



# Nifty Ideas and



# Surprising Flops



**Capstone Design**  
CONFERENCE 2024

JUNE 3-5, 2024 ▶ KNOXVILLE, TENNESSEE



5 June 2024

Facilitator: Susannah Howe

# Nifty/Flop Agenda

<b>Nifty/Flopper</b>	<b>Institution</b>	<b>Topic</b>
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**

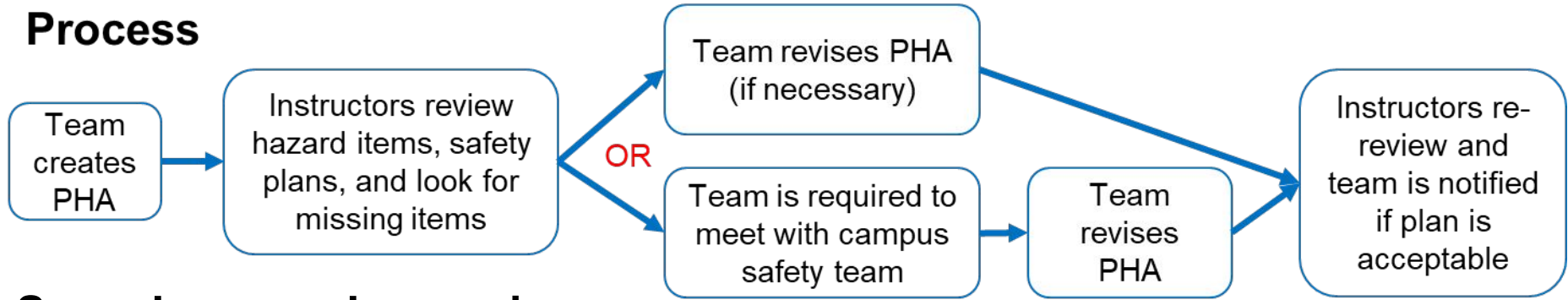
1. Information on hazards present (a list of hazards helps them get started)
2. A safety plan for each hazard
3. A list of any work that will occur outside the Studio



# 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



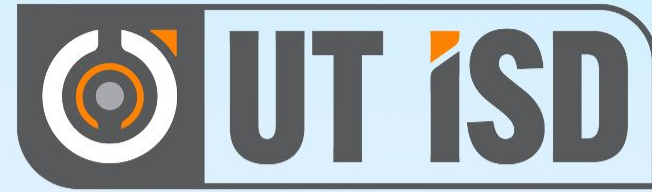
\* All participants will be vetted



# 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



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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

The screenshot displays the 'Search Current Projects' interface. The header includes the 'W' logo for the College of Engineering at the University of Washington and the name 'DVARGA'. A left sidebar contains navigation options: MANAGE, PROJECTS, STUDENTS, TAGS, NEW PROJECT, USERS, DEPARTMENT, DEPT. SETTINGS, MARKETING, and PROJECTS. The main content area features search filters for Department, Academic Year, and Filter Restrictions, along with buttons for 'Dept. Projects', 'All Projects', and 'RESET FILTERS'. A table below lists projects with columns for Project Title, Date Created, Sponsor Name, Faculty Lead, Department(s), Slots Available, and Students Interested. Each row includes a 'VIEW PROJECT' button.

<input type="checkbox"/>	Project Title	Date Created	Sponsor Name	Faculty Lead	Department(s)	Slots Available	Students Interested	<input type="button" value="VIEW PROJECT"/>
<input type="checkbox"/>	Autonomous Driver Vehicle Test Interface (1)	2023-11-06	PACCAR	Eli Patten	HCDE, M E	6	17	<input type="button" value="VIEW PROJECT"/>
<input type="checkbox"/>	Composite Part Sectional Repair Housing Apparatus using Expandable Materials (14)	2023-11-06	The Boeing Company	Navid Zobeiry	M E, MS E	5	31	<input type="button" value="VIEW PROJECT"/>
<input type="checkbox"/>	E-Truck System Definition and Modeling (7)	2023-11-06	PACCAR	Per Reinhall	ECE, M E	7	107	<input type="button" value="VIEW PROJECT"/>
<input type="checkbox"/>	E-Truck Electrical Architecture (9)	2023-11-06	PACCAR	Sep Makhous	ECE, M E	5	140	<input type="button" value="VIEW PROJECT"/>

# Capstone Dashboard - External Benefits



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

[Home](#) > [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.

