Virtual 2021 Capstone Design Conference
June 9, 2021 - 1:00-5:30 PM Eastern

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Capstone Design Conference 2021

Wednesday, June 9, 2021
1:00-5:00 PM Eastern

Nifty Ideas & Surprising Flops: Discussion

Facilitator: Susannah Howe (Smith College)
Presenters:
1. Sid Deliwala (University of Pennsylvania)
2. Robert Hart (University of Texas Dallas)
3. Shraddha Sangelkar (Rose-Hulman Institute of Technology)
4. Edward Latorre (University of Florida)
5. Beth DeBartolo (Rochester Institute of Technology)
6. Rachana Gupta (North Carolina State University)
7. Charles Radovich (University of Southern California)
8. Kris Jaeger-Helton (Northeastern University)
9. Jamie Canino (Trine University)
10. Todd Polk (University of Texas at Dallas)
11. Susannah Howe (Smith College)

→ Put Discussion notes after each presenter

1. Micro Design Course Sequences before Senior Year - Sid Deliwala (UPenn)

- Senior Design 30 sec videos on slide : GRASPER, PHAOX, EQUALMODEL, GLUVO
- When are the courses offered? How many credits?
    - Design Courses offered every year. There are minimum of 2 courses every year.
- Have you tried using peer evaluations to help with communication and team building?
    - [Beth DeBartolo, RIT] It's easy to incorporate peer evals; it's harder to incorporate them in a productive way. But done well, they're critical to team function.
    - [David Ullman] Scrum methods can help with team building and retrospection
    - [Vernon Ulrich] Teams of 6 to 8 work better for forcing teamwork; Peer evaluations are critical
    - [Michelle Londa, Texas State Univ] Embed more project based learning in courses prior to senior design
    - [Todd Polk] We use peer evals and they have proven to be very effective. Helps us as instructors locate poor performers to help them improve
    - [James Rains, Georgia Tech] Peer evaluation results do not have to be shared directly with students. There is value in only the teaching team review the evaluations, and then take action/intervene as needed.
    - [Seth Martin] I use https://peerassessment.com/
    - [Rob Ryan] At Temple, we have been using EduSourced in Sr Des (other courses also use CATME. I share the numeric scores with students in SD but all narrative comments are to faculty only
    - [Steven Beyerlein] I would be careful about approaching team feedback with an evaluation mindset that communicates raw judgement. I would recommend an assessment mindset that is more continuous improvement oriented. An assessment mindset focuses on identifying strengths and improvements asking for supporting data and action plans for each team member. IMO It is ideal to have a follow-up debriefing session with teams to discuss team assessment feedback.
        - [Keith UTK] Seconding that; if it is a faculty-coached team, have the coach share the feedback privately with team member and set goals for closing the differences in expectations among members
    - [XXX] Parker Team Player Survey for bonus points: https://www.psychometrics.com/assessments/parker-team-player-survey/
    - [Jenn Carlson] Do you find students participate when it is optional? is it for credit?
        - [anon] Making it optional encourages more people to submit
- [XXX] Thank you, Sid! Your point about starting technical communication curriculum early on resonates really strongly!
- Do the design courses in sophomore/junior year come from external sponsors, or are they framed entirely by the course instructor?
    - All by course instructors

- How to avoid possible duplication of concepts/taks?
  - It does happen but it still allows them to design
- How to support students developing presentation skills?
  - [anon] I feel that this task is all too often outsourced to Soc Sciences / Humanities instead of being owned by Engineering programs.
- Are the students required to present their micro designs in front of others? Group presentations require students to work together collaboratively. Also, peer review for me means all students reviewing all other students anonymously and while guided to provide constructive feedback. We don't use peer feedback to decide grades, but to allow students to get many points of feedback. If it is anonymous, structured, and has clear guidelines, it doesn't trigger issues.

