



## Panel 2B: Using Reflection in Capstone Design

**Facilitator:** Beth DeBartolo (RIT)

**Panelists:** Julie Ford (New Mexico Tech), Hugh McManus (Northeastern), Annie Abell (Ohio State)

**Description:** Capstone design students and teams can benefit from reflecting on their design strategies, their teamwork skills, and other desired outcomes. These panelists will share their experiences with this powerful tool.

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- Panelist Introduction
    - Julie Ford: New Mexico Tech
      - Technical communication specialist in ME; coordinates capstone
      - 4 semester capstone that starts in Junior year
    - Annie Abell: Ohio State
      - Product design and ME
      - College level requirement change to require reflection in all capstones
    - Hugh McManus: Northeastern
      - Industrial design and aero background
      - Lean process improvement
  - Q: Why reflection? And how?
    - JF - three different approaches:
      - individual assignment memo - justifying their contribution to team (reflection inherent) - assigned early to allow for intervention if necessary;
      - after presentation - students submit a self analysis of area of growth and strength;
      - preparedness portfolios as job search tool (see JF poster about this), includes a reflective statement on students' educational experience
    - AA:
      - Reflection & communication can lead to success or demise of a team (in both project & life)
      - What is your role in the team // what are you contributions // how do you think it's going – use reflections to facilitate conversations with team
      - Helps uncover hidden concerns and gives instructors insight into what is going on in teams → can intervene if there is something going on that they have not brought up in meetings
    - HM:
      - Different types of reviews throughout (design review, readiness review, presentations, etc.)



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- Initial reflection on hopes and fears, etc (see HM poster about this)
  - At end: peer and personal reflection, how things went; and course reflection (helpful for ABET and to understand what students know)
  - Epistemological: they know what they know after the reflection
- Q: Are reflections graded and, if so, and how? (Is the grading subjective?)
    - JF:
      - Individual assignments are graded in terms of enough details so JF can get a good picture of what the student actually did. JF models examples of how deep students should go with their detail.
      - For self-analysis of the presentation, JF can tell if students actually viewed their recording.
    - AA:
      - Grading is open-ended, much has to do with setting expectations and qualities desired in the documents.
        - Share rubrics that outline depth of reflection
        - Were they able to touch on enough of the different prompt aspects
      - Grade on completion (not how many words, paragraphs vs. bullet points, etc.)
        - Can give “check” but give individual feedback to think more deeply for next submission
    - HM:
      - Tends to be fairly simple – grade to see if student hit prompts and showed evidence that they learned something new
  - Q: Individual reflections - is this helpful for identifying students who are not actively participating? (As opposed to team reflections since students don't want to tell on their teammates for not performing)
    - JF: Have bs filter as instructor - need details and providing evidence
      - Include sketches of process, not just final design and say “I did this”
    - AA: Can stress that students should share feedback on teammates, but include more “check ins” to allow students to voice concerns before the end of the semester / capstone experience
      - Three self reflection and three peer review assignments throughout semester
      - Really helpful, and tells who is doing the minimum vs who is invested.
    - HM: interesting to look through performances of better performing students - don't just think of reflections as a way to capture underperforming students.
      - shows what might need to be beefed up in the course as well
  - Q to audience: How many attendees do reflection as part of their capstone? (show of hands)
    - Most raised hands, for at least individually; many also for team-based reflection
    - Bridget Smyser (Northeastern): Junior Level Lab class - do reflection after each report, list who did what in the lab and what in the paper, what is going well and what is going poorly, what do we need to fix
      - Can see mismatches in responses - can intervene with articles about communication and time management



