Connect with two colleagues at other institutions and gather information about how they think about design and their student experience. Focus on the high level aspects and objectives (because that's what a lot of our discussions focused on).

Villanova (Kat): Zoom call with AD of undergraduate affairs

- [ ] They have recently revamped their first-year engineering course to center around 4 competencies, and one of them is Engineering Design (just like us)
- [ ] Their senior year capstone design courses are individual department-based (just like us).
- [ ] They have been talking about offering interdisciplinary senior design but there is not much energy and effort to make it happen (...almost just like us)
- [ ] They think the key is to get their new revamped first-year course off the ground, then to work to weave design in sophomore and junior years (...almost like us)
- [ ] Design-thinking and implementing design to courses are exciting to those faculty with expertise in Design, but not everyone is that way.
- [ ] Catholic, mission/ministry values applied to design → more effort to implement more topics like design with empathy, human-centered design.

Worcester Polytechnic Institute (Kevin): Email exchange

- [ ] Most (not all) engineering departments use the university-required Major Qualifying Project (MQP) as the capstone experience.
- [ ] It is defined as: "To provide a capstone experience in the professional discipline, to develop creativity, instill self-confidence and enhance the ability to communicate ideas and synthesize fundamental concepts, every student must complete a Major Qualifying Project (MQP).", with more info here.
- [ ] Civ/Env Eng tries to have teams of 3-4 for the MQPs and 1-2 advisors per team, but smaller and larger teams happen on occasion. Individual MQPs are rare in Civ/Env Eng, but common in other departments.
- [ ] Design experiences and activities are also included in courses outside the MQP/capstone. Those courses would typically be junior or senior level. Products of that work vary by course and instructor.
- [ ] For the MQP, each team prepares a report and poster, the latter of which is presented at a campus-wide one day event. Posters are 'judged' by outside stakeholders, and finalists do a short snap talk for a cash prize.
- [ ] For Course grades - only four choices: A, B, C, or No Record. NR is as if they never took the course; doesn't go on transcript. So, no impact to GPA, but wasted tuition in a sense.
- [ ] For Project grades - A, B, C, and NR as above. But also:
    - [ ] SP for satisfactory progress, a temporary grade since a project extends across three 7-week terms,
    - [ ] NAC for Not Acceptable for Credit - this one does go on the transcript and is only used if the student has done something to publicly reflect poorly on other students, a client, the university, etc.
- [ ] My contact thinks students are primarily using AI for being lazier with research, rather than what it could do productively.

- [ ] Also, they have seen team skills decline over the last 10 years, due to screen dependence and the pandemic. Some students have personalities and privileges that have allowed them to bounce back; others have doubled-down on screens and further retreated. More face-to-face time is needed to restore imagination and communication abilities.

More info about their global projects (separate from design):
https://wpi.cleancatalog.net/global-projects-program

Carnegie Mellon CEE faculty (Deborah): phone call 7/23

- [ ] CEE Department has a sequence of four courses with design projects.
- [ ] Year 1:One semester 12 unit (a unit is an hour of work) class. Explore CEE, open to CEE and other engineering students, design projects including project management.
- [ ] Year 2: One semester 12 unit (a unit is an hour of work) class. Design process–only for CEE students, more focused on CEE specific projects and more in depth than Year 1 course.
- [ ] Year 3: One semester 12 unit (a unit is an hour of work) class. Design projects with real clients, covers (in addition to design) working with clients, stakeholder engagement, and ethics.
- [ ] Year 4: Senior Design Capstone. One semester 12 unit (a unit is an hour of work) class. One large project for all CEE students (30 to 50), Different aspects of project are assigned to students based on their interests: e.g., structures, environmental, water, geotech, etc. They try to incorporate everything learned in years 1–3 and build on that.

ECE Chair @ Rose Hulman (stu): meeting 7/18

- [ ] Strong focus on “systems thinking” - managing complexity through abstraction, impact of decision to other aspects of the system.
- [ ] Shifted focus to systems about 10 years ago due to employer feedback.
- [ ] Overall design is a lot about collecting, refining, and using information to make decisions in an iterative manner. Develop questions and seek answers.
- [ ] Major aspects:
    - [ ] Value proposition - who cares? What do they want? Stakeholder needs.
    - [ ] What does it have to do? Developing requirements, I/O and associated processing.
    - [ ] The creation itself
    - [ ] Verify against requirements and validate against stakeholder needs.
- [ ] Not a sequential process
- [ ] Experiences across all 4 years, all team-based projects. Senior design is client based, as well.
- [ ] Challenges - teamwork. Adopted Google’s Project Aristotle approach. Focused on psychological safety.
- [ ] Signature aspects: systems thinking and psychological safety
- [ ] Future? Minimize models used. Continually improve support for teamwork and conflict management.

