



Olin College of Engineering

Implementing Effective Teaming Strategies

in First- through Fourth-Year Courses

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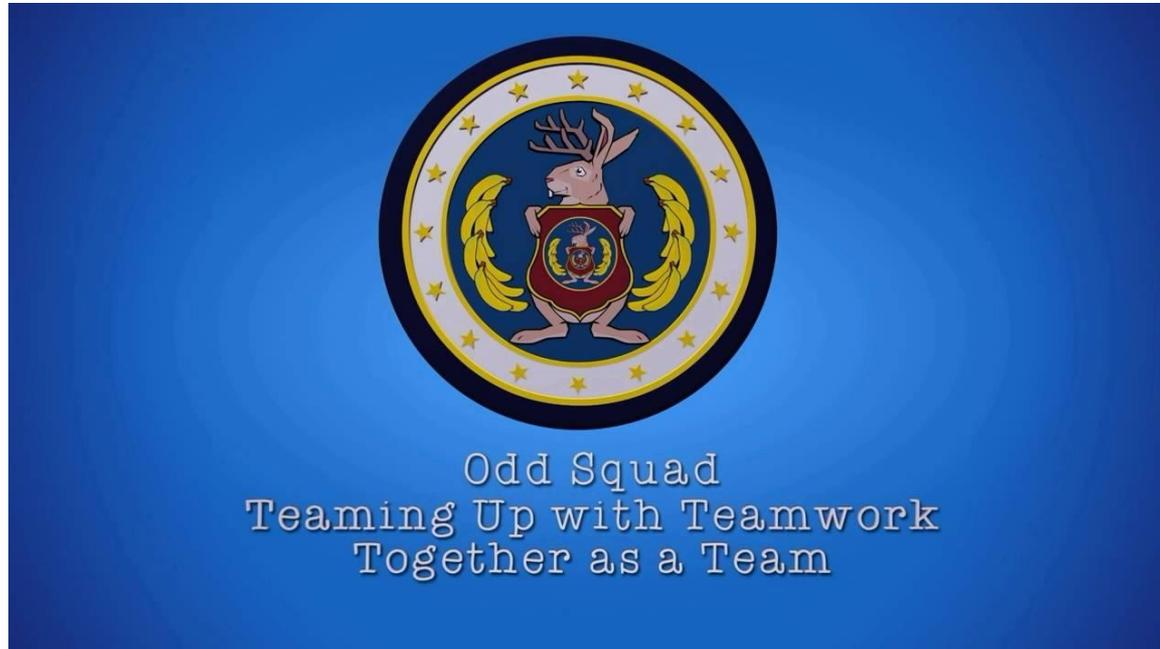
Pforzheimer Learning and Teaching Center, Wellesley College

15 February 2018

Road map for the workshop

- Why ask students to work in groups or teams?
- Three case studies
 - Two first-semester courses on design and modeling
 - A junior / senior level discrete math course
 - A stream of project-oriented courses
- Small group activity ~1:30
 - Design (or re-design) your own teaming experience
 - We are happy to stay past 2:00 for individual consultations or chats!

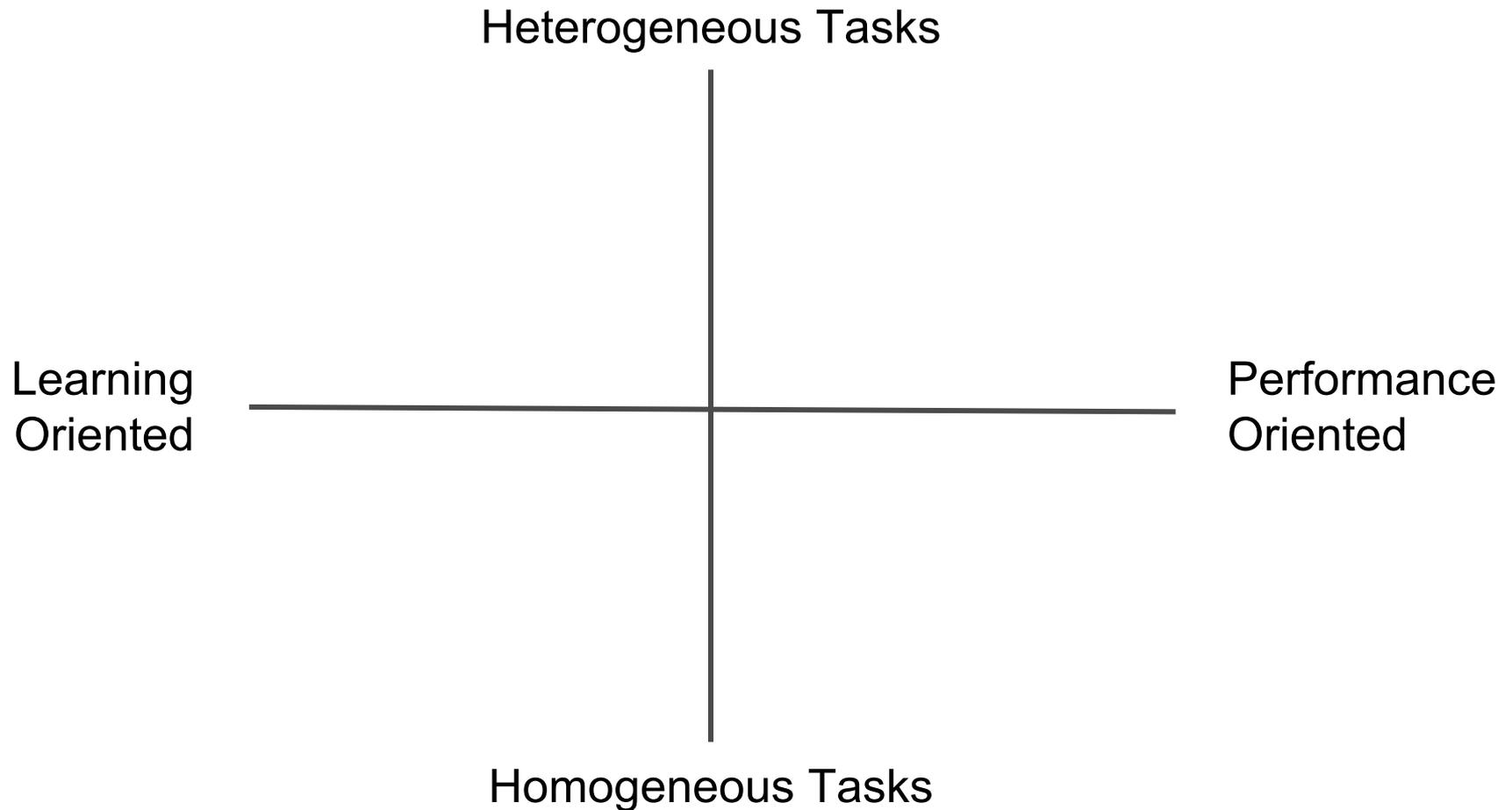
Why ask students to work in teams?



