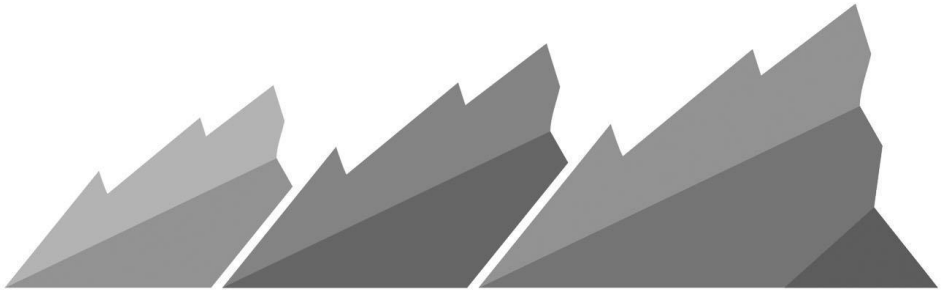
Welcome to the Virtual Capstone Conference 2025!



Session 3: Nifty Ideas and Surprising Flops

Some things to keep in mind today:

- Please mute unless talking
- Use the **Zoom Chat** for questions
- Use the **GoogleDoc** for comments and responses
- This session will be recorded

[1]

Nifty Ideas and Surprising **Flops**

[2]

Virtual Capstone Design Conference 2025

12 June 2025

Facilitator: Susannah Howe

Nifty/Flop Agenda

Nifty/Flopper	Institution	Topic
Kris Jaeger-Helton	Northeastern University	Capstone Orientation and Mentoring
Kristi Bartlett and Regina Hannemann	University of Kentucky	Incorporating Product Design Students
Peyton FitzGerald and Matt Traum	University of Florida	Outsourcing Custom Components
Arkasama Bandyopadhyay	Texas A&M University	Polling for Design Review Requirements
Beth DeBartolo	Rochester Institute of Technology	Hiring Computing Co-op Students
Shaz Vijlee	University of Portland	Ungrading in Capstone
Noe Vargas Hernandez	Univ. of Texas Rio Grande Valley	Senior Design Project Haiku

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Capstone Orientation and Mentoring …

Kris Jaeger-Helton, Northeastern

[Possibly] the Worst Capstone Orientation Model Ever: 2022

24 May 2022 and again on 20 June 2022

Hi All,

This is Professor Jaeger-Helton. I hope you are doing well and are excited for your upcoming final year! I have just completed my first year as the Director of IE Capstone and am looking forward to working with you and bringing forward what I have learned in the process.

I am writing to you in advance of Capstone to try to help set you up for success. I want to send you some guidelines to get you thinking and prepare you for the beginning of your Capstone experience. Professors Andrew Gouldstone and Greg Kowalski, with myself, and –in some cases Bridget Smyser– are the final word on many of the deadlines, projects, purchases, and decisions. We work as a team. That said, I am your contact person for the material below and elements specific to IE projects.

From spending some time with students who have completed Capstone and from past experience, questions and circumstances, I have compiled some observations and guidelines to help you develop a mindset and get you thinking in a productive and proactive way about the Capstone experience. Read on to get some of your initial questions answered. Also, feel free to ask me for further clarification or responses to other questions. Let me know if there is anything else I can cover or should add to this orientation write-up to keep you informed as we get started! I also have a couple of excellent students helping us compile a Student Capstone Guidebook as a course reference guide. That will be delivered when it is ready, maybe Fall.

CAPSTONE ATTENDANCE

As you may already know, there is no provision to waive, substitute, or miss either Capstone 1 or Capstone 2 under any circumstances. Your two scheduled Capstone courses are in reality a single follow-on course within a set. Specific projects are started in Capstone 1 and completed in the subsequent Capstone 2 offering that is associated with its original and unique Capstone 1 course. Therefore, plan to be on campus, enrolled for, and attend both components of Capstone course offerings. In either semester, do not plan to miss any Capstone classes.

Also, since there may appear to be times on the Capstone schedule that class will not be scheduled to meet, please hold that time free as we often need to be agile for our various speakers to reschedule AND you will be needing that time to meet with your team and/or your advisor and/or industry partner, particularly in Capstone 1. Not only will absences affect your final Capstone grade, but –more importantly– you will miss material, guidance, and answers that could save you time, quality, and effort.

