



Panel 1C: Capstone 101

Facilitator: Beth DeBartolo (RIT)

Panelists: Robert Hart (UT Dallas), John Parmigiani (Oregon State), Joanna Tsenn (Texas A&M)

Description: New to Capstone? New program? Feeling overwhelmed? This popular panel has veteran instructors, ideas, and tools to get you started.

Panelists:

Joanna Tsenn

Instructional Associate Professor at Texas A&M University in the Department of Engineering Technology and Industrial Distribution. Their program is large, with about 425 students going through capstone each year and around 70 new projects each semester. She also coordinates about 20 instructors, so her work includes both teaching and coordinating faculty members involved in capstone.

Robert Hart

Professor of practice at the University of Texas at Dallas. He has been teaching in the capstone program for about 14 years and will begin his 15th year in the fall. Their program usually has about 40 to 50 teams per year, with around 5 to 6 students per team. Their course combines mechanical engineering and biomedical engineering students, and most projects are industry-sponsored.

John Parmigiani

Associate professor at Oregon State University. He started teaching capstone in 2004, when he was assigned to the course on his first day on the job. He taught capstone directly for about 10 years. For another 10 years, he supported the capstone program by providing project lists, handling writing-intensive course requirements, hiring and coordinating technical writing graders, and helping with other program needs. More recently, he supports the current capstone instructor by helping provide projects and other assistance when needed.

Notes:

1. Kick-Off Process for Projects

Question: How do you kick off capstone projects, and what does the kickoff process look like?

Robert Hart:

It is important to set expectations at the beginning of the course. Students should understand from day one that capstone is not just another lab course; professionalism is expected from the start. Team-building exercises and social activities can help students get to know their teammates.

Joanna Tsenn:

Writing activities can also be introduced early, such as practicing professional email communication. This helps students learn how to communicate with sponsors in a professional and respectful way.

John Parmigiani:

Students should be assigned to projects as quickly as possible. Meetings with sponsors should also be set up during the first week so that teams can begin working with their clients early.

2. Project Assignment and Team Formation

Question: How do you assign students to projects and form teams?

John Parmigiani:

Student project preferences can be collected and taken into consideration, but the instructor should still make the final project and team assignments. It is helpful to ask students whether they care more about being on a specific project or working with specific teammates.

Robert Hart:

It is important to ask students if there is anyone they cannot work with or would feel uncomfortable working with. This can help prevent serious team conflicts after teams are formed.

Joanna Tsenn:

Student skill sets should also be collected. Project preference can be prioritized, but teams still need a balanced set of skills. It is also useful to ask whether students have taken certain prerequisite or technical courses so that each team has some relevant technical background.

3. GPA and Team Assignment

Questions: Should GPA be used in team assignment, and thoughts on placing stronger teams on high-profile sponsor projects?

Joanna Tsenn:

GPA is not used as the main factor for team assignment. Capstone performance does not always match GPA. Some students with average GPAs may perform very well because they are willing to make mistakes, learn, and work through open-ended problems.

Robert Hart:

GPA is not used in our program either. GPA mainly reflects performance in lecture-based coursework, but capstone requires a different set of skills.

John Parmigiani:

I never ask for GPA. However, in practice, instructors may sometimes feel pressure to place stronger teams on high-profile sponsor projects, especially when maintaining that sponsor relationship is important.

Beth DeBartolo (Host):

GPA does not necessarily correlate with capstone performance. Other information, such as extracurricular experience, work experience, and relevant project experience, may be more useful.

4. Student-Selected Teams

Question: Do you allow students to select their own teammates?

John Parmigiani:

Be careful with fully student-selected teams. Students may choose friends or roommates instead of people they can work with effectively.

Robert Hart:

Students may be allowed to choose one or two preferred teammates, but the instructor should still keep some control over team formation. This provides some flexibility while still allowing variability in team formation.

5. Student-Generated Projects

Question: What percentage of projects come from the official list, and what percentage are student-generated?

John Parmigiani:

Student-generated projects can create conflicts of interest. Students may unintentionally change the project requirements to make the project easier.

Joanna Tsenn:

Student-generated projects need to be proposed well in advance. Faculty should review the projects to decide whether they are suitable for capstone. In some cases, alumni or external clients can help provide context for these projects.

Audience Comment:

For student-led projects, one of the hardest parts is teaching students how to define a good problem. Students may need time to identify customers, understand needs, and develop appropriate project goals.

6. Competition Projects

Competition projects can be challenging because students may need help developing clear design criteria. Some programs allow students to submit project ideas, and then engineers or faculty review and refine those ideas before they become capstone projects.

