
# **Nifty** Ideas and Surprising **Flops**

Capstone Design
CONFERENCE 2024
JUNE 3–5, 2024 ▸ KNOXVILLE, TENNESSEE

5 June 2024

Facilitator: Susannah Howe

# Nifty/Flop Agenda

| Nifty/Flopper | Institution | Topic |
|---|---|---|
| Jim Hartman | UNC Charlotte | Dedicated Lab Space for Senior Design |
| Robert Hart | UT Dallas | Student Safety: Project Hazard Assessment |
| Keith Stanfill | UT Knoxville | Rebranding Senior Design as Consulting |
| Dorian Varga | U Washington | Capstone Dashboard |
| Kristina Kennedy | Ohio State | Know Your User before Designing for Them |
| Aaron Rubin | Smith | Design Reviewers: Peers vs. Faculty |
| Kris Jaeger-Helton | Northeastern | Posters, Papers, and Pitches |
| Beth DeBartolo | RIT | Mirror, Mirror: Reflection in Capstone |

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# Dedicated Lab Space

**Background:**

- UNC Charlotte does a 2 semester, multi-disciplinary senior design program
- Nominally, the first semester is design, the second semester is build
- We try to ensure that each project has a build, because that is where the most learning occurs

**Problem:**

- Where to do the build?
- Traditionally, it was done in Department labs
- However, Senior Design was getting squeezed out

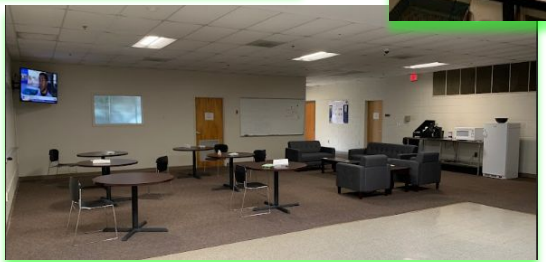
**What was Squeezing us out?**

- Instructional classes due to increases in the Undergraduate enrollment
- Research - Charlotte is projected to be R1 in 2025

# Dedicated Lab Space

## Initial Coping Attempts

- Small Senior Design lab pockets in different buildings
- Obtained a bigger space in a dilapidated old cafeteria building
- Assembly only
- Need to get a dedicated lab space with fabrication



## How?

Public Relations Campaign!

- Academic Affairs - Controls space
- New Dean
- COVID and State STEM funding
- New Science building created space

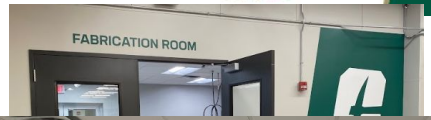
# Dedicated Lab Space

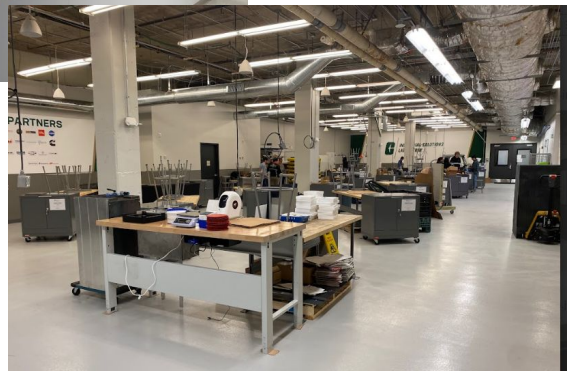
**Result?**

- New Lab Space opened, August 2023
- Significant improvement in Quality







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# Project Hazard Assessment

## Background

- Students know how to incorporate safety into their prototype designs – We teach this, cover it in design reviews, etc.
- Students know how to work safely – We require students to complete basic lab and tool safety training

