

Getting Student Engineering Teams Off to a Good Start

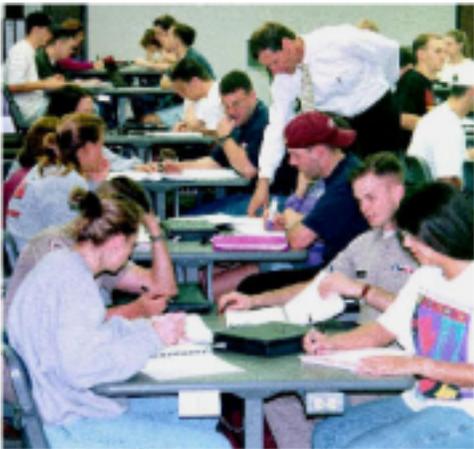
<http://www.foundationcoalition.org/teams>

Definition

A team is a **small group** of people with **complementary skills** who are committed to a **common purpose, performance goals, and approach** for which they hold themselves **mutually accountable**.¹ Although student teams may not satisfy all the requirements of the definition, the degree to which they do often determines their effectiveness.

Getting Teams Off to a Good Start

Once teams have been formed, instructors need to provide the foundation for success. "Students do not come to school with the social skills they need to collaborate effectively with others. So teachers need to teach the appropriate communication, leadership, trust, decision making, and conflict management skills to students and provide the motivation to use these skills in order for groups to function effectively."² **Faculty must take responsibility to help students develop their skills to participate in and lead teams.** Investing time and effort in helping teams establish goals, expectations for behavior, and trust will pay off with more productive teams and fewer team problems. Although an instructor can do many things to help the teams get off to a good start, the following six are especially important.



- **Get acquainted:** Taking time to learn about your teammates is a good investment.
- **Motivate groups to build teams:** Establishing and maintaining a high-performance team takes work. One way to help students invest the energy and time it will take to form and sustain an effective team is to help them better understand the importance of social, interpersonal, and team skills for their career and lifelong goals.
- **Establish a set of group goals:** Strategic learners need to be able to set and use meaningful goals to help them learn and to help them generate and maintain their motivation for studying.
- **Construct a code of cooperation:** Every team member has expectations about how the other members will perform. Helping each team articulate individual expectations and reach consensus on a set of common behavioral expectations yields positive results.
- **Organize:** Conducting productive meetings and organizing group tasks are skills that are learned, not innate. Further, certain tasks must be performed for a team to function effectively. Assigning roles to specific individuals can help the team operate more smoothly.
- **Potential problem members:** Reflection on potential difficulties and how they might be addressed can avoid problems later. Once the team has been started, instructors can provide additional team training that will be described in other documents in this series.

Getting acquainted

Investing time in getting to know your teammates will pay off in the long run. There are a number of icebreakers you can use to get to know your fellow students. The best icebreakers call for participants to explain something about themselves, their likes and dislikes, their backgrounds. These can be fun and can be completed in class or through e-mail correspondence.

Example 1 One short and effective exercise is "**Two Truths and a Lie**," in which students share with a group two truths and a lie about themselves. Someone in the group has to guess the lie.

Example 2 In another exercise, each member writes a **characteristic about self** on a slip of paper and puts it in a hat. Then, each member picks a slip and tries to match it with the right person.

Example 3 For the **nonverbal birthday lineup**, ask everyone to line up according to the month and day of birth with no talking. This inspires interesting means of communication toward a common goal.

Example 4 For **silent identification**, each participant is asked to silently write words or draw pictures that describe themselves. They pin these on their shirts, walk around, and look at each other. Descriptions are then shuffled, and participants are asked to match the person with the picture/words.

Example 5 **What kind of team?** Divide the team into groups of 4 to 6 people. Have each group discuss and identify an analogy for their team. For example: "We are like a three-ring circus—because we have many things going on at once and it feels chaotic at times." Allow ten minutes to discuss then have teams share.

These exercises help students appreciate different ideas and learn the preferences of others in their team or class. The idea is to learn more about the different students in your class.

