Making Effective Use of Your Peers

Your peers can significantly influence your academic performance, either positively or negatively.

Negative peer pressure put on those who apply themselves to learning is an age-old problem. Derisive terms like *dork*, *wimp, nerd*, *geek*, and *bookworm* are but a few of those used to exert social pressure on the serious student. You may have experienced this type of peer pressure in high school if your friends were not so serious about their academics as you, and you may have been forced into a pattern of studying alone— separating your academic life from your social life.

> ***The "lone-wolf" approach to your academics may have worked for you in high school, but it is doubtful that it will work for you in engineering study where the concepts are much more complex and the pace much faster.***

Even if you are able to make it through engineering study on your own, you will miss out on many of the benefits of collaborative learning and group study. We will explain these benefits below, but first you need to understand how the education process works.

As a student, you are an active participant in the *teaching/learning process*. You may not have given much thought to how this process works. Perhaps most important for you to understand is that the institution focuses primarily on the *teaching* part, while the *learning* part is left up to you.

Teaching Modes

The "teaching" part of the teaching/learning process is primarily achieved by the following well-known ***teaching modes***:

- Large lectures, in which one professor lectures to 300 or 500 students
- Small lectures, in which one professor lectures to 25 to 30 students
- Recitations, in which a teaching assistant reviews the material and solves the problems for small groups of ten to 15 students
- One-on-one tutoring, in which a tutor works with one student

Despite their obvious differences, all four teaching modes have the following features in common. Each involves a person who is knowledgeable about a subject (an "expert," if you will) communicating what he or she knows to a less knowledgeable person (the student). Generally, most of the communication is one-way—i.e., from the teacher to the student. And most important, students learn relatively little from participating in any of these modes.

That last feature should alarm you, or at least raise some doubt about its validity. If you are a dedicated, attentive student, how is it possible that only a limited amount of learning takes place in these teaching modes? Here's how: Imagine that you are in an engineering course, and your professor introduces a new principle. You go to the lecture, you go to the recitation, and you go to tutoring sessions, but you don't do anything outside of those activities. Then you are given an exam on the principle. What score would you expect to make?

The limited effect of these teaching modes—especially the lecture format—becomes quite apparent if you envision the process as one educator has aptly described it:

> ***The information passes from the notes of the professor to the notes of the student without passing through the mind of either one.***

Learning Modes

And then we have ***learning modes***. There are really only two:

(1) Solitary

(2) Collaborative

Either you try to learn by yourself, or you do it with others.

As I travel the country, I always make a special effort to visit Introduction to Engineering classes, where I make it a point to ask students, "How many of you regularly spend some part of your study time studying with at least one other student?" Generally, in a class of 30 students, three or four hands will go up. Then I ask, "How many of you spend all of your time studying by yourself?" This time, the remaining 90 percent of hands go up.

> ***My anecdotal research indicates that about 90 percent of first-year engineering students do virtually 100 percent of their studying alone.***

Hence, the predominant learning mode in engineering involves a student working alone to master what are often difficult, complex concepts and principles, and then apply them to solve equally difficult, complex problems.

The fact that most students study alone is indeed unfortunate because research shows that students who engage in collaborative learning and group study perform better academically, persist longer, improve their communication skills, feel better about their educational experience, and have enhanced self-esteem. As even more evidence, Karl A. Smith, Civil Engineering

professor at the University of Minnesota and a nationally recognized expert on cooperative learning, has found that [1]:

> ***Cooperation among students typically results in:***
>
> ***a. Higher achievement and greater productivity***
>
> ***b. More caring, supportive, and committed relationships***
>
> ***c. Greater psychological health, social competence, and self-esteem***

In my own anecdotal research, I have tried to understand why students study alone, so I also make it a point to ask students, "Why don't you study with other students?" I almost always get one of these three answers:

(1) "I learn more studying by myself."

(2) "I don't have anyone to study with."

(3) "It's not right. You're supposed to do your own work."

The first of these reasons is simply wrong. It contradicts all the research that has been done on student success and student learning. The second reason is really an excuse. Your classes are overflowing with other students who are working on the same homework assignments and preparing for the same tests that you are. The third reason is either a carryover from a former era when the culture of engineering education emphasized "competition" over "collaboration," or it comes from that old romanticized ideal of the "rugged individualist" that we debunked earlier. Today, the corporate buzzwords are "collaboration" and "teamwork," and engineering programs are under a strong mandate to turn out graduates who have the skills to work well in teams.

If you are using any of these reasons to justify your "lone-wolf" approach to your academic work, you should now see their inherent problems and, thus, you need to change your approach.

If you're still not convinced, then look at the issue from a different perspective. Instead of focusing on the weaknesses or problems of solitary study, consider the strengths or benefits of group study. In this new light, you will find three very powerful and persuasive reasons for choosing the collaborative approach over the solitary one:

(1) You'll be better prepared for the engineering "work world."

(2) You'll learn more.

(3) You'll enjoy it more.

Each of these is discussed in the following sections.

You'll Be Better Prepared for the Engineering Work World

Whether you choose to study alone or with others often depends on your view of the purpose of an engineering education. If you think the purpose of that education is to develop your proficiency at sitting alone mastering knowledge and applying that knowledge to the solution of problems, then that's what you should do. However, I doubt you will find anyone who will hire you to do that. It's not how practicing engineers work by and large.

So if you spend your four or five years of engineering study sitting alone mastering knowledge and applying that knowledge to the solution of problems (and perhaps becoming very good at it!), you will have missed out on much of what a quality education should entail.