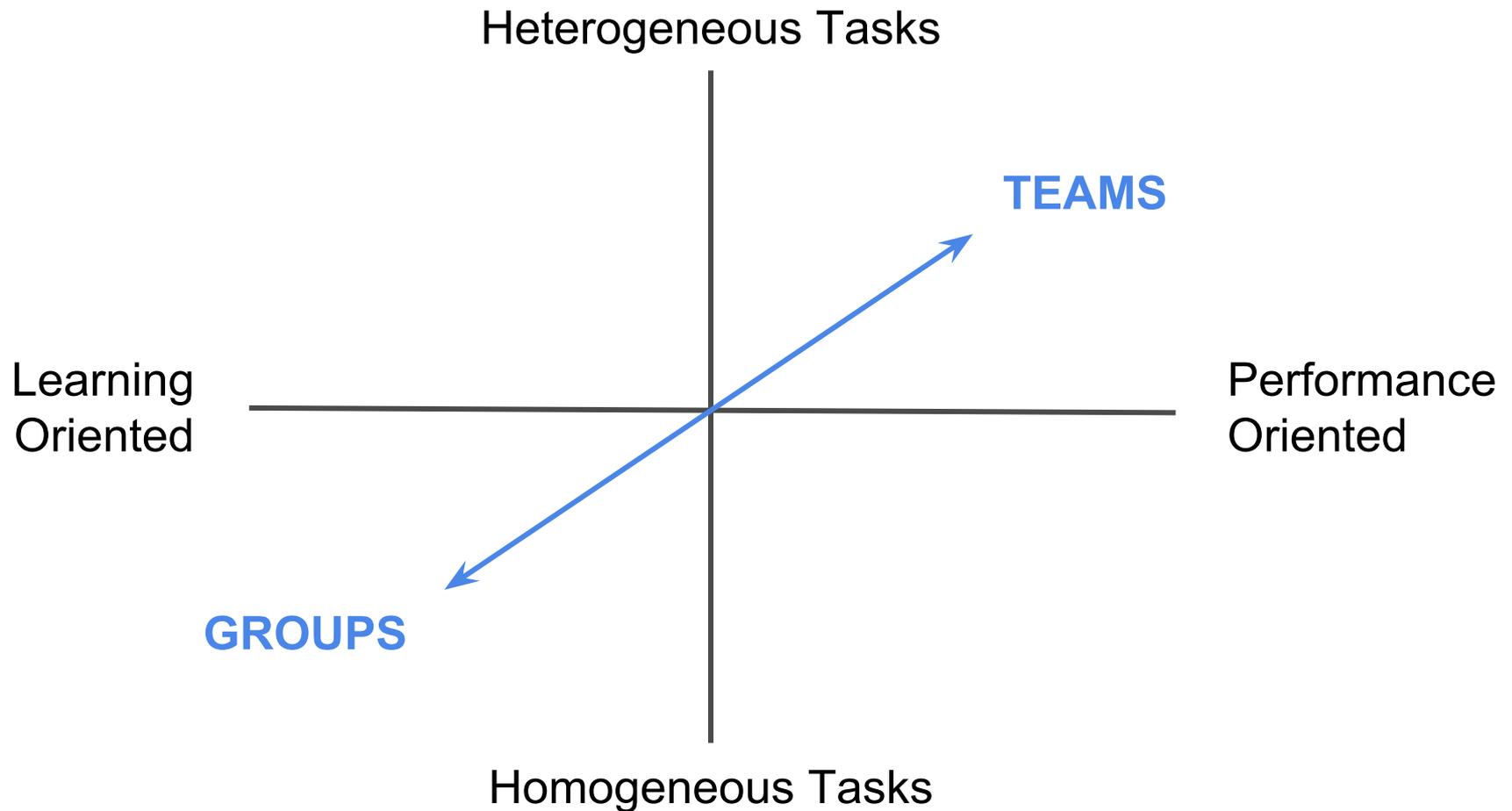
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- Need to use teamwork for specific **reasons**.