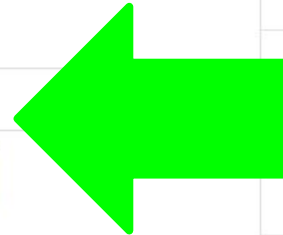
All Sponsors



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



https://www.engr.washington.edu/industry/capstone-projects/admin/project/create

ENGINEERING WASHINGTON

## Create New Capstone Project

### Sponsor Information

All fields, except sponsor website, are required

Project Title:

Sponsor Website:

Academic Year:

Sponsor Name:

Sponsor Type:

Project Restrictions:

NDA Required?:

### Eligible Students

Check which students are allowed to see this project. Defaults to being visible by both groups

Visible for undergraduate students

Visible for graduate students

### Project Discipline and Skill Structure

Controls/dynamics, manufacturing, fluids, plasma/propulsion/power, structures, etc.

### Faculty

Select Faculty

Exhibit A

## INDUSTRY CAPSTONE PROGRAM PROJECT PROPOSAL

### PROPOSED PROJECT TITLE:

ACADEMIC YEAR:  2023/2024  2024/2025

SPONSOR NAME:

SPONSOR TYPE:  INDUSTRY  UNIVERSITY  GOVERNMENT  NON-PROFIT

PROJECT RESTRICTIONS:  U.S. CITIZENS ONLY  U.S. PERSONS ONLY  NDA REQUIRED  EXPORT CONTROL DATA  
Restrictions are strongly discouraged

SPONSOR LIAISON (PROJECT AMBASSADOR):

ADDRESS: \_\_\_\_\_ PHONE: \_\_\_\_\_ EMAIL: \_\_\_\_\_

SPONSOR TECHNICAL (PROJECT MENTOR):

ADDRESS: \_\_\_\_\_ PHONE: \_\_\_\_\_ EMAIL: \_\_\_\_\_

SPONSOR PAYMENT (PROJECT INVOICE RECIPIENT):

ADDRESS: \_\_\_\_\_ PHONE: \_\_\_\_\_ EMAIL: \_\_\_\_\_

HOW ARE PAYMENTS PROCESSED BY YOUR ORGANIZATION? (CHECK ALL THAT APPLY):

ACH/WIRE,  PHYSICAL CHECK,  3RD PARTY (E.G., PAYEE CENTRAL, ARIBA)

### \$18,000 PROGRAM FEE

ANTICIPATED PROJECT COSTS (materials, travel, etc.): \$ \_\_\_\_\_

Note: If actual costs exceed the above projections an additional funding discussion will be required prior to any additional spending.

For Admins Only:

Maximum departmental assumed cost:

Sponsor assumed cost:

SPONSOR RESOURCES / FACILITIES PROVIDED: \_\_\_\_\_

UW RESOURCES / FACILITIES REQUIRED: \_\_\_\_\_

**PROJECT DESCRIPTION AND SCOPE:** UW reserves the right to share project description and scope information provided below.

Project description, motivation and relevance to lead department (non-confidential)

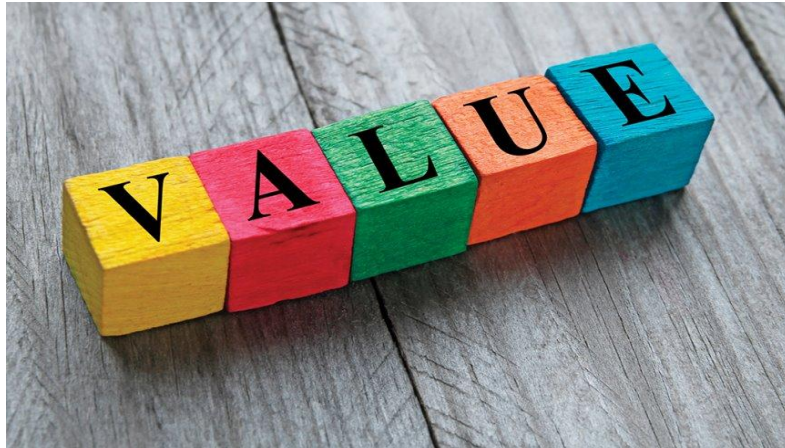
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# Know Your User before Designing for Them

