

## Teaching Philosophy

The college students I see in my classroom today seem very different from those I sat next to some four decades ago. Today's students are clearly very intelligent, and much more "worldly aware" than were their counterparts of the past, so while the approach might be slightly different, the one thing that has changed very little is the role of the teacher to inspire, to motivate, and to help them become self-directed learners. In this regard, one of the most important aspects of teaching in higher education is that of getting students to actively participate in their own learning process. If I can do that, the remainder of my job becomes relatively straight-forward and quite rewarding.

To facilitate meaningful learning, I try and make use of my experience in "real world" aerodynamic design to help students engage in their study of aerospace engineering. In particular, this perspective helps to bridge the gap between the engineering analysis tools that our students have learned, and the application of those tools to actual engineering problems. For the most part, the undergraduate engineering curriculum focuses very little on actual engineering, that is, creating something that solves a problem and/or makes something better, but rather, as it must, places emphasis on engineering analysis tools. As an analogy, the curriculum of an art school concentrates mostly on the mechanics of how to use brushes, mix colors, and so forth, but can do little to facilitate the creation of another Michelangelo. As a consequence, a number of our students come into the major without having a clear understanding of what engineers actually do. Thus, by challenging the students to "pull it all together" through realistic design activities, I try to give our students valuable exposure to the "art" of engineering design and help to instill a passion for engineering.

Along the lines of trying to give students a more realistic engineering experience, in 1991 I co-introduced the Flight Vehicle Design and Fabrication, Aerospace 204H/404H, now called simply the "sailplane class" by the students. The intention for this course was to help alleviate the problems best summarized in the following quotation from a 1995 report of the National Center for Advanced Technologies: "The curricula in most of the major universities in this country are badly out of balance, with a too-heavy emphasis on engineering science (analysis) and competition, at the expense of design (creative synthesis), manufacturing, and cooperative learning (teamwork)." All of the concerns noted in this quotation are addressed by the sailplane class, and for over twenty years, its success in achieving the desired goals has been well established. In this course, comprised of freshman through seniors, who enroll in the course for the entirety of their undergraduate program, the students design and fabricate full-scale aircraft. These efforts are largely student driven and require a great deal of discipline and self-motivation from those involved. By having the underclassmen mentored by upperclassmen that are committed and enthusiastic about learning, the underclassmen adopt a "scholarly approach" very early on in their undergraduate programs, and this "enlightenment" serves them well throughout all of their studies. I believe that this class comes the closest to representing what I think is my best practice and, as much as possible, I try to incorporate the pedagogical premises of this course into all those that I teach.

With regard to trying to help students develop the ability to go beyond analysis and think about the bigger picture, I think it is important to ask questions that help students understand what they do and don't know. Many of their lifelong experiences and observations can be of great value in trying to solve new problems, while at the same time, much more can be accomplished if these common-sense experiences are combined with recently learned engineering tools. I also realize that learning can be perplexing and challenging and that many students get uncomfortable when they are asked to do more, think deeper, and/or enter the unknown, but I don't shy from setting high expectations. I just try to provide these students with the support and foundation needed to be able to wrestle with engineering complexities and thinking.

Finally, I think that some of the most important lessons one can pass on to students do not come through carefully prepared lectures, but through the spontaneity of the classroom. One should not pass up "teaching moment" opportunities. Likewise, through enthusiasm and love of subject matter, one can help students to realize that without knowing enough to build a solid foundation, there is no way to fully appreciate and enjoy the discipline. The rewards are there, but not without a certain amount of effort. Better than my own words, I think my teaching philosophy is best captured in the following student comments from a recent SRTE. "He challenges you to really think about the problems and concepts, and makes you think about things in new and different ways.....he asks questions constantly and makes everyone think, puts you on the spot, and shows real examples...."