Once students feel comfortable with each other, the next step is to **earn the trust** from one another. Working as a team requires each member to contribute. It requires team effort. A common set of characteristics that helps build trust include (1) following through on promises and completing tasks, (2) having open, productive, and frequent communication, (3) surfacing problems when they arise and not collecting bad or hurt feelings, and (4) avoiding cliques within groups.

Motivating groups to build teams

Team members must invest considerable effort and energy in building and supporting their team. Some team members already understand the value of developing their social, interpersonal, and team skills and are ready and willing to invest their resources to develop their team. Other team members may question the value of learning to work and learn in a team. Some may have had outstanding academic records in high school and wonder why they need to learn to work more closely with others. Some may have participated on dysfunctional teams in high school and want to avoid repeating that experience. Some may place a higher priority on co-curricular activities and see the time and energy required by their teams as conflicting with their individual goals. One step that faculty members can take to increase the investment that team members are willing to make is to help them understand the value of team skills after graduation. Therefore, faculty members using teams in their courses can share the resources below with their students at the beginning of the term to help them get a clearer picture of the value of learning to work and learn as teams.

Helping students discover the value of teams deals with at least three major issues.

- Value of team skills after graduation: This helps students to know that employers value abilities for functioning effectively on teams.
- Overcoming negative attitudes about teams from prior experiences: Many students have negative experiences from prior participation on dysfunctional teams. Helping students understand how they can learn from past experiences and improve their experiences is important.
- Performance as a team often exceeds performance as individuals: Providing students opportunities to compare their performance on a task as individuals to their performance on the same task as a team may help students to better appreciate the value of teams.

Value of Team Skills after Graduation

If you can't operate as a team player, no matter how valuable you've been, you really don't belong at GE.⁴

"In today's organization technical competence only gets you up to the starting line. High-performance relationship management is the critical skill which allows you to go the distance."⁵

"The key to employability is acquiring the knowledge and skill sets in demand by employers. Those who fail to gain or maintain knowledge and skill with tools, such as computer-aided design and other software relevant to their work are disadvantaged. The lack of communication and interpersonal skills, needed to work effectively on teams, can also be a stumbling block."⁶

According to a study conducted by the American Society for Training and Development and the U.S. Department of Labor, Employment and Training Administration⁷, employers want their employees to have the following skills:

- Learning to Learn
- Adaptability: Creative Thinking and Problem Solving
- Organizational Effectiveness and Leadership
- Listening and Oral Communication
- Personal Management: Self-esteem, Goal Setting/Motivation, and Personal/Career Development
- Competence in Reading, Writing, and Computation
- Group Effectiveness: Interpersonal Skills, Negotiation, and Teamwork

During interviews, prospective employers often ask applicants questions about their teaming experiences. Example questions are listed below.

- We cannot do everything ourselves. Give me an example of a time when you dealt with this reality by creating a special team effort at work. Highlight the special aspects of the situation that best demonstrate your skills in this area.
- The term "participative management" has been used for years to describe a technique of building team spirit by collecting suggestions from others. Describe a time when you used suggestions to build team commitment.
- There is a big difference between being committed to an individual or to a team. Tell me about a time when your commitment to a person was tested because of your commitment to the team. Explain what you did and why.

Overcoming negative attitudes about teams from prior experiences

Many students have been in dysfunctional groups before coming to college. Ask them what happened that made the group fall apart. Then, ask them to identify what could have kept the group together. This may motivate them to want to have a better experience. The worse the previous experience, the more willing students are to learn from their mistakes. You might also ask them to write about their worst teaming experience and identify what went wrong.⁸

Performance as a team often exceeds performance as individuals

Students can learn the value of teams through exercises that they can complete as individuals and then as teams. Through these exercises students learn that they can perform more effectively as a team than as individuals. Examples of these exercises include

- LOGO Exercise: This exercise is available at http://www.fcae.umassd.edu/fcteambteamfacultyguide/frames_index.html. The site is password-protected. Check with [Ted Powers](#) at University of Massachusetts Dartmouth about access.
- Desert and Space Survival Exercises: These exercises are available at <http://www.eas.asu.edu/~asufc/teaminginfo/teams.html>.