ECE Chair @ The College of New Jersey - Stu (7/19/2024)

- [ ] Strong focus on the system that is created and how well it meets the requirements; communication of ideas in various forms; teamwork; evaluating the impact of the design on society, etc (this didn't come up much in the discussion so I'm not sure how serious the focus is). "Does it work?" was the phrase that come up again and again.
- [ ] Multiple design experiences across the curriculum. Most are specified projects with particular constraints; not much student agency. Limited scope of the projects.
- [ ] Teamwork for most of the experiences. A focus on "team contribution" which translates to the particular contributions of the particular person; little focus on team health, as a whole.
- [ ] The students are exposed to aspects of project management (budgets, planning, etc.) as well.
- [ ] They are evaluated on the above as well as potential solutions and decision making and communication of ideas.
- [ ] Capstone projects are a collection of faculty submitted projects and they will take really good student proposed projects from time to time.

Western University of Ontario, Mech Eng Faculty (Kevin): email exchange

- [ ] Design introduced in the first year in a common course, including a 'philosophy of design.' Includes "multiple team-based projects."
- [ ] That philosophy of design is not rigid, but the faculty there seem to have embraced the broader mindset of "design thinking," in the opinion of my colleague.
- [ ] After that course, continuation of that common design approach is "uneven across departments." But, some maintain a longitudinal structure to including design throughout their curriculum:
    - [ ] *In mechanical, for example, there is another design course in 2nd year called "Product Design and Development" which focuses on the mechanical design process (e.g. design specifications, constraints, concept generation/selection, detailed design, simulation, design for manufacturing/assembly, life cycle engineering). In 3rd year we have "Mechanical Components Design" which goes through specific design topics like gears, shafts, bearings, bolts, welding, etc. that are specific to mechanical design.*
- [ ] Regarding products of design: Common first-year course, as well as the Mech Eng courses described above, include low-fidelity prototyping. Capstone also includes several presentations and final poster.
- [ ] Assessment is numerical grading on 0-100 scale.
- [ ] Students seem to be embracing use of AI as a tool but are not well-equipped to judge its output, so that is something they continue to work on.
- [ ] With regard to team and student skills, communication needs more work than ten years ago.
- [ ] Writing and presentation skills are not as strong in entering students and, while improved by graduation, are still not as good as they would like.

Iron Range Engineering (Alan - advisory board)

- [ ] Curriculum is entirely project-based, de-emphasize content-based courses.

- [ ] Multi-year projects - integrated at multiple points into the curriculum.
- [ ] Industry-sponsored including internships
- [ ] Not “toy” projects, have real access to top-quality fabrication space. Flying cars, snow-mobiles, exercise equipment.
- [ ] Strong focus on professional development of students not just in design courses but across the entire curriculum.
- [ ] Student-driven - try to build agency and professionalism through projects.
- [ ] Qualitative evaluation on a regular basis by a team of faculty mentors/advisors.
- [ ] The students are not typical Bucknell or engineering students, this program is designed to train local residents to be engineers, not at all about academic status.

University of IOWA - Program for Enhanced Design Experience (PEDE) - (M. Laura - taught as Post-Doc)

https://engineering.uiowa.edu/me/senior-design-projects/pede

- [ ] Multi-disciplinary experience established in 1994 (mainly mechanical & industrial engineering);
- [ ] “Application of mechanical, thermal, fluid systems design; student or team design projects initiated at various levels in the design process and carried through to higher levels; emphasis on synthesis, written and oral communication”. - from their website
- [ ] Faculty with interest and consulting experience participate - ONE coordinator w/TA formally assigned;t
- [ ] have a team of faculty advisors & teaching assistants to aid students or serve as technical advisors as well as panelists for periodic design reviews;
- [ ] budget is 25-50K;
- [ ] two-semester sequence with 4 student teams;
- [ ] main design decisions are made by students with client input
- [ ] students earn full credit for two-semesters;
- [ ] industry liaison will contribute to final grade;
- [ ] not all students have had the same coursework - some are strong in design and others strong in management and/or computer science;
- [ ] full working prototypes are delivered to clients;
- [ ] industry partners are a team with 3-5 year contracts and return every year;
- [ ] students come one-week prior to the start of the semester for a jump-start week where they stay in hotels and spend time in the company learning context and skills needed to succeed in industry.

