



ESRE

ENVIRONMENTALLY AND SOCIALLY
RESPONSIBLE ENGINEERING

- EOP pilot grant
- Entrepreneurial Design Realization EDR follow-up grant
 - PBL: responsible engineering in multidisciplinary “do-ing”
- EOP institutionalization grant
 - Faculty workshop for developing sustainability aspects for courses

ESRE: Initially Mechanical and Civil/Environmental Engineering

Themes of the UMD approach

- De-siloing engineering (and technical solutions) and integrating with EVERYTHING else (ex. business, policy, ...)
 - Sociotechnical solutions, systems thinking, ... but **actual collaboration and do-ing** (not just awareness)
- Mapping the student learning outcomes throughout the entire educational experience
 - Can we do better than isolated assignments?
 - Are we actually graduating engineers that will **seek out** and solve the complex social and environmental issues facing the world today?
 - Not just ability, but **agency**, **empowerment**, and **practice**



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 - Social-technical solutions, systems thinking, ... but actual collaboration and co-creating (not just awareness)
- Mapping the student learning outcomes through entire educational experience
 - Are we actually graduating engineers that will seek out and solve the complex social and environmental issues facing the world today?
 - Not just ability, but agency, empowerment, and practice
 - What is the value in isolated assignments?

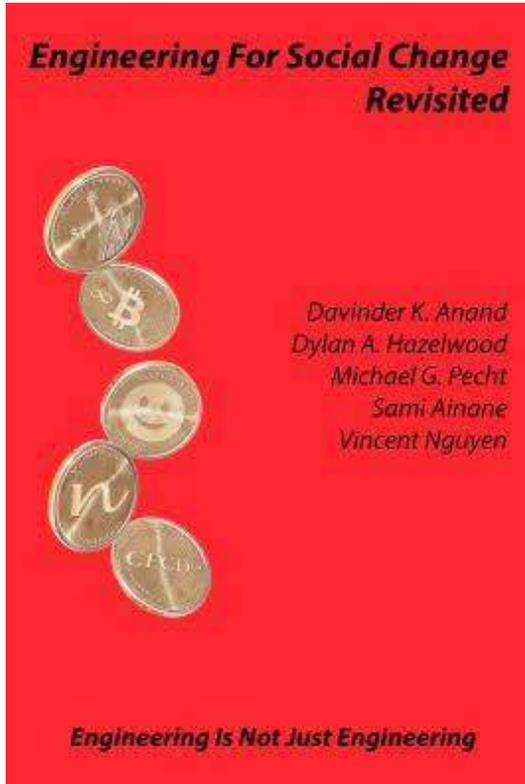
Campus Connections + ad hoc Relationships





NEILOM FOUNDATION

ENGINEERING FOR SOCIAL CHANGE



De-siloing engineering (and technical solutions) and integrating with **EVERYTHING** else



UNIVERSITY OF
MARYLAND

A. JAMES CLARK
SCHOOL OF ENGINEERING

Do you want to work on a project that makes a real positive impact?

Do you want to work on a product that goes out into the real world?

Design for production, real manufacturing and/or an actual physical implementation, project management, ...



ENVIRONMENTALLY AND SOCIALLY RESPONSIBLE ENGINEERING

ENES401: Entrepreneurial Design Realization

UMD undergraduates working on social and environmentally responsible projects that go out into the public domain.

Open to all majors (>90 credits)

Spring 2023 project: Custom accessibility solutions for local persons with disabilities

- Partner with Volunteers for Medical Engineering 
<https://imagemd.org/services/medical-engineering/>
- Work directly with local clients to deliver solutions that make impacts on their lives
- Follow-up build + implementations of designs from UMD and other local universities



Example projects from the past:

- Automated swing for a 16yo with Down Syndrome/CP. Adult scale with full actuation for swinging.
- Kitchen mobility device for a 20yo with Phocomelia (no arms), must raise/lower, translate, and support the client safely around a kitchen to reach multi-level cabinets and cooking + prep surfaces with feet.
- A device to allow a blind 14yo boy to follow his sister while riding a balance bike in an open (relatively obstacle free) environment.