Student teams also provide a support system that students can use when they cannot find their professor, don't remember their homework assignment, etc. Focus groups conducted with students across the Foundation Coalition show that, when students need help, the first resource they turn to is their team.

Establishing group goals

Every team works toward common goals; without common goals there is no team. Existence of common team goals does not imply that individual students have no individual goals. For example, a team may agree that one of its goals will be to build the most accurate Ping-Pong ball launcher for the assigned project. However, two team members may be individually aiming for As in the course, a third member may be focusing on a B, while the fourth may be content with a C. Without open, honest, and explicit conversations about goals, team members may have difficulty understanding the actions of other members. Without common goals the team does not generate energy to work together.

Understanding that different students have different goals can be eye opening. A member concentrating on getting an A may realize that other members have set their sights on lower grades while focusing on other campus activities, and vice versa. Such situations are likely to arise in teams in which instructors, in assigning teams, have emphasized heterogeneity in prior academic performance and skills. Further, members aiming for an A may feel more comfortable when they see other members doing less if they have realized others will be satisfied with a lower grade. However, the instructor should establish grading policies that may assign different grades to different members of the team.

Unrecognized differences in individual goals are one source of potential conflicts as the course progresses. Failure to establish common goals reduces commitment of the individual members to the team effort. Therefore, providing opportunity and structure to assist each team in constructing group goals to which all can be committed is important.

Team exercise: Ask each team to develop a set of goals for its activities during the course. A team may want to use the following process for developing a set of group goals.

On a sheet of paper, create a column for each team member and a column for the team. Ask each member, in turn, to state one of her/his goals for the course and record the goal in the appropriate column. Repeat a few (for example, five) times. Ask the team to select one goal from each column and synthesize the individual goals into a goal to be placed in the team column. Repeat to construct a small number of goals in the team column. Revise the goals in the team column to create a set of goals for the team. Each team should then submit its goals to the instructor.

After a few weeks have each team revisit its goals to determine if changes are necessary.

For further information: See material on group goals.⁹

Constructing a Code of Cooperation

Behavioral Expectations for Each Other

1. What is a code of cooperation?

A code of cooperation for a team is a set of standards that is developed by that team. These norms describe expected behavior for individual members and for the team as a whole. A code of cooperation may include expected penalties for failure to adhere to the norms. If a team is experiencing problems, the team (or the team and a facilitator) may refer to the code of cooperation for guidance in resolving problems.

2. Why is a code of cooperation important?

In a class in which significant amounts of work will be done in teams, each team may lack a set of norms for expected behavior. Each member of the team has expectations for behavior. However, another member of the team will have different expectations. Unless these individual expectations are communicated and the team develops a code of cooperation, problems may develop because one member may unknowingly fail to fulfill expectations of other members. The expectations of each member must be made explicit, and the team must work through the exercise of building a code of cooperation from these individual expectations.

Also, if team conflicts escalate to the point at which they require the instructor to serve as a facilitator, the instructor can refer to the team's code of cooperation when working with the team.

3. How might you help your teams create a code of cooperation?

The ability of a team to develop a code of cooperation that will help them to resolve conflicts later depends on the maturity of the students, the amount of prior team experience, and the mechanisms that instructors have established for grading team assignments. Suggestions to instructors depend on these factors.

The code of cooperation must reflect each team's expectations of its members. Instructors may not want to start by showing teams examples of other codes of cooperation prior to the exercise in which teams develop a code of cooperation. The experience of several instructors is that students return the examples to the instructor in a relatively unmodified form without going through the hard work of developing a code of cooperation for their team and their situation. However, once students begin to construct their own code of cooperation, showing them segments of other codes of cooperation that have been developed may be helpful. For an extended example of developing a code of cooperation, please refer to **Developing a Code of Cooperation**, another document in this series.

One challenge is the degree to which students take the task of establishing a code of cooperation seriously. Instructors of first-year students have noted that the initial version of a code of cooperation is quite idealistic. They sound nice, but the students don't really expect problems to arise. Instructors recognize the value of iteration in engineering design, and iteration has similar value in developing a code of cooperation. After the teams have been functioning for several weeks, encourage them to revise their codes of cooperation to reflect what they have learned after working together. Instructors tend to notice that later versions contain explicit rewards for good performance and penalties for failure to meet specific expectations.