Design experiences in chemE (Lafayette, Northeastern, Colorado, RPI, Rose-Hulman, CSU) - Brandon

No responses however I looked at websites
Northeastern does basically exactly what we do.

https://www.youtube.com/watch?v=Kwu25sNb1Gs

Lafayette

CHE 416 Green Design Analysis

One of the central roles of chemical engineers is to design and operate chemical processes yielding chemical products that meet customer specifications. Metrics for success include profit, but increasingly also incorporates sustainability. This course provides students with the fundamental tools needed for process design and practicing the principles of green engineering. Specific topics will include regulations and safety, heuristics, simulation software, economics, impact assessment, and life cycle analysis.

Prerequisite

CHE 324, CHE 411

CHE 422 Design Synthesis

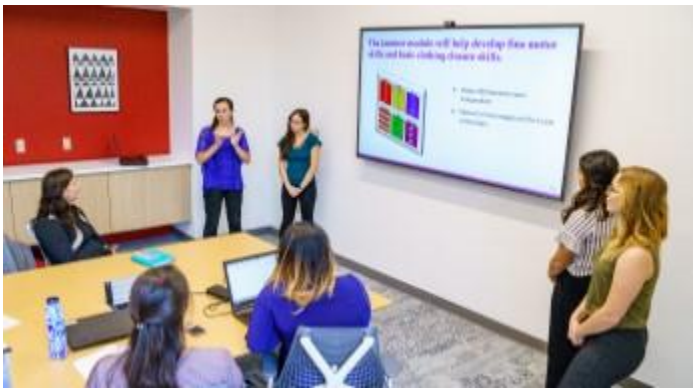
This capstone design course provides opportunities for the application of all prior course work in the resolution of an industrially realistic or derived chemical process design problem in a team format. Teams demonstrate a practical ability to define the required technical challenge, develop relevant criteria to evaluate alternatives, and present the resolution of the technical challenge in both oral and written formats.[W]

Colorado have had experneal client design for 25 years. Do similar to what we do
https://www.colorado.edu/chbecapstonedesign/

- [ ] Develop alternatives to freezing bulk solutions of protein therapeutics in bags or plastic bottles for stability during shipping and storage.
- [ ] Environmental feasibility of a idstream oil and gas processing facility
- [ ] Dry ice supply for mRNA vaccine products
- [ ] Disposable wound protector device
- [ ] Design a 50 L bioreactor and optimize a bioreactor seed train

Rose
https://www.rose-hulman.edu/career-services/for-recruiters-and-employers/Partnership-Projects/capstone-and-senior-design-projects.html

- [ ] project liaison to give timely feedback
- [ ] Projects may require financial support to cover items such as materials, prototypes, travel expense, equipment use, and administrative costs



Our students will:

- [ ] Devote 6-12 hours per week to your project, depending on credit hours awarded
- [ ] Provide frequent project updates
- [ ] Share their results in a formal paper, prototype or presentation

CSU
https://www.engr.colostate.edu/cbe/student-resources/senior-design/
Use industrially relevant projects, paper based

Chemical Engineering design ppt
Ford Versypt FOCAPD 2024.pptx

LAPSE:2024.1639

The Current Status of Process and Product Design □ What and How to Teach □ and a Vision for the Future

Warren D. Seider, Daniel R. Lewin

July 9, 2024

Published Article

LAPSE:2024.1639

Process design is a core component of chemical en-gineering education and either involves or is followed by an extensive design project in most schools. The design project is often considered a core activity in the educa-tion of future chemical engineers because it develops their skills in creative and critical thinking beyond the boundaries of their acquired knowledge, as well as training them in teamwork. Such skills are likely to be crucial to empower students to develop process technologies that respond to the relevant future challenges in process design. These future challenges include accommodating alternative raw materials and energy resources, addressing sustainability concerns, and arranging production schedules that are more flexible... (ABSTRACT ABBREVIATED)

Record ID **LAPSE:2024.1639**

Keywords Education, Process Design, Product Design

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