2. Getting to Know Each Other - Robert Hart (UT Dallas)
- [Keith Stanfill, UTK] UC-Boulder uses an early assignment: take a photo of the team sharing a meal and label each person on the photo. Could be as simple as eating a doughnut… teams that struggle with this activity typically struggle to work together
- [Dustin Rand, UVM] We did this at UVM prior to Covid and the deliverable was a 2 min video that required an intro the project, the team (including one unique thing about them) and the problem they are going to solve.   I think this worked well.
- [Rob Ryan, Temple] At Temple, we have been using EduSourced in Sr Des (other courses also use CATME. I share the numeric scores with students in SD but all narrative comments are to faculty only
- [David Schmidt, UMN] The Five Dysfunctions of a Team has some good ideas. Not about getting to know each other in the beginning but more on getting to know everyone's goals for the project and how each person has different styles. My lecture is titled "I HATE TEAMS"
- Other "team bonding" ideas:
  - [Jay Goldberg] You can ask teams to create a team logo. We had a team create golf shirts with their logos.
    - [Steve Beyerlein, UIdaho] Excellent self-contained team creativity idea that promotes team identity.
  - [Keith UTK] we do the same--team name and logo assignment
  - [Steve Beyerlein, UIdaho] Or asking a team to come up with a team name that they wouldn't be embarrassed to share with their grandmothers by the end of their first session together.
  - [Rod Wetterskog] Try an Escape Room!
- Question: Do you find students participate when it is optional? Is it for credit?
  - At UT-Dallas it is required, but we do not grade it. It is just to help them begin to bond and get to know each other before choosing a team leader.

3. Cancelling Kick-Off Project in Hybrid Mode - Shraddha Sangelkar (Rose Hulman)
- [Shraddha Joshi] Can you talk about how you adapted the kick-off for virtual environment?
    - A: The building part of the activity was cancelled
- Can you talk more about avoiding the checkbox mentality?
    - A: They need to move through the design process quickly, leaving very little time for iterations.
- [Steven Beyerlein, UIdaho] Do you feel that the two-week session is a repeat of a process students have addressed in a previous class?
    - *A: They saw process in freshman year*
- [Dustin Rand] I find that anything that is not directly related to their project is not well received. So any and all exercises should be applied to their project (students opinion).
    - Totally agree, I have the same experience. They think it is burdensome and a waste of time. We did collect motivation data 2 years ago. It was surprising that a lot of students indicated that they are doing this activity because they think it is good for them (not because they want to).
- [Sid Deliwala] most senior design projects still make most progress in last month (: Sometimes I wish we could do 2 senior design projects so from Fall semester they can take lessons leaned and use in Spring. They may appreciate agile process after their first attempt. Q: Anyone think 2 senior design projects in one year to teach design process a good idea?
    - This is the eternal problem with senior design - for the topics that are new and challenging, it's not unusual for students to appreciate it after they've had a chance to try it once. Rather than do two projects, we just wait for the "hey, that was really useful!" emails from students after they graduate.

4. MS Teams Course - Edward Latorre (U Florida)
- [Sid Deliwala, UPenn] The screen shot looks a lot like SLACK. Is TEAMS better?
    - [Edward Latorre, U Florida] It's better because of the integration with other software, e.g., we could work live on Office and other apps, start a video, etc.
- [Bridget Smyser] Was there anything about Teams that really didn't work? I've had mixed results.
    - [Cassie Bowman | ASU] We were planning to try TEAMS last year, but there is a max of 30 private channels and we had ~60 teams and our only choice would have been to have two separate TEAMS and split the teams. We've tried Slack one year, then Ryver the next, and Basecamp this past year. We're going back to Slack this year.
        - +1 from Bridget Smyser, Northeastern
        - +1 Todd Polk, UT Dallas