## The Missing Piece

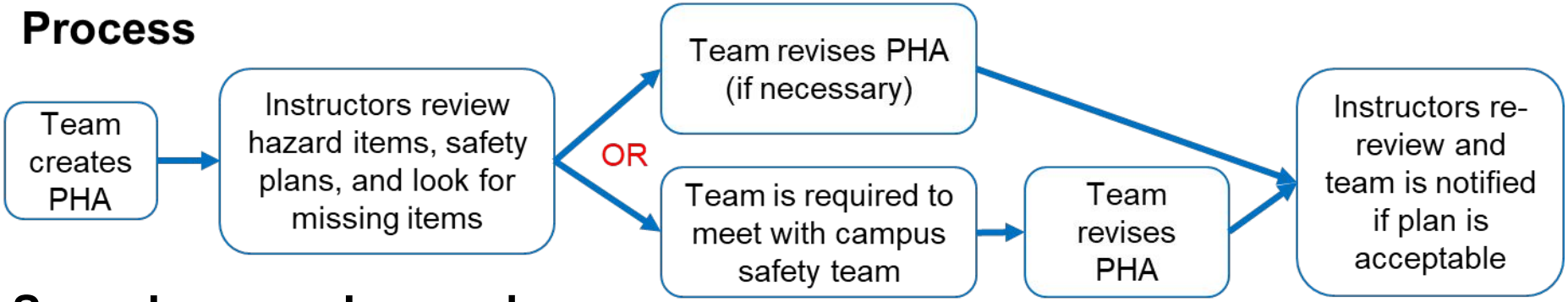
- Students may not recognize the temporary hazards that are present during prototype building and testing
- Monitoring this can be especially challenging in large programs

## Solution: Teams prepare a PHA document containing

1. Information on hazards present (a list of hazards helps them get started)
2. A safety plan for each hazard
3. A list of any work that will occur outside the Studio

# Project Hazard Assessment

## Process




## Some Lessons Learned

1. Timing matters (after CDR seems best)
2. Teams need to be specific in their descriptions
3. The deliverable is not graded to encourage openness
4. Have more than one person review PHA

***This works!*** Last Spring we were able to catch several issues early before students engaged in hazardous activities.

# Project Hazard Assessment

## Hazard List

1. Chemicals of any type other than those provided in the UTDesign Studio
2. Operational temperatures less than 0°F (-18°C) or greater than 120°F (49°C), excluding soldering
3. Compressed liquids and gasses at any elevated pressure, including the use of building-provided compressed air supply
4. Vacuum of any level
5. DC voltages greater than 50V
6. Any use of AC voltage that is internal to a device being built or modified
7. Electrical current great than 1A
8. Power greater than 50W
9. Any device that is intended to store and release significant amounts of energy (capacitors, springs, etc.)
10. Lifting or movement of objects greater than 50 lbs.
11. Lasers rated Class II and above
12. Devices producing noise/sound in excess of 85 decibels
13. Infrared/ultraviolet light sources other than a single LED
14. Radio frequency (RF) emitting equipment.
15. Ionizing radiation, X-rays, radioactive sources, etc.
16. Work involving any potential biological hazard (animals/animal tissues, pathogens, bodily fluids, etc.)
17. Work that requires the use of a ladder or elevated platform
18. Needles, scalpels, or other similar objects with sharp points or edges that can puncture or cut skin

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# Honors Interdisciplinary Senior Design EF437/438

## Features

- Capstone for Heath Integrated Business & Engineering Program
- 2 semesters x 3 credits
- Satisfy ABET & Gen Ed
- Faculty & sponsor mentors
- Open to all TCE & HCB seniors*

*Design, build & test authentic, business-relevant projects for corporate & non-profit organizations*

| 13 | 39 | 7 | 7 |
|---|---|---|---|
| majors | students | teams | sponsors |

HASLAM COLLEGE OF BUSINESS ♥ TICKLE COLLEGE OF ENGINEERING

* All participants will be vetted

UT ISD

THE UNIVERSITY OF TENNESSEE KNOXVILLE

# Rebranding


UT ISD develops business and engineering talent—delivering results on time and within budget