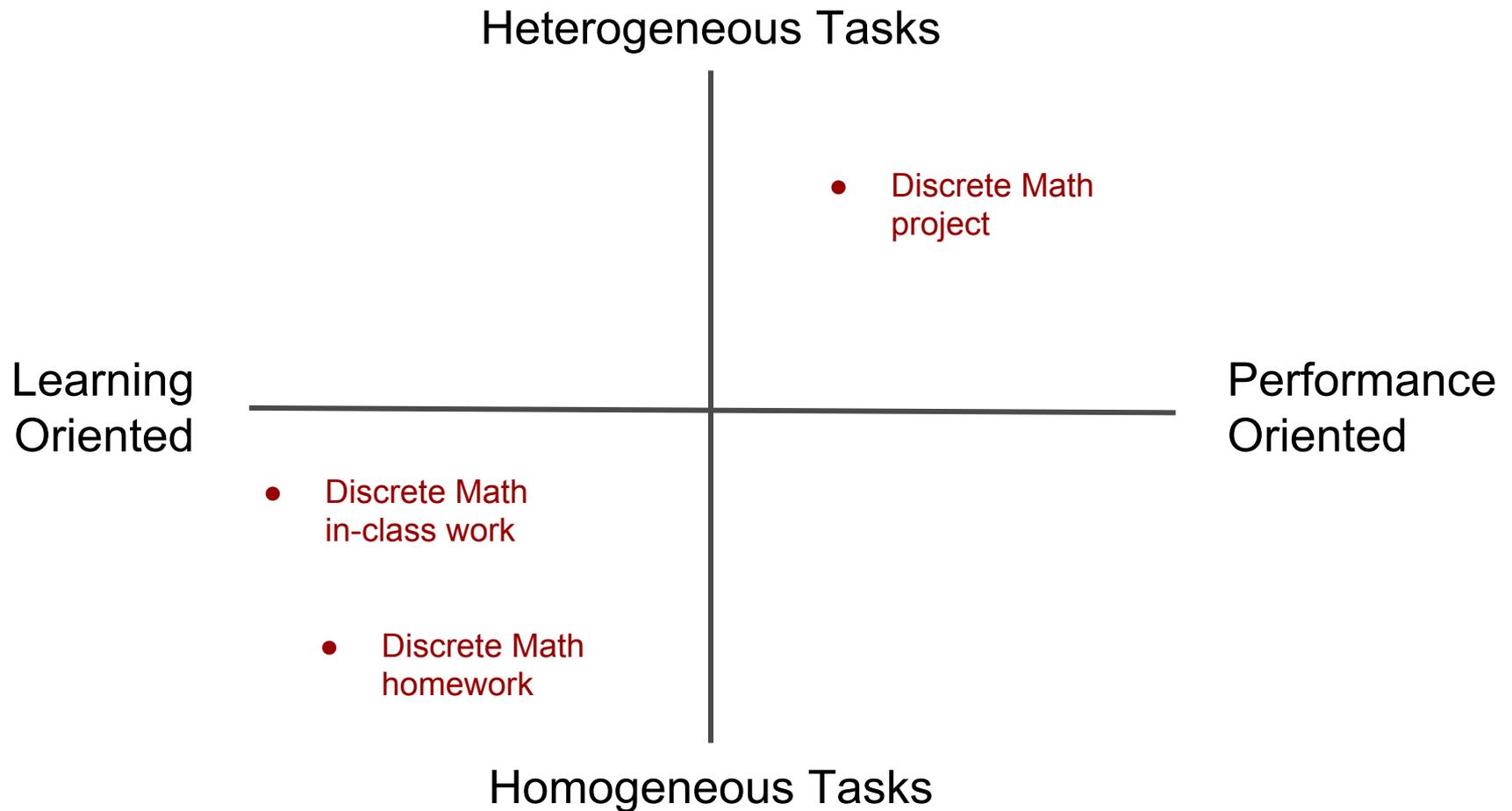
Why / how are you using teamwork?



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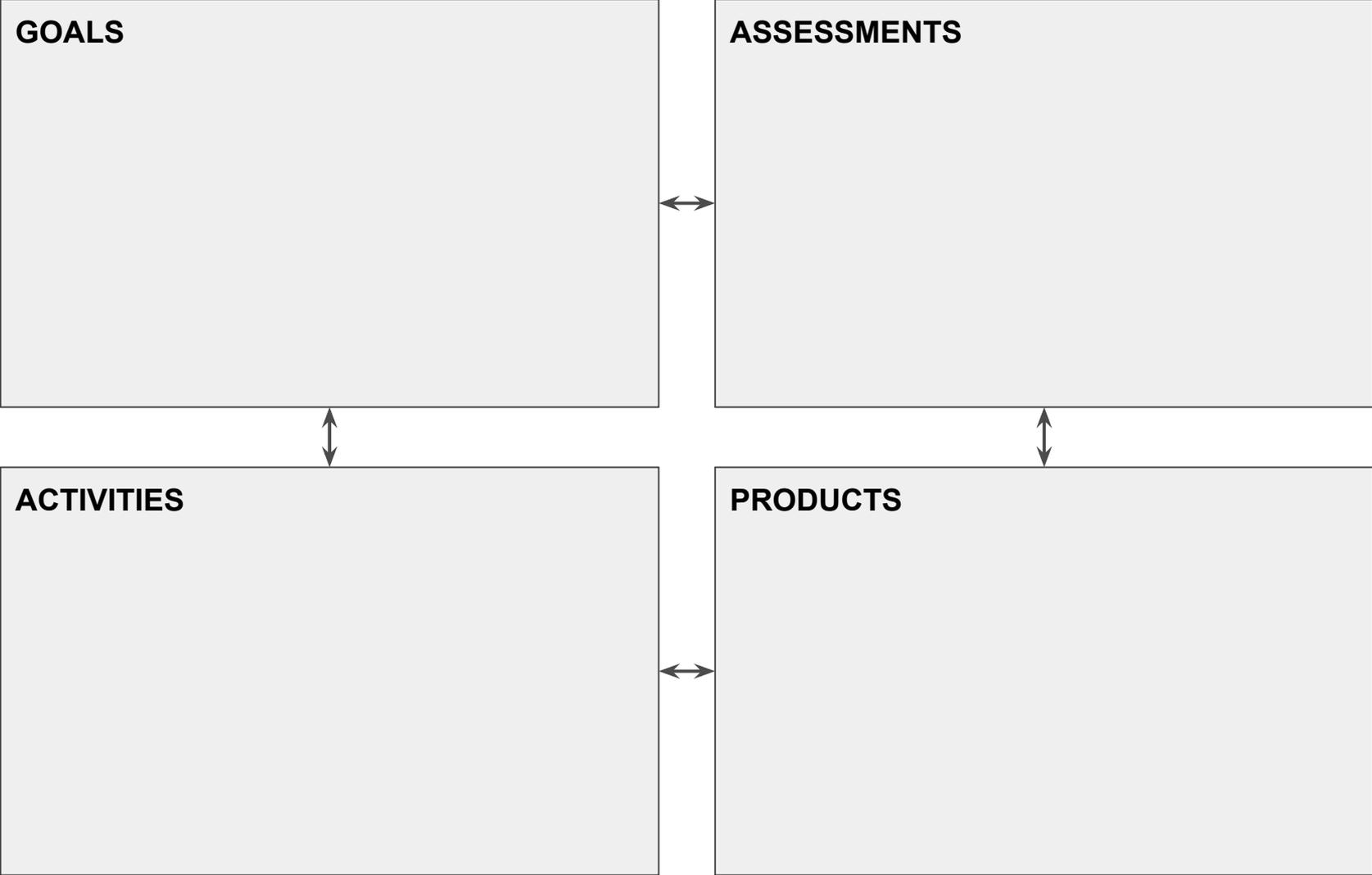


Why / how are you using teamwork?