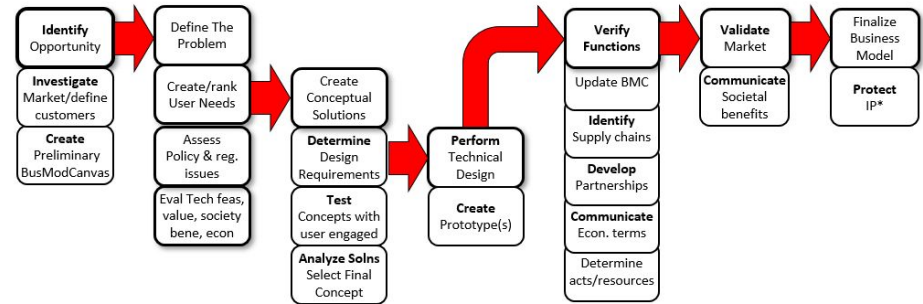


The Integrated Business & Engineering Senior Capstone is grounded in the *Value Creation Roadmap*



## 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)



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



THE OHIO STATE UNIVERSITY

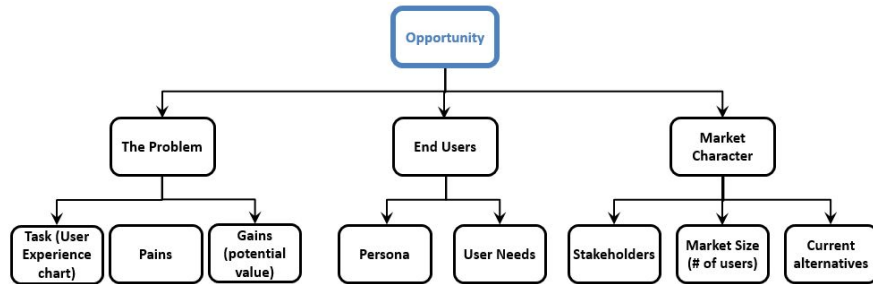
# Know Your User before Designing for Them



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



User Persona - "Logistical Crazyness" Parent

### Janelle Rogers

Age: 40  
Status: Married with four kids  
Occupation: Corporate Accountant  
Spouse Occupation: Technical Product Manager

Profile: Janelle is a busy parent with four kids, ranging in ages from still diapers to just starting freshman high school. Outside of Janelle's 9-5 corporate job, she spends most of her time chauffeuring her children around to their extracurriculars and daycares and working to keep her house in order. In her rare moments of free time, Janelle enjoys sipping tea while watching Law and Order.

Motivations	Frustrations
<ul style="list-style-type: none"><li>• Providing the best possible upbringing for her kids</li><li>• Keeping an orderly life by removing the craziness</li></ul>	<ul style="list-style-type: none"><li>• Getting dirty doing household chores</li><li>• Simply not enough hours in a day</li><li>• Kids messing up rooms right after she cleans them</li><li>• Finding time to wind down with her hectic schedule</li></ul>

Goals	Favorite Past Times
<ul style="list-style-type: none"><li>• Advance in her career while keeping family first</li><li>• Be able to return to entertaining friends and family at her household</li></ul>	<ul style="list-style-type: none"><li>• Reading stories with her kids</li><li>• Watching Law and Order</li><li>• Trying new cafes around town</li><li>• Online shopping on Amazon Prime</li></ul>

Family Technology Usage

Most Used Apps



# 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
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# Posters, Papers, & Pitches: Deliverables Slides



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

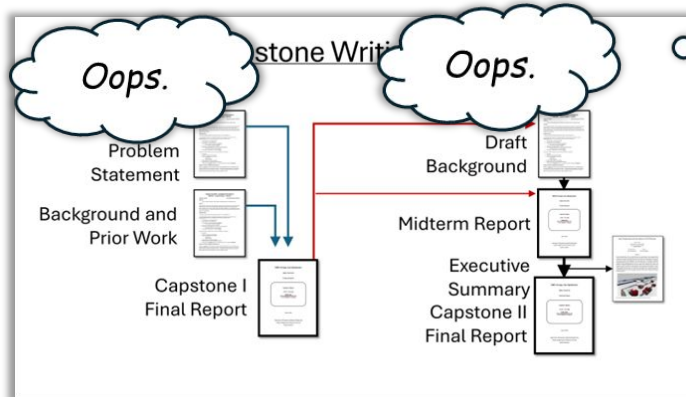
## Capstone Del...

- 12-14 M
- M
- F
- Execu
- Formal W
- Midterm and
- 5 memos
- Progress reporting
- Draft report sections etc.
- Attend all class meetings

And what are these "pitches" you have been talking about?