## Corporate Structure

- CEO, CBO, CLO, CLeO, …
- Lead consultant vs faculty mentor
- Weekly CEO memos

## Consulting practices

- Client focus, adding value
- BLUF communications
- Time estimation and tracking
- Team owns all deliverables

# Results

## Flops

- Alienated business students
- CEO memos unread
- Time estimation and tracking = administrivia
- Deliverables siloed by discipline
- Lost trust

## Nifty

- Weekly CBO reviews & sign off on business models
- BLUF communications

HASLAM COLLEGE OF BUSINESS

TICKLE COLLEGE OF ENGINEERING

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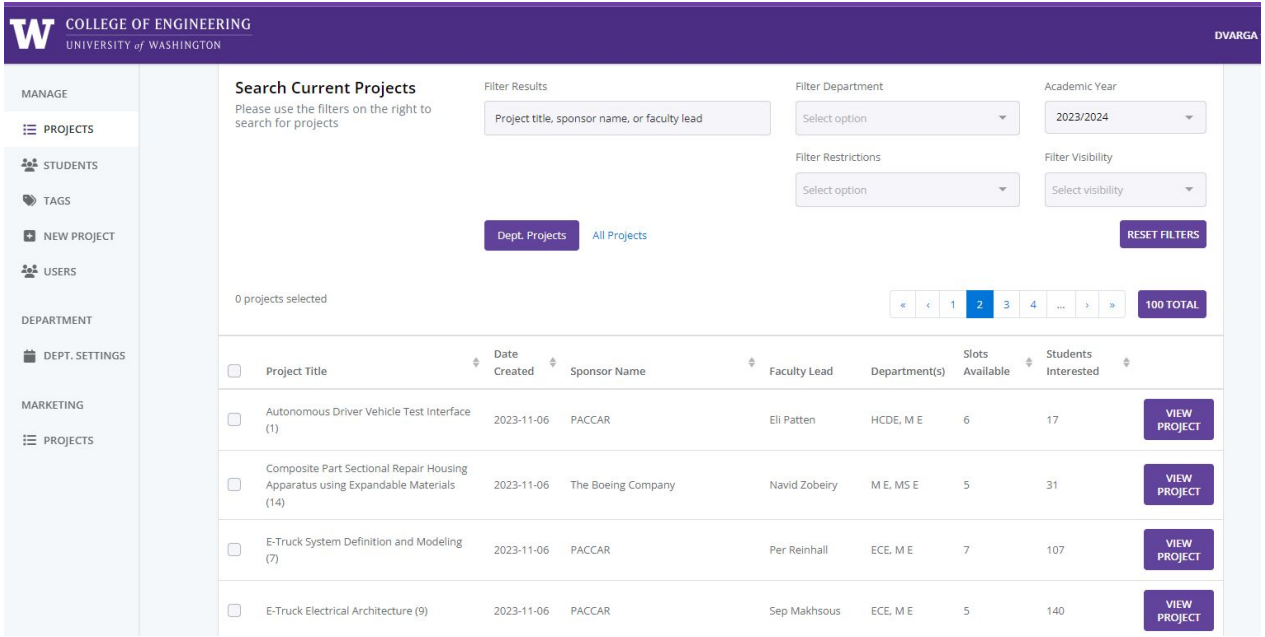
# Capstone Dashboard - Overview & Internal Benefits

Effectively cross-advertise projects across 10 engineering departments

Students: access projects they qualify for

Faculty: use the information to create student teams

Third year in use



# Capstone Dashboard - External Benefits

https://www.engr.washington.edu/industry/capstone-projects/2022-2023

Industry & alumni > Industry-Sponsored Student Capstone Projects

## Industry-Sponsored Student Capstone Projects

### 2022/2023

In the 2022/23 academic year the industry capstone program was supported by 56 sponsors and 100 real-world projects. Over four hundred students from across the College of Engineering participated. Scroll down to learn more about each project.

Search...