7. Client Onboarding Process

Robert Hart:

We have a staff member who helps with new customer relationships. This person makes initial contacts with companies and then introduces the sponsor to the instructor. After that, the instructor explains the program structure, timeline, expectations, and whether capstone is a good fit.

After projects begin, we hold a sponsor orientation, usually online during lunchtime. The orientation explains the timeline, when students will contact sponsors, and what sponsors should expect.

It is also important to evaluate the sponsor, not just the project. Some companies are mainly looking for engineering labor, which may not create a good learning experience. Better sponsors usually see the project as a mentoring relationship. If needed, the project can be rescoped.

John Parmigiani:

I usually contact previous sponsors to see whether they would like to work on another project. It is important to set expectations early, including scope, cost, intellectual property, timeline, and sponsor responsibilities. Projects that are not suitable for capstone should be turned down or redirected.

Joanna Tsenn:

We have a specialist who helps with sponsor contacts. During onboarding, we discuss what resources the project needs and whether it fits school regulations and safety rules. We also clarify how often sponsors should meet with teams.

8. Repeat or Multi-Year Projects

Question: What are the pros and cons of repeating projects from previous years?

Robert Hart:

We rarely repeat the exact same project. If a project comes back, it needs a new set of design challenges or requirements. It should not simply be the same project again.

Joanna Tsenn:

Repeat projects can be hard because the new team needs time to understand what the previous team did. This can take a lot of time and may be frustrating for students.

John Parmigiani:

I usually do not repeat the same project unless the project naturally creates a new experience every year.

Audience Comment:

Repeat projects can work if the project is redefined. For example, one year a team may build a working prototype, and the next year another team may focus on manufacturability.

9. One-Semester vs. Two-Semester Capstone

John Parmigiani:

Our structure uses two 10-week terms. The first term focuses on design, including CAD and design development. The second term focuses on building and testing.

Robert Hart:

Our program uses two semesters. The first semester focuses on design on paper. By the end of the first semester, students should have documentation detailed enough that someone else could build the project. The second semester focuses on building and testing.

Simple prototypes are encouraged when they help justify a design decision. During the in-depth design review, students need to show evidence or engineering justification for the design choices they made.

Joanna Tsenn:

Two semesters are important for projects that involve building and testing. Students need time to order parts, receive materials, troubleshoot, and revise. We try to have students order parts by the end of the first semester so they are ready to build after the break.

10. Student Workload and Credit Hours

Question: How much time do students dedicate to capstone compared with their other courses?

Robert Hart:

Capstone is three credits. Students may be taking around 15 to 18 credits total.

John Parmigiani:

Students may be taking around 16 to 17 credits.

Joanna Tsenn:

Students report spending around 8 to 10 hours per week outside of class on average. However, the workload increases near the end of each semester.

11. One-Semester Compressed Capstone

Question: What are your thoughts on compressing two capstone courses into one semester?

Joanna Tsenn:

Even in software or game-development projects, students still need “soak time.” They need time to learn, explore ideas, practice, and let the project mature.

Robert Hart:

Computer science projects may have more flexibility because students do not need to wait for parts or machine shop work. However, students still need structure. They need regular milestones so they do not wait until the night before a deadline.

12. Program Support and Project Planning Timeline

Question: When do you start planning and recruiting projects for the next cycle?

Joanna Tsenn:

We start reaching out in February for fall projects. Companies may need time to work through their budget cycles, so it helps to start early.

Robert Hart:

Some sponsors need a long lead time, while others think six months is too early. Sometimes sponsors send projects only a few weeks before the semester starts.

John Parmigiani:

You are always looking for projects. The timeline depends on the sponsor, but project recruitment is an ongoing process.

13. Coordinating Faculty Advisors and Studio Instructors

Question: How do you keep many projects on track when different faculty advisors are involved?

John Parmigiani:

This was a problem I never fully solved. It can be hard to keep faculty advisors consistent if the expectations are not clearly structured.

Joanna Tsenn:

We have a structured program with studio instructors. We hold weekly coordination meetings to explain what students should be working on, what is coming next, and what questions instructors should ask their teams.

Robert Hart:

We have several check-ins throughout the process. We meet individually with each team so that we know whether they are on track instead of relying only on mentors or advisors.

14. In-Depth Design Review

Question: How do you allocate time for detailed design reviews?

Robert Hart:

We spend about 45 minutes with each team during the design review. It takes a full week, and some meetings happen in the evening. The review is usually conducted by me and my co-instructor. This has been one of the most useful ways to improve project quality because it helps catch major design issues before teams move too far into building.

15. Course Structure

Joanna Tsenn:

Our course includes both lecture and studio. Lecture focuses on the process, while studio focuses on the product and team progress.

