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Philosophy of Teaching
Electrical Engineering and Computer Science

I believe that fundamental physical principles coupled with critical thinking skills provide the learning foundation of every good engineer. Thus, there are four essential tenets to my teaching philosophy: 1) guide and motivate students to recognize and fully understand the *fundamental* concepts in electrical engineering 2) help students develop their *critical thinking* skills such that advanced concepts are no longer viewed as complex maze but rather are extensions of several first principles 3) help students get a big picture of their field by *unifying* seemingly disparate concepts and coursework 4) and ultimately help students become *independent* learners.

As important as first principles are, they can be rather boring to a student. Thus, I motivate the material using a top-down approach, that is, show them where we hope to be at the end of the course and how we intend to get there. I emphasize the fundamentals because that is where the teacher plays the largest role for a student. As a teacher, I already have an idea of the big picture, therefore, I can accurately asses the important principles that should be covered for the most effective lectures. However, I must present the material to cater to different styles of learning. Each student can have a varying style of learning: some can learn on their own out of a text book, some need examples, and some need an analogy to tie the material together. In my courses, I assign readings in the textbook, however, I do not expect the students to understand everything they read. Thus, I lecture on the material and use many chalk board examples that show applications of the material. A study conducted by the National Training Laboratories found that "one remembers about 5% of what is heard in a lecture and about 90% of what is used immediately, or is taught to others." Therefore, I incorporate group activities in some lectures such that students can teach each other in small groups by solving problems together. Such activities not only help the learning process as students teach each other, but also build valuable communication skills and organize thought processes on how to approach problems.

Critical thinking is one of the most important skills to an engineer. In order to solve new problems, engineers should be able to think through them. The final solution to a problem is rarely obvious, and as such, the thinking process must be developed and refined with practice. In a term, I assign several individual and group design projects that incorporate multiple ideas and first principles. Projects early in a term are broken down with milestones such that students can begin to learn how to approach a multifaceted problem on their own. The importance of holding office hours during these projects is critical to the development of the students' critical thinking skills. In office hours, students that seek more direction on how to approach a problem can get individual attention while explaining their thought processes. In addition to projects, students use their critical thinking skills on a more regular basis during weekly timed quizzes. The quizzes are not designed to test memorization as the use of an equation sheet is encouraged, rather, they are designed to test problem solving as each quiz cannot be completed if not approached properly. Students should be challenged but they should not be frustrated, which is why I adjust teaching and assessment based on regular feedback from the students via anonymous comments after each unit covered in a course.

Many electrical engineering concepts that are repeated in several courses and can initially seem like disparate ideas. In my teaching, I show the cohesive nature of these concepts by presenting several of their manifestations during a lecture. That way, students can recognize that what they are learning in one class directly applies to several others in their curriculum. This unification is important because students can focus their efforts on critical thinking and problem solving after they grasp the fundamentals, rather than spend time understanding the same concept over again merely because it was presented in a different way. As students learn to evaluate problems on their own, they become independent learners who can distill and, more importantly, apply information on their own to challenges in their field.

When developing the Law of the Lever, Archimedes said "Give me a place to stand and I will move the Earth." It is no exaggeration to state that engineers have developed civilization-changing advancements. They have, in effect, moved the Earth with alternating current, the light bulb, personal computers, the World Wide Web, satellite communication, and cellular technology. At the basis of complex developments is a good foundation of critical thinking skills and first principles leveraged in creative and judicious ways to solve real-world problems. The hallmark of a good teacher is one who can help students build foundations of knowledge upon which they can stand so that they may move the Earth as well.