All Sponsors

All departments

SUBMIT

**Access Laser**

**An Optoelectronic Closed-Loop Control System for RF Amplifiers**

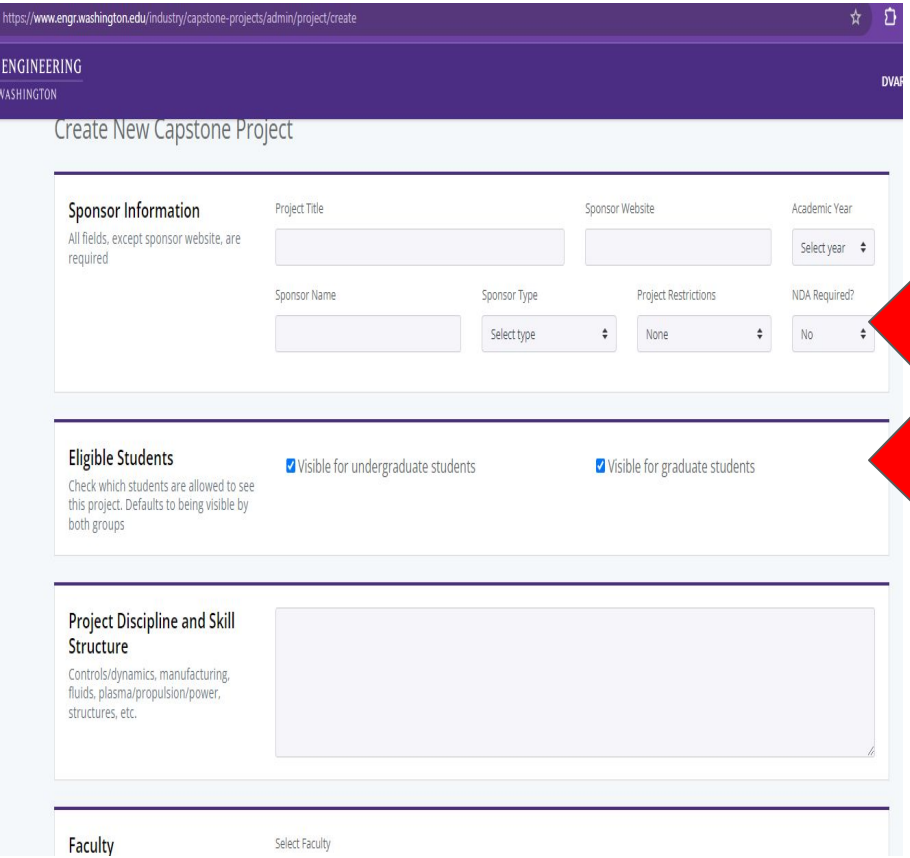
This student team worked to design and implement a closed-loop control