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- AGILE retrospectives – at the end of each two week sprint. Need to return their reflections in the report. Cite in next week - ask how they addressed reflection in the previous sprint
  - 4Ls: Liked, learned, lacked, longed for → Make actionable items - what can students change in the next sprint?
  - Discussion (in group) – focused on team solving together and holding each other accountable. Not as a way to perform peer evaluation. (There are other forms to hear about conflict/communication problems or sponsor/time management stuff.)
- Q: How do you create a good prompt?
  - AA: this is important to consider because garbage in = garbage out
    - provide a reading or some resources, such as 4 categories of teamwork. Then put their reflection within terms of that framework: eg, what have you been doing and how could you improve
    - Also have lecture on giving feedback - how to do it in a constructive way
      - Ask students to reflect on how they like to receive feedback
    - Takes a lot of iteration to tune the prompts
  - JF: ask students to use the argumentation model - what is the claim you are making? What is the supporting evidence? Providing examples from prior students works well too and helps students understand expectations
  - HM: use structured exercises where structure provides guidance for reflection: What do you think? What does the team think? What do other people think?
    - Things like SWOT analysis help focus the reflection
    - Students appreciate having focused questions - not a general discussion
  - HM: We say "you can't know if we don't tell you, and we can't know if you don't tell us".
    - Ask students to help us calibrate - is what we are seeing correct? Without authentic reflection, we wonder if there is an issue we cannot see
    - Model honesty and openness to the students at the beginning.
- Q: How to implement for large classes (say 200 students)? Any tools to streamline?
  - Streamlined grading - excellent, good, insufficient (with rubric) so don't need to pour over every detail
  - Skim to look for red flags (or have TA review for red flags) and review them in more details
  - Look for great things (green flags) and anonymize it for the class
  - Maybe opportunity to self grade?
    - Feedback Fruits (<https://feedbackfruits.com/>) can help automate process → lowers grade for certain things
  - Sequential reflections - can ask how they addressed previous reflections
- Q: How to introduce reflections in the course?
  - AA: Talk about it a lot, pull it into what they're doing. Try to put that safety net in to have them think deeply about how it is actually going. Try to make it a safe space to fail.
  - Set up the value of reflection so that it does not become a superficial way to get points.



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- JF: Make them realize there is value in this - not just busy work. Tie into growth mindset – you don't know everything about design, this is your chance to fail and learn from them
- HM: Make the purpose clear. Do group reflections in class after explaining the importance. Individual ones in Canvas or another option (Survey Monkey - but need to pay)
- You're going to design and build and likely fail, and we want you to know what to do when it doesn't work out (since design often doesn't work!). Want them to think deeply about what has happened
- Make sure they know they will not fail if their project doesn't work
- Q: Do you recommend peer grading of reflections?
  - AA: Could be a little bit scary. Need to set up expectations. Not all questions might be a good idea to discuss with peers. If you make clear that it will be shared with another team member or class mate, then you could implement it. Could be between teams
  - Other suggestion: Take assignments and make a word cloud
    - Different word cloud based on the prompts - give overall idea of what people are thinking
- Q: What types of reflections should we be doing that are not just teamwork based or 'what is working well and what is not' but get more into design and the inherent complexity of it? How can we push students to think deeply about their designs?
  - HM: We do team reflection on the project as a conversation with staff – this is what we see, what do you see? Not written. Often get more info from conversation than writing.
  - AA: Team meetings. A lot of discussions are in those meetings about projects. What are the options, and why is one better than the other? What makes sense for this context? AA's students are reluctant to pick a solution because "How do we know we're doing the right thing?" They have to form a mindset that can face the challenge. What are the tools you have to determine the course of action?
  - JF: Preparedness portfolios (still written) – process makes students look back at projects they have done. Makes them think about their own evolution as students.
  - Other suggestion - include reflection into design reviews
- Q: Agile is about learning from the previous sprint to inform the next sprint, and reflecting on what you learned from each iteration. Do students have to write things down before they learn from it? Students are reluctant to do prototypes without the whole solution.
  - AA: Prototyping is about answering a question (not a final design). The questions change at different points depending on what part of the project you are in
  - Using prototyping (<https://www.pretotyping.org>) helps to encourage students to ask questions early on to see if they're "solving for the right it" and thereby reflect on the initial approaches being used.
  - Should we be calling it 'reflection'? Or do students then devalue it?
- Q for AA (specifically) - What is the new reflection requirement at OSU? What exposure do students have about metacognition before capstone?
  - When they begin, students take a first-year reflection class about goals (opening bookend).



