

# Teaming Across Curriculum: One-Pager for Team Formation

Shraddha Sangelkar, Benjamin Mertz, Ashley Bernal, Patrick Cunningham  
*Rose-Hulman Institute of Technology*

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Corresponding Author: Shraddha Sangelkar, [sangelka@rose-hulman.edu](mailto:sangelka@rose-hulman.edu)

The way teams are formed can have a significant impact on both team performance and student attitudes toward the course<sup>1</sup>. The main audience for this work is experienced capstone instructors who would like to help the other faculty in their department make informed decisions while forming teams. Newer faculty often ask for advice on managing teams from the faculty mentors who primarily teach project-based classes such as capstone design. Prior experiences that senior students receive before coming to a capstone design course are important because they can significantly influence the students' perceptions when dealing with teams.

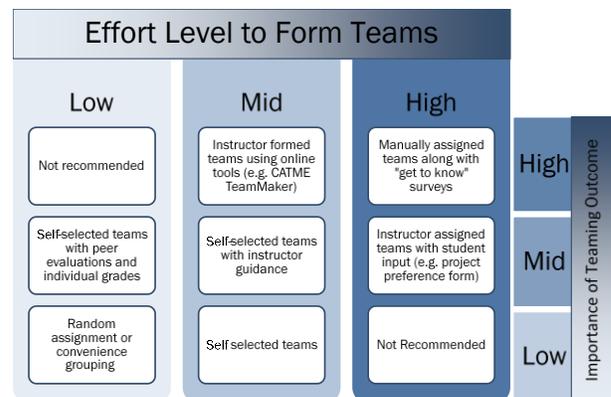
This work summarizes the advantages of various methods of team formation and strategies that may help mitigate negative impacts, as described in the literature. The information is summarized as a one-page visual team formation handout that highlights the key aspects of each method and acts as a guide to make informed decisions regarding which method to use. Our goal is to mitigate some anxiety around the complicated topic of team formation. The idea is to help instructors choose team formation strategies that will facilitate course learning objectives. As a disclaimer, this one-pager was created for small class sizes at the authors' institution. While many of these strategies will work for larger class sizes, the logistics of managing large numbers of students might necessitate special consideration of effort level in the choice of team formation methods. A few key ideas from the team formation one-pager are summarized below.

## Why does this impact most instructors?

For the purposes of this paper, we define a team as a group consisting of more than one person working towards a common goal and the group has at least one team submission that is graded. Such cooperative experiences in the coursework may include projects, labs, assignments, or other class activities. ABET criteria 5 of student outcomes evaluates "an ability to function effectively on a team ..." <sup>2</sup>. In many institutions, this outcome is measured in the capstone class but the training for ability to work effectively on team occurs throughout the curriculum. This work originated as a part of curricular thread on cooperation in the Mechanical Engineering Department at Rose-Hulman. As part of a curriculum improvement process, we are working to coordinate "threads" that cut across courses in the curriculum. For more detail on the work completed by our cooperation thread group and other such threads, please see authors' prior work<sup>3</sup>. One on-going effort of the working group involves creating a series of one-page guides focused on managing student teams. This paper focusses on the first of these guides on the topic of team formation. In the future, our goal is to develop similar handouts on teaming instruction and managing dysfunction. The main idea of how to use this guide is summarized further.

## Where does your course fit?

Literature suggests that randomly assigning teams does not necessarily enrich teaming experience<sup>4</sup>. Instructor role and extent of instructor control in forming teams varies depending on the time devoted for forming teams and Course Learning Outcomes for both teaming and core concepts<sup>5</sup>. We recommend that the faculty using this one-pager should (1) choose their course learning outcomes, (2) decide on how much effort they are willing to put in to team formation, and then (3) choose a strategy that is most



**Figure 1. This visual aims at helping the instructor make decisions on forming teams based on the course outcomes and effort involved in forming teams**

suitable for them. A question to contemplate would be the purpose of using teams in the course. Importance of teaming outcomes or the purpose of using teams in a course may be - **High:** Specific teaming outcomes are being assessed as a part of the course objectives and teaming is a major part of the course, **Medium:** Some teaming assessment is given but it is not the primary focus of course objectives or instruction, or **Low:** Teaming is used for logistical reasons such as lack of equipment or ease of assessment, and teamwork is not being assessed explicitly.