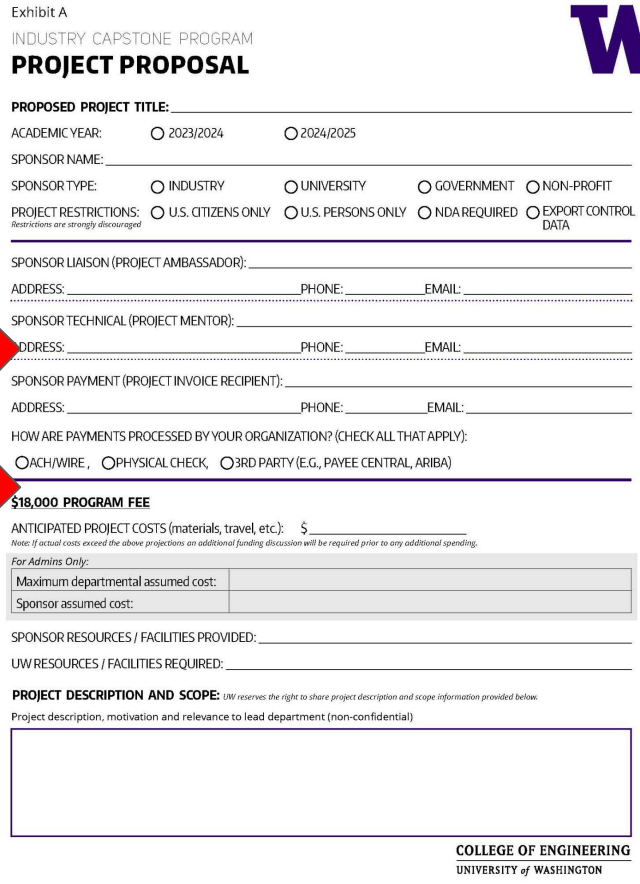
**Industry Capstone Program**

- 2022/2023 Projects
- 2021/2022 Projects
- 2020/2021 Projects
- 2019/2020 Projects
- 2018/2019 Projects
- 2017/2018 Projects
- Capstone Project Proposal

Questions?

# Capstone Dashboard - Challenges



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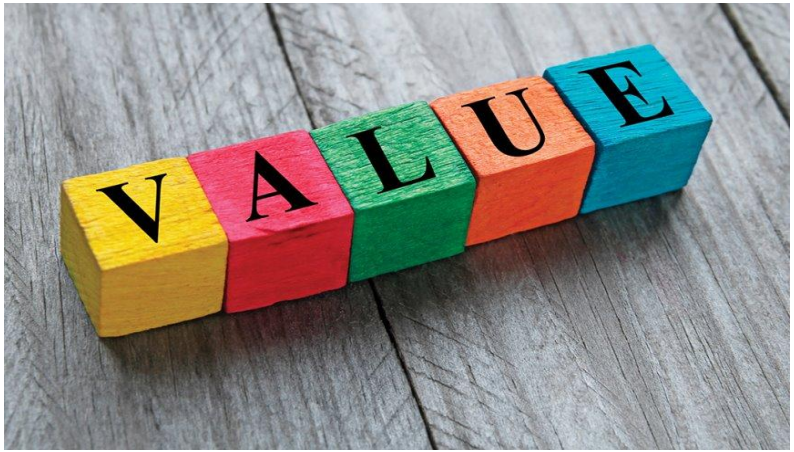
# Know Your User before Designing for Them

The Integrated Business & Engineering Senior Capstone is grounded in the *Value Creation Roadmap*




## Value Creation Process (Course Roadmap)

**Introduced to the Value Creation process in 1282 (design for limb-difference);**
**Put the process *to work* for in 5901 (industry-sponsored project)**

- **Identify** Opportunity
- **Investigate** Market/define customers
- **Create** Preliminary BusModCanvas
- Define The Problem
- Create/rank User Needs
- Assess Policy & reg. issues
- Eval Tech feas, value, society bene, econ
- Create Conceptual Solutions
- **Determine** Design Requirements
- **Test** Concepts with user engaged
- **Analyze Solns** Select Final Concept
- **Perform** Technical Design
- **Create** Prototype(s)
- **Verify Functions**
- Update BMC
- **Identify** Supply chains
- **Develop** Partnerships
- **Communicate** Econ. terms
- Determine acts/resources
- **Validate** Market
- **Communicate** Societal benefits
- Finalize Business Model
- **Protect** IP*