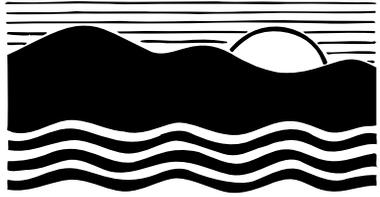
If interested in this project email: vince1@umd.edu or dbigio@umd.edu

New Course: Entrepreneurial Design Realization (EDR)

- Responsible engineering projects that **go out into the public domain**
- Multi-disciplinary
- NSF iCorps model
- Stakeholder involvement and co-development
- Social entrepreneurship
- Implementation and logistics of “Do-ing”



Oyster Desiccation Project



University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE



- Prototype in the water at collaborating research institution
- Venture Capitalist pitch



The Team



Aaron Mendelsohn
Analysis and Outreach



Wyatt Element
Testing and Integration



Paul Davis
Designer

Resources



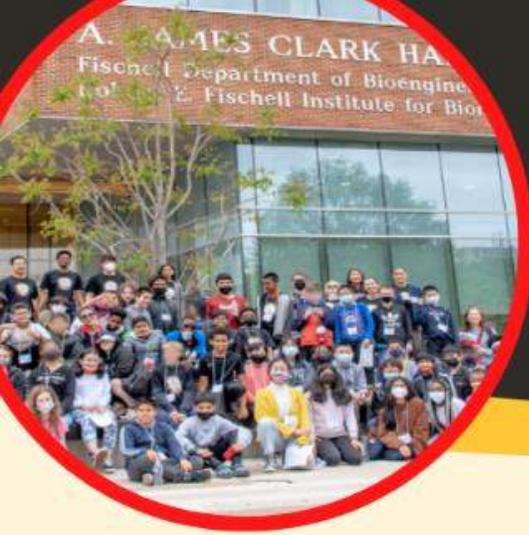
Donald Webster
Senior Agent
UMCES

Don is a senior member of the UMCES with years of experience in the oyster industry.



Shannon Hood
PhD Researcher
UMCES

Shannon is a valuable resource in the oyster research field, who has given us a facility at which to test and develop our equipment (Horn Point).



G.O.A.L. KITS: ENGINEERING OUTREACH



CONNECTING THE COMMUNITY TO STEM OPPORTUNITIES

Summer 2021 Survey

Demographics

- 73%** Black/African American
- 15%** Latinx/Hispanic
- 43%** did not identify a person in their immediate family who attended college
- 59%** female

EXPERIENCE

The G.O.A.L. kit program offers fun, hands-on experiences to increase knowledge and understanding of STEM concepts and provides an opportunity for creative problem solving and critical thinking skills.

COMMUNITY

Local school systems are invited to participate in a design challenge to gain exposure into the STEM field, connect students across the community with an equitable opportunity, and increase attraction to the STEM pathway.

IMPLEMENT

The University of Maryland community collaborates with local teachers to design and manufacture a teaching kit that engages middle and high school students with a creative project that addresses social challenges.

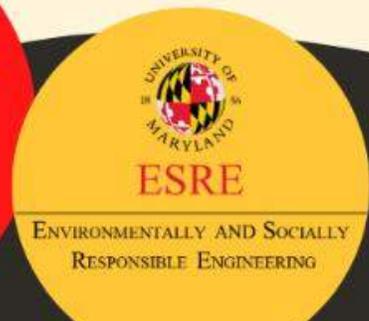
5 past culminating events on-campus

600 students Summer 2022

750 students expected 2023

5000+ kits distributed in **3** local school districts!

Prince George's, Montgomery, and D.C.