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- They take another one (1 credit) at the end of senior year (closing bookend). Assemble portfolios, and reflect on where they're going.
- But engineering already requires too many credits to add a separate course; so engineering convinced the university to make this closing bookend part of capstone
- Q: How to encourage students to be more open to feedback?
  - AA: From day one, "Here's our culture, here's what we're doing, lots of feedback from the beginning."
    - From beginning of semester, they have to give feedback to other teams (on presentations)
    - Provide a lot of designerly blogs and articles to read
  - JF: Modeling it as best you can as an instructor. Making it clear to recognize positive and negative feedback. Ensuring your feedback is not just areas to improve/fix, but also clarifying what they are doing well
  - HM: Use rubrics early – evaluate compared to them. Need to evaluate each other's technical work
  - Kris Jaeger-Helton (Northeastern): tips used to improve quality of reflection
    - Provide students a 'heads-up' at the start of the period that there will be a reflection/feedback at the end, so that students can ensure they are paying attention and taking notes and the processors have more time to process
    - Provide dedicated time within class to reflect in the moment
    - Provide an opportunity to improve on their reflection/organize it more outside of class
  - Other Suggestion: Legacy letter:
    - A letter written at the end of the year for the juniors - give advice to the next year's seniors in a letter in what you wish you knew going into your capstone project
    - [instructors don't edit it, except for curse words and calling specific people out]
- Q: Some assignments are called "squishy" by students and other professors. Too many assignments are 'not about their projects' according to them. How to convince other faculty to value the reflection assignments?
  - AA: There could be too many assignments. Need to communicate value the same way we communicate to students.
    - Be strategic about what to cut and what to include... prune the assignments and show that you are being mindful that
    - Have examples of how non-technical skills are useful / desired in the workplace
  - HM: We used to do weekly reflective memos but removed them. We need to make it clear that we're not wasting people's time
  - JF: Make short reflections as a part of class time - could only take a few minutes. Assignments don't need to be lengthy to be valuable.
  - Other idea: Use time that is already blocked off for something else - e.g., sprint retrospectives in class; team coach discussion meetings during the weekly meetings



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- Q: How long should students spend on reflection?
  - JF: varies - some can just be a few minutes at the end of class, or a comment on a Canvas submission assignment
  - AA: does 3 reflection/semester that should take students 20-60 minutes to do thoroughly
    - not really graded for writing
    - things that are baked into conversations don't add more to the list
  - HM: aims for purpose-driven reflections
    - have a whole class dedicated to X (where X = SWOT or similar)
    - give a worksheet while other students are presenting to give them a reflective exercise and also get feedback for that team. Also ask what students can learn from other teams - what techniques can they "steal" while watching other teams present?
  - Other idea: Feedback one-on-one with students (5 minutes each, using time carved out of weekly coach meeting), then a performance review (10 mins/student) at the end of the semester. (Done for class of 35 - probably wouldn't work for class of 150)
- Q: Sometimes reflections lead to very mechanical answers. How to coach students away from that?
  - AA: Need several rounds to craft prompts well. [Contact AA to request her prompts]
  - JF: Prompts are different enough that she doesn't get mechanical answers. It is valuable for students to hear from guest speakers who reflect on what they got out of capstone and how it relates to their job experiences.
  - HM: Don't typically get a lot of wooden responses. Notes the importance of the summative reflection in the whole process
  - HM: For the Final Presentation, has a jury panel with alums joining via Zoom. Always closes with the jury giving advice and reflecting on what they took away from capstone.
  - Suggested Tool: Joe Tranquillo (Bucknell) compiled a [Reflection Deck of Cards](#) with prompts
    - useful for how to talk about the capstone experience for a job interview
- Closing Q: What was one time that reflection was amazing and captured "This is what it's all about"?
  - HM: At the end of the year the students finally get it. I learned what I knew and what I didn't know.
  - AA: There was one student who wrote the most insightful thing – I wanted to work for her.
    - AA asks her students "Where do you think your classmates will be in ten years?" The student who was excellent at reflection got positive feedback ("she will be Girl Bossing") from her peers.
  - JF: gets emails from students who graduated five (or more) years ago who get in touch to say "I hated your class or didn't think it was important, but now it's so valuable for my job" - sometimes delayed reflections are the best!
  - ED: asked "What did you think you were going to learn, what did you actually learn?" One student commented "I thought I was going to learn FEM, I learned how to manage teammates." ED considers this a success!