**Intellectual Property created will be transferred back to the industry sponsor.*

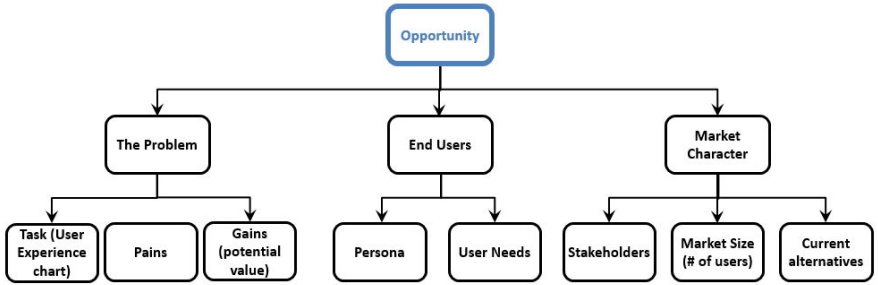
THE OHIO STATE UNIVERSITY

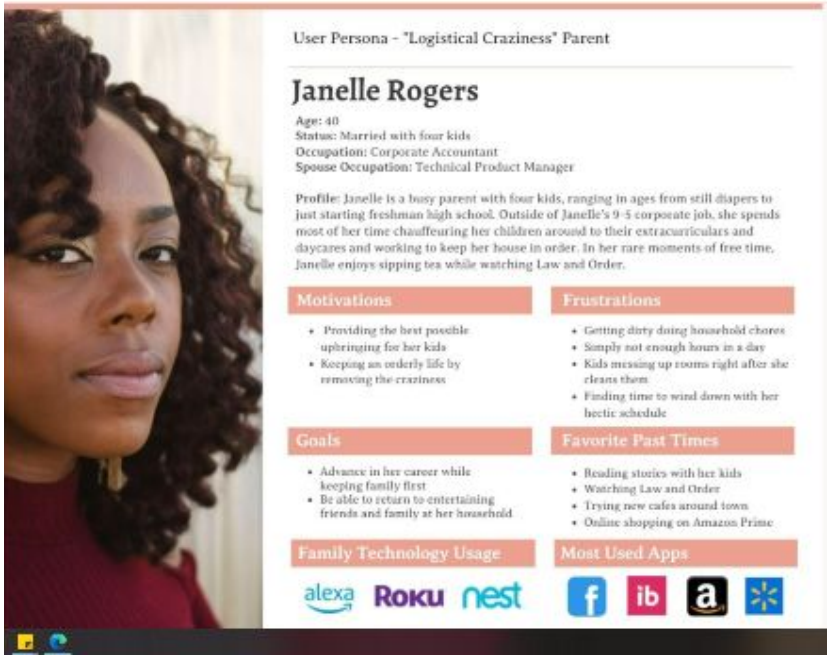
# Know Your User before Designing for Them

Value Creation is grounded in defining the OPPORTUNITY which is built upon understanding the END USER (Persona & User Needs)

## An Opportunity to Create Economic and/or Social Value

First, we will dig in and clarify the OPPORTUNITY



# Know Your User before Designing for Them

Let's put our students to the test to see if the approach has sunken in…

## Individual Mini-Design Challenge

- Create glasses for an end user (me)
- Available materials – pipe cleaners (4/person)
- Work time: 10 mins
- Sell me your product

**Results?**

- Wrong size
- Not visually appealing
- Uncomfortable
- Did they even *know* what problem they were solving or what I (end user) needed before designing?

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# Design Reviewers: Peers vs. Faculty

## Design Reviews at Smith

Format

- Teams of 3-4 students
- Present for ~10 mins
- Q&A for ~20 mins
- Quasi-stage gate (typically 4 per year)

Content Examples

- Scoping
- Concept generation results and/or selection
- Final design justification
- Etc etc etc

## Goals for Presenters

Primary:

- Technical feedback

Secondary Examples:

- Idea Generation
- Presentation Practice
- Planning
- Identification of on-campus resources

Move the project forward!

## Goals for Instructor (me)

Primary:

- How well does the team and the individuals know the project / content?
- Provide Technical Feedback

Secondary:

- Identify topics to address at future team meetings
- 10,000 ft view of the project

# Design Reviewers: Peers vs. Faculty

## Peer Review Format:

- Shadow Team of 3-4 Students
- 1-2 Faculty
- Qualitative feedback from shadows and faculty (i.e. no grading or summative comments)

Pros:
- Big Benefit for Shadow Teams
- Good working sessions

Cons:
- Peers could tangent the conversation
- Not clear that the projects moved forward!