- ○ [Shraddha Sangelkar, Rose-Hulman] How did you manage opening multiple tabs in MS teams or going back to previous screen?
    - ■ [Eli Patten] I think you can 'pop out' most tabs into their own window so it doesn't have to keep reloading as you go back and forth
    - ■ [Edward Latorre, U Florida] yes you can
  - ○ [Todd Polk - UT Dallas] We used a similar setup with Teams at UTD. Found out that there is a private channel limit that we exceeded and had to setup a separate Team for half of the teams. Very annoying!
    - ■ [Shawn Alborz] @Todd, I do not believe that we have a full blown version of Teams, and OIT releases features one by one to us
    - ■ [Bridget Smyser, Northeastern] @Todd - same problem. When you have 37 teams you can't really set things up in the same channel. We had a general channel, but then let them set up their own teams if they so chose.
    - ■ [Todd Polk] @Shawn - sort of the same issue - checked with our OIT and they said it was a hard Teams limit
    - ■ [Edward Latorre, U Florida] - I don't have that problem (for better or worse), but my first attempt would be to have everyone in the same general channel, have the 30 privates, and then another general exclusively to manage the remaining private channels (the general channel in the second team wouldn't be used).
- ● [Eli Patten] Q: Were students 'forced' to use teams for inter-team communication? I've used teams and found that most use their own discord or chat channel for interteams comms, but it was good to have a channel where they could all ask me questions or I could easily reach out to them
  - ○ A: It was part of the package for the whole course (MS environment). 8 of 14 capstone teams used MS Teams extensively and very well; the other 6 used some different platforms too.
- ● [Dustin Rand, UVM] We used teams, but gave teams their own Team and not a channel. This gave them privacy and prevented their meetings from showing up on everyone's calendar.
  - ○ [Edward Latorre, U Florida] events on the private channels didn't show up in mine. The privacy between teams was good.
- ● [Michelle Londa, TSU] Any correlation between grades and use of MS Teams?
  - ○ [Bridget Smyser, Northeastern] @Michelle - we didn't notice anything. The important thing was that they were communicating and sharing ideas, which was independent of platform
  - ○ [Edward Latorre, U Florida] - not with grades, but with the teams that I could not oversee/communicate, they either did great or not great, i.e. fine with some while others could have really used the help with the project or managing teamwork. During exit interviews, the latter agreed on the missed opportunities.
- ● [Dustin Rand] we used MS Planner as an add in to Teams. It is a Trello like tool for managing tasks.
- ● [Sid Deliwala, UPenn] I loved the fact that each of our teams were channels on SLACK

5. Let's Sort of Do Agile Stuff - Beth DeBartolo (RIT)
- [Jay Goldberg] How did your students learn about Agile methods? From their coop employers or any lectures in your class? David Ullman can discuss how to do this with you.
  - A: Most of our students learn this on co-op (it's required for our engineering students)
- [John Estell] are you trying to create a MVP as part of your Agile process?
  - [Beth] I think it's safe to say that our industrial clients would consider our projects to be MVP-level prototpying
- [Eli Patten] I'm also considering ways to bring it into our program.
- [Alex Szatmary] What aspects of Agile were you not fully implementing that you now think are essential? Agile for hardware can be great but requires some modifications from Agile for software.
  - Basically requiring it formally. We encourage prototyping, daily (or class-ly) updates on individual progress toward the team's vision for the phase, reflecting and adapting every few weeks, keeping in close contact with the client, adapting the end goal if necessary, etc. It's not required, so it's not consistently done or enforced. I agree that it needs to be adapted for hardware, and still think it can work, but needs to be approached differently than we did.
- [Steve Larimore] At the University of Arizona, we have 18 teams/projects (both software and hardware) using Agile and 42 teams/projects using Waterfall - When we look at the results at the end - there was no difference (final Design Day Scores) between the two processes.
  - That's an interesting piece of data!

6. Good Poster, Bad Poster Workshop - Rachana Gupta (NCSU)
- [Kris Jaeger-Helton] Did their assessments tend to agree with yours overall?
  - [Rachana] yes, and it made opinions more credible to students
- [Steven Beyerlein] Great technique to promote students' ownership of the poster performance criteria. The technique could be applied to other capstone deliverables.
- [Jenn Carlson - Michigan MDP] We tried the "Better Poster" format in 2019 with good success. In 2020 virtually we used the 3 minute thesis format which was a good fit for the end of a long year when everyone was burnt out being online (we run calendar year long projects).
  - [Rachana] Thanks. That looks great.