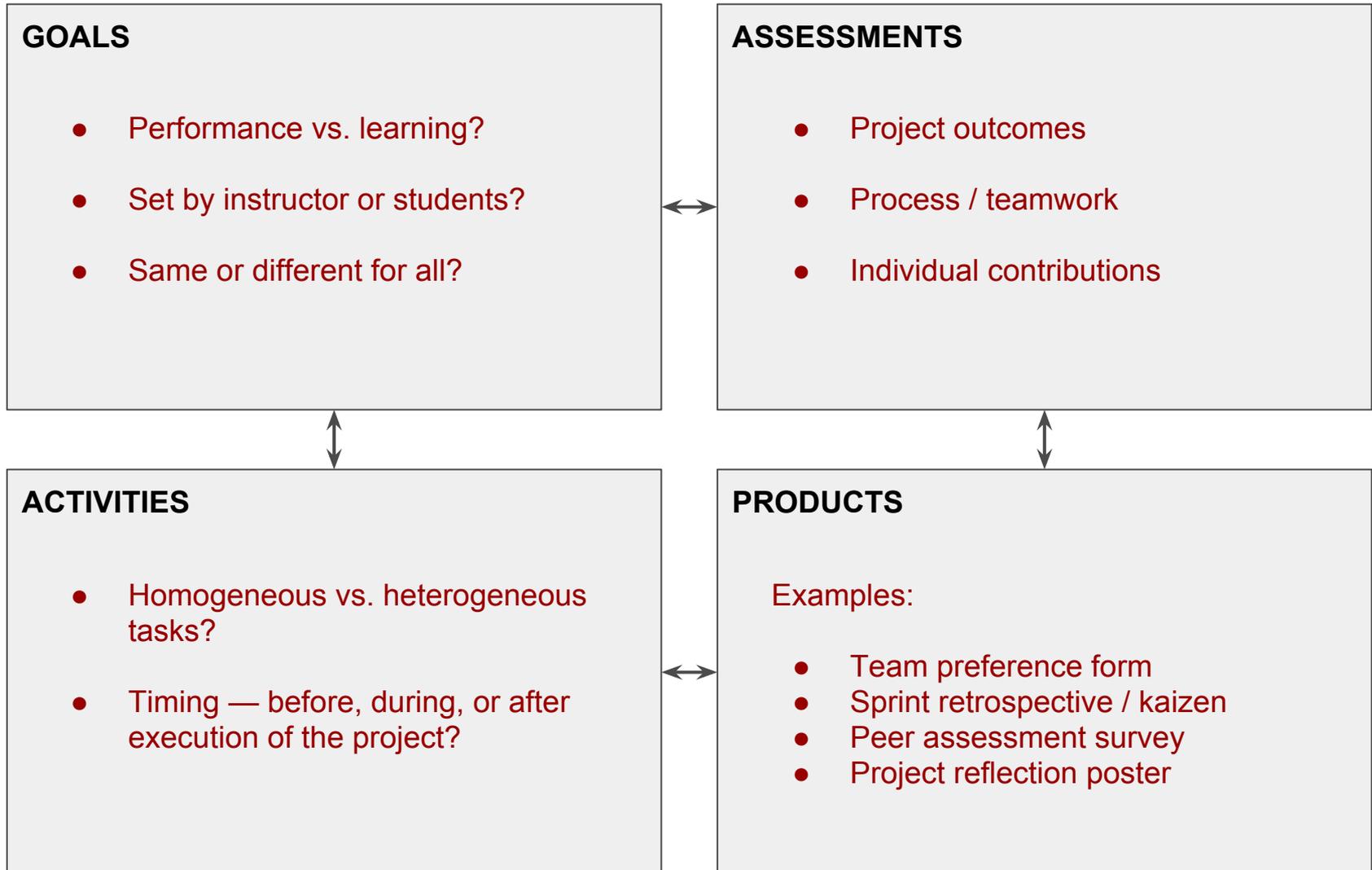
CASE STUDIES

Key elements of a learning experience



team-oriented

Key elements of a [^]learning experience



Case study 1: DesNat and ModSim

- Who: All 90ish first-year students
- What: Two introductory engineering courses
 - **Design Nature**
(biology-inspired intro to mechanical design engineering)
 - **Modeling and Simulation of the Physical World**
(physics + math + computing / using models to do work)
- Where: Three adjacent studios
 - Dedicated space shared between the two courses
(same studio assignments for both)
- When: Fall of first semester

Types of teamwork



ModSim projects (x3)

Heterogeneous Tasks

• DesNat final project

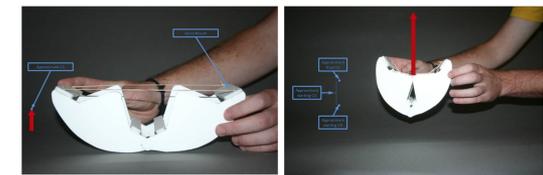
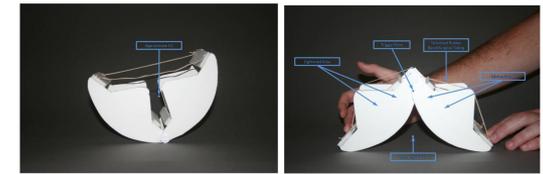


Learning Oriented

Performance Oriented

DesNat hopper project (individual)

Homogeneous Tasks



Goals and assessment

- Instructors' main goals: Expose students to key ideas, develop their curiosity and ability to learn on their own
 - Specific content goals are assessed primarily through individual assignments rather than project work
- Students are given wide latitude to define the goals of each project, for example:
 - Hopper project (DN): How far can it jump while executing a backflip?
 - Thermal project (MS): Can we design a passive freezer that keeps ice cream cold through the entire spring semester?

