Teaching Philosophy

Civilization, science, technology, culture, and all other parts of society have developed through each generation, building upon the wisdom of those before. Different approaches have been employed regarding how to convey this lore through the generations, with the commonality that those entrusted to impart the learning were teachers; individuals striving to boil down the current understanding into a compact form, allowing each generation to springboard upon the existing tribal knowledge in order to reach new and greater heights of enlightenment. In years past, when mankind's understanding was smaller, it was possible to instruct through memorization, mnemonic devices, and other techniques, but the growing complexity and breath of cognizance has made this problematic. Given the exponential growth of comprehension and each field's increasing complexity, even today's hyperspecialization is mired down by the density of information; individuals can no longer memorize all known diseases, laws, chemicals, or mechanisms. To battle this, tools have been developed that allow individuals to search and access facts relatively easily. Unfortunately, determining the data required for a particular situation can be vexing. Moreover, in a world where the average functional usefulness of technical specifications is under three years, it is vital for professionals to continually pursue the expanding frontiers of knowledge through life-long learning.

As such, today's professors must evolve away from providing facts to be memorized and towards being conveyors of problem solving approaches and logical reasoning skills. To do this, it is important to demonstrate to students methodologies for simplifying complex problems that allow the effects of assumptions to be correctly transcribed back when determining the solution's validity for the original, real world situation. Underlying general principles must also be conveyed so that, if new theories are derived, the students can ascertain if the solution needs to be adjusted. One unchanging aspect, however, is the need for technical professionals to learn how to clearly and succinctly communicate their thoughts, ideas, and solutions in oral and written form. This requirement, whilst in opposition to the trend within most social media, is crucial since almost all systems are designed and built by teams of individuals; not an single person, as was common in the past. In today's teaming environment, it does not matter how smart you are or how much you know, if you cannot explain it to others; and the actual implementable real world solution is never just a boxed-in number with units.

To this end, I educate in an atypical fashion wherein each class is a discussion/debate on a particular subject/situation, rather than the typical method of simply solving engineering problems on the board. While the mathematical solution is still covered, the discussion also ranges over the solution's validity, the practicality of implementation, and other similar topics, with the students debating between themselves the various points while I correct/add information, as needed, to help the students understand the fundamental issues involved and how to assess the solution's validity when applied to the real-world scenario. Beyond the engineering aspects, the discussion/debate approach also strengthens the student's ability to express themselves verbally and to defend their thoughts; skills needed when working in a teaming environment. This approach is also reflected in my course evaluations wherein I require essay solutions that discuss, in-depth, the fundamental principles driving the problem/solution. Moreover, the students must justify why their solution is preferred over the variety of other workable solutions. This technique broadens the students' understanding that there are multiple solutions to every real-world problem but that some solutions meet the given requirements better then others. This evaluation technique also strengthens the students' written communication skills and critical thinking skills.

In consideration of these aspects, last year I was asked to teach a section of statics with the goal of demonstrating how my approach can be applied to lower level courses. The objective was to develop a course delivery and evaluation methodology that could be implemented consistently across the entire ME program. The difficulty with this is that in lower level courses, students are not yet sufficiently educated to understand the full depth of real world scenarios. Hence, my goal was to demonstrate that students at this level could still be taught to list and understand their assumptions, appraise the validity of these assumptions, and estimate how valid the quantitative solution is with respect to the actual real-life scenario, including whether the answer will be high or low, and roughly to what degree; rather than only solving the mathematical problem, as was the current situation. To do this, I developed a set of guidelines and examples that could be used for the education and evaluation of the non-quantitative aspects of engineering problems that faculty can use in the classroom and for evaluating student performance in order to help their students gain a more complete understanding of the validity of the quantitative approaches that are provided in all of their ME courses and how to apply and assess the validity when applied to real world scenarios. One advantage that I had when developing this generalized approach is that, over the years, I have taught every required course in the ME curriculum at one point or another. Furthermore, while at ASU, I revamped the ME department's entire curriculum, including assessing what should be covered in each course (both in major and out), developing syllabi/course objectives, choosing textbooks, etc. in order to realign the ME program with ABET requirements; thereby showing me the connections between the courses that are taken towards producing confident, competent, well-rounded mechanical engineers. This background helped me to develop a generalized technique that was, ultimately presented, discussed, and adopted by the ME faculty.

I also apply my educational approach outside of the classroom, especially with respect to the undergraduate students working on my projects. My view is that research is as much of an educational setting as the classroom. As such, any student considering higher education, or wanting to learn what research is like, should be provided the opportunity. Hence, I do not believe I have ever turned down any student, from my department or others, who wanted a research experience. When working with my researchers, my students are taught independence and self-reliance. The students are required to draft their own research plan and justify their approach, draft their own papers, respond to reviewers comments, etc. As they perform these activities, I guide them not only with respect to the subject material but also regarding the best ways to achieve each requirement. I do not believe in doing it for them. The result of this is that almost all of them are published; most with multiple publications. Moreover, over 70% have continued on for an advanced degree. I also do not believe that our role as educators is complete once a student graduates but that, instead, students should consider us an on-going resource that is available throughout their careers to call upon when needed. This viewpoint is one that I feel is important to convey to students as a part of obtaining their Penn State degree and is an aspect that I also, personally enjoy. In addition, as can be seen in my biography, I am also engaged with young individuals outside of PSU in numerous ways. In all of these endeavors, my goal has been to help improve the education of our youth and to serve as a role model through my actions.