Robert Hart:

Our course is three credits and meets once a week for about two hours and 25 minutes. We split the teams in half. Half come for the first 75 minutes, and the other half come for the second 75 minutes. This makes the class more manageable.

The other 75 minutes are used for team meetings, mentor meetings, client meetings, or project work. The classroom portion is flipped. Students watch videos before class, and class time is used for activities that reinforce major concepts.

16. Getting New Sponsor Projects

Question: What suggestions do you have for finding new sponsor projects?

John Parmigiani:

Reach out to faculty members, industry relations contacts, department contacts, career fair contacts, and competition project organizers. If you have funding, it is easier to get projects.

Joanna Tsenn:

Former students are a valuable source of projects. LinkedIn and alumni events can help maintain connections. Inviting potential sponsors to serve as expo judges can also help. Cold calling has not worked well for me.

Robert Hart:

Get involved with local business organizations, professional societies, chambers of commerce, and manufacturing groups. Speaking at local organizations can help build sponsor contacts.

17. Student Motivation

Question: How do you motivate students and keep them accountable?

Robert Hart:

Peer evaluation is useful for understanding team problems and identifying why students are underperforming. Do not assume that underperformance always means laziness. There may be team conflict, health issues, mental health issues, or other challenges.

Joanna Tsenn:

We have an expo where students present to industry judges. This gives students a public audience and encourages pride in their work. We also use a prototype milestone before the final showcase because students work toward deadlines.

18. Writing-Intensive Course

John Parmigiani:

We used to have a writing co-instructor, but the course started to feel like a writing course with an engineering project attached. Writing is important, but the course still needs to remain focused on engineering design.

Joanna Tsenn:

We require a background research paper early in the semester. This forces students to start researching their projects early, before the design and prototyping workload becomes heavier.

19. Documentation

Robert Hart:

Documentation is built through intermediate deliverables. For example, the project definition document helps students clarify scope, deliverables, constraints, and requirements. Internal reports may not go directly to the client, but they form the foundation for the final formal report.

20. Writing Support

John Parmigiani:

We hired professional technical writers to help with grading and comments during major writing periods.

Joanna Tsenn:

Engineering instructors teach writing in our program, but we have worked with writing specialists to learn how to grade more efficiently and how to teach writing in capstone.

Robert Hart:

We rely on team mentors. Major written deliverables are submitted to mentors first. The mentor gives feedback, and then students revise before final submission.

21. Tools and Systems

Robert Hart:

EduSourced: A peer-evaluation tool has been very helpful. It returns survey and evaluation results directly to students, so instructors do not need to manually sort and distribute feedback. We use it for peer evaluations, final evaluations, mentor evaluations, and surveys. Some things are still managed in Excel.

Joanna Tsenn:

We use a lot of Google Forms. We have considered CATME, but it may be too much for students to learn and use. For now, we keep peer evaluation simple.

Audience Comments:

Google Forms and Excel are still commonly used.

22. Managing Change in Capstone Programs**Robert Hart:**

We keep a shared document with every idea for improving the course. At the beginning of each semester, we review the list and decide what is realistic to implement. New instructors should not try to do everything at once. Building a capstone program takes time.

Joanna Tsenn:

We keep notes throughout the semester and use weekly instructor coordination meetings to discuss changes. For bigger changes, we try to pilot them with a smaller group first. Small iterative improvement works better than making too many major changes at once.

John Parmigiani:

Changes can be made from year to year. There are many ways to run capstone, and programs need time to stabilize and find what works.

Beth DeBartolo (Host):

The Capstone Benchmarking Survey can be a useful resource.

23. AI Policy in Capstone**John Parmigiani:**

The basic principle is that students should not submit work that is not their own and claim it as their own.

Joanna Tsenn:

Sponsor expectations vary. Some sponsors want students to use AI, while others do not allow it because of confidentiality concerns. AI-detection systems are unreliable, so programs should be careful about relying on them.

Robert Hart:

Be careful, especially with confidentiality and client expectations.

Beth DeBartolo (Host):

Some clients will clarify their own AI restrictions.

Joanna Tsenn:

AI tools can be introduced as support tools for activities such as brainstorming or FMEA.

Beth DeBartolo (Host):

AI should be framed as a support tool, not a replacement for student work.

24. Closing Advice for New Capstone Instructors

Question: If you could go back in time, what advice would you give yourself as a first-year capstone instructor?

Robert Hart:

Have a well-defined process. Structure helps prevent procrastination. Major assignments should happen before the final expo so students still have time to revise.

John Parmigiani:

Add structure and intermediate assignments. This helps students avoid last-minute work.

Joanna Tsenn:

Create a safe environment where students can make mistakes. Capstone is about problem solving, design, professionalism, and learning through the process.

Beth DeBartolo (Host):

Structure is very important in capstone.