Activities and products

- **Team formation**
 - ModSim: Tables of 4 self-organize into pairs (Project 1); then teams formed by studio instructors based on preference forms (Projects 2 & 3)
 - DesNat: Hopper project is individual (same tables as ModSim); students pitch final project ideas, then instructors form teams

Activities and products

Partner Preferences

Modeling and Simulation of the Physical World

Partnerships usually work best when both people are operating with similar expectations and similar previous experience. With that in mind, this partner preferences form is important in creating partnerships that are effective, productive and positive.

Name _____

What final product are you committed to producing?

Minimum Viable Product Above and Beyond

What project topic(s) are exciting to you?

A. Epidemiology (SIR) B. Thermodynamics (Coffee Cooling)

C. Another First Order System (with all the extra work this will entail)

What is your level of comfort/confidence in programming?

Not So Comfortable or Confident Comfortable and Confident

How willing are you to teach your partner (if they have a differing level of experience)?

Not so Willing Very Willing

Is there anyone you would not work well with? _____

Is there someone you know you want to work with (in your studio)? If so, talk to that person and STAPLE your two sheets together. We do not, however, guarantee that we will meet your wishes!

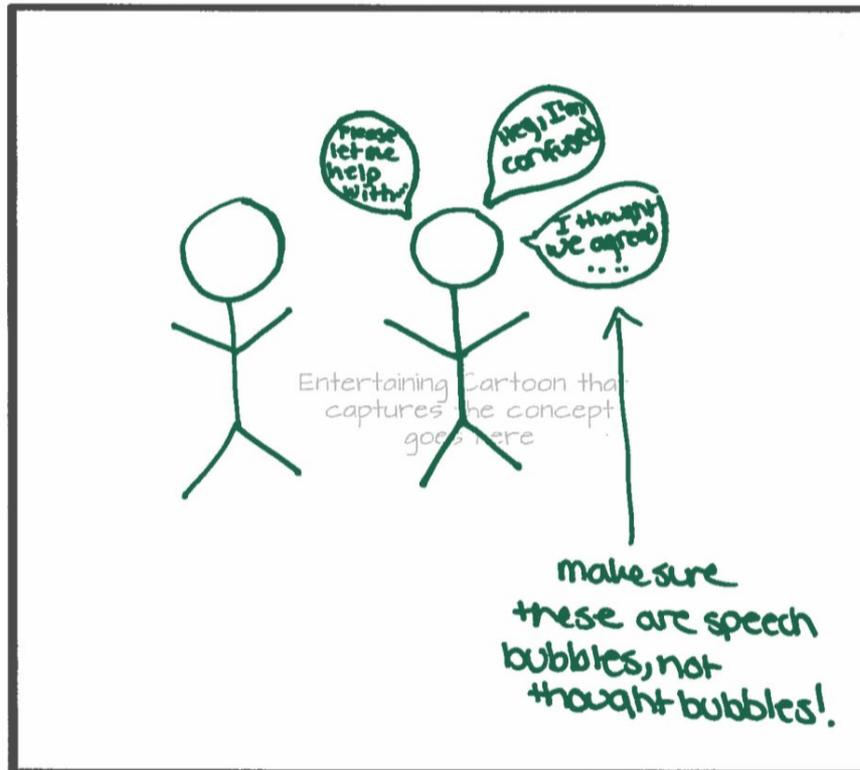
Anything else?

Activities and products

- **Project scaffolding**
 - DesNat: Team launch activity focused on aligning tasks with learning goals (and avoiding common pitfalls)
 - Both: Multiple formal check-ins per project, plus LOTS of open studio time with instructors and NINJAs (TAs)
 - ModSim: Full-class retrospective in the auditorium after Project 1 (expected to do on their own after Project 2)

Activities and products

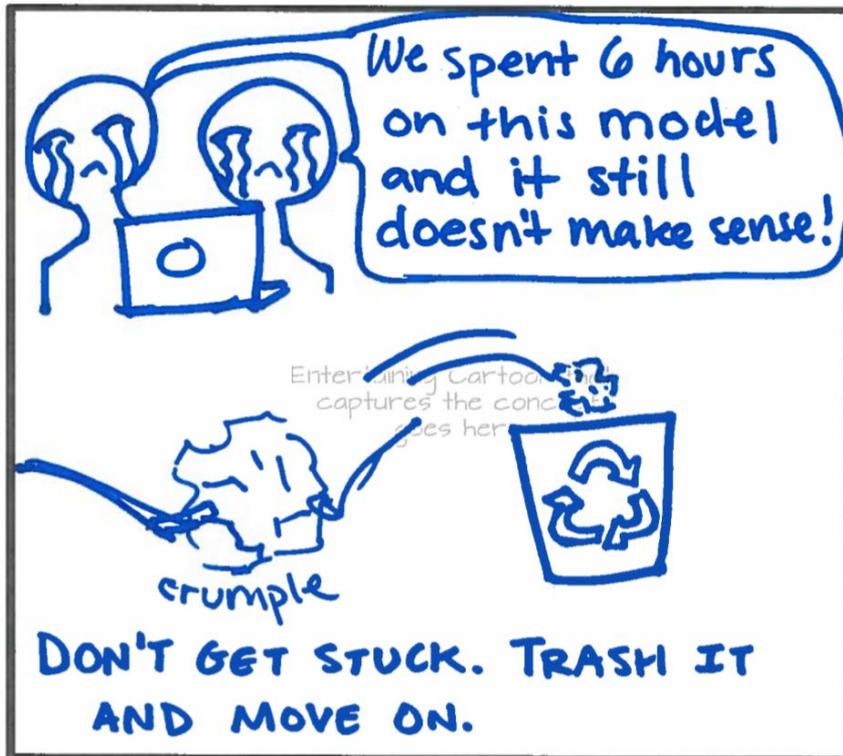
Be a self-advocate



Actually express what you are feeling, especially when you're struggling and/or feel like there have been miscommunications. It will more than likely improve your project and working experience.

