

# Teamwork For Large Projects

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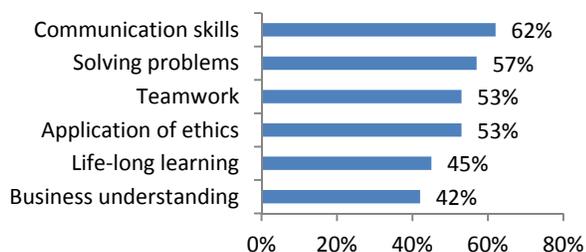
Through the course of a four year NSF project, we interviewed over 140 engineers and conducted case studies of six engineering firms from varying industries. Over 2000 engineers or engineering graduates also responded to surveys. All of this data enabled us to draw conclusions about the ways of thinking, skills, values and identities of practicing engineers. This report on teamwork is one of a series of brief reports on ideas for further enhancing the connection between engineering courses and engineering practice.

This first column page details data from engineering graduates on the importance of teamwork. The remainder of this report provides offers succinct summaries of suggested activities, assignments, instructional principles, and additional resources that can help students develop teamwork skills.

“If I have to name two things that can derail a technically competent engineer who works hard, it’s the inability to work in teams and inability to effectively communicate.”

--*Engineering Professional*

The following graph of survey results indicates that the ability to work productively in teams is among the four work skills most often identified as important by practicing engineers. The percentages indicate the percent of engineers ranking these skills as “essential” in their work.



## Example Activity

Once students are in their teams and have discussed and understood their project assignment, ask them to conduct a “pre-mortem”—to imagine that their project has failed and to identify the likely sources of this failure. Encourage your students to range through the gamut of possibilities: group conflict, scheduling challenges, client challenges, technical challenges, etc. Prompt them to reflect on their own previous group experiences and, if possible, on word of mouth re: ongoing projects. This exercise encourages students to think realistically about project challenges, identify common obstacles to project success, and devise strategies for avoiding or surmounting them. This activity can also prepare the group to draft a compact of agreed-upon behavioral norms.

## Example Assignment

Ask your student teams to each discuss and reach consensus on a group compact: a document establishing norms of behavior that all team members agree to follow. Typically, such a document will cover, at a minimum, team goals, team roles, attendance obligations, behavior during meetings, acceptable response times to emails and other communications, and time and effort expectations. Ask each group to provide a 5-minute presentation on their compact that spells out its content and rationale. After presenting their compact, the team should entertain questions from the rest of the class. This Q and A should yield valuable feedback and enable students to think comparatively and critically. The teams, having now been exposed to several different charters and wide-ranging discussion, can then revise their compacts. The final compact should be signed by all team members.

**Follow up:** After several weeks of work in teams, ask the students to revisit and revise their compact in light of their experience.

## Pedagogical Principles

Students should not only be encouraged to manage their own team but also be given the tools to do so. Early activities and assignments should assist them in developing a team compact and planning their work. A little hands-on instruction at the front end of the course can allow instructors to then step back and let the students “figure it out for themselves.” Requiring that groups devise compacts, insisting that they make regular use of assessment tools, setting interim deadlines, and pointing teams toward additional resources that help them manage schedules and interpersonal conflicts—all these measures can provide students the directed autonomy they need to obtain a challenging, productive team experience. Finally, though teams should be strongly encouraged to resolve their own conflicts, instructors should be willing to intervene if team dysfunction degrades the educational value of the team experience for fully participating team members.

Instructors may need to remind students that the teams should foster diverse skill development. When practical, teams should rotate roles and responsibilities to spur all team members to develop new skills.

## Assessment

Students should be encouraged to perform scheduled self-assessments and peer assessments that provide feedback regarding adherence to their compact and overall contribution to the project. These assessments can be as simple as constructing a quick pie chart depicting the relative contributions of each group member or as complicated as an expository analysis of group dynamics. Students may develop in-house assessment tools for their own use, but instructors should also be given access to a satisfactory assessment tool that they may either develop themselves or ask the students to devise. Students may be more likely to buy in to the team experience if they know that instructor feedback and evaluation will account for both overall team performance and individual contributions. Assessment must be done in reasonable proportion if it is to avoid becoming “busy work,” and assessment activities should be framed as important feedback that can enhance individual and team performance, not a simple grade.

## Links

### [Foundation Coalition’s student-teams resource](#)

Provides a comprehensive, detailed, yet compact resource for instructors and students. Of particular value are the dozen “mini-documents” covering essentials such as organizing teams, enabling decision making, teaching effective interpersonal communication, resolving conflict, and monitoring team performance.

### [MIT’s Sloan School communication notes](#)

Includes concise documents on teamwork basics and offers a variety of documents and slides oriented toward communication tasks pertinent to working in teams, including documents on giving and receiving feedback, and on holding difficult conversations. Also supplies straightforward instruction aimed at improving student writing.

### [Team-Maker and Effectiveness Survey](#)

A group of engineering educators developed a tool for forming teams ([Team-Maker](#)) and assessing the effectiveness of teams ([CATME](#)). The CATME tool gather peer and self evaluations give feedback to team members and faculty.

### [Course Materials for Teamwork](#)

Washington State materials for engineering design projects with a section specifically devoted to creating teams.

### [Link to Online Teamwork Report](#)

If you’re reading a paper copy, find a digital version at <http://hplengr.engr.wisc.edu/resources.htm>