REQUIREMENTS for a PROPOSAL

Professor Smyser and I have been researching several past years of Capstone projects and conducting extensive statistical analyses to identify primary predictors of Capstone success. We have published our findings with the American Society for Engineering Education. We will discuss more of the findings as we lead into Capstone 1, but there is one we want to share with you from our regression analysis: That is-

Students who properly develop and propose their own Capstone projects (particularly in IE) have shown a statistically higher success level than those who do not develop a project.

Many of you are still on co-op, and so you may be interested in working with co-op contacts to create and/or develop a Capstone project proposal BEFORE the START of Capstone 1. This has been done successfully with countless companies in the past.

Once the project has (1) an industry contact, (2) a proposal (examples provided), and (3) a letter of commitment (examples provided), and (4) it has been approved by the NU Capstone Committee – you could be good to go. Doing this will also have a bearing on your ability to solidify a Capstone team. We will also guide you in addressing NDA (Non-Disclosure Agreements) and IP (Intellectual Property) details with the industry contact and NU, if necessary.

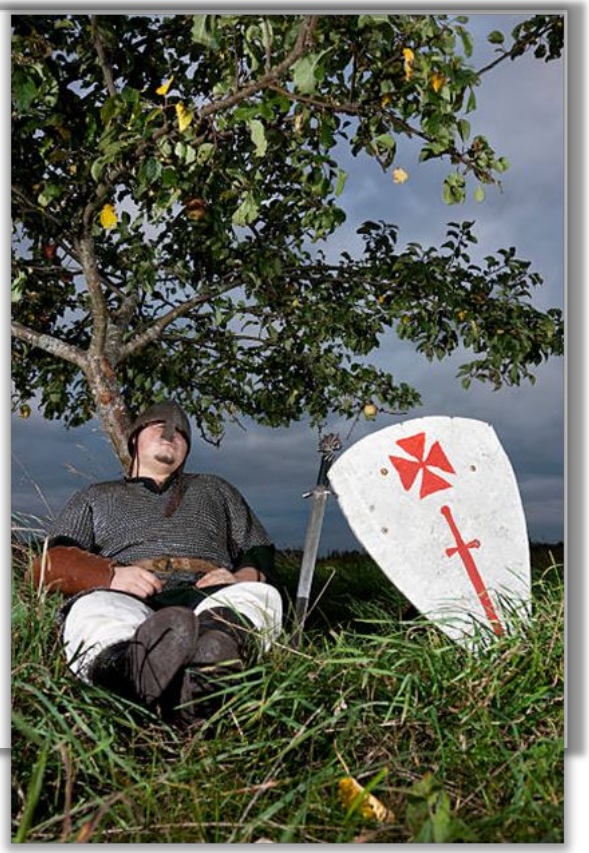
Accordingly, I have attached examples of 5 project proposals in case you would like to propose a project on your own. The JetBlue/Massport, LeanBox and Photodynamic Device proposals were created and submitted by Capstone teams – or some members- with the input and supervision of their proposed Advisor in advance of their Capstone 1 semester; the Bose® and Zipcar® proposals were set out by the faculty and were approved for Capstone eligibility, then developed further over time. If you propose your own, it would be more extensive than the Zipcar® one, but may not need to be quite as comprehensive as the Jet Blue/Massport Proposal.

You are *not required* to develop an original project proposal for the Capstone class. Oftentimes faculty have contacts and have their own projects to put forth, which are typically of primary interest to them. However, a strong student-generated proposal with a sound structure and development can be very rewarding for you and will be happily supported by your Faculty Advisor! Read the DEADLINES and TIMING section below for additional information about this opportunity. Nonetheless, you will be completing a Capstone project, regardless of its source.