Activities and products

Scrap what Doesn't work



If you are trying to make something work simply because you have committed a lot of time and energy, it may just end up being a waste. Use your time and resources to focus on finding something doable that will work better.

Activities and products



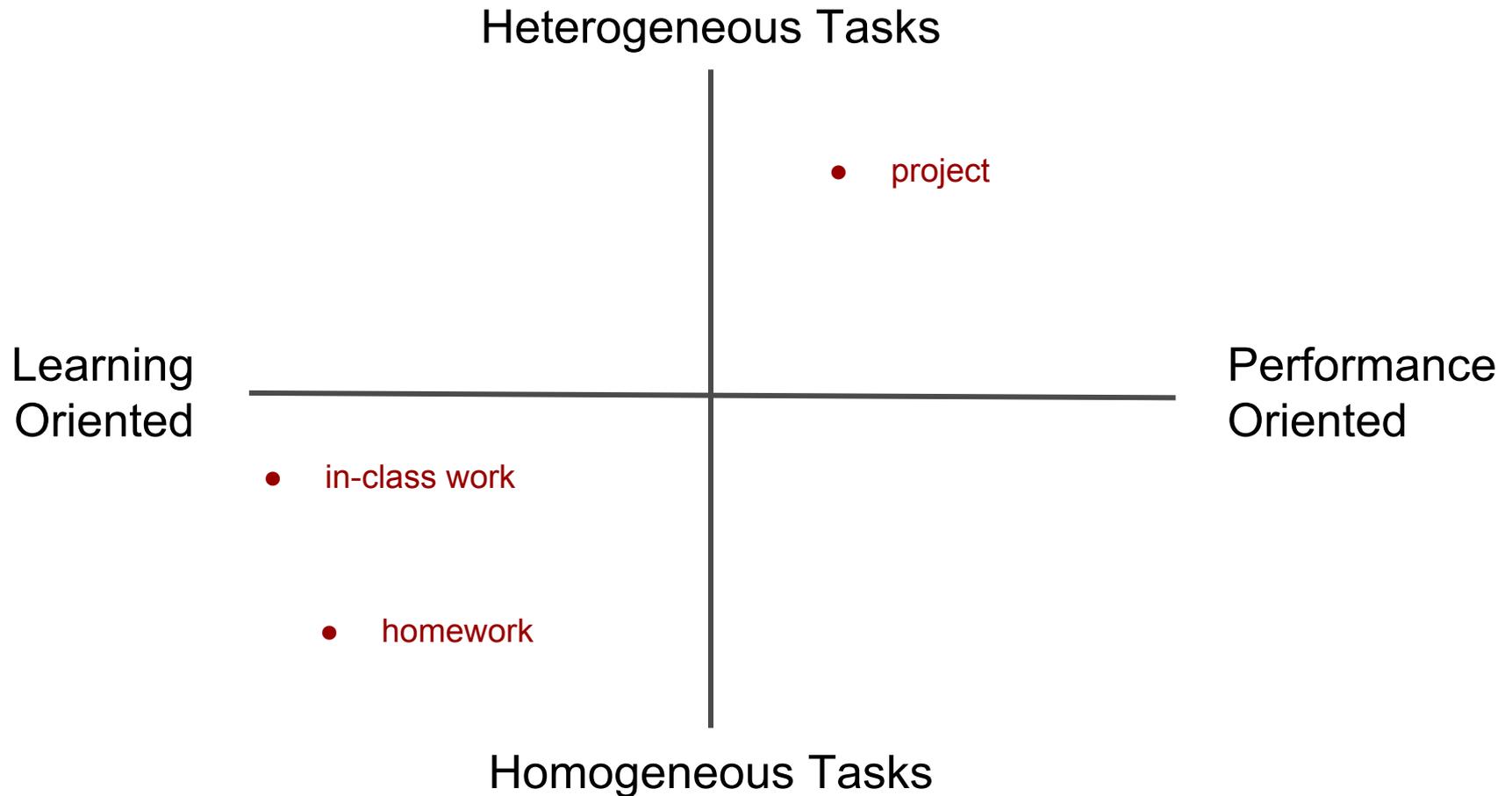
Make sure to get as much feedback as possible.

Summary of advice here

Case study 2: Discrete Mathematics

- **Who / when / where:** 33 juniors and seniors in an ordinary classroom with movable tables
- **What:** A proof-based, rigorous discrete mathematics course analogous to Wellesley's *Math 225: Combinatorics and Graph Theory*
- **Why teamwork?**

Types of teamwork



Instructor goals

- **In-class groups**
 - Help each other learn (troubleshoot concepts)
- **Homework groups**
 - Increase learning/understanding of too-hard-to-do-alone problems
 - ... but every student must attempt every problem before group meeting
 - Improve communication skills
- **Project teams**
 - Increase performance: wider/deeper project & better presentation
 - Improve teaming skills
 - More fun; higher commitment

If I were to elaborate, I would say that I feel like I **learned the most from group homeworks**, both in terms of **discrete science topics** and other **broader skills** that will be useful in my future. To list few things that I can think on top of my head right now, those things are: communication skills (both in terms of **technical communication** or **interpersonal**), **reinforced understanding** of discrete math **through working on challenging problems with others.**

Other useful thing that I got out of this class, which is more “meta-related”, is an **opportunity to communicate and work on heavily technical materials with my peers. Group homeworks**, though they could be **frustrating and stressful** at times, proved to be a **meaningful** experience to me in retrospect.