7. Conducting Experiments over Zoom - Charles Radovich (USC)

- I've got a paper at this year's ASEE conference about how we managed to do a measurements and analysis course with students at home, on campus, overseas, and everywhere else it seems. We did kits as well, but also had them build off the arduino kits they got in freshman year. - Bridget Smyser
- [Rachel Monfredo] Did you get all of the equipment back?
  - [Charles] The $30/per student hardware kits, no. Considered that a gift :)

8. Evolution of the Design Review (DR) - Kris Jaeger-Helton (Northeastern)
- [Sid Deliwala, UPenn] Is the design review at the end of the semester?
  - A: Beginning of capstone 2, assigned very first day, with examples, but due in 3-4 weeks, so they can seek out experts, schedule with them, and also develop and submit a plan for feedback prior to the DR.
- [Shraddha Sangelkar] How many experts do they need to seek out (per team)?
  - A: They need at least 1(approved) but they can ask more if they choose - and this is encouraged, especially if they are working to address multiple subproblems.

- [Jeffrey Yin] Did you participate in their design review sessions? I would think it's a big overhead if you have a large number of teams.
  - A: You are right, Jeffrey! As the coordinator, I oversee the plan -and provide feedback on it- and then evaluate the write-ups which include the reflection, reviews and next steps. This helps us know where the teams stand on sticky issues and see how they are processing feedback. But I do not attend them.
- [Shraddha Joshi] How did the students seek out experts? Were these alumni? faculty members? industry experts? [Rachana Gupta] Do you have a list of expert volunteers they can choose from?
  - A, Answering together: We do not have a specific list of experts, but we have drawn from our alumni list. We provide guidance on how to find experts (authors, conference speakers, co-op contacts, faculty from other departments. The Advisors are a great help in directing teams to colleagues from professional societies as well.
- [Beth DeBartolo] Do you get formal feedback from the Subject Matter Experts on the students?
  - A: The SMEs are only in the role of consultants and we have decided not to ask more of them or to pursue them for any additional input. They do not address the same levels of problems across the board (from software selection to storage container selection, to forecasting models), so it would be tough to assess their impressions equivalently. In the write-ups, students have expressed how valuable it is to work on outlining their problem(s) clearly and succinctly and to get fresh perspectives.
- [Sid Deliwala] I have had hard time getting advisors to read reports and to give detailed and constructive feedback to team members

- - A: Design Reviews - The Advisors and Course Coordinators are not candidates to be experts for the DRS. (We can be consultants at any time). We want the students to reach further for this. So Advisors are not being consulted here. Nor are they required to read the DR write-up, but they are encouraged to do so AND the DR is discussed at the next Advisor meeting.
- [Jenny Retherford] How do the experts feel about the reflection narrative created by the students? any feedback on this being valuable? having any relevance or relation to professional practice?
  - A: Teams are not required to provide the SMEs with the write-ups. However, the students are very grateful and they typically write follow-up thank yous to the SMEs outlining what they have learned. Teams have also let their SMEs know how the project is going; we have decided not to try to manage all that at this stage. Many teams will seek out additional experts as well.
- [Keith, UTK] we do second semester technical and business Qualification Review Boards where the team presents privately to a panel of experts. The teams write up a structured memo to the QRB members summarizing feedback, specific actions, and their plan for implementation; there is a follow up QRB after 5 weeks; same process. The fall semester includes 2 design reviews with industry; they use the same feedback memo directed to the industry client;
  - A: A great approach!
- [John Estell, Ohio Northern] We've used Project Review Boards for over a decade - twice in the first semester, once in the second semester, where a mix of faculty (but not the advisor) and industry reviewers meet with 4-5 teams for 30 minutes each for their design reviews.
  - Usually it works, but sometimes teams receive (bad) advice that goes against what the client wants in a design. How can we best protect projects from scope creep suggestions - or a major change in direction - that may occur from suggestions made at a design review?
    - A: We are very clear that it is up to them and their advisor to weigh out a change in direction, that the SMEs are consulting with them, not directing them.
  - [Beth @ RIT] It seems like that's the role of the project advisor - helping the students balance conflicting feedback.
    - A: Exactly, Beth!
  - [John @ ONU] I've had to be proactive, advising my teams to deflect suggestions from other faculty members by saying something like "that's a great idea! We'll run it by our client at our next meeting"...
    - A: Right John - repeated from above: We are very clear that it is up to them and their advisor to weigh out a change in direction, that the SMEs are consulting with them, not directing them.