CAPSTONE PROJECT OPTIONS: SOURCES, SELECTION, and ASSIGNMENT

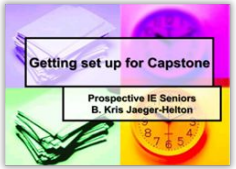
Project proposals for the class to bid for may be set forth by any of a variety of sources: from faculty, from a small pool of projects, from industry and organizations that may be in contact with our IE program, from co-op contacts, from graduate and research programs, from academic or university needs, and possibly as second phases from previous Capstone initiatives. Sometimes the number of projects that have a reasonable scope and IE application are limited –or they may not be in an area of your primary interest– so this is another reason to consider proposing one of your own that you have seen in your experiences that may have strong project potential.

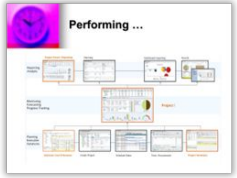
Project assignment (i.e., determining which project you and your assigned team will take on for Capstone) has worked in a variety of ways, but essentially you will be bidding on or requesting to be assigned to a project if you did not develop your own to be approved. There is no guarantee that you will get your top choices for projects, but again every effort will be made to balance the assignments in a way that considers all preferences and other critical aspects of the planning profile, like advisors, team sizes, and relevant individual factors (for example, defense-related projects use US Citizens and other companies require that you have a vehicle). Team creation will be addressed below and will not be done by me.



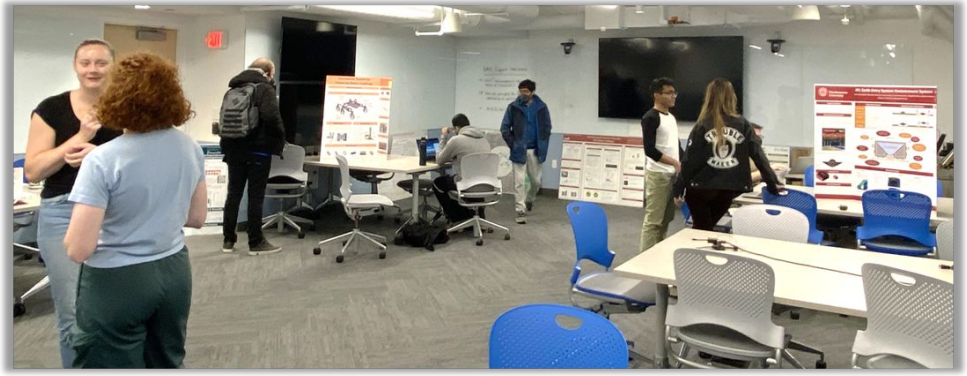
Pre-Capstone Orientation Letter (TLDR)

Reasonable Capstone Orientation Model – Slides: 2023





A More Effective and Contextual Capstone Orientation Model – Slides and Posters: 2024



[Possibly] the Most Efficient Capstone Orientation Model – Slides, Posters, & Mentors: 2025

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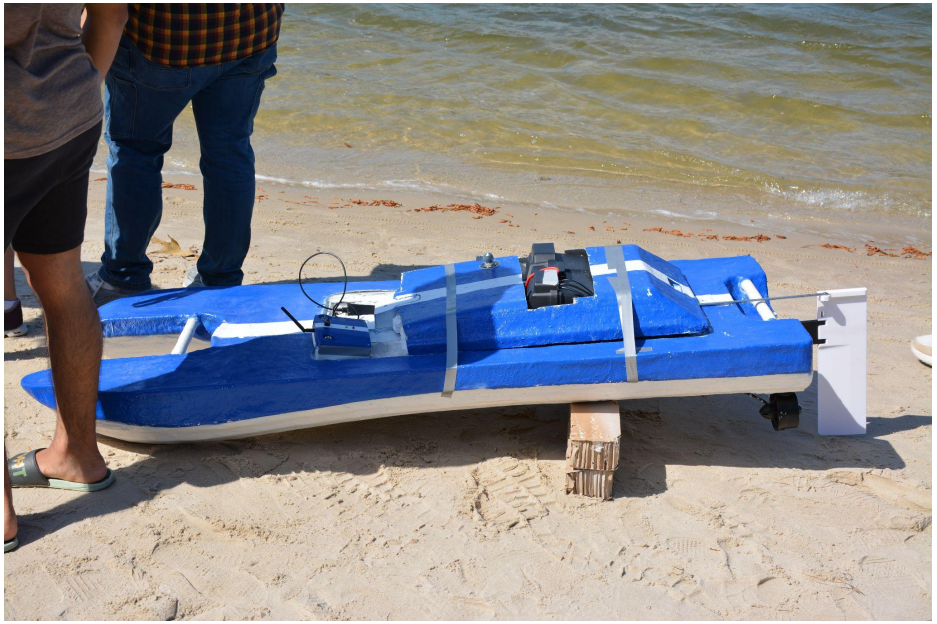
Incorporating Product Design Students