Communicating your ideas and working with others will be important skills that I will need in future, and I am glad that I was able to practice that in this setting.

Group Homeworks at the beginning of the semester were **really fun**, and I loved my first team. We had a really great workflow where each meeting, there would be at least **one different person for most of the problems that didn't fully understand it, so they were the ones that wrote it up after a good discussion together.** I was very proud of our team dynamic, and also just enjoyed writing up work that I was confused about until I had a good grasp of it.

Student goals

- **In-class groups**
 - No formal goal setting; students can choose which problems to solve
- **Homework groups**
 - Twice per semester, new groups write a team contract (learning goals, behaviors)
 - Every week, groups set a group goal or individual goals
 - Every week, groups do “plus/delta” reflections, refine goals
- **Project teams**
 - Team determines topic, emphasis, minimum viable product, stretch goals
 - Team must justify why the project is suitable based on individual members

... I think I'm going to be most **proud** of the project. This might just be because it's a larger project, but it's **really challenging** and **interesting math** and I'm really excited to help figure it out, **make it clear to other students**, and **share it** with some of our class.

Activities: Team formation

- **In-class groups**
 - Suggest not sitting with homework groups
 - Some students move around strategically
- **Homework groups**
 - Physical sorting based on **when** they want to do their work
- **Project teams**
 - Two in-person “project fairs”

Team formation is important to students

THANK YOU for scaffolding homework groups and teams the way you did. A lot of profs assume that we know who we want to work with and will figure that out. That is very **anxiety-inducing**. Also, the people we think we want to work with may have **priorities** we're not aware of etc. making the chance of teaming with people who don't care as much/care more very likely. So, thank you and please do that structure again.

Activities: Instructor check-ins

- **In-class groups**
 - Groups are fluid
 - NINJAs and instructor circulate throughout class
- **Homework groups**
 - Rare interventions beyond requiring contracts, goals, and plus/deltas
- **Project teams**
 - Instructor meets with ~every team during ~6 classes
 - Instructor meets with teams as needed outside of class
 - Instructor meets with every team to go over presentation

Assessment / accountability

- **In-class groups**
 - Slight accountability captured in “engagement” grade
- **Homework groups**
 - Every week, the team writes a short “who did what” statement
 - New: Students certify which problems they contributed to & fully understand
 - Every team member gets the same grade on certified problems
 - Re-dos are done individually (for now)
- **Project teams**
 - Each student submits an individual, detailed “who did what”
 - Every team member gets the same grade modulo
 - “who did whats”
 - assessment of how the team has functioned
 - assessment of the oral presentation / Q&A

Discrete Math – Takeaways

- Clear guidelines and expectations
- Very little time spent on scaffolding teamwork
- Very rewarding teaming experiences for the students
- Riding on the coattails of 2-3 years of team experiences

Case study 3: “Extended Design Stream” (P&M → PoE → UOCD → SCOPE / ADE)

- Who / when: All Olin students (+ Babson & Wellesley students, too!), from spring first semester onward
- What: A growing cluster of courses, including ...
 - **Products and Markets**
(introduction to entrepreneurship / how to create value?)
 - **Principles of Engineering**
(integrating mechanical, electrical, and software systems)
 - **User-Oriented Collaborative Design**
(design thinking, ethnographic methods, concept development, interaction design)
 - **Senior Capstone Program in Engineering / Affordable Design and Entrepreneurship**

Cross-cutting themes

- Working effectively as a member of a project team is an explicit learning outcome of all of these courses
- Projects increase in scope, duration, and complexity
 - The stakes go up, but students are also better prepared
 - Enables cumulative development of teaming skills
- Links between courses evolved organically
 - Mainly through cross-pollination by faculty and students
 - Examples of re-sequencing in both directions