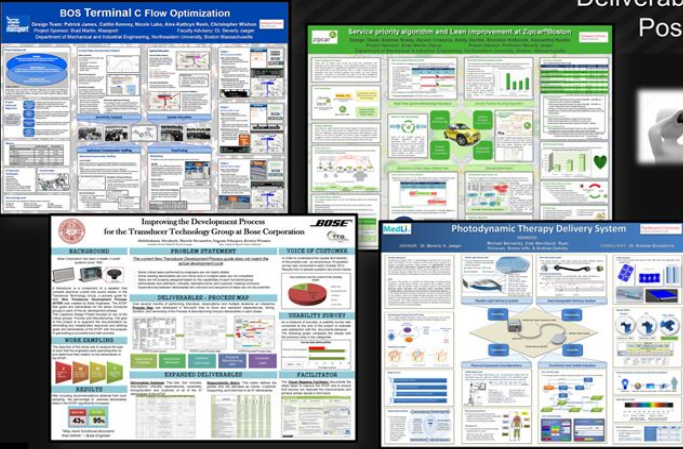

What does this Final Report look like? Entail!?





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



**Deliverables: Posters**



**Deliverables: Papers**





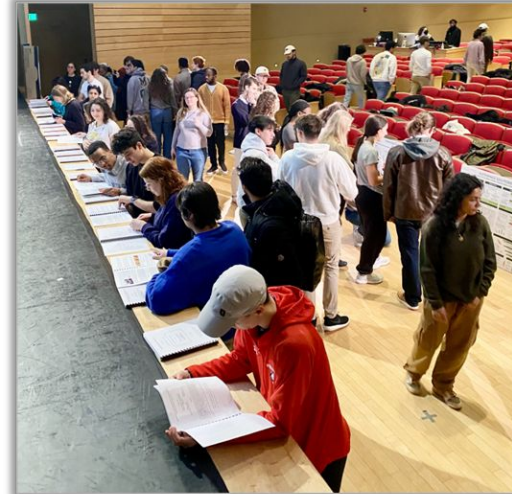
# Posters, Papers, & Pitches: Let's engage them in the vision!



## **Benefits**

- Active
- Physical
- Hands-on

- Social
- Bonding
- Interactive



- A Change
- Ownership
- Photos OK

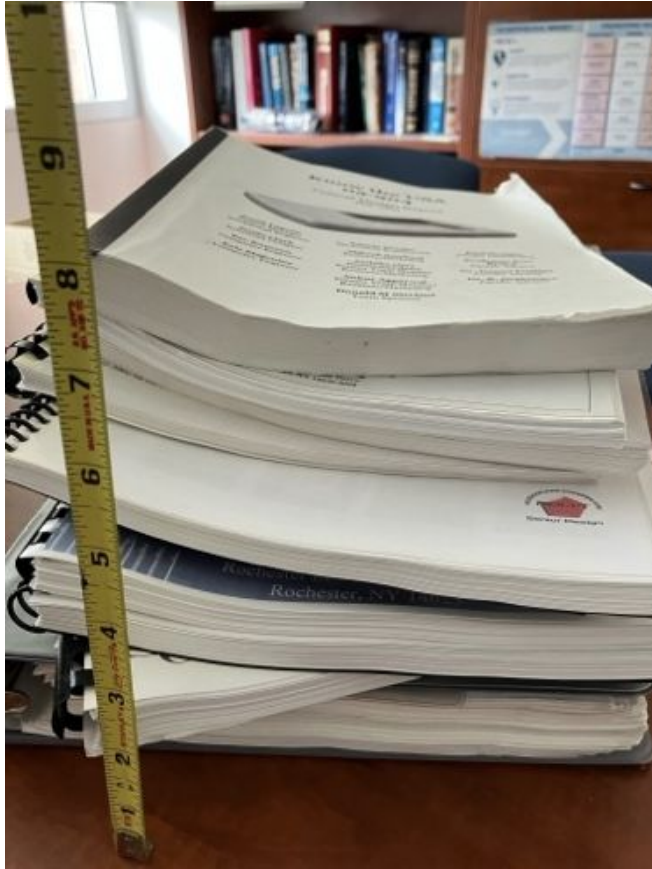
- Free to ask Qs
- See +/- examples
- Better final posters

→ *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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5 June 2024

Facilitator: Susannah Howe