- 7 ECE capstone teams included a 3rd year product design student
- ECE capstone course 2 semesters, Design course 1 semester
- 6 continued together into second semester voluntarily
- Projects all included some mechanical design components: healthcare drone, UAV competition, electric boat competition, pediatric physical therapy projects: modular sensory wall, animal noise toy, 2 adaptive board games
- Our expectations versus reality

Kristi Bartlett and Regina Hannemann, Univ. of Kentucky

Incorporating Product Design Students



Kristi Bartlett and Regina Hannemann, Univ. of Kentucky

Incorporating Product Design Students

Kristi Bartlett and Regina Hannemann, Univ. of Kentucky

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Outsourcing Custom Components

Background

- Capstone Mechanical Engineering Design Course
  - Unique group organization (CEOs, CFOs, CPOs, COOs)
- Design + Manufacturing of concept
- Past semesters struggled with deadlines

About Me

- 12 months manufacturing industry experience
  - Variety of products
- TA for DFM course

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THEISSEN TRAINING SYSTEMS

Peyton FitzGerald and Matt Traum, Univ. of Florida

Outsourcing Custom Components

Semester	Unfinished Parts	Finished Parts	# Technicians	Students Enrolled	# Groups
2025 Spring	5	165	1	110	12
2024 Fall	16	36	2	71	8
2024 Summer	9	26	1	15	2
2024 Spring	2	91	2.5	78	10
2023 Fall	0	32	3	88	13
2023 Summer	0	11	1	22	2
2023 Spring	82	160	3	97	13
2022 Fall	3	121	3	106	15
2022 Summer	0	27	1	13	2
2022 Spring	3	12	3	125	18
2021 Fall	3	92	4	99	4

Implementation

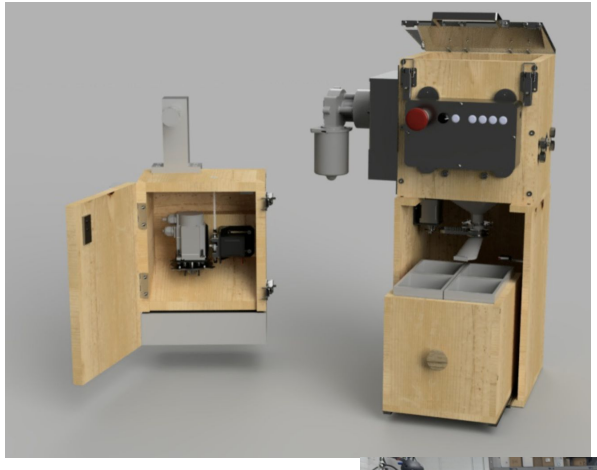
- Goal: create working prototype
- Provided DFM advice and guidelines
  - Major gap in curriculum
- Worked with local fabricators
  - Served as POC until halfway point
  - Outsourced ~85% of parts
- Higher success rate than previous semesters

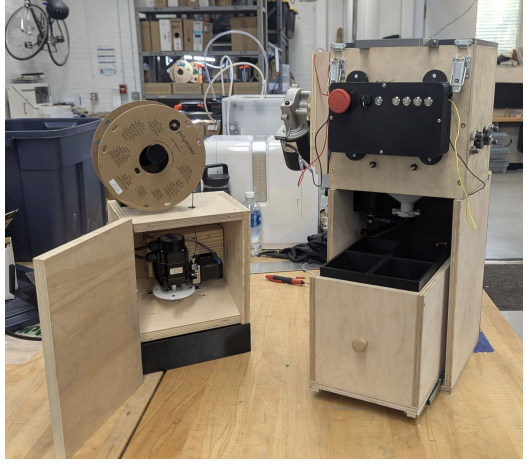
Peyton FitzGerald and Matt Traum, Univ. of Florida