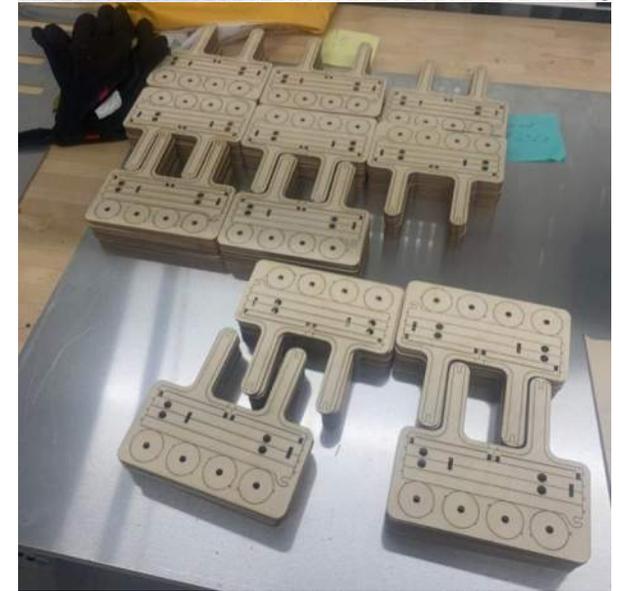
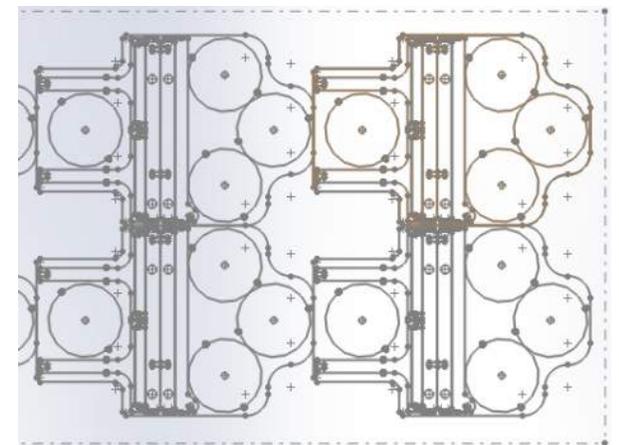
Design, Build, Test



3d printed prototype

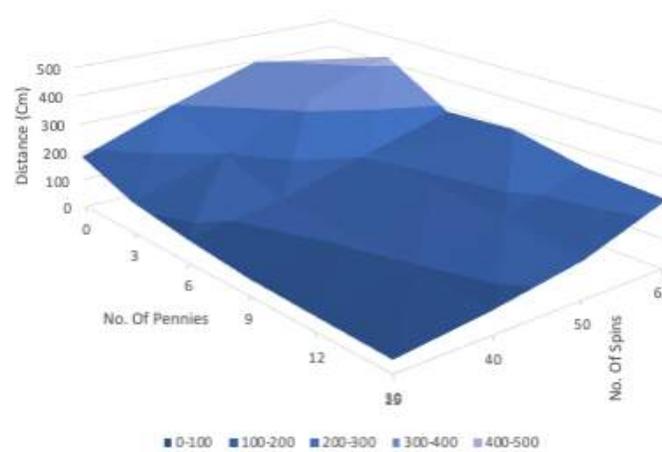


Physical testing



Pre-production runs verifying manufacturing + assembly + QC

No. Of Pennies & No. Of Spins Vs Total Distance (cm)



Stakeholder Testing

- “Maryland Day” campus-wide event
 - Short interaction times
- 150 kits built and run



Culminating Event/Curriculum testing with Teachers + Students

~68 students from teacher partner
Field trip to ME capstone "Design Day"