A quality education provides you not only the ability to learn and to apply what you learn, but also the ability to communicate what you have learned to others; the ability to explain your ideas to others and to listen to others explain their ideas to you; and the ability to engage in dialogues and discussions on problem formulations and solutions. You may land on a very important "breakthrough" idea, but if you can't convince others of it, it is unlikely that your idea will be adopted.

You'll Learn More

Do you recall our earlier discussion of traditional teaching modes, all of which kept learning to a minimum? In essence, group study and collaborative learning take up where the traditional modes leave off—and the result is an increase in what you learn.

There are a number of ways to explain how this happens. One is the adage that *"two minds work better than one."* Through collaborative study, not only will more information be brought to bear, but you will have the opportunity to see others' thought processes at work. Perhaps you have played the game *Trivial Pursuit*. It always amazes me how a small group of people working together can come up with the answer to a question that a member of the group working alone could not have done.

Another explanation comes from the claim that "if you really want to learn a subject, teach it." It's true! As an undergraduate engineering student, I took three courses in thermodynamics. Yet I didn't really understand the subject until I first taught it. When two students work together collaboratively, in effect, half the time one student is teaching the other, and half the time the roles are reversed.

You'll Enjoy It More

Group study is more fun and more stimulating than solitary study, and because you'll enjoy it more, you are likely to do more of it. This wonderful benefit of group study can be illustrated by the following personal story.

My Own Experience with Group Study

> ***When I was working on my Ph.D., a close friend of mine and I took most of our courses together. To prepare for exams, typically we would meet early on a Saturday morning in an empty classroom and take turns at the chalkboard deriving results, discussing concepts, and working problems. Before we knew it, eight or ten hours would have passed. There is no way I would have spent that amount of time studying alone on a Saturday at home. Would you? The temptations of TV, the Internet, telephones, and friends, along with the need to run errands or do work around the house, would surely have prevailed over my planned study time. By integrating my academic work with my social needs, I enjoyed studying more and did more of it.***

Frequently Asked Questions about Collaborative Learning

Once students embrace the concept of collaborative learning, they generally have questions on how to make it work. The three most frequently asked (and probably most important) questions are:

- What percentage of your studying should be done in groups?
- What is the ideal size of a study group?
- What can be done to keep the group from getting off task?

Although there are no definitive answers to these questions, the following points serve as fairly reliable guidelines.

Percentage of Time. Certainly, you should not spend all of your study time working collaboratively. I would suggest somewhere between 25 and 50 percent. Prior to coming

together, each member of a group should study the material and work as many problems as possible to gain a base level of proficiency. The purpose of the group work should be to reinforce and deepen that base level of understanding. The better prepared group members are when they come together, the more they can accomplish during their study sessions.

Size of Study Group. When you hear the term "study group," what size group do you think of? Five? Ten? Fifteen? My ideal size is ***two***. Study "partners." When two people work together, it is easier to maintain a balanced dialogue, in which each is the "teacher" for half the time. Triads can work well too. In larger groups, however, it can be difficult to ensure equal participation, and members often feel the need to compete for their "fair share" of the time. Even between study partners, a conscious effort may be required to keep one of the two from dominating the dialogue. So my advice is to keep the groups small. If more people come together to study, it's okay. Generally, subgroups of two's or three's will develop.

Staying on Task. You may find it difficult to stay on task when working with others. There are no simple solutions to this problem, for it really boils down to each student's discipline and commitment to his or her education. Once again, though, size may be a factor: the larger the group, the more difficult it will be to keep everyone focused on academics. Yet even in groups of two or three, staying on task can be a problem.

I have found it helpful to split up a group's meeting time into a series of short study periods with breaks between each period. Agree, for example, to study for 45 minutes, and then take a 15-minute break. After the break, it's back to work for another 45 minutes, followed by another 15-minute break. And so on.

If nothing else seems to help your group to stay on task, then you're left with only one solution: *just do it*.

It Really Works

> ***I often conduct workshops on collaborative learning, and at some point I have half of the class work on a problem in small groups and the other half work by themselves on the same problem. After about ten minutes, the ones who are working alone start looking at their watches and appear restless and bored. When time is called after 45 minutes, those who are working in groups are disappointed and ask for more time. They often express that they are just getting "hot" on a solution to the problem.***
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> ***Then, the next day I ask, "How many of you continued thinking about, working on, or talking to others about the problem we did yesterday?" Most of those who worked in groups raise their hands, whereas those who worked alone do not.***

New Paradigm

Collaboration and *cooperation* represent a major new paradigm shift in business and industry, replacing the paradigm of *competition* that began with the Industrial Revolution and held sway well into the 20th century.

Collaborative learning represents the same paradigm shift in engineering education. *Collaborative learning* is consistent with modern engineering management practice and with what industry representatives tell us they want in our engineering graduates. *Competition* and *individual achievement* are outdated notions, and rightly so. W. Edwards Deming, father of the "quality" movement, recently made a compelling case about these changes [2]:

> ***We have grown up in a climate of competition between people, teams, departments, divisions, pupils, schools, universities. We have been taught by economists that competition will solve our problems. Actually, competition, we see now, is destructive. It would be better if everyone would work together as a system, with the aim for everybody to win. What we need is cooperation and transformation to a new style of management . . . . Competition leads to loss. People pulling in opposite directions on a rope only exhaust themselves. They go nowhere. What we need is cooperation. Every example of cooperation is one of benefit and gains to them that cooperate. Cooperation is especially productive in a system well managed.***

References

1. Smith, Karl A., "Cooperation in the College Classroom," Notes prepared by Karl A. Smith, Department of Civil Engineering, University of Minnesota, Minneapolis, MN, 1993.
2. Deming, W. Edwards, *The New Economics for Industry, Government, Education*, MIT Center for Advanced Study, Cambridge, MA, 1993.