# Teaching Philosophy

Receiving an education in physics and/or engineering is an excellent way to prepare oneself for problem solving and critical thinking tasks to be met in either industry or academic situations. While I do believe the above statement about critical thinking, I also see that there is a waning in the development of practical skills to accompany the knowledge and problem solving abilities that we are teaching the next generation of scientists and engineers. I speak from experience on this issue, having worked both as an engineer and then physicist in industrial and academic positions. As an engineer and experimental physicist I have a great need for practical skills and knowledge that I feel should have been provided to a greater degree in my own university education. With this in mind it is my goal as a teacher to provide a set of practical skills to enhance the problem solving and critical thinking education that is already well developed in the scientific community.

When I speak of practical skills I mean those skills that are necessary to take a solution to completion after critical thinking has revealed a solution. These might be instrumentation issues, or numerical algorithm implementation. They might also be the applied knowledge of how thermodynamics applies to automotive turbo chargers or how p/n-type semiconductors are put to use for solar energy. Whether scientist or engineer, it is beneficial to gain a perspective on the practicality of physics.

Applied and practical skills can be brought into the classroom in a variety of ways. The use of demonstrations can enhance the material presented in the textbooks and lectures. As an instructor in a general physics course I like to introduce practical demos on a weekly basis, or more often if appropriate. When teaching a computational physics course, I have been known to encourage the use of laptops in class and frequently would bring my own for use during instruction, sometimes to reveal unfamiliar features of specific software or for interactively coding examples with the students to illustrate principles from the lecture. I have found that bringing in demonstrations and real world tools not only increases the interest of the students, but also effectively illustrates ideas that may seem more obscure when given in a lecture alone.

Student-based research is another way to reinforce classroom material and provide practical skills to the students. This can be done in the obvious, and valuable, manner of requiring a research component in the educational process. Another path that I have found successful is to bring active research into the classroom. Using data from an ongoing student project to teach least squares fitting techniques, for example, connects the classroom and research to maintain student interest. With the research conducted in my laboratory it is possible to bring the experiments into class and have the students witness, or even perform, the experiments themselves. Bringing the research to the student and inviting the students into the laboratory adds perspective to typical lecture material and provides valuable skills to students who will, one day, be seeking employment.

Finally, as with most things in life, communication is key. It is not only important to be a good communicator in the lecture but also to open avenues of communication to the student that are two-way paths. It is important for an instructor to gain feedback from his/her students in order to assess both the quality of the students knowledge and the quality of the instructors teaching. One way I address this issue in smaller classes (less than 20 students) is to have the students answer a questionnaire about themselves and their interests (personal and scholastic) as well as expectations for the current course. This provides me with information to better design the demos and examples that I will use, and in so doing the course seems more useful to the students. Another method of communication that I have used is the web. The web has become a natural place for people to seek information, thus providing information to students this way is easy and effective. With web-based systems, WebCT for example, it is possible to dispense course information and materials to the

students without waiting for classroom hours, and to converse with students needing assistance, or provide them with a virtual classroom to discuss amongst each other. No matter the methods one chooses to use, it is necessary to constantly evaluate ones ability to communicate most effectively to avoid a decline in teaching ability.