SCIENCE, TECHNOLOGY & SOCIETY

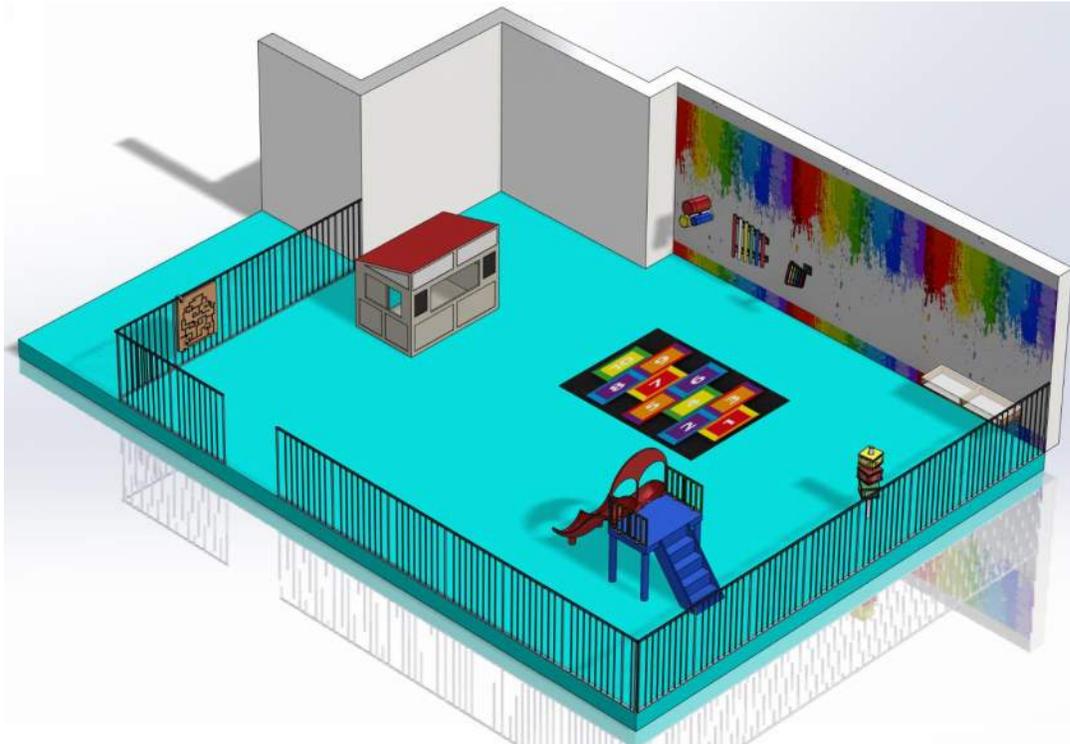


LeFrak Playground Renovation

Joshua Lawrence, Michelle Dang, John Hoffpauir, Gordon Chen, Josh Hartsock

ENVIRONMENTALLY AND SOCIALLY
RESPONSIBLE ENGINEERING

ENES401: Entrepreneurial Design realization (All Majors)
UMD undergraduates working on social and environmentally responsible project to go out into the public domain



Our Goal: Provide the children with new opportunities to learn and develop essential skills through use of specialized custom equipment suited for therapeutic use, along with other changes to the playground environment.

A communication enrichment program for **3-5 years olds with hearing and speech disorders**

Changes to the playground will allow enriching activities to be conducted outside, and provide a better opportunity to learn and grow.

A continuation of an ENME 472 capstone project started in Spring 2022 by the LEAP Frogs:

Megan Gertmenian, Julie Hirsch, Madison Kaczorowski, Andrea Sullivan, Selam Wolday, and Alex Zimmerman

New Playground Equipment

3 Custom Components

Designed to be incorporated into numerous enriching activities

3 Standard Playground Components

Implemented to make the playground fun and exciting for the children

Environment Changes

Wall Mural

Makes the playground more inviting and raises more awareness

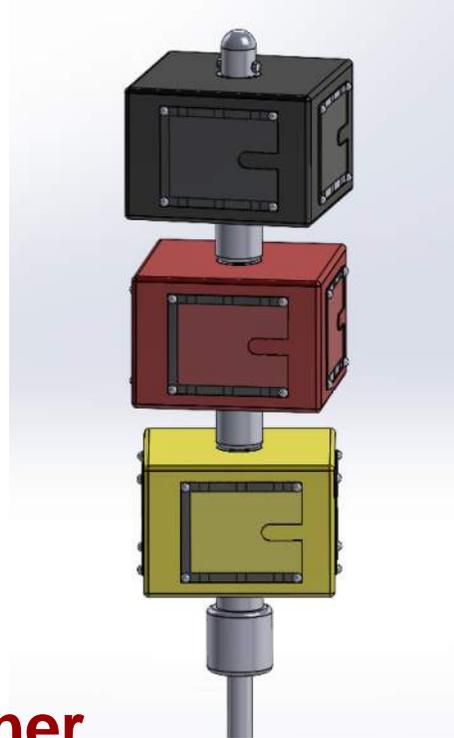
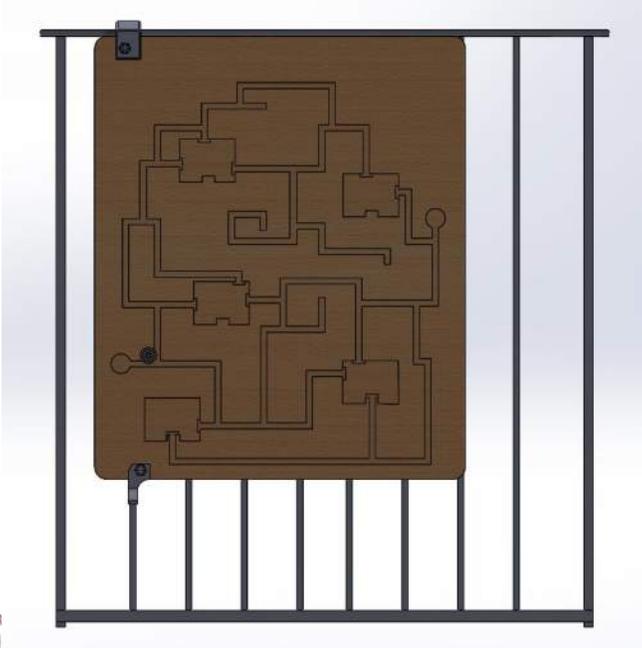
Resurfacing