Organizing

An Organized Team is a Happy Team

Teams often need help in establishing patterns for how they will operate. Each of the following issues is developed in detail in other documents. However, to help provide a solid foundation at the beginning, an instructor may want to mention the following issues.

Time Management Procrastination can be a problem for anyone, but bad things can happen when it occurs in a team! First, tendencies of individual team members to procrastinate can feed on each other ("It must not be a problem since they are not worried yet."). Second, a procrastinator may be perceived as a slacker or freeloader (they have not done their part *yet*) and disregarded, discounted, or ignored. Third, if individuals are performing a sequence of tasks, delays of only two days in accomplishing each task can delay the final product by two weeks or more.

Effective Communication Encourage teams to recognize that communicating well requires *speaking and listening* in addition to *writing and reading*. Speaking and listening, especially listening, are often largely untaught skills.¹⁰ A crucial requirement for teams is to have team members who listen to one another and who fully consider the views of their fellow team members. Paying attention to how you listen and speak to others helps students understand each other and avoid hurt feelings. Although students spend a large amount of time listening to lectures, their active listening skills can be improved considerably. Refer to **Effective Communication** for more information.

Effective Meetings and Decision Processes Raise the following issues with your students at the beginning.

Agendas Encourage them to establish agendas before the meeting. A simple agenda may answer when, where, and why? A more complete agenda may address the following questions: When? Where? How long? What do we intend to accomplish? Who is bringing what materials that might be needed?

Fix a Time to End Without an agreement to end meetings at a fixed time, some teams will coerce members to simply continue (all night, if necessary) until the job is done. All team members have a right to be able to plan the part of their life that is unrelated to this class. Stress will build between the team member who has another commitment and the member who lives for the team.

Minutes At the end of the meeting a recorder should have compiled at least a list of decisions, conclusions, and action items, i.e., as a result of this meeting, who is going to do what by when. Each team may want to keep a notebook or alternative record to collect and preserve minutes. Strategies for recording may differ for beginning and experienced teams.

More information is available in **Effective Meetings and Decision Processes**.

Work Assignment and Work Division Professionals frequently sketch a plan or an outline for an assigned task without completing all the details so that others can use the outline to complete their tasks. Students may require support and guidance for learning to draft a solution that enables the entire team to work together effectively.

Team Roles

A team needs to have certain functions performed in order to work effectively. Therefore, teams can improve their effectiveness if they identify these functions and decide on how they will be performed. The most common way to accomplish this task is to assemble a set of functions into a role and then decide how team members will be assigned to roles. Knowing everyone's role and being familiar with the responsibility of those roles create efficiency and flexibility.

One of the most commonly identified team roles is team leader. However, students have various mental models of leadership (for example, that a team leader supervises the other team members). Since such supervisory models conflict with the required functions of a team leader, instructors may want to label the role as team coordinator or team convener. These labels better describe the functions to be performed by the team leader who coordinates and prepares for meetings, ensures all necessary resources are available for the meetings, and guides the team through decision-making and problem-solving processes. Other useful roles are listed on the right (Possible Team Roles).

Team Exercise (Setting Roles): Once an instructor has clarified the nature and purpose of roles, asking each team to identify various team roles and describing the functions that might be performed by each role may be a useful exercise. After individual teams have tackled this task, an instructor might solicit input from various teams and lead the class toward a consensus list of roles and their definitions. In this way, the instructor can increase ownership and understanding of team roles.

Clarifying roles is always important. To clarify roles the instructor might review roles frequently, relate team members' expectations with overall team performance, clarify responsibilities when action planning, learn what others do on the team, and figure out ways to help each other.³ An important recommendation is to have students rotate their roles and have the instructor informed on when these roles are rotated. This way, students learn more about the different responsibilities in a team, in addition to just being a team member.