## Goals for Presenters

Primary:
- ❓ Technical feedback

Secondary:
- ✅ Idea Generation
- ✅ Presentation Practice
- ❓ Planning
- ✅ Identification of on-campus resources

Move the project forward! ❓

## Goals for me as instructor

Primary:
- ✅ How well does the team and the individuals know the project / content?
- ❓ Provide Technical Feedback

Secondary:
- ✅ Identify topics to address at future team meetings
- ✅ 10,000 ft view of the project

# Design Reviewers: Peers vs. Faculty

## Faculty Review Format:

- 2 DC Faculty
  + 1 Faculty/staff/alum
- Feedback summarized by DC Faculty

Pros:
- Focus on technical feedback
- Less people -> more discussion
- Fresh eyes from the Faculty/staff/alum
- More helpful for teams

Cons:
- Lost the peer involvement / benefit to the shadow teams

## Goals for Presenters

Primary:
- ☑ Technical feedback

Secondary:
- ☑ Idea Generation
- ☑ Presentation Practice
- ☑ Planning
- ☑ Identification of on-campus resources

Move the project forward! ✓

## Goals for me as instructor

Primary:
- ☑ How well does the team and the individuals know the project / content?
- ☑ Provide Technical Feedback

Secondary:
- ☑ Identify topics to address at future team meetings
- ☑ 10,000 ft view of the project

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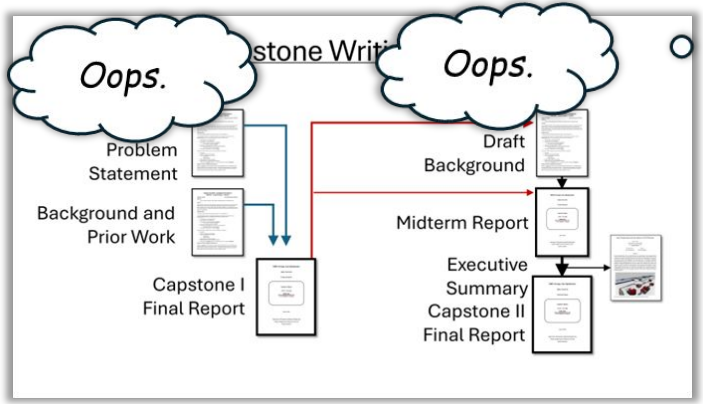
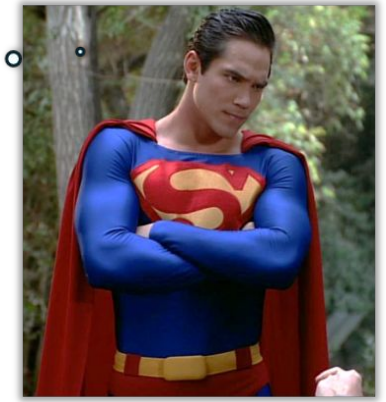
# Posters, Papers, & Pitches: *Deliverables Slides*

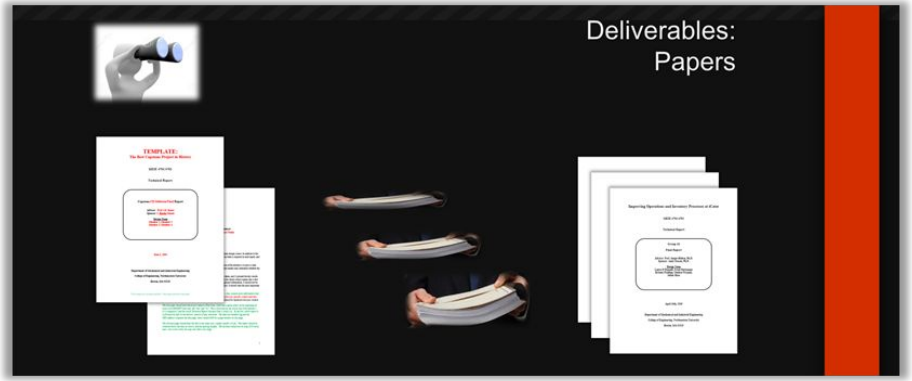
Wait! We have to do posters!?! When? How?