Safer playground environment with lower maintenance and longer lifespan

Proposed Renovations: Custom Equipment

Maze

- **Function:**
 - Channel custom peg from one block to next
 - Motor stimulant
- **Cost:**
 - Approx. **\$1000**

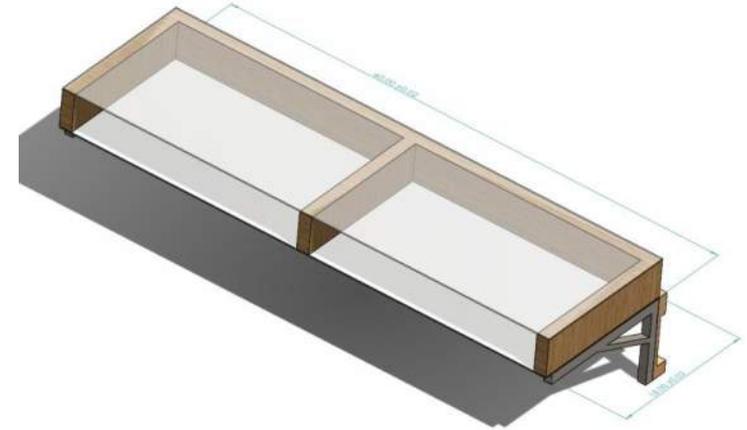


Spinner

- **Function:**
 - Motor and Visual Stimulant
 - Slots for custom images
- **Cost:**
 - Approx. **\$800**

Table

- **Function:**
 - Used for drawing and writing activity
 - Sensory stimulant
 - Folds into wall
- **Cost:**
 - Approx. **\$600**



Proposed Renovations: Off the Shelf

New Playground Slide!

- **Vibrant:**
 - New Colors!
- **Textured:**
 - Sensory stimulation!
- **Cost:**
 - Approx. **\$6.1K**



Rainbow Trio!

- **Vibrant:**
 - Colorful and Lively!
- **Functional:**
 - Sound and motor stimulation!
- **Cost:**
 - Approx. **\$4000**

Playhouse!

- **Functional:**
 - Communicative Learning
 - Recreational-use
- **Cost:**
 - Approx. **\$400**



Budget Pitch (*currently seeking funding by Facilities Management*)



Level One: (Will be completed)

Total: **\$2,900**

- Custom Components
 - Spinner - \$800
 - Maze - \$1,500
 - Table - \$545
- Installation (if done ourselves)
 - Concrete - \$30
 - Sonotubes - \$25

Level Two:

Total: **\$11,000**

- Off The Shelf (OTS)
 - Slide - \$6,700
 - Playhouse - \$600
 - Rainbow Trio - \$3,700
- Total for everything- **\$46,080**

Level Three:

Total: **\$32,180**

- Resurfacing
 - American Floor Mats - \$28,000
- Other
 - Fence Paint - \$120
- Contingency (10%) - \$4,060

