille Birch is a graduate of the Bioengineering and Computer Science departments at the University of Washington. She developed curriculum concerning the interplay of diversity and ethics for undergraduate engineering students at UW and is interested in the power of education to enact change in future generations of engineers. She currently works for Microsoft in the Bay Area.
Design and Implementation of an Engineering for Social Justice Curriculum

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Course Description

- Explores social justice in a science and engineering context
- Focused on race, gender, sexuality, and disability
- We emphasize what students can do to advocate for and represent diverse peoples
- How to promote social justice through science and engineering practice.
Why Use a Social Justice Theme?

> Engineering can – and should - be a vehicle for social justice

> Most engineering students lack exposure to social justice in their coursework

> Attract students to engineering through social justice theme:
  - Interdisciplinary field, may attract students from all majors
  - Appealing to underrepresented students, who are more likely to make educational and career choices based on opportunities for service to their communities


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Course Topics: Main Themes

Please see handout for complete list

> How cultural and scientific theories of gender/sex, race, disability, and sexuality influence one another

> Who gets to be a scientist or engineer

> Who defines which questions researchers ask and which problems engineers solve
    ...and who benefits from these solutions

> The role social justice plays in science and engineering practice
How do our cultural ideas about race, gender, disability and sexuality influence science/engineering knowledge and practice?

On the other hand, how does our science/engineering practice influence our cultural ideas about race, gender, disability and sexuality?

How can we use science and engineering to promote social justice for all people?
Learning Objectives

Please see handout for complete list

1. Identify how cultural concepts of race, gender, sexuality, and disability have shaped scientific thought and engineering practice (and vice versa) through history.

2. Apply ethical analysis and creative problem solving techniques to design solutions for diverse user groups.

3. Propose approaches to promote social justice in science and engineering practice.

4. Critically evaluate claims about the science of human difference and reflect on how these scientific theories have been used to promote or fight inequality.

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Learning Objectives

Please see handout for complete list

5. Evaluate the positive and negative **impacts** of science, engineering and technology on **marginalized groups**.

6. Identify how scientists and engineers handle **implicit bias** during research and design processes.

7. Recognize social justice issues in your community and field of study, and feel **empowered to affect change**.
Bias in scientific narrative

Recognizing bias of authors and researchers

The Egg and the Sperm: How Science Has Constructed a Romance Based on Stereotypical Male-Female Roles

https://www.journals.uchicago.edu/doi/abs/10.1086/494680?journalCode=signs

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Theories that have been used to justify bias

Debunking negative stereotypes about marginalized people

Samuel Morton
_Crania Americana_ (1878)

*What Happens When Geneticists Talk Sloppily About Race*

The field widely agrees that race is a social construct, but gets into trouble when it ignores semantics.

_IAN HOLMES_  APR 25, 2018

https://www.independent.co.uk/news/science/fury-at-dna-pioneers-theory-africans-are-less-intelligent-than-westerners-394898.html

Fury at DNA pioneer's theory: Africans are less intelligent than Westerners

Celebrated scientist attacked for race comments: "All our social policies are based on the fact that their intelligence is the same as ours - whereas all the testing says not really"

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Theories that have been used to justify bias

Debunking negative stereotypes about marginalized people

Is There Something Unique about the Transgender Brain?

Imaging studies and other research suggest that there is a biological basis for transgender identity

https://www.scientificamerican.com/article/is-there-something-unique-about-the-transgender-brain/

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How does who engineers are affect what engineering is?

- Different experiences, values → different design considerations
- Assumptions about who our end-user is and what they want

4th place!

5th place!

Top priorities:
- Sexual function
- Bladder/bowel function
- Trunk stability


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Going beyond historical examples...

Henrietta Lacks (HeLa cells)

Tuskegee Syphilis Study (Alabama)

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... to learn how bias exists today

Gender/Sex

Disability

Race

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Stella Young’s TEDTalk: “I’m not your inspiration.”

https://www.ted.com/talks/stella_young_i_m_not_your_inspiration_thank_you_very_much

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Manu Platt: “The Danger of Acting Now”

https://www.youtube.com/watch?v=P1wUnuJSb9Q
Miscarrying at Work: The Physical Toll of Pregnancy Discrimination


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Where a Taboo Is Leading to the Deaths of Young Girls

Why the Medical Research Grant System Could Be Costing Us Great Ideas


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Fixed: The Science/Fiction of Human Enhancement

http://www.fixedthemovie.com/

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Assignments

See handout for full details

> Weekly written reflections
> Participation
> Individual analysis paper on topic of choice
> Team project addressing any social justice issue and proposing a solution
Individual Topic Examples

- Gender gap in portrayal of women in gaming
- Cross-cultural medical ethics in female genital cutting
- Using toys to promote diversity in the STEM pipeline
- Racial bias in facial recognition systems and impact on law enforcement
- Ethics and societal impact of prenatal genetic testing
- Racial inequality in public transportation
- Use of technology by homeless youth
- Inequity in stem cell therapy research
- Promoting use of electric vehicles in low-income populations

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Team Project Examples

- Improving voter turnout and making voting more accessible for underrepresented people
- Improving accessibility of menstrual products for homeless women
- Improving access to healthy food for people in low-resource areas
- Effects of prolonged screen time on children from high- and low-income families
- Inspiring youth in foster care to pursue STEM

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Creating and Inclusive Environment

> Learn names!

> Establish class norms for confidentiality and respect

> To prevent triggers:
  - Instructor will provide a list of topics before class.
  - Students have the option to leave the room or complete an alternate assignment, no questions asked.

> Students do not have to talk.
  - No calling on students; only volunteers who raise their hands.
  - Discuss prompts in small groups before sharing with class.
Syllabus:
Statement of Diversity and Inclusion

“Our teaching team strives to provide an **inclusive learning environment** in which all students feel **safe and respected**. We appreciate **diversity** and respect each student’s **individuality**. We welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, identities, national origins, religious affiliations, sexual orientations, ability, and other **visible and nonvisible differences**.

Students should know:
• Every student will be treated with respect and fairness by teaching team.
• In return, students are expected to treat their classmates and the teaching team with respect at all times.
• Any student who has suggestions or concerns about inclusivity should talk to Dr. Hendricks. Your feedback and suggestions are welcome!”

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Course Assessment: Student Feedback

End of quarter reflection

“After this class, I feel like I am looking at the world in terms of how accessible it is for different people with different abilities.”

“I’m less apologetic about my interest in issues that directly affect me (feminism and racism/stereotypes…). I shouldn’t moderate my interests.”

“I think I can be more considerate of social justice issues in future projects [and have an] idea of how to design for disadvantaged communities.”

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Course Assessment: Student Feedback

End of course evaluations

“This was a topic that I hadn't explored much before and... I now feel more confident tackling topics of social justice.”

“This was a very stimulating course in that it raised questions I've never had the opportunity to discuss in an academic setting before.”

“I enjoyed taking a break from the technical aspects of my other engineering courses to take a higher level look at engineering and how it impacts society.”

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“Not as much diversity in the class as I had hoped--lots of white women, very few males of color (few males in general), didn't always feel comfortable voicing my experiences/frustration at others' lack of understanding of systematic issues.”
Future Work

> Re-structure in-class debate (student feedback)

> Include discussion of power and privilege (reviewer comment)

> Other instructor observations
Thank you!

What are your questions?

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