9. Action Items after Critical Design - Jamie Canino (Trine)

- [Dustin Rand] who keeps track of the comments during the presentation? Do you have a column for what they did?
    - [Jamie] The faculty (me) and the students do it together. Often there is a point where we stop the presentation and say something like "so that is going to be an action item"
    - [Jamie] Only faculty can close an action item so students usually submit powerpoint slides to their advisors.
- Who is present at the design review?
    - [Jamie] all faculty involved with the project
- General comment/Question: How many programs have the advisors present during design reviews? In the ME program at Northeastern, students can invite their advisors, but are not required to, and many of us advisors actually discourage them from inviting us, because we don't want the advisor's comments or presence to prevent the students from freely expressing their ideas.
    - [Jamie] Our "critical design review" is a technical review of their project so it is important that project advisors attend. In addition to project advisors we have our lab manager to critique their manufacturing plan and sometimes others attend for corporate sponsored projects.
- [Sid Deliwala, UPenn] I have had hard time getting advisors to read reports and to give detailed and constructive feedback to team members
    - [Jamie] Our design reviews are oral presentations. The good thing is that once advisors leave the review they are done. All of the action items should already be listed and they can give their feedback quickly because it is oral.

10. **Expo Preview** - Todd Polk (UT Dallas)
    - [Bridget, NE] we have a similar session, but separate from the final day for the jury. It happens about a week before the final day, which gives them a chance to practice their pitches and also get feedback on their posters. When COVID hit, we did a video version. We call it prototype show off day.
    - [Rachana Gupta] How long is your judging per team? And how many teams do you have?
        - [Todd Polk, UTD] - we have ~40 teams. 20 minute judging windows and each team see 6 judges.
        - [John Estell, ONU] we have about 10 teams in our department, around 25-30 overall in the college. 30 minute judging windows, 4-5 projects per judge. We schedule in the early evening, and provide Subway for dinner beforehand for the judges.
    - [Mark Easley] Same for judges and visitors, never get to see ALL the projects during an expo
        - [ToddPolk, UTD] - I agree Mark, but there is a limit to how long we can keep them engaged after a long day.

- [Shraddha Sangelkar] We flip the order, first judges then for friends. Why did you choose pre-view instead of post-view?
  - [Bridget Smyser] we purposely did the students first, and a week before, mostly to force the students to get things done earlier in the term. They may not be 100% done, but it forces them to budget their time better.
  - [Robert Hart, UTD] We require the prototype to be functionally complete several weeks before expo. We have a paper at ASEE this year on the process.

11. Scavenger Hunt for Reflection and Transfer - Susannah Howe (Smith)
- [John Estell, ONU] Great quote: "To passively engage in your project is to fail before even starting."
- [Shraddha Sangelkar] When was this activity done, beginning or end? my students are checked out in the last 2 weeks - :(+1 from Sid Deliwala, +1 from Jenn Carlson
  - A: This was done during the last formal class period. It's pitched to the students as a fun event, and intended to help wrap up the year
- [Jenn Carlson] was it optional? required? for curricular points or just bragging rights?
  - A: it was part of class, so if students missed class they would miss it. No curricular points, just bragging rights!
- [Rachana Gupta] Did you come up with all the activities by yourself or did students choose some by themselves?
  - A: The capstone teaching team (3 of us) developed the activities together - we had a brainstorming session one Saturday in the late afternoon (with beverages) and had a great time being creative. Fun for us too! Some of the activities we can definitely use again in future years.

Miscellaneous
- [Sid Deliwala] Anyone want to chime in on Final Reports ? I think a lot of effort does not get noticed
  - [Beth @ RIT] Our final reports are a technical paper, students do a peer review before the final submission, and we let the format adapt to any conference or competition the team wants to enter, or they can submit it as an invention disclosure in preparation for submitting a provisional patent application. These seem to get more thoroughly read and they're actually useful for more than an academic exercise. I guess that makes it a "nifty" :) The students document all their work on a wiki that they continually update throughout the semesters, and that gets graded in chunks. There's no massive final report to grade at the end, just a 6-page tech paper, poster, lightning talk video, and their final phase wiki updates. We used to have teams submitting a 50+ page report at the end of each semester, and it wasn't adding value.