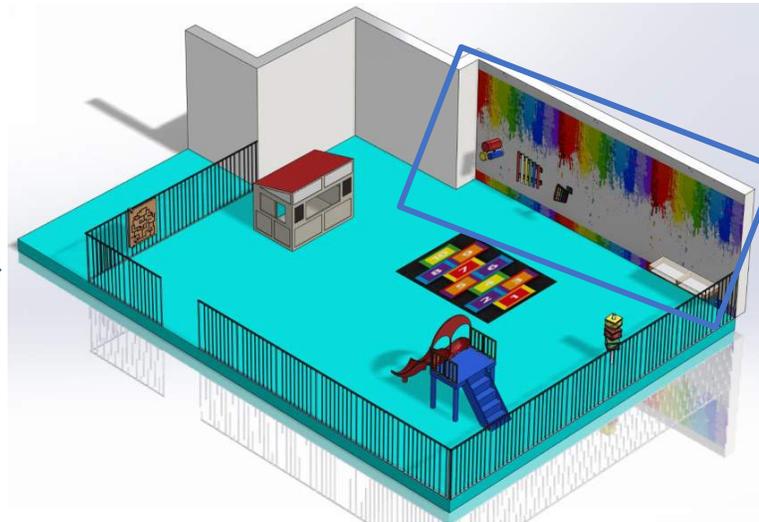
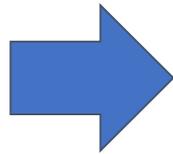
Art - Playground Mural



DEPARTMENT OF ART



Mural to the back wall of the playground
Will be completed during Spring 2023 Semester in Professor
Brandon J. Donahue's Advanced Painting 427 Class
Mural concept ideas worked with LEAP





ESRE

ENVIRONMENTALLY AND SOCIALLY RESPONSIBLE ENGINEERING

EDR lessons learned

- **Multidisciplinary? 3 semesters of only ME students so far...**
 - **Hurdles with approval for course/major requirements**
 - Individual unit requirements approvals etc.
 - Lots of advertising + cold calls to other departments
- Just received a college course number designation
- Listed on STS minor + Working on Gen Ed credit
 - ****S23 is first semester with out of major students + multiple projects***
- **Funding + entrepreneurial challenges**
- Project scoping: mini-social-technical problems
- **Faculty support**
- **Limited individual experiences, how does this move the needle for all at UMD?**
- ...



Mapping the student learning outcomes through entire educational experience



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Faculty Sustainability Teaching Workshop

- Generating specific course modifications
- First workshop Jan '23
 - 4 day event
 - “Spiral” method of topics
- Attendees:
 - 5 Departments
 - 4 Directors of Undergraduate Studies
 - Associate Dean of UG
 - Students



