



<virtual> Capstone Design Conference 2025

Thursday, June 12, 2025

1:00-5:30pm EDT

Session 2 Scary Numbers

Panel 2: Scary numbers - rapid scale-up and scale-back impacts on capstone (2:30-3:40 PM Eastern)

Panel Info:

Facilitator: Bridget Smyser (Northeastern Univ.)

Sidekick: Joanna Tsenn (Texas A&M University)

Panelists:

Kurt Stresau (Univ. of Central Florida)

Jim Hartman (UNC, Charlotte)

Allyson Gibson (Brigham Young Univ.)

Notes:

- **Kurt (UCF):** 700 students per year in AE/ME, 2000 across the college
- Allyson (BYU) 450 students, ME, MFG, EE, CpE, Cyber, ... Role is external relations and project coaching
- Jim (UNCC): 410 students in multidisciplinary program—approximately 70 projects/year

How fast did your program ramp up and what was the biggest challenge?

- BYU: step function growth: 1990 ME & MFG, 2017 added EE/CpE. Challenge translating resources across different engineering disciplines (from ME/Mfg to ECE, etc.)
- UNCC: replacing the sponsor attrition is ongoing challenge—tariffs make
- UCF: steady 9-10% CAGR over the last 10 years; freshman and sophomore growth—54% in AE/ME

How has space caught up (or kept up...or not?) with the growth? How do you manage the physical space constraints as you get more students?

- UNCC: 4th space in last 10 years; impressed upon administration that safe spaces were needed because of liability (don't want students doing work on required projects at home); lots of scrambling to find new space; off-cycle projects start in January causing a crunch as August projects are in the build phase 10ksf

- UCF: liability case, students DO do work at home –don't buy the students tools; capital plan–got approved for a 20,000 sf space for capstone; will not meet planned growth needs; a new pitch for a 100Ksf innovation center
- BYU: most of the product/physical space is in the new building
- Shraddha (Rose-Hulman): We use hot-spaces. Originally we didn't like the idea but it is getting popular amongst students. What we mean by hot-space is that there are 20-ish tables in the room and 40ish carts assigned to teams in a large room. They can use the table when they are working and then store away the projects when not actively being used.
- Follow-Up Q: **Sq ft/team allocation?**
 - UNCC: not specific allocation but keep space flexible so you can rearrange as needed
 - BYU: similar
 - UCF: based on the need for a given project; project storage space is vital. The conversation is not just about having space but using space intelligently

What are the biggest challenges for student management?

- UCF: student slacking, social loafing; mentors are key–those that can spot the loafers, insuring everyone is doing their job; be careful having faculty who don't want to teach traditional courses–you can be a dumping ground for faculty who don't want to interact with students
- BYU: one coach per team traditionally–hard to find new coaches and pay them; insuring that all students are participating and trying get them re-engaged
- UNCC: consistent mentoring; industry adjuncts work great; research faculty are less capable of discerning student effort because of research/faculty load; don't have faculty grade–have a smaller number of graders; free-riders are frustrating for the students that are driven hard by their mentors; need faculty with hands-on experience
- Keith Epstein (UVM): I encourage team members who struggle with slacking team members to understand why. What motivates them, if not grades? Everyone can be a leader if they understand what motivates their teammates. I offer to step in if needed to help, but encourage the students to think of this as a leadership development opportunity and try themselves first.

Audience Questions:

David Schmidt (UMN BBE). Panelist question: **All our capstone programs here are single-disciplined siloed by department. What are the benefits of multi-disciplinary? Who pushed that transition?** I envision lots of turf wars.

- Mark Anderson (RPI) - I believe ABET requirements drove the original multidisciplinary approach. ABET has changed their wording in the most recent 'update' tho we still run multidisciplinary teams where appropriate / possible. After much wrestling, we now have a single program independent wording for all the participating programs who, due to the way the system works, each have different catalog numbers for the course. A benefit is the ability to have 7 person teams.

Pkirby: **So what do you do if you find out a student is not holding up their agreed upon work within their team? Can the team get rid of a student who is slacking after initial conversations to potentially address issues/needs?**

- Mark Anderson (RPI) - no, students are on a team for the duration. Last semester we introduced specific individual metrics that helped document those students where previously it was anecdotal.
- Alan Cheville: I've had a lot of success with having larger teams with an assigned undergraduate student project manager. We meet with PMs weekly to get updates on team function and status.

Rachana Gupta: **What are typical teams to mentor/instructor ratio?**

- Bridget: 3 teams count as a course
- Panelist comment (Kurt): be careful of setting these so capstone doesn't become a dumping ground for research faculty who need course credit and aren't fit to advise teams
- Mark Anderson (RPI) - we have a staff + faculty person per team of 7 students.
- Chris Bohn (UNL)- each project as a faculty member and a staff project manager. The faculty members typically supervise 5-6 projects per year (driven by courseload equivalency); the PMs typically work with 10-13 projects per year (driven by scheduling difficulties if they work with more).