Required roles depend on the length of existence of the team. For short-term teams, the following roles may be necessary: coordinator, timekeeper, encourager, gatekeeper, and recorder. For teams of four the roles of encourager and gatekeeper can be combined. For long-term teams, the following roles may be necessary: coordinator, facilitator, recorder, and timekeeper.

Possible Team Roles

Coordinator coordinates and prepares for meetings, ensures all necessary resources are available for the meetings, and guides the team through decision-making and problem-solving processes.

Recorder is responsible for doing the writing during team exercises and providing copies of said material.

Timekeeper is responsible for keeping track of time, as well as keeping the team moving so that they finish the task on target.

Encourager encourages all the other team members to actively participate and controls the verbose, dominant members.

Gatekeeper solicits input from members who are not actively contributing. Also, he/she reminds the team when they are getting off task.

Facilitator focuses on the quality of the processes that the team is using and team maintenance. A facilitator focuses on how the team is accomplishing its tasks, while other members may be focusing on performance.

Devil's advocate takes a position opposite to that held by the team to ensure that all sides of an issue are considered. This responsibility should be undertaken by all team members. This role may be unnecessary, since many people fill this role naturally. Assigning this role may overemphasize its function.

Addressing potential problem team members

One of the questions frequently raised by faculty members and students about the use of teams is the potential problem of students who either don't contribute substantively or don't make the effort to do their parts. A faculty member must be prepared at the beginning of a course to address this issue. There are two vehicles for addressing the *freeloader* problem. One is the grading policy for the course. The second are mechanisms through which teams might address the problem if it arises.

Grading: To students, the expectations of an instructor are reflected in the grading policy. For students, if the instructor values certain behaviors, certain concepts, certain performances, these will appear as components of the grade. So, for example, if an instructor values performance as a team a percentage of the grade will depend on one or more assignments done as a team. However, if teams submit an assignment and each team member receives the same grade for an assignment, then a member who made no effort to contribute could receive the same grade as a member who made significant contributions or substantial effort. The same grade for every team member may encourage freeloading. Therefore, an instructor may develop a procedure to assign differentiated grades to encourage individual accountability. One way to assign differentiated grades is to use **Peer Assessment** or peer evaluation, which is the topic of another document in this series. An instructor might get better results from a peer evaluation if it is preceded by one or more cycles of peer assessment and feedback.

Possible team mechanism: On assignments submitted by a team, ask that each member of the team who made a reasonable effort to contribute to the assignment sign it. If the team thinks that a member of the team has not met the criteria for signing, then that member should be not permitted to sign and will not receive credit for the assignment. A suggested criterion is "I did my fair share of the work, AND I have a general understanding of the (entire) contents of the submission."

Possible team mechanism: Another mechanism or pair of mechanisms that might be offered to a team to address slackers is "firing" or "resigning." For example, an instructor might allow a team to "fire" a team member who consistently refuses to make an effort to contribute. An instructor might require that a student who has been fired complete the rest of the course work as an individual or find another team that will accept that person as a member. Alternatively, an instructor might allow a member to "resign" if the member thinks that the other members consistently fail to make an effort to contribute. Again, an instructor might require that a student who has resigned either complete the rest of the course work as an individual or find another team that will accept that person as a member.

Another type of potential problem member is the dominating team member who refuses to allow other team members to contribute ideas or concerns. These types of members can be *worse* than freeloaders in terms of team development. Raising these types of problems early with the entire class and asking them how these problems might be addressed can help provide teams with tools to handle these problems if they should arise.

Role Evaluation and Self-assessment Ask students to assess their performance on a team, how they are performing their assigned roles, and how their performances might be improved.

Instructor Role The instructor's role is crucial and active. Monitoring the teaming process can be as important as grading the team submissions. Once a problem is brought to the attention of the instructor, he/she has a responsibility to get involved and precipitate resolution. Often, student teams are not experienced, mature, and trained enough to deal with these kinds of issues on their own. An instructor should provide facilitation and/or guidance. To reduce the magnitude of team problems that might be encountered, instructors should encourage teams to identify problem members with an on-going evaluation process and by statements like "If I don't know about it I can't help solve it" and "I will have no sympathy for a long-standing team problem that comes to light at the end of the project or semester."

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