

# Teaching and Learning Philosophy

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Proficiency in a topic of science occurs when the level of connections between knowledge, techniques, and experience rises to the point where a student can both formulate and solve problems without the need for external instruction. Our educational system has excelled in providing the first two: knowledge and techniques. In order to become a producer of knowledge and not only a consumer, I believe a student in the sciences must have an opportunity to gain confidence and experience in a non-traditional academic environment, in essence, a chance to feel special early in a career. Preferentially happening sooner rather than later, this may be a summer research experience or a project-oriented class within the university curriculum. This provides not only a way for the non-academic minded student to experience what science or engineering "is really about" but for all students to understand why what is being taught in classrooms will be important and useful in their futures. I myself have been the beneficiary of such special experiences as early as high school.

## Teaching in the college classroom

The sheer quantity of information a student in the sciences must visit or master in the formal education phase of a career ensures that the efficient college lecture will remain a bulwark of our university system. But even assuming an increasing self-determination and self-motivation on the student's part, there are ways I as a teacher can improve and facilitate learning in my students. From freshman to the most senior faculty member, few mind a clear, well-organized talk. In small lecture settings as well as discussion-based classes a range of active learning techniques can be used which better include in the learning-environment a variety of students who learn differently. For example, having a small writing assignment due at the start of class or a quick quiz can ensure that students come prepared. After having already done the work, active participation and engagement in a discussion is often assured. The real key, especially apparent in the teaching-as-research theme, is to be flexible and dynamic in an environment of continuous assessment and improvement.

## Examples and experience

At the University of Wisconsin-Madison, I had the opportunity to teach an undergraduate course on *Nanotechnology and Society*, developing a syllabus and course portfolio for a 3-credit seminar class. I've also had the opportunity to give several guest lectures for graduate courses in the physics and electrical engineering departments. These represent a broad range. At the graduate level, my general philosophy is the old cliché: content is king. I seek for my lectures to be relevant, interesting, and necessary. For the freshman and non-technical student, though, the goals are broader. I very often used assignments, debates, expectations, and other tools to motivate and teach general, professional skill-sets such as written and verbal communication abilities as well as content.