### Criteria for forming effective teams

The authors recommend considering the criteria below when forming teams with any method. It is important to allow students to opt-out of questions pertaining to grades, gender, ethnicity if such data is collected for team formation.

1. Three to five-person team size is ideal. Initially, aim for 4-person teams which leaves room for dropouts, or reassignments (quitting/firing). Pairs are useful for collaboration but do not provide a rich teaming experience
2. Teams work better when members have common blocks of available time<sup>6</sup>
3. Student teams with homogeneous curricular interest and heterogeneous GPA perform better<sup>7</sup>
4. Students that are under-represented in engineering: (a) In the first two years of the curriculum, avoid isolating at-risk minority students (b) After second year, risk of dropping out becomes minimal so focus on preparing students for the workforce

Students have reported that their worst group work experiences were from self-selected teams<sup>8</sup>. Instructor assigned teams with research-based criteria may improve student teaming experience<sup>1</sup>. To overcome student resistance, provide students the option to dissolve and reform teams at the project midpoint. Unless they choose to stay together (most teams will choose to stay), allow requests to quit or fire from a team. In case things do not go as planned, facilitate a mini crisis-clinic to help teams and provide coaching to deal with team dysfunction. If teams are self-selected by the students, a few considerations can be used for improving the experience. Facilitate a pre-mingling activity with prescribed questions so that the students can get to know other students' skills and abilities. Instructors can also give students rules under which they can form teams (e.g. team members cannot be from the same athletic team).

We shared this one-page guide at the annual faculty teaching workshop offered at Rose-Hulman in Aug 2021. This workshop is attended by all new faculty who joined the institute in that academic year, and it is open to all existing Rose-Hulman faculty who may be enthusiastic about learning new ideas. Some feedback received from this workshop is summarized here: *"I feel like I know how to assign teams and what to look for"*, *"I understand how team formation affects time and assessment"*, and *"I didn't pay attention to teams before, and now I know why I had some of the problems I had"*. This guide was primarily formulated for the Mechanical Engineering Department at Rose-Hulman. Rose-Hulman is a small private institution with small class sizes of approximately 24 students and the institute's mission is focused on individual attention and support. Strategies that work best for small class sizes may not necessarily work the same for large design classes. Our hope is that our peers can adapt this guide and use a modified version of this one-pager to fit their institutional needs and mission.

### References

1. Paretto M, Layton R, Laguette S, Speegle G. Managing and mentoring capstone design teams: Considerations and practices for faculty. *International Journal of Engineering Education*. 2011;26(6):1992.
2. ABET. 2020 [cited 2020 January 20]. Available from: <https://www.abet.org/accreditation/accreditation-criteria/>.
3. Sangelkar S, Mertz BE, Bernal A, Cunningham P. Benchmarking Teaming Instruction Across a Curriculum. *Proceedings of the ASEE 2019 Annual Conference and Exposition*; 2019; Tampa, FL.
4. Bacon DR, Stewart KA, Silver WS. Lessons from the best and worst student team experiences: How a teacher can make the difference. *Journal of Management Education*. 1999;23(5):467-88.
5. Parker R, Sangelkar S, Swenson M, Ford JD. Launching for success: A review of team formation for capstone design. *The International journal of engineering education*. 2019;35(6):1926-36.
6. Ohland MW, Loughry ML, Woehr DJ, Bullard LG, Felder RM, Finelli CJ, et al. The comprehensive assessment of team member effectiveness: Development of a behaviorally anchored rating scale for self-and peer evaluation. *Academy of Management Learning & Education*. 2012;11(4):609-30.
7. Brickell LCJL, Porter LCDB, Reynolds LCMF, Cosgrove CRD. Assigning students to groups for engineering design projects: A comparison of five methods. *Journal of Engineering Education*. 1994;83(3):259-62.
8. Oakley B, Felder RM, Brent R, Elhajj I. Turning student groups into effective teams. *Journal of student centered learning*. 2004;2(1):9-34.