SCIENCE, TECHNOLOGY & SOCIETY



COLLEGE OF
EDUCATION

UNIVERSITY OF MARYLAND
A. JAMES CLARK SCHOOL OF ENGINEERING



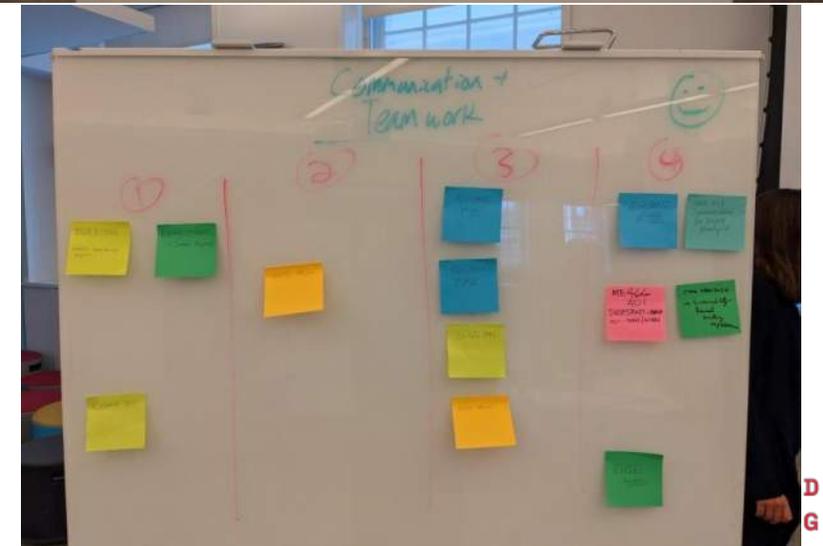
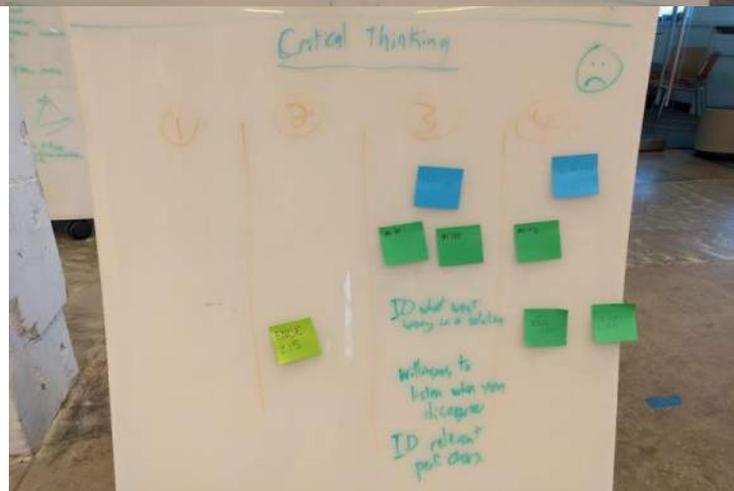
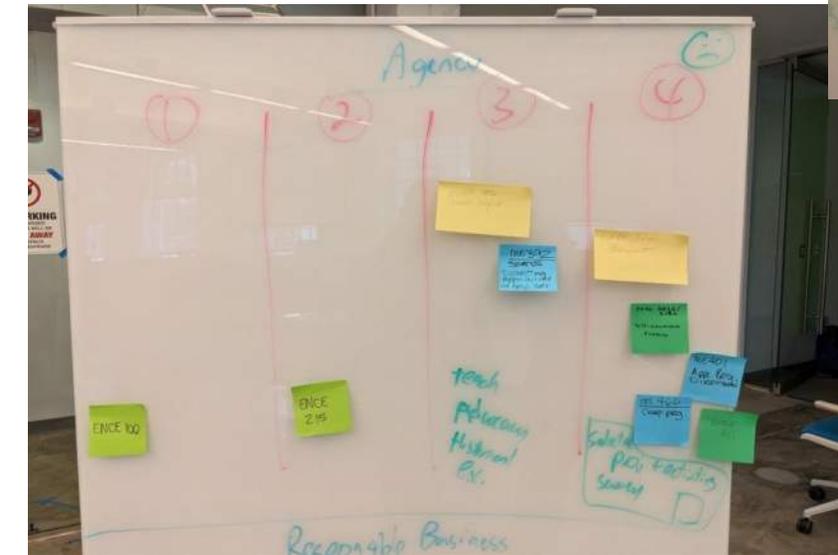
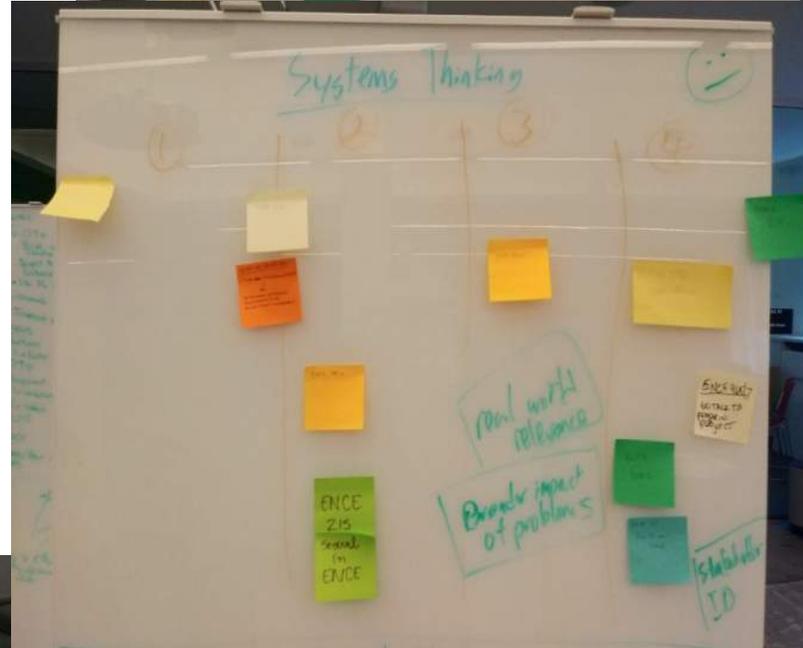
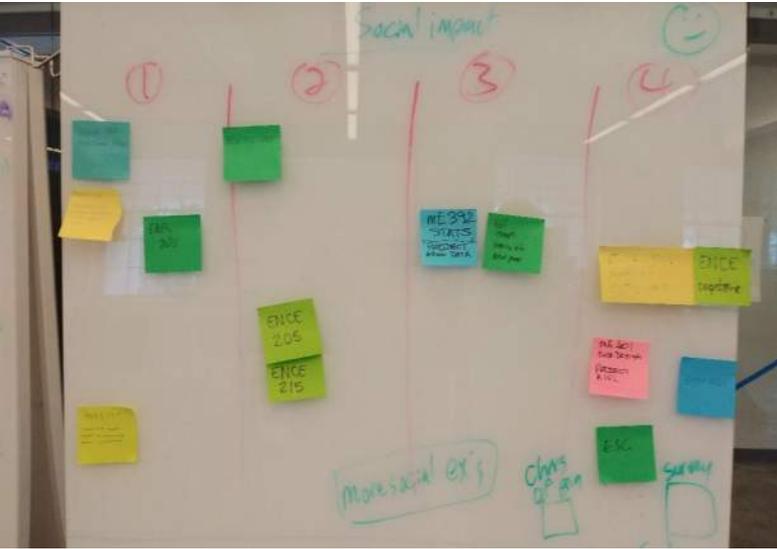
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What should we be including in the curriculum?