What does this Final Report look like? Entail?!?

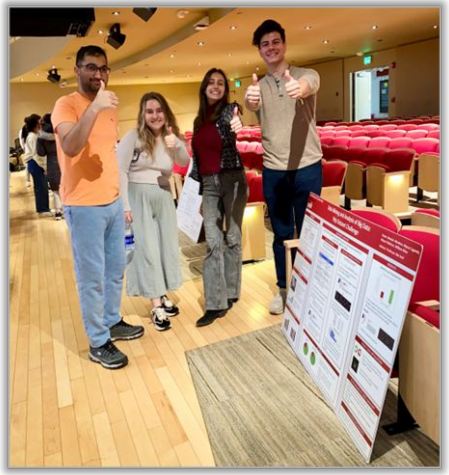


# Posters, Papers, & Pitches: *Let's tell them what to expect*!


# Posters, Papers, & Pitches: *Let's engage them in the vision*!



**Benefits**

- Active
- Physical
- Hands-on

- Social
- Bonding
- Interactive

- A Change
- Ownership
- Photos OK

- Free to ask Qs
- See +/- examples
- Better final posters

→ *Next step: Links to Pitch videos*

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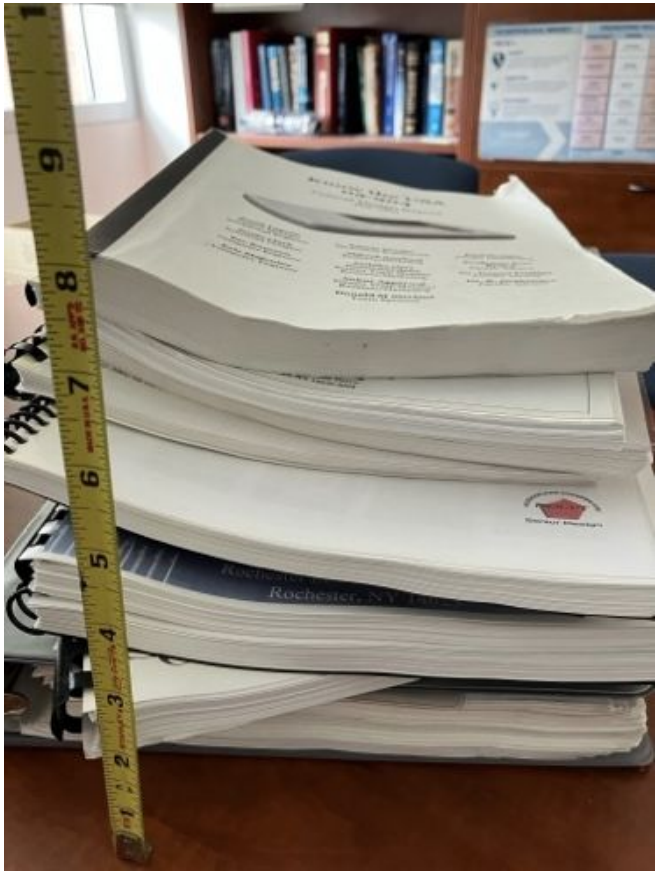
# Mirror, Mirror: Reflection in Capstone



**Our capstone class requires a LOT of writing**

RIT | Kate Gleason College Multidisciplinary Senior Design

# Mirror, Mirror: Reflection in Capstone

**“Writing Intensive” designation**

**“Threshold Concepts & Reflection” Teaching Circle**

**Time to DO vs time to THINK**

- Reflection after each design phase (8x per year, couple of sentences)
- Once at the end of each semester (reflect on what/how you learned)

# Mirror, Mirror: Reflection in Capstone

✅ **~75% compliance on an ungraded assignment!**

✅ **Team members made extremely insightful statements about their learning**

✅ **8x phase reflections showed evolution of thought process through the project**

✅ **Students wrote well beyond the expected <1page guideline**

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