Outsourcing Custom Components

Future

- Trial run proved chaotic
  - Didn’t know what students needed (resources, advice) – created as semester progressed
- Beneficial role for course
  - Liaison between fabricators was key
  - Until curriculum incorporates more DFM
  - Second set of eyes
- Online implementation
  - Offload communication w/ fabricators to students
  - Drawing revision would be critical





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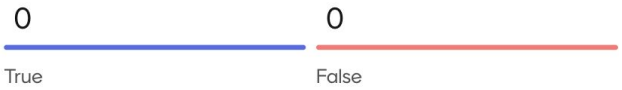
Polling and Design Review Requirements

- The capstone program for Texas A&M mechanical engineering students includes two courses over two semesters
- Lecture and studio component: 3-4 teams/studio, 5-6 students/team
- The first of the two courses, MEEN 401, a writing intensive (W) course
- Three design review (DR) reports
  - DR1 report individual effort
  - Students given an opportunity to revise based on studio instructor feedback
- Requirements clearly provided to them via the online learning management system
- Students did not follow the requirements closely for DR1 report in Fall 2024
- Mentimeter used to develop several true or false questions covering the requirements.

Polling and Design Review Requirements

True or False: Your studio instructor knows the course concepts. So you do not need to define SNPS, mission statement, etc. in the DR1 report.



True or False: In the Problem section, you must write a coherent explanation of how your technical questions lead your team to its mission statement.

True or False: In-text citations should be numbered in alphabetical order of the list of references.

True or False: Figures in the appendices are labeled as Figure 1, Figure 2, etc.

Arkasama Bandyopadhyay, TAMU

Polling and Design Review Requirements

- Students responded to the polling questions in studio.
- After the active participation, students followed the requirements of the revised DR1 and DR2 reports better.
- Studio instructor feedback on the first iteration of the DR1 report likely played a significant role in the results.
- Menti questions likely aided in student engagement and long term retention of the information.

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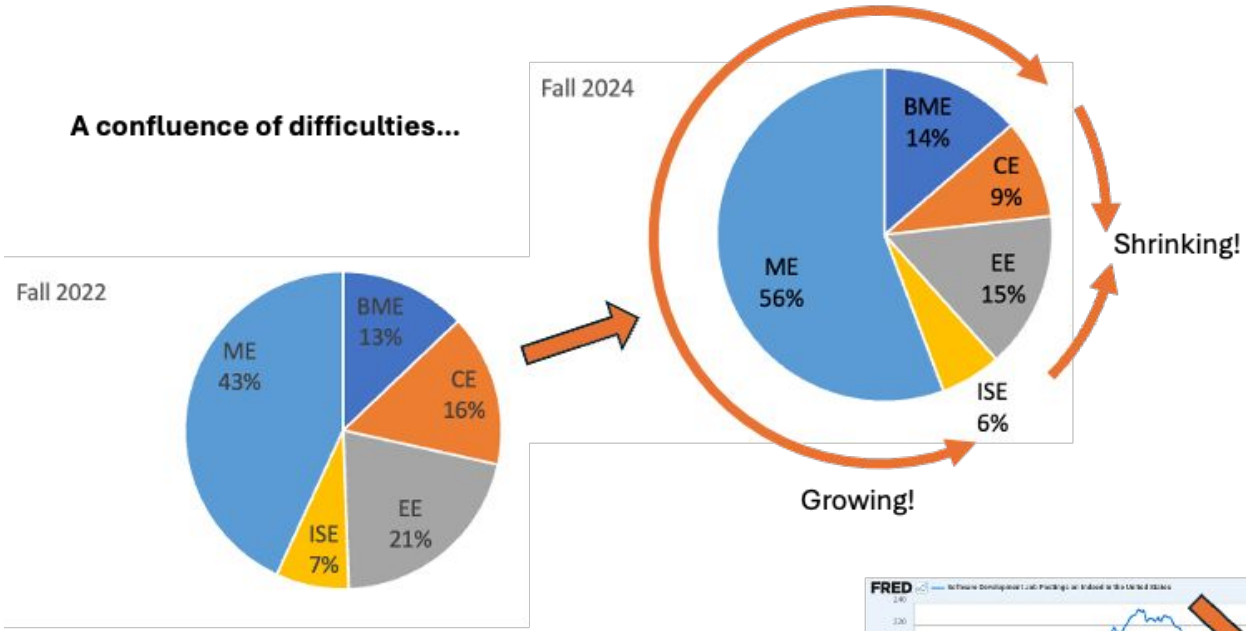
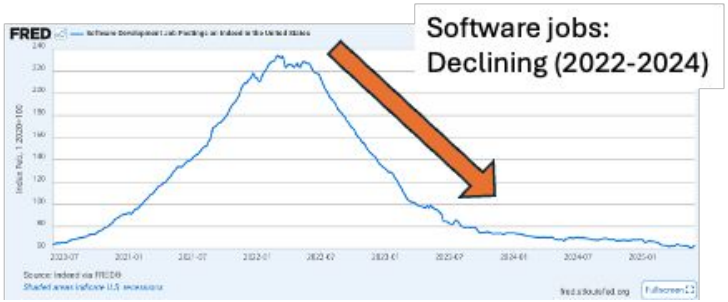
Hiring Computing Co-op Students