Tim Kennedy: **What does compensation look like for coach/mentors?**

- Stanfill (UTK): I pay \$3000 to mentor a project—used for summer salary or partial buyout; business coaches are paid out of donor funds; \$1500/ team
- Keith Epstein (UVM): Used to be nothing, but I now give \$100/year voucher to take team out for snacks/drinks on campus.
- Robert Hart (UTD): We pay \$1500 per semester (\$3K total for a two-semester project). This is funded from project sponsorship fees.
- Beth DeBartolo (RIT): about the same as UTK and UTD (a little less, \$2700ish?), but we arrived at that using our institute adjunct hiring guidelines and figure 3 teams=1 course.
- UCF: \$20,000 sponsor fee to support the program (not the project); adjunct faculty hired to do mentoring \$2500 per project (over 2 semesters); have some coaches mentoring 5 teams that are doing the same project—like a competition team; only one will get to go to the competition (like SAE Aero competition) or internal competition with outside judges—all teams do competitive performance testing
- BYU: coaching model, \$7000 to \$8000 to pay for coach—will likely cut that in half; all adjuncts paid from sponsor funds
- UNCC: pay adjuncts \$1750/semester/team adjunct 2-4 hours per week per team; faculty: 3 projects get release for one course

Roberto Lopez (Franciscan U): **Is there any lecturing done during capstone sessions or are these fully devoted to project work and progress reports?**

- Keith Epstein (UVM): I do 30-45 minutes per week of lecture/updates/guest speakers/student share, out of 6 hours/week total. Most of the time is used for team work in the lab. There are many videos on specific design-related topics that students watch and take quizzes on before doing many of the deliverables.

- Chris Bohn (UNL): Class time is project time, but there are workshops that the teams need to do, which look like a mix of virtual lecture and working on some part of the project's plan (developing a vision, roadmapping, preparing a test plan, etc).

Roger Hilten: **What does the in-class experience look like for these larger programs?** We have 240 students in Ag-ME capstone. Sometimes we're all together. Sometimes not. Engaging that many students is tough. How do you manage?

- BYU: broken into teaching pods where the faculty teach their pod sections—keep it consistent
- UNCC: one classroom; limit the number of F2F lectures to the big messages; virtual lectures for the more skill-based topics
- UCF: 500 capacity classrooms (70,000 students on one campus), course follows product design and systems engineering; JIT for project deliverables; dozens of project advisors meet weekly to get the students team-based feedback

How do you cover ABET issues like engineering standards?

- UNCC: devote lecture to standards, responsible to design to standards and codes, industry sponsors teach the teams what standards they need to complete the project; have to buy the standards...
- UCF: need to be stronger than we are... it is challenging; as program grows, the diversity of projects grows and the applicable standards are divergent, too. Push for written reports to include mandatory sections like codes and standards—discuss successful negatives and required—make it relevant to their project
- BYU: focus on the standards that are applicable to the project; assignments based on the specific projects
- Keith Epstein (UVM): We have a prior art review lesson, quiz, and team deliverable that was developed in partnership with the university library (research librarian). It covers patents, standards, and papers.
- FWIW: ANSI University Program: <https://www.ansi.org/education/activities/standards-university-outreach> lots of standards available for free upon request. Also, check with university library to see what they have

Maria Elena Chavez Echeagaray: **Are all the mentors/coaches faculty members or do you consider graduate students?**

- Robert Hart (UTD): We have used faculty, grad students, and practicing engineers. We did a multi-year survey of student feedback about their mentor. The results are in a paper presented at the 2024 Capstone Design Conference.
- Mark Anderson (RPI) - we have a chief engineer (CE) / project engineer (PE) approach. The chief is faculty, the project engineer is a staff member in our group. The PE typically spends more time with teams, so support up to 2 teams in each of up to 4 sections. CE's might have 3 teams but typically for only one or two sections max. We usually have one TA for misc support.

Hadar Ziv: **Is it required/expected to compensate industry mentors, or is it more based on their good will, being an alum, etc.?**

- Kurt/UCF: All projects have mentor. They're paid \$2500/team for a two-semester sequence. Want to have each mentor oversee 2-3 teams.

Melodie Lawton: **Any challenges with students distracted by their department research projects, other courses, visiting grad schools, attending conferences, senioritis, etc? If so, how do you address this?**

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How do you allocate the funds to a project?