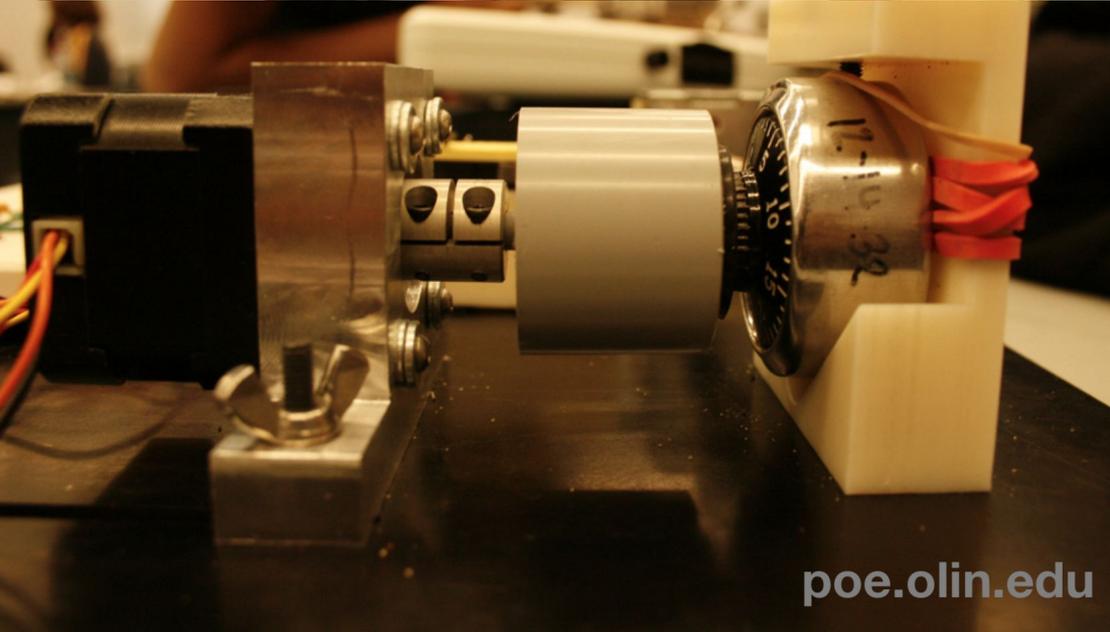
Products and Markets



USER ORIENTED COLLABORATIVE DESIGN



design.olin.edu/courses/uocd



poe.olin.edu

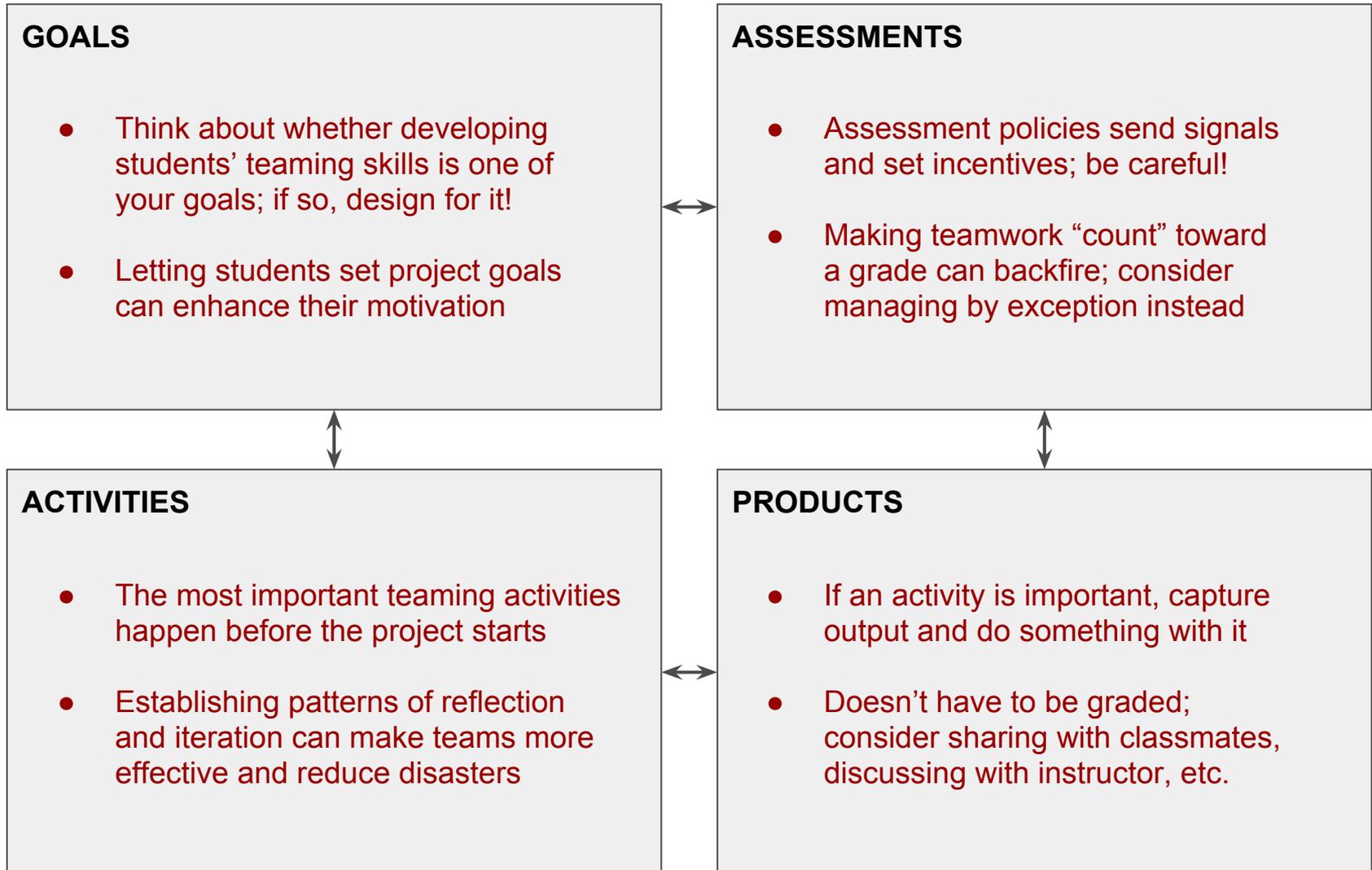


Alison and Debbie demoing a grater
at 1 of 3 pilot sites in PKK, Ghana

Details ... another time!

- Who are we kidding to think we could have covered all of these courses in an hour??
 - We want to give you time to think about **your** courses!
- But we've brought a bunch of example documents, which you are welcome to look at
 - Please get in touch with us if you'd like to adapt them for your own needs

Synthesis: Some high-level takeaways



ACTIVITY

Designing a teamwork experience

from goals to implementation

... time to roll up your sleeves!

Questions, comments, thoughts?

Please feel free to stay and chat with us,
or drop us a note anytime:

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Thank you and have a nice day!

Thanks also to our wonderful colleagues and teaching team collaborators ...

Modeling & Simulation:

- Allen Downey, John Geddes, Christopher Lee, Rehana Patel, Mark Somerville, Alexandra Coso Strong, Alison Wood

Products & Markets:

- James Bowen, Aaron Hoover, Caitrin Lynch, Marco Morales, Lawrence Neeley, Joanne Pratt, Molly Rubenstein, Karen Utgoff

SCOPE:

- Samantha Michalka, Alisha Sarang-Sieminski, Alexandra Coso Strong, Ruth Levine, Jessica McCarthy

And consider
joining us
in June at
the Summer
Institute!

DESIGNING STUDENT-CENTERED LEARNING EXPERIENCES

June 4-8, 2018

a weeklong workshop for faculty teams engaged in curricular
change initiatives at their institution



Olin Collaboratory Summer Institute

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Hands-on analysis and design exercises, case studies, and discussions with experts equip attendees with the learner-centered mindsets and practical tools to create and launch new courses and programs.

previous attendees said:

I have a game plan now to produce the senior design curricular changes within [my] college of engineering.

It was really helpful for me to realize where I'm still stuck in my perceptions of how a classroom works.

It was amazing how one week of discussion made [our faculty team] closer.

It was a great week, to learn and reflect on undergraduate education innovation.