- **EOP framework** Learning Outcomes + **DEI** and **Agency**:
 - Systems Thinking
 - Communication and Teamwork
 - Environmental Impact
 - Social Impact
 - Critical Thinking
 - Responsible Business
 - DEI
 - Agency

4 year mapping



Assessments: Not just those tied to ABET or University Reporting



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- Assessments that are not within our traditional reporting categories
- Indirect assessments
- Metrics that might not look good (currently), but would really let us know when we move the needle

1st, 3rd, 4th year surveys

Which projects with a social or environmental aspect have you participated in *while at UMD* (in class, in projects)? Please list.

To what extent do you disagree or agree with the following?

- Nothing I can do as an engineer or private person will make things better on the planet.

Is there a time when you acted to improve some situation? Please explain.

To what extent do you disagree or agree with the following? - I feel confident in using engineering knowledge or approaches for the advancement of human welfare and a sustainable future.



SCHOOL OF
PUBLIC POLICY

Empowerment, responsibility,
motivation, empathy, evidence of
action

To what extent is it a *junior* engineers' responsibility to reshape companies' goals to address environmental and social impacts of their technology/product?

As an engineer, if you work for a company your responsibilities will likely include earning a reasonable living for yourself and your family and ensuring that your company makes a profit. What are other impacts do you want to have?

To what extent do you agree with the following statements? - I have the skills I need as an engineer to positively impact the society and the environment. Based on the previous question, what are the skills that you have (did you get these skills from any of the UMD courses that you have taken?) and the skills that you don't have that you think you may need?

DEI LO Examples

- **Students will learn how to work successfully in diverse cross-cultural teams, creating team spaces where input from all members are heard and considered.**

Appreciation of multiple perspectives on teams:

Rate the following statement: "This course experience has improved my appreciation of having multiple perspectives in engineering groups" (ex. additional viewpoints, accuracy checking, differing expertise, ...)

- **Students will engage in socially responsible projects aimed at fostering inclusion and addressing systemic inequities.**

Tracking of self-selected capstone project topics: projects with ties to environmental or social aspects, ties to design for inclusion, ...

***MechE + Hearing and Speech collaboration in developing DEI LO's,
This approach was presented as example of DEI LO integration at
University-wide workshop***



DEPARTMENT OF
HEARING AND
SPEECH SCIENCES

(Re)-defining Engineers and Engineering

Prompt from a class unrelated to sustainability:

“Provide a list of characteristics or skills that you feel are critical to an engineering professional.”

- Environmental/social literacy or responsibility?
- Valuing of perspectives?
- Empathy?
- Ethics?





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Lessons Learned

- Still a ways to go with assessment and tracking
 - Tying with ABET or University LO assessment provides precedent and longevity
- Efforts are scattered, but made possible by the scattered ad hoc partnerships developed