- UCF: past history is a guide; for Brave New World projects: team has to develop a proposal; for sponsored projects there is a built in threshold with a way to ask for more; built a tool into JIRA to manage purchasing
- BYU: \$1500 budget built in, and invoice the sponsors at the end (\$22,000 sponsor fee).; have a staff that does all the purchasing; order system approved by mentor/coach and staff orders
- Mark Anderson (RPI) - we also use student purchase requests. I joke with students that your budget is \$0, because otherwise they might think they have to spend the budget amount. Instead, we explain that unlike a previous design course, we pay for all materials - but you have to budget and justify all purchases, all must be signed off by our staff member. Rarely do teams need \$1000. If materials are to be delivered to a client afterwards, we usually ask them to purchase those and drop ship to campus.
- UNCC: \$9,500/project and \$3250 for travel and supplies; have to renegotiate with the sponsor—Either get additional funds or dial back on the deliverables; students turn in a purchase request, coach approves, staff orders and charges back to project
- Jenn Carlson (UM MDP) Our teams get a standard budget of \$3k out of a \$24k fee. Some use it and some don't (we have all kinds of projects including CS, DS, etc). If we know a project needs more (a robot-drone project) we get that from the sponsor directly. That sponsor purchased the robot and drone for the students and the budget went towards sponsor travel and sensors, etc. We have 20-25 teams each year. We have an admin who does the purchasing on the students' behalf. (similar to how Jim at UNCC is describing his process)
- Keith Epstein (UVM): Depends on the size of the company, but it's about 50% of the total fee charged to the company. We use a web-based tool called Precoro for students to create POs for a staff person to order and track the receipt of orders.

If you can't get enough industry sponsors, what do you do?

- BYU: facing that now! This year, focusing on humanitarian projects. Outreach to alums seeking project ideas and separately seeking sponsors who are willing to invest in a humanitarian project. In progress, but looking good so far.
- UCF: Strong believer in student motivation. Surveys students in advance of course re their passions. Drones, assistive devices, therapeutics, robotics. Keeps the data year over year and goes back to it occasionally to generate 1-pagers for "project of need" that he may be able to turn to in the future. Competitions also, can update entries from previous years.

- UNCC: for last few semesters, even had to turn some away. Not so this year - now looking for different ideas. Likely competition projects and dept-created projects. Hasn't yet put multiple teams on the same sponsor's project (especially given funding limits and expenses for building). May increase number of students per team (recognizing that it's very corrosive if everyone has not enough work)
 - At RIT, I've had students tell me afterward that they were really happy to have been on a department-sponsored project (like lab hardware) because they could graduate feeling like they had made an impact on the university. We were afraid they'd feel disappointed about not getting a company project, but we were wrong!
- UTK: ME department does 6 to 8 Battle Bot competition projects each year for filler projects
- Mark Anderson (RPI) - we maintain a list of internally generated projects - just in case! We also solicit projects from faculty that support their research or coursework.

What's the best advice to someone you can give about scale up (or scale down)?

- UNCC: plan ahead so as not to have to beat the bushes at the last minute for project ideas.
- UCF: not sure anyone has had to scale down... UCF is looking at massive scale up! 14,000 students currently with a plan of being at 20,000 by 2032. Did shift to a year-round program: start projects in August, January, and May. (Keeps spaces utilized all year long).
- BYU: Adding in new disciplines contributes to scale up - try to be aware of needs/feelings of the students. Many opportunities to offend if things have been written for a previous group/discipline. Aim for inclusion.

Roger Hilten: We do as many interdisciplinary projects as we can. The scale down issue we face it that our EE and CSEE programs are not growing like ME. We can't staff our interdis projects adequately. **How do your programs deal with imbalances across disciplines vs project needs?**

- Jenn Carlson (UM MDP) We are a non capstone multidisciplinary design program. We are at the mercy of student supply and demand and that becomes a consideration when taking projects. We don't have a ton of ChemE/MSE so I can only take max one of those projects or I might not be able to fill it.
- Kurt Stresau (UCF) I hired more adjunct faculty with experiences in mechanical engineering design, now 36 adjuncts
- Beth DeBartolo (RIT): We have exactly the same problem - I hired some co-ops to fill the gaps.
- Mark Anderson (RPI) - to Jenn, you might consider accepting Chem/MSE only on a student population contingency basis. No students, can't do it this semester, but thank you.

Lightning Round

- UCF: growth is coming; it becomes a management challenge that we weren't trained for; communicate with other programs that have grown-the information is out there and learn from others. Do not go it alone! It is unlikely that I will encounter a headache or speedbump that others in the Capstone Design Community have not encountered.

- UNCC: Survey your constituents often to understand their level of satisfaction—students and sponsors; read all the responses—be open to changing; coach the students to be specific about what they are dissatisfied with—don't say "we don't have enough tools" instead say what tools are needed. Even as a 20-year-old program, they're making changes every year. Industry, Student and Faculty feedback drive the program changes. The Capstone Conference is a great source of information and compare notes with. Come to TAMU next year! The Capstone Conference is GOLD! Helps to talk to your dean: here are 10 universities that are doing X, can get support for what you'd like to do.
- BYU: be agile, be willing to try things and see how they work. Some things may fail -but do not be afraid of failure such that it paralyzes you. Leverage best practices and tailor them to your program.