

# MY TEACHING PHILOSOPHY

While teaching a class or directing a Ph.D. student, I have seven goals.

1. I want students to want to understand both the theory and applications of the course material, which should represent the current state of the art.

Hence, I continue to do significant research. In this way, I can convey the latest discoveries, demonstrate their applications, and describe the creative process.

For example, I now teach a new equilibrium in game theory that gives sensible strategies in such important classic games as Prisoner's Dilemma. This new equilibrium is defined in a paper of mine under revision. Currently, the Nash equilibrium provides the solutions in competitive situations and often gives irrational ones as in Prisoner's Dilemma. In the Chicken Game, effectively a model of the Cuban Missile Crisis of 1962, the new equilibrium - not the Nash one - gives the strategies fortunately followed then.

2. Students learn best when they enjoy doing so.

To make technical material entertaining, I humanize the subject matter to make students more receptive. When teaching logic in a decision theory course, I tell how the famous Austrian logician Kurt Gödel, appearing for his U.S. citizenship, argued with the judge that the U.S. Constitution was flawed. Twenty years later, in 1972, Kenneth Arrow won the Nobel Prize in Economics by showing that logically consistent group decision-making is impossible.

I then reduce a concept to its simplest terms. To make it understandable beyond rote memorization, I tie a concept to some key illustration. For example, I illustrate the computational complexity of algorithms with a comparison of finding the shortest simple path in a network with finding the longest one.

3. I want to have fun.

When all else fails, humor can revitalize a lecture as well as the lecturer. For example, students in a recent class were overwhelmed by stochastic branching processes. To lighten the atmosphere, I led the class in inventing a new word to describe their current plight - being in the wrong place at the

wrong time. We decided upon “malgent” as the adjective and “malgence” as the noun. We calculated how many people would know the word in six months if each new convert used it daily in conversation. Might it get in the dictionary? Would we become famous? Of course, the spread of our neologisms represents a stochastic branching process.

4. I want to instill enthusiasm for learning in my students, teach them how to learn by themselves, and make them realize that ultimately they are responsible for their education.

I emphasize to students that their graduation is truly just a commencement of the educational process. Most of their learning lies ahead, for the world is changing faster and faster, the information explosion accelerating. Their minds must be flexible and open to new ideas. I mention Nobel Prize winning physicist Richard Feynman’s explanation of how he learned things. He would start at the beginning of a book and read until he got stuck. Then he started over and got a little further. Continuing this process, he finally understood the material.

The point is that there are no short cuts for even the most brilliant. But hearing the genesis of ideas, fundamental but simple illustrations of the concepts, and the real-world applications of theory prepares one to focus on what’s important. And focusing on the key issues is a critical skill in learning.

5. I want to teach students to think both independently and originally.

This objective entails teaching them to challenge both books and me. It means trying to develop a student’s confidence in his/her own ideas and opinions. It means trying to make them want to simply to understand the wonders of our universe. I also demand that students always ask the simple question, “Does this make sense?” about any solution they obtain. It can save them much trouble or even identify some gap in knowledge.

Such discoveries require an open and prepared mind. In the early 1960’s meteorologist Edward Lorenz wrote a computer program that modeled weather behavior. Utilizing numerous complex formulas, this program seemed to give good forecasts starting from a given set of initial weather conditions. During one series of runs, however, Lorenz tried to recreate a previous weather pattern after simply rounding off the numerical values of the initial conditions to one lower decimal place. Much to his surprise, the second results differed dramatically from the first ones. This outcome didn’t make sense to him. But Lorenz had discovered the “butterfly effect,” which led to the field of chaos theory.

**Finally, I tell students that another key of creativity is recognizing implicit assumptions and challenging them. In other words, one must think out of the box. Maybe the equation  $x^2 = -1$  has a solution. I stress that learning and creativity are often a trial and error process. A mistake is a step forward. Knowing this fact can eliminate a major impediment to success in anything - the fear of failure and hence the fear of trying.**

**6. I want to teach students to communicate effectively.**

**Effective communication may well be the most important skill a student learns. Presentations and reports will represent a major role in his/her professional life and chances of advancement, so I require one in each of my classes. To communicate effectively, one must first know the audience and present material at a suitable level. I state that effective professional communication adheres to the following hierarchy: (i) substance, (ii) clarity, (iii) enthusiasm (iv) simplicity, (v) brevity, and (vi) euphony.**

**7. I try to instill professional ethics.**

**Honesty is the only defensible policy. Eventually a person's professional dishonesty will haunt him/her. At best, the person will lose the respect and trust of colleagues. At worst, the person could be convicted of a crime. Dishonesty also prevents one from gaining the self-respect of accomplishment on his/her merits. The best policy is to treat others as one wants to be treated, while standing up for one's own rights.**