- Enrollment trends changing (surprise!)
- Job market difficult
- How to staff multidisc. projects?

Context:
- Large multidisciplinary capstone program
- Co-op school



Beth DeBartolo, RIT

Hiring Computing Co-op Students

Idea	Pro	Con	What to do?
Find more mechanical-focused projects and cancel some CE/EE focused projects	Fits our available student enrollment	It's kinda late…	OK to proceed, but still need other options
"Mechanical Engineers, you're going to learn a lot of new stuff for your capstone project!"	Makes for a good story for ME students in job interviews	A tall order, many projects are just too complex to expect novices to do advanced work	OK to proceed, but still need other options
Hire co-op students from College of Computing to fill gaps	Expertise in programming, software system development, and embedded systems; each student can support multiple teams	Getting "paid" in credit ≠ getting paid in money. Will engineers be bitter and resentful?	No other scalable ideas, so let's do it!

Hiring Computing Co-op Students

- Co-ops were paid, working on average 30 hours per week (estimated 10 hours per week per team)
- Funded with revenue from paid industry-sponsored projects
- Each co-op supported no more than 1 industry-sponsored project (avoid IP conflict of interest)
- Engineering students were uniformly happy to have the support they needed to get their projects done
- Computing students were happy to have meaningful on-campus jobs in a tight market
- **We're doing it again this year!**

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Ungrading in Capstone - Background

Capstone (ideally) emulates the real world practice of engineering, BUT the real world practice of engineering doesn't get grades.

Alternative Grading - umbrella term

Ungrading - one method of alternative grading

Instead of giving grades throughout the term, give formative, detailed, feedback as often as possible. Then coach the students in assessing themselves.

Shaz Vijlee, Univ. of Portland

Ungrading in Capstone - In Action

Students are informed that we evaluate four categories in Capstone: Professionalism, Communication, Technical Ability, and Project Management

Each category has about 5 requirements, and each requirement has three ratings.

Category

	X. Low Rating	Y. Medium Rating	Z. High Rating
1. **Requirement**	Description	Description	Description
2. **Requirement**	Description	Description	Description
3. **Requirement**	Description	Description	Description
4. **Requirement**	Description	Description	Description

Professionalism Requirements

	X. Unprofessional	Y. Needs Development	Z. Professional
1. **Composure**	Over- or under-confident and negatively impacts team morale.	Over- or under-confident and positively impacts team morale.	Calm, confident, and positively impacts team morale.
2. **Participation**	Not actively engaged in meetings. Excessively late/absent. Dominates conversations.	Actively engaged in meetings. Often late/absent or dominating conversations.	Actively engaged in meetings, on time. Not dominating conversations. Provides input in the event of absence.
3. **Receiving Feedback**	Did not incorporate feedback.	Incorporated some feedback in future work.	Always responds to and is open to incorporating feedback in future work.
4. **Communication**	No communication of work/progress to advisors.	Some communication of work/progress to advisor(s).	Frequent communication of progress/work to advisor(s).
5. **Reliability**	The individual left tasks unfinished and did not maintain a high standard.	The individual completed tasks either late or at a low standard.	The individual completed tasks promptly and with high standards.
6. **Initiative**	Never does tasks without being directed by teammates or advisors.	Usually waits on other teammates to assign them tasks when they could easily start on their own.	Self-starter where appropriate. Not overly- or under-reliant on prompts for tasks from the team.

'Requirements Engineering' - Near the end of the term, the students are asked to rate themselves in each requirement and provide evidence for that rating.

Shaz Vijlee, Univ. of Portland

Ungrading in Capstone - Outcomes & Next

Anecdote: From feedback, 'Sarah' was a terrible communicator (maybe a D-)

I gave her feedback and some mentoring. It turns out she was incredibly intimidated by her faculty advisor.

Over the course of the semester, she found ways to improve her communication skills, and her team noticed.

At the end of the semester, she reflected on her experience, and noticed her improvement (and her potential to improve further). She felt (slightly) more confident.

Ungrading helps teach students an application of continuous improvement techniques to use for their entire life, and has incredible potential in an ambiguous class like Capstone.

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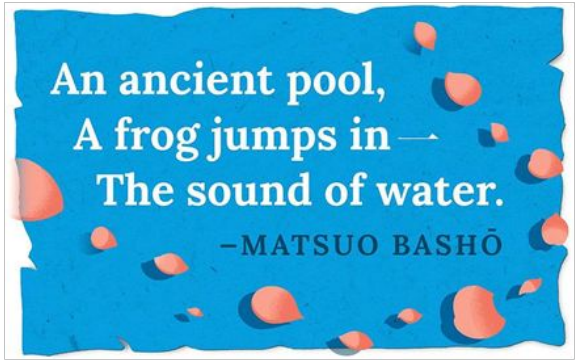
Senior Design Project Haiku - 1

What is haiku?
A short, three-line poem of Japanese origin
… with some rules
… that we are going to ignore.



Traditional Haikus:
- Focus on nature (kigo).
- Use a cutting word (kireji).
- Unrhymed
- **Juxtaposes** two images or ideas to create an unexpected or surprising effect.

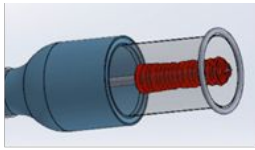
Why ask Senior Design students to create a Haiku for their project?
- An exercise of communication outside of the traditional technical domain.
- We engineers need to improve our communication skills towards non-technical audiences.
- Makes you think of the essence of your project.

Noe Vargas Hernandez, UTRGV

Senior Design Project Haiku - 2

1. Sand has called our name.
   Will we make the cut in time?
   It's now or never.

   Design for a Blood Clot Removal Catheter for Minimizing Vessel Damage and Embolization

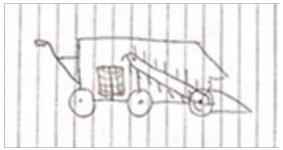


2. Mesquite beans up on a tree
   Pick, pick, pick
   How ‘bout shake, shake, shake

   Redesign of a Filter System for Industrial Machining Fluids

3. The presence of pain,
   Enjoyment hard to attain,
   The ramp eases pain

   Design of a Personal Beach Cleanup Device

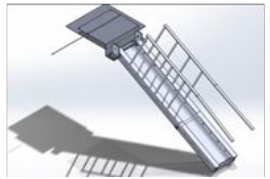


4. clot within the vein
   petals bloom to hold it safe
   peace through soft design

   Design of a Mechanical Mesquite Bean Harvester

5. Filtering life not just water
   Letting tension go
   staying fresh like a mesh

   Design of a RV (Recreational Vehicles) automotive Stair



Noe Vargas Hernandez, UTRGV

Senior Design Project Haiku - 3

one nifty idea
one flop
why stop?

Noe Vargas Hernandez, UTRGV

[3]

Nifty Ideas and Surprising **Flops**

[4]

Virtual Capstone Design Conference 2025

12 June 2025

Facilitator: Susannah Howe

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Image Citations

[1] 14 Clever Ideas from Homes around the World - Houzz
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[2] What to Know about Creating a Living Plant Wall - This Old House
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